WiNG™ 5.9.1

Wireless Controller and Service Platform

System Reference Guide

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About This Guide

This manual supports the following Access Point, controller and service platform models:

- *Wireless Controllers* – RFS4000, RFS6000
- *Service Platforms* - NX5500, NX5500E, NX7500, NX75XX, NX7510E, NX9500, NX9510, NX9600, NX9610, VX9000, VX9000E
- *Access Points* – AP6522, AP6532, AP6562, AP7161, AP7502, AP7522, AP7532, AP7562, AP7602, AP7612, AP7622, AP7632, AP7662, AP8122, AP8132, AP8163, AP8232, AP8432 and AP8533.

✓ **NOTE:** Throughout this guide, unless specific model references are needed, AP8122, AP8132, AP8163 models are referred to as AP81XX.

This section is organized into the following:

- *Document Convention*
- *Notational Conventions*
- *End-User Software License Agreement*

Document Convention

The following conventions are used in this manual to draw your attention to important information:

NOTE: Indicates tips or special requirements.

CAUTION: Indicates conditions that can cause equipment damage or data loss.

WARNING! Indicates a condition or procedure that could result in personal injury or equipment damage.

Switch Note: Indicates caveats unique to a particular RFS series controller or NX series service platform.

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The following notational conventions are used in this document:

- *Italics* are used to highlight specific items in the general text, and to identify chapters and sections in this and related documents
  - Bullets (•) indicate:
    - lists of alternatives
    - lists of required steps that are not necessarily sequential
    - action items
  - Sequential lists (those describing step-by-step procedures) appear as numbered lists

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1 Overview

Extreme Networks' WiNG 5 operating system is the next generation in the evolution of WLAN architectures. WiNG 5 OS is designed to scale efficiently from the smallest networks to large, geographically dispersed deployments. The co-operative, distributed control plane innovation in the WiNG 5 architecture offers a software-defined networking (SDN)-ready operating system that can distribute controller functionality to every Access Point in your network. Now, every Access Point is network aware, providing the intelligence required to truly unleash optimal performance, all wireless LAN infrastructure can work together to ensure every transmission is routed through the most efficient path, every time.

WiNG 5 brings you the resiliency of a standalone Access Point network without the vulnerability of a centralized controller, with advancements that take performance, reliability, security, scalability and manageability to a new level. The result? Maximum network uptime and security with minimal management. And true seamless and dependable mobility for your users.

WiNG 5 advances the following technology:

Comprehensive Wi-Fi support - WiNG supports all Wi-Fi protocols, including 802.11a/b/g/n/ac, allowing you to create a cost-effective migration plan based on the needs of your business.

Extraordinary scalability - With WiNG, you can build any size network, from a small WLAN network in a single location to a large multi-site network that reaches all around the globe.

Extraordinary flexibility - No matter what type of infrastructure you deploy, WiNG 5 delivers intelligence to all: standalone independent Access Points or adaptive Access Points that can be adopted by a controller but can switch to independent mode; virtual controllers; physical controllers in branch offices, the *network operating center* (NOC) or the cloud.

The power of distributed intelligence - WiNG distributes intelligence right to the network edge, empowering every controller and Access Point with the intelligence needed to be network-aware, able to identify and dynamically route traffic over the most efficient path available at that time.

Extraordinary network flexibility and site survivability - WiNG provides the best of both worlds: true hierarchical management that delivers a new level of management simplicity and resiliency by enabling controllers to adopt and manage other controllers and Access Points, while allowing adopted infrastructure to also stand on its own.

Gap-free security - When it comes to security, there can be no compromises. WiNG's comprehensive security capabilities keep your network and your data safe, ensuring compliance with PCI, HIPAA and other government and industry security regulations.

Connectivity for the largest indoor and outdoor spaces - In addition to enabling a robust indoor WLAN, our patented MeshConnex™ technology enables the extension of Wi-Fi networks to the largest of outdoor spaces from an expansive outdoor campus environment to an entire city.

Powerful centralized management - With WiNG you get complete control over every aspect of your WLAN. This single powerful windowpane enables zero touch infrastructure deployment, rich analytics that can help you recognize and correct brewing issues before they impact service quality and user connectivity, along with centralized and remote troubleshooting and issue resolution of the entire network.

Application Visibility and Control - With WiNG you get visibility & control over Layer-7 applications with an embedded DPI engine at the Access Point. Extreme Networks' NSight (an add-on module to WiNG) provides real-time visibility and in-depth insight into every dimension of the network including layer-7 application visibility, client devices, device & OS types and users. At a glance the administrator can discern the top applications by usage or by count at every level of the network from site level to Access Points and clients. This is achieved by *Deep Packet Inspection* (DPI) of every flow of every user at the Access Point. The embedded DPI engine in the WiNG OS can detect and identify thousands of applications real time and report to NSight. In addition to detection, firewall and QOS policies can leverage the application context to enforce policies.

1.1 Distributed Intelligence

WiNG 5 enables all WLAN infrastructure with the intelligence required to work together to determine the most efficient path for every transmission. The need to route all traffic through a controller is eliminated, along with the resulting congestion and latency, resulting in higher throughput and superior network performance. Since all features are available at the access layer, they remain available even when the controller is offline, for example, due to a WAN outage, ensuring site survivability and extraordinary network resilience. In addition, you get unprecedented scalability, large networks can support as many as 10,000 nodes without impacting throughput or manageability, providing unprecedented scalability.

1.2 High Availability Networks

WiNG 5 enables the creation of highly reliable networks, with several levels of redundancy and failover mechanisms to ensure continuous network service in case of outages. APs in remote sites coordinate with each other to provide optimized routing and self-healing, delivering a superior quality of experience for business critical applications. Even when WiNG 5 site survivable APs lose communication with the controller, they continue to function, able to bridge traffic while still enforcing QoS and security policies, including stateful inspection of Layer2 (locally bridged) or Layer 3 traffic.

1.3 Gap Free Security

When it comes to wireless security, one size does not fit all. A variety of solutions are required to meet the varying needs and demands of different types of organizations. Regardless of the size of your WLAN or your security requirements, our tiered approach to security allows you to deploy the features you need to achieve the right level of security for your networks and your data. And where a hub-and-spoke architecture can't stop threats until they reach the controller inside your network, WiNG 5 distributes security features to every access point, including those at the very edge of your network, creating an around-the-clock constant network perimeter guard that prevents threats from entering your network for unprecedented gap free security.

1.4 Outdoor Wireless and Mesh Networking

When you need to extend your wireless LAN to outdoor spaces, our patented MeshConnex technology combines with comprehensive mesh networking features to enable you to create secure, high performance, flexible and scalable mesh networks. With our mesh technology, you can cover virtually any area without installing cabling, enabling the creation of cost-effective outdoor wireless networks that can provide coverage to enterprise workers in vast campus-style environments as well as public safety personnel in patrol cars.

1.5 Network Services, Routing and Switching

WiNG 5 integrates network services like built-in DHCP server, AAA server and routing protocols like policy based routing and OSPF, Layer 2 protocols like MSTP and Link Aggregation. Integration of services and routing/ switching protocols eliminates the need for additional servers or other networking gear in small offices thereby reducing Total Cost of Ownership (TCO). In large networks, where such services are deployed on a dedicated server/ router at the NOC, this provides a backup solution for remote sites when the WAN link to the NOC is temporarily lost. Integrating also provides the added benefit of coordination across these services on failover from primary to standby, assisting a more meaningful behavior, rather than when each fails over independently of the other for the same root cause.

1.6 Management, Deployment and Troubleshooting

WiNG's comprehensive end-to-end management capabilities cover deployment through day-to-day management. You get true zero-touch deployment for access points located anywhere in the world, the simplicity of a single window into the entire network, plus the ability to remotely troubleshoot and resolve issues. And since our management technology is manufacturer-agnostic, you can manage your Extreme Networks WLAN infrastructure as well as any legacy equipment from other manufacturers, allowing you to take advantage of our advanced WLAN infrastructure without requiring a costly rip and replace of your existing WLAN.

2 Web UI Features

The WiNG software contains a Web UI allowing network administrators to manage and view Access Point, controller and service platform settings, configuration data and status. This *Graphical User Interface* (GUI) allows full control of all administration features.

Access Points, controllers and service platforms also share a *Command Line Interface* (CLI) for managing and viewing settings, configuration and status. For more information on the command line interface and a full list of available commands, refer to the *Wireless Services CLI Reference Guide* available at www.extremenetworks.com/support.

For information on how to access and use the Web UI, see:

- *Accessing the Web UI*
- *Glossary of Icons Used*

2.1 Accessing the Web UI

Access Points, controllers and service platforms use a UI accessed using any supported Web browser on a client connected to the subnet the Web UI is configured on.

2.1.1 Browser and System Requirements

To access the GUI, a browser supporting Flash Player 11 is recommended. The system accessing the GUI should have a minimum of 1 GB of RAM for the UI to display and function properly, with the exception of NX service platforms which require 4 GB of RAM. The Web UI is based on Flex, and does not use Java as the underlying UI framework. A resolution of 1280 x 1024 pixels for the GUI is recommended.

The following browsers are required to access the WiNG Web UI:

- Firefox 3.5 or higher
- Internet Explorer 7 or higher
- Google Chrome 2.0 or higher
- Safari 3 and higher
- Opera 9.5 and higher

NOTE: Throughout the Web UI leading and trailing spaces are not allowed in any text fields. In addition, the “?” character is also not supported in text fields.

2.1.2 Connecting to the Web UI

1 Connect one end of an Ethernet cable to a LAN port on the front of the controller or service platform and connect the other end to a computer with a working Web browser.

2 Set the computer to use an IP address between 192.168.0.10 and 192.168.0.250 on the connected port. Set a subnet/network mask of 255.255.255.0.

Once the computer has an IP address, point the browser to: https://192.168.0.1/ and the following login screen will display.

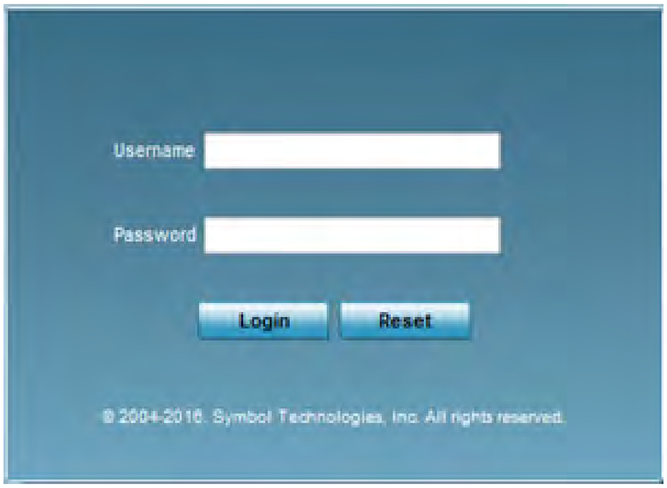


Figure 2-1 *Web UI Login Screen*

3 Enter the default username *admin* in the **Username** field.
Enter the default password *admin123* in the **Password** field.

4 Click the Login button to load the management interface.

5 If this is the first time the UI has been accessed on RFS4011 model controllers, a dialogue displays to begin an initial setup wizard. For more information on using the initial setup wizard on these models see *Using the Initial Setup Wizard*.

2.2 Glossary of Icons Used

The UI uses a number of icons used to interact with the system, gather information, and obtain status for the entities managed by the system. This chapter is a compendium of the icons used. This chapter is organized as follows:

- *Global Icons*
- *Dialog Box Icons*
- *Table Icons*
- *Status Icons*
- *Configurable Objects*
- *Configuration Objects*
- *Configuration Operation Icons*
- *Access Type Icons*
- *Administrative Role Icons*
- *Device Icons*

2.2.1 Global Icons

▸ *Glossary of Icons Used*

This section lists global icons available throughout the interface.

	Logout – Select this icon to log out of the system. This icon is always available and is located at the top right corner of the UI.
+	*Add* – Select this icon to add a row in a table. When selected, a new row is created in the table or a dialog box displays where you can enter values for a particular list.
−	*Delete* – Select this icon to remove a row from a table. When selected, the selected row is deleted.
⬇	*More Information* – Select this icon to display a pop up with supplementary information that may be available for an item.
🗑	*Trash* – Select this icon to remove a row from a table. When selected, the row is immediately deleted.
	Create new policy – Select this icon to create a new policy. Policies define different configuration parameters that can be applied to individual device configurations, profiles and RF Domains.
⚙	*Edit policy* – Select this icon to edit an existing configuration item or policy. To edit a policy, select a policy and this icon.

2.2.2 Dialog Box Icons

▸ *Glossary of Icons Used*

These icons indicate the current state of various controls in a dialog. These icons enables you to gather the status of all the controls in a dialog. The absence of any of these icons next to a control indicates the value in that control has not been modified from its last saved configuration.

✎	*Entry Updated* – Indicates a value has been modified from its last saved configuration.
	Entry Update – States that an override has been applied to a device profile configuration.

*	*Mandatory Field* – Indicates this control value is a mandatory configuration item. You are not allowed to proceed further without providing all mandatory values in this dialog.
✖	*Error in Entry* – Indicates there is an error in a supplied value. A small red popup provides a likely cause of the error.

2.2.3 Table Icons

▶ *Glossary of Icons Used*

The following two override icons are status indicators for transactions:

☰	*Table Row Overridden* – Indicates a change (profile configuration override) has been made to a table row and the change will not be implemented until saved. This icon represents a change from this device's profile assigned configuration.
+	*Table Row Added* – Indicates a new row has been added to a table and the change is not implemented until saved. This icon represents a change from this device's profile assigned configuration.

2.2.4 Status Icons

▶ *Glossary of Icons Used*

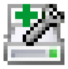
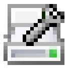
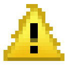
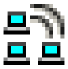
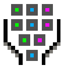
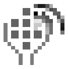
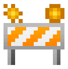
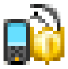
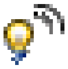
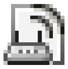
These icons indicate device status, operations, or any other action that requires a status returned to the user.

⊗	*Fatal Error* – States there is an error causing a managed device to stop functioning.
‼	*Error* – Indicates an error exits requiring intervention. An action has failed, but the error is not system wide.
!	*Warning* – States a particular action has completed, but errors were detected that did not prevent the process from completing. Intervention might still be required to resolve subsequent warnings.
✓	*Success* – Indicates everything is well within the network or a process has completed successfully without error.
↓	Information – This icon always precedes information displayed to the user. This may either be a message displaying progress for a particular process, or just be a message from the system.

2.2.5 Configurable Objects

▸ Glossary of Icons Used

These icons represent configurable items within the UI.

	*Device Configuration* – Represents a configuration file supporting a device category (Access Point, wireless controller etc.).
	*Auto Provisioning Policy* – Represents a provisioning policy. Provisioning policies are a set of configuration parameters that define how Access Points and wireless clients are adopted and their management configuration supplied.
	*Critical Resource Policy* – States a critical resource policy has been applied. Critical resources are resources whose availability is essential to the network. If any of these resources is unavailable, an administrator is notified.
	*Wireless LANs* – States an action impacting a managed WLAN has occurred.
	*WLAN QoS Policy* – States a *quality of service policy* (QoS) configuration has been impacted.
	*Radio QoS Policy* – Indicates a radio's QoS configuration has been impacted.
	*AAA Policy* – Indicates an *Authentication, Authorization and Accounting* (AAA) policy has been impacted. AAA policies define RADIUS authentication and accounting parameters.
	*Association ACL* – Indicates an *Access Control List* (ACL) configuration has been impacted. An ACL is a set of configuration parameters either allowing or denying access to network resources.
	*Smart RF Policy* – States a Smart RF policy has been impacted. Smart RF enables neighboring Access Point radios to take over for an Access Point radio if it becomes unavailable. This is accomplished by increasing the power of radios on nearby Access Points to compensate for the coverage hole created by the non-functioning Access Point.
	*Profile* – States a device profile configuration has been impacted. A profile is a collection of configuration parameters used to configure a device or a feature.

	Bridging Policy – Indicates a bridging policy configuration has been impacted. A bridging policy defines which VLANs are bridged, and how local VLANs are bridged between the wired and wireless sides of the network.
	RF Domain – States an RF Domain configuration has been impacted.
	Firewall Policy – Indicates a firewall policy has been impacted. Firewalls provide a barrier that prevents unauthorized access to resources while allowing authorized access to external and internal resources.
IP	*IP Firewall Rules* – Indicates an IP firewall rule has been applied. An IP based firewall rule implements restrictions based on the IP address in a received packet.
MAC	*MAC Firewall Rules* – States a MAC based firewall rule has been applied. A MAC based firewall rule implements network allowance restrictions based on the MAC address in a received data packet.
	Wireless Client Role – Indicates a wireless client role has been applied to a managed client. The role could be either sensor or client.
	WIPS Policy – States the conditions of a WIPS policy have been invoked. WIPS prevents unauthorized access to the network by checking for (and removing) rogue Access Points and wireless clients.
	Device Categorization – Indicates a device categorization policy has been applied. This is used by the intrusion prevention system to categorize Access Points or wireless clients as either sanctioned or unsanctioned devices. This enables devices to bypass the intrusion prevention system.
	Captive Portals – States a captive portal is being applied. Captive portal is used to provide temporary controller, service platform or Access Point access to requesting wireless clients.
	DNS Whitelist – A DNS whitelist is used in conjunction with captive portal to provide access to requesting wireless clients.
0101	*DHCP Server Policy* – Indicates a DHCP server policy is being applied. DHCP provides IP addresses to wireless clients. A DHCP server policy configures how DHCP provides IP addresses.
	RADIUS Group – Indicates the configuration of RADIUS group has been defined and applied. A RADIUS group is a collection of RADIUS users with the same set of permissions.

	RADIUS User Pools – States a RADIUS user pool has been applied. RADIUS user pools are a set of IP addresses that can be assigned to an authenticated RADIUS user.
	RADIUS Server Policy – Indicates a RADIUS server policy has been applied. A RADIUS server policy is a set of configuration attributes used when a RADIUS server is configured for AAA.
	Management Policy – Indicates a management policy has been applied. Management policies configure access control, authentication, traps and administrator permissions.
	BGP – *Border Gateway Protocol* (BGP) is an inter-ISP routing protocol which establishes routing between ISPs. ISPs use BGP to exchange routing and reachability information between *Autonomous Systems* (AS) on the Internet. BGP makes routing decisions based on paths, network policies and/or rules configured by network administrators.

2.2.6 Configuration Objects

▸ *Glossary of Icons Used*

These configuration icons are used to define the following:

	Configuration – Indicates an item capable of being configured by an interface.
	View Events / Event History – Defines a list of events. Click this icon to view events or view the event history.
	Core Snapshots – Indicates a core snapshot has been generated. A core snapshot is a file that records status events when a process fails on a wireless controller or Access Point.
	Panic Snapshots – Indicates a panic snapshot has been generated. A panic snapshot is a file that records status when a wireless controller or Access Point fails without recovery.
	UI Debugging – Select this icon/link to view current NETCONF messages.
	View UI Logs – Select this icon/link to view the different logs generated by the UI, FLEX and the error logs.

2.2.7 Configuration Operation Icons

▶ *Glossary of Icons Used*

The following operations icons are used to define configuration operations:

↶	*Revert* – When selected, any unsaved changes are reverted to their last saved configuration settings.
📥	*Commit* – When selected, all changes made to the configuration are written to the system. Once committed, changes cannot be reverted.
💾	*Commit and Save* – When selected, changes are saved to the configuration.

2.2.8 Access Type Icons

▶ *Glossary of Icons Used*

The following icons display a user access type:

🌐🔑	*Web UI* – Defines a Web UI access permission. A user with this permission is permitted to access an associated device's Web UI.
🔑	*Telnet* – Defines a TELNET access permission. A user with this permission is permitted to access an associated device using TELNET.
🔒🔑	*SSH* – Indicates a SSH access permission. A user with this permission is permitted to access an associated device using SSH.
🖥🔑	*Console* – Indicates a console access permission. A user with this permission is permitted to access an associated device using the device's serial console.

2.2.9 Administrative Role Icons

- *Glossary of Icons Used*

The following icons identify the different administrative roles allowed on the system:

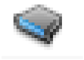
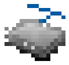
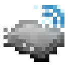
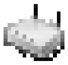
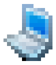
👤	*Superuser* – Indicates superuser privileges. A superuser has complete access to all configuration aspects of the connected device.
👤	*System* – States system user privileges. A system user is allowed to configure general settings, such as boot parameters, licenses, auto install, image upgrades etc.
👤	*Network* – Indicates network user privileges. A network user is allowed to configure wired and wireless parameters, such as IP configuration, VLANs, L2/L3 security, WLANs and radios.
👤	*Security* – Indicates security user privileges. A security level user is allowed to configure all security related parameters.
👤	*Monitor* – Defines a monitor role. This role provides no configuration privileges. A user with this role can view the system configuration but cannot modify it.
👤 ?	*Help Desk* – Indicates help desk privileges. A help desk user is allowed to use troubleshooting tools like sniffers, execute service commands, view or retrieve logs and reboot the controller or service platform.
👤 🌐	*Web User* – Indicates a web user privilege. A Web user is allowed accessing the device's Web UI.

2.2.10 Device Icons

- *Glossary of Icons Used*

The following icons represent the different device types managed by the system:

🌐	*System* – This icon represents the entire WiNG supported system, and all of its member controller, service platform or Access Points that may be interacting at any one time.
☁	*Cluster* – This icon represents a cluster. A cluster is a set of wireless controllers or service platforms working collectively to provide redundancy and load sharing amongst its members.

	*Service Platform* – This icon indicates an NX5500, NX7500, or NX9000 series service platform that's part of the managed network
	Wireless Controller – This icon indicates a RFS6000 wireless controller that's part of the managed network.
	Wireless Controller – This icon indicates a RFS6000 wireless controller that's part of the managed network.
	Access Point – This icon lists any Access Point that's part of the managed network.
	*Wireless Client* – This icon defines any wireless client connection within the network.

3 Quick Start

WiNG controllers and service platforms utilize an initial setup wizard to streamline getting on the network for the first time. This wizard configures location, network and WLAN settings and assists in the discovery of Access Points and their connected clients.

3.1 Using the Initial Setup Wizard

Once deployed and powered on, complete the following to get the controller or service platform up and running and access more advanced user interface functions:

1 Connect one end of an Ethernet cable to a port on the front of the controller or service platform, and connect the other end to a computer with a working Web browser.

2 Set the computer to use an IP address between 192.168.0.10 and 192.168.0.250 on the connected port. Set a subnet/network mask of 255.255.255.0.

3 Once the computer has an IP address, point the Web browser to: https://192.168.0.1/. The following login screen displays.

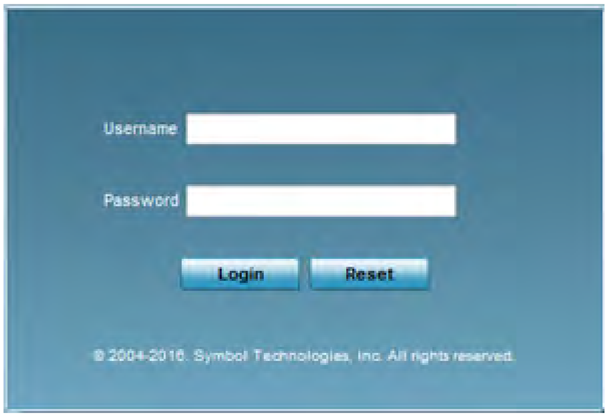


Figure 3-1 *Web UI Login Screen*

4 Enter the default username **admin** in the **Username** field.

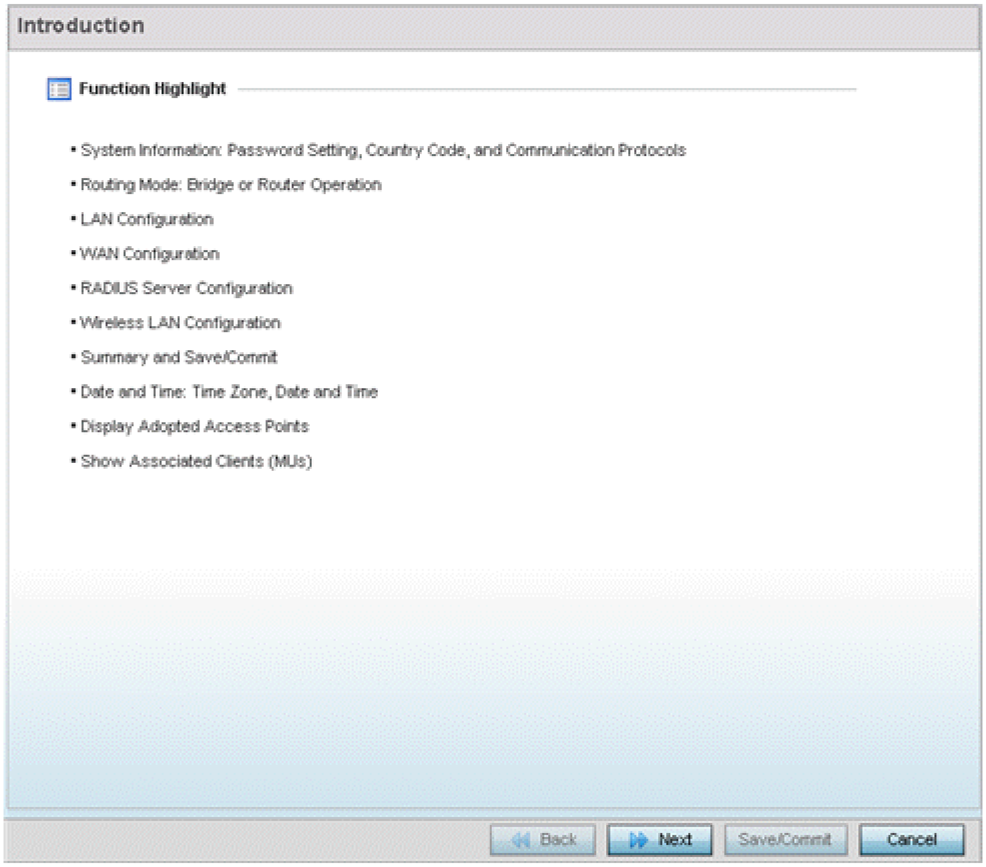
5 Enter the default password **admin123** in the **Password** field.

6 Select the preferred language to display for the *graphical user interface* (GUI).

7 Select the **Login** button to load the management interface.

✓ **NOTE:** When logging in for the first time, you are prompted to change the password to enhance device security in subsequent logins.

✓ **NOTE:** If you get disconnected when running the wizard, you can connect again and resume the wizard setup.



Introduction

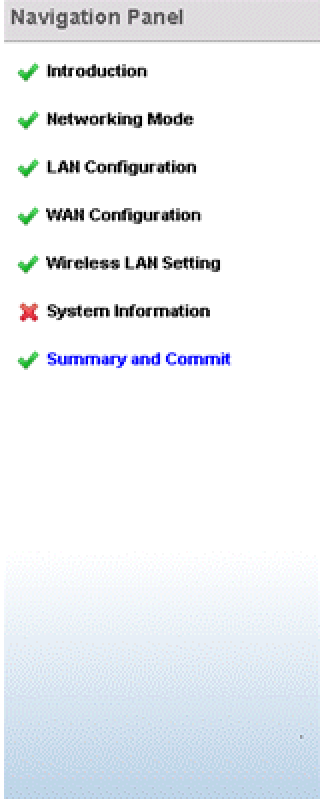
Function Highlight

- System Information: Password Setting, Country Code, and Communication Protocols
- Routing Mode: Bridge or Router Operation
- LAN Configuration
- WAN Configuration
- RADIUS Server Configuration
- Wireless LAN Configuration
- Summary and Save/Commit
- Date and Time: Time Zone, Date and Time
- Display Adopted Access Points
- Show Associated Clients (MUs)

Figure 3-2 *Initial Setup Wizard - Introduction*

The **Introduction** screen displays first (on the right-hand side of the screen), and lists the various actions that can be performed using the setup wizard.

The wizard displays a **Navigation Panel** on the left-hand side of each screen to assist the administrator in assessing which tasks still require completion before the controller or service-platform can be deployed.



Navigation Panel

✓ Introduction

✓ Networking Mode

✓ LAN Configuration

✓ WAN Configuration

✓ Wireless LAN Setting

✗ System Information

✓ Summary and Commit

Figure 3-3 *Initial Setup Wizard - Navigation Panel*

A green checkmark to the left of an item in the Navigation Panel defines the task as having its minimum required configuration set correctly. A red X defines a task as still requiring at least one parameter be defined correctly.

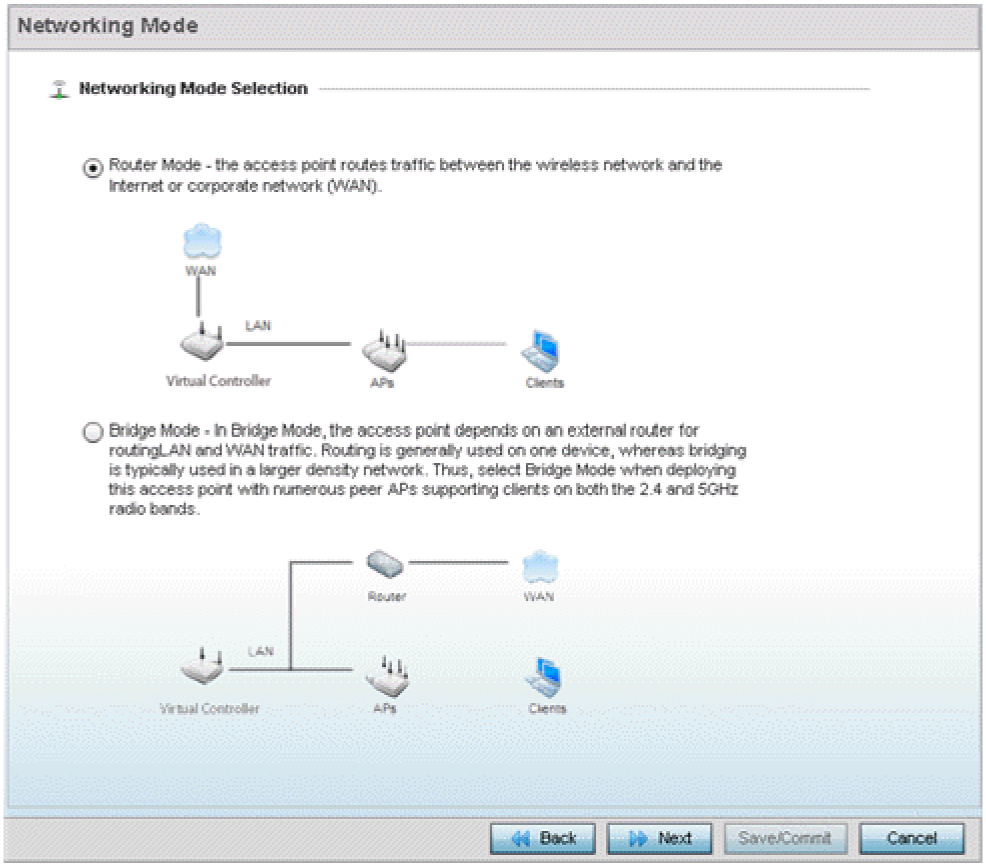
8 Select **Save/Commit** within each page to save the updates made to that page's configuration.

9 Select **Next** to proceed to the next page listed in the Navigation Panel.

10 Select **Back** to revert to the previous screen in the Navigation Panel without saving your updates. Selecting **Cancel** closes the wizard without committing any updates.

NOTE: While you can scroll to any page in the Navigation Panel at any time, you cannot complete the wizard until each task in the Navigation Panel has a green checkmark displayed to the left of the task.

11 Select **Next.** The wizard displays the **Networking Mode** screen to define routing or bridging functionality.



Networking Mode

Networking Mode Selection

● Router Mode - the access point routes traffic between the wireless network and the Internet or corporate network (WAN).

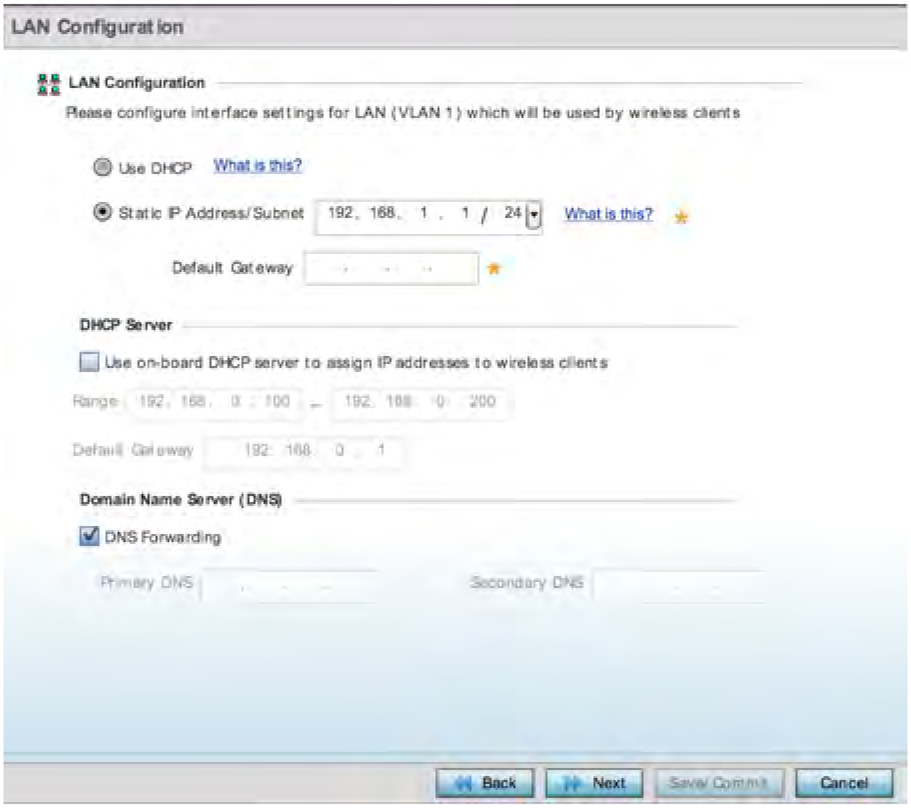
○ Bridge Mode - In Bridge Mode, the access point depends on an external router for routingLAN and WAN traffic. Routing is generally used on one device, whereas bridging is typically used in a larger density network. Thus, select Bridge Mode when deploying this access point with numerous peer APs supporting clients on both the 2.4 and 5GHz radio bands.

Figure 3-4 *Initial Setup Wizard - Networking Mode*

12 Select one of the following network mode options:

- *Router Mode* - In Router Mode, connected Access Points route traffic between the *local network* (LAN) and the Internet or *external network* (WAN). Router mode is recommended in a deployment supported by just a single Access Point. When Router Mode is selected, an additional WAN screen is available in wizard screen flow to configure interface settings for an Access Point's WAN port.
- *Bridge Mode* - In Bridge Mode, connected Access Points depend on an external router for routing LAN and WAN traffic. Routing is generally used on one device, whereas bridging is typically used in a larger network. Thus, select Bridge Mode when deploying numerous peer Access Points supporting clients on both the 2.4 and 5GHz radio bands.

13 Select **Next**. The wizard displays the **LAN Configuration** screen to set the LAN interface configuration.



LAN Configuration

LAN Configuration

Please configure interface settings for LAN (VLAN 1) which will be used by wireless clients

○ Use DHCP What is this?

● Static IP Address/Subnet 192 . 168 . 1 . 1 / 24 What is this?

Default Gateway

DHCP Server

□ Use on-board DHCP server to assign IP addresses to wireless clients

Range 192 . 168 . 0 . 100 – 192 . 168 . 0 . 200

Default Gateway 192 . 168 . 0 . 1

Domain Name Server (DNS)

☑ DNS Forwarding

Primary DNS

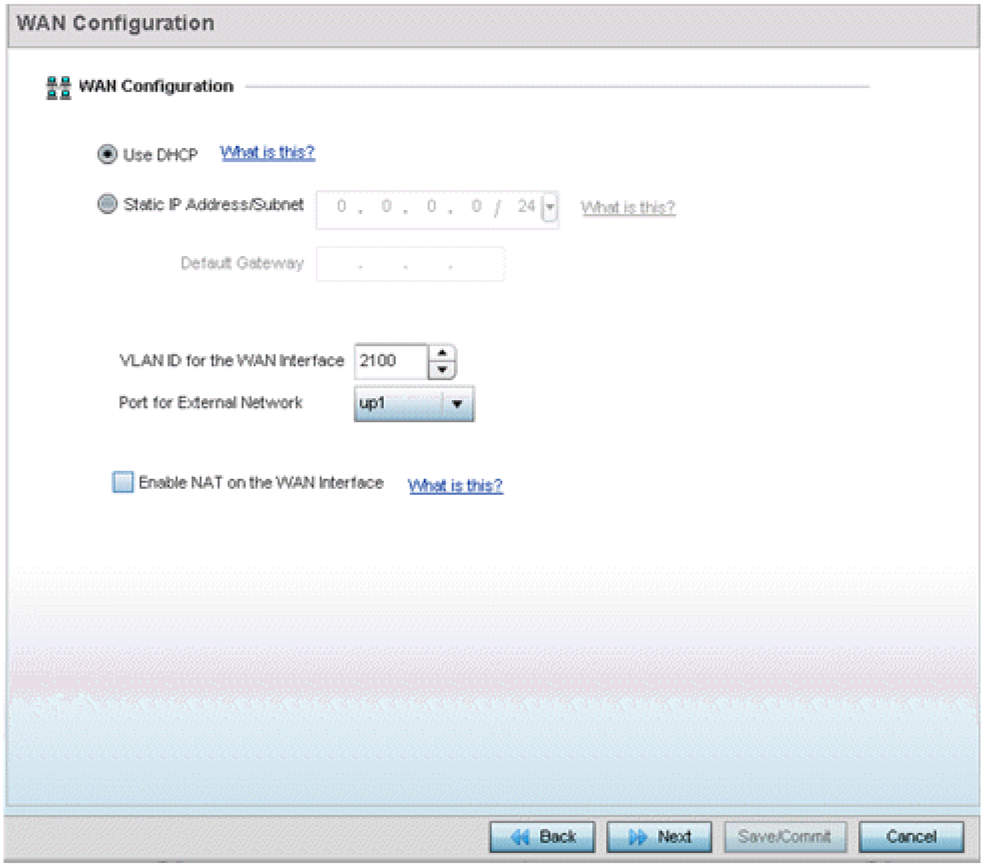
Secondary DNS

Figure 3-5 *Initial Setup Wizard - LAN Configuration*

14 Set the following DHCP information for the LAN interface:

- *Use DHCP* - Select Use DHCP to enable an automatic network address configuration using local DHCP server resources.
- *Static IP Address/Subnet* - Enter an IP Address and a subnet for the LAN interface. If Use DHCP is selected, this field is not available. When selecting this option, define the following DHCP Server and *Domain Name Server* (DNS) resources, as those fields are enabled on the bottom portion of the screen.
  - *Use on-board DHCP server to assign IP addresses to wireless clients* - Select this option to enable the DHCP server to provide IP and DNS support to requesting clients on the LAN interface.
  - *Range* - Enter a starting and ending IP Address range for client assignments on the LAN interface. Avoid assigning IP addresses from x.x.x.1 - x.x.x.10 and x.x.x.255, as they are often reserved for standard network services. This is a required parameter.
  - *Default Gateway* - Define a default an address for use with the default gateway. This is a required parameter.
- *DNS Forwarding* - Select this option to allow a DNS server to translate domain names into IP addresses. If this option is not selected, a primary and secondary DNS resource must be specified. DNS forwarding is useful when a request for a domain name is made but the DNS server, responsible for converting the name into its corresponding IP address, cannot locate the matching IP address.
  - Primary DNS - Enter an IP Address for the main Domain Name Server providing DNS services for the LAN interface.
  - Secondary DNS - Enter an IP Address for the backup Domain Name Server providing DNS services for the LAN interface.

15 Select **Next**. If Router was selected as the Access Point mode the wizard displays the **WAN Configuration** screen. If Bridge was selected, the wizard proceeds to the **Wireless LAN Setting** screen.



WAN Configuration

WAN Configuration

● Use DHCP What is this?

○ Static IP Address/Subnet 0 . 0 . 0 . 0 / 24 What is this?

Default Gateway . . .

VLAN ID for the WAN Interface 2100

Port for External Network up1

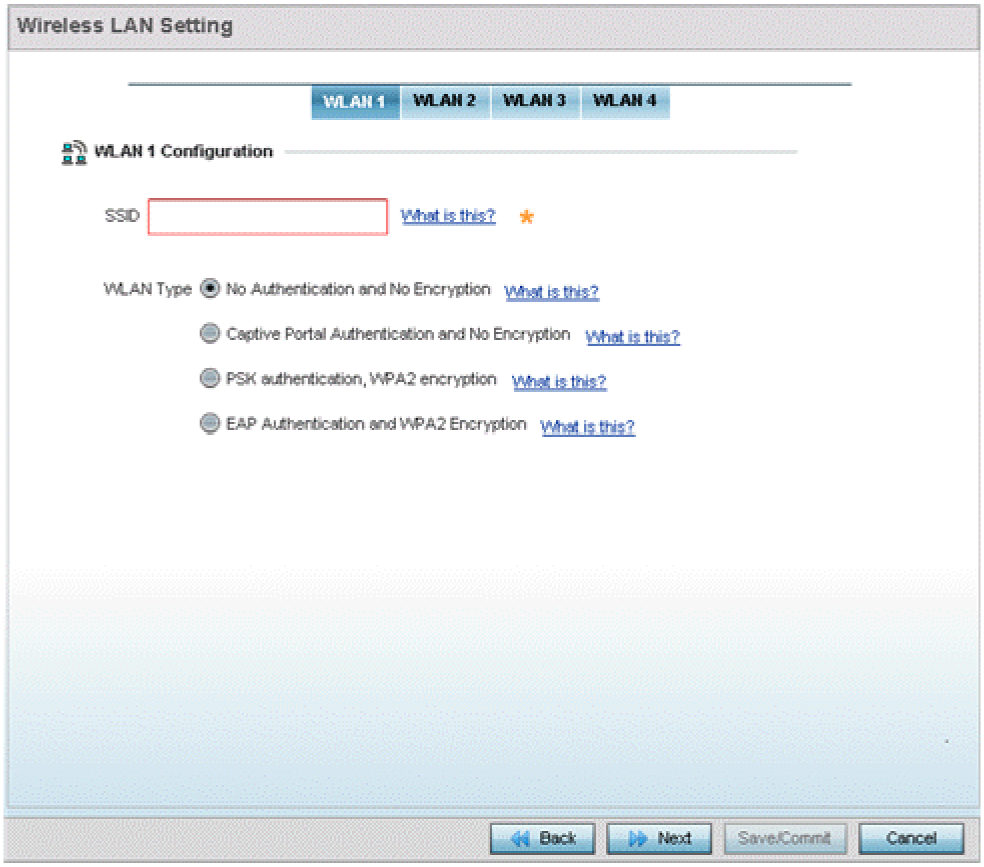
□ Enable NAT on the WAN Interface What is this?

Figure 3-6 *Initial Setup Wizard - WAN Configuration*

16 Set the following DHCP and Static IP Address/Subnet information to define how traffic is routed between the *local network* (LAN) and the Internet or *external network* (WAN).

- *Use DHCP* - Select Use DHCP to enable an automatic network address configuration using local DHCP server resources.
- *Static IP Address/Subnet* - Enter an IP Address/Subnet and gateway for the WAN interface. These are required fields
  - *Default Gateway* -Enter an IP Address for the default gateway on the WAN interface. If Use DHCP is enabled, this field is not configurable.
  - *VLAN ID for the WAN Interface* - Set the VLAN ID (virtual interface) to associate with the physical WAN Interface. The default setting is VLAN 2100.
  - *Port for External Network* - Select the physical port connected to the WAN interface. The list of available ports varies based on the controller or service platform model.
  - *Enable NAT on the WAN Interface* - Select the option to allow traffic to pass between WAN and LAN interfaces.

17 Select **Next**. The wizard displays the **Wireless LAN Setting** screen to define up to four WLAN configurations for the controller or service platform.



Wireless LAN Setting

WLAN 1 Configuration

SSID ☐ *

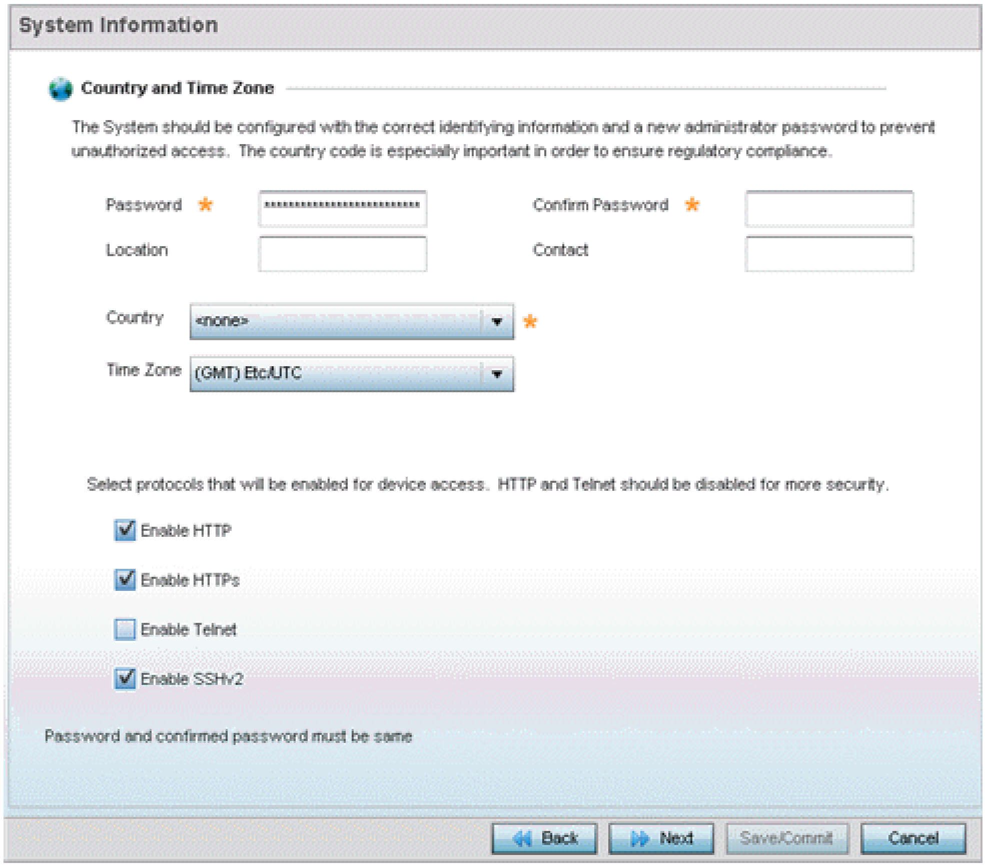
WLAN Type
● No Authentication and No Encryption
○ Captive Portal Authentication and No Encryption
○ PSK authentication, WPA2 encryption
○ EAP Authentication and WPA2 Encryption

Figure 3-7 *Initial Setup Wizard - Wireless LAN Settings*

18 Set the following parameters for up to four WLAN configurations:

- *SSID* - Enter or modify the *Services Set Identification* (SSID) associated with the WLAN. The WLAN name is auto-generated using the SSID until changed by the administrator. The maximum number of characters is 32. Do not use any of these characters (< > | " & \ ? ,).
- *WLAN Type* - Select a basic authentication and encryption scheme for the WLAN. Available options include:
  - *No Authentication and No Encryption* (provides no security at all)
  - *Captive Portal Authentication and No Encryption*
  - *PSK authentication, WPA2 encryption*
  - *EAP Authentication and WPA2 Encryption*

19 Select **Next.** The wizard displays the **System Information** screen to set device deployment, administrative contact and system time information. The system time can either be set manually or be supplied by a dedicated *Network Time Protocol (NTP)* resource.



System Information

Country and Time Zone

The System should be configured with the correct identifying information and a new administrator password to prevent unauthorized access. The country code is especially important in order to ensure regulatory compliance.

Password * ****************************

Confirm Password *

Location

Contact

Country <none> *

Time Zone (GMT) Etc/UTC

Select protocols that will be enabled for device access. HTTP and Telnet should be disabled for more security.

☑ Enable HTTP

☑ Enable HTTPs

☐ Enable Telnet

☑ Enable SSHv2

Password and confirmed password must be same

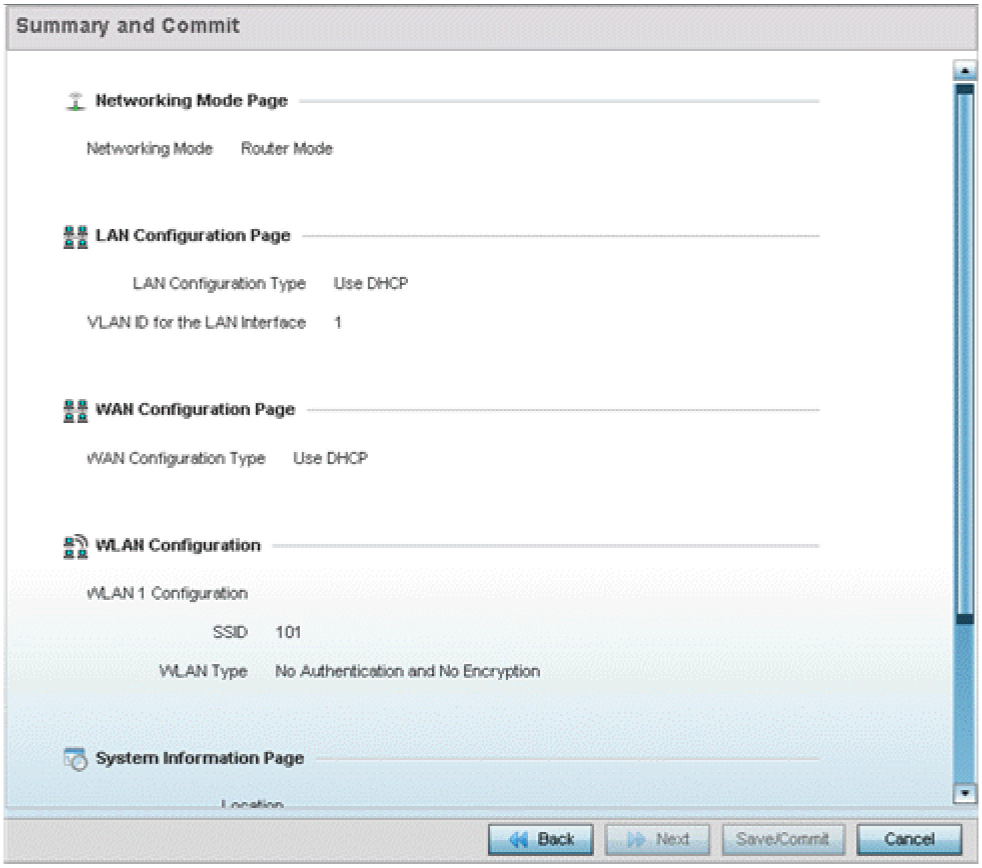
Figure 3-8 *Initial Setup Wizard - System Information*

20 Refer to the **Country and Time Zone** field to set the following deployment information:

- *Password* - Enter and confirm a system password used to login into the controller or service platform on subsequent login attempts.Changing the default system password is strongly recommended to secure the proprietary configuration data maintained on the controller or service platform.
- *Location* - Define the location of the controller or service platform deployment.
- *Contact* - Specify the contact information for the administrator. The credentials provided should accurately reflect the individual responding to service queries.
- *Country* - Select the country where the controller or service platform is deployed. The controller or service platform prompts for the correct country code on the first login. A warning message also displays stating an incorrect country setting may result in illegal radio operation. Selecting the correct country is central to legal operation. Each country has its own regulatory restrictions concerning electromagnetic emissions and the maximum RF signal strength that can be transmitted.
- *Time Zone* - Set the time zone where the controller or service platform is deployed. This is a required parameter. The setting should be complimentary with the selected deployment country.

Refer to the **Select protocols that will be enabled for device access** area and enable those controller or service platform interfaces for accessing the controller or service platform. HTTP and Telnet are considered relatively insecure and only should be enabled is necessary.

21 Select **Next.** The wizard displays the **Summary and Commit** screen to summarize the screens (pages) and settings updated using the wizard.



Summary and Commit

Networking Mode Page

Networking Mode Router Mode

LAN Configuration Page

LAN Configuration Type Use DHCP

VLAN ID for the LAN Interface 1

WAN Configuration Page

WAN Configuration Type Use DHCP

WLAN Configuration

WLAN 1 Configuration

SSID 101

WLAN Type No Authentication and No Encryption

System Information Page

Location

Figure 3-9 *Initial Setup Wizard - Summary and Commit*

No user intervention or additional settings are required within this screen. Its an additional means of validating the Access Point’s updated configuration before it’s deployed. However, if a screen displays settings not intended as part of the initial configuration, the any screen can be selected again from within the Navigation Panel and its settings modified accordingly.

22 If the configuration displays as intended, select **Save/Commit** to implement these settings to the controller or service platform configuration. If additional changes are warranted based on the summary, either select the target page from the Navigational Panel, or use the **Back** and **Next** buttons to scroll to the target screen.

4 Dashboard

The dashboard enables administrators to review and troubleshoot network device operation. Additionally, the dashboard allows an administrative review of the network's topology, an assessment of network's component health and a diagnostic review of device performance.

By default, the **Dashboard** displays the **System** screen, which is the top level in the device hierarchy. To view information for **Access Points**, **RF Domains** or **Controllers** select the associated item in the tree.

For more information, refer to the following:

- *Summary*
- *System Screen*
- *RF Domain Screen*
- *Controller*
- *Access Point Screen*
- *Network View*
- *Debug Wireless Clients*
- *Debug Captive Portal Clients*
- *Packet Capture*

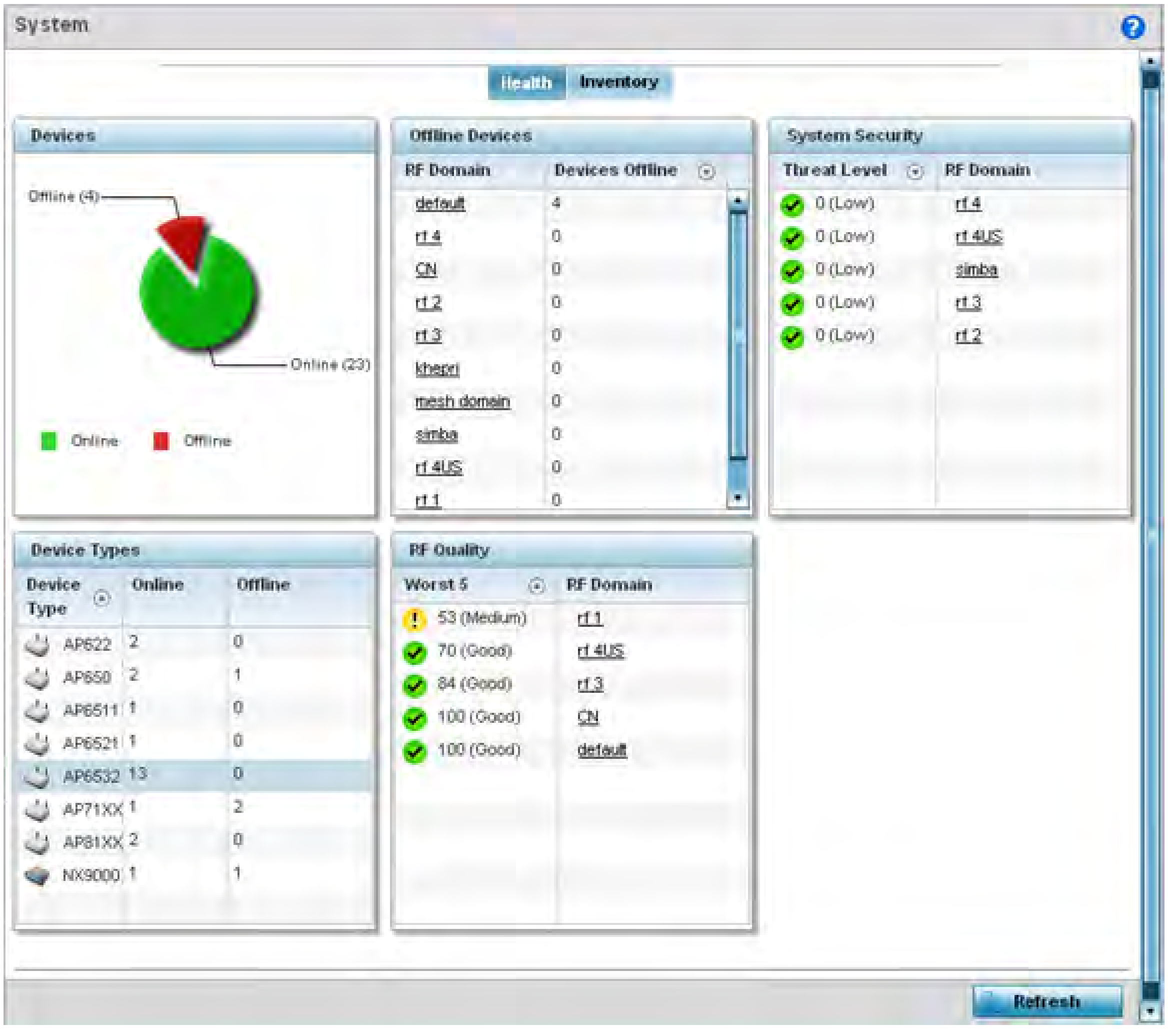
4.1 Summary

The **Dashboard** displays information organized by device association and inter-connectivity between the connected Access Points and wireless clients.

1 To review dashboard information, select **Dashboard**.

2 Select **Summary** if it's not already selected by default.

The Dashboard displays the **Health** tab by default.



Devices

Offline Devices

RF Domain	Devices Offline
default	4
rf 4	0
CN	0
rf 2	0
rf 3	0
khepri	0
mesh domain	0
simba	0
rf 4US	0
rf 1	0

System Security

Threat Level	RF Domain
✓ 0 (Low)	rf 4
✓ 0 (Low)	rf 4US
✓ 0 (Low)	simba
✓ 0 (Low)	rf 3
✓ 0 (Low)	rf 2

Device Types

Device Type	Online	Offline
AP622	2	0
AP650	2	1
AP6511	1	0
AP6521	1	0
AP6532	13	0
AP71XX	1	2
AP81XX	2	0
NX9000	1	1

RF Quality

Worst 5	RF Domain
! 53 (Medium)	rf 1
✓ 70 (Good)	rf 4US
✓ 84 (Good)	rf 3
✓ 100 (Good)	CN
✓ 100 (Good)	default

Figure 4-1 *System Dashboard screen - Health tab*

4.1.1 Device Listing

▸ *Summary*

The device menu displays information as a hierarchical tree, comprised of system, controller/service platform and Access Point connection relationships.

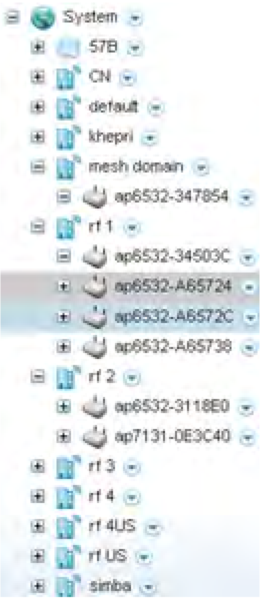


Figure 4-2 *Dashboard Menu Tree*

The **Search** option, at the bottom of the screen, enables you to filter (search amongst) RF Domains. The **By** drop-down menu refines the search. You can further refine a search using the following:

- *Auto* – The search is automatically set to device type.
- *Name* – The search is performed for the device name specified in the **Search** text box.
- *WLAN* – The search is performed for the WLAN specified in the **Search** text box.
- *IP Address* – The search is performed for the IP Address specified in the **Search** text box.
- *MAC Address* – The search is performed for the MAC Address specified in the **Search** text box.

4.2 System Screen

The **System** screen displays system-wide network status. The screen is partitioned into the following tabs:

- *Health* – The Health tab displays information about the state of the WiNG device managed system.
- *Inventory* – The Inventory tab displays information on the physical devices managed within the WiNG wireless network.

4.2.1 Health

▸ *Health*

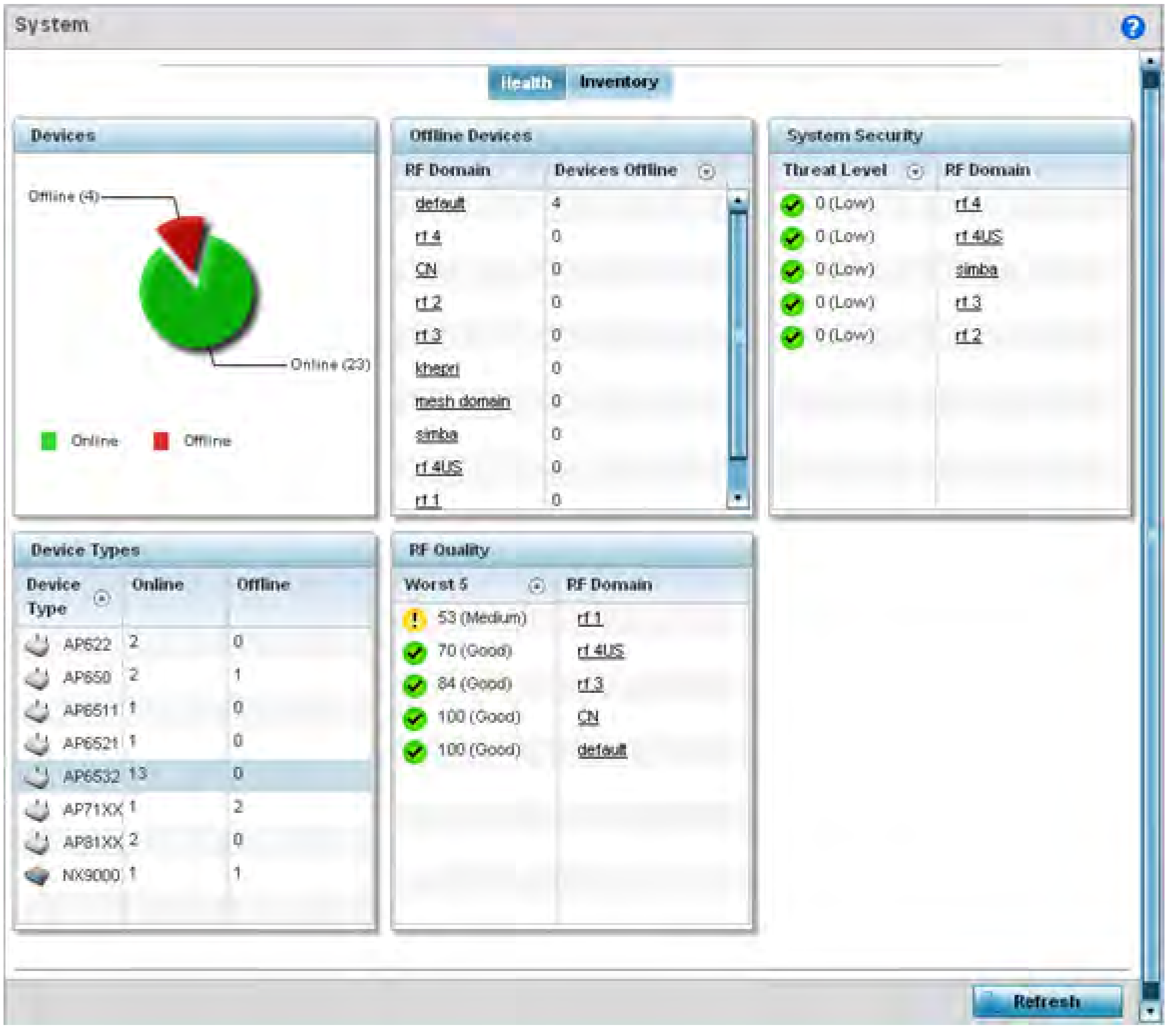
The **Health** tab displays device performance status for managed devices, and includes their RF Domain memberships.

To assess system health:

1 Select **Dashboard**.

2 Select **Summary** if it’s not already selected by default.

3 Select **System**. The **Health** tab displays by default.



Offline Devices

RF Domain	Devices Offline
default	4
rf 4	0
CN	0
rf 2	0
rf 3	0
khepri	0
mesh domain	0
simba	0
rf 4US	0
rf 1	0

System Security

Threat Level	RF Domain
✓ 0 (Low)	rf 4
✓ 0 (Low)	rf 4US
✓ 0 (Low)	simba
✓ 0 (Low)	rf 3
✓ 0 (Low)	rf 2

Device Types

Device Type	Online	Offline
AP622	2	0
AP650	2	1
AP6511	1	0
AP6521	1	0
AP6532	13	0
AP71XX	1	2
AP81XX	2	0
NX9000	1	1

RF Quality

Worst 5	RF Domain
! 53 (Medium)	rf 1
✓ 70 (Good)	rf 4US
✓ 84 (Good)	rf 3
✓ 100 (Good)	CN
✓ 100 (Good)	default

Figure 4-3 *System Dashboard screen - Health tab*

The **Health** screen is partitioned into the following fields:

- The **Devices** field displays a ratio of offline versus online devices within the system. The information is displayed in pie chart format to illustrate device support ratios.
- The **Device Type** field displays a numerical representation of the different controller, service platform and Access Point models in the current system. Their online and offline device connections are also displayed. Does this device distribution adequately support the number and types of Access Point radios and their client load requirements.
- The **Offline Devices** field displays a table of supported RF Domains within the system, with each RF Domain listing the number offline devices within that RF Domain. Listed RF Domains display as individual links that can be selected to RF Domain information in greater detail.
- The **RF Quality Index** displays RF quality per RF Domain. It's a measure of the overall effectiveness of the RF environment displayed in percentage. It's a function of the connect rate in both directions, retry rate and error rate.

The **RF Quality** field displays an average quality index supporting each RF Domain. The table lists the bottom five (5) RF quality values for RF Domains. Listed RF Domains display as individual links that can be selected to RF Domain information in greater detail. Use this diagnostic information to determine what measures can be taken to improve radio performance in respect to wireless client load and the radio bands supported.

The quality is measured as:

- 0-20 – *Very poor quality*

- 20-40 – *Poor quality*
- 40-60 – *Average quality*
- 60-100 – *Good quality*

The **System Security** field displays RF intrusion prevention stats and their associated threat level. The greater the number of unauthorized devices, the greater the associated threat level. The System Security field displays a list of up to five RF Domains in relation to the number of associated wireless clients. The RF Domains appear as links that can be selected to display RF Domain information in greater detail.

4.2.2 Inventory

System Screen

The system screen's **Inventory** tab displays granular data on specific devices supported within the network. The screen provides a complete overview of the number and state WiNG managed devices. Information is displayed in easy to read tables and graphs. This screen also provides links for more detailed information.

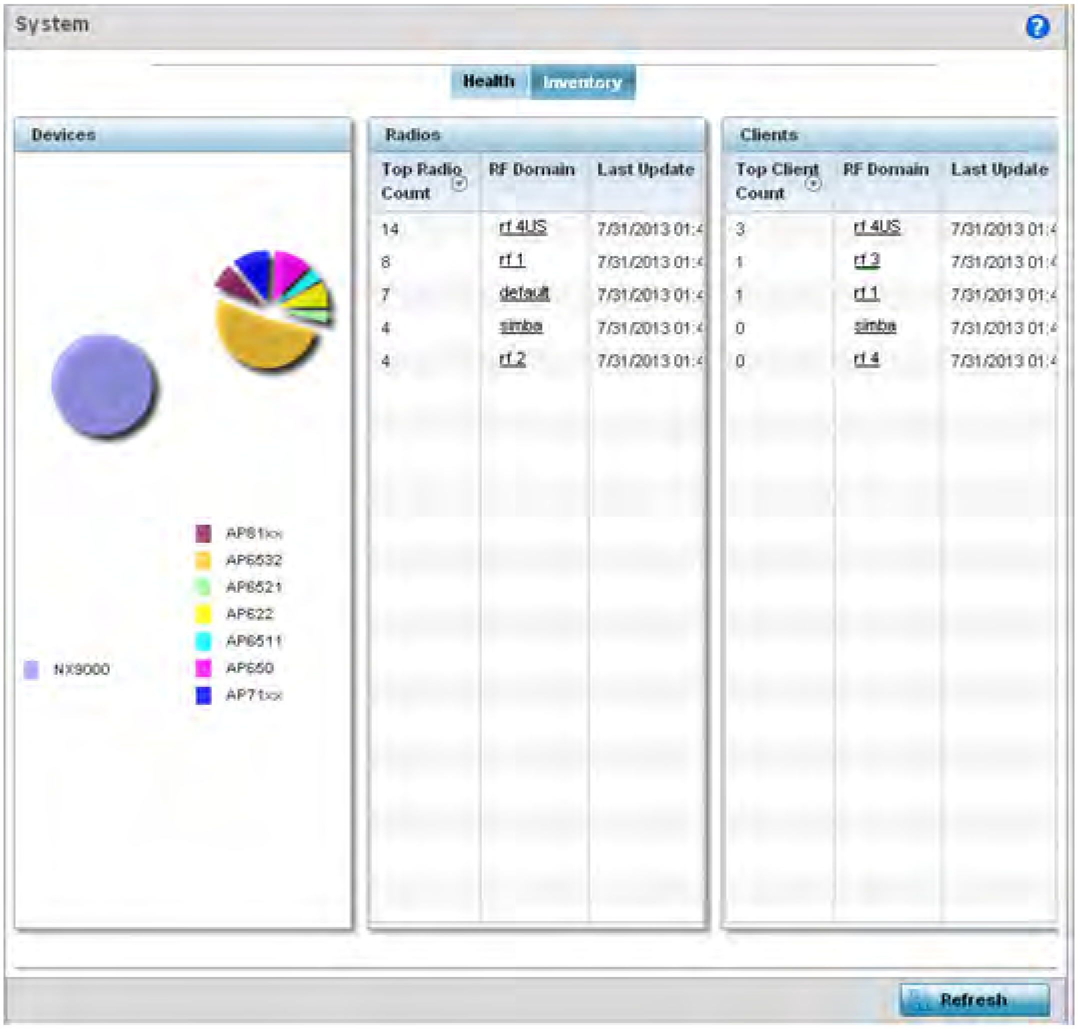
To assess the system inventory:

1 Select **Dashboard**.

2 Select **Summary** if it's not already selected by default.

3 Select **System**.

4 Select the **Inventory** tab.



Radios

Top Radio Count	RF Domain	Last Update
14	rf 4US	7/31/2013 01:4
8	rf 1	7/31/2013 01:4
7	default	7/31/2013 01:4
4	simba	7/31/2013 01:4
4	rf 2	7/31/2013 01:4

Clients

Top Client Count	RF Domain	Last Update
3	rf 4US	7/31/2013 01:4
1	rf 3	7/31/2013 01:4
1	rf 1	7/31/2013 01:4
0	simba	7/31/2013 01:4
0	rf 4	7/31/2013 01:4

Figure 4-4 *System screen - Inventory tab*

The information within the Inventory tab is partitioned into the following fields:

- The **Devices** field displays a ratio of peer controllers and service platforms as well as their managed Access Point radios. The information is displayed in pie chart format. The Device Type field displays a numerical representation of the different controller models and connected Access Points in the current system.
- The **Radios** field displays top performing radios, their RF Domain memberships and a status time stamp. RF Domain information can be selected to review RF Domain membership information in greater detail. Information in the Radio area is presented in two tables. The first lists the total number of Radios managed by this system, the second lists the top five RF Domains in terms of the number of available radios.
- The wireless **Clients** field lists the top five RF Domains with the highest total number of clients managed by connected devices in this system. RF Domain information can be selected to review RF Domain membership information in greater detail. Select **Refresh** to update the screen to its latest values.

4.3 RF Domain Screen

RF Domains allow administrators to assign configuration data to multiple devices deployed in a common coverage area, such as in a floor, building or site. Each RF Domain contains policies that can determine a Smart RF or WIPS configuration.RF Domains enable administrators to override WLAN SSID name and VLAN assignments. This enables the deployment of a global WLAN across multiple sites and unique SSID name or VLAN assignments to groups of Access Points servicing the global WLAN. This WLAN override technique eliminates the requirement for defining and managing a large number of individual WLANs and profiles.

A configuration contains (at a minimum) one default RF Domain and can optionally use additional user defined RF Domains:

- Default RF Domain - Automatically assigned to each controller or service platform and associated Access Point by default.
- User Defined RF Domains - Created by administrators and manually assigned to individual controller or service platforms, but can be automatically assigned to Access Points using adoption policies.

Each controller and service platform is assigned to only one RF Domain at a time. However, a user defined RF Domain can be assigned to multiple controllers or service platforms as required. User defined RF Domains can be manually assigned or automatically assigned to Access Points using an AP provisioning policy.

The **RF Domain** screen displays system-wide network status. The screen is partitioned into the following tabs:

- *RF Domain Health* – The Health tab displays information about the state of the RF Domain and network performance as tallied from its collective device members.
- *RF Domain Inventory* – The Inventory tab displays information on the physical devices comprising the RF Domain.

4.3.1 RF Domain Health

The **Health** tab displays the status of the RF Domain’s device membership.

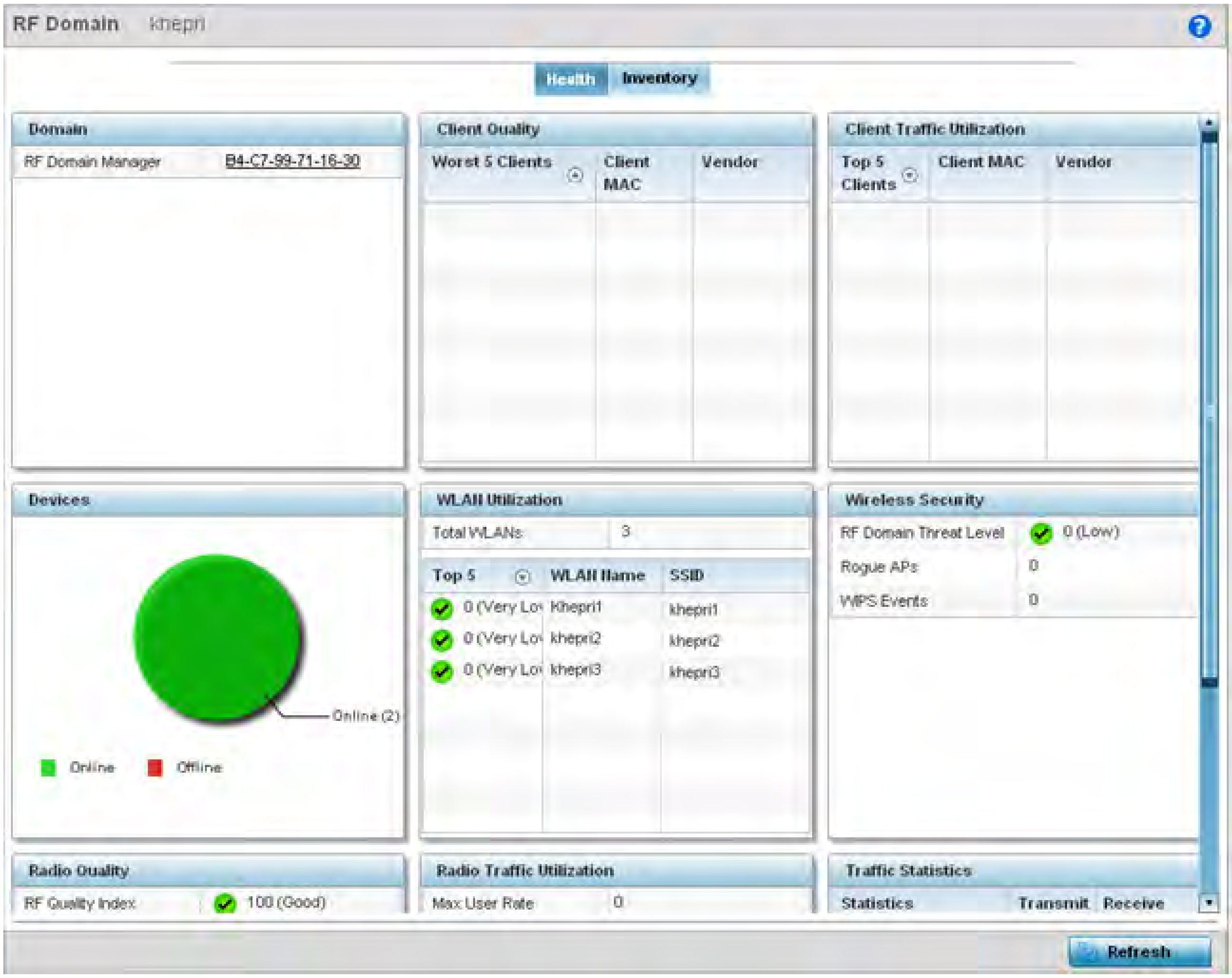
To assess the RF Domain health:

1 Select **Dashboard**.

2 Select **Summary** if it’s not already selected by default.

3 Expand the **System** node to display RF Domains.

4 Select a **RF Domain**. The **Health** tab displays by default.



Domain

RF Domain Manager	B4-C7-99-71-16-30

Client Quality

Worst 5 Clients	Client MAC	Vendor

Client Traffic Utilization

Top 5 Clients	Client MAC	Vendor

Devices

WLAN Utilization

Total WLANs	3

Top 5	WLAN Name	SSID
✓ 0 (Very Lo	Khepri1	khepri1
✓ 0 (Very Lo	khepri2	khepri2
✓ 0 (Very Lo	khepri3	khepri3

Wireless Security

RF Domain Threat Level	✓ 0 (Low)
Rogue APs	0
WIPS Events	0

Radio Quality

RF Quality Index	✓ 100 (Good)

Radio Traffic Utilization

Max User Rate	0

Traffic Statistics

Statistics	Transmit	Receive

Figure 4-5 *RF Domain screen - Health tab*

Refer to the following RF Domain health information for member devices:

- The **Domain** field lists the RF Domain manager reporting utilization statistics. The MAC address displays as a link that can be selected to display RF Domain information in at more granular level. A RF Domain manager can retain and store new firmware images for RF Domain member Access Points.
- The **Devices** field displays the total number of devices and the status of the devices in the network as a graph. This area displays the total device count managed by this device and their status (online vs. offline) as a pie graph.
- The **Radio Quality** table displays a table of RF quality on a per radio basis. It is a measure of the overall effectiveness of the RF environment displayed in percentage. It is a function of the transmit retry rate in both directions and the error rate. This area of the screen displays the average quality index across all the defined RF Domain on the wireless controller. The table lists worst five of the RF quality values of all the radios defined on the wireless controller. The quality is measured as:
  - 0-20 - *Very poor quality*
  - 20-40 - Poor quality
  - 40-60 - *Average quality*
  - 60-100 - *Good quality*

5 Select a **Radio Id** to view all the statistics for the selected radio in detail.

- The Client Quality table displays RF quality for the worst five performing clients.It is a function of the transmit retry rate in both directions and the error rate. This area of the screen displays the average quality index across all the defined RF Domain on the wireless controller. The quality is measured as:
  - 0-20 - *Very poor quality*
  - 20-40 - Poor quality
  - 40-60 - *Average quality*
  - 60-100 - *Good quality*

6 Select a client to view its statistics in greater detail.

- **WLAN Utilization** displays how efficiently the WLANs are used. Traffic utilization is defined as the percentage of current throughput relative to the maximum possible throughput for the WLAN. The total number of WLANs is displayed above the table. The table displays a list of the top five WLANs in terms of overall traffic utilization. It displays the utilization level names, WLAN name and SSIDs for each of the top five WLANs.
- **Radio Traffic Utilization** displays how efficiently the RF medium is used. Traffic utilization is defined as the percentage of current throughput relative to the maximum possible throughput for the RF Domain. The Traffic Index area displays an overall quality level for radio traffic and the Max User Rate displays the maximum data rate of associated radios. The table displays a list of the top five radios in terms of overall traffic utilization quality. It displays the radio names, MAC Addresses and radio types for each of the top five radios.
- **Client Traffic Utilization** displays how efficiently the RF medium is utilized for connected clients. Traffic utilization is defined as the percentage of current throughput relative to the maximum possible throughput for the clients in the RF Domain. The table displays a list of the top five performing clients in respect to overall traffic utilization. It displays the client names, MAC Addresses and vendor for each of the top five clients.
- **Wireless Security** displays the overall threat index for the system. This index is based on the number of Rogue/Unsanctioned APs and Wireless Intrusion Protection System (WIPS) events detected. The index is in the range 0 - 5 where 0 indicates there are no detected threats. An index of 5 indicates a large number of intrusion detection events or rogue/unsanctioned APs detected.
- **Traffic Statistics** include transmit and receive values for Total Bytes, Total Packets, User Data Rate, Broadcast/Multicast Packets, Management Packets, Tx Dropped Packets and Rx Errors.

4.3.2 RF Domain Inventory

Refer to the following RF Domain inventory data collected by member controllers, service platforms or Access Points:

To review the RF Domain inventory:

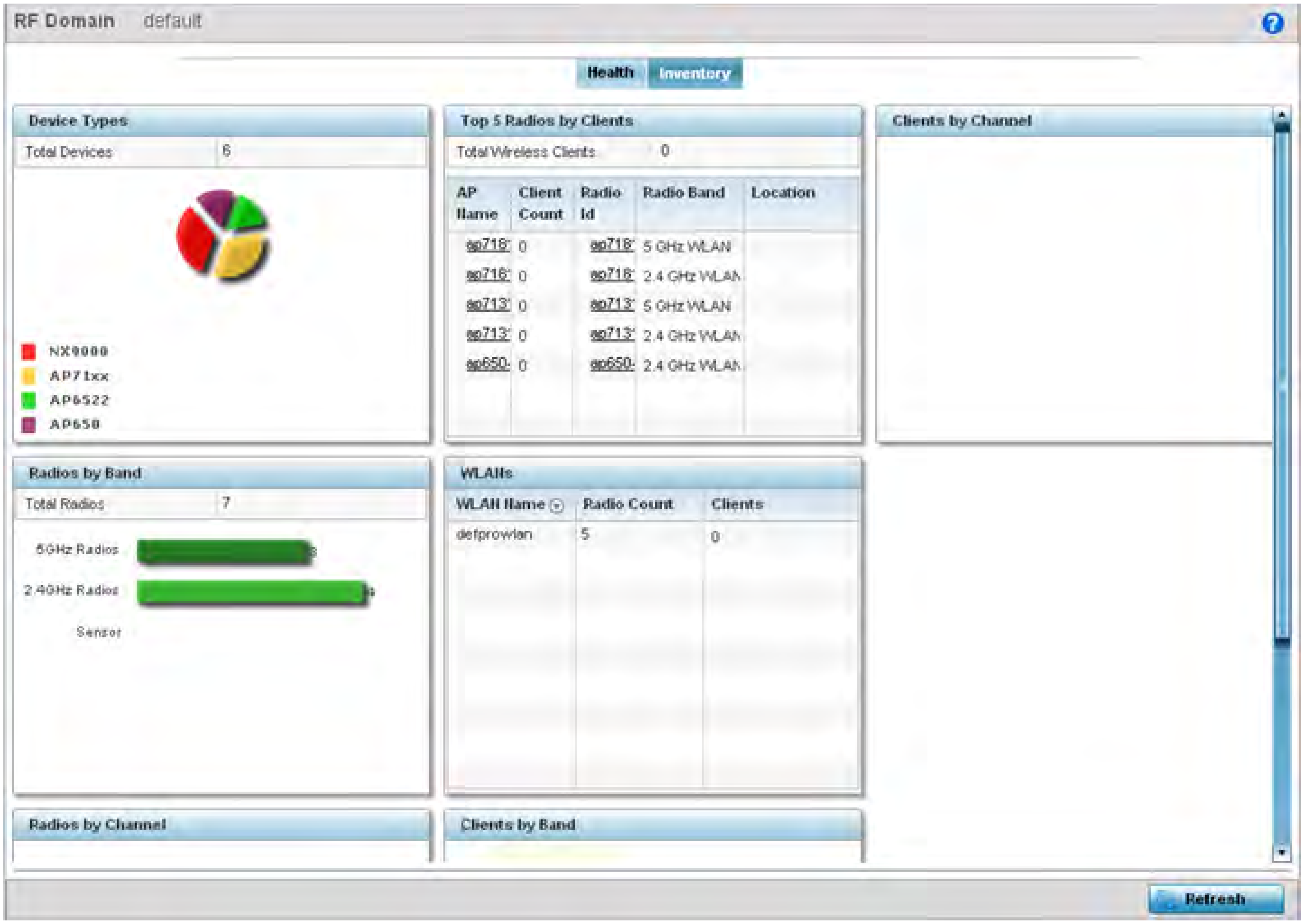
1 Select **Dashboard**.

2 Select **Summary** if it’s not already selected by default.

3 Expand the **System** node to display RF Domains.

4 Select a **RF Domain**.

5 Select the **Inventory** tab.



Total Devices	6

Total Radios	7

Top 5 Radios by Clients

Total Wireless Clients	0

AP Name	Client Count	Radio Id	Radio Band	Location
ap718	0	ap718	5 GHz WLAN	
ap718	0	ap718	2.4 GHz WLAN	
ap713	0	ap713	5 GHz WLAN	
ap713	0	ap713	2.4 GHz WLAN	
ap650-	0	ap650-	2.4 GHz WLAN	

WLANs

WLAN Name	Radio Count	Clients
defprowlan	5	0

Figure 4-6 *RF Domain screen - Inventory tab*

- The **Inventory** tab displays information on the devices managed by RF Domain member devices in the controller, service platform or Access Point managed network. The Inventory screen enables an administrator to overview of the number and state of the devices in the selected RF Domain. Information is displayed in easy to read tables and graphs.
- The **Device Types** table displays the devices types populating the RF Domain. The Device Type area displays an exploded pie chart that displays the type of device and their numbers in the RF Domain.
- The **Radios by Band** table displays a bar graph of RF Domain member device radios classified by their radio band or sensor dedication. Review this information to assess whether RF Domain member radios adequately support client device traffic requirements.
- The **Radios by Channel** table displays pie charts of the different channels utilized by RF Domain member radios. These dedicated channels should be as segregated as possible from one another to avoid interference. If too many radios are utilizing a single channel, consider off-loading radios to non utilized channels to improve RF Domain performance.
- The **Top 5 Radios by Clients** table displays a list of radios with the highest number of clients. This list displays the radio IDs as links that can be selected to display individual radio information in greater detail.
- The **WLANs** table displays a list of WLANs utilized by RF Domain member devices. The table is ordered by WLAN member device radio count and their number of connected clients. Use this information to assess whether the WLAN is overly populated by radios and clients contributing to congestion.

- The **Clients by Band** table displays the radio band utilization of connected RF Domain member clients. Assess whether the client band utilization adequately supports the intended radio deployment objectives of the connected RF Domain member Access Point radios.
- The **Clients of Channel** table displays a bar-graph of wireless clients classified by their frequency. Information for each channel is further classified by their 802.11x band. In the 5GHz channel, information is displayed classified under 802.11a and 802.11an bands. In the 2.4 GHz channel, information is displayed classified under 802.11b, 802.11bg, and 802.11bgn band.

4.4 Controller

The **Wireless Controller** screen displays system collected network status for controllers and service platforms. The screen is partitioned into two tabs:

- *Controller Health* – The Health tab displays information about the state of the controller or service platform managed wireless network.
- *Controller Inventory* – The Inventory tab displays information on the physical devices managed by the controller or service platform.

NOTE: A T5 controller can also be selected from the dashboard's controller level to display a set of unique T5 dashboard screens. A T5 controller uses a different operating system to manage its connected radio devices, as opposed to the WiNG operating used by RFS controllers and NX service platforms. However, a T5 controller, once enabled as a supported external device, can provide data to WiNG to assist in a T5's management within a WiNG supported subnet populated by both types of devices. For information on enabling controller adoption of external devices (for T5 support specifically) refer to, *Adoption Overrides (Controllers Only) on page 5-48*.

4.4.1 Controller Health

To assess the controller or service platform's network health:

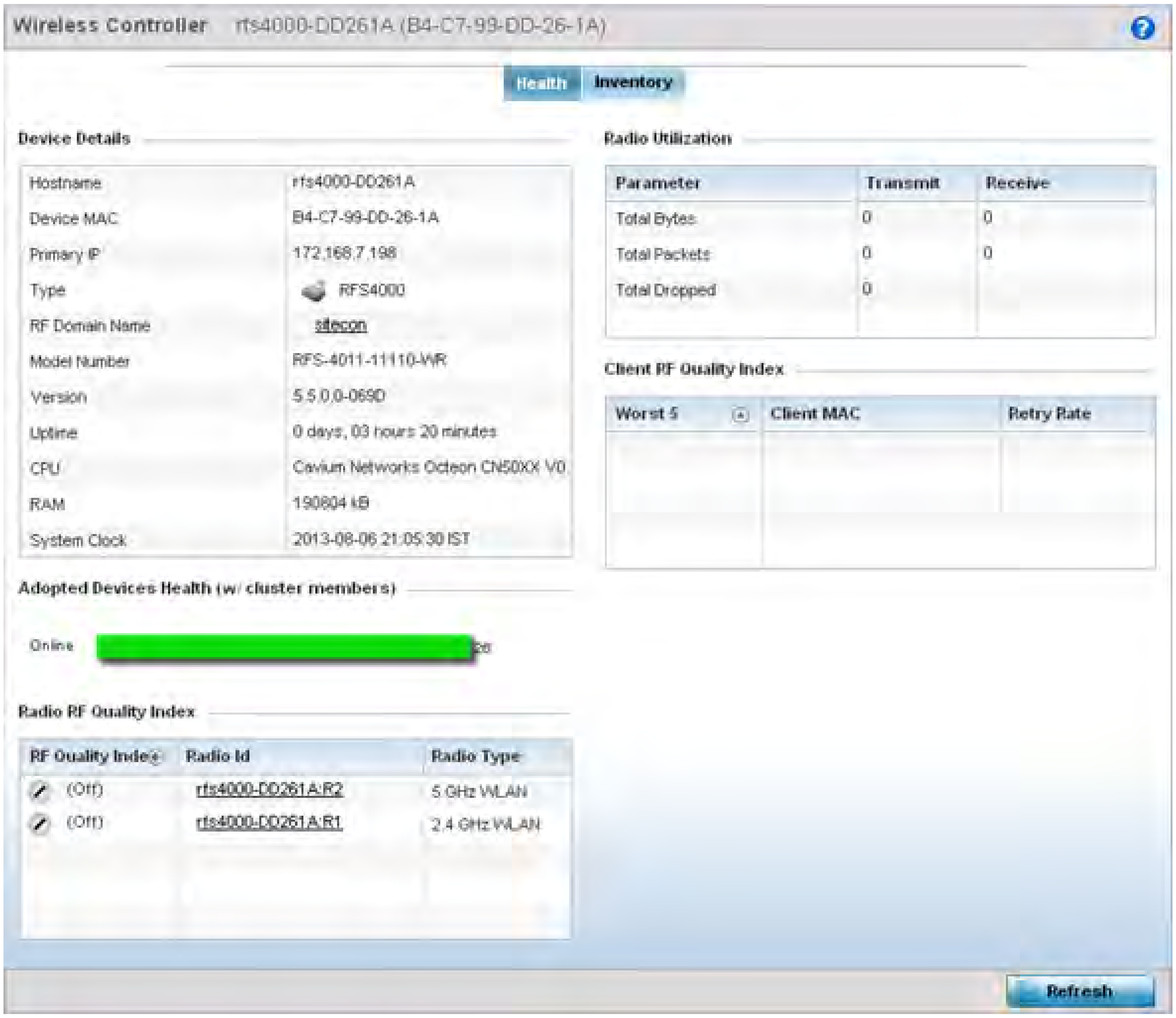
1 Select **Dashboard**.

2 Select **Summary** if it's not already selected by default.

3 Expand the **System** node to display RF Domains.

4 Select and expand a **RF Domain** to expose its member controllers or service platforms.

5 Select a controller or service platform. The **Health** tab display by default.



Wireless Controller rfs4000-DD261A (B4-C7-99-DD-26-1A)

Device Details

Hostname	rfs4000-DD261A
Device MAC	B4-C7-99-DD-26-1A
Primary IP	172.168.7.198
Type	RFS4000
RF Domain Name	sitecon
Model Number	RFS-4011-11110-WR
Version	5.5.0.0-069D
Uptime	0 days, 03 hours 20 minutes
CPU	Cavium Networks Octeon CN50XX V0
RAM	190804 kB
System Clock	2013-08-06 21:05:30 IST

Adopted Devices Health (w/ cluster members)

Online

Radio RF Quality Index

RF Quality Index	Radio Id	Radio Type
(Off)	rfs4000-DD261A:R2	5 GHz WLAN
(Off)	rfs4000-DD261A:R1	2.4 GHz WLAN

Radio Utilization

Parameter	Transmit	Receive
Total Bytes	0	0
Total Packets	0	0
Total Dropped	0	

Client RF Quality Index

Worst 5	Client MAC	Retry Rate

Figure 4-7 *Wireless Controller screen - Health tab*

Refer to the **Device Details** table for information about the selected controller or service platform The following information is displayed:

- **Hostname** - Lists the administrator assigned name of the controller or service platform.
- **Device MAC** - Lists the factory encoded MAC address of the controller or service platform.
- **Type** - Indicates the type of controller or service platform. An icon representing the RFS controller or NX service platform device type is displayed along with the model number.
- **RF Domain Name** - Lists the RF Domain to which the controller or service platform belongs. The RF Domain displays as a link that's selectable to display RF Domain data in greater detail.
- **Model Number** - Lists the model number and hardware SKU information of the selected controller or service platform to refine its intended deployment region.
- **Version** - Lists the firmware version currently running on the controller or service platform. Compare this version against the version currently on the support site to ensure the controller or service platform has the latest feature set available.
- **Uptime** - Displays the duration the controller or service platform has been running since it was last restarted.
- **CPU** - Displays the CPU installed on this controller or service platform.
- **RAM** - Displays the amount of RAM available for use in this system.
- **System Clock** - Displays the current time set on the controller or service platform.

The **Adopted Devices Health (w/ cluster members)** displays a graph of Access Points in the system with the available Access Points in green and unavailable Access Points in red.

The **Radio RF Quality Index** provides a table of RF quality on a per radio basis. It is a measure of the overall effectiveness of the RF environment displayed in percentage. It is a function of the connect rate in both directions, the retry rate and the error rate. The screen displays the average quality index within the Access Point single radio. The table lists bottom five (5) of the RF quality values by Access Point radio. The quality is measured as:

- 0-20 - *Very poor quality*
- 20-40 - *Poor quality*
- 40-60 - *Average quality*
- 60-100 - *Good quality*

6 Select a radio Id to view statistics in greater detail.

The **Radio Utilization** table displays how efficiently the RF medium is used. Radio utilization is defined as the percentage of current throughput relative to the maximum possible throughput for the radio. The Radio Utilization table displays the Access Point radios in terms of the number of associated wireless clients and the percentage of utilization. It also displays a table of packets types transmitted and received.

The **Client RF Quality Index** displays a table of RF quality on a per client basis. It is a measure of the overall effectiveness of the RF environment displayed in percentage. It is a function of the connect rate in both directions, the retry rate and the error rate. This area of the screen displays the average quality index for a client. The table lists bottom five (5) of the RF quality values by a client. Quality is measured as:

- 0-20 - *Very poor quality*
- 20-40 - *Poor quality*
- 40-60 - *Average quality*
- 60-100 - *Good quality*

7 Select a client MAC to view all the statistics for the selected client in greater detail.

4.4.2 Controller Inventory

The **Inventory** tab displays information for the devices managed by the system. This screen enables a system administrator to have a complete overview of the number and state of managed devices. Information is displayed in easy to read tables and graphs. The Inventory screen also provides links for the system administrator to get more detailed information.

To assess the controller or service platform inventory:

1 Select **Dashboard**.

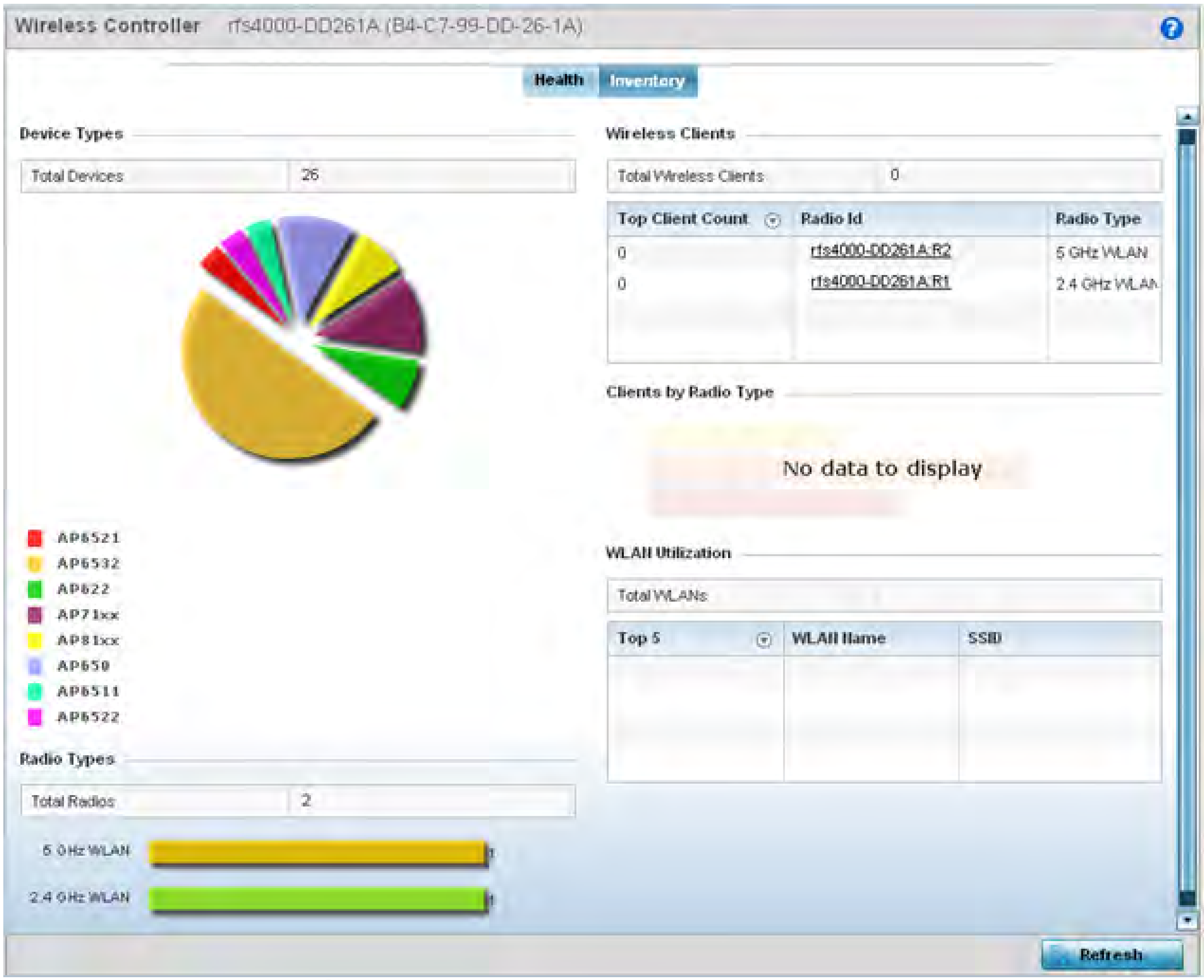
2 Select **Summary** if it’s not already selected by default.

3 Expand the **System** node to display RF Domains.

4 Select and expand a **RF Domain** to expose its member controllers or service platforms.

5 Select a controller or service platform.

6 Select the **Inventory** tab.



Wireless Controller rfs4000-DD261A (B4-C7-99-DD-26-1A)

Device Types

Total Devices	26

Radio Types

Total Radios	2

Wireless Clients

Total Wireless Clients	0

Top Client Count	Radio Id	Radio Type
0	rfs4000-DD261A:R2	5 GHz WLAN
0	rfs4000-DD261A:R1	2.4 GHz WLAN

Clients by Radio Type

No data to display

WLAN Utilization

Total WLANs	

Top 5	WLAN Name	SSID

Figure 4-8 *Wireless Controller screen - Inventory tab*

The **Inventory** tab displays information on the devices managed by the controller or service platform. The Inventory screen enables an administrator to overview of the number and state of controller or service platform managed devices and their utilization. Refer to the following Inventory data:

- The **Device Types** field displays a ratio of devices managed by this controller or service platform in pie chart format. The Device Type area displays an exploded pie chart that displays the type of device and their numbers in the current system.
- The **Radios Type** field displays the total number of radios managed by this controller or service platform. The graph lists the number of radios in both the 2.4 GHz and 5 GHz radio bands.
- The **Wireless Clients** table lists clients managed by this controller or service platform by connected client count. Information is presented in two (2) tables and a graph. The first table lists the total number of clients managed by the listed controller or service platform. The second lists the top five (5) radios in terms of the number of connected clients. The graph just below the table lists the number of clients by radio type.
- The **WLAN Utilization** table displays utilization statistics for controller or service platform WLAN configurations. Information displays in two tables. The first table lists the total number of WLANs managed by this system. The second table lists the top five (5) WLANs in terms of the usage percentage along with the name and network identifying SSID.

4.4.3 T5 Controller Dashboard

A T5 controller can be selected from the dashboard's controller level to display a set of unique T5 dashboard screens. A T5 controller uses a different operating system to manage its connected radio devices, as opposed to the WiNG operating used by RFS controllers and NX service platforms. However, a T5 controller, once enabled as a supported external device, can provide data to WiNG to assist in a T5's management within a WiNG supported subnet populated by both types of devices.

To review a T5's controller dashboard:

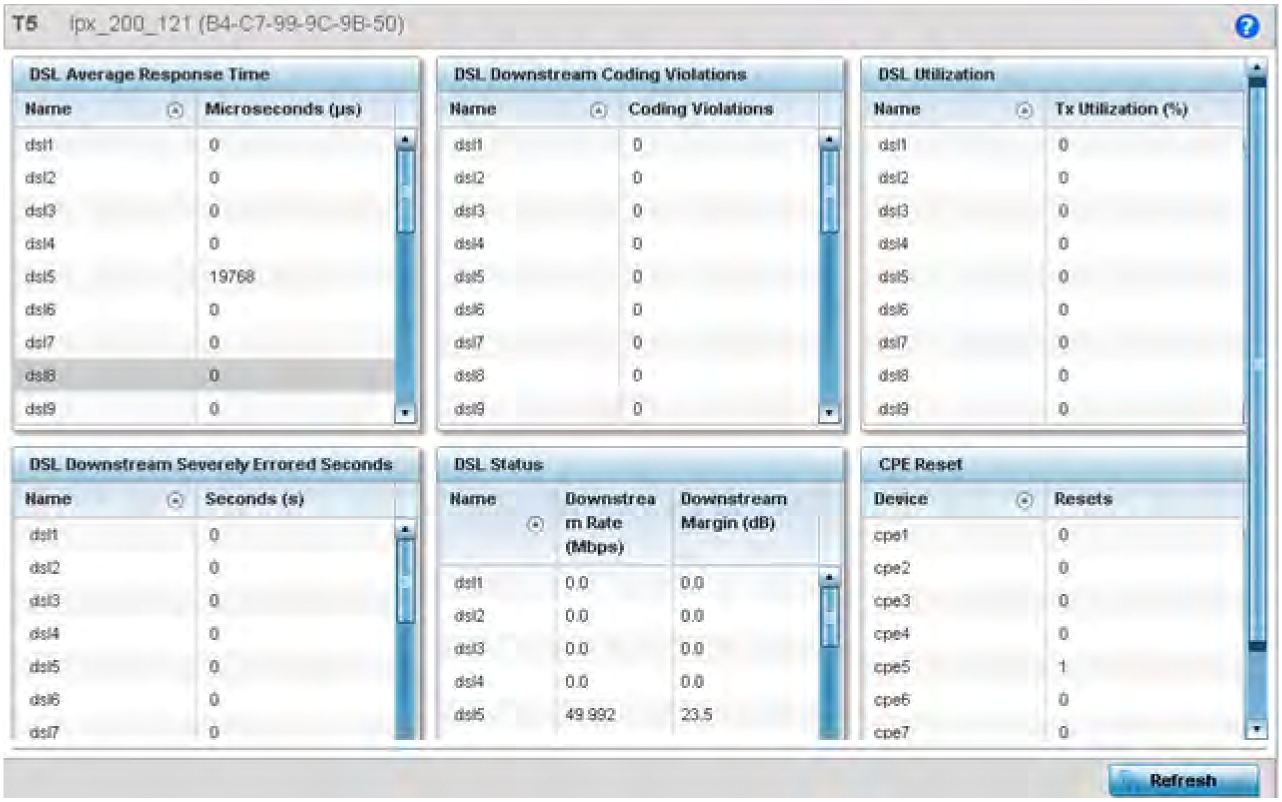
1 Select **Dashboard**.

2 Select **Summary** if it's not already selected by default.

3 Expand the **System** node to display RF Domains.

4 Select and expand a **RF Domain** to expose its member controllers or service platforms.

5 Select a T5 controller from amongst the devices listed at the dashboard's controller level. T5 devices will not appear at any other level in the dashboard's device tree.



T5 lpx_200_121 (B4-C7-99-9C-9B-50)

DSL Average Response Time

Name	Microseconds (µs)
dsl1	0
dsl2	0
dsl3	0
dsl4	0
dsl5	19768
dsl6	0
dsl7	0
dsl8	0
dsl9	0

DSL Downstream Coding Violations

Name	Coding Violations
dsl1	0
dsl2	0
dsl3	0
dsl4	0
dsl5	0
dsl6	0
dsl7	0
dsl8	0
dsl9	0

DSL Utilization

Name	Tx Utilization (%)
dsl1	0
dsl2	0
dsl3	0
dsl4	0
dsl5	0
dsl6	0
dsl7	0
dsl8	0
dsl9	0

DSL Downstream Severely Errored Seconds

Name	Seconds (s)
dsl1	0
dsl2	0
dsl3	0
dsl4	0
dsl5	0
dsl6	0
dsl7	0

DSL Status

Name	Downstream Rate (Mbps)	Downstream Margin (dB)
dsl1	0.0	0.0
dsl2	0.0	0.0
dsl3	0.0	0.0
dsl4	0.0	0.0
dsl5	49.992	23.5

CPE Reset

Device	Resets
cpe1	0
cpe2	0
cpe3	0
cpe4	0
cpe5	1
cpe6	0
cpe7	0

Figure 4-9 *T5 Dashboard tab*

6 Refer to the following T5 specific dashboard stats to assess whether a CPE's DLS connection is problematic and has excessive device rests (rendering the T5 device temporarily offline).

The *Customer Premises Equipment* (CPEs) are the T5 managed radio devices. These CPEs use *Digital Subscriber Line* (DSL) as their high speed Internet access mechanism using the CPE's physical wallplate connection and phone jack.

DSL Average Response Time	Lists each CPE's DSL name and its average response time in microseconds. Use this data to assess whether a specific DSL is experiencing response latency negatively impacting performance.
DSL Downstream Coding Violations	Displays each listed DSL's number of coding violations as a measure of erroneous data degrading the DSL's performance within the T5's network coverage area.
DSL Utilization	Lists each CPE's DSL name and its transmit utilization by percentage of overall load.
DSL Downstream Severely Eroded Seconds	Displays each listed DSL's eroded seconds, as a negative measure of delivery latency degrading the DSL's performance within the T5's network coverage area.
DSL Status	Lists the name of the DSL utilized on T5 managed CPE devices, and their downstream (transmit) data rate (in Mbps) and downstream throughput margin (in dB).
CPE Reset	The a selected CPE's number of resets. A reset renders the CPE offline until completed, and consequently should be carefully tracked to ensure consistent online availability amongst CPEs in the same radio coverage area.

7 Select a T5 device from amongst the devices listed in the dashboard's controller level, and right click the arrow to the right to list an additional menu of diagnostic activities that can be administrated for the selected T5 device.

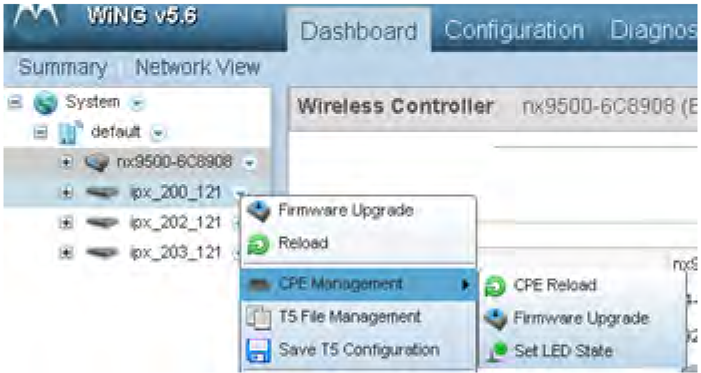
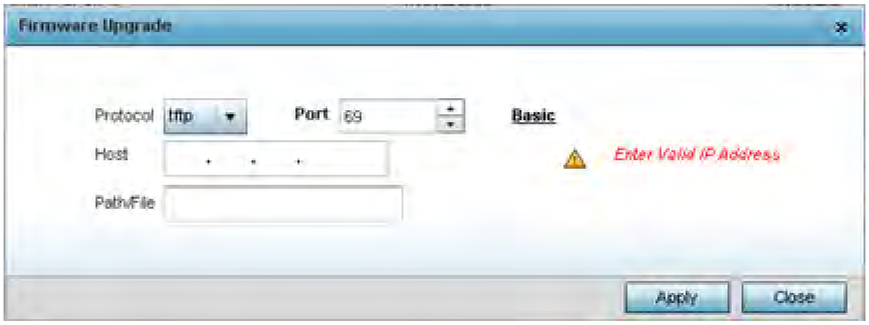


Figure 4-10 *T5 Dashboard Menu Path*

Use these additional T5 configuration items to optionally upgrade T5 managed device firmware, reload configurations, upgrade the T5 CPE and manage T5 managed device LED status.

8 Select **Firmware Upgrade** to conduct firmware updates for T5 managed devices.



Protocol tftp
Port 69
Host . . .
Path/File

Figure 4-11 *T5 Dashboard Firmware Upgrade*

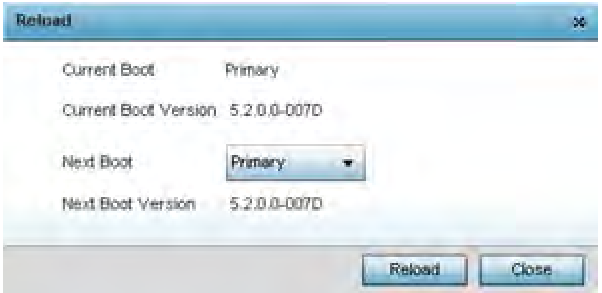
By default, the **Firmware Upgrade** screen displays the tftp server parameters for the target T5 device firmware file.

9 Provide the following information to accurately define the location of the T5 device firmware file.

Protocol	Select the FTP or TFTP protocol used for updating T5 device firmware.
Port	Use the spinner control, or manually set, the T5 device port used by the selected transfer protocol for firmware updates.
Host	Provide the numeric IP address of the resource used to update the firmware.
User Name	Define the user name used to access either a FTP or TFTP resource.
Password	Specify the password for the user account to access a FTP or a TFTP resource.
Path/File	Specify the correct directory path to the firmware file. Enter the complete relative path to the file on the server.

10 Select **Apply** to save the T5 device firmware connection protocol settings. Select **Close** to exit the Firmware Upgrade popup.

11 Select **Reload** to administrate current and next boot version available to the selected T5 device.



Current Boot Primary
Current Boot Version 5.2.0.0-007D
Next Boot Primary
Next Boot Version 5.2.0.0-007D

Figure 4-12 *T5 Dashboard Device Reload*

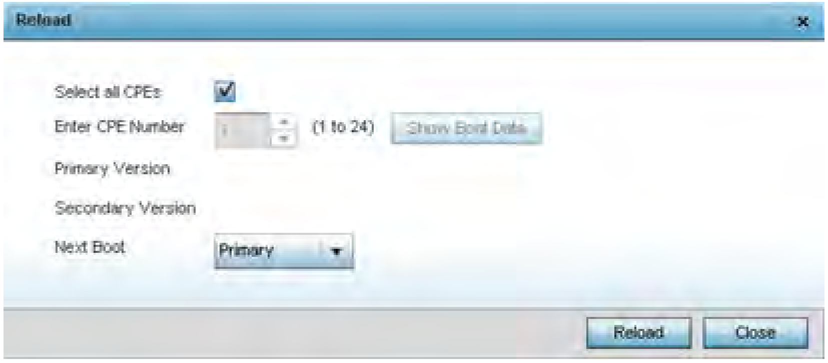
12 Review the following **Current** and **Next Boot Versions** and optionally apply a *primary* or *secondary* designation to the next boot version used in pending T5 managed device updates:

Current Boot	Lists whether the firmware image for a current T5 managed device boot is the *primary* or *secondary* firmware image.
Current Boot Version	Lists the firmware version currently utilized with T5 managed device boots.

Next Boot	Use the drop-down menu to specify whether the next boot is the *primary* or *secondary* firmware image.
Next Boot Version	Lists this version used the next time the T5 managed radio device is booted.

13 Select **Reload** to apply the current and next boot settings to a T5 update. Select **Close** to exit the Reload popup.

14 Expand the **CPE Management** item from the T5 dashboard and select **CPE Reload**. *Customer Premises Equipment* (CPE) are the T5 managed radio devices.



Reload

Select all CPEs ☑

Enter CPE Number 1 (1 to 24)

Primary Version

Secondary Version

Next Boot Primary

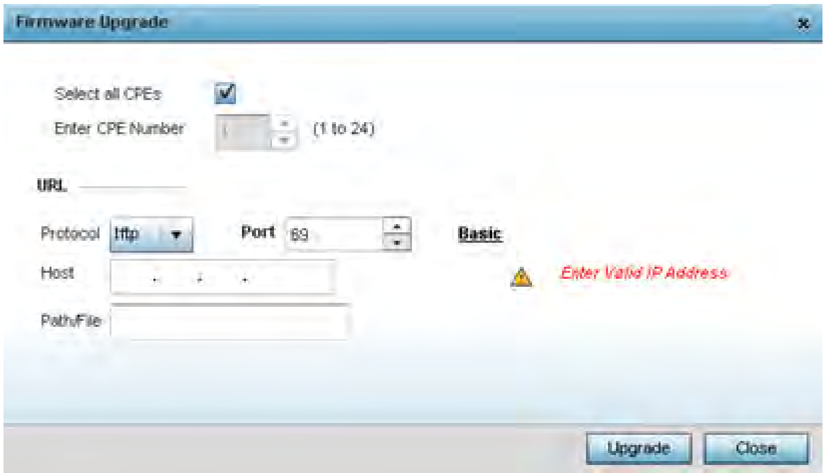
Figure 4-13 *T5 Dashboard CPE Management Reload*

15 Use the **Reload** screen to specify the CPEs to target for a T5 managed device firmware upgrade.

Select all CPEs	Select this option to use the settings specified in the *Firmware Upgrade* and *Reload* screens to update all the selected T5's managed CPE devices.
Enter CPE Number	If wanting to administrate an update to a specific T5 managed CPE, use the spinner control to select a specific CPE (1 - 24) for update. This option is enabled only when Select all CPEs is disabled. Select *Show Boot Data* to supply display the *Primary* and *Secondary* firmware versions utilized in the update.
Primary Version	When *Show Boot Data* is selected, this column lists the *Primary Version* utilized for the selected T5 managed CPE device update.
Secondary Version	When *Show Boot Data* is selected, this column lists the *Secondary Version* utilized for the selected T5 managed CPE device update.
Next Boot	Use the drop-down menu to specify whether the next boot is the *primary* or *secondary* firmware image utilized for the selected T5 managed CPE device update.

16 Select **Reload** to make available the selected firmware images(s) to the T5 in advance of initiating device upgrades. Select **Close** to exit the Reload popup.

17 Expand the **CPE Management** item from the T5 dashboard and select **Firmware Upgrade** to apply the defined upgrade settings to the selected T5's managed CPE devices.



Select all CPEs ☑

Enter CPE Number 1 (1 to 24)

Protocol tftp Port 69

Host . . .

Enter Valid IP Address

Path/File

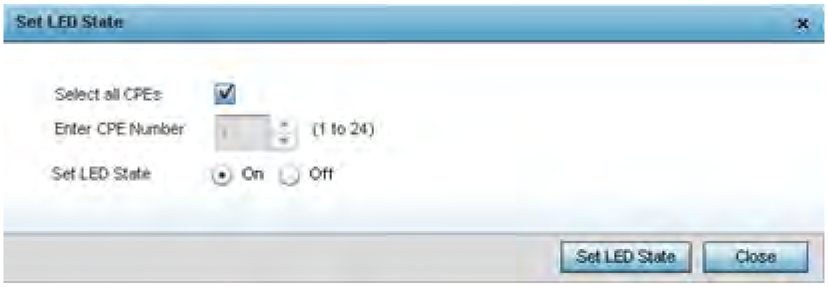
Figure 4-14 *T5 Dashboard CPE Reload*

18 Use the **Reload** screen to specify the CPEs to target for a T5 managed device firmware upgrade.

Select all CPEs	Select this option to use the settings specified in the *Firmware Upgrade* and *Reload* screens to update all T5's managed CPE devices.
Enter CPE Number	If wanting to administrate an update to a specific T5 managed CPE, use the spinner control to select a specific CPE (1 - 24) for update. This option is enabled only when *Select all CPEs* is disabled. Select *Show Boot Data* to supply display the *Primary* and *Secondary* firmware versions utilized in the update.
Protocol	Select the FTP or TFTP communication protocol used for updating T5 managed CPE device firmware.
Port	Use the spinner control, or manually set, the T5 device port used by the selected transfer protocol for CPE device firmware updates.
Host	Provide the numeric IP address of the resource used to update the CPE device firmware.
Path/File	Specify the correct directory path to the T5 managed CPE device firmware file. Enter the complete relative path to the file.

19 Select **Upgrade** to initiate the update from the T5 to the selected CPE device(s). Select **Close** to exit the Firmware Upgrade popup.

20 Expand the **CPE Management** item from the T5 dashboard and select **Set LED State** to administrate the LED behavior of the T5 managed CPE devices.



Select all CPEs ☑

Enter CPE Number 1 (1 to 24)

Set LED State ● On ○ Off

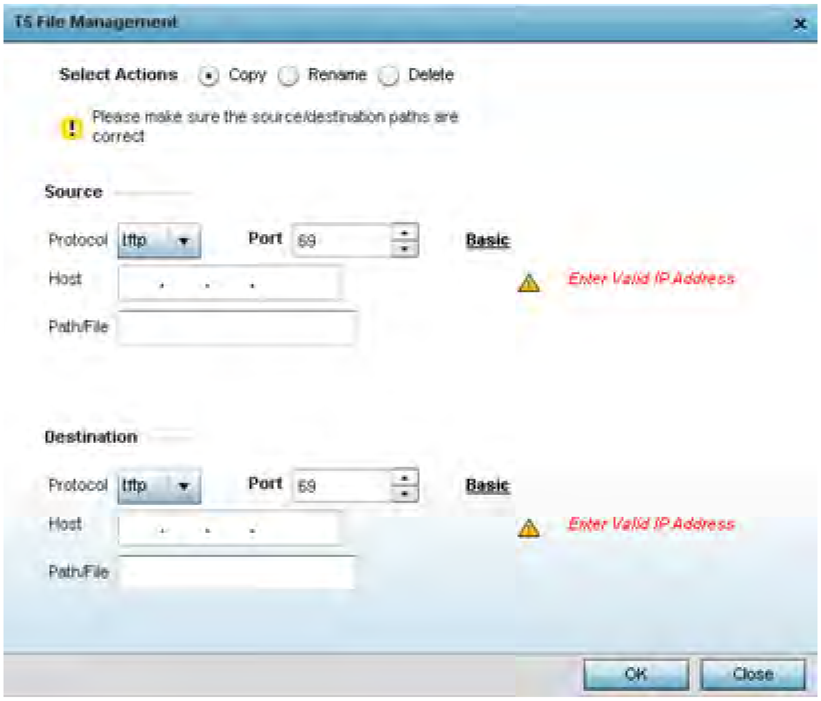
Figure 4-15 *T5 Dashboard Set LED State*

21 Use the **Set LED State** screen to set the LED behavior T5 managed CPE devices.

Select all CPEs	Select this option to apply the administrated LED state to each T5 managed CPE device.
Enter CPE Number	If wanting to set a specific T5 managed CPE LED, use the spinner control to set the CPE to be impacted by the ELD state setting. This setting could be quite useful in deployments where a specific CPE's LED illumination could be disruptive (such as a hospital etc.). This option is enabled only when *Select all CPEs* is disabled.
Set LED State	Define whether the LEDs remain on or off for the selected T5 managed CPE devices. The default setting is On.

22 Select **Start LED State** to initiate the LED behavior updates to the selected T5 managed CPE device(s). Select **Close** to exit the Set LED State popup.

23 Select **T5 File Management** to set the *Source* and *Destination* addresses used for T5 device configuration file updates.



T5 File Management

Select Actions ● Copy ○ Rename ○ Delete

Please make sure the source/destination paths are correct

Source

Protocol tftp Port 69 Basic

Host . . .

Enter Valid IP Address

Path/File

Destination

Protocol tftp Port 69 Basic

Host . . .

Enter Valid IP Address

Path/File

Figure 4-16 *T5 Dashboard T5 File Management*

NOTE: The configuration parameters displayed within the T5 File Management screen differ (increase or reduce) depending on whether *Copy*, *Rename* or *Delete* is selected as the management action. When **Copy** is selected, both source and destination protocols, ports, host addresses and paths are required for transfers. If the action is to **Rename** a configuration, both source and destination paths are required for name update. If the action is to **Delete**, only the path to the target file is required. All supplied paths and addresses must be set correctly for the selected action to be successful.

24 Set the following **T5 File Management** *Source* and/or *Destination* transfer protocols and address information. Options differ depending on selected **Copy**, **Rename** or **Delete** file management action.

Selected Action	Select *Copy* to enable parameters where the correct source and destination T5 device port, host IP address and directory path must be specified. Select *Rename* to correctly provide the source and destination directory paths of a renamed T5 configuration file. Select *Delete* to define the correct directory path of a target T5 configuration file to delete and remove. The default setting is Copy.
Protocol	Select the FTP or TFTP communication protocol used for updating T5 file transfers. This option is only available when *Copy* is the selected action.
Port	Use the spinner control, or manually set, the T5 device port used by the selected transfer protocol. This option is only available when *Copy* is the selected action.
Host	Provide the numeric IP address of the resource used to update the CPE device firmware. This option is only available when *Copy* is the selected action.
Path/File	Specify the correct directory path to the location(s) of the source and destination T5 device addresses. This option is only available when *Copy* is the selected action.
Source	If *Renaming* or *Deleting* a T5 configuration file, correctly enter the directory path of the target file to be renamed or deleted.
Destination	If Renaming a T5 configuration file, correctly enter the directory path of the target file to be renamed.

25 Select **OK** to apply the selected file management action. Select **Close** to exit the T5 File Management popup.

4.4.4 EX3500 Switch Dashboard

The EX3500 series switch is a Gigabit Ethernet Layer 2 switch with either 24 or 48 10/100/1000-BASE-T ports, and four *small form factor pluggable* (SFP) transceiver slots for fiber connectivity. Each 10/100/1000 Mbps port supports both the IEEE 802.3af and IEEE 802.3at-2009 PoE standards. Each EX3500 series switch includes an SNMP-based management agent, which provides both in-band and out-of-band access for management. An EX3500 series switch utilizes an embedded HTTP Web agent and command line interface (CLI) somewhat different from the WiNG operating system, while still enabling the EX3500 series switch to provide WiNG controllers PoE and port management resources.

Going forward NX9600, NX9500, NX7500, NX5500 WiNG managed services platforms and WiNG VMs can discover, adopt and partially manage EX3500 series Ethernet switches, as DHCP option 193 has been added to support external device adoption. DHCP option 193 is a simplified form of DHCP options 191 and 192 used by WiNG devices currently. DHCP option 193 supports pool1, hello-interval and adjacency-hold-time parameters.

When adopted to a managing controller or service platform, an EX3500 switch can display a unique dashboard helpful to administrators to better assess the interoperability of the selected EX3500 with its connected controller or service platform.

☑ **NOTE:** To enable the adoption of an EX3500 switch, the **Allow Adoption of External Devices** option must be enabled. For more information, refer to *Adoption Overrides (Controllers Only) on page 5-48*.

To review an EX3500 switch dashboard:

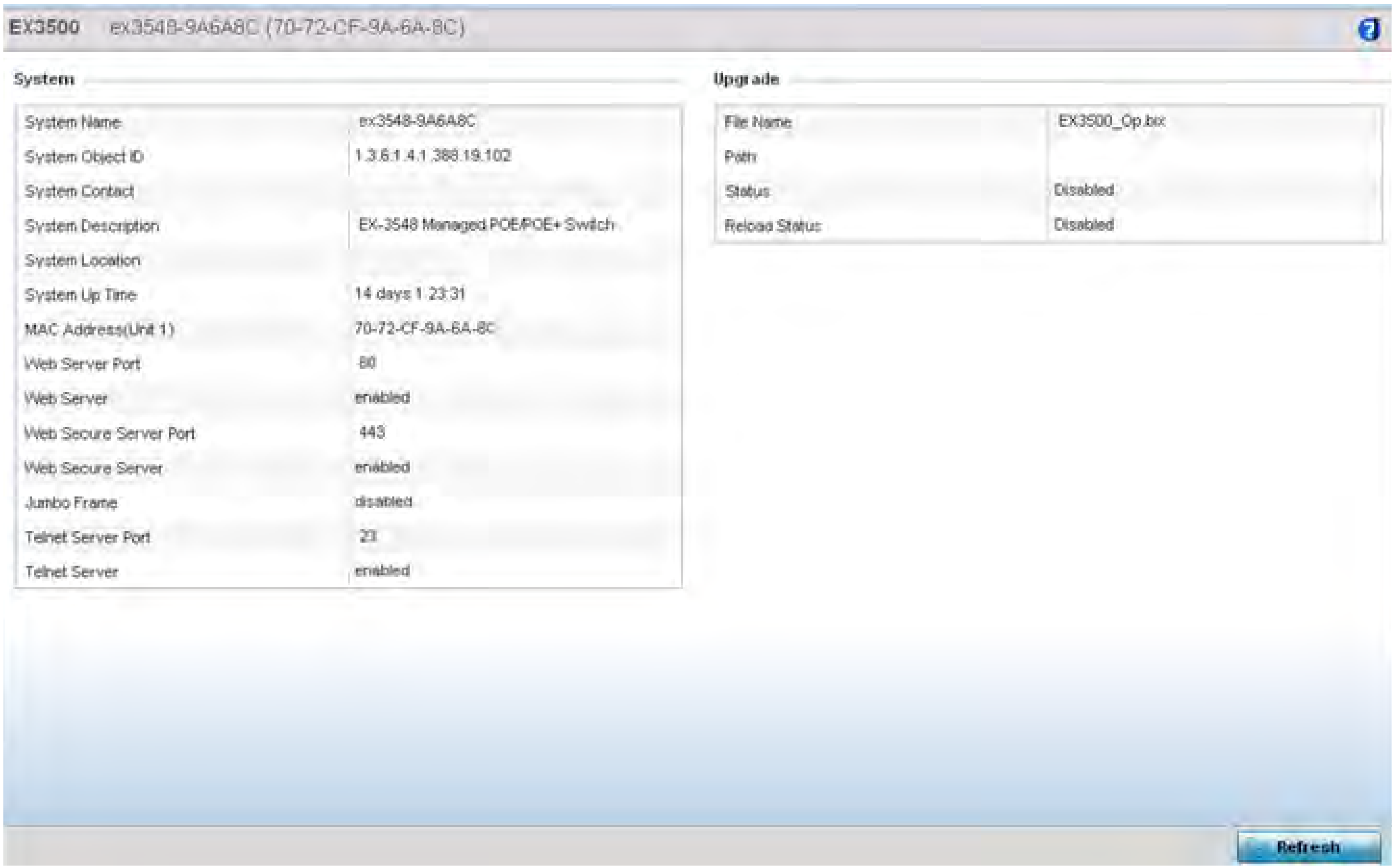
1 Select **Dashboard**.

2 Select **Summary** if it's not already selected by default.

3 Expand the **System** node to display RF Domains.

4 Select and expand a **RF Domain** to expose its member controllers or service platforms.

5 Select an EX3500 switch from amongst the devices listed.



EX3500 ex3548-9A6A8C (70-72-CF-9A-6A-8C)

System

System Name	ex3548-9A6A8C
System Object ID	1.3.6.1.4.1.388.19.102
System Contact	
System Description	EX-3548 Managed POE/POE+ Switch
System Location	
System Up Time	14 days 1:23:31
MAC Address(Unit 1)	70-72-CF-9A-6A-8C
Web Server Port	80
Web Server	enabled
Web Secure Server Port	443
Web Secure Server	enabled
Jumbo Frame	disabled
Telnet Server Port	23
Telnet Server	enabled

Upgrade

File Name	EX3500_Op.bix
Path	
Status	Disabled
Reload Status	Disabled

Figure 4-17 *EX3500 Dashboard*

6 Refer to the following **System** information to assess dashboard information for the selected EX3500 switch.

System Name	Displays the administrator assigned system name of the selected EX3500 switch.
System Object ID	Lists the numeric ID used to determine the monitoring capabilities of the EX3500 switch.
System Contact	Lists the EX3500 switch administrative contact assigned to respond to events created by, or impacting, this selected EX3500 switch and the RF Domain devices it helps support.
System Description	Displays the administrator defined system description provided by the administrator upon initial deployment of this particular EX3500 switch.
System Location	Lists a 255 character maximum EX3500 switch location reflecting the switch's physical deployment location.
System Up Time	Displays the cumulative time since this EX3500 was last rebooted or lost power.
MAC Address (Unit 1)	Lists the factory encoded MAC address of the selected EX3500 as its hardware identifier.
Web Server Port	Displays the Web server port the EX3500 is using. Port 80 is the default port the Web server expects to listen to.
Web Server	Lists whether the Web server facility is *enabled/disabled* between this selected EX3500 switch and its connected controller or service platform. A Web server is a program using a client/server model and the *Hypertext Transfer Protocol* (HTTP) to serve files forming Web pages to Web resource requesting clients.
Web Secure Server Port	Lists the numeric virtual server port providing secure Web resources with the selected EX3500. Any system with multiple open ports, multiple services and multiple scripting languages is vulnerable simply because it has so many points of entry to watch. The secure open port has been specifically designated and utilizes the latest security patches and updates.
Web Secure Server	Lists whether the secure Web server functionality has been *enabled* or *disabled* for the selected EX3500's management session with the WiNG controller or service platform.
Jumbo Frame	Lists whether support for jumbo Ethernet frames with more than 1500 bytes of payload has been *enabled* or *disabled*. Jumbo frames support up to 9000 bytes, but variations must be accounted for. Many Gigabit Ethernet switches and Gigabit Ethernet network interface cards support jumbo frames. Some Fast Ethernet switches and Fast Ethernet network interface cards also support jumbo frames.
Telnet Server Port	Lists the numeric Telnet server port used with the selected EX3500's session with the WiNG controller or service platform to test for open ports. The listed port is the port number where the server is listening.
Telnet Server	Displays whether Telnet functionality is currently *enabled* or *disabled* for the selected EX3500 switch.

7 Refer to the **Upgrade** field to assess the EX3500's current firmware and upgrade configuration status.

Filename	Lists the target firmware file queued for subsequent uploads to the selected EX3500 switch.

Path	Lists the complete relative path to the EX3500 switch firmware file defined for subsequent upgrades.
Status‘	Lists whether a device firmware upgrade is currently *enabled* and queued for the selected EX3500 or is currently *disabled*.
Reload Status	Displays the selected EX3500’s current firmware reload status.

Periodically select **Refresh** to update the statistics counters to their latest values.

4.5 Access Point Screen

The **Access Point** screen displays system-wide network status for standalone or controller connected Access Points. The screen is partitioned into the following tabs:

- *Access Point Health* – The Health tab displays information about the state of the Access Point managed network.
- *Access Point Inventory* – The Inventory tab displays information on the physical devices managed within the Access Point managed network.

4.5.1 Access Point Health

To assess Access Point network health:

1 Select **Dashboard**.

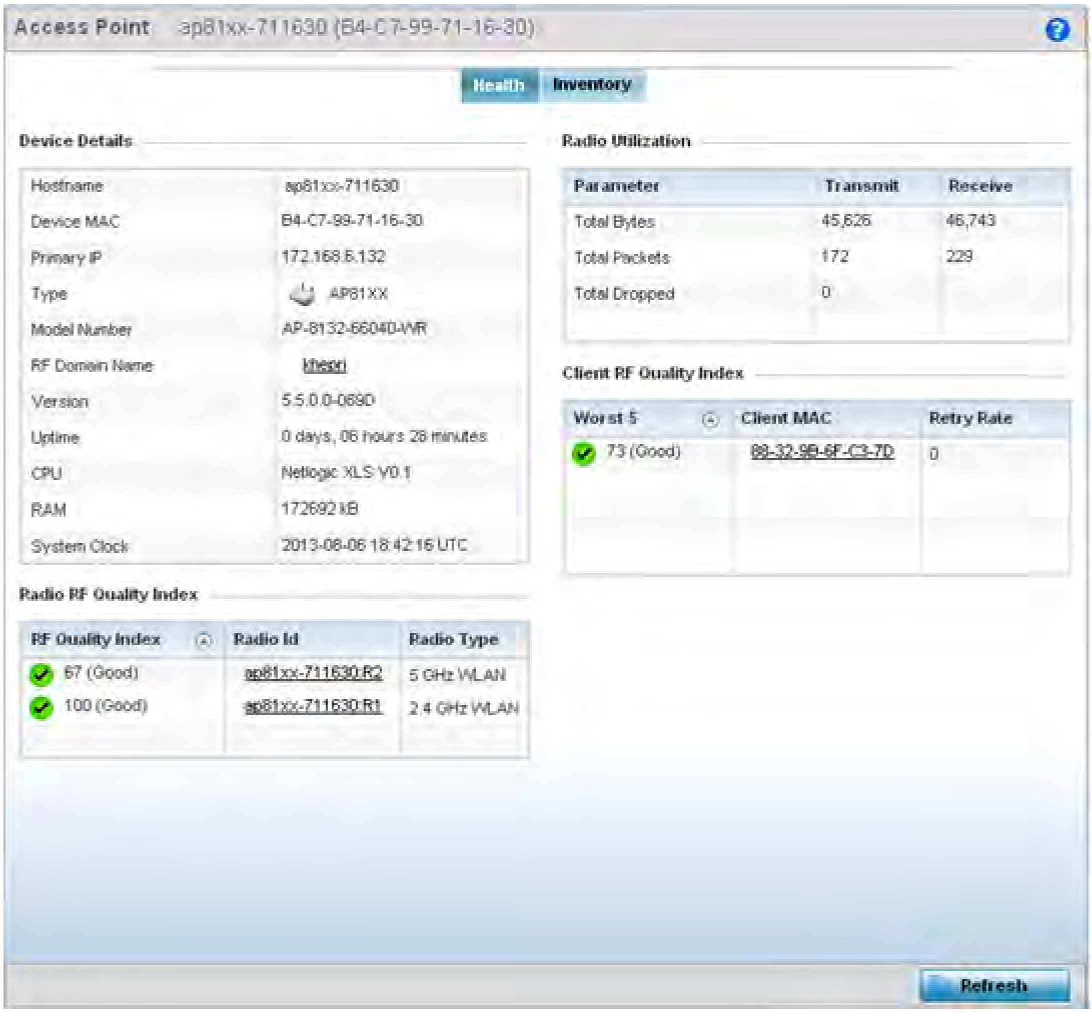
2 Select **Summary** if it’s not already selected by default.

3 Expand the **System** node to display RF Domains.

4 Select and expand a **RF Domain** to expose its member controllers or service platforms.

5 Select a controller or service platform and expand the menu item to display connected Access Points.

6 Select an Access Point. The **Health** tab display by default.



Device Details

Hostname	ap81xx-711630
Device MAC	B4-C7-99-71-16-30
Primary IP	172.168.6.132
Type	AP81XX
Model Number	AP-8132-66040-WR
RF Domain Name	khepri
Version	5.5.0.0-069D
Uptime	0 days, 06 hours 28 minutes
CPU	Netlogic XLS V0.1
RAM	172692 kB
System Clock	2013-08-06 18:42:16 UTC

Radio Utilization

Parameter	Transmit	Receive
Total Bytes	45,626	46,743
Total Packets	172	229
Total Dropped	0	

Client RF Quality Index

Worst 5	Client MAC	Retry Rate
✓ 73 (Good)	88-32-9B-6F-C3-7D	0

Radio RF Quality Index

RF Quality Index	Radio Id	Radio Type
✓ 67 (Good)	ap81xx-711630:R2	5 GHz WLAN
✓ 100 (Good)	ap81xx-711630:R1	2.4 GHz WLAN

Figure 4-18 *Access Point screen - Health tab*

The **Device Detail** field displays the following information about the selected Access Point:

- **Hostname** - Lists the administrator assigned name of the selected Access Point.
- **Device MAC** - Lists the factory encoded MAC address of the selected Access Point.
- **Primary IP Address** - Lists the IP address assigned to the Access Point as a network identifier.
- **Type** - Indicates the Access Point model type. An icon representing the Access Point is displayed along with the model number.
- **RF Domain Name** - Lists the RF Domain to which the Access Point belongs. The RF Domain displays as a link that can be selected to display Access Point RF Domain membership data in greater detail.
- **Model Number** - Lists the specific model number of the Access Point.
- **Version** - Lists the version of the firmware running on the Access Point. Compare this version against the version currently on the support site to ensure the Access Point has the latest feature set available.
- **Uptime** - Displays the duration the Access Point has been running from the time it was last restarted.
- **CPU** - Displays the CPU installed on this Access Point.
- **RAM** - Displays the amount of RAM available for use in this system.
- **System Clock** - Displays the current time on the Access Point.
- The **Radio RF Quality Index** displays a table of RF quality per radio. It is a measure of the overall effectiveness of the RF environment displayed in percentage. It is a function of the connect rate in both directions, the retry rate and error rate. The quality is measured as:

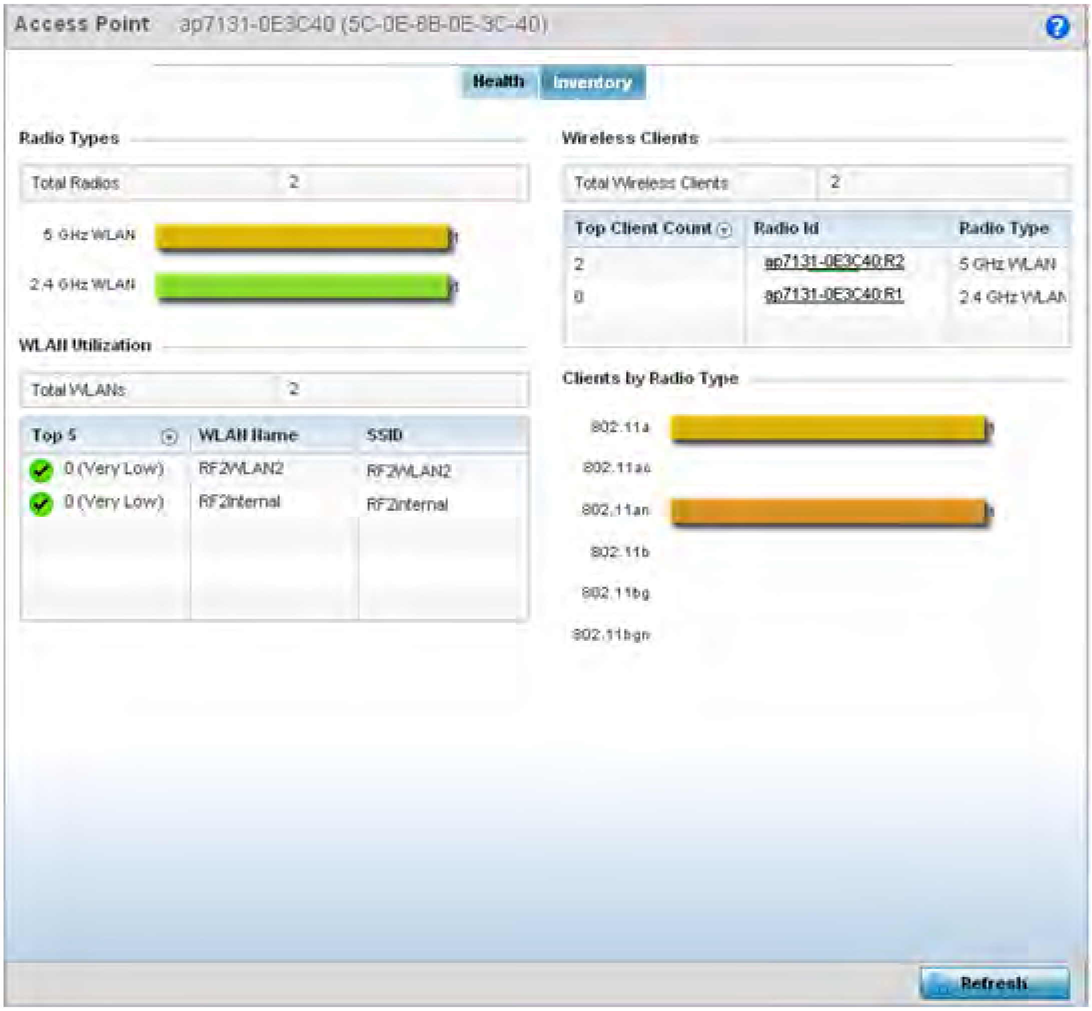
  - 0-20 - *Very poor quality*
  - 20-40 - *Poor quality*
  - 40-60 - *Average quality*
  - 60-100 - *Good quality*
- The **Radio Utilization** Index area displays how efficiently the RF medium is used. Radio utilization is defined as the percentage of current throughput relative to the maximum possible throughput for the radio. The Radio Utilization displays radios in terms of the number of associated wireless clients and percentage of utilization. It also lists packets types transmitted and received.
- The **Client RF Quality** Index displays a table of RF quality on a per client basis. It is a measure of the overall effectiveness of the RF environment displayed in percentage. It is a function of the connect rate in both directions, the retry rate and the error rate. This area of the screen displays the average quality index for a client. The table lists bottom five (5) of the RF quality values by client. The quality is measured as:
  - 0-20 - *Very poor quality*
  - 20-40 - *Poor quality*
  - 40-60 - *Average quality*
  - 60-100 - *Good quality*

4.5.2 Access Point Inventory

The Access Point **Inventory** tab displays granular data on devices managed by the selected Access Point. Information is displayed in easy to read tables and graphs.

To assess Access Point network health:

1. Select **Dashboard.**
2. Select **Summary** if it’s not already selected by default.
3. Expand the **System** node to display RF Domains.
4. Select and expand a **RF Domain** to expose its member controllers or service platforms.
5. Select a controller or service platform and expand the menu item to display connected Access Points.
6. Select an **Access Point.**
7. Select the **Inventory** tab.



Access Point ap7131-0E3C40 (5C-0E-8B-0E-3C-40)

Radio Types

Total Radios	2

WLAN Utilization

Total WLANs	2

Top 5	WLAN Name	SSID
✓ 0 (Very Low)	RF2WLAN2	RF2WLAN2
✓ 0 (Very Low)	RF2Internal	RF2Internal

Wireless Clients

Total Wireless Clients	2

Top Client Count	Radio Id	Radio Type
2	ap7131-0E3C40:R2	5 GHz WLAN
0	ap7131-0E3C40:R1	2.4 GHz WLAN

Clients by Radio Type

Figure 4-19 *Access Point screen - Inventory tab*

The information within the **Inventory** tab is partitioned into the following fields:

- The **Radios Type** field displays the total number of radios utilized by this Access Point. The graph lists the number of radios in the 2.4 GHz and 5 GHz radio bands and funtioning as a sensor.
- The **WLAN Utilization** table displays utilization statistics for controller or service platform WLAN configurations. Information displays in two tables. The first table lists the total number of WLANs managed by this system. The second table lists the top five (5) WLANs in terms of the usage percentage along with their name and network identifying SSID.
- The **Wireless Clients** table lists clients managed by this Access Point by connected client count. Information is presented in two (2) tables and a graph. The first table lists the total number of clients managed by the listed Access Point. The second lists the top five (5) radios in terms of the number of connected clients. The graph just below the table lists the number of clients by radio type.

4.6 Network View

The **Network View** functionality displays device association connectivity amongst controllers, service platforms, Access Point radios and wireless clients. This association is represented by a number of different graphs.

To review the wireless controller's Network Topology, select **Dashboard > Network View**.

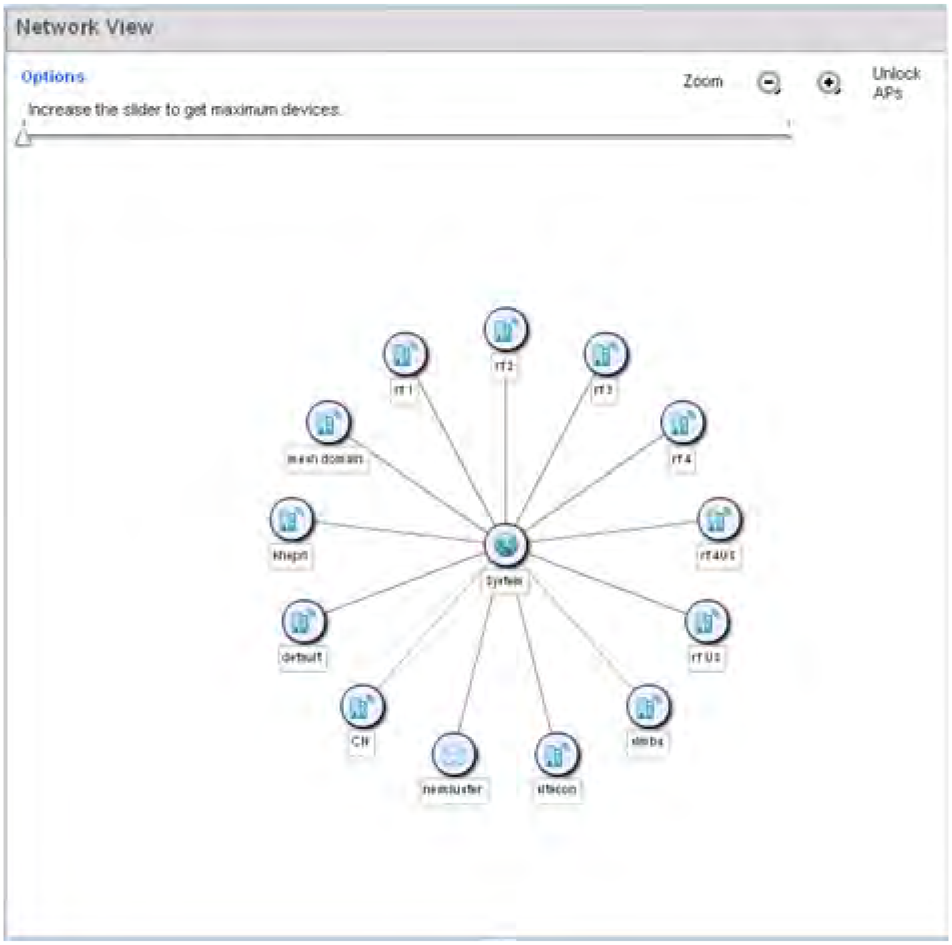


Figure 4-20 *Network View Topology*

- The screen displays icons for the different views available to the system. Apart from device specific icons, the following three icons are available:
  - *default* – Displays information about the default RF Domain.
  - *system* – Displays information about the current system.
  - *cluster* – Displays information about clusters managed by this system.

Use the icons to navigate quickly within top level groupings.

The middle field displays a Network View, or graphical representation of the network. Nodes display whether or not they are members of a cluster or mesh domain. Use this information to assess whether the topology of the network has changed in such a manner that devices need to be added or moved. This field changes to display a graphical network map.

Use the Lock / Unlock icon in the upper right of the screen to prevent users from moving APs around within the specified area.

4.7 Debug Wireless Clients

An administrator has the ability to select a RF Domain and capture connected client debug messages at an administrator assigned interval and location. Client debug information can either be collected historically or in real-time.

To troubleshoot issues with wireless client connectivity within a controller, service platform or Access Point managed RF Domain:

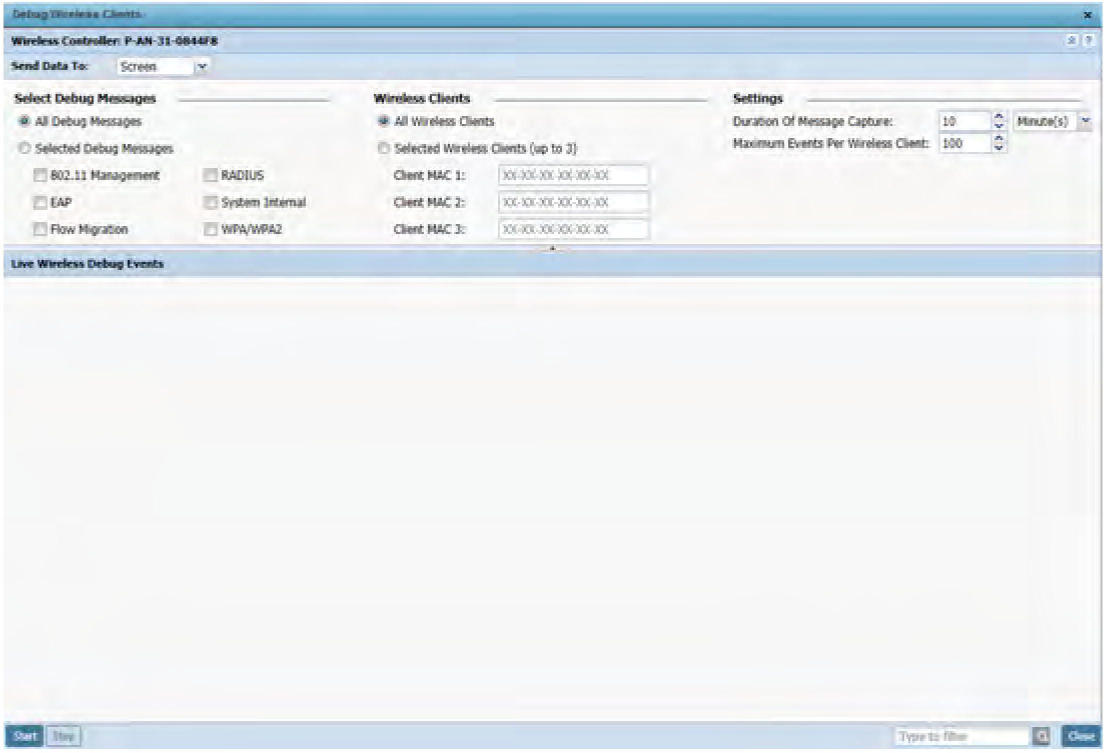
1 Select **Dashboard.**

2 Expand the **System** node to display controller, service platform or Access Point managed RF Domains.

3 Select and expand a RF Domain and click on the down arrow to the right of the RF Domain's name

4 Select **Troubleshooting**.

5 Select **Debug Wireless Clients.**



Wireless Controller: P-AN-31-0844F8

Send Data To: Screen

Select Debug Messages

● All Debug Messages
○ Selected Debug Messages
□ 802.11 Management □ RADIUS
□ EAP □ System Internal
□ Flow Migration □ WPA/WPA2

Wireless Clients

● All Wireless Clients
○ Selected Wireless Clients (up to 3)
Client MAC 1: XX-XX-XX-XX-XX-XX
Client MAC 2: XX-XX-XX-XX-XX-XX
Client MAC 3: XX-XX-XX-XX-XX-XX

Settings

Duration Of Message Capture: 10 Minute(s)
Maximum Events Per Wireless Client: 100

Figure 4-21 *Debug Wireless Clients screen*

6 Refer to the following remote debug information for RF Domain member connected wireless clients:

RF Domain	Displays the administrator assigned name of the selected RF Domain used for wireless client debugging. RF Domains allow administrators to assign configuration data to multiple devices deployed in a common coverage area, such as in a floor, building or site.
Send Data To	Use the *Send Data To* drop-down menu to select where wireless client debug messages are collected. If Screen is selected the wireless client debug information is sent to the *Live Wireless Debug Events* window at the bottom of the dialog window. If *File* is selected, the file location must be specified in the *File Location* section of the window.

Select Debug Messages	Select *All Debug Messages*, to display all wireless client debug information for the selected wireless clients on the current RF Domain. Choose *Selected Debug Messages to* specify which types of wireless client debug messages to display. If the *Selected Debug Messages* radio button is selected, you can display information for any combination of the following: - *802.11 Management* - *EAP* - Flow Migration - RADIUS - System Internal - WPA/WPA2
Wireless Clients	Select *All Wireless Clients* to display debug information for all wireless clients currently associated to the current RF Domain. Choose *Selected Wireless Clients* to display information only for specific wireless clients (between 1 and 3). If the Selected Wireless Clients radio button is selected enter the MAC address for up to three wireless clients. The information displayed or logged to the file will only be from the specified wireless clients.
Duration of Message Capture	Use the spinner controls to select how long to capture wireless client debug information. This can range between 1 second and 24 hours, with the default value being 1 minute.
Maximum Events Per Wireless Client	Use the spinner controls to select the maximum number of debug messages displayed per wireless client. Set the number of messages from 1 - 9999 events with the default value being 100 events.
File Location	When the *Send Data To* field is set to *File*, the *File Location* configuration displays below the configuration section. If *Basic* is selected, enter the URL in the following format: URL Syntax: tftp://<hostname|IP>[:port]/path/file ftp://<user>:<passwd>@<hostname|IP>[:port]/path/file IPv6 URL Syntax: tftp://<hostname|[IPv6]>[:port]/path/file *ftp://<user>:<passwd>@<hostname|[IPv6]>[:port]/path/file* If *Advanced* is selected, configure the Target, Port, Host/IP, User, Password and optionally the path for the wireless client debug log file you wish to create.
Live Wireless Debug Events	When the *Send Data To* field is set to *Screen,* this area displays live debug information for connected wireless clients in the selected RF Domain.

When all configuration fields are complete, select **Start** to start the wireless client debug capture. If information is being sent to the screen it displays in the Live Wireless Debug Events section. If the data is being sent to a file, that file populates with remote debug information. If you have set a long message capture duration and wish to end the capture early, select **Stop**.

4.8 Debug Captive Portal Clients

An administrator can select a RF Domain and capture captive portal client and authentication debug messages at an administrator assigned interval and location. Captive portal debug information can either be collected historically or in real-time.

To troubleshoot captive portal client debug messages:

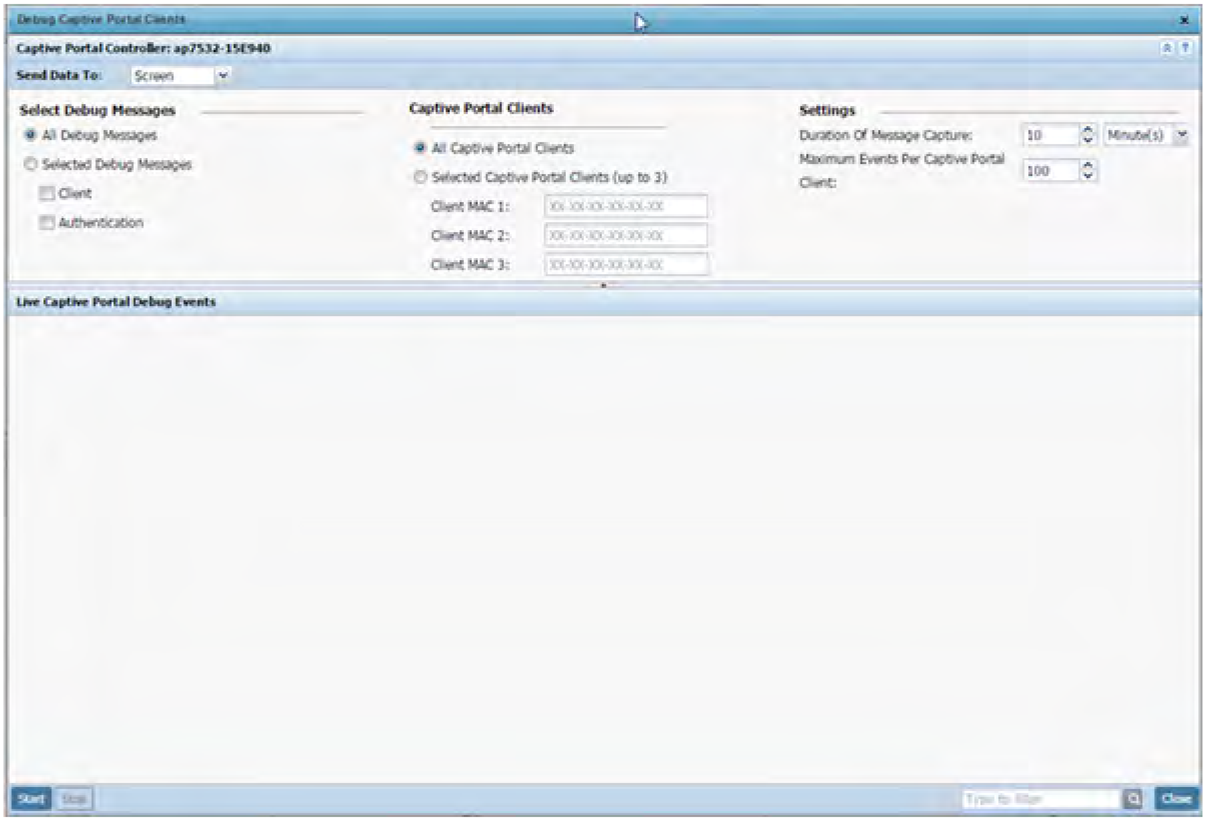
1 Select **Dashboard.**

2 Expand the **System** node to display controller, service platform or Access Point managed RF Domains.

3 Select and expand a RF Domain and click on the down arrow to the right of the RF Domain's name

4 Select **Troubleshooting**.

5 Select **Captive Portal Clients.**



Captive Portal Controller: ap7532-15E940

Send Data To: Screen

● All Debug Messages
○ Selected Debug Messages
□ Client
□ Authentication

● All Captive Portal Clients
○ Selected Captive Portal Clients (up to 3)
Client MAC 1: XX-XX-XX-XX-XX-XX
Client MAC 2: XX-XX-XX-XX-XX-XX
Client MAC 3: XX-XX-XX-XX-XX-XX

Duration Of Message Capture: 10 Minute(s)
Maximum Events Per Captive Portal Client: 100

Figure 4-22 *Debug Wireless Clients screen*

6 Use the **Send Data To** drop-down menu to select where captive portal debug messages are collected. If *Screen* is selected, information is sent to the *Live Wireless Debug Events* window at the bottom of the screen. If *File* is selected, the file location must be specified in the *File Location* field.

7 Select **Debug Message** settings to refine how captive portal client debug messages are trended:

All Debug Messages	Select this option to capture all captive portal client and captive portal authentication request events collectively without filtering by type.
Select Debug Messages	Choose *Selected Debug Messages* to specify the type of captive portal event messages to display. Options include captive portal client events and events specific to captive portal authentication requests.

8 Set **Captive Portal Clients** filter options to refine which clients are included in the debug messages.

All Captive Portal Clients	Select *All Captive Portal Clients* to display debug information for each client utilizing a captive portal for network access within the selected RF Domain.
Select Captive Portal Clients (up to 3)	Optionally display captive portal debug messages for specific clients (1 - 3). Enter the MAC address for up to three wireless clients. The information displayed or logged to the file is only from the specified wireless clients. Change the client MAC addresses as needed when clients are no longer utilizing the RF Domain's captive portal resources.

9 Define the following captive portal client **Settings** to determine how messages are trended:

Duration of Message Capture	Use the spinner controls to set the message capture interval for captive portal debug information. This can range between 1 second and 24 hours.
Maximum Events Per Captive Portal Client	Use the spinner controls to select the maximum number of captive portal event messages displayed per RF Domain member client. Set the number of messages from 1 - 9999 events with the default value being 100 events.

10 When all configuration fields are complete, select **Start** to start the captive portal client debug message capture. Information sent to the screen displays in the **Live Captive Portal Debug Events** field. If you have set a long message capture duration and wish to end the capture early, select **Stop**.

4.9 Packet Capture

An administrator can capture connected client packet data based on the packet's address type or port on which received. Dropped client packets can also be trended to assess RF Domain client connectivity health.

To administrate RF Domain packet captures:

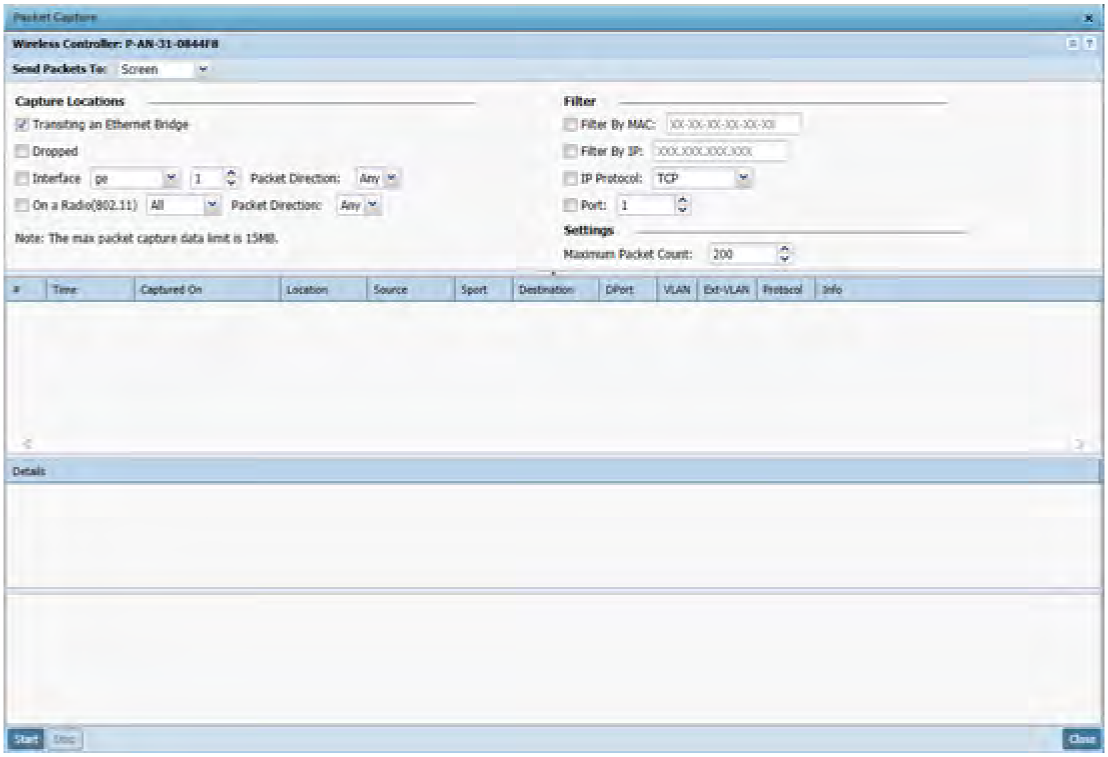
1 Select **Dashboard.**

2 Expand the **System** node to display controller, service platform or Access Point managed RF Domains.

3 Select and expand a RF Domain and click on the down arrow to the right of the RF Domain's name

4 Select **Troubleshooting**.

5 Select **Packet Capture.**



Packet Capture

Wireless Controller: P-AN-31-0844F8

Send Packets To: Screen

Capture Locations

☑ Transiting an Ethernet Bridge

□ Dropped

□ Interface ge 1 Packet Direction: Any

□ On a Radio(802.11) All Packet Direction: Any

Note: The max packet capture data limit is 15MB.

Filter

□ Filter By MAC: XX-XX-XX-XX-XX-XX

□ Filter By IP: XXX.XXX.XXX.XXX

□ IP Protocol: TCP

□ Port: 1

Settings

Maximum Packet Count: 200

#	Time	Captured On	Location	Source	Sport	Destination	DPort	VLAN	Ext-VLAN	Protocol	Info

Figure 4-23 *Packet Capture screen*

6 Refer to the following packet capture data for RF Domain member connected wireless clients:

RF Domain	Displays the administrator assigned name of the selected RF Domain used for wireless client packet captures. RF Domains allow administrators to assign configuration data to multiple devices deployed in a common coverage area, such as in a floor, building or site.
Send Data To	Use the *Send Data To* drop-down menu to select where wireless client packet capture messages are collected. If *Screen* is selected client packet capture data is sent to the *Live Wireless Debug Events* window at the bottom of the dialog window. If *File* is selected, the file location must be specified in the *File Location* section of the window.
Dropped	Select *Dropped* to create an event entry each time a packet is dropped from a client connected to a RF Domain member device. Use this information to assess whether a particular RF Domain is experiencing high levels of dropped packets that may require administration to distribute client connections more evenly.
Interface	Select Interface to specify packet capture on a specific interface on the current RF Domain. If Interface is selected, specify the interface name and number and specify a Packet Direction
On a Radio (802.11)	Select *On a Radio (802.11)* to capture packets only on 802.11 radios. If selecting this option, specify which radios should be used and specify a *Packet Direction*.

Filter (MAC, IP, Protocol, Port)	Filter packet captures based on specific criteria. Select one or more of the following and specify the relevant information: - *Filter by MAC* - Filter By IP - IP Protocol - Port
Maximum Packet Count	Set the *Maximum Packet Count* to limit the number of packets captured for trending. Set this value between 1 - 10000 packets, with a default value of 200.

7 Select **Start** to begin the packet capture. Information sent to the screen displays in the lower portion of the window. If the data is being sent to a file, that file populates with the packet capture information. If you have set a long message capture duration and wish to end the capture early, select **Stop.**

5 Device Configuration

Managed devices can either be assigned unique configurations or have existing RF Domain or Profile configurations modified (overridden) to support a requirement that dictates a device's configuration be customized from the configuration shared by its profiled peer devices.

When a device is initially managed by the controller or service platform, it requires several basic configuration parameters be set (system name, deployment location etc.). Additionally, the number of permitted device licenses needs to be accessed to determine whether a new Access Point can be adopted.

Refer to the following to set a device's basic configuration, license and certificate usage:

- *Basic Configuration*
- *Basic Device Configuration*
- *Auto Provisioning Policies*
- *Managing an Event Policy*
- *Managing MINT Policies*

RF Domains allow administrators to assign configuration data to multiple devices deployed in a common coverage area (floor, building or site). In such instances, there's many configuration attributes these devices share as their general client support roles are quite similar. However, device configurations may need periodic refinement (overrides) from their original RF Domain administered design. For more information, see RF Domain Overrides on page 5-32.

Profiles enable administrators to assign a common set of configuration parameters and policies to controller or service platforms and Access Points. Profiles can be used to assign shared or unique network, wireless and security parameters to wireless controllers and Access Points across a large, multi segment, site. The configuration parameters within a profile are based on the hardware model the profile was created to support. The controller and service platform supports both default and user defined profiles implementing new features or updating existing parameters to groups of controllers, service platforms or Access Points.

However, device profile configurations may need periodic refinement from their original administered configuration. Consequently, a device profile could be applied an override from the configuration shared amongst numerous peer devices deployed within a particular site. For more information, see Profile Overrides on page 5-38.

Adoption is the process an Access Point uses to discover controller or service platforms available in the network, pick the most desirable, establish an association, obtain its configuration and consider itself provisioned.

At adoption, an Access Point solicits and receives multiple adoption responses from available controllers or service platforms on the network. Modify existing adoption policies or create a new one as needed to meet the adoption requirements of a device and its assigned profile. For more information, see Auto Provisioning Policies on page 5-268.

Lastly, use **Configuration** > **Devices** to define and manage a critical resource policy. A critical resource policy defines a list of device IP addresses on the network (gateways, routers etc.). The support of these IP address is interpreted as critical to the health of the network. These devices addresses are pinged regularly by the controller or service platform. If there's a connectivity issue, an event is generated stating a critical resource is unavailable. For more information, see Overriding a Profile's Critical Resource Configuration on page 5-233.

5.1 Basic Configuration

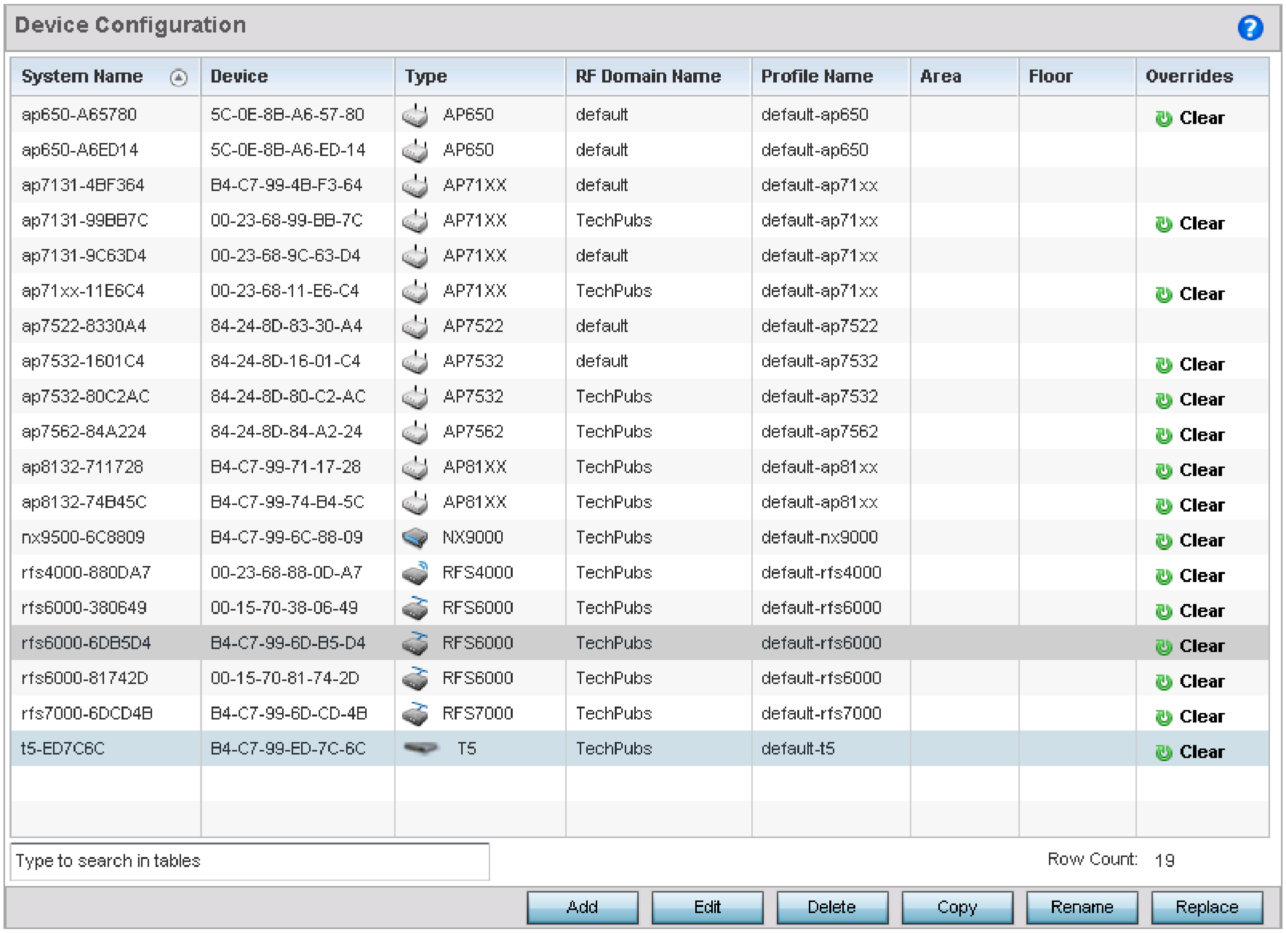
Device Configuration

To assign a Basic Configuration:

1 Select the **Configuration** tab from the Web UI.

2 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of devices.



Device Configuration

System Name	Device	Type	RF Domain Name	Profile Name	Area	Floor	Overrides
ap650-A65780	5C-0E-8B-A6-57-80	AP650	default	default-ap650			Clear
ap650-A6ED14	5C-0E-8B-A6-ED-14	AP650	default	default-ap650			
ap7131-4BF364	B4-C7-99-4B-F3-64	AP71XX	default	default-ap71xx			
ap7131-99BB7C	00-23-68-99-BB-7C	AP71XX	TechPubs	default-ap71xx			Clear
ap7131-9C63D4	00-23-68-9C-63-D4	AP71XX	default	default-ap71xx			
ap71xx-11E6C4	00-23-68-11-E6-C4	AP71XX	TechPubs	default-ap71xx			Clear
ap7522-8330A4	84-24-8D-83-30-A4	AP7522	default	default-ap7522			
ap7532-1601C4	84-24-8D-16-01-C4	AP7532	default	default-ap7532			Clear
ap7532-80C2AC	84-24-8D-80-C2-AC	AP7532	TechPubs	default-ap7532			Clear
ap7562-84A224	84-24-8D-84-A2-24	AP7562	TechPubs	default-ap7562			Clear
ap8132-711728	B4-C7-99-71-17-28	AP81XX	TechPubs	default-ap81xx			Clear
ap8132-74B45C	B4-C7-99-74-B4-5C	AP81XX	TechPubs	default-ap81xx			Clear
nx9500-6C8809	B4-C7-99-6C-88-09	NX9000	TechPubs	default-nx9000			Clear
rfs4000-880DA7	00-23-68-88-0D-A7	RFS4000	TechPubs	default-rfs4000			Clear
rfs6000-380649	00-15-70-38-06-49	RFS6000	TechPubs	default-rfs6000			Clear
rfs6000-6DB5D4	B4-C7-99-6D-B5-D4	RFS6000	TechPubs	default-rfs6000			Clear
rfs6000-81742D	00-15-70-81-74-2D	RFS6000	TechPubs	default-rfs6000			Clear
rfs7000-6DCD4B	B4-C7-99-6D-CD-4B	RFS7000	TechPubs	default-rfs7000			Clear
t5-ED7C6C	B4-C7-99-ED-7C-6C	T5	TechPubs	default-t5			Clear

Type to search in tables

Row Count: 19

Figure 5-1 *Device Configuration screen*

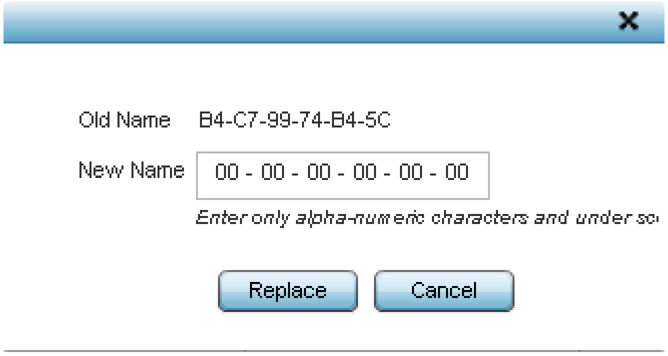
Refer to the following device settings to determine whether a configuration update or RF Domain or Profile change is warranted:

System Name	Displays the name assigned to the device when the basic configuration was defined. This is also the device name that appears within the RF Domain or Profile the device supports.
Device	Displays the device's factory assigned MAC address used as hardware identifier. The MAC address cannot be revised with the device's configuration.
Type	Displays the device model for the listed controller, service platform or Access Point.

RF Domain Name	Lists RF Domain memberships for each listed device. Devices can either belong to a default RF Domain based on model type, or be assigned a unique RF Domain supporting a specific configuration customized to that device model.
Profile Name	Lists the profile each listed device is currently a member of. Devices can either belong to a default profile based on model type, or be assigned a unique profile supporting a specific configuration customized to that model.
Area	List the physical area where the controller or service platform is deployed. This can be a building, region, campus or other area that describes the deployment location.
Floor	List the building Floor name representative of the location within the area or building the controller or service platform was physically deployed. Assigning a building Floor name is helpful when grouping devices in RF Domains and Profiles, as devices on the same physical building floor may need to share specific configuration parameters in respect to radio transmission and interference requirements specific to that location.
Overrides	The Overrides column contains an option to clear all profile overrides for any devices that contain overrides. To clear an override, select the clear button to the right of the device.

3 Select **Add** to create a new device, select **Edit** to modify an existing device or select **Delete** to remove an existing device.Optionally **Copy** or **Rename** a device as needed.

4 Use the **Replace** button to replace an existing access point with another Access Point. The Replace feature enable you to swap an existing Access Point with a new one without disrupting normal operations. The configuration of the old Access Point is automatically copied to the newly added Access Point. The following screen is displayed.



Old Name B4-C7-99-74-B4-5C

New Name 00 - 00 - 00 - 00 - 00 - 00

Enter only alpha-numeric characters and under sc

Figure 5-2 *Device Configuration screen - Replace*

5 Enter the MAC address of the new Access Point in the **New Name** field and select the **Replace** button. The new Access Point is added to the list of devices and the configuration from the old Access Point is applied to it. The old Access Point is then removed from the device list.

5.2 Basic Device Configuration

Device Configuration

Setting a device's Basic Configuration is required to assign a device *name,* deployment *location*, and system *time*. Similarly, the Basic Configuration screen is where Profile and RF Domain assignments are made. RF Domains allow administrators to assign configuration data to multiple devices deployed in a common coverage area, such as in a floor, building or site. Each RF Domain contains policies that can determine a Smart RF or WIPS configuration.

Profiles enable administrators to assign a common set of configuration parameters and policies to controllers, service platforms and Access Points. Profiles can be used to assign common or *unique* network, wireless and security parameters to wireless controllers and Access Points across a large, multi segment, site. The configuration parameters within a profile are based on the hardware model the profile was created to support. A controller and service platform support both default and user defined profiles implementing new features or updating existing parameters to groups of peer devices and Access Points. The central benefit of a profile is its ability to update devices collectively without having to modify individual device configurations one at a time.

☑ **NOTE:** Once devices have been assigned membership in either a profile or RF Domain, an administrator must be careful not to assign the device a configuration update that removes it from membership from a RF Domain or profile. A RF Domain or profile configuration must be re-applied to a device once its configuration has been modified in a manner that differentiates it from the configuration shared by the devices comprising the RF Domain or profile.

To assign a device a Basic Configuration:

1 Select the **Configuration** tab from the Web UI.

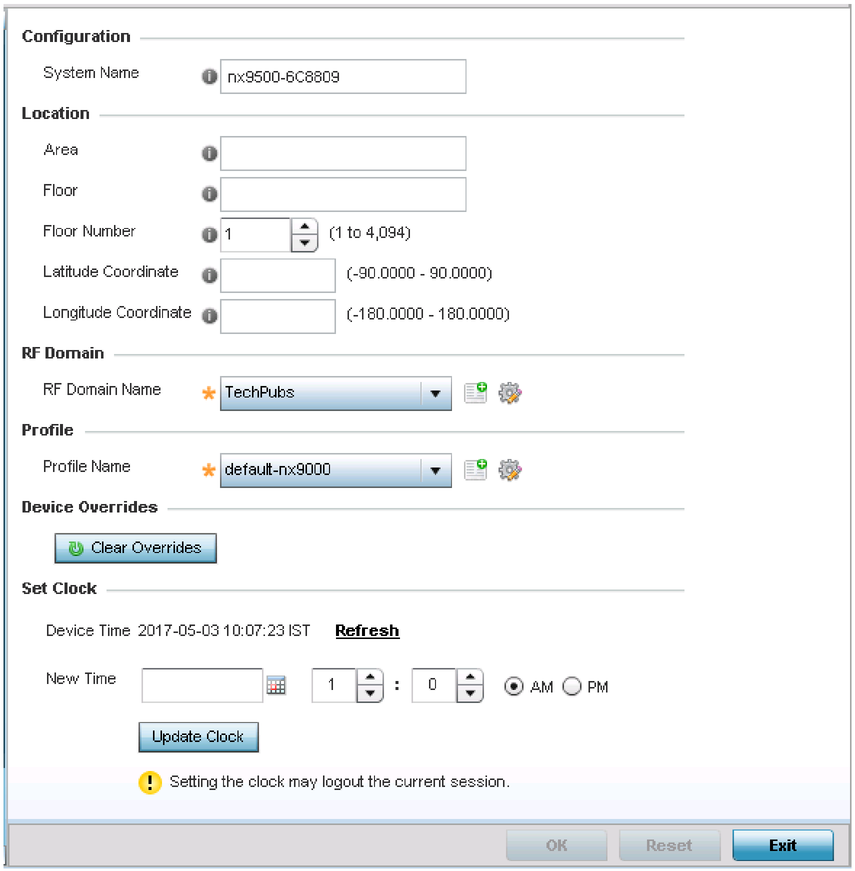
2 Select **Devices** from the Configuration tab.

The *Device Configuration* screen displays a list of managed devices or peer controllers, service platforms or Access Points.

3 Select a target device (by double-clicking it) from amongst those displayed.

Devices can also be selected directly from the *Device Browser* in the lower, left-hand, side of the UI.

The **Basic Configuration** screen displays by default.



Configuration

System Name nx9500-6C8809

Location

Area

Floor

Floor Number 1 (1 to 4,094)

Latitude Coordinate (-90.0000 - 90.0000)

Longitude Coordinate (-180.0000 - 180.0000)

RF Domain

RF Domain Name * TechPubs

Profile

Profile Name * default-nx9000

Device Overrides

Set Clock

Device Time 2017-05-03 10:07:23 IST

New Time 1 : 0 ● AM ○ PM

Setting the clock may logout the current session.

Figure 5-3 *Basic Configuration screen*

4 Set the following **Configuration** settings for the target device:

System Name	Provide the selected device a system name up to 64 characters. This is the device name that appears within the RF Domain or Profile the device supports.
Area	Assign the device an *Area* name representative of the location the controller or service platform was physically deployed. The name cannot exceed 64 characters. Assigning an area name is helpful when grouping devices in RF Domains and profiles, as devices in the same physical deployment location may need to share specific configuration parameters in respect to radio transmission and interference requirements specific to that location.
Floor	Assign the target a device a building *Floor* name representative of the location the Access Point was physically deployed. The name cannot exceed 64 characters. Assigning a building Floor name is helpful when grouping devices within the same general coverage area.
Floor Number	Use the spinner control to assign a numerical floor designation in respect to the floor's actual location within a building. Set a value from 1 - 4094. The default setting is the 1st floor.

Latitude Coordinate	Set the latitude coordinate where devices are deployed within a floor. When looking at a floor map, latitude lines specify the *east-west* position of a point on the Earth's surface. The exact location of a device deployment can be ascertained by aligning the latitude and longitude points on the earth's surface.
Longitude Coordinate	Set the longitude coordinate where devices are deployed within a floor. When looking at a floor map, longitude lines specify the *north-south* position of a point on the Earth's surface. The exact location of a device deployment can be ascertained by aligning the longitude and latitude points on the earth's surface.

5 Use the **RF Domain** drop-down menu to select an existing RF Domain for device membership.

6 If a RF Domain configuration does not exist suiting the deployment requirements of the target device, select the **Create** icon to create a new RF Domain configuration, or select the **Edit** icon to modify the configuration of a selected RF Domain. For more information, see About RF Domains on page 9-1 or Managing RF Domains on page 9-2.

7 Use the **Profile** drop-down menu to select an existing device profile for multiple device deployment uniformity.

8 If a profile configuration does not exist suiting the deployment requirements of the target device, select the **Create** icon to create a new profile configuration, or select the **Edit** icon to modify the configuration of a selected profile. For more information, see General Profile Configuration on page 8-5.

9 If necessary, select the **Clear Overrides** button to remove all existing overrides from the device.

10 Refer to the **Set Clock** parameter to update the system time of the target device.

11 Refer to the **Device Time** parameter to assess the device's current time, or whether the device time is unavailable. Select **Refresh** as required to update the device's reported system time.

12 Use the **New Time** parameter to set the calendar day, hour and minute for the target device. Use the *AM* and *PM* radio buttons to refine whether the updated time is for the morning or afternoon/evening.

13 When completed, select **Update Clock** to commit the updated time to the target device.

14 If a T5 controller is deployed, select it from the **Type** drop-down menu and configure CPE VLAN Settings, in addition to the other parameters described in this section.

A T5 controller uses the a somewhat different operating system to manage its connected radio devices, as opposed to the WiNG operating used by RFS controllers and NX service platforms. However, a T5 controller, once enabled as a supported external device, can provide data to WiNG to assist in a T5's management within a WiNG supported subnet populated by both types of devices. The *Customer Premises Equipment* (CPEs) are the T5 controller managed radio devices. These CPEs use a *Digital Subscriber Line* (DSL) as their high speed Internet access mechanism using the CPE's physical wallplate connection and phone jack.

VLAN	Set a VLAN from 1 - 4,094 used as a virtual interface for connections between the T5 controller and its managed CPE devices.
Start IP	Set a starting IP address used in a range of addresses available to T5 controller connecting CPE devices.
End IP	Set an end IP address used in a range of addresses available to T5 controller connecting CPE devices.

15 Select **OK** to save the changes made to the screen. Selecting Reset reverts the screen to its last saved configuration.

5.2.1 License Configuration

▸ *Basic Device Configuration*

Licenses are purchased directly for the number of permissible adoptions per controller, service platform or managed cluster.

✓ **NOTE:** The Licenses screen is only available to wireless controllers capable of sustaining device connections, and thus requires license support to set the maximum number of allowed device connections. The License screen is not available for Access Points.

Managing infrastructure devices requires a license key to enable software functionality or define the number of adoptable devices permitted. My Licenses is a Web based online application enabling you to request a license key for license certificates for products.

✓ **NOTE:** For detailed instructions on using My Licenses to add hardware or software licenses and register certificates, refer to the My Licenses Users Guide, available at www.extremenetworks.com/support.

The Licenses screen also contains a facility where new licenses can be applied to increase the number of device adoptions permitted, or to allow the use of the advanced security features.

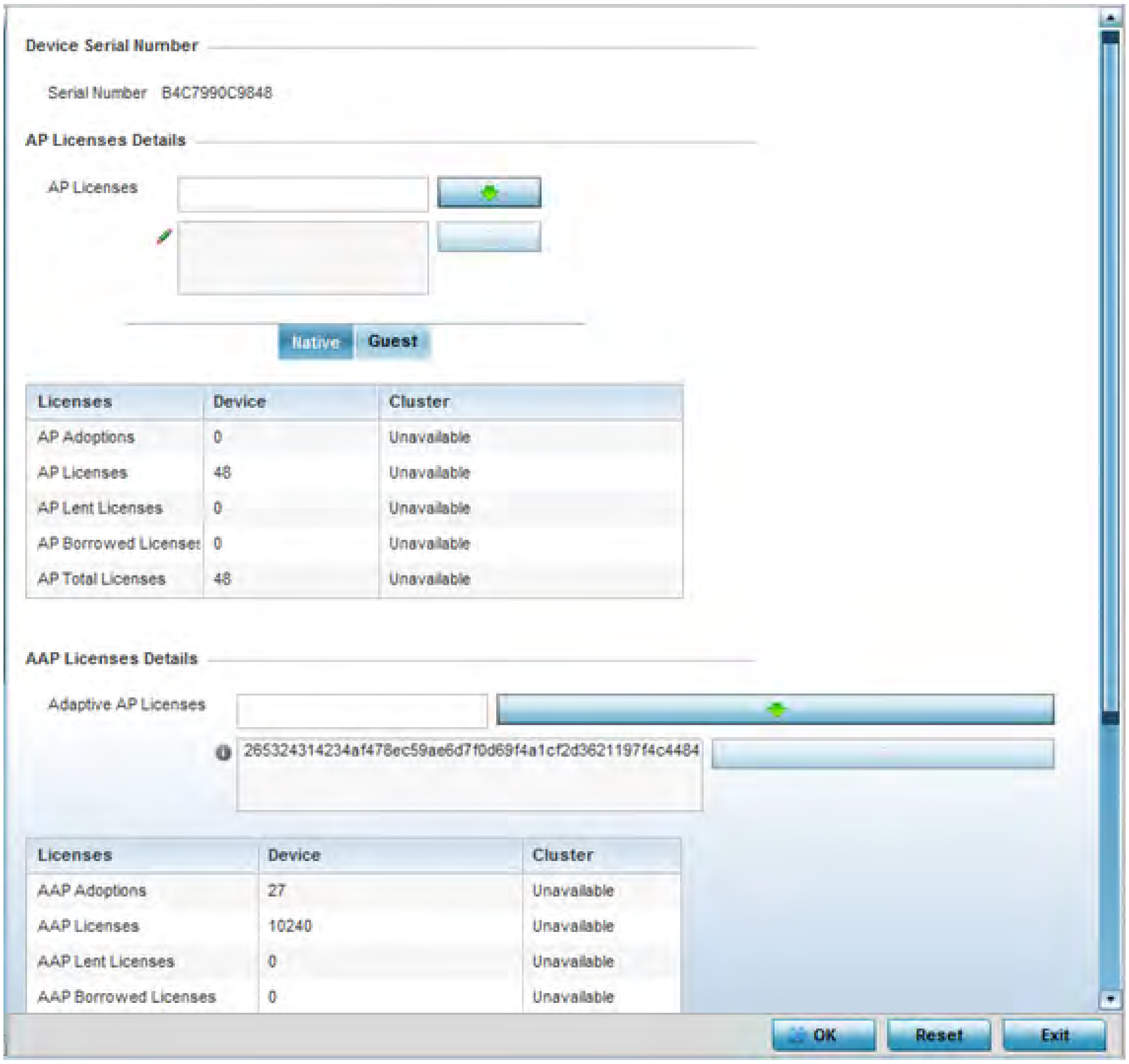
Each controller and service platform family has multiple models to choose from that range from zero licenses to the maximum number that can be loaded for that specific SKU.

To configure a device's a license configuration:

1. Select the **Configuration** tab from the Web UI.
2. Select **Devices** from the Configuration tab.

   The *Device Configuration* screen displays a list of managed devices or peer controllers, service platforms or Access Points.
3. Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

   Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.
4. Select **Licenses** from the Device menu options.



Device Serial Number

Serial Number B4C7990C9848

AP Licenses Details

AP Licenses

Licenses	Device	Cluster
AP Adoptions	0	Unavailable
AP Licenses	48	Unavailable
AP Lent Licenses	0	Unavailable
AP Borrowed Licenses	0	Unavailable
AP Total Licenses	48	Unavailable

AAP Licenses Details

Adaptive AP Licenses

265324314234af478ec59ae6d7f0d69f4a1cf2d3621197f4c4484

Licenses	Device	Cluster
AAP Adoptions	27	Unavailable
AAP Licenses	10240	Unavailable
AAP Lent Licenses	0	Unavailable
AAP Borrowed Licenses	0	Unavailable

Figure 5-4 *Device Licenses screen*

The License screen displays the **Device Serial Number** of the controller or service platform generating the license key.

NOTE: When assessing *lent* and *borrowed* license information, its important to distinguish between site controllers and NOC controllers.

NOC controllers are NX9000, NX9500, NX9510, NX7500 and RFS6000.

Site controllers are NX5500, NX7500, RFS4000 and RFS6000.

5 Review the **AP Licenses** table to assess the specific number of adoptions permitted, as dictated by the terms of the current license. The **Native** tab displays by default. Select the **Guest** tab to display guest licenses.

AP Adoptions	The *Device* column Lists the total number of AP adoptions made by the controller or service platform. If the installed license count is 10 APs and the number of AP adoptions is 5, 5 additional APs can still be adopted under the terms of the license. The total number of APs adoptions varies by platform, as well as the terms of the license. The *Cluster* column lists the total number of AP adoptions made by the cluster membership (all members). If the installed license count is 100 APs and the number of AP adoptions is 50, 50 additional APs can still be adopted under the terms of the AP licenses, pooled by the cluster members.
AP Licenses	The *Device* column lists the number of APs available for adoption under the restrictions of the license. This number applies to dependent mode adaptive APs only, and not independent mode APs. The *Cluster* column lists the number of APs available for adoption by cluster members under the restrictions of the licenses, as pooled amongst the cluster members.
AP Lent Licenses	Lent licenses are the total number of AP licenses the NOC controller lends (if needed) to its site controllers so site controllers can adopt APs in excess of its own installed AP license count. AP lent licenses can be non-zero only in controllers currently configured as the NOC (NOC controller). Lent Licenses is always zero in controllers configured as the site (site controller).
AP Borrowed Licenses	Borrowed licenses are the total number of AP licenses borrowed by the site controller from the NOC controller (NOC controllers if a NOC controller is in a cluster). AP borrowed licenses are always zero in the NOC controller. AAP borrowed licenses can be non-zero only on site controllers.
AP Total Licenses	Lists the cumulative number of both *Device* and *Cluster* AP licenses supported by the listed controller or service platform.

NOTE: The following is a licensing example: Assume there are two site controllers (S1 and S2) adopted to a NOC controller (N1). S1 has 3 installed AP licenses, and S2 has 4 installed AP licenses. Eight APs seek to adopt on S1, and ten APs seek to adopt on S2. N1 has 1024 installed licenses. N1 lends 5 (8-3) AP licenses to S1, and 6 (10-4) AP licenses to S2.

N1 displays the following in the Device column: AP Adoptions: 2 (site controllers S1 and S2) AP Licenses: 1024 AP Lent Licenses: 11 (5 to S1 + 6 to S2) AP Borrowed Licenses: 0 AP Total Licenses: 1013 (1024 – 11 lent) S1 displays the following in the Device column: AP Adoptions: 8 AP Licenses: 3 AP Lent Licenses: 0 AP Borrowed Licenses: 5 AP Total Licenses: 8 (3 + 5 borrowed). S2 displays the following in the Device column: AP Adoptions: 10 AP Licenses: 4 AP Lent Licenses: 0 AP Borrowed Licenses: 6 AP Total Licenses: 10 (4 + 6 borrowed).

6 Review the **AAP Licenses** table to assess the specific number of adoptions permitted, as dictated by the terms of the current license.

AAP Adoptions	The *Device* column Lists the total number of AAP adoptions made by the controller or service platform. If the installed license count is 10 APs and the number of AAP adoptions is 5, 5 additional AAPs can still be adopted under the terms of the license. The total number of AAPs adoptions varies by platform, as well as the terms of the license. The *Cluster* column lists the total number of AAP adoptions made by the cluster membership (all members). If the installed license count is 100 APs and the number of AAP adoptions is 50, 50 additional AAPs can still be adopted under the terms of the AAP licenses, pooled by the cluster members.
AAP Licenses	The *Device* column lists the number of AAPs available for adoption under the restrictions of the license. This number applies to dependent mode adaptive AAPs only, and not independent mode AAPs. The *Cluster* column lists the number of AAPs available for adoption by cluster members under the restrictions of the licenses, as pooled amongst the cluster members.
AAP Lent Licenses	Lent licenses are the total number of AAP licenses the NOC controller lends (if needed) to its site controllers so site controllers can adopt adaptive APs in excess of its own installed AAP license count. AAP lent licenses can be non-zero only in controllers currently configured as the NOC (NOC controller). Lent Licenses is always zero in controllers configured as the site (site controller).
AAP Borrowed Licenses	Borrowed licenses are the total number of AAP licenses borrowed by the site controller from the NOC controller (NOC controllers if a NOC controller is in a cluster). AAP borrowed licenses are always zero in the NOC controller. AAP borrowed licenses can be non-zero only on site controllers.
AAP Total Licenses	Lists the cumulative number of both *Device* and *Cluster* AAP licenses supported by the listed controller or service platform.

7 Refer to the **Feature Licenses** field to apply licenses and provision advanced security and analytics features:

Advanced Security	Enter the provided license key required to install the Role Based Firewall feature and increase the number of IPSec VPN tunnels. The number of IPSec tunnels varies by platform.
Analytics Licenses	Enter the provided license key required to install Analytics (an enhanced statistical management tool) for NX7500 and NX9000 series service platforms.

8 Refer to the **Web Filtering License** field if required to provide a 256 character maximum license string for the Web filtering feature. Web filtering is used to restrict access to specific resources on the Internet.

9 Select **OK** to save the changes made to the applied licenses. Selecting **Reset** reverts the screen to its last saved configuration.

5.2.2 Assigning Certificates

▶ *Basic Device Configuration*

A certificate links identity information with a public key enclosed in the certificate. A *certificate authority* (CA) is a network authority that issues and manages security credentials and public keys for message encryption. The CA signs all digital certificates it issues with its own private key. The corresponding public key is contained within the certificate and is called a CA certificate. A browser must contain the CA certificate in its Trusted Root Library so it can trust certificates *signed* by the CA's private key.

Depending on the public key infrastructure, the digital certificate includes the owner's public key, the certificate expiration date, the owner's name and other public key owner information. Each certificate is digitally signed by a *trustpoint*. The trustpoint signing the certificate can be a certificate authority, corporation or individual. A trustpoint represents a CA/identity pair containing the identity of the CA, CA-specific configuration parameters, and an association with an enrolled identity certificate.

SSH keys are a pair of cryptographic keys used to authenticate users instead of, or in addition to, a username/ password. One key is private and the other is public key. *Secure Shell* (SSH) public key authentication can be used by a requesting client to access resources, if properly configured. A RSA key pair must be generated on the client. The public portion of the key pair resides with the controller or service platform, while the private portion remains on a secure local area of the client.

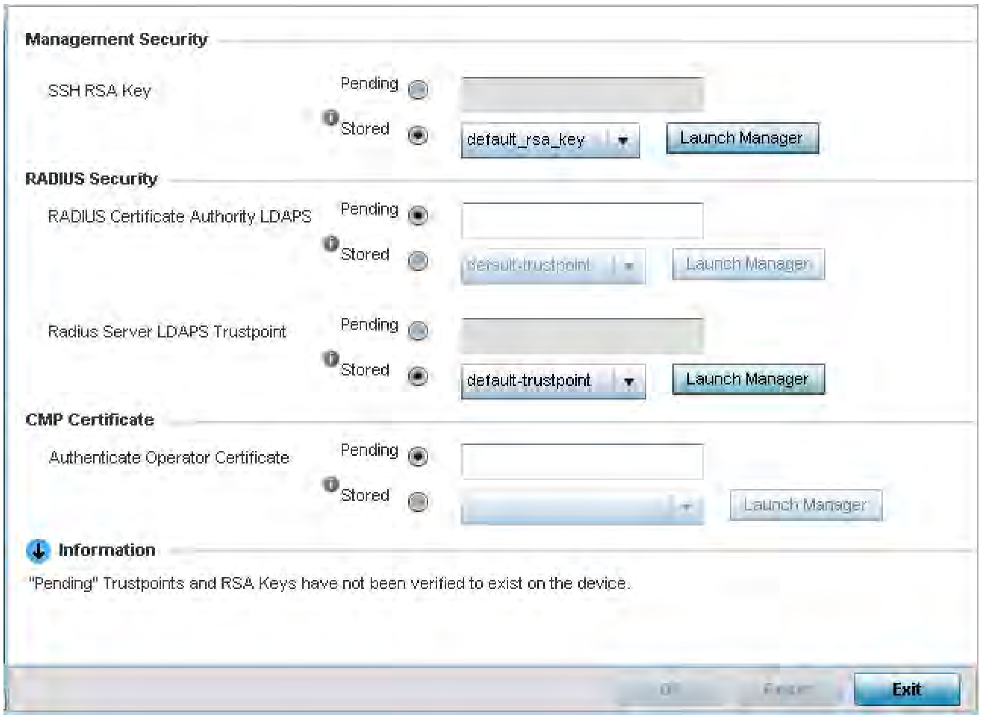
To configure certificate usage:

1 Select the **Configuration** tab from the Web UI.

2 Select **Devices** from the Configuration tab.

The *Device Configuration* screen displays a list of managed devices or peer controllers, service platforms or Access Points.

3 Select **Certificates** from the Device menu.



Management Security

SSH RSA Key — Pending ○ — Stored ● default_rsa_key ▾ Launch Manager

RADIUS Security

RADIUS Certificate Authority LDAPS — Pending ● — Stored ○ default-trustpoint ▾ Launch Manager

Radius Server LDAPS Trustpoint — Pending ○ — Stored ● default-trustpoint ▾ Launch Manager

CMP Certificate

Authenticate Operator Certificate — Pending ● — Stored ○ ▾ Launch Manager

Information

"Pending" Trustpoints and RSA Keys have not been verified to exist on the device.

Figure 5-5 *Device Certificates screen*

4 Set the following **Management Security** certificate configurations:

SSH RSA Key	Either use the default_rsa_key or select the Stored radio button to enable a drop-down menu where an existing certificate can be used. To leverage an existing key, select the Launch Manager button. For more information, see RSA Key Management on page 5-21.

☑ **NOTE:** Pending trustpoints and RSA keys are typically not verified as existing on a device.

5 Set the following **RADIUS Security** certificate configurations:

RADIUS Certificate Authority	Either use the default-trustpoint or select the *Stored* radio button to enable a drop-down menu where an existing certificate can be leveraged. To leverage an existing certificate, select the *Launch Manager* button.
RADIUS Server Certificate	Either use the default-trustpoint or select the *Stored* radio button to enable a drop-down menu where an existing certificate/trustpoint can be used. To leverage an existing trustpoint, select the *Launch Manager* button.
RADIUS Certificate Authority LDAPS	Either use the LDAP server default-trustpoint or select the *Stored* radio button to enable a drop-down menu where an existing certificate can be leveraged. To leverage an existing certificate, select the *Launch Manager* button.
Radius Server LDAPS Trustpoint	Either use the LDAP server default-trustpoint or select the *Stored* radio button to enable a drop-down menu where an existing certificate/ trustpoint can be used. To leverage an existing trustpoint, select the *Launch Manager* button.

6 Refer to the **CMP Certificate** field to optionally use *Certificate Management Protocol* (CMP) as an Internet protocol to obtain and manage digital certificates in a *Public Key Infrastructure* (PKI) network. A *Certificate Authority* (CA) issues the certificates using the defined CMP. Using CMP, a device can communicate to a CMP supported CA server, initiate a certificate request and download the required certificates from the CA server. CMP supports multiple request options through for device communicating to a CMP supported CA server. The device can initiate a request for getting the certificates from the server. It can also auto update the certificates which are about to expire.

Either use the server default-trustpoint or select the *Stored* radio button to enable a drop-down menu where an existing certificate/trustpoint can be selected. To leverage an existing trustpoint, select the **Launch Manager** button.

7 Select **OK** to save the changes made to the certificate configurations. Selecting **Reset** reverts the screen to its last saved configuration.

For more information on the certification activities supported, refer to the following:

- *Certificate Management*
- *RSA Key Management*
- *Certificate Creation*
- *Generating a Certificate Signing Request*

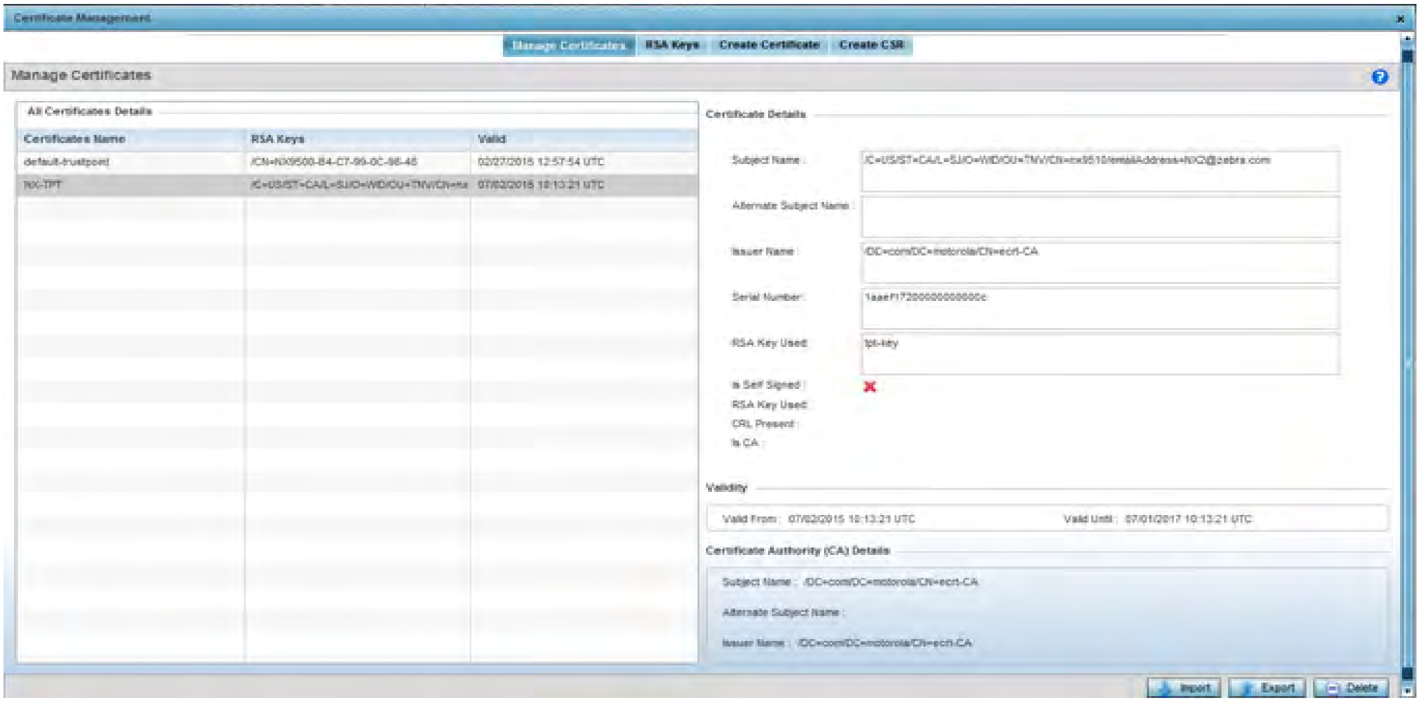
5.2.2.1 Certificate Management

▶ *Assigning Certificates*

A *stored* certificate can be leveraged from a different managed device if not wanting to use an existing certificate or key. Device certificates can be imported and exported to and from the controller or service platform to a secure remote location for archive and retrieval as required for other managed devices.

To configure trustpoints for use with certificates:

1 Select **Launch Manager** from either the *HTTPS Trustpoint*, *SSH RSA Key*, *RADIUS Certificate Authority* or *RADIUS Server Certificate* parameters.



Manage Certificates

All Certificates Details

Certificates Name	RSA Keys	Valid
default-trustpoint	/CN=NX9500-B4-C7-99-0C-98-46	02/27/2015 12:57:54 UTC
NX-TPT	/C=US/ST=CA/L=SJ/O=WD/OU=TNV/CN=nx	07/02/2015 10:13:21 UTC

Certificate Details

Subject Name : /C=US/ST=CA/L=SJ/O=WD/OU=TNV/CN=nx9510/emailAddress=NX2@zebra.com

Alternate Subject Name :

Issuer Name : /DC=com/DC=motorola/CN=ecrt-CA

Serial Number: 1aaef17200000000000c

RSA Key Used: tpt-key

Is Self Signed : ✗

RSA Key Used:

CRL Present :

Is CA :

Validity

Valid From : 07/02/2015 10:13:21 UTC Valid Until : 07/01/2017 10:13:21 UTC

Certificate Authority (CA) Details

Subject Name : /DC=com/DC=motorola/CN=ecrt-CA

Alternate Subject Name :

Issuer Name : /DC=com/DC=motorola/CN=ecrt-CA

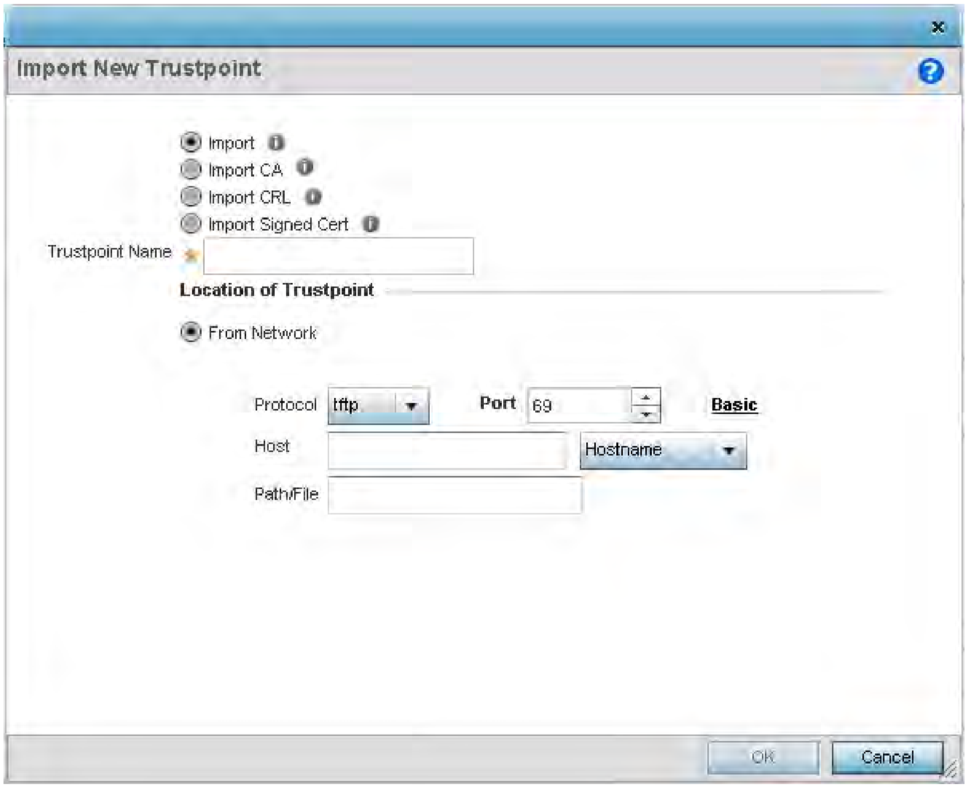
Figure 5-6 *Certificate Management - Manage Certificates screen*

The Certificate Management screen displays with the **Manage Certificates** tab displayed by default.

2 Select a device from amongst those displayed to review its certificate information.

3 Refer to the **All Certificates Details** to review the certificate's properties, self-signed credentials, validity duration and CA information.

4 To optionally import a certificate, select the **Import** button from the Certificate Management screen.



Import New Trustpoint

● Import
○ Import CA
○ Import CRL
○ Import Signed Cert

Trustpoint Name

Location of Trustpoint

● From Network

Protocol: tftp
Port: 69
Host: Hostname

Figure 5-7 *Certificate Management - Import New Trustpoint screen*

5 Define the following configuration parameters required for the **Import** of the trustpoint.

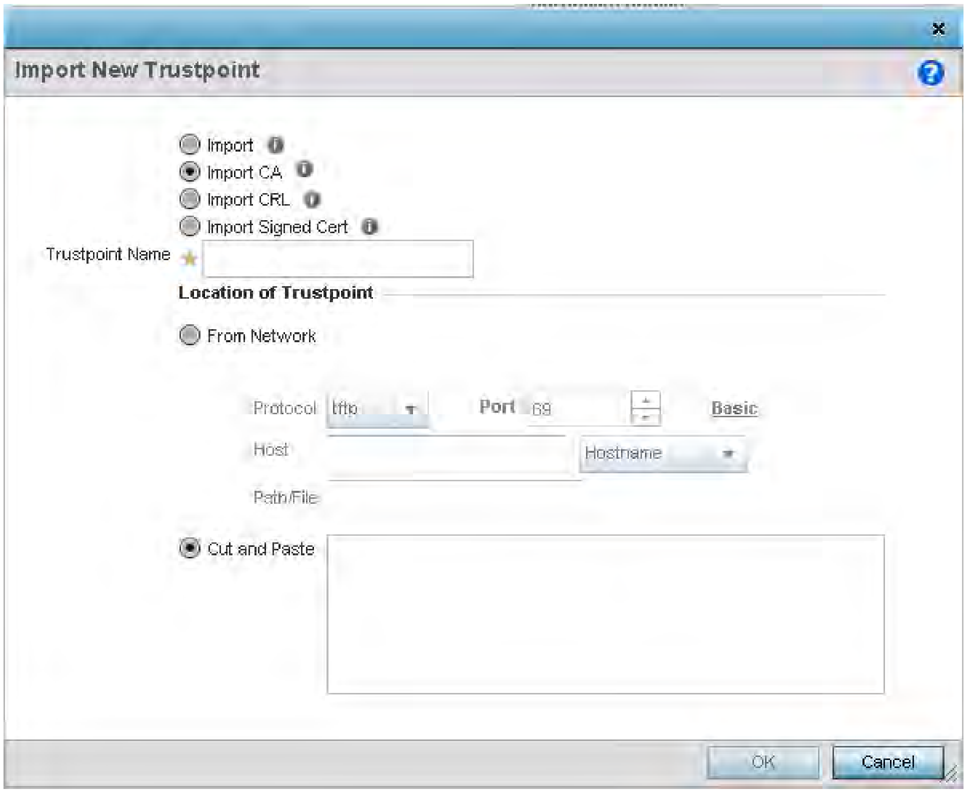
Trustpoint Name	Enter the 32 character maximum name assigned to the target trustpoint. The trustpoint signing the certificate can be a *certificate authority*, *corporation* or *individual*.
URL	Provide the complete URL to the location of the trustpoint. If needed, select *Advanced* to expand the dialog to display network address information to the location of the target trustpoint. The number of additional fields that populate the screen is also dependent on the selected protocol.
Protocol	Select the protocol used for importing the target trustpoint. Available options include: tftp ftp sftp http cf usb1-4
Port	Use the spinner control to set the port. This option is not valid for *cf* and *usb1-4*.

Host	Provide the hostname string or numeric IP address of the server used to import the trustpoint. Hostnames cannot include an underscore character. This option is not valid for *cf* and *usb1-4.* Select *IPv4 Address* to use an IPv4 formatted address as the host. Select IPv6 Address to use an IPv6 formatted address as the host. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.
Path/File	Specify the path to the trustpoint file. Enter the complete relative path to the file on the server.

6 Select **OK** to import the defined trustpoint. Select **Cancel** to revert the screen to its last saved configuration.

7 To optionally import a CA certificate, select the **Import CA** button from the Certificate Management screen.

A CA is a network authority that issues and manages security credentials and public keys for message encryption. The CA signs all digital certificates it issues with its own private key. The corresponding public key is contained within the certificate and is called a CA certificate.



Import New Trustpoint

○ Import
● Import CA
○ Import CRL
○ Import Signed Cert

Trustpoint Name

Location of Trustpoint

○ From Network

Protocol tftp Port 69 Basic

Host Hostname

Path/File

● Cut and Paste

OK Cancel

Figure 5-8 *Certificate Management - Import CA Certificate screen*

8 Define the following configuration parameters required for the **Import** of the CA certificate:

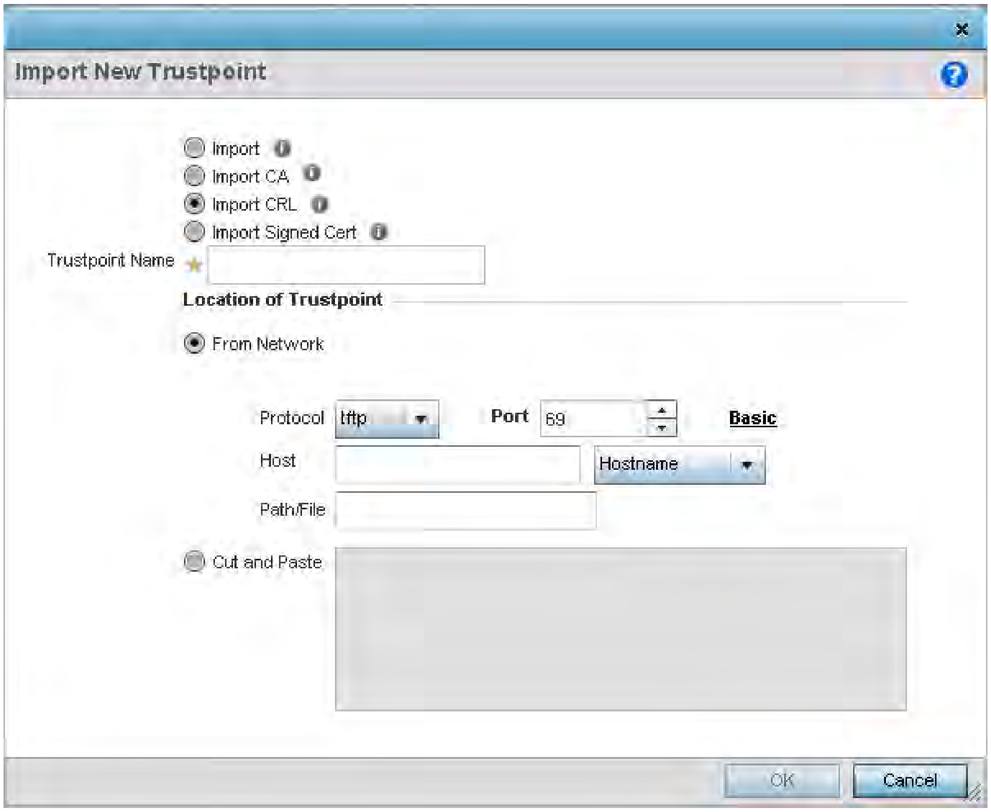
Trustpoint Name	Enter the 32 character maximum name assigned to the target trustpoint signing the certificate. A trustpoint represents a CA/identity pair containing the identity of the CA, CA specific configuration parameters, and an association with an enrolled identity certificate.
URL	Provide the complete URL to the location of the trustpoint. If needed, select *Advanced* to expand the dialog to display network address information to the location of the target trustpoint. The number of additional fields populating the screen is dependent on the selected protocol.
Advanced / Basic	Click the *Advanced* or *Basic* link to switch between a basic URL and an advanced location to specify trustpoint location.
Protocol	Select the protocol used for importing the target CA certificate. Available options include: tftp ftp sftp http cf usb1-4
Port	Use the spinner control to set the port. This option is not valid for *cf* and *usb1-4*.
Host	Provide the hostname string or numeric IP address of the server used to import the CA. Hostnames cannot include an underscore character. This option is not valid for *cf* and *usb1-4*. Select *IPv4 Address* to use an IPv4 formatted address as the host. Select IPv6 Address to use an IPv6 formatted address as the host. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.
Path/File	Specify the path to the CA file. Enter the complete relative path to the file on the server.
Cut and Paste	Select the *Cut and Paste* radio button to simply copy an existing CA into the cut and paste field. When pasting, no additional network address information is required.

9 Select **OK** to import the defined CA certificate. Select **Cancel** to revert the screen to its last saved configuration.

10 Select the **Import CRL** button from the Certificate Management screen to optionally import a CRL to a controller or service platform.

If a certificate displays within the Certificate Management screen with a CRL, that CRL can be imported. A *certificate revocation list* (CRL) is a list of certificates that have been revoked or are no longer valid. A certificate can be revoked if the CA had improperly issued a certificate, or if a private-key is compromised. The most common reason for revocation is the user no longer being in sole possession of the private key.

For information on creating a CRL to use with a trustpoint, refer to Setting the Profile’s Certificate Revocation List (CRL) Configuration on page 8-166.



○ Import
○ Import CA
● Import CRL
○ Import Signed Cert

Trustpoint Name

Location of Trustpoint

● From Network

Protocol tftp
Port 69
Host
Hostname
Path/File

○ Cut and Paste

Figure 5-9 *Certificate Management - Import CRL screen*

11 Define the following configuration parameters required for the **Import** of the CRL

Trustpoint Name	Enter the 32 character maximum name assigned to the target trustpoint signing the certificate. A trustpoint represents a CA/identity pair containing the identity of the CA, CA-specific configuration parameters, and an association with an enrolled identity certificate.
From Network	Select the *From Network* radio button to provide network address information to the location of the target CRL. The number of additional fields that populate the screen is also dependent on the selected protocol. This is the default setting.
URL	Provide the complete URL to the location of the CRL. If needed, select *Advanced* to expand the dialog to display network address information to the location of the CRL. The number of additional fields that populate the screen is also dependent on the selected protocol.
Protocol	Select the protocol used for importing the CRL. Available options include: tftp ftp sftp http cf usb1-4
Port	Use the spinner control to set the port. This option is not valid for *cf* and *usb1-4*.

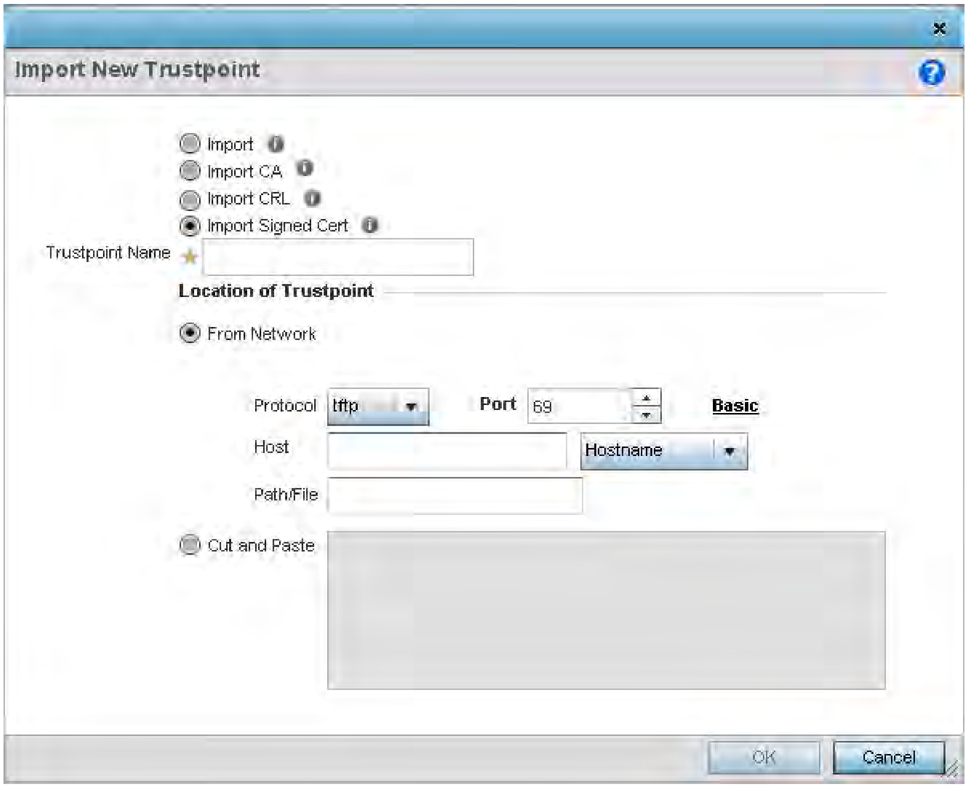
Host	Provide the hostname string or numeric IP address of the server used to import the CRL. Hostnames cannot include an underscore character. This option is not valid for *cf* and *usb1-4*. Select *IPv4 Address* to use an IPv4 formatted address as the host. Select *IPv6 Address* to use an IPv6 formatted address as the host. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.
Path/File	Specify the path to the CRL file. Enter the complete relative path to the file on the server.
Cut and Paste	Select the *Cut and Paste* radio button to simply copy an existing CRL into the cut and paste field. When pasting, no additional network address information is required.

12 Select **OK** to import the CRL. Select **Cancel** to revert the screen to its last saved configuration.

13 To import a signed certificate, select the **Import Signed Cert** button from the Certificate Management screen.

Signed certificates (or root certificates) avoid the use of public or private CAs. A self-signed certificate is an identity certificate signed by its own creator, thus the certificate creator also signs off on its legitimacy. The lack of mistakes or corruption in the issuance of self signed certificates is central.

Self-signed certificates cannot be revoked which may allow an attacker who has already gained access to monitor and inject data into a connection to spoof an identity if a private key has been compromised. However, CAs have the ability to revoke a compromised certificate, preventing its further use.



Import New Trustpoint

○ Import
○ Import CA
○ Import CRL
● Import Signed Cert

Trustpoint Name

Location of Trustpoint

● From Network

Protocol: tftp
Port: 69
Basic
Host: Hostname
Path/File

○ Cut and Paste

OK
Cancel

Figure 5-10 *Certificate Management - Import Signed Cert screen*

14 Define the following parameters required for the **Import** of the CA certificate:

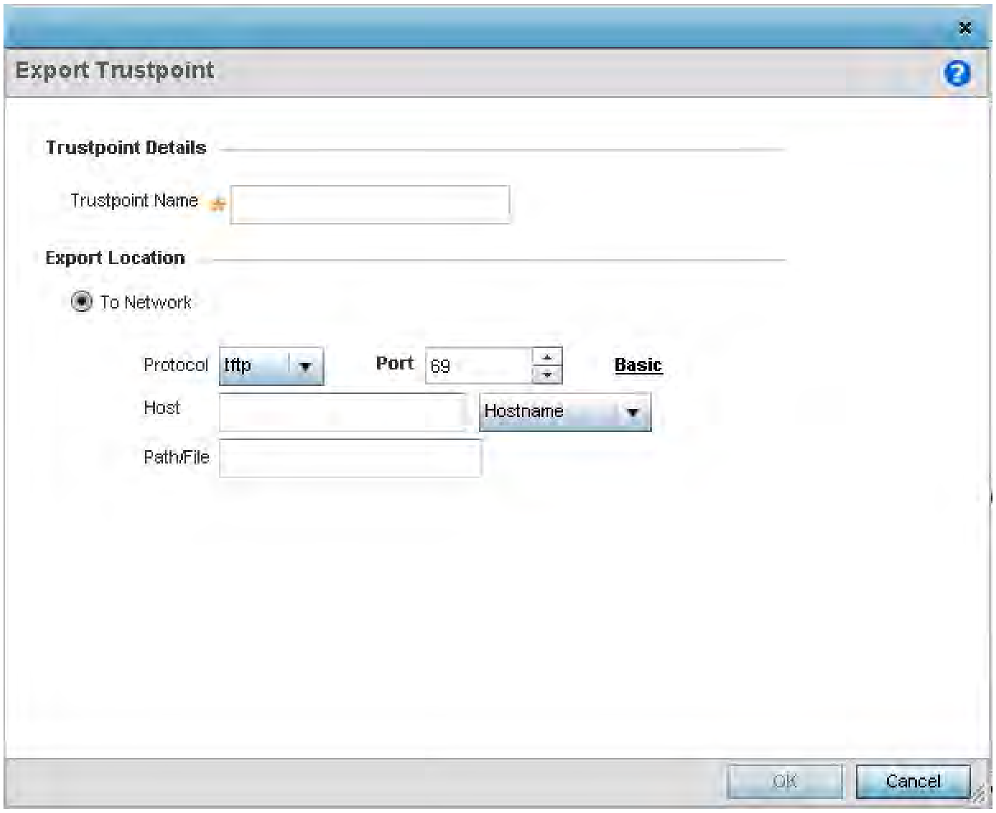
Certificate Name	Enter the 32 character maximum trustpoint name with which the certificate should be associated.
From Network	Select the *From Network* radio button to provide network address information to the location of the signed certificate. The number of additional fields that populate the screen is dependent on the selected protocol. From Network is the default setting.
URL	Provide the complete URL to the location of the signed certificate. If needed, select *Advanced* to expand the dialog to display network address information to the location of the signed certificate. The number of additional fields populating the screen is dependent on the selected protocol.
Protocol	Select the protocol for importing the signed certificate. Available options include: tftp ftp sftp http cf usb1-4
Port	Use the spinner control to set the port. This option is not valid for *cf* and *usb1-4*.
Host	Provide the hostname string or numeric IP address of the server used to import the signed certificate. Hostnames cannot include an underscore character. This option is not valid for *cf* and *usb1-4*. Select *IPv4 Address* to use an IPv4 formatted address as the host. Select *IPv6 Address* to use an IPv6 formatted address as the host. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.
Path/File	Specify the path to the signed certificate file. Enter the complete relative path to the file on the server.
Cut and Paste	Select the *Cut and Paste* radio button to simply copy an existing certificate into the cut and paste field. When pasting, no additional network address information is required.

15 Select **OK** to import the signed certificate. Select **Cancel** to revert the screen to its last saved configuration.

16 To optionally export a trustpoint to a remote location, select the **Export** button from the Certificate Management screen.

Once a certificate has been generated on the controller or service platform's authentication server, export the self signed certificate. A digital CA certificate is different from a self signed certificate. The CA certificate contains the public and private key pairs. The self certificate only contains a public key. Export the self certificate for publication on a Web server or file server for certificate deployment or export it in to an active directory group policy for automatic root certificate deployment.

17 Additionally export the key to a redundant RADIUS server so it can be imported without generating a second key. If there’s more than one RADIUS authentication server, export the certificate and don’t generate a second key unless you want to deploy two root certificates.



Trustpoint Name

● To Network

Protocol tftp

Port 69

Host

Hostname

Path/File

Figure 5-11 *Certificate Management - Export Trustpoint screen*

18 Define the following configuration parameters required for the **Export** of the trustpoint.

Trustpoint Name	Enter the 32 character maximum name assigned to the trustpoint. The trustpoint signing the certificate can be a certificate authority, corporation or individual.
URL	Provide the complete URL to the location of the trustpoint. If needed, select *Advanced* to expand the dialog to display network address information to the location of the trustpoint. The number of additional fields that populate the screen is dependent on the selected protocol.
Protocol	Select the protocol used for exporting the target trustpoint. Available options include: tftp ftp sftp http cf usb1-4
Port	Use the spinner control to set the port. This option is not valid for *cf* and *usb1-4*.

Host	Provide the hostname string or numeric IP address of the server used to export the trustpoint. Hostnames cannot include an underscore character. This option is not valid for *cf* and *usb1-4*. Select *IPv4 Address* to use an IPv4 formatted address as the host. Select *IPv6 Address* to use an IPv6 formatted address as the host. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.
Path/File	Specify the path to the signed trustpoint file. Enter the complete relative path to the file on the server.
Cut and Paste	Select the *Cut and Paste* radio button to simply copy an existing trustpoint into the cut and paste field. When pasting, no additional network address information is required.

19 Select **OK** to export the defined trustpoint. Select **Cancel** to revert the screen to its last saved configuration.

20 To optionally delete a trustpoint, select the **Delete** button from within the Certificate Management screen. Provide the trustpoint name within the **Delete Trustpoint** screen and optionally select **Delete RSA Key** to remove the RSA key along with the trustpoint. Select **OK** to proceed with the deletion, or **Cancel** to revert to the Certificate Management screen

5.2.2.2 RSA Key Management

▶ *Assigning Certificates*

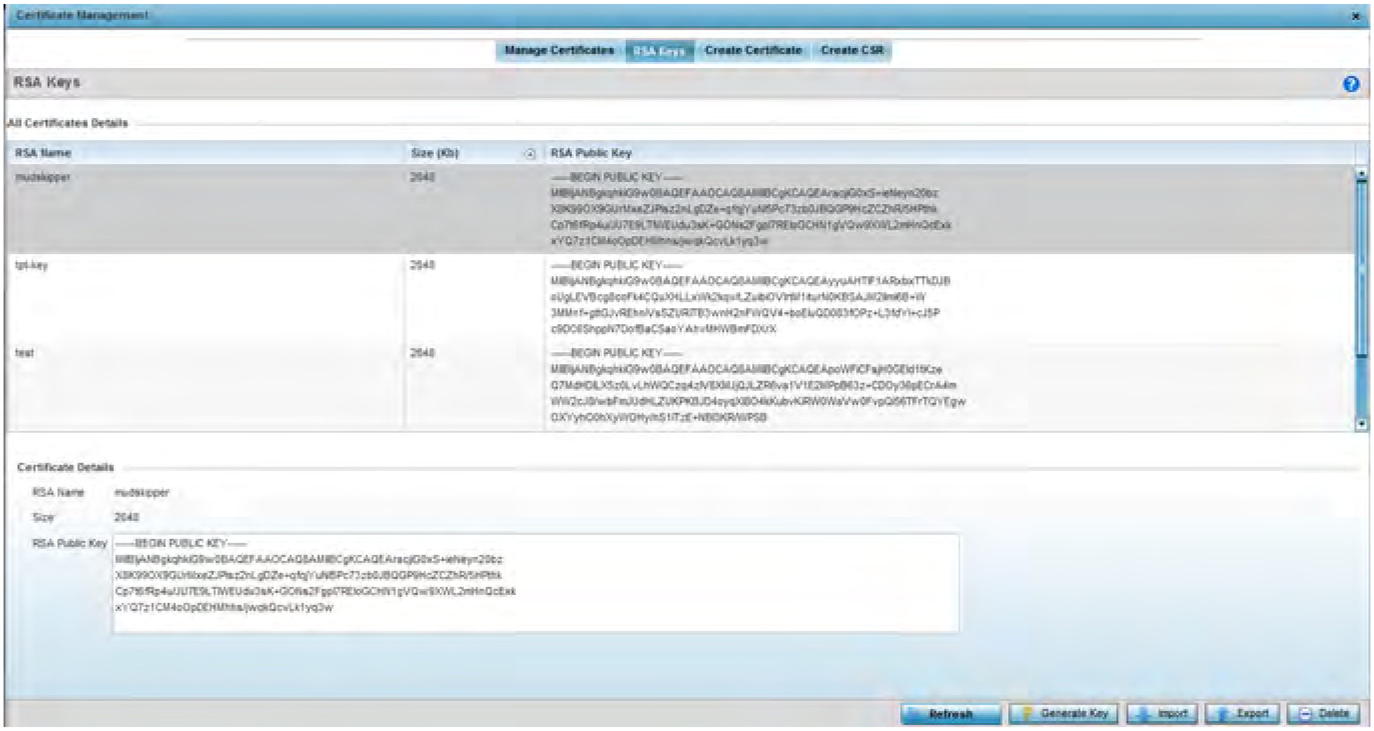
Refer to the RSA Keys screen to review existing RSA key configurations that have been applied to managed devices. If an existing key does not meet the needs of a pending certificate request, generate a new key or import/ export an existing key to and from a remote location.

Rivest, Shamir, and Adleman (RSA) is an algorithm for public key cryptography. It's an algorithm that can be used for certificate signing and encryption. When a device trustpoint is created, the RSA key is the private key used with the trustpoint.

To review existing device RSA key configurations, generate additional keys or import/export keys to and from remote locations:

1 Select the **Launch Manager** button from either the SSH RSA Key, RADIUS Certificate Authority or RADIUS Server Certificate parameters (within the Certificate Management screen).

2 Select **RSA Keys** from the Certificate Management screen.



RSA Keys

All Certificates Details

RSA Name	Size (Kb)	RSA Public Key
mudskipper	2048	-----BEGIN PUBLIC KEY----- MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAracjG0xS+ieNeyn20bz X8K99OX9GUrIxeZJPlsz2nLgDZe+qfqjYuN8Pc73zb0JBQGP9HcZCZhR/5HPthk Cp7t6fRp4uUU7E9LTWEUdu3aK+GONs2Fgpl7REbGCHN1gVQw9XWL2mHnQcExk xYQ7z1CM4oOpDEHMhha/jwqkQcvLk1yq3w
tpt-key	2048	-----BEGIN PUBLIC KEY----- MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAyyuAHTF1ARxbxTTkDJB oUgLEVBcg8ooFk4CQuXHLLxWN2kqvfLZuboOVtW14urN0KBSAJlI2lmK6+W 3MMnf+gtGJvREhnVsSZURiTE0wnH2nFWQV4+boEkGD0031OPz+L3fdYl+cJ5P c9DO6ShppN7DofBaCSaoYAtvMHWBmFDUX
test	2048	-----BEGIN PUBLIC KEY----- MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEApoWFiCFajH0GEld1fKze Q7MdHDiLX5z0LvLhWQCzq4zlVEXMJjQJLZRlva1V1E2MPpB63z+CDOy36pECrA4m WW2cJ8/wbFmJUdHLZUKPKBJD4oyqXBO4kKubvKRW0WaVw0FvpQ66TFrTQYEgw OXYyhO0hXyWGHyInS1lTzE+NBDKRWPSB

Certificate Details

RSA Name mudskipper

Size 2048

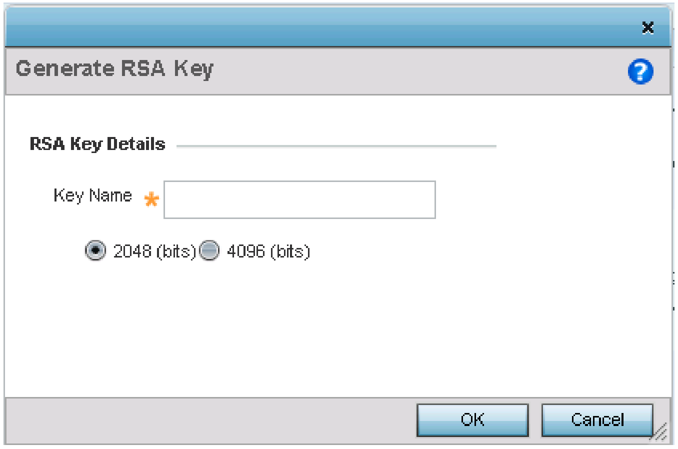
RSA Public Key -----BEGIN PUBLIC KEY-----
MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAracjG0xS+ieNeyn20bz
X8K99OX9GUrIxeZJPlsz2nLgDZe+qfqjYuN8Pc73zb0JBQGP9HcZCZhR/5HPthk
Cp7t6fRp4uUU7E9LTWEUdu3aK+GONs2Fgpl7REbGCHN1gVQw9XWL2mHnQcExk
xYQ7z1CM4oOpDEHMhha/jwqkQcvLk1yq3w

Figure 5-12 *Certificate Management - RSA Keys screen*

3 Select a listed device to review its current RSA key configuration.

Each key can have its size and character syntax displayed. Once reviewed, optionally generate a new RSA key, import a key from a selected device, export a key to a remote location or delete a key from a selected device.

4 Select **Generate Key** to create a new key with a defined size.



RSA Key Details

Key Name *

● 2048 (bits) ○ 4096 (bits)

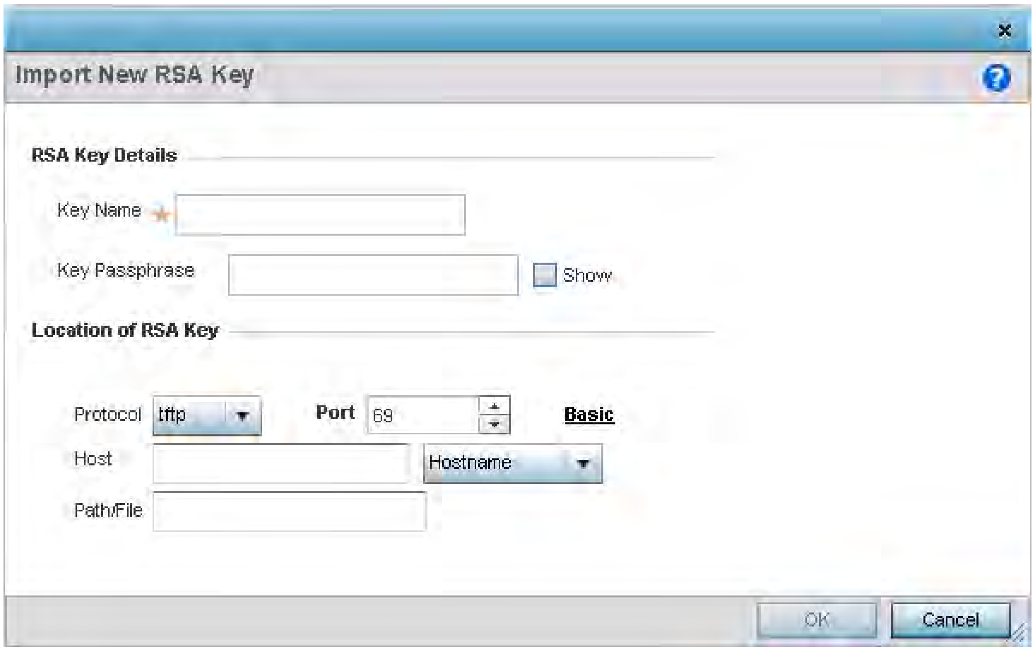
Figure 5-13 *Certificate Management - Generate RSA Keys screen*

5 Define the following configuration parameters required for the **Import** of the key:

Key Name	Enter the 32 character maximum name assigned to the RSA key.
Key Size	Set the size of the key as either 2048 (bits) or 4096 (bits). Leaving this value at the default setting of 2048 is recommended to ensure optimum functionality.

6 Select **OK** to generate the RSA key. Select **Cancel** to revert the screen to its last saved configuration.

7 To optionally import a CA certificate, select the **Import** button from the Certificate Management > RSA Keys screen.



Protocol: tftp

Port: 69

Host: Hostname

Path/File

Figure 5-14 *Certificate Management - Import New RSA Key screen*

8 Define the following parameters required for the **Import** of the RSA key:

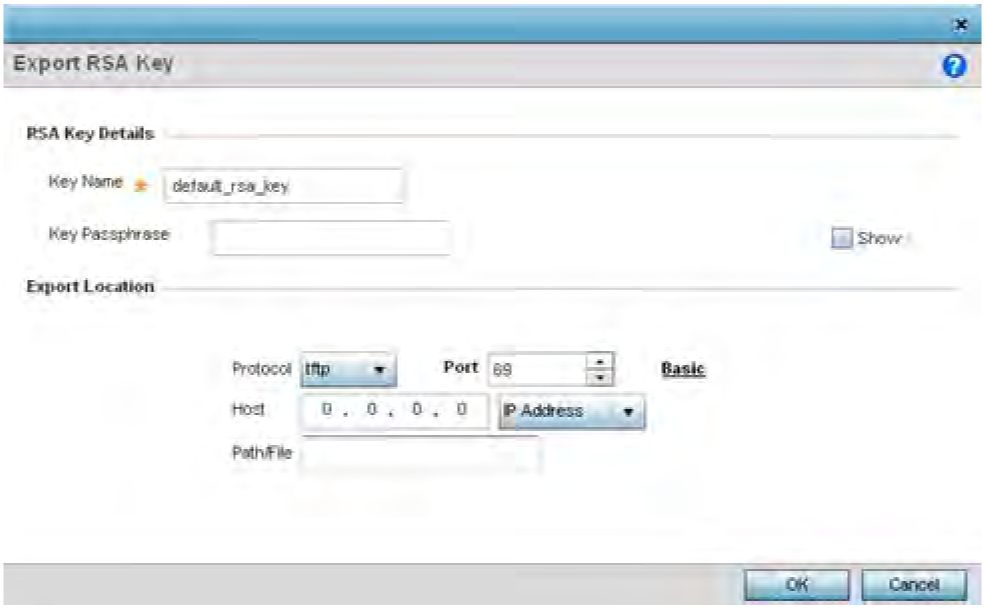
Key Name	Enter the 32 character maximum name assigned to identify the RSA key.
Key Passphrase	Define the key used by both the controller or service platform and the server (or repository) of the target RSA key. Select the *Show* to expose the actual characters used in the passphrase. Leaving the Show unselected displays the passphrase as a series of asterisks "*".
URL	Provide the complete URL to the location of the RSA key. If needed, select *Advanced* to expand the dialog to display network address information to the location of the target key. The number of additional fields that populate the screen is dependent on the selected protocol.
Advanced or **Basic**	Select either the *Advanced* or *Basic* link to switch between a basic URL and an advanced location to specify key location.
Protocol	Select the protocol used for importing the target key. Available options include: tftp ftp sftp http cf usb1-4
Port	Use the spinner control to set the port. This option is not valid for *cf* and *usb1-4*.

Host	Provide a text string hostname or numeric IP address of the server used to import the RSA key. Hostnames cannot include an underscore character. This option is not valid for *cf* and *usb1-4*. Select *IPv4 Address* to use an IPv4 formatted address as the host. Select *IPv6 Address* to use an IPv6 formatted address as the host. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.
Path/File	Specify the path to the RSA key. Enter the complete relative path to the key on the server.

9 Select **OK** to import the defined RSA key. Select **Cancel** to revert the screen to its last saved configuration.

10 To optionally export a RSA key to a remote location, select the **Export** button from the Certificate Management > RSA Keys screen.

Export the key to a redundant RADIUS server to import it without generating a second key. If there's more than one RADIUS authentication server, export the certificate and don't generate a second key unless you want to deploy two root certificates.



Export RSA Key

RSA Key Details

Key Name ★ default_rsa_key

Key Passphrase

□ Show

Export Location

Protocol tftp

Port 69

Host 0 . 0 . 0 . 0 IP Address

Path/File

Figure 5-15 *Certificate Management - Export RSA Key screen*

11 Define the following configuration parameters required for the **Export** of the RSA key.

Key Name	Enter the 32 character maximum name assigned to the RSA key.
Key Passphrase	Define the key passphrase used by both the controller or service platform and the server. Select *Show* to expose the actual characters used in the passphrase. Leaving the Show unselected displays the passphrase as a series of asterisks "*".
URL	Provide the complete URL to the location of the key. If needed, select *Advanced* to expand the dialog to display network address information to the location of the target key. The number of additional fields that populate the screen is dependent on the selected protocol.

Protocol	Select the protocol used for exporting the RSA key. Available options include: tftp ftp sftp http cf usb1-4
Port	Use the spinner control to set the port. This option is not valid for *cf* and *usb1-4*.
Host	Provide a text string hostname or numeric IP address of the server used to export the RSA key. Hostnames cannot include an underscore character. This option is not valid for cf and usb1-4. Select *IPv4 Address* to use an IPv4 formatted address as the host. Select *IPv6 Address* to use an IPv6 formatted address as the host. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.
Path / File	Specify the path to the key. Enter the complete relative path to the key on the server.

12 Select **OK** to export the defined RSA key. Select **Cancel** to revert the screen to its last saved configuration.

13 To optionally delete a key, select the **Delete** button from within the Certificate Management > RSA Keys screen. Provide the key name within the **Delete RSA Key** screen and select **Delete Certificates** to remove the certificate. Select **OK** to proceed with the deletion, or **Cancel** to revert back to the Certificate Management screen.

5.2.2.3 Certificate Creation

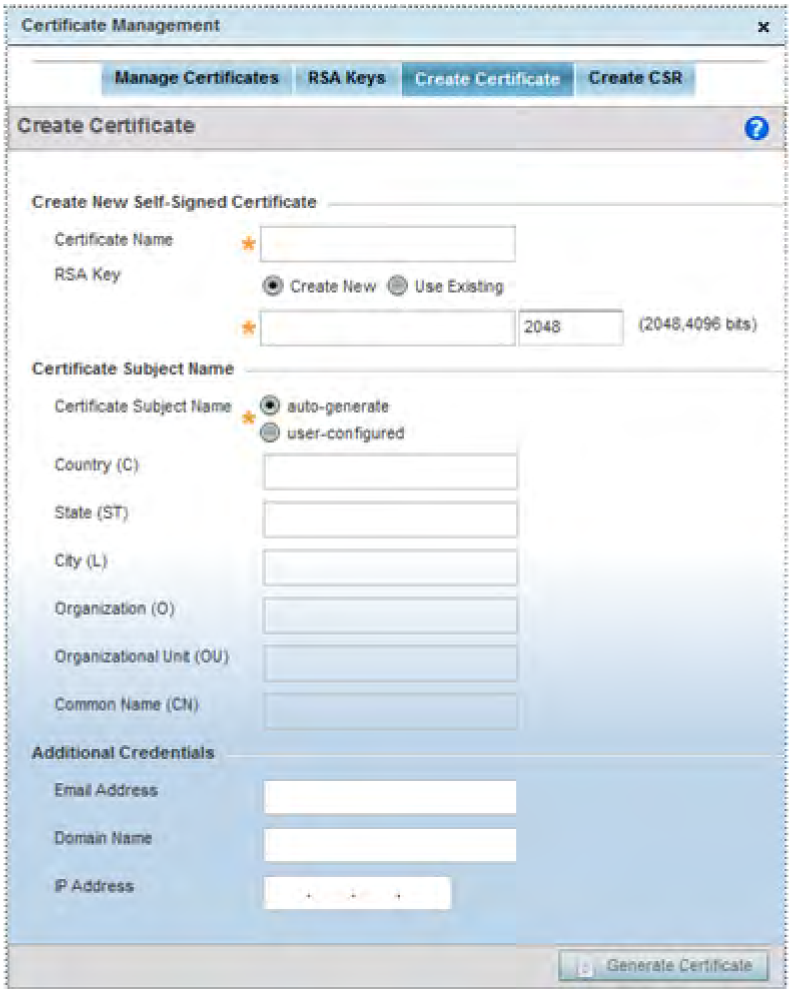
▶ *Assigning Certificates*

The Certificate Management screen provides the facility for creating new self-signed certificates. Self signed certificates (often referred to as root certificates) do not use public or private CAs. A self signed certificate is a certificate signed by its own creator, with the certificate creator responsible for its legitimacy.

To create a self-signed certificate that can be applied to a managed device:

1 Select the **Launch Manager** button from either the SSH RSA Key, RADIUS Certificate Authority or RADIUS Server Certificate parameters (within the Certificate Management screen).

2 Select **Create Certificate** from the upper, left-hand, side of the Certificate Management screen.



Certificate Management ×

Manage Certificates | RSA Keys | Create Certificate | Create CSR

Create Certificate

Create New Self-Signed Certificate

Certificate Name *

RSA Key ● Create New ○ Use Existing

* 2048 (2048,4096 bits)

Certificate Subject Name

Certificate Subject Name * ● auto-generate ○ user-configured

Country (C)

State (ST)

City (L)

Organization (O)

Organizational Unit (OU)

Common Name (CN)

Additional Credentials

Email Address

Domain Name

IP Address . . .

Generate Certificate

Figure 5-16 *Certificate Management - Create Certificate screen*

3 Define the following configuration parameters required to **Create New Self-Signed Certificate**:

Certificate Name	Enter the 32 character maximum name assigned to identify the name of the trustpoint associated with the certificate. A trustpoint represents a CA/identity pair containing the identity of the CA, CA-specific configuration parameters, and an association with an enrolled identity certificate.
RSA Key	Select a radio button and use the drop-down menu to set the key used by both the controller or service platform and the server (or repository) of the target RSA key. Optionally select *Create New* and enter a 32 character name used to identify the RSA key. Set the size of the key to either 2,048 or 4,096 bits. Leaving this value at the default setting of 2,048 is recommended to ensure optimum functionality.

4 Set the following **Certificate Subject Name** parameters required for the creation of the certificate:

Certificate Subject Name	Select either *auto-generate* to automatically create the certificate's subject credentials or *user-configurable* to manually enter the credentials of the self signed certificate. The default setting is auto-generate.
Country (C)	Define the *Country* used in the certificate. The field can be modified by the user to other values. This is a required field and must not exceed 2 characters.
State (ST)	Enter a *State/Prov.* for the state or province name used in the certificate. This is a required field.
City (L)	Enter a *City* to represent the city used in the certificate. This is a required field.
Organization (O)	Define an *Organization* for the organization represented in the certificate. This is a required field.
Organizational Unit (OU)	Enter an *Org. Unit* for the organization unit represented in the certificate. This is a required field.
Common Name (CN)	If there's a common name (IP address) for the organizational unit issuing the certificate, enter it here.

5 Select the following **Additional Credentials** required for the generation of the self signed certificate:

Email Address	Provide an *Email Address* used as the contact address for issues relating to this certificate request.
Domain Name	Enter a *fully qualified domain name* (FQDN) is an unambiguous domain name that specifies the node's position in the DNS tree hierarchy absolutely. To distinguish an FQDN from a regular domain name, a trailing period is added. For example, *somehost.example.com*. An FQDN differs from a regular domain name by its absoluteness, since a suffix is not added.
IP Address	Specify the IP address used as the destination for certificate requests.Only IPv4 formatted IP addresses are permitted, not IPv6 formatted addresses.

6 Select the **Generate Certificate** button at the bottom of the Certificate Management > Create Certificate screen to produce the certificate.

5.2.2.4 Generating a Certificate Signing Request

▸ *Assigning Certificates*

A *certificate signing request* (CSR) is a request to a certificate authority to apply for a digital identity certificate. The CSR is a block of encrypted text generated on the server the certificate is used on. It contains the organization name, common name (domain name), locality and country.

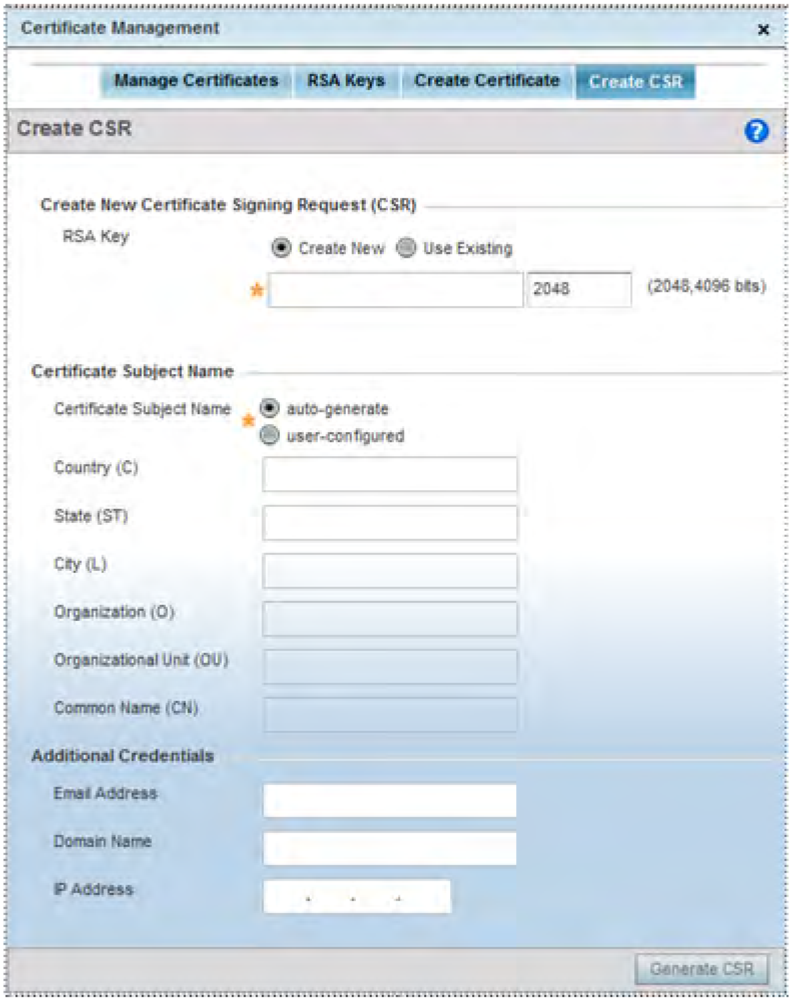
A RSA key must be either created or applied to the certificate request before the certificate can be generated. A private key is not included in the CSR, but is used to digitally sign the completed request. The certificate created with a particular CSR only works with the private key generated with it. If the private key is lost, the certificate is no longer functional.The CSR can be accompanied by other identity credentials required by the certificate authority, and the certificate authority maintains the right to contact the applicant for additional information.

If the request is successful, the CA sends an identity certificate digitally signed with the private key of the CA.

To create a CSR:

1 Select the **Launch Manager** button from either the SSH RSA Key, RADIUS Certificate Authority or RADIUS Server Certificate parameters (within the Certificate Management screen).

2 Select **Create CSR** from the upper, left-hand, side of the Certificate Management screen.



RSA Key ● Create New ○ Use Existing

* 2048 (2048,4096 bits)

Certificate Subject Name * ● auto-generate ○ user-configured

Figure 5-17 *Certificate Management - Create CSR screen*

3 Define the following configuration parameters required to **Create New Certificate Signing Request (CSR)**:

RSA Key	Select a radio button and use the drop-down menu to set the key used by both the controller or service platform and the server (or repository) of the target RSA key. Optionally select *Create New* to use new RSA key and provide a 32 character name used to identify the RSA key. Set the size of the key to either 2,048 or 4,096 bits. Leaving this value at the default setting of 2,048 is recommended to ensure optimum functionality.

4 Set the following **Certificate Subject Name** parameters required for the creation of the certificate:

Certificate Subject Name	Select either the *auto-generate* radio button to automatically create the certificate's subject credentials or *user-configurable* to manually enter the credentials of the self signed certificate. The default setting is auto-generate.
Country (C)	Define the *Country* used in the CSR. The field can be modified by the user to other values. This is a required field and must not exceed 2 characters.

State (ST)	Enter a *State/Prov.* for the state or province name represented in the CSR. This is a required field.
City (L)	Enter a *City* represented in the CSR. This is a required field.
Organization (O)	Define the *Organization* represented in the CSR. This is a required field.
Organizational Unit (OU)	Enter the *Org. Unit* represented in the CSR. This is a required field.
Common Name (CN)	If there's a common name (IP address) for the organizational unit issuing the certificate, enter it here.

5 Select the following **Additional Credentials** required for the generation of the CSR:

Email Address	Provide an email address used as the contact address for issues relating to this CSR.
Domain Name	Enter a *fully qualified domain name* (FQDN) is an unambiguous domain name that specifies the node's position in the DNS tree hierarchy absolutely. To distinguish an FQDN from a regular domain name, a trailing period is added. ex: somehost.example.com. An FQDN differs from a regular domain name by its absoluteness; as a suffix is not added.
IP Address	Specify the IP address used as the destination for certificate requests.Only IPv4 formatted IP addresses are permitted, not IPv6 formatted addresses.

6 Select the **Generate CSR** button to produce the CSR.

5.2.3 Port Mirroring (NX4524 and NX6524 Service Platforms only)

Basic Device Configuration

NX4524 and NX6524 model service platforms have the ability to mirror data packets transmitted or received on any of their GE ports (GE port 1 - 24). Both transmit and receive packets can be mirrored from a source to a destination port as needed to provide traditional *spanning* functionality on the 24 GE ports.

☑ **NOTE:** Port mirroring is not supported on NX4500 or NX6500 models, as they only utilize GE ports 1 - 2. Additionally, port mirroring is not supported on uplink (up) ports or wired ports on any controller or service platform model.

To set a NX4524 or NX6524 service platform port mirror configuration:

1 Select the **Configuration** tab from the Web UI.

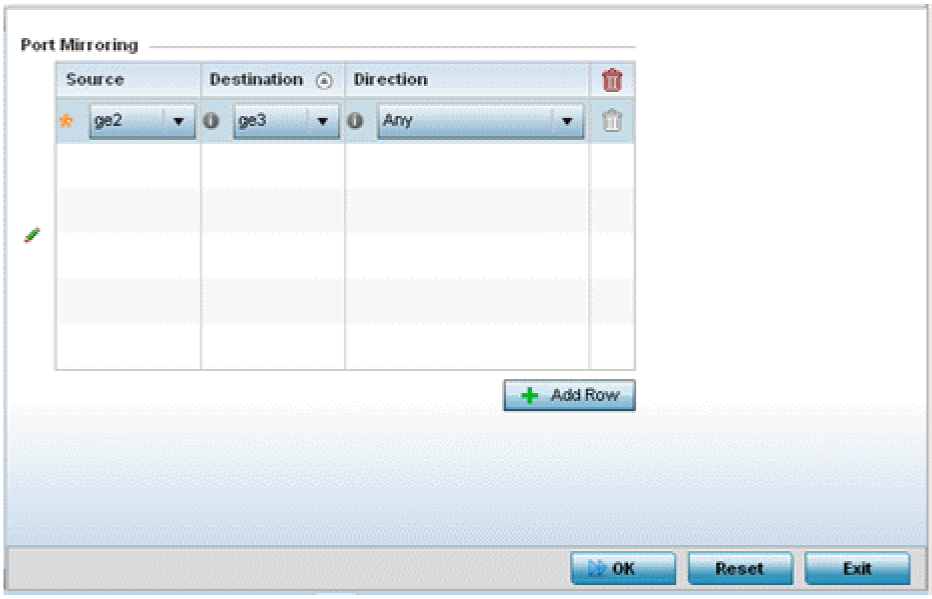
2 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

3 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

4 Select **Mirroring** from the Device menu options.



Port Mirroring

Source	Destination	Direction
ge2	ge3	Any

Figure 5-18 *Port Mirroring screen*

5 Set the following **Port Mirroring** values to define the ports and directions data is spanned on the NX4524 or NX6524 model service platform:

Source	Select the GE port (1 - 24) used as the data source to span packets to the selected destination port. The packets spanned from the selected source to the destination depend on whether *Inbound, Outbound* or *Any* is selected as the direction. A source port cannot be a destination port.
Destination	Select the GE port (1 - 24) used as the port destination to span packets from the selected source. The destination port serves as a duplicate image of the source port and can be used to send packets to a network diagnostic without disrupting the behavior on the original port. The destination port transmits only mirrored traffic and does not forward received traffic. Additionally, address learning is disabled on the destination port.
Direction	Define the direction data packets are spanned from the selected source to the defined destination. Packets spanned from the source to the destination depend on whether *Inbound* (received packets only), *Outbound* (transmitted packets only) or *Any* (packets in either direction) is selected.

6 Select **+ Add Row** to add different sources, destinations and directions for additional GE port spanning configurations.

7 Select **OK** to save the changes made to the NX4524 or NX6524 port mirroring configuration. Selecting **Reset** reverts the screen to its last saved configuration.

5.2.4 Wired 802.1x Configuration

▸ *Basic Device Configuration*

802.1X is an IEEE standard for media-level (Layer 2) access control, providing the capability to *permit* or *deny* connectivity based on user or device identity. 802.1X allows port based access using authentication. An 802.1X enabled port can be dynamically *enabled* or *disabled* depending on user identity or device connection.

Before authentication, the endpoint is unknown, and traffic is blocked. Upon authentication, the endpoint is known and traffic is allowed. The controller or service platform uses source MAC filtering to ensure only the authenticated endpoint is allowed to send traffic.

To configure a device's wired 802.1x configuration:

1 Select the **Configuration** tab from the Web UI.

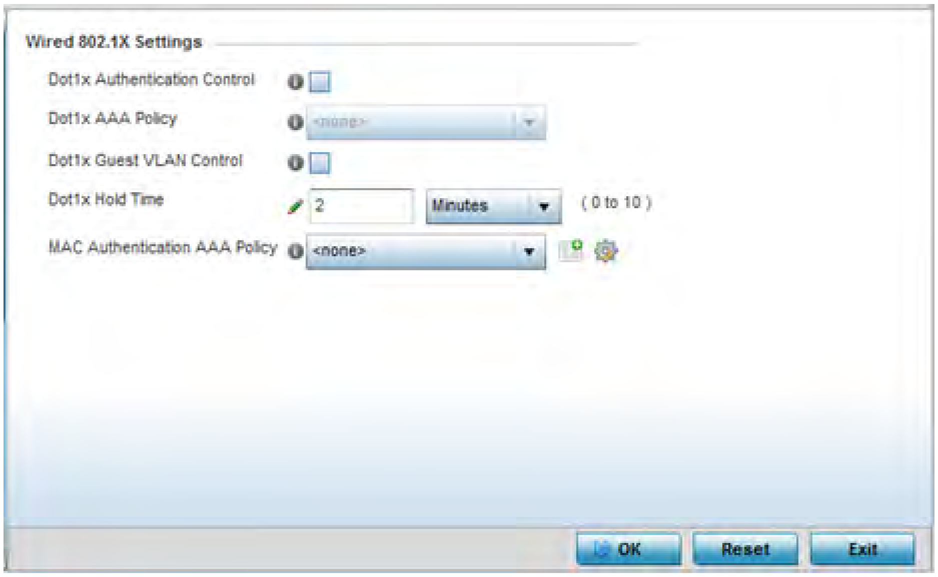
2 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

3 Select a device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

4 Select **Wired 802.1x** from the Device menu options.



Wired 802.1X Settings

Dot1x Authentication Control □

Dot1x AAA Policy <none>

Dot1x Guest VLAN Control □

Dot1x Hold Time 2 Minutes (0 to 10)

MAC Authentication AAA Policy <none>

Figure 5-19 *Device Wired 802.1x screen*

5 Review the **Wired 802.1x Settings** area to configure the following parameters:

Dot1x Authentication Control	Select this option to globally enable 802.1x authentication. 802.1x authentication is disabled by default.
Dot1x AAA Policy	Use the drop-down menu to select a AAA policy to associate with wired 802.1x traffic. If a suitable AAA policy does not exist, select the *Create* icon to create a new policy or the *Edit* icon to modify an existing policy.
Dot1x Guest VLAN Control	Select this option to globally enable the use of 802.1x guest VLANs.
Dot1x Hold Time	Set a hold time value (after the last hello packet) in either *Seconds* (0 - 600) or *Minutes* (0 - 10). When exceeded, the controller's 802.1X enabled port and its destination end-point connection is defined as lost and the connection must be re-established.
MAC Authentication AAA Policy	Use the drop-down menu to select an AAA authentication policy for MAC address authentication. If a suitable MAC AAA policy does not exist, click the *Create* icon to create a new policy or the *Edit* icon to modify an existing policy.

6 Select **OK** to save the changes made to the 802.1x configurations. Selecting **Reset** reverts the screen to its last saved configuration.

5.2.5 RF Domain Overrides

▸ *Basic Device Configuration*

Use **RF Domain Overrides** to define configurations overriding the configuration set by the target device's original RF Domain assignment.

RF Domains allow administrators to assign configuration data to multiple devices deployed in a common coverage area (floor, building or site). In such instances, there's many configuration attributes these devices share, since their general client support roles are quite similar. However, device configurations may need periodic refinement from their original RF Domain administered design.

A controller or service platform configuration contains (at a minimum) one default RF Domain, but can optionally use additional user defined RF Domains:

- *Default RF Domain* - Automatically assigned to each controller, service platform and associated Access Points by default. A default RF Domain is unique to a specific model.
- *User Defined RF Domains* - Created by administrators and manually assigned to individual controllers, service platforms or Access Points, but can be automatically assigned to Access Points using adoption policies.

Each controller, service platform and Access Point is assigned one RF Domain at a time. However, a user defined RF Domain can be assigned to multiple devices as required. User defined RF Domains can be manually assigned or automatically assigned to Access Points using an auto provisioning policy. The more devices assigned a single RF Domain, the greater the likelihood one of the device's configurations will require an override deviating that device's configuration from the original RF Domain assignment shared by the others.

To review the RF Domain's original configuration requirements and the options available for a target device, refer to Managing RF Domains on page 9-2.

To define a device's RF Domain override configuration:

1 Select the **Configuration** tab from the Web UI.

2 Select **Devices** from the Configuration tab.

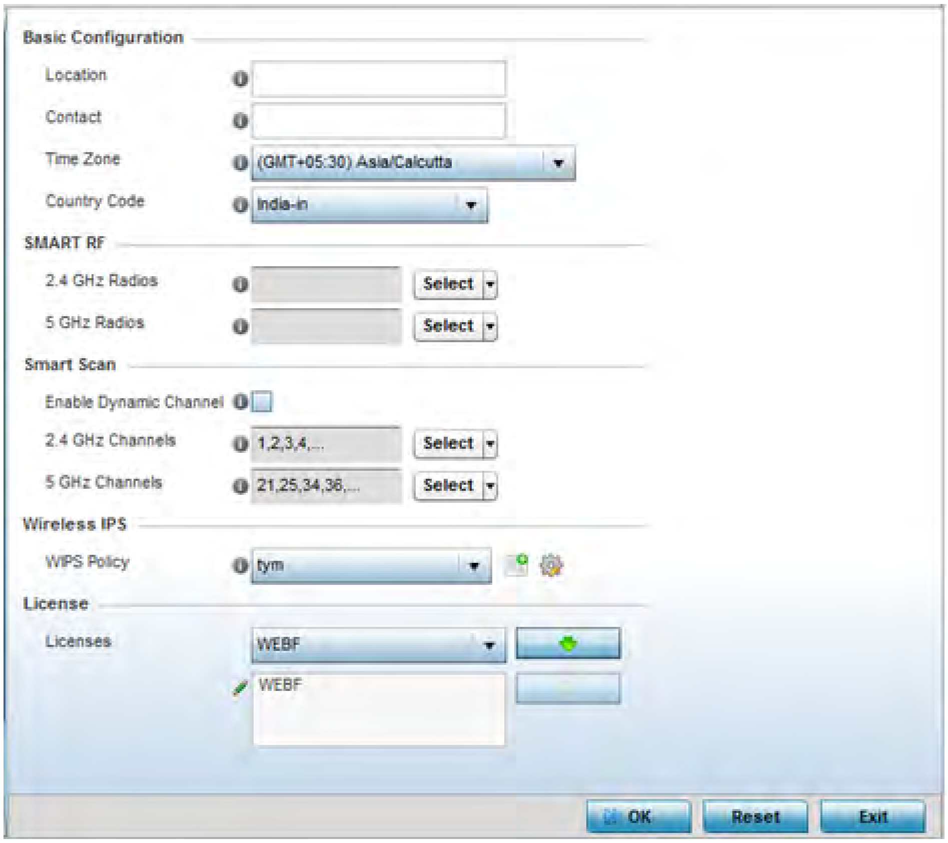
The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

3 Select a device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

4 Expand the **RF Domain Overrides** menu option to display its sub-menu options.

5 Select **RF Domain**.



Basic Configuration

Location

Contact

Time Zone: (GMT+05:30) Asia/Calcutta

Country Code: India-in

SMART RF

2.4 GHz Radios

5 GHz Radios

Smart Scan

Enable Dynamic Channel ☐

2.4 GHz Channels: 1,2,3,4,...

5 GHz Channels: 21,25,34,36,...

Wireless IPS

WIPS Policy: tym

License

Licenses: WEBF

WEBF

Figure 5-20 *RF Domain Overrides - Basic Configuration screen*

> ✓ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

6 Refer to the **Basic Configuration** field to review the basic settings defined for the target device's RF Domain configuration, and optionally assign/remove overrides to and from specific parameters.

Location	Provide the 64 character maximum deployment location set for the controller or service platform as part of its RF Domain configuration.
Contact	Enter the 64 character maximum administrative contact for the controller or service platform as part of its RF Domain configuration.
Time Zone	Set the time zone utilized by the selected device as part of its RF Domain configuration.
Country Code	Set the country code utilized by the device as part of its RF Domain configuration. Selecting the correct country is central to legal operation. Each country has its own regulatory restrictions concerning electromagnetic emissions and the maximum RF signal strength that can be transmitted.

7 Refer to the **Smart RF** section to configure Smart RF policy and dynamic channel settings.

2.4 GHz Radios	Select an override group of channels Smart RF can use for channel compensation adjustments in the 2.4 GHz band.
5 GHz Radios	Select an override group of channels Smart RF can use for channel compensation adjustments in the 5 GHz band.

8 Refer to the **Smart Scan** section to configure Smart RF policy and dynamic channel settings.

Enable Dynamic Channel	Select this option to enable dynamic channel switching for Smart RF radios.
2.4 GHz Channels	Select legal channels (device radios transmit in specific channels unique to their country of operation) from the drop-down menu for 2.4GHz Smart RF radios.
5 GHz Channels	Select legal channels (device radios transmit in specific channels unique to their country of operation) from the drop-down menu for 5GHz Smart RF radios.

9 Use the **WIPS Policy** drop-down menu to apply a WIPS policy to the RF Domain.

The *Wireless Intrusion Protection System* (WIPS) provides continuous protection against wireless threats and act as an additional layer of security complementing wireless VPNs and encryption and authentication policies. Controllers and service platforms support WIPS through the use of dedicated sensor devices, designed to actively detect and locate unauthorized AP devices. After detection, they use mitigation techniques to block devices using manual termination, air lockdown or port suppression.

Select the **Create** icon to define a new WIPS policy that can be applied to the RF Domain, or select the **Edit** icon to modify or override an existing WIPS policy.

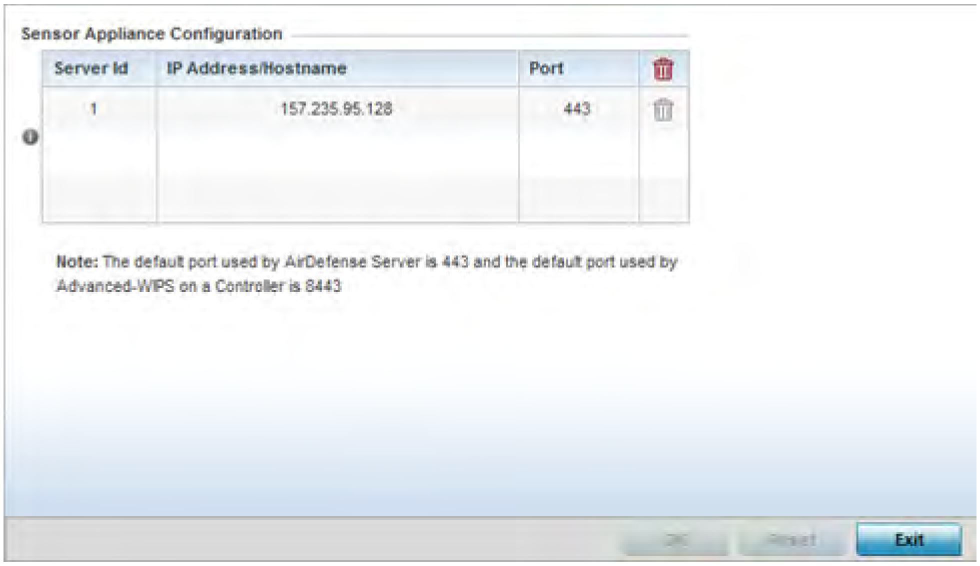
For an overview of WIPS and instructions on how to create a WIPS policy that can be used with a RF Domain, see Intrusion Prevention on page 10-51.

10 Use the **Licenses** drop-down menu to obtain and leverage feature licenses from RF Domain member devices.

11 Select **OK** to save the changes and overrides made to the RF Domain configuration. Selecting **Reset** reverts the screen to its last saved configuration.

12 Select **Sensor** from within the expanded RF Domain Overrides menu to define ADSP server credentials for WiNG controller or service platform data exchanges.

Controllers and service platforms support dedicated sensor devices, designed to actively detect and locate unauthorized AP devices. After detection, they use mitigation techniques to block devices using manual termination, air lockdown or port suppression.



Sensor Appliance Configuration

Server Id	IP Address/Hostname	Port
1	157.235.95.128	443

Note: The default port used by AirDefense Server is 443 and the default port used by Advanced-WIPS on a Controller is 8443

Figure 5-21 *RF Domain - Sensor screen*

13 Select the **+ Add Row** button to populate the **Server Appliance Configuration** field with up to three rows for ADSP server credentials:

Server Id	Use the spinner control to assign a numerical ID for up to three WIPS server resources. The server with the lowest defined ID is the first reached by the controller or service platform. The default ID is 1.
IP Address/Hostname	Provide the numerical (non DNS) IP address or hostname of each server used as a WIPS sensor server by RF Domain member devices. A hostname cannot exceed 64 characters or contain an underscore.
Port	Use the spinner control to specify the port of each WIPS sensor server utilized by RF member devices. The default port is 443.

14 Select **OK** to save the changes to the ADSP appliance sensor configuration, or select **Reset** to revert to the last saved configuration.

15 Select **Client Name** from within the expanded RF Domain Overrides:

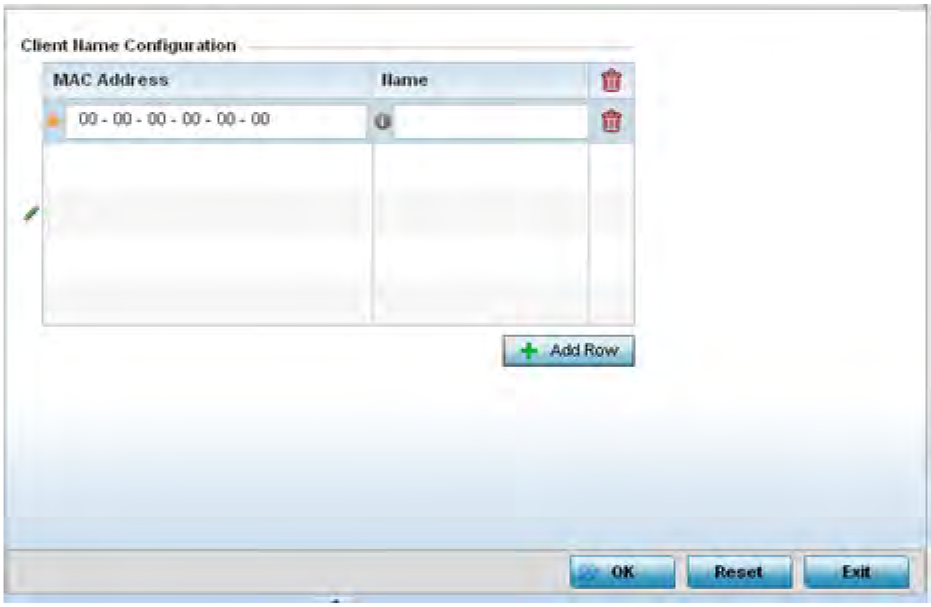


Figure 5-22 *Client Name screen*

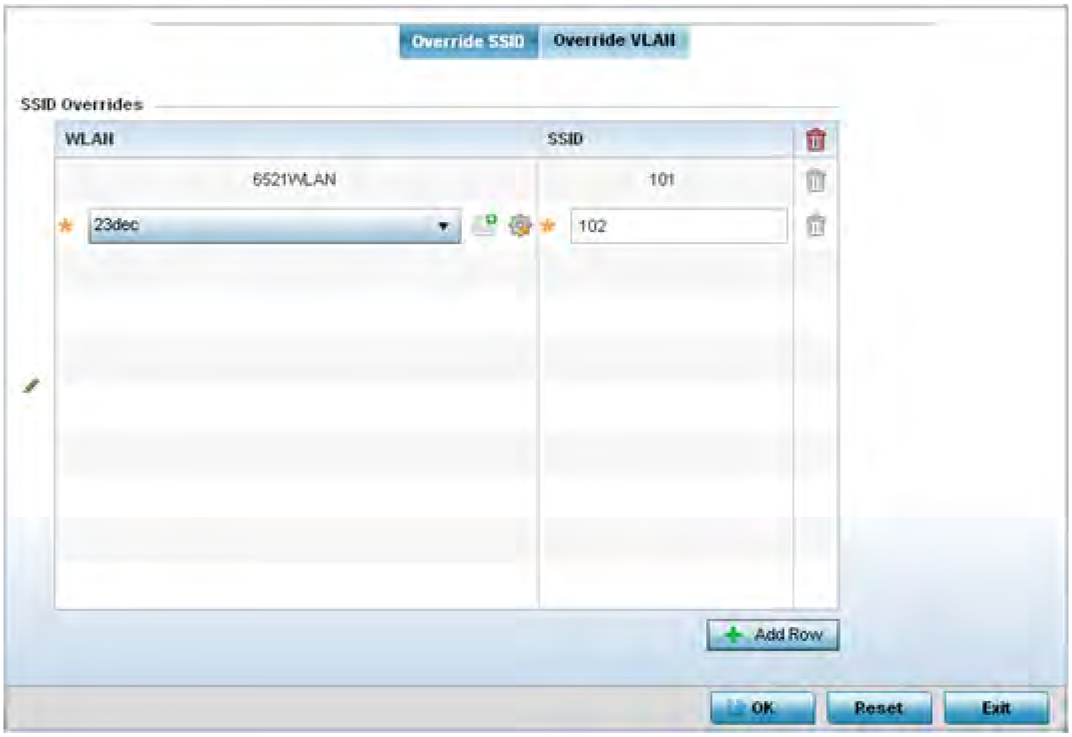
16 Click **+ Add Row** to add client name information to the table.

MAC Address	Enter the MAC address of the device assigned a client name for controller, service platform or Access Point management.
Name	Enter the name assigned to this client.

17 Select **OK** to save the changes and overrides made to the Client Name Configuration. Selecting **Reset** reverts the screen to its last saved configuration.

18 Select **WLAN Override** from within the expanded RF Domain Overrides menu.

✓ **NOTE:** The WLAN Override option does not appear as a sub menu option under RF Domain Overrides for either controllers or service platforms, just Access Points.



WLAN	SSID
6521WLAN	101
23dec	102

Figure 5-23 *WLAN Override screen - Override SSID tab*

The WLAN Override screen displays with the **Override SSID** tab displayed by default.

19 Optionally define up to 3 overrides for the listed WLAN SSID assignment:

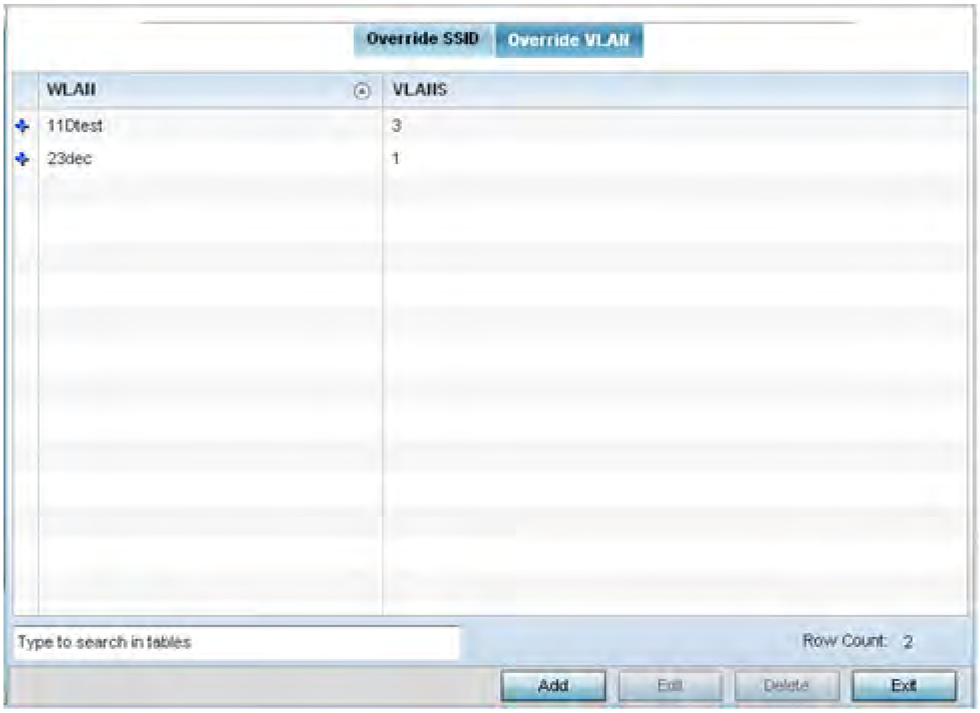
WLAN	Optionally use the drop-down menu to change the WLAN assignment for the listed Access Point. Select either the *Create* icon to define a new WLAN configuration, or select the *Edit* icon to modify an existing WLAN configuration.
SSID	Optionally change the SSID associated with the WLAN. The WLAN name is auto-generated using the SSID until changed (overridden). The maximum number of characters used for the SSID is 32.

20 Select the **Add Row** button as needed to add additional WLAN SSID overrides.

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

21 Select **OK** to save the changes and overrides. Selecting **Reset** reverts the screen to its last saved configuration.

22 Select the **Override VLAN** tab to review any VLAN assignment overrides that may have been or optionally add or edit override configurations.



WLAN	VLANS
11Dtest	3
23dec	1

Figure 5-24 *WLAN Override screen - Override VLAN tab*

The Override VLAN tab displays VLANs assigned to the Access Point's WLAN. Select **Add** to create a new client limit for a specific WLAN and VLAN or **Edit** to modify an existing configuration.

23 Optionally define a VLAN's wireless client limit override configuration.

VLANS	Use the spinner control to set a virtual interface ID (1 - 4094).
Wireless Client Limit	Use the spinner control to set the number of users permitted on the VLAN. Set the value to 0 to have an unlimited number of users.

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

24 Select **OK** to save the changes and overrides. Selecting **Reset** reverts the screen to its last saved configuration.

5.2.6 Profile Overrides

Basic Device Configuration

Profiles enable administrators to assign a common set of parameters and policies to controllers, service platforms and Access Points. Profiles can be used to assign shared or *unique* network, wireless and security parameters to wireless controllers and Access Points across a large, multi segment, site. The configuration parameters within a profile are based on the hardware model the profile was created to support. Controllers and service platforms support both default and user defined profiles implementing new features or updating existing parameters to groups of devices. The central benefit of a profile is its ability to update devices collectively without having to modify individual device configurations. Power and Adoption overrides apply specifically to Access Points, while Cluster configuration overrides apply to only controller or service platform configurations.

However, device profile configurations may need periodic refinement from their original administered design. Consequently, a device profile could require modification from a profile configuration shared amongst numerous devices deployed within a particular site.

Use Profile Overrides to define configurations overriding the parameters set by the target device's original profile assignment.

To review a profile's original configuration requirements and the options available for a target device, refer to General Profile Configuration on page 8-5.

To define a device's general profile override configuration:

1 Select the **Configuration** tab from the Web UI.

2 Select **Devices** from the Configuration tab.

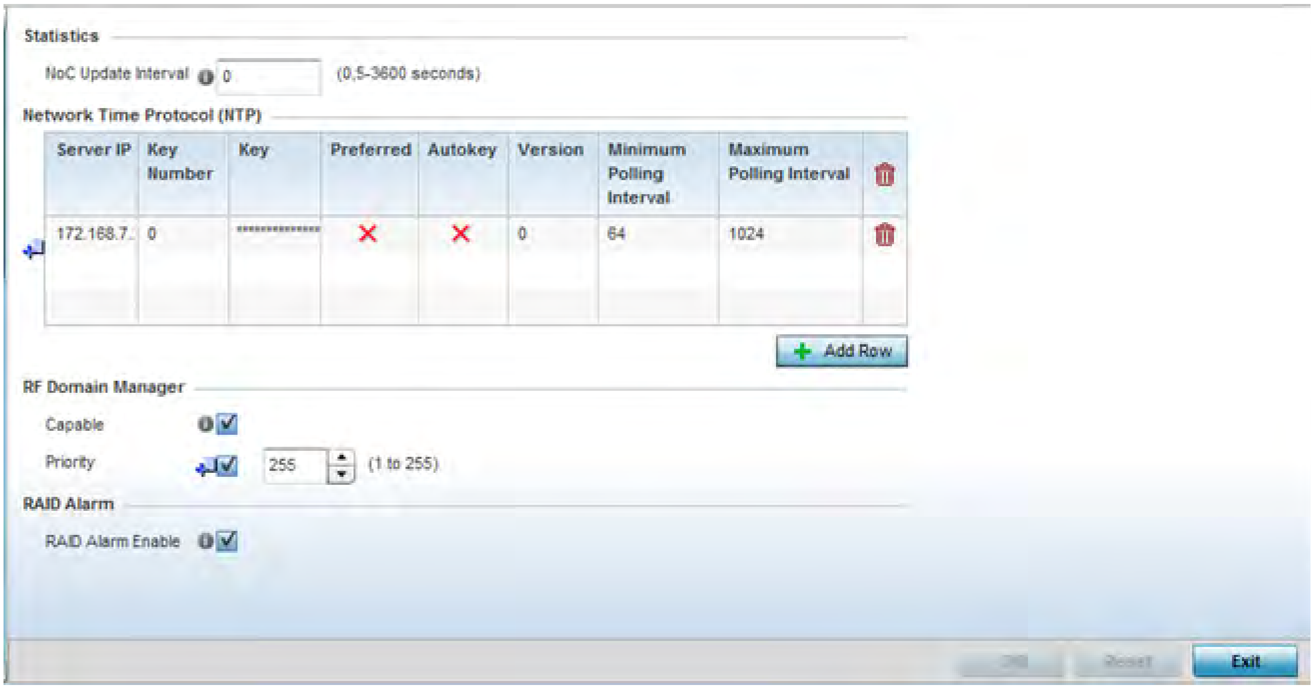
The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

3 Select a device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

4 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

5 Select **General** if it doesn't display by default.



Statistics

NoC Update Interval 0 (0.5-3600 seconds)

Network Time Protocol (NTP)

Server IP	Key Number	Key	Preferred	Autokey	Version	Minimum Polling Interval	Maximum Polling Interval
172.168.7..	0	***************	✗	✗	0	64	1024

RF Domain Manager

Capable ☑

Priority ☑ 255 (1 to 255)

RAID Alarm

RAID Alarm Enable ☑

Figure 5-25 *Profile Overrides - General screen*

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

6 Select the **IP Routing** option (within the **Settings** field) to enable routing for the device.

7. Set a **NoC Update Interval** of 0, or from 5-3600 seconds for updates from the RF Domain manager to the controller or service platform.

8. Select **+ Add Row** below the **Network Time Protocol (NTP)** table to launch a screen used to define (or override) the configurations of NTP server resources the controller or service platform uses it obtain its system time. Set the following parameters to define the NTP configuration:

Server IP	Set the IP address of each server as a potential NTP resource. Provide either a hostname or an IPv4 formatted IP address. Hostnames cannot include an underscore character.
Key Number	Select the number of the associated *Authentication Key* for the NTP resource.
Key	If an autokey is not being used, manually enter a 64 character maximum key the controller or service platform and NTP resource share to securely interoperate.
Preferred	Select the radio button to designate this particular NTP resource as preferred. If using multiple NTP resources, preferred resources are given first opportunity to connect to the controller or service platform and provide NTP calibration.
AutoKey	Select the radio button to enable an *Autokey* configuration for the controller or service platform and NTP resource. The default setting is disabled.
Version	Use the spinner control to specify the version number used by this NTP server resource. The default setting is 0.
Minimum Polling Interval	Use the drop-down menu to select the minimum polling interval. Once set, the NTP resource is polled no sooner then the defined interval. Options include *64*, *128*, *256*, *512* or *1024* seconds. The default setting is 64 seconds.
Maximum Polling Interval	Use the drop-down menu to select the maximum polling interval. Once set, the NTP resource is polled no later then the defined interval. Options include *64*, *128*, *256*, *512* or *1024* seconds. The default setting is 1024 seconds.

9. Refer to the **RF Domain Manager** field to elect RF Domain Manager devices and assign them a priority in the election process:

Capable	Select this option to elect this controller a RF Domain manager capable of storing and provisioning configuration and firmware images for other members of the RF Domain. The RF-domain-manager updates any state changes to the rest of the devices in the RF Domain. This setting is enabled by default.
Priority	Select this option to set the priority of this device becoming the RF Domain Manager versus other capable RF Domain members. The higher the value (1 - 255) the higher priority assigned to the device in the RF Domain Manager election process.

10. Refer to the **RAID Alarm** field to either *enable* or *disable* the chassis alarm that sounds when events are detected that degrade RAID support (drive content mirroring) on a service platform.

☑ **NOTE:** RAID controller drive arrays are available within NX7530 and NX9000 series service platforms only. However, they can be administrated on behalf of a profile by a different model service platform or controller.

Service platforms include a single Intel MegaRAID controller (virtual drive) with RAID-1 mirroring support enabled. The online virtual drive supports up to two physical drives that could require hot spare substitution if a drive were to fail. An administrator can manage the RAID controller event alarm and syslogs supporting the array hardware from the service platform user interface and is not required to reboot the service platform BIOS.

For information on setting the service platform drive array configuration and diagnostic behavior of its member drives, refer to *RAID Operations*. To view the service platform's current RAID array status, drive utilization and consistency check information, refer to RAID Statistics on page 15-114.

11 Select **OK** to save the changes and overrides made to the general profile configuration. Select **Reset** to revert to the last saved configuration.

5.2.6.1 Cluster Configuration Overrides (Controllers and Service Platforms Only)

▸ *Profile Overrides*

A redundancy group (cluster) is a set of controllers or service platforms (nodes) uniquely defined by a profile configuration. Within the redundancy group, members discover and establish connections to other peers and provide wireless self-healing support in the event of cluster member failure.

A cluster's AP load balance is typically distributed evenly amongst the controllers or service platforms in the cluster. Define how often this profile is load balanced for AP radio distribution as often as you feel required, as radios can come and go and members can join and exit the cluster. For information on setting a profile's original cluster configuration (before applying an override), see Profile Cluster Configuration (Controllers and Service Platforms) on page 8-8.

As cluster memberships increase or decrease and their load requirements change, a profile may need an override applied to best suit a site's cluster requirements.

To apply an override (if required) to a profile cluster configuration:

1 Select the **Configuration** tab from the Web UI.

2 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of devices or peer controllers service platforms or Access Points.

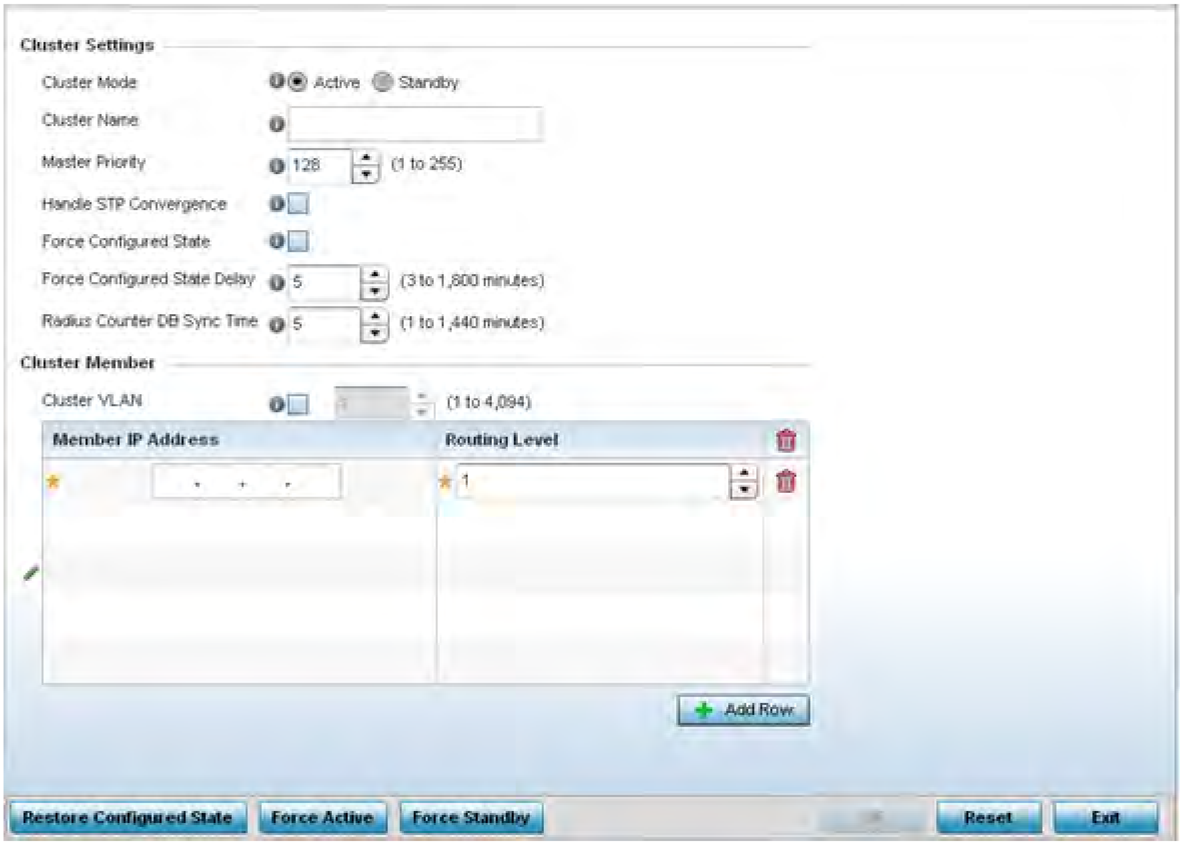
3 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

4 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

5 Select **Cluster**.

✓ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Cluster Settings

Cluster Mode ● Active ○ Standby

Cluster Name

Master Priority 128 (1 to 255)

Handle STP Convergence □

Force Configured State □

Force Configured State Delay 5 (3 to 1,800 minutes)

Radius Counter DB Sync Time 5 (1 to 1,440 minutes)

Cluster Member

Cluster VLAN □ 1 (1 to 4,094)

Member IP Address	Routing Level
. . .	1

Figure 5-26 *Profile Overrides - Cluster screen*

6 Optionally define the following **Cluster Settings** and overrides:

Cluster Mode	A member can be in either an *Active* or *Standby* mode. All active member controllers or service platforms can adopt Access Points. Standby members only adopt Access Points when an active member has failed or sees an Access Point that's not yet adopted. The default cluster mode is Active and enabled for use with the profile.
Cluster Name	Define a name for the cluster name unique to its configuration or profile support requirements. The name cannot exceed 64 characters.
Master Priority	Set a priority value from 1 and 255 with the higher value being given higher priority. This configuration is the device's priority to become cluster master. In cluster environment one device from cluster members is elected as cluster master. This configuration is the device's priority to become cluster master. The default is 128.

Handle STP Convergence	Select the radio button to enable *Spanning Tree Protocol* (STP) convergence for the controller or service platform. In general, this protocol is enabled in layer 2 networks to prevent network looping. Spanning Tree is a network layer protocol that ensures a loop-free topology in a mesh network of inter-connected layer 2 controller or service platform. The spanning tree protocol disables redundant connections and uses the least costly path to maintain a connection between any two controllers or service platforms in the network. If enabled, the network forwards data only after STP convergence. Enabling STP convergence delays the redundancy state machine execution until the STP convergence is completed (the standard protocol value for STP convergence is 50 seconds). Delaying the state machine is important to load balance APs at startup. The default setting is disabled.
Force Configured State	Select the radio button to allow this controller or service platform to take over for an active member if it were to fail. A standby controller or service platform in the cluster takes over APs adopted by the failed active member. If the failed active member were to come back up, the active member starts a timer based on the Auto Revert Delay interval. At the expiration of the Auto Revert Delay, the standby member releases all adopted APs and goes back to a monitoring mode. The Auto Revert Delay timer is stopped and restarted if the active member goes down and comes up during the Auto Revert Delay interval. The default value is disabled.
Force Configured State Delay	Specify a delay interval in minutes (3 - 1,800). This is the interval a standby member waits before releasing adopted APs and goes back to a monitoring mode when an active cluster member becomes active again after a failure. The default interval is 5 minutes.
Radius Counter DB Sync Time	Specify a sync time (from 1 - 1,440 minutes) a RADIUS counter database uses as its synchronization interval with the dedicated NTP server resource. The default interval is 5 minutes.

7 Within the **Cluster Member** field, select **Cluster VLAN** to enable a spinner control to designate the VLAN where cluster members are reachable. Specify a VLAN from 1 - 4094.

Specify the IP addresses of the VLAN’s cluster members using the **Member IP Address** table.

8 Select **Restore Configured State** to restore this cluster member back into role of taking over for an active member if it were to fail.

9 Select **Force Active** to revert this cluster member back into its default active state and provide the ability to adopt Access Points.

10 Select **Force Standby** to only adopt Access Points when an active member has failed or sees an Access Point that’s not yet adopted.

11 Select **OK** to save the changes and overrides made to the profile’s cluster configuration. Select **Reset** to revert to the last saved configuration.

5.2.6.2 Access Point Radio Power Overrides (Access Points Only)

▸ *Profile Overrides*

A profile can manage the transmit output power of the Access Point radios it supports within the network.

NOTE: The Power option only appears within the Profile Overrides menu tree if an Access Point is selected from within the main Devices screen. Power management is configured differently for controllers or service platforms, so the Power screen only displays for Access Points.

Use the **Power** screen to set or override one of two power modes (3af or Auto) for a managed Access Point. When automatic is selected, the Access Point safely operates within available power. Once the power configuration is determined, the Access Point configures its operating power characteristics based on its model and power configuration.

An Access Point uses a *complex programmable logic device* (CPLD). The CPLD determines proper supply sequencing, the maximum power available and other status information. One of the primary functions of the CPLD is to determine the Access Point's maximum power budget. When an Access Point is powered on (or performing a cold reset), the CPLD determines the maximum power provided by the POE device and the budget available to the Access Point. The CPLD also determines the access point hardware SKU and the number of radios. If the Access Point's POE resource cannot provide sufficient power (with all intended interfaces enabled), some of the following interfaces could be disabled or modified:

- The Access Point's transmit and receive algorithms could be negatively impacted
- The Access Point's transmit power could be reduced due to insufficient power
- The Access Point's WAN port configuration could be changed (either enabled or disabled)

To define an Access Point's power configuration or apply an override to an existing parameter:

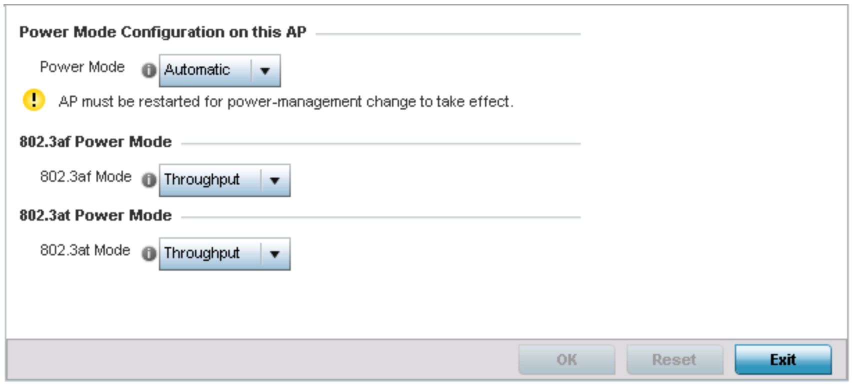
1 Select the Devices tab from the Web UI.

2 Select **Profile Overrides** to expand its sub menu items.

3 Select **Power.**

A screen displays where an Access Point's power configuration can be defined or overridden for a profile.

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Power Mode Configuration on this AP

Power Mode: Automatic

AP must be restarted for power-management change to take effect.

802.3af Power Mode

802.3af Mode: Throughput

802.3at Power Mode

802.3at Mode: Throughput

Figure 5-27 *Access Point Profile Power Override screen*

4 Use the **Power Mode** drop-down menu to set or override the **Power Mode Configuration on this AP**.

NOTE: Single radio model Access Point's always operate using a full power configuration. The power management configurations described in this section do not apply to single radio models.

When an Access Point is powered on for the first time, the system determines the power budget available to the Access Point. Using the **Automatic** setting, the Access Point automatically determines the best power configuration based on the available power budget. Automatic is the default setting.

If 802.3af is selected, the Access Point assumes 12.95 watts are available. If the mode is changed, the Access Point requires a reset to implement the change. If 802.3at is selected, the Access Point assumes 23 - 26 watts are available.

5 Set or override the Access Point radio's **802.3af Power Mode** and the radio's **802.3at Power Mode**.

Use the drop-down menu to define a mode of either **Range** or **Throughput**.

Select **Throughput** to transmit packets at the radio's highest defined basic rate (based on the radio's current basic rate settings). This option is optimal in environments where the transmission range is secondary to broadcast/multicast transmission performance. Select **Range** when range is preferred over performance for broadcast/multicast (group) traffic. The data rates used for range are the lowest defined basic rates. Throughput is the default setting for both 802.3af and 802.3at.

6 Select **OK** to save the changes and overrides made to the Access Point power configuration. Select **Reset** to revert to the last saved configuration.

5.2.6.3 Access Point Adoption Overrides (Access Points Only)

▸ *Profile Overrides*

Adoption is the process an Access Point uses to discover available controllers or service platforms, pick the most desirable one, establish an association and optionally obtain an image upgrade and configuration. Adoption is configurable and supported within a device profile and applied to other Access Points supported by the profile. Individual attributes of an Access Point's auto provisioning policy can be overridden as specific parameters require modification.

At adoption, an Access Point solicits and receives multiple adoption responses from controllers and service platforms available on the network. These adoption responses contain loading policy information the Access Point uses to select the optimum controller or service platform for adoption. By default, an auto provisioning policy generally distributes AP adoption evenly amongst available controllers and service platforms. Modify existing adoption policies or create a new one as needed to meet the adoption requirements of a device and their assigned profile.

NOTE: A device configuration does not need to be present for an auto provisioning policy to take effect. Once adopted, and the device's configuration is defined and applied by the controller or service platform, the auto provisioning policy mapping does not have impact on subsequent adoptions by the same device.

An auto provisioning policy enables an administrator to define adoption rules for the supported Access Points capable of being adopted by a wireless controller.

To define an Access Point's adoption configuration or apply an override:

1 Select the **Devices** from the Web UI.

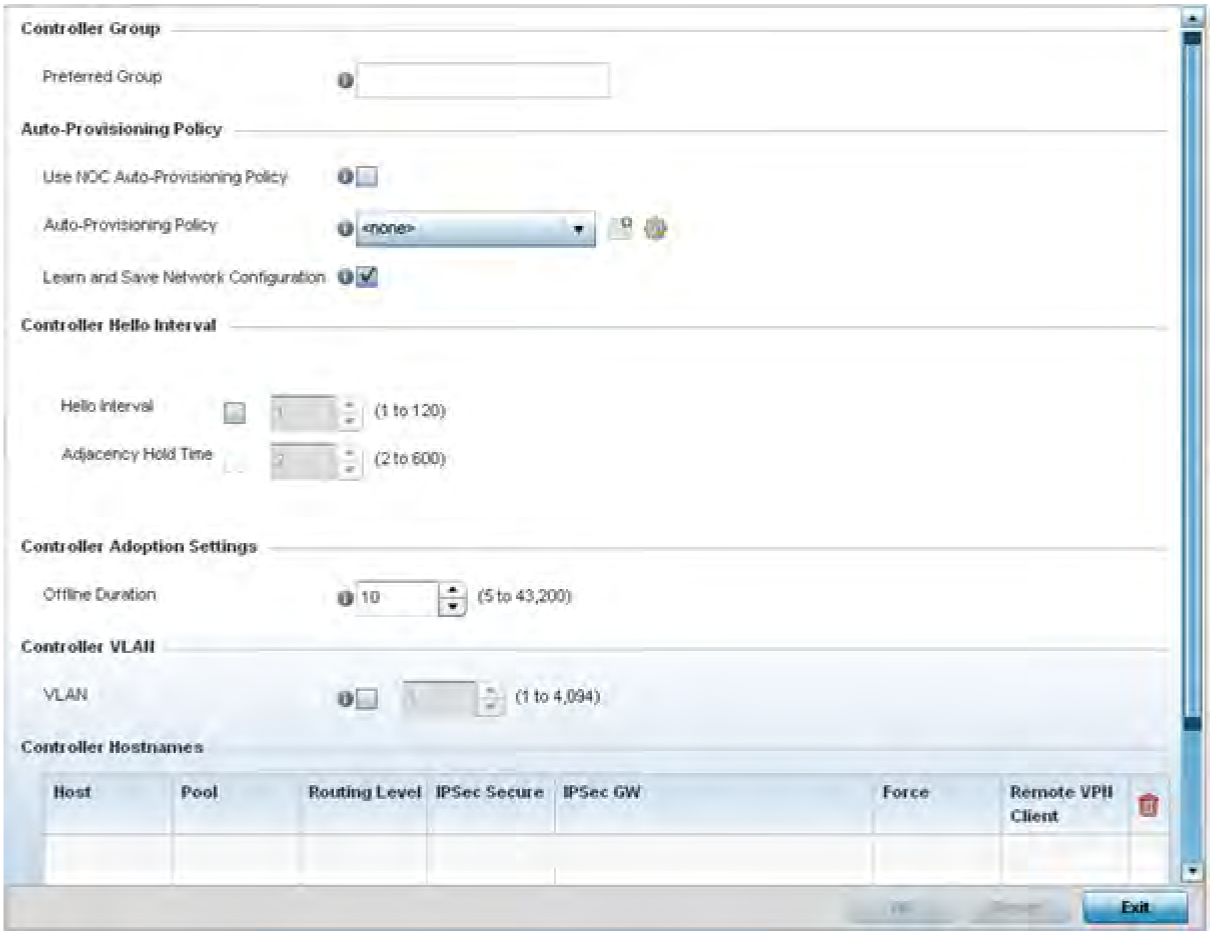
2 Select **Profiles** from the Configuration tab.

3 Select **Profile Overrides** to expand its sub-menu items.

4 Select **Adoption**.

A screen displays where an Access Point's adoption configuration can be defined and overridden for a profile.

> **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Controller Group

Preferred Group

Auto-Provisioning Policy

Use NOC Auto-Provisioning Policy □

Auto-Provisioning Policy <none>

Learn and Save Network Configuration ☑

Controller Hello Interval

Hello Interval □ 1 (1 to 120)

Adjacency Hold Time 2 (2 to 600)

Controller Adoption Settings

Offline Duration 10 (5 to 43,200)

Controller VLAN

VLAN □ 1 (1 to 4,094)

Controller Hostnames

Host	Pool	Routing Level	IPSec Secure	IPSec GW	Force	Remote VPN Client

Figure 5-28 *Access Point Adoption Override screen*

5 Define or override the **Preferred Group** used as optimal group for the Access Point's adoption. The name of the preferred group cannot exceed 64 characters.

6 Set the following **Auto-Provisioning Policy** settings for Access Point adoptions:

Use NOC Auto-Provisioning Policy	Select this option to use the NOC controller's auto provisioning policy and not the policy maintained locally. The NOC is an elected controller or service platform capable of provisioning all of its peer controllers, service platforms and adopted devices. This setting is disabled by default. NOC controllers are NX9000, NX9500, NX9510, NX7500, and RFS6000 models.

Auto-Provisioning Policy	Select an auto provisioning policy from the drop-down menu. To create a new auto provisioning policy, select the *Create* icon or modify an existing one by selecting the *Edit* icon.
Learn and Save Network Configuration	Select this option to learn and save the configuration of any device requesting adoption. This setting is enabled by default.

7 Set the following **Controller Hello Interval** settings manage message exchanges and connection re-establishments between adopting devices:

Hello Interval	Define an interval (from 1 - 120 seconds) between hello keep alive messages exchanged with the adopting device. These messages serve as a connection validation mechanism to ensure the availability of the adopting resource.
Adjacency Hold Time	Set the time (from 2 - 600 seconds) after the last hello packet after which the connection between the controller and Access Point is defined as lost and their connection is re-established. When a hello interval is set, an adjacency hold time is mandatory and should be higher then the hello interval.

8 Use the spinner control to define an **Offline Duration** timeout (from 5 - 43,200 minutes) to detect whether an adopted device is offline. The default setting is 10 minutes.

9 Use the spinner control to define a **Controller VLAN**. Select to enable this field and select the VLAN on which the adopting controllers can be found by the Access Point.

10 Enter **Controller Hostnames** as needed to define or override resources for Access Point adoption.

11 Select **+ Add Row** as needed to populate the table with IP Addresses or Hostnames used as Access Point adoption resources into the managed network.

Host	Use the drop-down menu to specify whether the adoption resource is defined as a (non DNS) *IP Address* or a *Hostname*. Once defined, provide the numerical IP or Hostname. A Hostname cannot exceed 64 characters and cannot include an underscore character.
Pool	Use the spinner control to set a pool of either 1 or 2. This is the pool the target controller or service platform belongs to.
Routing Level	Define a routing level (either 1 or 2) for the link between adopting devices. The default setting is 1.
IPSec Secure	Enable this option to provide IPSec secure peer authentication on the connection (link) between the adopting devices. This option is disabled by default.
IPSec GW	Select the numerical IP address or administrator defined hostname of the adopting controller resource.
Force	Enable this setting to create a forced link between an Access Point and adopting controller, even when not necessarily needed. This setting is disabled by default.
Remote VPN Client	Displays whether a secure controller link has been established using a remote VPN client.

12 Select **OK** to save the changes and overrides made to the Access Point profile adoption configuration. Select **Reset** to revert to the last saved configuration.

5.2.6.4 Adoption Overrides (Controllers Only)

▸ *Profile Overrides*

Adoption is the process an Access Point uses to discover available controllers, pick the most desirable controller, establish a controller association and optionally obtain an image upgrade and configuration. Adoption is configurable and supported within a device profile and applied to other Access Points supported by the profile. Individual attributes of an Access Point's auto provisioning policy can be overridden as specific parameters require modification.

At adoption, an Access Point solicits and receives multiple adoption responses from controllers and service platforms available on the network. These adoption responses contain loading policy information the Access Point uses to select the optimum controller or service platform for adoption. By default, an auto provisioning policy generally distributes AP adoption evenly amongst available controllers and service platforms. Modify existing adoption policies or create a new one as needed to meet the adoption requirements of a device and their assigned profile.

NOTE: A device configuration does not need to be present for an auto provisioning policy to take effect. Once adopted, and the device's configuration is defined and applied by the controller or service platform, the auto provisioning policy mapping does not have impact on subsequent adoptions by the same device.

To define a controller or service platform's adoption configuration:

1 Select the **Devices** from the Web UI.

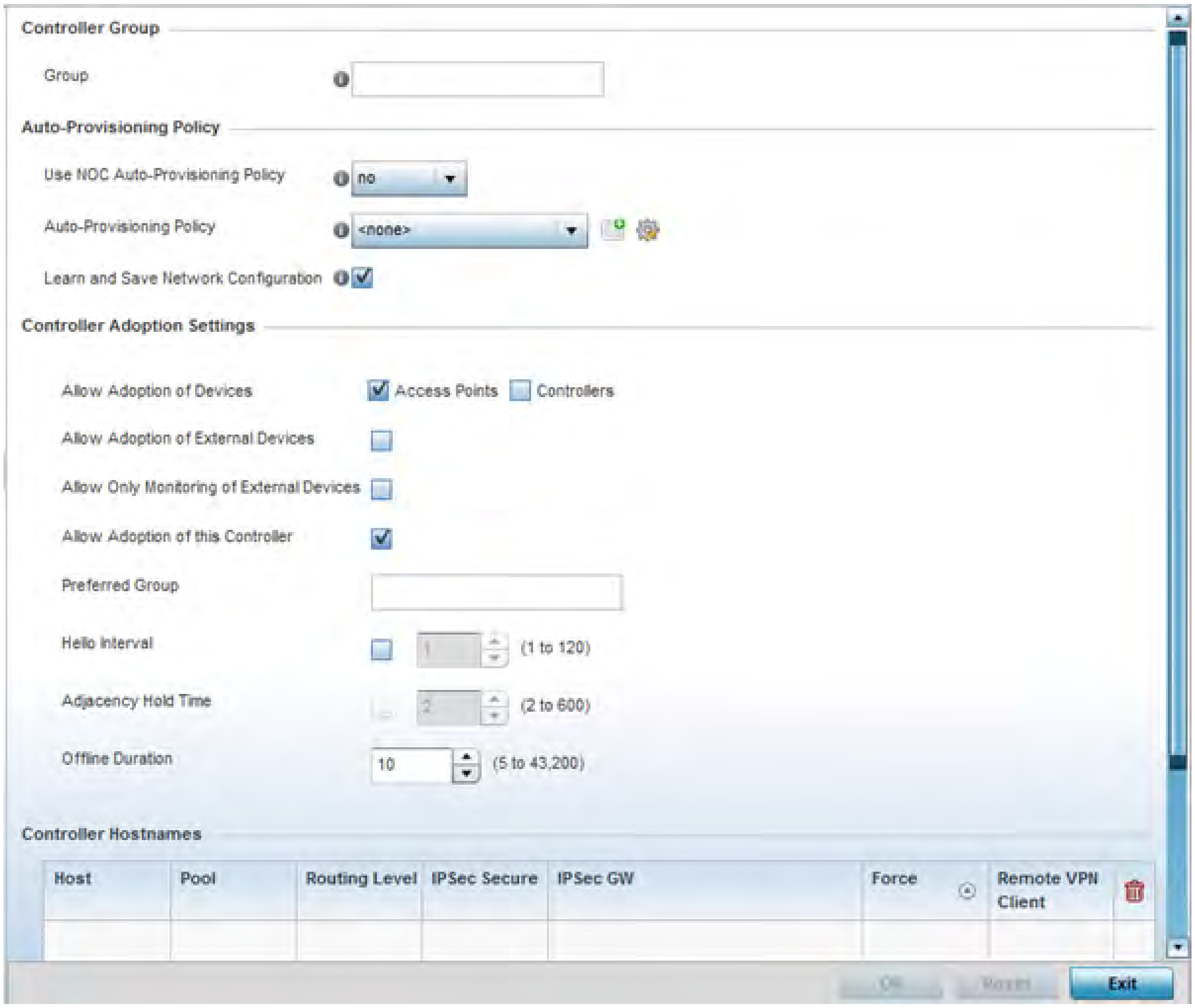
2 Select **Profiles.**

3 Select **Profile Overrides** to expand its sub-menu items.

4 Select **Adoption.**

A screen displays where a controller or service platform's adoption configuration can be set or overridden for a profile.

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Controller Group

Group

Auto-Provisioning Policy

Use NOC Auto-Provisioning Policy: no

Auto-Provisioning Policy: <none>

Learn and Save Network Configuration ☑

Controller Adoption Settings

Allow Adoption of Devices ☑ Access Points ☐ Controllers

Allow Adoption of External Devices ☐

Allow Only Monitoring of External Devices ☐

Allow Adoption of this Controller ☑

Preferred Group

Hello Interval ☐ 1 (1 to 120)

Adjacency Hold Time ☐ 2 (2 to 600)

Offline Duration 10 (5 to 43,200)

Controller Hostnames

Host	Pool	Routing Level	IPSec Secure	IPSec GW	Force	Remote VPN Client

Figure 5-29 *Controller Adoption Override screen*

5 Within the **Controller Group** field, use the **Group** item to set provide the controller group this controller or service platform belongs to. A preferred group can also be selected for the adoption of this controller or service platform. The name of the preferred group cannot exceed 64 characters.

6 Set the following **Auto Provisioning Policy** parameters:

Use NOC Auto-Provisioning Policy	Select this option to use the NOC's auto provisioning policy instead of the policy local to the controller or service platform. The NOC is an elected controller or service platform capable of provisioning all of its peer controllers, service platforms and adopted devices. This setting is disabled by default.
Auto-Provisioning Policy	Select an auto provisioning policy from the drop-down menu. To create a new auto provisioning policy, select the *Create* icon or modify an existing one by selecting the *Edit* icon.

Learn and Save Network Configuration	Select this option to enable allow the controller tor service platform to maintain a local configuration records of devices requesting adoption and provisioning. This feature is enabled by default.
Rerun Policy Rules Every Time AP Adopted	Enabling this feature applies adoption rules on Access Points each time they're subsequently adopted, not just the first time. This setting is disabled by default.

7 Set the following **Controller Adoption Settings** settings:

Allow Adoption of Devices	Select either *Access Points* or *Controllers* (or both) to refine whether this controller or service platform can adopt just networked Access Points or peer controller devices as well.
Allow Adoption of External Devices	Select this option to enable this controller or service platform to adopt T5 model devices or EX3500 model switches.
Allow Monitoring of External Devices	Select this option to enable monitoring only of T5 model devices or EX3500 model switches by this controller or service platform. When enabled, WiNG does not configure EX3500 switches or a T5, it only monitors those devices for statistics and events.
Allow Adoption of this Controller	Select this option to enable this controller or service platform to be capable of adoption by other controllers or service platforms. This setting is disabled by default, and must be selected to allow peer adoptions and enable the four settings directly below it.
Preferred Group	If *Allow Adoption of this Controller* is selected, provide the controller group preferred as the adopting entity for this controller or service platform. If utilizing this feature, ensure the appropriate group is provided within the Controller Group field.
Hello Interval	Select this option to define the hello packet exchange interval (from 1 - 120 seconds) between the controller or service platform and an adoption requesting Access Point.
Adjacency Hold Time	Select this option to set a hold time interval (from 2 - 600 seconds) for the transmission of hello packets.
Offline Duration	Use the spinner control to define a timeout (from 5 - 43,200 minutes) to detect whether an adopted device is offline. The default setting is 10 minutes.

8 Enter **Controller Hostnames** as needed to define resources for adoption.

9 Select **+ Add Row** as needed to populate the table with IP Addresses or Hostnames used as Access Point adoption resources into the managed network.

Host	Use the drop-down menu to specify whether the adoption resource is defined as a (non DNS) *IP Address* or a *Hostname*. Once defined, provide the numerical IP or Hostname. A Hostname cannot exceed 64 characters or contain an underscore.
Pool	Use the spinner control to set a pool of either 1 or 2. This is the pool the target controller or service platform belongs to.
Routing Level	Define a routing level (either 1 or 2) for the link between adopting devices. The default setting is 1.
IPSec Secure	Enable this option to provide IPSec secure peer authentication on the connection (link) between the adopting devices. This option is disabled by default.

IPSec GW	Select the numerical IP address or administrator defined hostname of the adopting controller resource.
Force	Enable this setting to create a forced link between an Access Point and adopting controller, even when not necessarily needed. This setting is disabled by default.
Remote VPN Client	Displays whether a secure controller link has been established using a remote VPN client.

10 Select **OK** to save the changes and overrides made to the profile's adoption configuration. Select **Reset** to revert to the last saved configuration.

5.2.7 Profile Interface Override Configuration

▸ *Profile Overrides*

A profile's interface configuration can be defined to support separate physical Ethernet configurations both unique and specific to RFS4000, RFS6000 controllers and NX5500, NX7500 and NX9000 series service platforms. Ports vary depending on platform, but controller or service platform models do have some of the same physical interfaces.

A controller or service platform requires its Virtual Interface be configured for layer 3 (IP) access or layer 3 service on a VLAN. A Virtual Interface defines which IP address is associated with each VLAN ID the controller or service platform is connected to.

If the profile is configured to support an Access Point radio, an additional Radios option is available, unique to the Access Point's radio configuration.

Each profile interface configuration can have overrides applied to customize the configuration to a unique controller or service platform deployment. However, once an override is applied to this configuration it becomes independent from the profile that may be shared by a group of devices in a specific deployment and my need careful administration until a profile can be re-applied to the target controller or service platform. For more information, refer to the following:

- *Ethernet Port Override Configuration*
- *Virtual Interface Override Configuration*
- *Port Channel Override Configuration*
- *VM Interface Override Configuration*
- *Radio Override Configuration*
- *WAN Backhaul Override Configuration*
- *PPPoE Override Configuration*
- *Bluetooth Configuration*

5.2.7.1 Ethernet Port Override Configuration

▸ *Profile Interface Override Configuration*

The ports available on controllers vary depending RFS controller model. The following ports are available to controllers:

- RFS4000 - ge1, ge2, ge3, ge4, ge5, up1
- RFS6000 - ge1, ge2, ge3, ge4, ge5, ge6, ge7, ge8, me1, up1

GE ports on RFS4000 and RFS6000 models are RJ-45 ports supporting 10/100/1000Mbps.

ME ports are available on RFS6000 and RFS7000 platforms. ME ports are out-of-band management ports used to manage the controller via CLI or Web UI, even when the other ports on the controller are unreachable.

The following ports are available to NX series service platform models:

- *NX5500* - ge1, ge2
- *NX7500* - ge1-ge10, xge1-xge2
- *NX9000* series - ge1, ge2

☑ **NOTE:** For a NX7500 model service platform, there are options for either a 2 port or 4 port network management card. Either card can be managed using WiNG. If the 4 port card is used, ports ge7-ge10 are available. If the 2 port card is used, ports xge1-xge2 are available.

UP ports are available on RFS4000 and RFS6000 controller. An UP port supports either RJ-45 or fiber. The UP port is the preferred means to connect to the backbone as it has a non-blocking 1gbps connection unlike the GE ports.

The following ports are available on Access Points:

- AP6521 - GE1/POE (LAN)
- AP6522 - GE1/POE (LAN)
- AP6532 - GE1/POE
- AP6562 - GE1/POE
- AP7161 - GE1/POE (LAN), GE2 (WAN)
- AP7502 - GE1 (THRU), fe1, fe2, fe3,
- AP7522 - GE1/POE (LAN)
- AP7532 - GE1/POE (LAN)
- AP7602 - GE1/POE (LAN), GE2 (WAN)
- AP7612 - GE1/POE (LAN), GE2 (WAN)
- AP7622 - GE1/POE (LAN)
- AP7632 - GE1/POE (LAN)
- AP7662 - GE1/POE (LAN), GE2 (WAN)
- AP81XX - GE1/POE (LAN), GE2 (WAN)
- AP82XX - GE1/POE (LAN), GE2 (WAN)

T5 controllers have the following Ethernet port designations:

- *T5*- ge1-ge2 (T5 controller managed CPE devices have ports fe1 - fe2)

To set a profile’s Ethernet port configuration and potentially apply overrides to the profile’s configuration:

1 Select the **Configuration** tab from the Web UI.

2 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

3 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

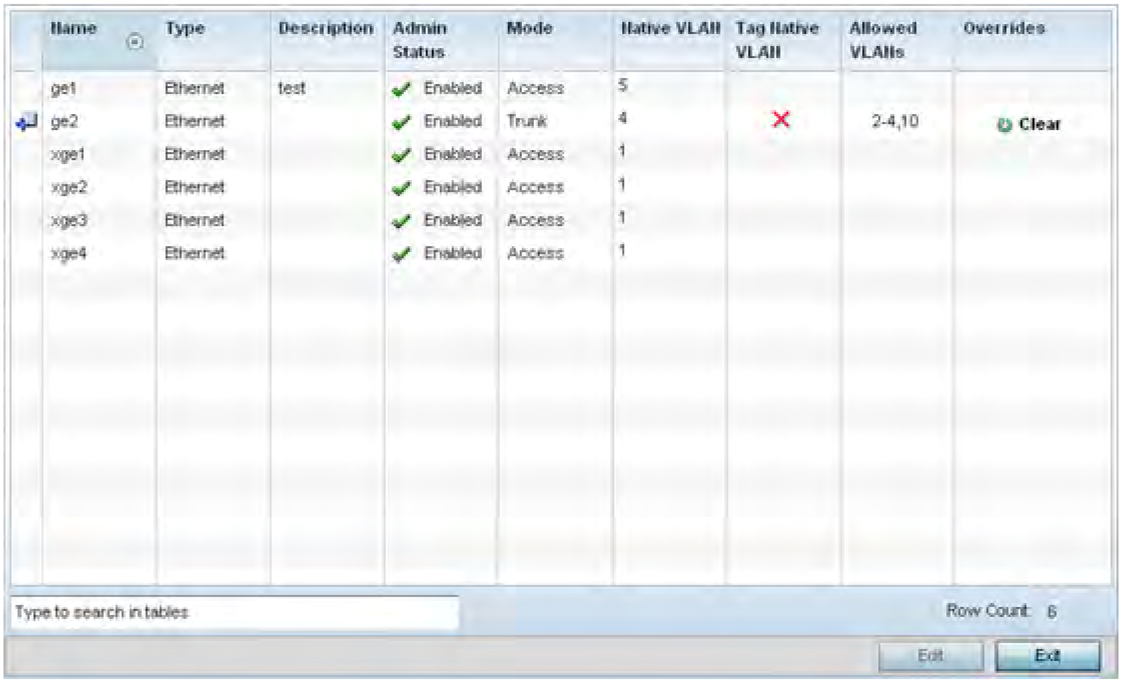
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

4 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

5 Select **Interface** to expand its sub menu options.

6 Select **Ethernet Ports**.

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Name	Type	Description	Admin Status	Mode	Native VLAN	Tag Native VLAN	Allowed VLANs	Overrides
ge1	Ethernet	test	✓ Enabled	Access	5			
ge2	Ethernet		✓ Enabled	Trunk	4	✗	2-4,10	Clear
xge1	Ethernet		✓ Enabled	Access	1			
xge2	Ethernet		✓ Enabled	Access	1			
xge3	Ethernet		✓ Enabled	Access	1			
xge4	Ethernet		✓ Enabled	Access	1			

Row Count: 6

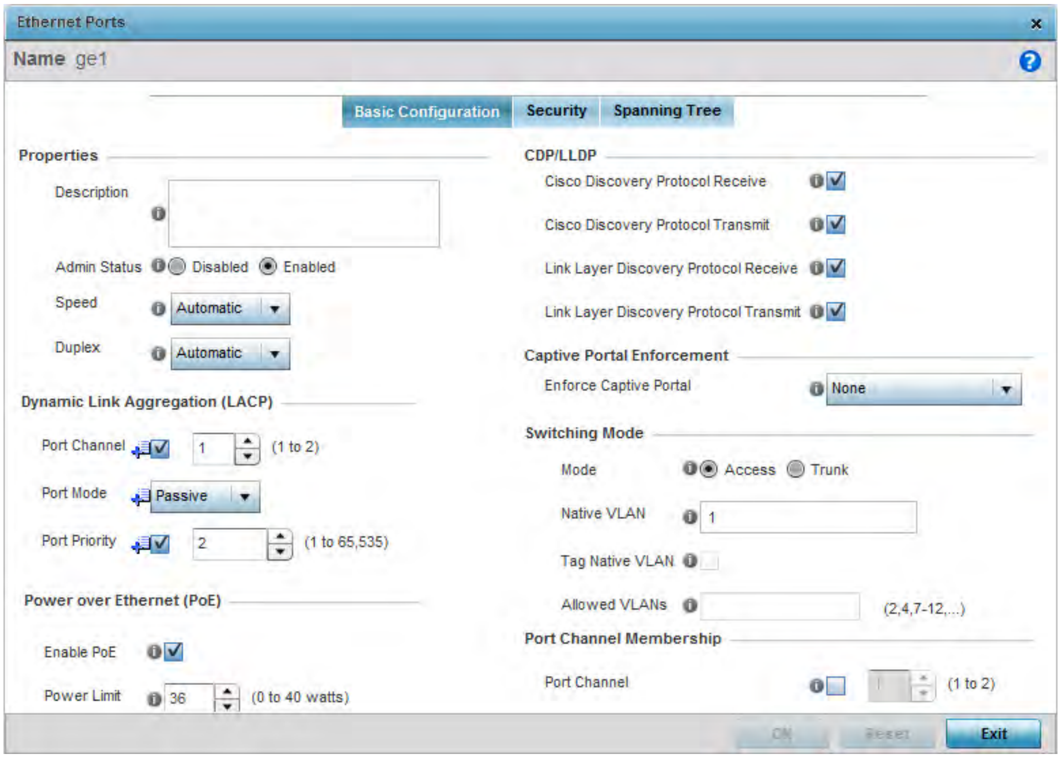
Figure 5-30 *Profiles Overrides - Ethernet Ports screen*

7 Refer to the following to assess port status and performance:

Name	Displays the physical port name reporting runtime data and statistics. Supported ports vary depending on controller or service platform model. RFS4000 - ge1, ge2, ge3, ge4, ge5, up1 RFS6000 - ge1, ge2, ge3, ge4, ge5, ge6, ge7, ge8, me1, up1 *NX5500* - ge1, ge2 *NX7500* - ge1-ge10, xge1-xge2 *NX9000* series- ge1, ge2, xge1-xge4
Type	Displays the physical controller or service platform port type. *Cooper* is used on RJ45 Ethernet ports and *Optical* materials are used on fiber optic gigabit Ethernet ports.
Description	Displays an administrator defined description for each listed controller or service platform port.
Admin Status	A green check mark defines the port as active and currently enabled with the profile. A red “X” defines the port as currently shut down and not available for use. The interface status can be modified with the port configuration as needed.

Mode	Displays the profile's switching mode as either *Access* or *Trunk* (as defined within the Ethernet Port Basic Configuration screen). If Access is selected, the listed port accepts packets only from the native VLAN. Frames are forwarded untagged with no 802.1Q header. All frames received on the port are expected as untagged and mapped to the native VLAN. If set to Trunk, the port allows packets from a list of VLANs added to the trunk. A port configured as Trunk supports multiple 802.1Q tagged VLANs and one Native VLAN which can be tagged or untagged.
Native VLAN	Lists the numerical VLAN ID (1 - 4094) set for the native VLAN. The native VLAN allows an Ethernet device to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame. Additionally, the native VLAN is the VLAN untagged traffic is directed over when using a port in trunk mode.
Tag Native VLAN	A green check mark defines the native VLAN as tagged. A red "X" defines the native VLAN as untagged. When a frame is tagged, the 12 bit frame VLAN ID is added to the 802.1Q header so upstream Ethernet devices know which VLAN ID the frame belongs to. The device reads the 12 bit VLAN ID and forwards the frame to the appropriate VLAN. When a frame is received with no 802.1Q header, the upstream device classifies the frame using the default or native VLAN assigned to the Trunk port. A native VLAN allows an Ethernet device to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame.
Allowed VLANs	Displays those VLANs allowed to send packets over the listed controller or service platform port. Allowed VLANs are only listed when the mode has been set to Trunk.
Overrides	A Clear option appears for each Ethernet port configuration that has an override applied to the profile's configuration. Select Clear to revert this specific interface configuration to the profile configuration originally defined by the administrator for this interface.

8 To edit or override the configuration of an existing controller or service platform port, select it from amongst those displayed and select the **Edit** button. The Ethernet Port **Basic Configuration** screen displays by default.



Ethernet Ports

Name ge1

Properties

Description: (blank)

Admin Status ○ Disabled ● Enabled

Speed: Automatic

Duplex: Automatic

Dynamic Link Aggregation (LACP)

Port Channel ☑ 1 (1 to 2)

Port Mode: Passive

Port Priority ☑ 2 (1 to 65,535)

Power over Ethernet (PoE)

Enable PoE ☑

Power Limit 36 (0 to 40 watts)

CDP/LLDP

Cisco Discovery Protocol Receive ☑

Cisco Discovery Protocol Transmit ☑

Link Layer Discovery Protocol Receive ☑

Link Layer Discovery Protocol Transmit ☑

Captive Portal Enforcement

Enforce Captive Portal: None

Switching Mode

Mode ● Access ○ Trunk

Native VLAN 1

Tag Native VLAN □

Allowed VLANs (2,4,7-12,...)

Port Channel Membership

Port Channel □ 1 (1 to 2)

Figure 5-31 *Profile Overrides - Ethernet Ports Basic Configuration screen*

9 Set or override the following Ethernet port **Properties**:

Description	Enter a brief description for the controller or service platform port (64 characters maximum). The description should reflect the port's intended function to differentiate it from others with similar configurations, or perhaps just the name of the physical port.
Admin Status	Select the *Enabled* radio button to define this port as active to the profile it supports. Select the *Disabled* radio button to disable this physical port in the profile. It can be activated at any future time when needed. Admin status is enabled by default.
Speed	Select the speed at which the port can receive and transmit the data. Select either *10 Mbps*, *100 Mbps* or *1000 Mbps*. Select either of these options to establish a 10, 100 or 1000 Mbps data transfer rate for the selected half duplex or full duplex transmission over the port. These options are not available if Auto is selected. Select *Automatic* to enable the port to automatically exchange information about data transmission speed and duplex capabilities. Auto negotiation is helpful when in an environment where different devices are connected and disconnected on a regular basis. Automatic is the default setting.
Duplex	Select either *Half*, *Full* or *Automatic* as the duplex option. Select Half duplex to send data over the port, then immediately receive data from the same direction in which the data was transmitted. Like a Full-duplex transmission, a Half-duplex transmission can carry data in both directions, just not at the same time. Select Full duplex to transmit data to and from the port at the same time. Using Full duplex, the port can send data while receiving data as well. Select Automatic to enable to the controller or service platform to dynamically duplex as port performance needs dictate. Automatic is the default setting.

10 Enable or disable the following **CDP/LLDP** parameters used to configure *Cisco Discovery Protocol* (CDP) and *Link Layer Discovery Protocol* (LLDP) for this profile's Ethernet port configuration:

Cisco Discovery Protocol Receive	Select this option to allow the CDP to be received on this port. If enabled, the port sends out periodic interface updates to a multicast address to advertise its presence to neighbors. This option is enabled by default.
Cisco Discovery Protocol Transmit	Select this option to allow the CDP to be transmitted on this port. If enabled, the port sends out periodic interface updates to a multicast address to advertise its presence to neighbors.
Link Layer Discovery Protocol Receive	Select this option to allow the LLDP to be received on this port. If enabled, the port sends out periodic interface updates to a multicast address to advertise its presence to neighbors. This option is enabled by default.
Link Layer Discovery Protocol Transmit	Select this option to allow the LLDP to be transmitted on this port. If enabled, the port sends out periodic interface updates to a multicast address to advertise its presence to neighbors.

11 If supported and applicable, set or override the following **Power Over Ethernet (PoE)** parameters used with this profile's Ethernet port configuration:

Enable POE	Select this option to configure the selected controller or service platform port to use Power over Ethernet. To disable PoE on a port, uncheck this option. PoE is supported on RFS4000 and RFS6000 model controllers. When enabled, the controller or service platform supports 802.3af PoE on each of its ge ports. The PoE allows users to monitor port power consumption and configure power usage limits and priorities for each ge port.
Power Limit	Use the spinner control to set the total watts available for PoE on the ge port. Set a value from 0 - 40 watts.
Power Priority	Set the power priority for the listed port to either to either *Critical, High* or *Low*. This is the priority assigned to this port versus the power requirements of the other supports available on the controller or service platform.

12 Select **Enforce Captive Portal** to automatically apply captive portal access permission rules to data transmitted over this specific Ethernet port. This setting is disabled by default.

A captive portal is an access policy for providing temporary and restrictive access using a standard Web browser. Captive portals provides authenticated access by capturing and re-directing a wireless user's Web browser session to a captive portal login page where the user must enter valid credentials to access to the network. Once logged into the captive portal, additional *Terms and Agreement*, *Welcome*, *Fail* and *No Service* pages provide the administrator with a number of options on captive portal screen flow and user appearance.

Captive portal enforcement allows wired network users to pass traffic through the captive portal without being redirected to an authentication page. Authentication instead takes place when the RADIUS server is queried against the wired user's MAC address. If the MAC address is in the RADIUS server's user database, the user can pass traffic on the captive portal. If **None** is selected, captive portal policies are not enforced on the wired interface. If **Authentication Failure** is selected, captive portal policies are enforced only when RADIUS authentication of the client's MAC address is not successful. If Always is selected, captive portal policies are enforced regardless of whether the client's MAC address is in the RADIUS server's user database. For information on configuring a captive portal policy, see Configuring Captive Portal Policies on page 11-1.

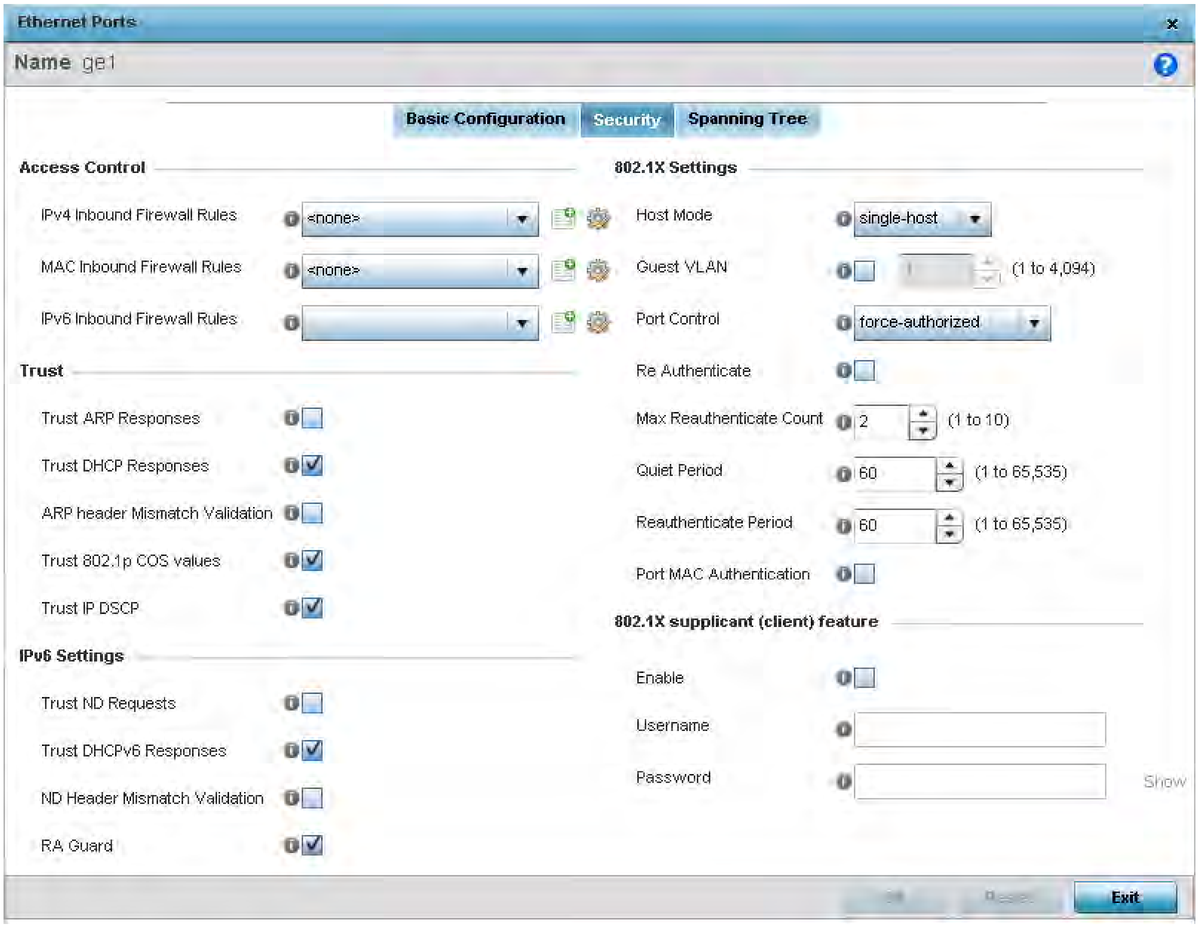
13 Define or override the following **Switching Mode** parameters applied to the Ethernet port configuration:

Mode	Select either the *Access* or *Trunk* radio button to set the VLAN switching mode over the port. If Access is selected, the port accepts packets only form the native VLANs. Frames are forwarded out the port untagged with no 802.1Q header. All frames received on the port are untagged and are mapped to the native VLAN. If the mode is set to Trunk, the port allows packets from a list of VLANs you add to the trunk. A port configured as Trunk supports multiple 802.1Q tagged VLANs and one Native VLAN which can be tagged or untagged. Access is the default mode.
Native VLAN	Use the spinner control to define a numerical **Native VLAN ID** from 1 - 4094. The native VLAN allows an Ethernet device to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame. Additionally, the native VLAN is the VLAN which untagged traffic will be directed over when using a port in trunk mode. The default VLAN is 1.
Tag Native VLAN	Select this option to tag the native VLAN. Controller and service platforms support the IEEE 802.1Q specification for tagging frames and coordinating VLANs between devices. IEEE 802.1Q adds four bytes to each frame identifying the VLAN ID for upstream devices that the frame belongs. If the upstream Ethernet device does not support IEEE 802.1Q tagging, it does not interpret the tagged frames. When VLAN tagging is required between devices, both devices must support tagging and be configured to accept tagged VLANs. When a frame is tagged, the 12 bit frame VLAN ID is added to the 802.1Q header so upstream Ethernet devices know which VLAN ID the frame belongs to. The device reads the 12 bit VLAN ID and forwards the frame to the appropriate VLAN. When a frame is received with no 802.1Q header, the upstream device classifies the frame using the default or native VLAN assigned to the Trunk port. The native VLAN allows an Ethernet device to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame. This feature is disabled by default.
Allowed VLANs	Selecting *Trunk* as the mode enables the *Allowed VLANs* parameter. Add VLANs that exclusively send packets over the listed port.

14 Optionally select the **Port Channel** check box from the **Port Channel Membership** area and define or override a setting from 1 - 8 using the spinner control. This sets the channel group for the port.

15 Select **OK** to save the changes and overrides made to the profile's Ethernet Port Basic Configuration. Select **Reset** to revert to the last saved configuration.

16 Select the **Security** tab.



Ethernet Ports

Name ge1

Basic Configuration | Security | Spanning Tree

Access Control

IPv4 Inbound Firewall Rules: <none>

MAC Inbound Firewall Rules: <none>

IPv6 Inbound Firewall Rules:

Trust

Trust ARP Responses □

Trust DHCP Responses ☑

ARP header Mismatch Validation □

Trust 802.1p COS values ☑

Trust IP DSCP ☑

IPv6 Settings

Trust ND Requests □

Trust DHCPv6 Responses ☑

ND Header Mismatch Validation □

RA Guard ☑

802.1X Settings

Host Mode: single-host

Guest VLAN □ 1 (1 to 4,094)

Port Control: force-authorized

Re Authenticate □

Max Reauthenticate Count: 2 (1 to 10)

Quiet Period: 60 (1 to 65,535)

Reauthenticate Period: 60 (1 to 65,535)

Port MAC Authentication □

802.1X supplicant (client) feature

Enable □

Username:

Password: Show

Figure 5-32 *Profile Overrides - Ethernet Ports Security screen*

17 Refer to the **Access Control** field. As part of the Ethernet port's security configuration, Inbound IP and MAC address firewall rules are required.

18 Use the **MAC Inbound Firewall Rules** drop-down menus to select the firewall rules to apply to this profile's Ethernet port configuration. The firewall inspects MAC traffic flows and detects attacks typically not visible to traditional wired firewall appliances.

Use the **IPv4 Inbound Firewall Rules** drop down menu to select the IPv4 specific firewall rules to apply to this profile's Ethernet port configuration. IPv4 is a connectionless protocol for packet switched networking. IPv4 operates as a best effort delivery method, as it does not guarantee delivery, and does not ensure proper sequencing or duplicate delivery (unlike (TCP). IPv4 hosts can use link local addressing to provide local connectivity.

19 Use the **IPv6 Inbound Firewall Rules** drop down menu to select the IPv6 specific firewall rules to apply to this profile's Ethernet port configuration. IPv6 is the latest revision of the *Internet Protocol* (IP) designed to replace IPv4. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.

20 If a firewall rule does not exist suiting the data protection needs of the target port configuration, select the **Create** icon to define a new rule configuration or the **Edit** icon to update or override an existing configuration. For more information, see Configuring IP Firewall Rules on page 10-20 or Wireless Firewall on page 10-1.

21 Refer to the **Trust** field to define or override the following:

Trust ARP Responses	Select this option to enable ARP trust on this port. ARP packets received on this port are considered trusted, and the information from these packets is used to identify rogue devices within the network. The default value is disabled.
Trust DHCP Responses	Select this option to enable DHCP trust on this port. If enabled, only DHCP responses are trusted and forwarded on this port, and a DHCP server can be connected only to a DHCP trusted port. The default value is enabled.
ARP header Mismatch Validation	Select this option to enable a mismatch check for the source MAC in both the ARP and Ethernet header. The default value is enabled.
Trust 802.1p COS values	Select this option to enable 802.1p COS values on this port. The default value is enabled.
Trust IP DSCP	Select this option to enable IP DSCP values on this port. The default value is enabled.

NOTE: Some vendor solutions with VRRP enabled send ARP packets with Ethernet SMAC as a physical MAC and inner ARP SMAC as VRRP MAC. If this configuration is enabled, a packet is allowed, despite a conflict existing.

22 Set the following **IPv6 Settings**:

Trust ND Requests	Select this option to enable the trust of neighbor discovery requests required on an IPv6 network on this Ethernet port. This setting is disabled by default.
Trust DHCPv6 Responses	Select this option to enable the trust all DHCPv6 responses on this Ethernet port. DHCPv6 is a networking protocol for configuring IPv6 hosts with IP addresses, IP prefixes or other configuration attributes required on an IPv6 network. This setting is enabled by default.
ND Header Mismatch Validation	Select this option to enable a mismatch check for the source MAC within the ND header and Link Layer Option. This setting is disabled by default.
RA Guard	Select this option to enable router advertisements or ICMPv6 redirects from this Ethernet port. This setting is disabled by default.

23 Set the following **802.1X Settings**:

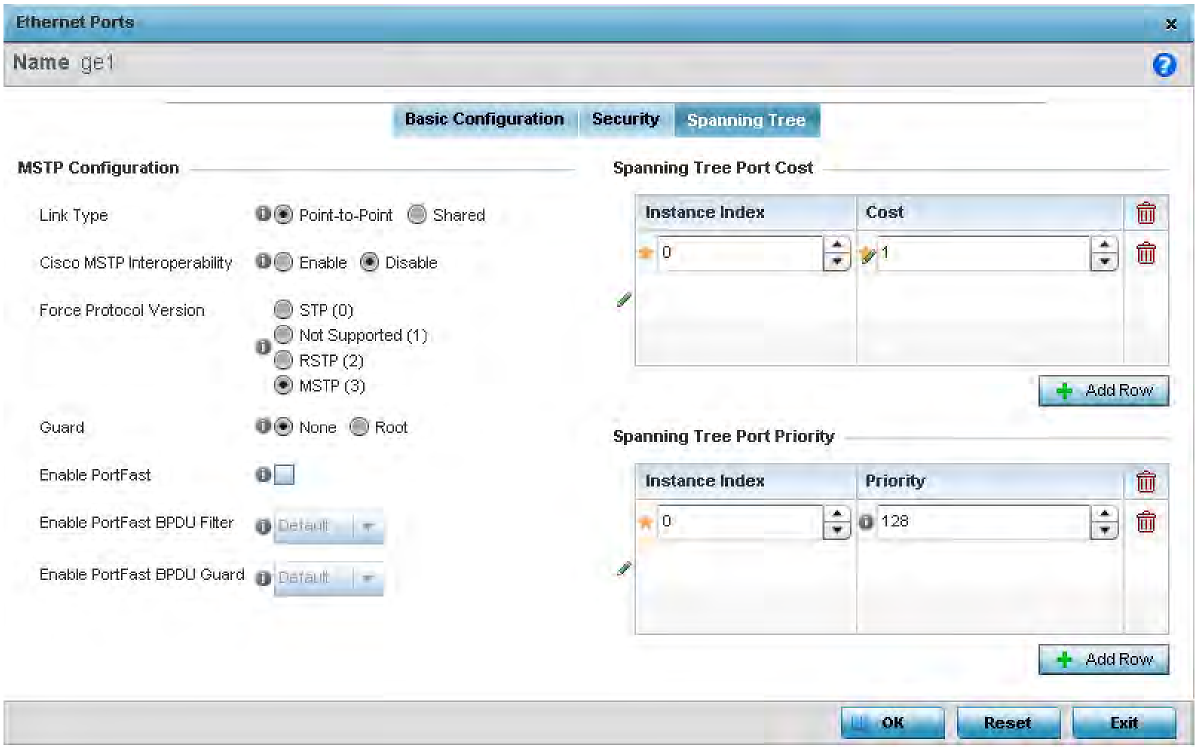
Host Mode	Use the drop-down menu to select the host mode configuration to apply to this port. Options include *single-host* or *multi-host*. The default setting is single-host.
Guest VLAN	Specify a guest VLAN for this port from 1 - 4094. This is the VLAN traffic is bridged on if this port is unauthorized and the guest VLAN is globally enabled.
Port Control	Use the drop-down menu to set the port control state to apply to this port. Options include *force-authorized*, *force-unauthorized* and *automatic*. The default setting is port-authorized.
Re Authenticate	Select this setting to force clients to reauthenticate on this port. The default setting is disabled, thus clients do not need to reauthenticate for connection over this port until this setting is enabled.
Max Reauthenticate Count	Set the maximum reauthentication attempts (1 - 10) before this port is moved to unauthorized. The default setting is 2.

Quiet Period	Set the quiet period for this port from 1 - 65,535 seconds.This is the maximum wait time 802.1x waits upon a failed authentication attempt. The default setting is 60 seconds.
Reauthenticate Period	Use the spinner control to set the reauthentication period for this port from 1 - 65,535 seconds. The default setting is 60 seconds.
Port MAC Authentication	When enabled, a port's MAC address is authenticated, as only one MAC address is supported per wired port. When successfully authenticated, packets from the source are processed. Packets from all other sources are dropped. Port MAC authentication is supported on RFS4000, RFS6000 model controllers and NX9000 series service platforms. Port MAC authentication may be enabled on ports in conjunction with Wired 802.1x settings for a MAC Authentication AAA policy.

24 Select **Enable** within the **802.1x supplicant (client) feature** field to enable a *username* and *password* pair used when authenticating users on this port. This setting is disabled by default. The password cannot exceed 32 characters.

25 Select **OK** to save the changes and overrides made to the Ethernet port's security configuration. Select **Reset** to revert to the last saved configuration.

26 Select the **Spanning Tree** tab.



Name ge1

MSTP Configuration

Link Type ● Point-to-Point ○ Shared

Cisco MSTP Interoperability ○ Enable ● Disable

Force Protocol Version ○ STP (0) ○ Not Supported (1) ○ RSTP (2) ● MSTP (3)

Guard ● None ○ Root

Enable PortFast □

Enable PortFast BPDU Filter Default

Enable PortFast BPDU Guard Default

Spanning Tree Port Cost

Instance Index	Cost
0	1

Spanning Tree Port Priority

Instance Index	Priority
0	128

Figure 5-33 *Profile Overrides - Ethernet Ports Spanning Tree screen*

27 Set or override the following parameters for the port's **MSTP Configuration**:

Enable as Edge Port	Select this option to define this port as an edge port. Using an edge (private) port, you can isolate devices to prevent connectivity over this port.
Link Type	Select either the *Point-to-Point* or *Shared* radio button. Selecting Point-to-Point indicates the port should be treated as connected to a point-to-point link. Selecting Shared indicates this port should be treated as having a shared connection. A port connected to a hub is on a shared link, while one connected to a controller or service platform is a point-to-point link.
Cisco MSTP Interoperability	Select either the *Enable* or *Disable* radio buttons. This enables interoperability with Cisco's version of MSTP over the port, which is incompatible with standard MSTP.
Force Protocol Version	Sets the protocol version to either *STP(0)*, *Not Supported(1)*, *RSTP(2)* or *MSTP(3)*. MSTP is the default setting.
Guard	Determines whether the port enforces root bridge placement. Setting the guard to *Root* ensures the port is a designated port. Typically, each guard root port is a designated port, unless two or more ports (within the root bridge) are connected together. If the bridge receives superior BPDUs on a guard root-enabled port, the guard root moves the port to a root-inconsistent STP state. This state is equivalent to a listening state. No data is forwarded across the port. Thus, the guard root enforces the root bridge position.
Enable PortFast	Select this option to enable drop-down menus for both the Enable Portfast BPDU Filter and Enable Portfast BPDU guard options for the port.
Enable PortFast BPDU Filter	Enable PortFast to invoke a BPDU filter for this portfast enabled port. Enabling the BPDU filter feature ensures this PortFast enabled port does not transmit or receive BPDUs.
Enable PortFast BPDU Guard	Enable PortFast to invoke a BPDU guard for this portfast enabled port. Enabling the BPDU Guard feature means this portfast-enabled port will shutdown on receiving a BPDU.

28 Refer to the **Spanning Tree Port Cost** table.

Define or override an **Instance Index** using the spinner control and set the **Cost**. The default path cost depends on the user defined speed of the port.The cost helps determine the role of the port in the MSTP network. The designated cost is the cost for a packet to travel from this port to the root in the MSTP configuration. The slower the media, the higher the cost.

Speed	Default Path Cost
<=100000 bits/sec	200000000
<=1000000 bits/sec	20000000
<=10000000 bits/sec	2000000
<=100000000 bits/sec	200000
<=1000000000 bits/sec	20000
<=10000000000 bits/sec	2000

<=100000000000 bits/sec	200
<=1000000000000 bits/sec	20
>1000000000000 bits/sec	2

29 Select **+ Add Row** as needed to include additional indexes.

30 Refer to the **Spanning Tree Port Priority** table.

Define or override an **Instance Index** using the spinner control and then set the **Priority**. The lower the priority, the greater likelihood of the port becoming a designated port. Applying a higher override value impacts the port's likelihood of becoming a designated port.

31 Select **+ Add Row** needed to include additional indexes.

32 Select **OK** to save the changes and overrides made to the Ethernet Port Spanning Tree configuration. Select **Reset** to revert to the last saved configuration.

5.2.7.2 Virtual Interface Override Configuration

▸ *Profile Interface Override Configuration*

A virtual interface is required for layer 3 (IP) access to the controller or service platform or to provide layer 3 service on a VLAN. The virtual interface defines which IP address is associated with each VLAN ID the controller is connected to. A virtual interface is created for the default VLAN (VLAN 1) to enable remote controller administration. A virtual interface is also used to map VLANs to IP address ranges. This mapping determines the destination for controller or service platform routing.

To review existing virtual interface configurations and create a new virtual interface configuration, modify (override) an existing configuration or delete an existing configuration:

1 Select the Configuration tab from the Web UI.

2 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

3 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

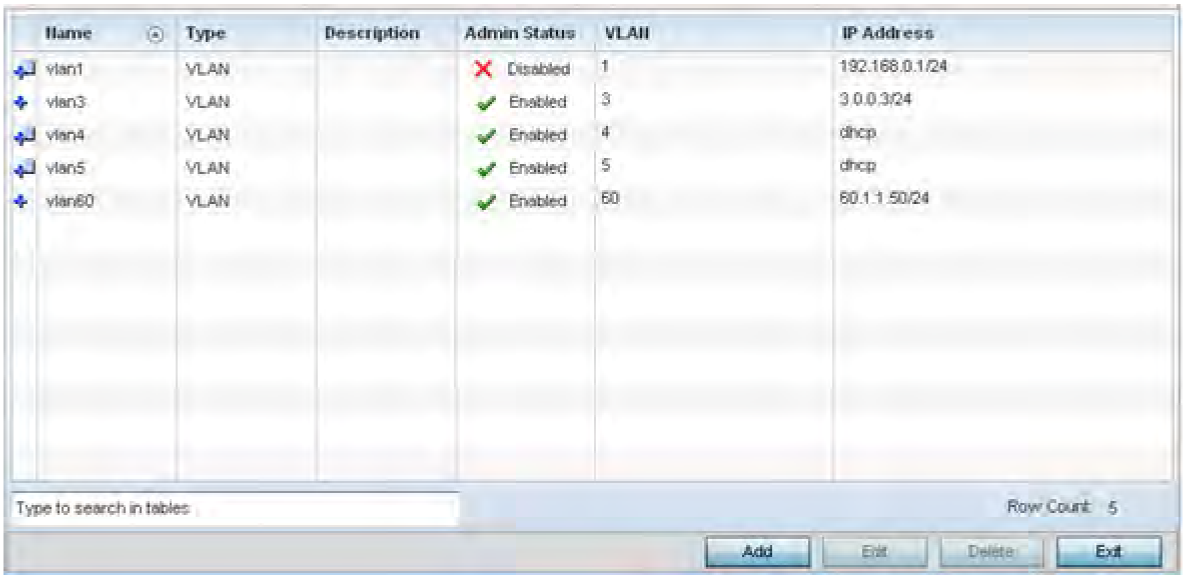
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

4 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

5 Select **Interface** to expand its sub menu options.

6 Select **Virtual Interfaces**.

☑ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Name	Type	Description	Admin Status	VLAN	IP Address
vlan1	VLAN		✗ Disabled	1	192.168.0.1/24
vlan3	VLAN		✓ Enabled	3	3.0.0.3/24
vlan4	VLAN		✓ Enabled	4	dhcp
vlan5	VLAN		✓ Enabled	5	dhcp
vlan60	VLAN		✓ Enabled	60	60.1.1.50/24

Type to search in tables

Row Count 5

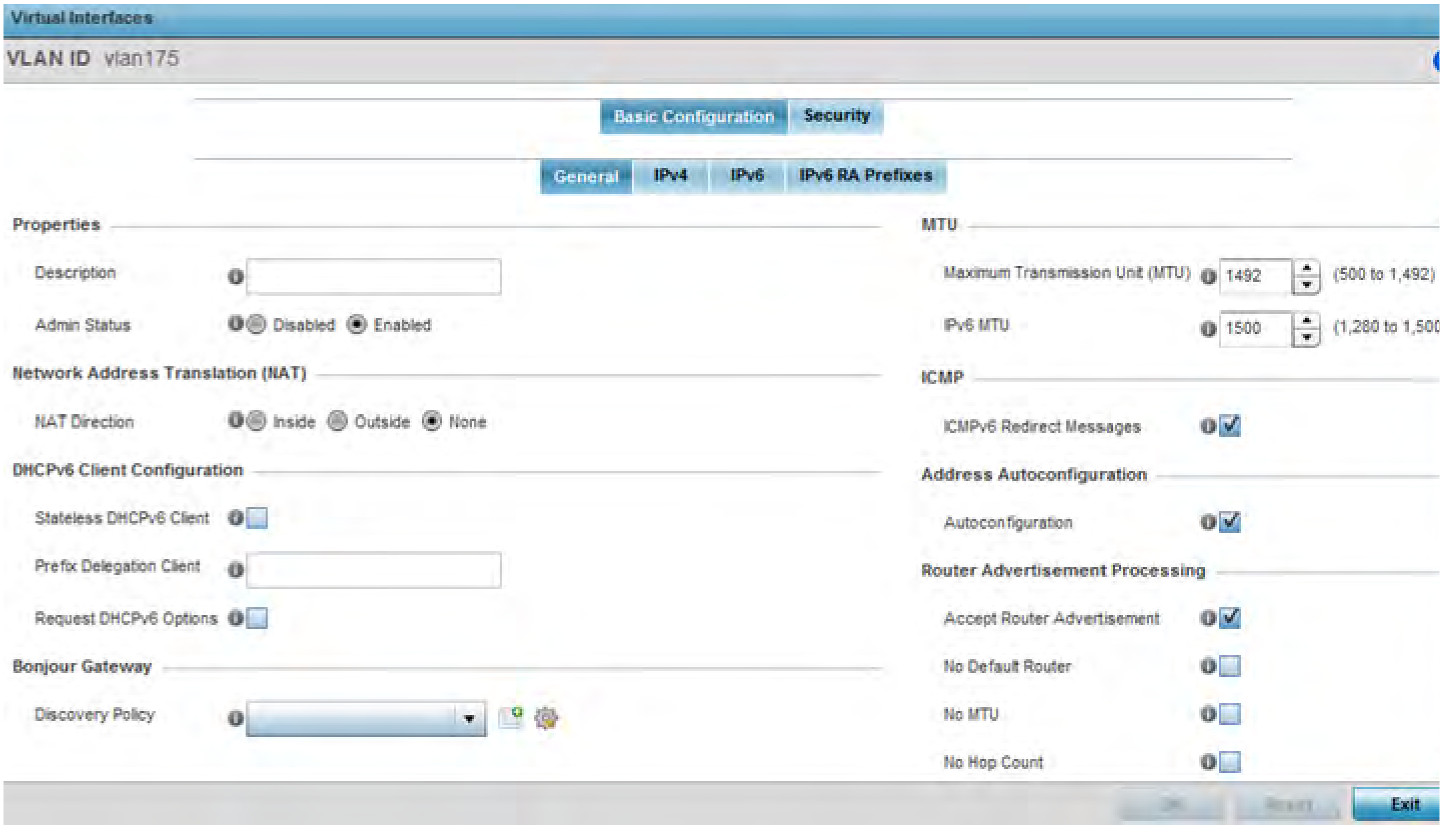
Figure 5-34 *Profile Overrides - Virtual Interfaces screen*

7 Review the following parameters unique to each virtual interface configuration to determine whether a parameter override is warranted:

Name	Displays the numeric ID of each listed virtual interface assigned when it was created. The name is between 1 - 4094, and cannot be modified as part of a virtual interface edit.
Type	Displays the type of virtual interface for each listed interface.
Description	Displays the description defined for the virtual interface when it was either initially created or edited.
Admin Status	A green check mark defines the listed virtual interface configuration as active and enabled with its supported profile. A red "X" defines the virtual interface as currently shut down. The interface status can be modified when a new virtual interface is created or an existing one modified.
VLAN	Displays the numerical VLAN ID associated with each listed interface.
IP Address	Defines whether DHCP was used to obtain the primary IP address used by the virtual interface configuration.

Once the configurations of existing virtual interfaces have been reviewed, determine whether a new interface requires creation, or an existing virtual interface requires edit (override) or deletion.

8 Select **Add** to define a new virtual interface configuration, Edit to modify or override the configuration of an existing virtual interface or **Delete** to permanently remove a selected virtual interface.



Virtual Interfaces

VLAN ID vlan175

Basic Configuration | Security

General | IPv4 | IPv6 | IPv6 RA Prefixes

Properties

- Description:
- Admin Status: ○ Disabled ● Enabled

Network Address Translation (NAT)

- NAT Direction: ○ Inside ○ Outside ● None

DHCPv6 Client Configuration

- Stateless DHCPv6 Client: □
- Prefix Delegation Client:
- Request DHCPv6 Options: □

Bonjour Gateway

- Discovery Policy:

MTU

- Maximum Transmission Unit (MTU): 1492 (500 to 1,492)
- IPv6 MTU: 1500 (1,280 to 1,500

ICMP

- ICMPv6 Redirect Messages: ☑

Address Autoconfiguration

- Autoconfiguration: ☑

Router Advertisement Processing

- Accept Router Advertisement: ☑
- No Default Router: □
- No MTU: □
- No Hop Count: □

OK | Reset | Exit

Figure 5-35 *Profile Overrides - Virtual Interfaces Basic Configuration screen*

The **Basic Configuration** screen displays by default regardless of a whether a new virtual interface is being created or an existing one is being modified. Select the **General** tab if not selected by default.

9 If creating a new virtual interface, use the VLAN ID spinner control to define a numeric VLAN ID from 1 - 4094.

10 Define or override the following parameters from within the **Properties** field:

Description	Provide or edit a description (up to 64 characters) for the virtual interface that helps differentiate it from others with similar configurations.
Admin Status	Either select the *Disabled* or *Enabled* radio button to define this interface's current status within the managed network. When set to Enabled, the virtual interface is operational and available to the controller or service platform. The default value is enabled.

11 Define or override the **Network Address Translation (NAT)** direction.

Select either the **Inside**, **Outside** or **None** radio buttons.

- *Inside* - The inside network is transmitting data over the network its intended destination. On the way out, the source IP address is changed in the header and replaced by the (public) IP address.
- *Outside* - Packets passing through the NAT on the way back to the managed LAN are searched against to the records kept by the NAT engine. There the destination IP address is changed back to the specific internal private class IP address in order to reach the LAN over the switch managed network.
- *None* - No NAT activity takes place. This is the default setting.

NOTE: Refer to Setting the Profile's NAT Configuration on page 8-186 for instructions on creating a profile's NAT configuration.

12 Set the following **DHCPv6 Client Configuration**. The *Dynamic Host Configuration Protocol for IPv6* (DHCPv6) provides a framework for passing configuration information.

Stateless DHCPv6 Client	Select this option to request information from the DHCPv6 server using stateless DHCPv6. DHCPv6 is a networking protocol for configuring IPv6 hosts with IP addresses, IP prefixes or other configuration attributes required on an IPv6 network. This setting is disabled by default.
Prefix Delegation Client	Specify a 32 character maximum request prefix for prefix delegation from a DHCPv6 server over this virtual interface. Devices use prefixes to distinguish destinations that reside on-link from those reachable using a router.
Request DHCPv6 Options	Select this option to request DHCPv6 options on this virtual interface. DHCPv6 options provide configuration information for a node that must be booted using the network rather than locally. This setting is disabled by default.

13 Set the **Bonjour Gateway** settings for the virtual interface.Bonjour is Apple's implementation of zero-configuration networking (Zeroconf). Zeroconf is a group of technologies that include service discovery, address assignment and hostname resolution. Bonjour locates devices such as printers, other computers and services that these computers offer over a local network. Bonjour provides a general method to discover services on a *local area network* (LAN). It allows users to set up a network without any configuration. Services such as printers, scanners and file-sharing servers can be found using Bonjour. Bonjour only works within a single broadcast domain. However, with special DNS configuration, it can be extended to find services across broadcast domains.

14 Select the Bonjour Gateway discover policy from the drop-down menu. Select the **Create** icon to define a new Bonjour Gateway policy configuration or select the **Edit** icon to modify an existing Bonjour Gateway policy configuration.

15 Set the following MTU settings for the virtual interface:

Maximum Transmission Unit (MTU)	Set the PPPoE client *maximum transmission unit* (MTU) from 500 - 1,492. The MTU is the largest physical packet size in bytes a network can transmit. Any messages larger than the MTU are divided into smaller packets before being sent. A PPPoE client should be able to maintain its point-to-point connection for this defined MTU size. The default MTU is 1,492.
IPv6 MTU	Set an IPv6 MTU for this virtual interface from 1,280 - 1,500. A larger MTU provides greater efficiency because each packet carries more user data while protocol overheads, such as headers or underlying per-packet delays, remain fixed; the resulting higher efficiency means a slight improvement in bulk protocol throughput. A larger MTU results in the processing of fewer packets for the same amount of data. The default is 1,500.

16 Within the **ICMP** field, define whether ICMPv6 redirect messages are sent. Redirect requests data packets be sent on an alternative route. This setting is enabled by default.

17 Within the **Address Autoconfiguration** field, define whether to configure IPv6 addresses on this virtual interface based on the prefixes received in router advertisement messages. Router advertisements contain prefixes used for link determination, address configuration and maximum hop limits. This setting is enabled by default.

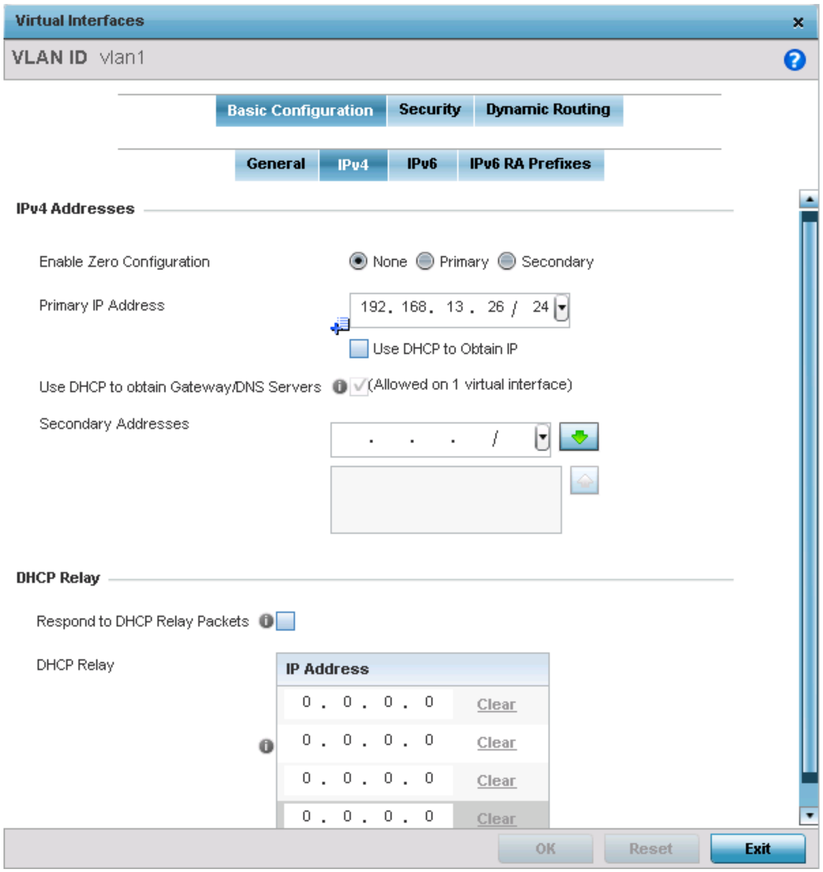
18 Set the following **Router Advertisement Processing** settings for the virtual interface. Router advertisements are periodically sent to hosts or sent in response to solicitation requests. The advertisement includes IPv6 prefixes and other subnet and host information.

Accept RA	Enable this option to allow router advertisements over this virtual interface. IPv6 hosts can configure themselves automatically when connected to an IPv6 network using the neighbor discovery protocol via ICMPv6 router discovery messages. When first connected to a network, a host sends a link-local router solicitation multicast request for its configuration parameters; routers respond to such a request with a router advertisement packet that contains Internet layer configuration parameters.This setting is enabled by default.
No Default Router	Select this option to consider routers unavailable on this interface for default router selection. This setting is disabled by default.
No MTU	Select this option to not use the existing MTU setting for router advertisements on this virtual interface. If the value is set to zero no MTU options are sent. This setting is disabled by default.
No Hop Count	Select this option to not use the hop count advertisement setting for router advertisements on this virtual interface. This setting is disabled by default.

19 Select **OK** to save the changes. Select Reset to revert to the last saved configuration.

20 Select the **IPv4** tab to set IPv4 settings for this virtual interface.

IPv4 is a connectionless protocol. It operates on a best effort delivery model that does not guarantee delivery or assures proper sequencing or avoidance of duplicate delivery (unlike TCP).



VLAN ID vlan1

IPv4 Addresses

Enable Zero Configuration ● None ○ Primary ○ Secondary

Primary IP Address 192. 168. 13. 26 / 24

□ Use DHCP to Obtain IP

Use DHCP to obtain Gateway/DNS Servers ✓ (Allowed on 1 virtual interface)

Secondary Addresses . . . /

DHCP Relay

Respond to DHCP Relay Packets □

DHCP Relay

IP Address
0 . 0 . 0 . 0
0 . 0 . 0 . 0
0 . 0 . 0 . 0
0 . 0 . 0 . 0

Figure 5-36 *Virtual Interfaces - Basic Configuration screen - IPv4 tab*

21 Set the following network information from within the **IPv4 Addresses** field:

Enable Zero Configuration	Zero configuration can be a means of providing a primary or secondary IP addresses for the virtual interface. Zero configuration (or zero config) is a wireless connection utility included with Microsoft Windows XP and later as a service dynamically selecting a network to connect based on a user's preferences and various default settings. Zero config can be used instead of a wireless network utility from the manufacturer of a computer's wireless networking device. This value is set to None by default.
Primary IP Address	Define the IP address for the VLAN associated Virtual Interface.
Use DHCP to Obtain IP	Select this option to allow DHCP to provide the IP address for the Virtual Interface. Selecting this option disables the Primary IP address field.
Use DHCP to obtain Gateway/DNS Servers	Select this option to allow DHCP to obtain a default gateway address and DNS resource for *one* virtual interface. This setting is disabled by default and only available when the *Use DHCP to Obtain IP* option is selected.
Secondary Addresses	Use the *Secondary Addresses* parameter to define additional IP addresses to associate with VLAN IDs. The address provided in this field is used if the primary IP address is unreachable.

22 Refer to the **DHCP Relay** field to set the DHCP relay server configuration used with the Virtual Interface.

Respond to DHCP Relay Packets	Select this option to allow the onboard DHCP server to respond to relayed DHCP packets on this interface. This setting is disabled by default.
DHCP Relay	Provide IP addresses for DHCP server relay resources. DHCP relays exchange messages between a DHCPv6 server and client. A client and relay agent exist on the same link. When A DHCP request is received from the client, the relay agent creates a relay forward message and sends it to a specified server address. If no addresses are specified, the relay agent forwards the message to all DHCP server relay multicast addresses. The server creates a relay reply and sends it back to the relay agent. The relay agent then sends back the response to the client.

23 Select **OK** to save the changes to the IPv4 configuration. Select **Reset** to revert to the last saved configuration.

24 Select the **IPv6** tab to set IPv6 settings for this virtual interface.

IPv6 is the latest revision of the *Internet Protocol* (IP) designed to replace IPv4. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons. IPv6 hosts can configure themselves automatically when connected to an IPv6 network using the neighbor discovery protocol via ICMPv6 router discovery messages. When first connected to a network, a host sends a link-local router solicitation multicast request for its configuration parameters; routers respond to such a request with a router advertisement packet that contains Internet layer configuration parameters.

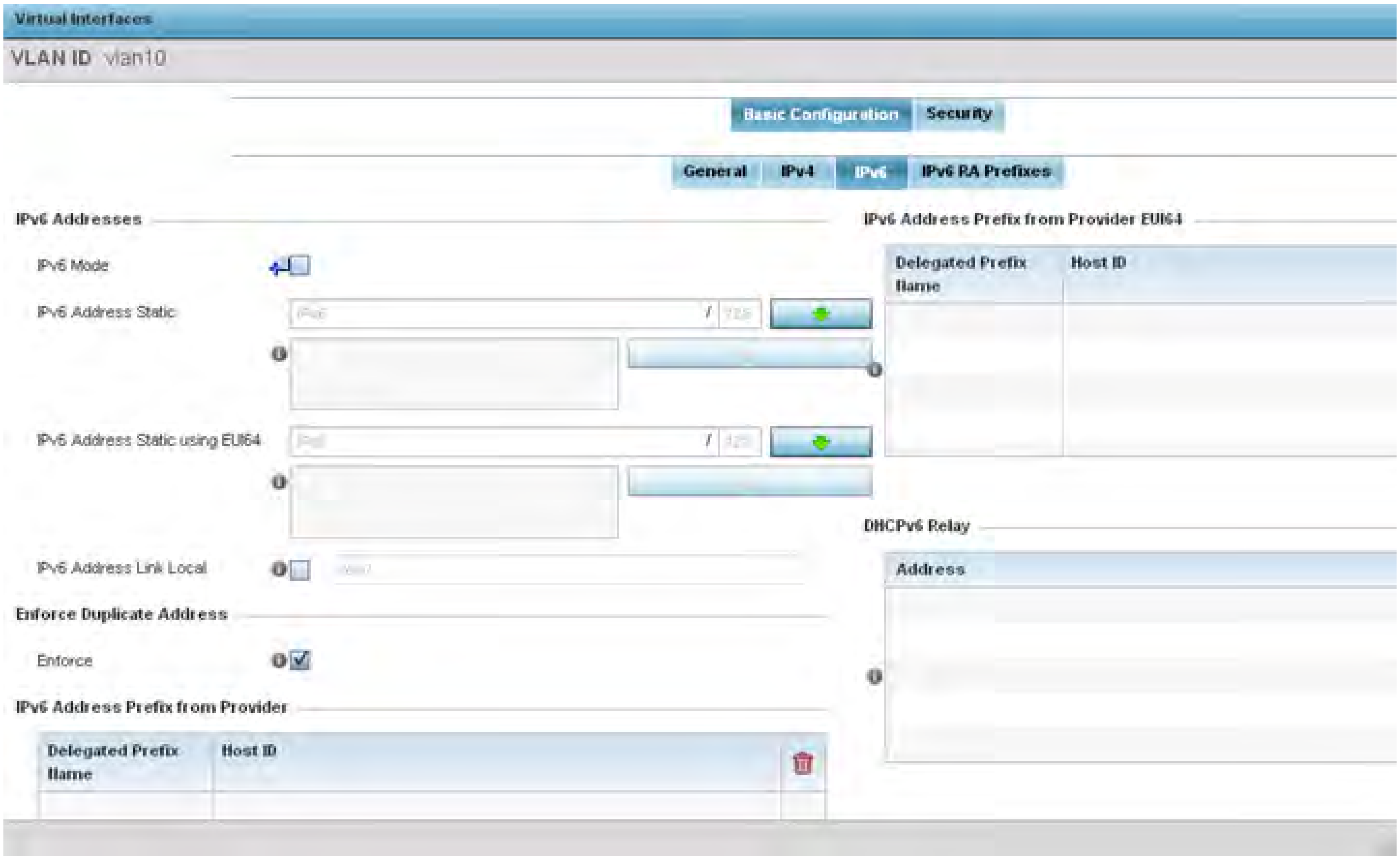


Figure 5-37 *Virtual Interfaces - Basic Configuration screen - IPv6 tab*

25 Refer to the **IPv6 Addresses** field to define how IP6 addresses are created and utilized.

IPv6 Mode	Select this option to enable IPv6 support on this virtual interface. IPv6 is disabled by default.
IPv6 Address Static	Define up to 15 global IPv6 IP addresses that can created statically. IPv6 addresses are represented as eight groups of four hexadecimal digits separated by colons.
IPv6 Address Static using EUI64	Optionally set up to 15 global IPv6 IP addresses (in the EUI-64 format) that can created statically. The IPv6 EUI-64 format address is obtained through a 48-bit MAC address. The MAC is initially separated into two 24-bits, with one being an OUI (*Organizationally Unique Identifier*) and the other being client specific. A 16-bit 0xFFFE is then inserted between the two 24-bits for the 64-bit EUI address. IEEE has chosen FFFE as a reserved value which can only appear in EUI-64 generated from the an EUI-48 MAC address.
IPv6 Address Link Local	Provide the IPv6 local link address. IPv6 requires a link local address assigned to every interface the IPv6 protocol is enabled, even when one or more routable addresses are assigned.

26 Enable the **Enforce Duplicate Address** option to enforce duplicate address protection when any wired port is connected and in a forwarding state. This option is enabled by default.

27 Refer to the **IPv6 Address Prefix from Provider** table to create IPv6 format prefix shortcuts as supplied by an ISP.

28 Select **+ Add Row** to launch a sub screen wherein a new delegated prefix name and host ID can be defined.

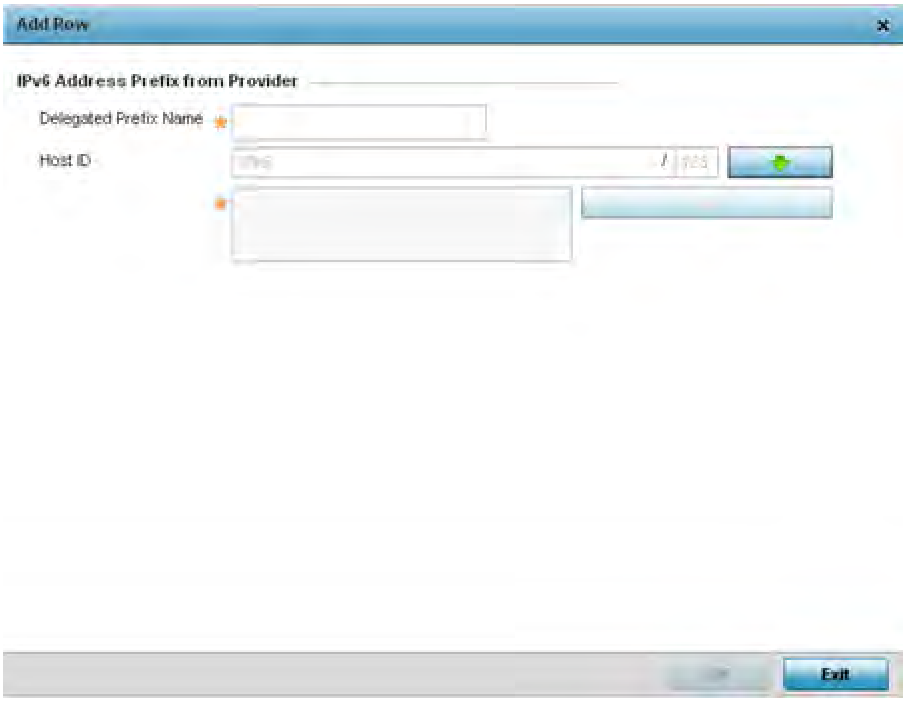


Figure 5-38 *Virtual Interfaces - Basic Configuration screen - IPv6 tab - Add Address Prefix from Provider*

Delegated Prefix Name	Enter a 32 character maximum name for the IPv6 address prefix from provider.
Host ID	Define the subnet ID, host ID and prefix length.

29 Select **OK** to save the changes to the new IPv6 prefix from provider. Select **Exit** to close the screen without saving the updates.

30 Refer to the **IPv6 Address Prefix from Provider EUI64** table to set an (abbreviated) IP address prefix in EUI64 format.

31 Select **+ Add Row** to launch a sub screen wherein a new delegated prefix name and host ID can be defined in EUI64 format.

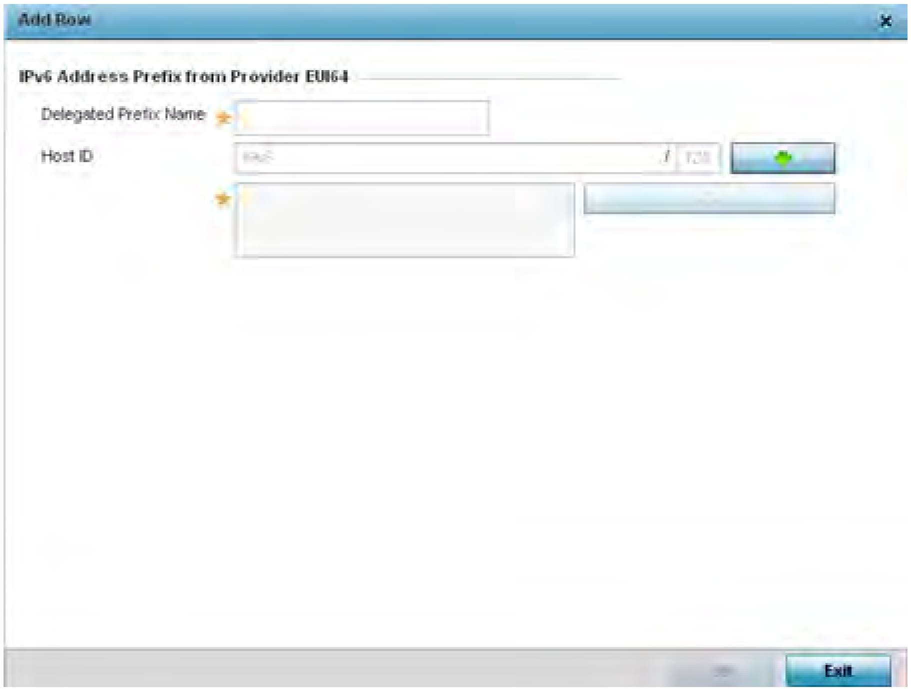


Figure 5-39 *Virtual Interfaces - Basic Configuration screen - IPv6 tab - Add Address Prefix from Provider EUI64*

Delegated Prefix Name	Enter a 32 character maximum name for the IPv6 prefix from provider in EUI format. Using EUI64, a host can automatically assign itself a unique 64-bit IPv6 interface identifier without manual configuration or DHCP.
Host ID	Define the subnet ID and prefix length.

32 Select **OK** to save the changes to the new IPv6 prefix from provider in EUI64 format. Select **Exit** to close the screen without saving the updates.

33 Refer to the **DHCPv6 Relay** table to set the address and interface of the DHCPv6 relay.

The DHCPv6 relay enhances an extended DHCP relay agent by providing support in IPv6. DHCP relays exchange messages between a DHCPv6 server and client. A client and relay agent exist on the same link. When A DHCP request is received from the client, the relay agent creates a relay forward message and sends it to a specified server address. If no addresses are specified, the relay agent forwards the message to all DHCP server relay multicast addresses. The server creates a relay reply and sends it back to the relay agent. The relay agent then sends back the response to the client.

34 Select **+ Add Row** to launch a sub screen wherein a new DHCPv6 relay address and interface VLAN ID can be set.

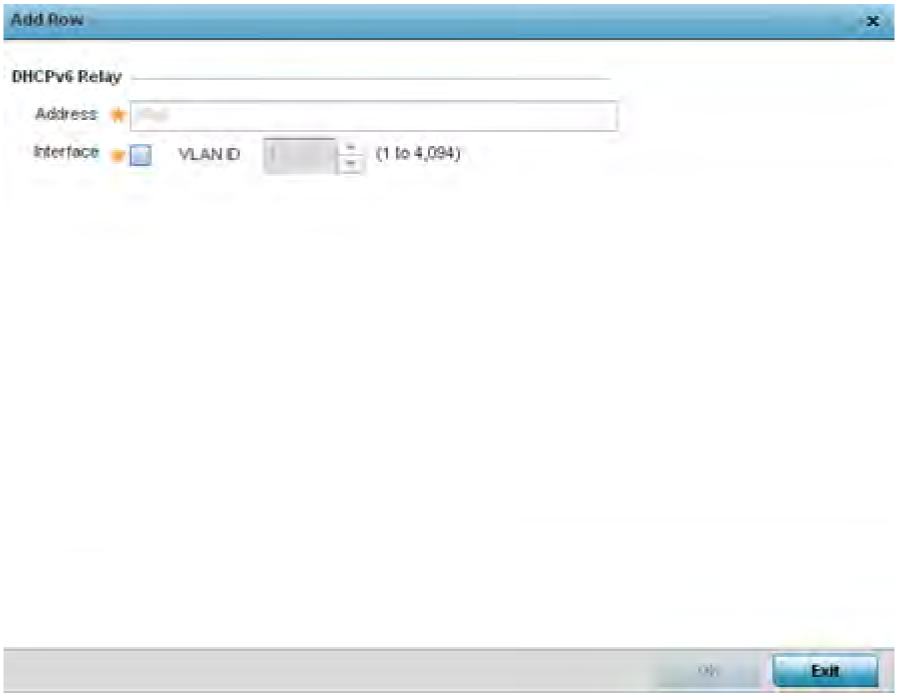
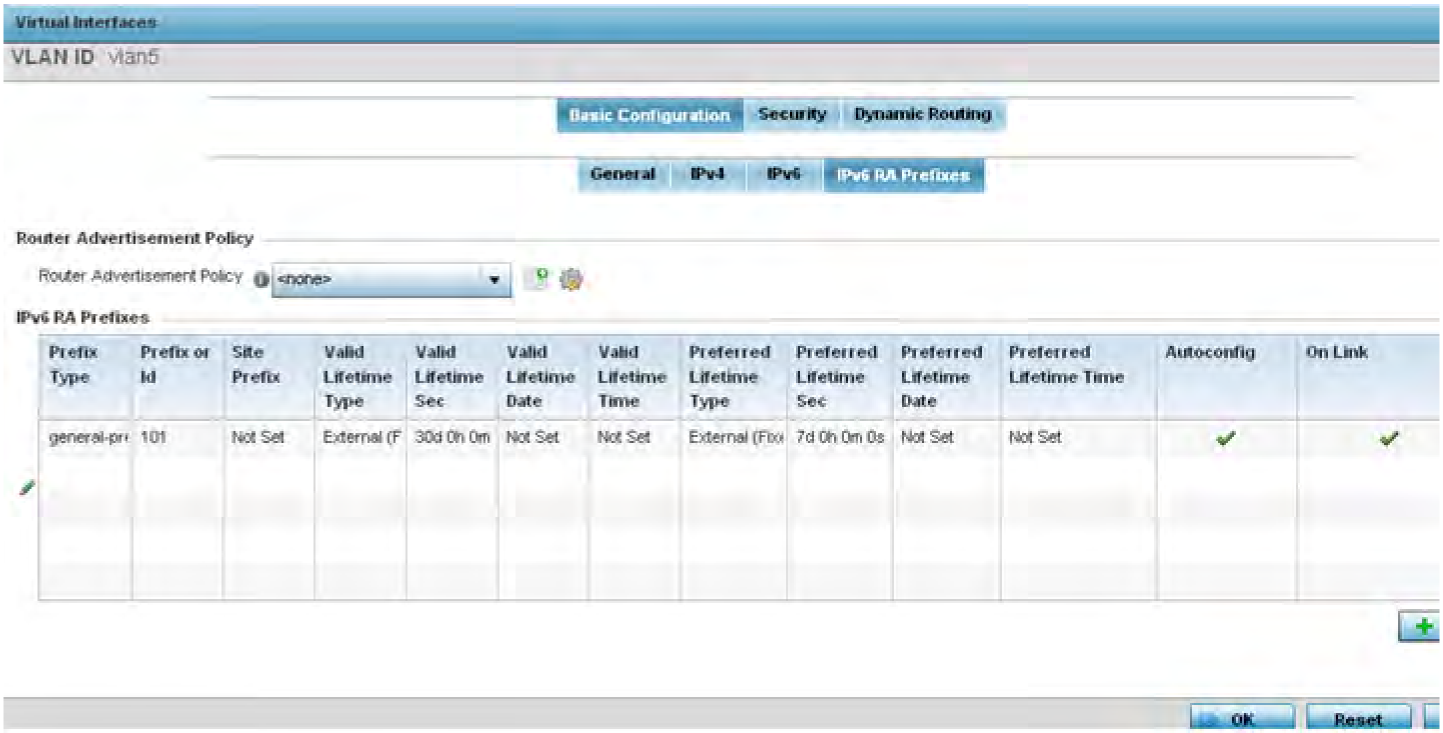


Figure 5-40 *Virtual Interfaces - Basic Configuration screen - IPv6 tab - Add DHCPv6 Relay*

Address	Enter an address for the DHCPv6 relay. These DHCPv6 relay receive messages from DHCPv6 clients and forward them to DHCPv6 servers. The DHCPv6 server sends responses back to the relay, and the relay then sends these responses to the client on the local network.
Interface	Select this option to enable a spinner control to define a VLAN ID from 1 - 4,094 used as the virtual interface for the DHCPv6 relay. The interface designation is only required for link local and multicast addresses. A local link address is a locally derived address designed for addressing on a single link for automatic address configuration, neighbor discovery or when no routing resources are available.

35 Select **OK** to save the changes to the DHCPv6 relay configuration. Select **Exit** to close the screen without saving the updates.

36 Select the **IPv6 RA Prefixes** tab.



VLAN ID vlan5

Router Advertisement Policy

Router Advertisement Policy <none>

IPv6 RA Prefixes

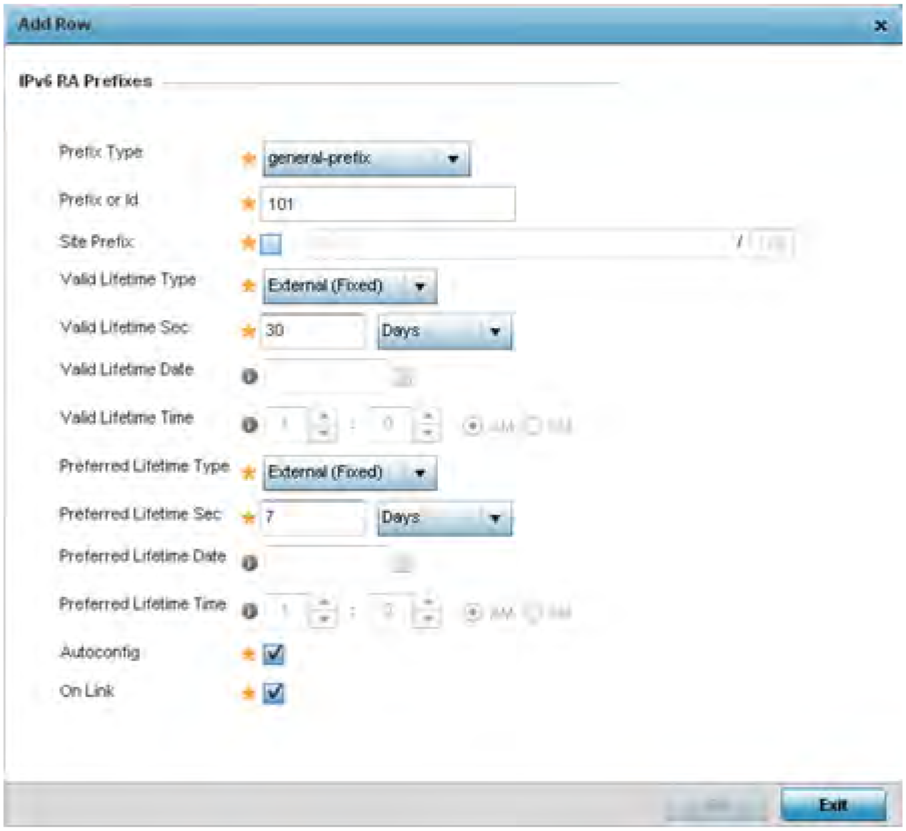
Prefix Type	Prefix or Id	Site Prefix	Valid Lifetime Type	Valid Lifetime Sec	Valid Lifetime Date	Valid Lifetime Time	Preferred Lifetime Type	Preferred Lifetime Sec	Preferred Lifetime Date	Preferred Lifetime Time	Autoconfig	On Link
general-pr	101	Not Set	External (F	30d 0h 0m	Not Set	Not Set	External (Fix	7d 0h 0m 0s	Not Set	Not Set	✓	✓

Figure 5-41 *Virtual Interfaces - Basic Configuration screen - IPv6 RA Prefixes tab*

37 Use the **Router Advertisement Policy** drop-down menu to select and apply a policy to the virtual interface.

Router advertisements are periodically sent to hosts or sent in response to solicitation requests. The advertisement includes IPv6 prefixes and other subnet and host information.

38 Review the configurations of existing IPv6 advertisement policies. If needed select **+ Add Row** to define the configuration of an additional IPv6 RA prefix.



Add Row

IPv6 RA Prefixes

Prefix Type: general-prefix

Prefix or Id: 101

Site Prefix: □ /

Valid Lifetime Type: External (Fixed)

Valid Lifetime Sec: 30 Days

Valid Lifetime Date:

Valid Lifetime Time: 1 : 0 ● AM ○ PM

Preferred Lifetime Type: External (Fixed)

Preferred Lifetime Sec: 7 Days

Preferred Lifetime Date:

Preferred Lifetime Time: 1 : 0 ● AM ○ PM

Autoconfig: ☑

On Link: ☑

Figure 5-42 *Virtual Interfaces - Basic Configuration screen - Add IPv6 RA Prefix*

39 Set the following **IPv6 RA Prefix** settings:

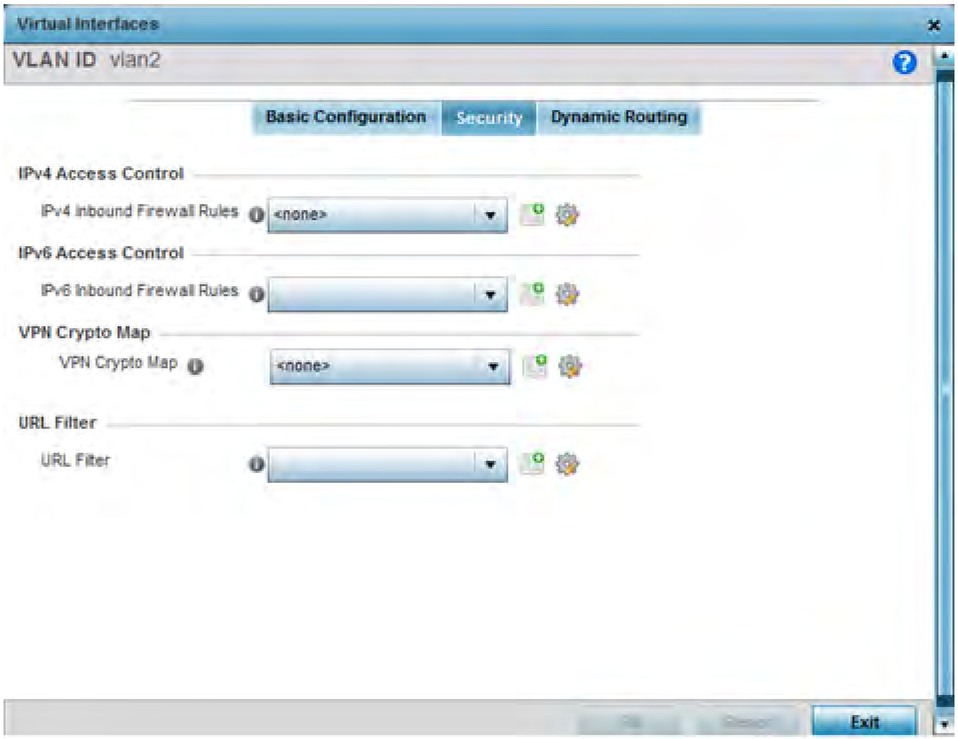
Prefix Type	Set the prefix delegation type used with this configuration. Options include, *Prefix*, and *prefix-from-provider*. The default setting is Prefix. A prefix allows an administrator to associate a user defined name to an IPv6 prefix. A provider assigned prefix is made available from an *Internet Service Provider* (ISP) to automate the process of providing and informing the prefixes used.
Prefix or ID	Set the actual prefix or ID used with the IPv6 router advertisement.
Site Prefix	The site prefix is added into a router advertisement prefix. The site address prefix signifies the address is only on the local link.
Valid Lifetime Type	Set the lifetime for the prefix's validity. Options include *External (fixed), decrementing* and *infinite*. If set to External (fixed), just the *Valid Lifetime Sec* setting is enabled to define the exact time interval for prefix validity. If set to decrementing, use the lifetime date and time settings to refine the prefix expiry period. If the value is set for infinite, no additional date or time settings are required for the prefix and the prefix will not expire. The default setting is External (fixed).
Valid Lifetime Sec	If the lifetime type is set to *External (fixed),* set the *Seconds, Minutes, Hours* or *Days* value used to measurement criteria for the prefix's expiration. 30 days, 0 hours, 0 minutes and 0 seconds is the default lifetime.
Valid Lifetime Date	If the lifetime type is set to *External (fixed)*, set the date in MM/DD/YYYY format for the expiration of the prefix.

Valid Lifetime Time	If the lifetime type is set to *decrementing*, set the time for the prefix's validity.
Preferred Lifetime Type	Set the administrator preferred lifetime for the prefix's validity. Options include *External (fixed), decrementing* and *infinite*. If set to External (fixed), just the *Valid Lifetime Sec* setting is enabled to define the exact time interval for prefix validity. If set to decrementing, use the lifetime date and time settings to refine the prefix expiry period. If the value is set for infinite, no additional date or time settings are required for the prefix and the prefix will not expire. The default setting is External (fixed).
Preferred Lifetime Sec	If the administrator preferred lifetime type is set to *External (fixed)*, set the *Seconds, Minutes, Hours* or *Days* value used to measurement criteria for the prefix's expiration. 30 days, 0 hours, 0 minutes and 0 seconds is the default lifetime.
Preferred Lifetime Date	If the administrator preferred lifetime type is set to *External (fixed),* set the date in MM/DD/YYYY format for the expiration of the prefix.
Preferred Lifetime Time	If the preferred lifetime type is set to *decrementing,* set the time for the prefix's validity.
Autoconfig	Autoconfiguration includes generating a link-local address, global addresses via stateless address autoconfiguration and duplicate address detection to verify the uniqueness of the addresses on a link. This setting is enabled by default.
On Link	Select this option to keep the IPv6 RA prefix on the local link. The default setting is enabled.

40 Select **OK** to save the changes to the IPv6 RA prefix configuration. Select **Exit** to close the screen without saving the updates.

41 Select **OK** to save the changes and overrides. Select **Reset** to revert to the last saved configuration.

42 Select the **Security** tab.



VLAN ID vlan2

IPv4 Access Control

IPv4 Inbound Firewall Rules <none>

IPv6 Access Control

IPv6 Inbound Firewall Rules

VPN Crypto Map

VPN Crypto Map <none>

URL Filter

URL Filter

Figure 5-43 *Profile Overrides - Virtual Interfaces Security screen*

43 Use the **IPv4 Inbound Firewall Rules** drop down menu to select the IPv4 specific inbound firewall rules to apply to this profile's virtual interface configuration. Select the **Create** icon to define a new IPv4 firewall rule configuration or select the **Edit** icon to modify an existing configuration.

IPv4 is a connectionless protocol for packet switched networking. IPv4 operates as a best effort delivery method, since it does not guarantee delivery, and does not ensure proper sequencing or duplicate delivery (unlike (TCP).

IPv4 and IPv6 are different enough to warrant separate protocols. IPv6 devices can alternatively use stateless address autoconfiguration. IPv4 hosts can use link local addressing to provide local connectivity.

44 Use the **IPv6 Inbound Firewall Rules** drop down menu to select the IPv6 specific inbound firewall rules to apply to this profile's virtual interface configuration. Select the **Create** icon to define a new IPv6 firewall rule configuration or select the **Edit** icon to modify an existing configuration.

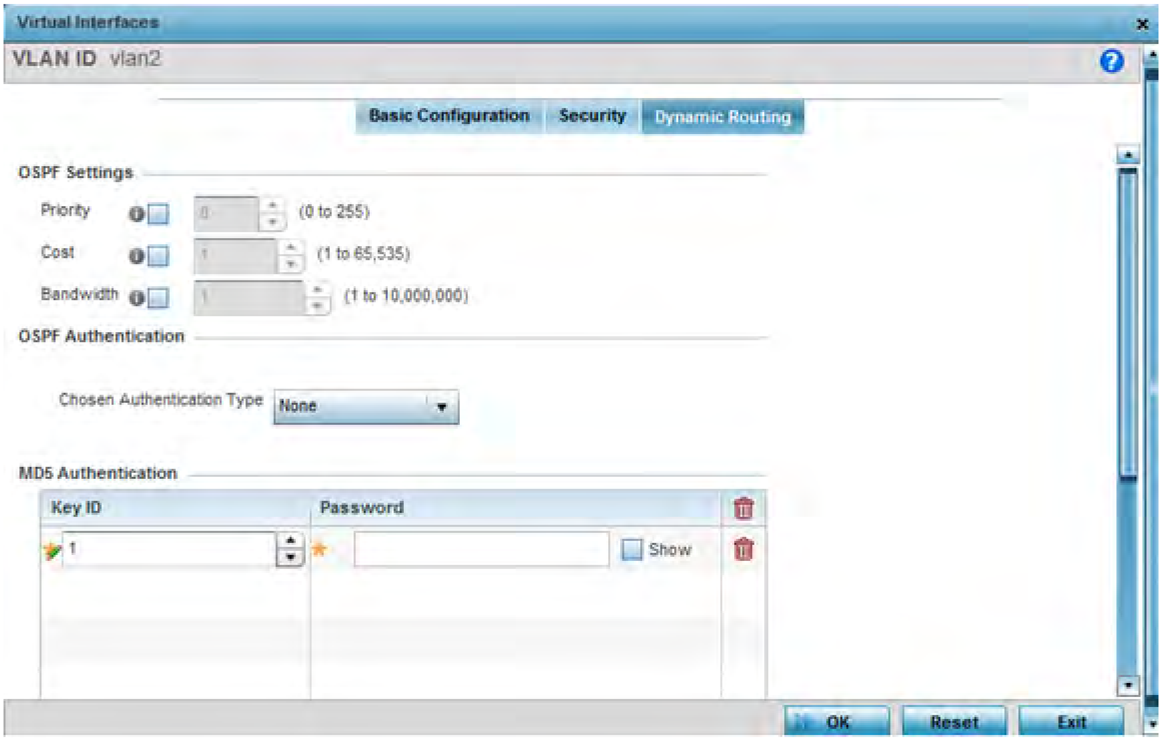
IPv6 is the latest revision of the *Internet Protocol* (IP) replacing IPv4. IPV6 provides enhanced identification and location information for systems routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.

45 Use the **VPN Crypto Map** drop-down menu to select or override the **Crypto Map** configuration applied to this virtual interface.

Crypto Map entries are sets of configuration parameters for encrypting packets that pass through the VPN Tunnel. If a Crypto Map configuration does not exist suiting the needs of this virtual interface, select the **Create** icon to define a new Crypto Map configuration or the **Edit** icon to modify an existing configuration. For more information, see Overriding a Profile's VPN Configuration on page 5-207.

46 Use the **URL Filter** drop-down menu to select or override the **URL Filter** configuration applied to this virtual interface. URL filtering is used to restrict access to undesirable resources on the Internet.

47 Select the **Dynamic Routing** tab (if available with your controller or service platform).



VLAN ID vlan2

OSPF Settings

Priority □ 0 (0 to 255)

Cost □ 1 (1 to 65,535)

Bandwidth □ 1 (1 to 10,000,000)

OSPF Authentication

Chosen Authentication Type None

MD5 Authentication

Key ID	Password
1	□ Show

Figure 5-44 *Profile Overrides - Virtual Interfaces Security screen*

48 Define or override the following parameters from within the **OSPF Settings** field:

Priority	Select this option to set the OSPF priority used to select the network designated route. Use the spinner control to set the value from 0 - 255.
Cost	Select this option to set the cost of the OSPF interface. Use the spinner control to set the value from 1 - 65,535.
Bandwidth	Set the OSPF interface bandwidth (in Kbps) from 1 - 10,000,000.

49 Select the authentication type from the **Chosen Authentication Type** drop-down used to validate credentials within the OSPF dynamic route. Options include *simple-password*, *message-digest*, *null* and *None*. The default value is None.

50 Select the **+ Add Row** button at the bottom of the **MD5 Authentication** table to add the Key ID and Password used for an MD5 validation of authenticator credentials. Use the spinner control to set the OSPF message digest authentication key ID. The available range is from 1 - 255. The password is the OSPF key either displayed as series or asterisks or in plain text (by selecting **Show**).

51 Select the **OK** button located at the bottom right of the screen to save the changes and overrides to the Dynamic Routing screen. Select **Reset** to revert to the last saved configuration.

5.2.7.3 Port Channel Override Configuration

▶ *Profile Interface Override Configuration*

Profiles can utilize customized port channel configurations as part of their interface settings. Existing port channel profile configurations can be overridden as the become obsolete for specific device deployments.

To define or override a port channel configuration on a profile:

1 Select the **Configuration** tab from the Web UI.

2 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

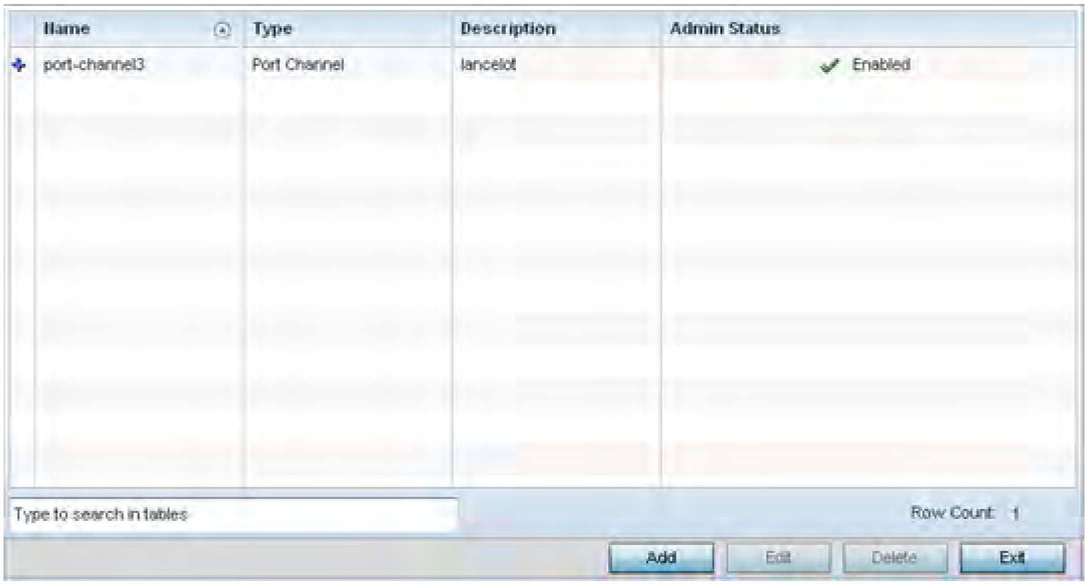
3 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the *Device Browser* in the lower, left-hand, side of the UI.

4 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

5 Select **Interface** to expand its sub menu options.

6 Select **Port Channels**.



Name	Type	Description	Admin Status
port-channel3	Port Channel	lancelot	✓ Enabled

Figure 5-45 *Profile Overrides - Port Channels screen*

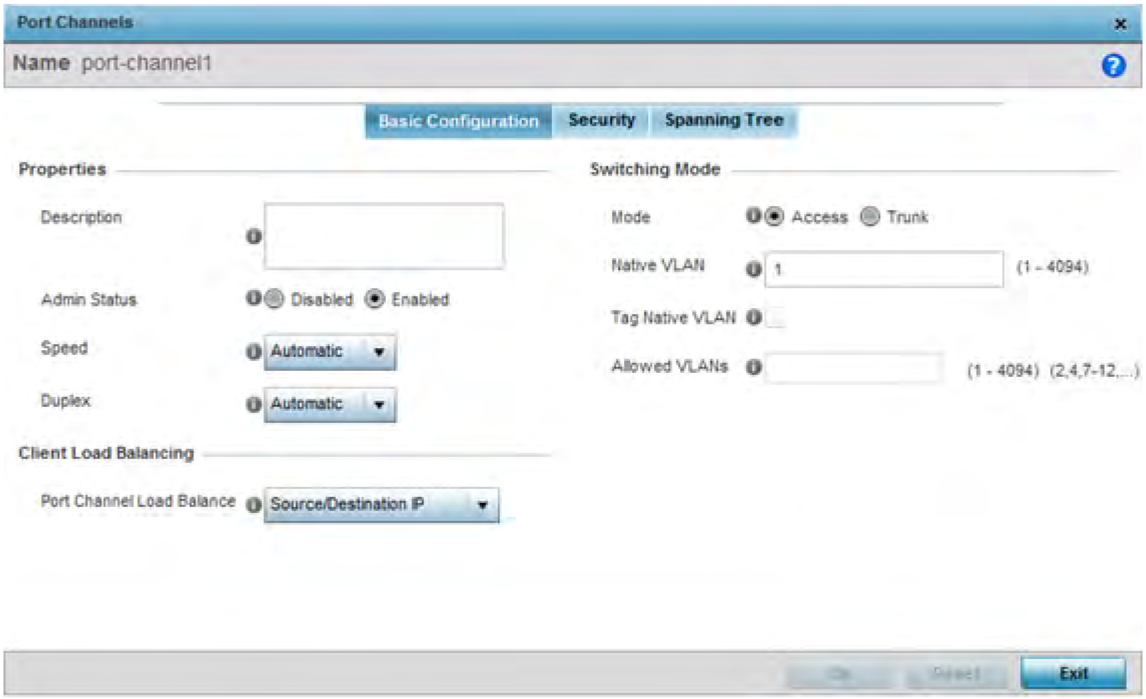
NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

7 Refer to the following to review existing port channel configurations and status to determine whether a parameter requires an override:

Name	Displays the port channel's numerical identifier assigned when it was created. The numerical name cannot be modified as part of the edit process.
Type	Displays whether the type is port channel.

Description	Lists a a short description (64 characters maximum) describing the port channel or differentiating it from others with similar configurations.
Admin Status	A green check mark defines the listed port channel as active and currently enabled with the profile. A red “X” defines the port channel as currently disabled and not available for use. The interface status can be modified with the port channel configuration as required.

8 To edit or override the configuration of an existing port channel, select it from amongst those displayed and select the **Edit** button. The port channel Basic Configuration screen displays by default.



Name port-channel1

Properties

Description

Admin Status ○ Disabled ● Enabled

Speed Automatic

Duplex Automatic

Client Load Balancing

Port Channel Load Balance Source/Destination IP

Switching Mode

Mode ● Access ○ Trunk

Native VLAN 1 (1 - 4094)

Tag Native VLAN □

Allowed VLANs (1 - 4094) (2,4,7-12,...)

Figure 5-46 *Profile Overrides - Port Channels Basic Configuration screen*

9 Set or override the following port channel **Properties**:

Description	Enter a description for the controller or service platform port channel (64 characters maximum).
Admin Status	Select the *Enabled* radio button to define this port channel as active to the profile it supports. Select the *Disabled* radio button to disable this port channel configuration in the profile. It can be activated at any future time when needed. The default setting is enabled.

Speed	Select the speed at which the port channel can receive and transmit data. Select either 10 Mbps, 100 Mbps or 1000 Mbps to establish a 10, 100 or 1000 Mbps data transfer rate for the selected half duplex or full duplex transmission. These options are not available if Auto is selected. Select Automatic to allow the port channel to automatically exchange information about data transmission speeds and duplex capabilities. Auto negotiation is helpful in an environment where different devices are connected and disconnected on a regular basis. Automatic is the default setting.
Duplex	Select either half, full or automatic as the duplex option. Select **Half** duplex to send data over the port channel, then immediately receive data from the same direction in which the data was transmitted. Like a full-duplex transmission, a half-duplex transmission can carry data in both directions, just not at the same time. Select **Full** duplex to transmit data to and from the port channel at the same time. Using full duplex, the port channel can send data while receiving data as well. Select **Automatic** to enable to the controller or service platform to dynamically duplex as port channel performance needs dictate. Automatic is the default setting.

10 Use the **Port Channel Load Balance** drop-down menu from the **Client Load Balancing** section to define whether port channel load balancing is conducted using a *Source/Destination IP* or a *Source/Destination MAC*. Source/ Destination IP is the default setting.

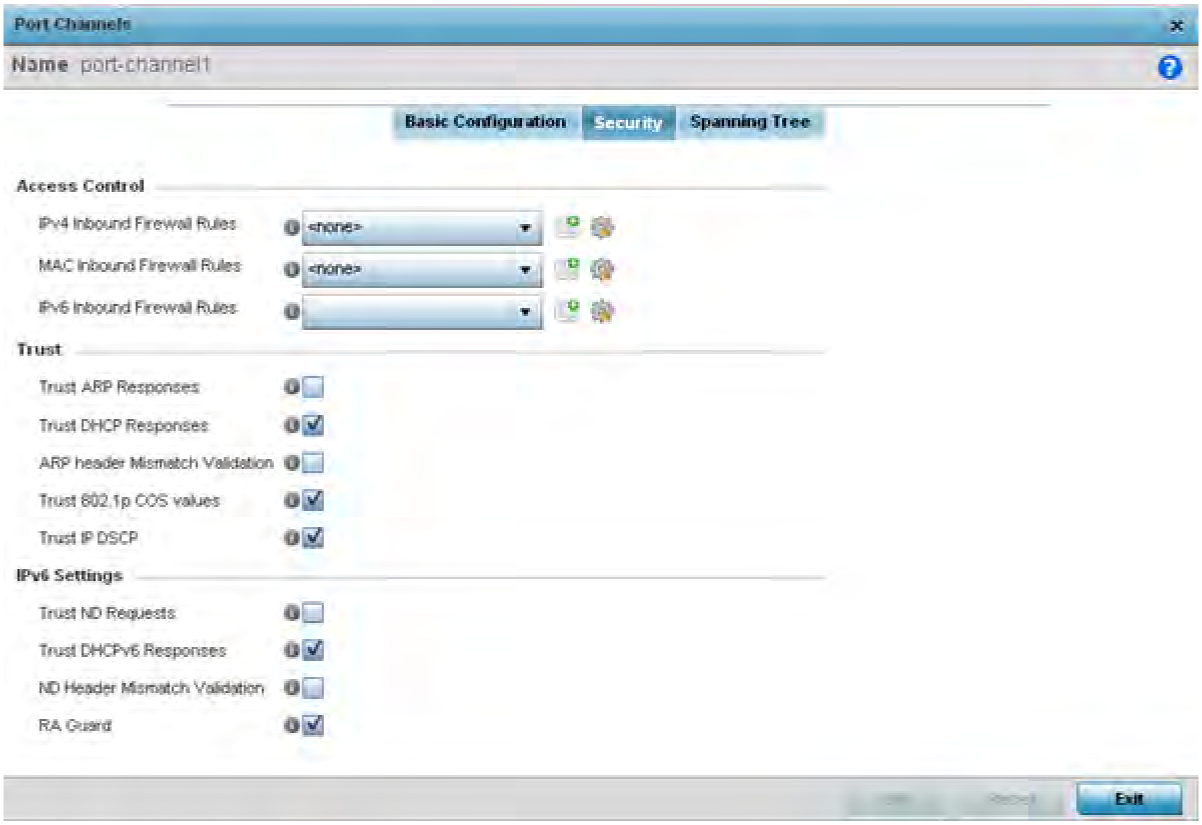
11 Define or override the following **Switching Mode** parameters to apply to the port channel configuration:

Mode	Select either the *Access* or *Trunk* radio button to set the VLAN switching mode over the port channel. If Access is selected, the port channel accepts packets only from the native VLAN. Frames are forwarded untagged with no 802.1Q header. All frames received on the port are expected as untagged and are mapped to the native VLAN. If the mode is set to Trunk, the port channel allows packets from a list of VLANs you add to the trunk. A port channel configured as Trunk supports multiple 802.1Q tagged VLANs and one Native VLAN which can be tagged or untagged. Access is the default setting.
Native VLAN	Use the spinner control to define a numerical *Native VLAN ID* from 1 - 4094. The native VLAN allows an Ethernet device to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame. Additionally, the native VLAN is the VLAN untagged traffic will be directed over when using trunk mode. The default value is 1.

Tag the Native VLAN	Select this option to tag the native VLAN. Controllers and service platforms support the IEEE 802.1Q specification for tagging frames and coordinating VLANs between devices. IEEE 802.1Q adds four bytes to each frame identifying the VLAN ID for upstream devices that the frame belongs. If the upstream Ethernet device does not support IEEE 802.1Q tagging, it does not interpret the tagged frames. When VLAN tagging is required between devices, both devices must support tagging and be configured to accept tagged VLANs. When a frame is tagged, a 12 bit frame VLAN ID is added to the 802.1Q header, so upstream Ethernet devices know which VLAN ID the frame belongs to. The device reads the 12 bit VLAN ID and forwards the frame to the appropriate VLAN. When a frame is received with no 802.1Q header, the upstream device classifies the frame using the default or native VLAN assigned to the Trunk port. The native VLAN allows an Ethernet device to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame. This setting is disabled by default.
Allowed VLANs	Selecting *Trunk* as the mode enables the *Allowed VLANs* parameter. Add VLANs that exclusively send packets over the port channel.

12 Select **OK** to save the changes and overrides to the port channel Basic Configuration. Select **Reset** to revert to the last saved configuration.

13 Select the **Security** tab.



Name port-channel1

Access Control

IPv4 Inbound Firewall Rules <none>

MAC Inbound Firewall Rules <none>

IPv6 Inbound Firewall Rules

Trust

Trust ARP Responses □

Trust DHCP Responses ☑

ARP header Mismatch Validation □

Trust 802.1p COS values ☑

Trust IP DSCP ☑

IPv6 Settings

Trust ND Requests □

Trust DHCPv6 Responses ☑

ND Header Mismatch Validation □

RA Guard ☑

Figure 5-47 *Profile Overrides - Port Channels Security screen*

14 Refer to the **Access Control** section. As part of the port channel's security configuration, Inbound IPv4 IP, IPv6 IP and MAC address firewall rules are required.

15 Use the drop-down menus to select the firewall rules to apply to this profile's Ethernet port configuration. The firewall inspects IP and MAC traffic flows and detects attacks typically not visible to traditional wired firewall appliances

16 Use the **IPv4 Inbound Firewall Rules** drop down menu to select the IPv4 specific firewall rules to apply to this profile's port channel configuration. IPv4 is a connectionless protocol for packet switched networking. IPv4 operates as a best effort delivery method, as it does not guarantee delivery, and does not ensure proper sequencing or duplicate delivery (unlike (TCP). IPv4 hosts can use link local addressing to provide local connectivity.

17 Use the **IPv6 Inbound Firewall Rules** drop down menu to select the IPv6 specific firewall rules to apply to this profile's port channel configuration. IPv6 is the latest revision of the *Internet Protocol* (IP) designed to replace IPv4. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.

18 If a firewall rule does not exist suiting the data protection needs of the target port channel configuration, select the **Create** icon to define a new rule configuration or the **Edit** icon to modify an existing firewall rule configuration.

19 Refer to the **Trust** section to define or override the following:

Trust ARP Responses	Select this option to enable ARP trust on this port channel. ARP packets received on this port are considered trusted, and information from these packets is used to identify rogue devices. The default value is disabled.
Trust DHCP Responses	Select this option to enable DHCP trust. If enabled, only DHCP responses are trusted and forwarded on this port channel, and a DHCP server can be connected only to a DHCP trusted port. The default value is enabled.
ARP header Mismatch Validation	Select this option to enable a source MAC mismatch check in both the ARP and Ethernet header. The default value is enabled.
Trust 802.1p COS values	Select this option to enable 802.1p COS values on this port channel. The default value is enabled.
Trust IP DSCP	Select this option to enable IP DSCP values on this port channel. The default value is disabled.

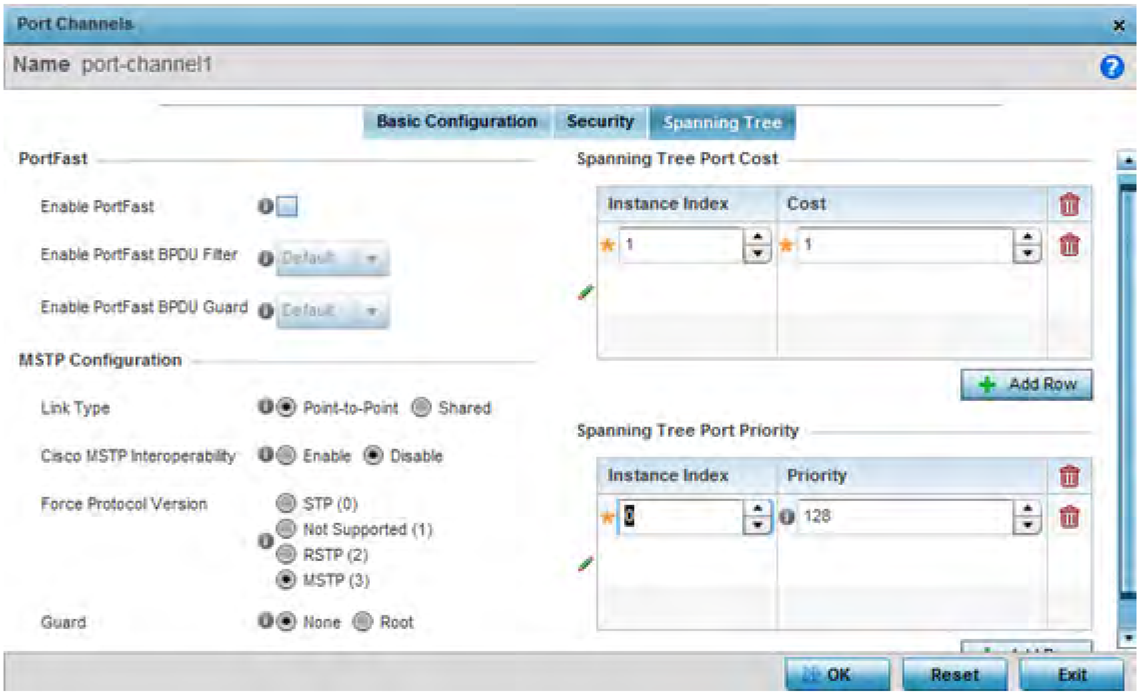
20 Refer to the **IPv6 Settings** field to define the following:

Trust ND Requests	Select the check box to enable *neighbor discovery* (ND) request trust on this port channel (neighbor discovery requests received on this port are considered trusted). Neighbor discovery allows the discovery of an adjacent device's MAC addresses, similar to *Address Resolution Protocol* (ARP) on Ethernet in IPv4. The default value is disabled.
Trust DHCPv6 Responses	Select the check box to enable DHCPv6 trust. If enabled, only DHCPv6 responses are trusted and forwarded on this port channel, and a DHCPv6 server can be connected only to a trusted port. The default value is enabled.

ND header Mismatch Validation	Select the check box to enable a mismatch check for the source MAC in both the ND header and link layer option. The default value is disabled.
RA Guard	Select this option to allow router advertisements or IPv6 redirects from this port. Router advertisements are periodically sent to hosts or sends in response to solicitation requests. The advertisement includes IPv6 prefixes and other subnet and host information.This setting is enabled by default.

21 Select **OK** to save the changes and overrides to the security configuration. Select **Reset** to revert to the last saved configuration.

22 Select the **Spanning Tree** tab.



Port Channels

Name port-channel1

Basic Configuration | Security | Spanning Tree

PortFast

Enable PortFast □

Enable PortFast BPDU Filter: Default

Enable PortFast BPDU Guard: Default

MSTP Configuration

Link Type ● Point-to-Point ○ Shared

Cisco MSTP Interoperability ○ Enable ● Disable

Force Protocol Version ○ STP (0) ○ Not Supported (1) ○ RSTP (2) ● MSTP (3)

Guard ● None ○ Root

Spanning Tree Port Cost

Instance Index	Cost
1	1

Add Row

Spanning Tree Port Priority

Instance Index	Priority
0	128

Figure 5-48 *Profile Overrides - Port Channels Spanning Tree screen*

23 Define or override the following **PortFast** parameters for the port channel’s MSTP configuration:

Enable PortFast	Select this option to enable drop-down menus for both the Enable Portfast BPDU Filter and Enable Portfast BPDU guard options for the port. This setting is disabled by default.
Enable PortFast BPDU Filter	Enable PortFast to invoke a BPDU filter for this portfast enabled port channel. Enabling the BPDU filter feature ensures this port channel does not transmit or receive any BPDUs.
Enable PortFast BPDU Guard	Enable PortFast to invoke a BPDU guard for this portfast enabled port channel. Enabling the BPDU Guard feature means this port will shutdown on receiving a BPDU. Hence no BPDUs are processed.

24 Set or override the following **MSTP Configuration** parameters for the port channel:

Enable as Edge Port	Select this option to define this port as an edge port. Using an edge (private) port, you can isolate devices to prevent connectivity over this port channel. This setting is disabled by default.
Link Type	Select either the *Point-to-Point* or *Shared* radio button. Selecting Point-to-Point indicates the port should be treated as connected to a point-to-point link. Selecting Shared indicates this port should be treated as having a shared connection. A port connected to a hub is on a shared link, while one connected to a controller or service platform is a point-to-point link. Point-to-Point is the default setting.
Cisco MSTP Interoperability	Select either the *Enable* or *Disable* radio buttons. This enables interoperability with Cisco's version of MSTP, which is incompatible with standard MSTP. This setting is disabled by default.
Force Protocol Version	Sets the protocol version to either *STP(0), Not Supported(1), RSTP(2)* or *MSTP(3).* MSTP is the default setting.
Guard	Determines whether the port channel enforces root bridge placement. Setting the guard to *Root* ensures the port is a designated port. Typically, each guard root port is a designated port, unless two or more ports (within the root bridge) are connected together. If the bridge receives superior (BPDUs) on a guard root-enabled port, the guard root moves the port to a root-inconsistent STP state. This state is equivalent to a listening state. No data is forwarded across the port. Thus, the guard root enforces the root bridge position.

25 Refer to the **Spanning Tree Port Cost** table.

26 Define or override an **Instance Index** using the spinner control and then set the **Cost**. The default path cost depends on the user defined port speed. The cost helps determine the role of the port channel in the MSTP network.

The designated cost is the cost for a packet to travel from this port to the root in the MSTP configuration. The slower the media, the higher the cost.

Speed	Default Path Cost
<=100000 bits/sec	200000000
<=1000000 bits/sec	20000000
<=10000000 bits/sec	2000000
<=100000000 bits/sec	200000
<=1000000000 bits/sec	20000
<=10000000000 bits/sec	2000
<=100000000000 bits/sec	200
<=1000000000000 bits/sec	20
>1000000000000 bits/sec	2

27 Refer to the **Spanning Tree Port Priority** table.

Define or override an **Instance Index** using the spinner control, then set the **Priority**. The lower the priority, the greater likelihood of the port becoming a designated port.

28 Select **+ Add Row** as needed to include additional indexes.

29 Select **OK** to save the changes and overrides made to the Ethernet Port Spanning Tree configuration. Select **Reset** to revert to the last saved configuration.

5.2.7.4 VM Interface Override Configuration

▸ *Profile Interface Override Configuration*

WiNG provides a dataplane bridge for external network connectivity for *Virtual Machines* (VMs). VM Interfaces define which IP address is associated with each VLAN ID the service platform is connected to and enables remote service platform administration. Each custom VM can have up to a maximum of two VM interfaces. Each VM interface can be mapped to one of sixteen VMIF ports on the dataplane bridge. This mapping determines the destination for service platform routing.

By default, VM interfaces are internally connected to the dataplane bridge via VMIF1. VMIF1 is an untagged port providing access to VLAN 1 to support the capability to connect the VM interfaces to any of the VMIF ports. This provides the flexibility to move a VM interface onto different VLANs as well as configure specific firewall and QOS rules.

To define or override a VM interfaces configuration on a profile:

1 Select the **Configuration** tab from the Web UI.

2 Select **Devices** from the Configuration tab.

The *Device Configuration* screen displays a list of managed devices or peer controllers, service platforms or Access Points.

3 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

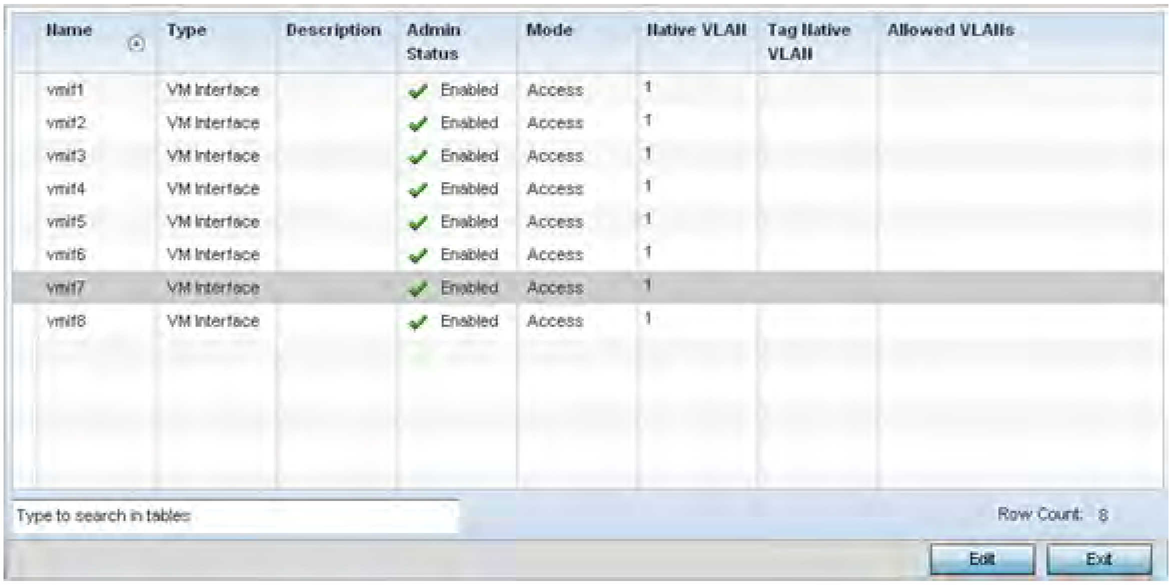
Devices can also be selected directly from the *Device Browser* in the lower, left-hand, side of the UI.

4 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

5 Select **Interface** to expand its sub menu options.

6 Select **VM Interfaces**.

The VM Interfaces screen displays.



Name	Type	Description	Admin Status	Mode	Native VLAN	Tag Native VLAN	Allowed VLANs
vmif1	VM Interface		✓ Enabled	Access	1		
vmif2	VM Interface		✓ Enabled	Access	1		
vmif3	VM Interface		✓ Enabled	Access	1		
vmif4	VM Interface		✓ Enabled	Access	1		
vmif5	VM Interface		✓ Enabled	Access	1		
vmif6	VM Interface		✓ Enabled	Access	1		
vmif7	VM Interface		✓ Enabled	Access	1		
vmif8	VM Interface		✓ Enabled	Access	1		

Type to search in tables

Row Count: 8

Figure 5-49 *Profile Overrides - VM Interfaces screen*

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

7 Refer to the following to review existing port channel configurations and status to determine whether a parameter requires an override:

Name	Displays the VM interface numerical identifier assigned when it was created. The numerical name cannot be modified as part of the edit process.
Type	Displays whether the type is a VM interface.
Description	Lists a short description (64 characters maximum) describing the VM interface or differentiating it from others with similar configurations.
Admin Status	A green check mark defines the listed VM interface as active and currently enabled with the profile. A red “X” defines the VM interface as currently disabled and not available for use. The interface status can be modified with the VM interface Basic Configuration screen as required.
Mode	Displays the layer 3 mode of the VM interface as either *Access* or *Trunk* (as defined within the VM Interfaces Basic Configuration screen). If Access is selected, the listed VM interface accepts packets only from the native VLAN. Frames are forwarded untagged with no 802.1Q header. All frames received on the port are expected as untagged and mapped to the native VLAN. If set to Trunk, the port allows packets from a list of VLANs added to the trunk. A VM interface configured as Trunk supports multiple 802.1Q tagged VLANs and one Native VLAN which can be tagged or untagged.
Native VLAN	Lists the numerical VLAN ID (1 - 4094) set for the native VLAN. The native VLAN allows a VM interface to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame. Additionally, the native VLAN is the VLAN untagged traffic is directed over when using a VM interface in trunk mode.

Tag Native VLAN	A green check mark defines the native VLAN as tagged. A red "X" defines the native VLAN as untagged. When a frame is tagged, the 12 bit frame VLAN ID is added to the 802.1Q header so upstream VM interface ports know which VLAN ID the frame belongs to. The device reads the 12 bit VLAN ID and forwards the frame to the appropriate VLAN. When a frame is received with no 802.1Q header, the upstream VM interface classifies the frame using the default or native VLAN assigned to the Trunk port. A native VLAN allows a VM interface to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame.
Allowed VLANs	Displays those VLANs allowed to send packets over the listed VM interface. Allowed VLANs are only listed when the mode has been set to Trunk.

8 To edit or override the configuration of an existing VM interface, select it from amongst those displayed and select the **Edit** button. The VM Interfaces Basic Configuration screen displays by default.

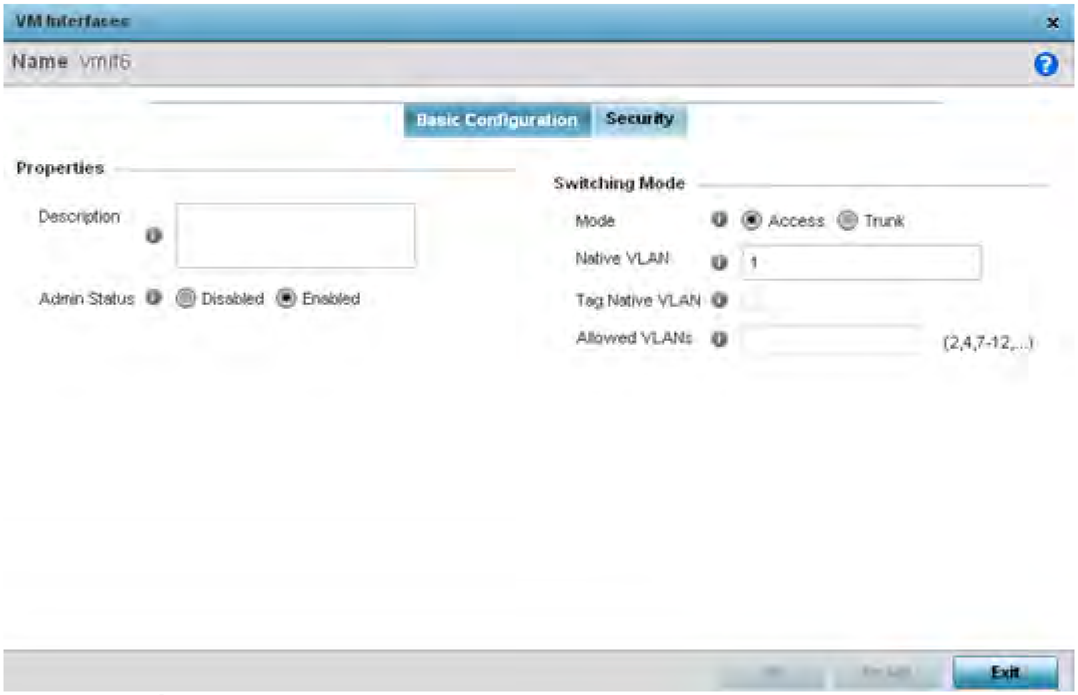


Figure 5-50 *Profile Overrides - VM Interfaces Basic Configuration screen*

9 Set or override the following VM Interface **Properties**:

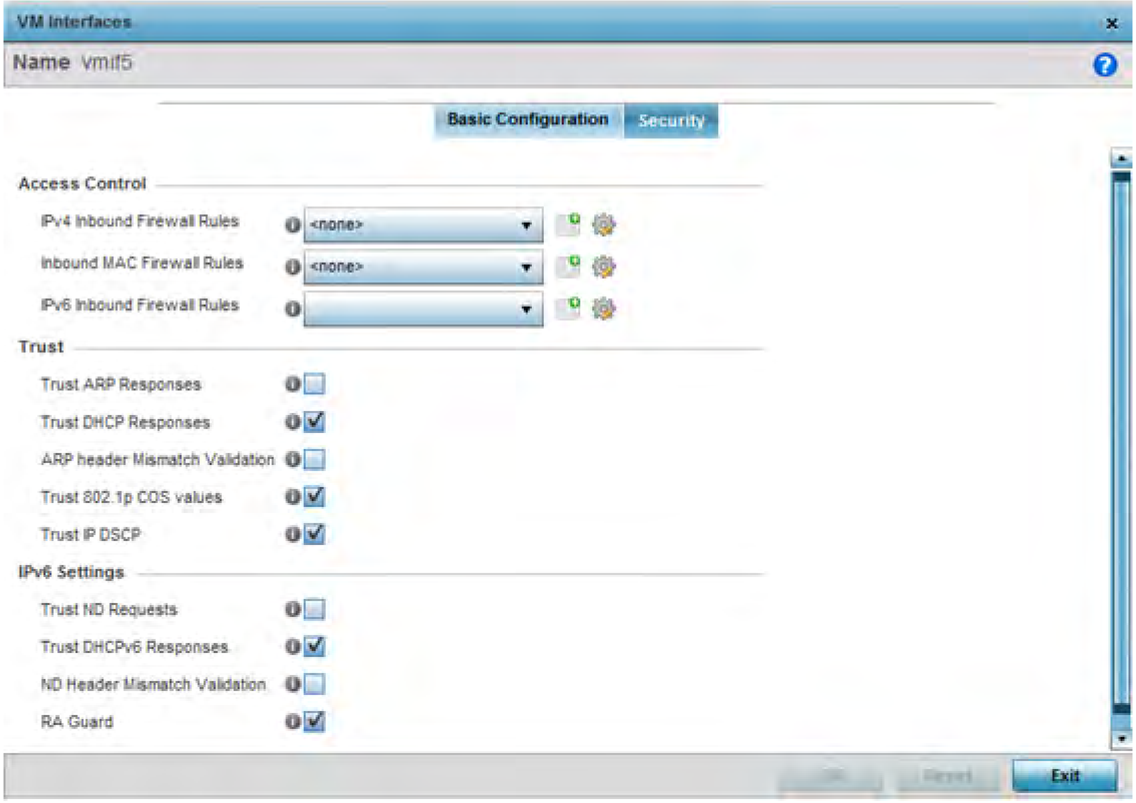
Description	Enter a description for the controller or service platform VM interface (64 characters maximum).
Admin Status	Select the *Enabled* radio button to define this VM interface as active to the profile it supports. Select the *Disabled* radio button to disable this VM interface configuration in the profile. It can be activated at any future time when needed. The default setting is disabled.

10 Define or override the following **Switching Mode** parameters to apply to the VM Interface configuration:

Mode	Select either the *Access* or *Trunk* radio button to set the VLAN switching mode over the VM interface. If Access is selected, the VM interface accepts packets only from the native VLAN. Frames are forwarded untagged with no 802.1Q header. All frames received on the VMIF port are expected as untagged and are mapped to the native VLAN. If the mode is set to Trunk, the VM interface allows packets from a list of VLANs you add to the trunk. A VM interface configured as Trunk supports multiple 802.1Q tagged VLANs and one Native VLAN which can be tagged or untagged. Access is the default setting.
Native VLAN	Use the spinner control to define a numerical *Native VLAN ID* from 1 - 4094. The native VLAN allows an Ethernet device to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame. Additionally, the native VLAN is the VLAN untagged traffic will be directed over when using trunk mode. The default value is 1.
Tag the Native VLAN	Select this option to tag the native VLAN. Service platforms support the IEEE 802.1Q specification for tagging frames and coordinating VLANs between devices. IEEE 802.1Q adds four bytes to each frame identifying the VLAN ID for upstream VMIF that the frame belongs. If the upstream VMIF does not support IEEE 802.1Q tagging, it does not interpret the tagged frames. When VLAN tagging is required between VM interface ports, both VM interfaces must support tagging and be configured to accept tagged VLANs. When a frame is tagged, a 12 bit frame VLAN ID is added to the 802.1Q header, so upstream VM interfaces know which VLAN ID the frame belongs to. The 12 bit VLAN ID is read and the frame is forwarded to the appropriate VLAN. When a frame is received with no 802.1Q header, the upstream VMIF classifies the frame using the default or native VLAN assigned to the Trunk port. The native VLAN allows a VM interface to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame. This setting is disabled by default.
Allowed VLANs	Selecting *Trunk* as the mode enables the *Allowed VLANs* parameter. Add VLANs that exclusively send packets over the VM interface. The available range is from 1 - 4094. The maximum number of entries is 256.

11 Select **OK** to save the changes and overrides to the VM interface basic configuration. Select **Reset** to revert to the last saved configuration.

12 Select the **Security** tab.



Name vmif5

Access Control

IPv4 Inbound Firewall Rules <none>

Inbound MAC Firewall Rules <none>

IPv6 Inbound Firewall Rules

Trust

Trust ARP Responses □

Trust DHCP Responses ☑

ARP header Mismatch Validation □

Trust 802.1p COS values ☑

Trust IP DSCP ☑

IPv6 Settings

Trust ND Requests □

Trust DHCPv6 Responses ☑

ND Header Mismatch Validation □

RA Guard ☑

Figure 5-51 *Profile Overrides - VM Interfaces Security screen*

13 Refer to the **Access Control** field. As part of the VM interface's security configuration, IPv4 and IPv6 Inbound and MAC Inbound address firewall rules are required.

14 Use the drop-down menus to select the firewall rules to apply to this profile's VM interface configuration. The firewall inspects IP and MAC traffic flows and detects attacks typically not visible to traditional wired firewall appliances.

15 Use the **IPv4 Inbound Firewall Rules** drop down menu to select the IPv4 specific firewall rules to apply to this profile's VM interface configuration. IPv4 is a connectionless protocol for packet switched networking. IPv4 operates as a best effort delivery method, as it does not guarantee delivery, and does not ensure proper sequencing or duplicate delivery (unlike (TCP). IPv4 hosts can use link local addressing to provide local connectivity.

16 Use the **IPv6 Inbound Firewall Rules** drop down menu to select the IPv6 specific firewall rules to apply to this profile's VM interface configuration. IPv6 is the latest revision of the *Internet Protocol* (IP) designed to replace IPv4. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.

17 If a firewall rule does not exist suiting the data protection needs of the target VM interface configuration, select the **Create** icon to define a new rule configuration, or the **Edit** icon to modify an existing firewall rule configuration.

18 Refer to the **Trust** section to define or override the following:

Trust ARP Responses	Select this option to enable ARP trust on this VM interface. ARP packets received on this port are considered trusted, and information from these packets is used to identify rogue devices. The default value is disabled.
Trust DHCP Responses	Select this option to enable DHCP trust on this VM interface. If enabled, only DHCP responses are trusted and forwarded on this VM interface, and a DHCP server can be connected only to a DHCP trusted port. The default value is enabled.
ARP header Mismatch Validation	Select this option to enable a source MAC mismatch check in both the ARP and Ethernet header. The default value is enabled.
Trust 802.1p COS values	Select this option to enable 802.1p COS values on this VM interface. The default value is enabled.
Trust IP DSCP	Select this option to enable IP DSCP values on this VM interface. The default value is disabled.

19 Set the following **IPv6 Settings**:

Trust ND Requests	Select this option to enable the trust of neighbor discovery requests required on an IPv6 network on this VM interface. This setting is disabled by default.
Trust DHCPv6 Responses	Select this option to enable the trust all DHCPv6 responses on this VM interface. DHCPv6 is a networking protocol for configuring IPv6 hosts with IP addresses, IP prefixes or other configuration attributes required on an IPv6 network. DHCPv6 relay agents receive messages from clients and forward them a DHCPv6 server. The server sends responses back to the relay agent, and the relay agent sends the responses to the client on the local link. This setting is enabled by default.
ND Header Mismatch Validation	Select this option to enable a mismatch check for the source MAC within the ND header and link layer option. This setting is disabled by default.
RA Guard	Select this option to enable router advertisements or ICMPv6 redirects from this VM interface. Router advertisements are periodically sent to hosts or sent in response to neighbor solicitation requests. The advertisement includes IPv6 prefixes and other subnet and host information. This setting is disabled by default.

20 Select **OK** to save the changes and overrides to the security configuration. Select **Reset** to revert to the last saved configuration.

5.2.7.5 Radio Override Configuration

▶ *Profile Interface Override Configuration*

Access Points can have their radio profile configurations overridden once their radios have successfully associated to the network.

To define a radio configuration override from the Access Point's associated controller or service platform:

1 Select **Devices** from the Configuration tab.

The *Device Configuration* screen displays a list of managed devices or peer controllers, service platforms or Access Points.

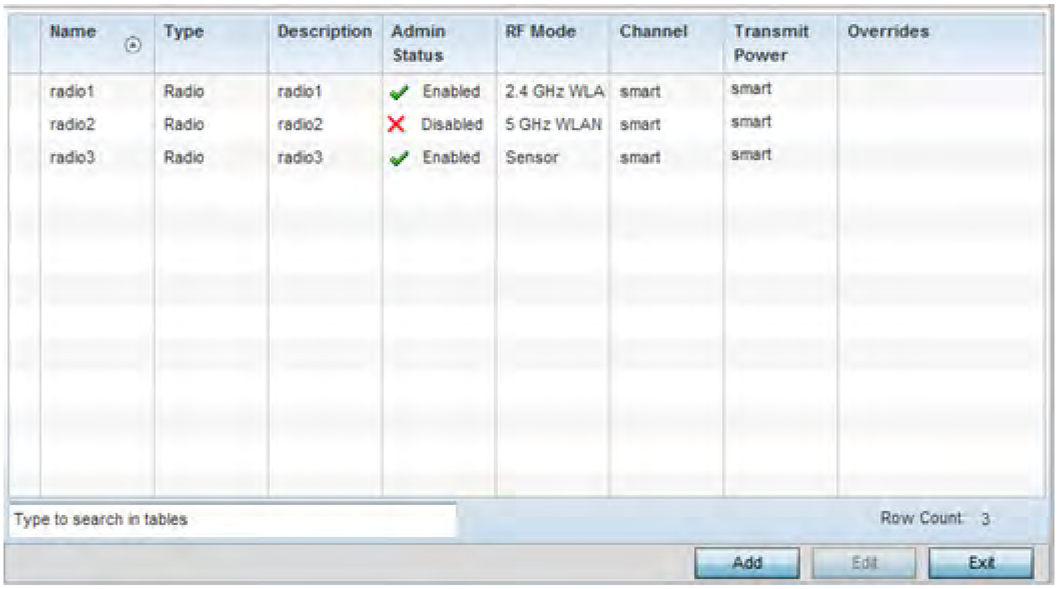
2 Select an Access Point (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the *Device Browser* in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Interface** to expand its sub menu options.

5 Select **Radios**.



Name	Type	Description	Admin Status	RF Mode	Channel	Transmit Power	Overrides
radio1	Radio	radio1	✓ Enabled	2.4 GHz WLA	smart	smart	
radio2	Radio	radio2	✗ Disabled	5 GHz WLAN	smart	smart	
radio3	Radio	radio3	✓ Enabled	Sensor	smart	smart	

Figure 5-52 *Profile Overrides - Radios screen*

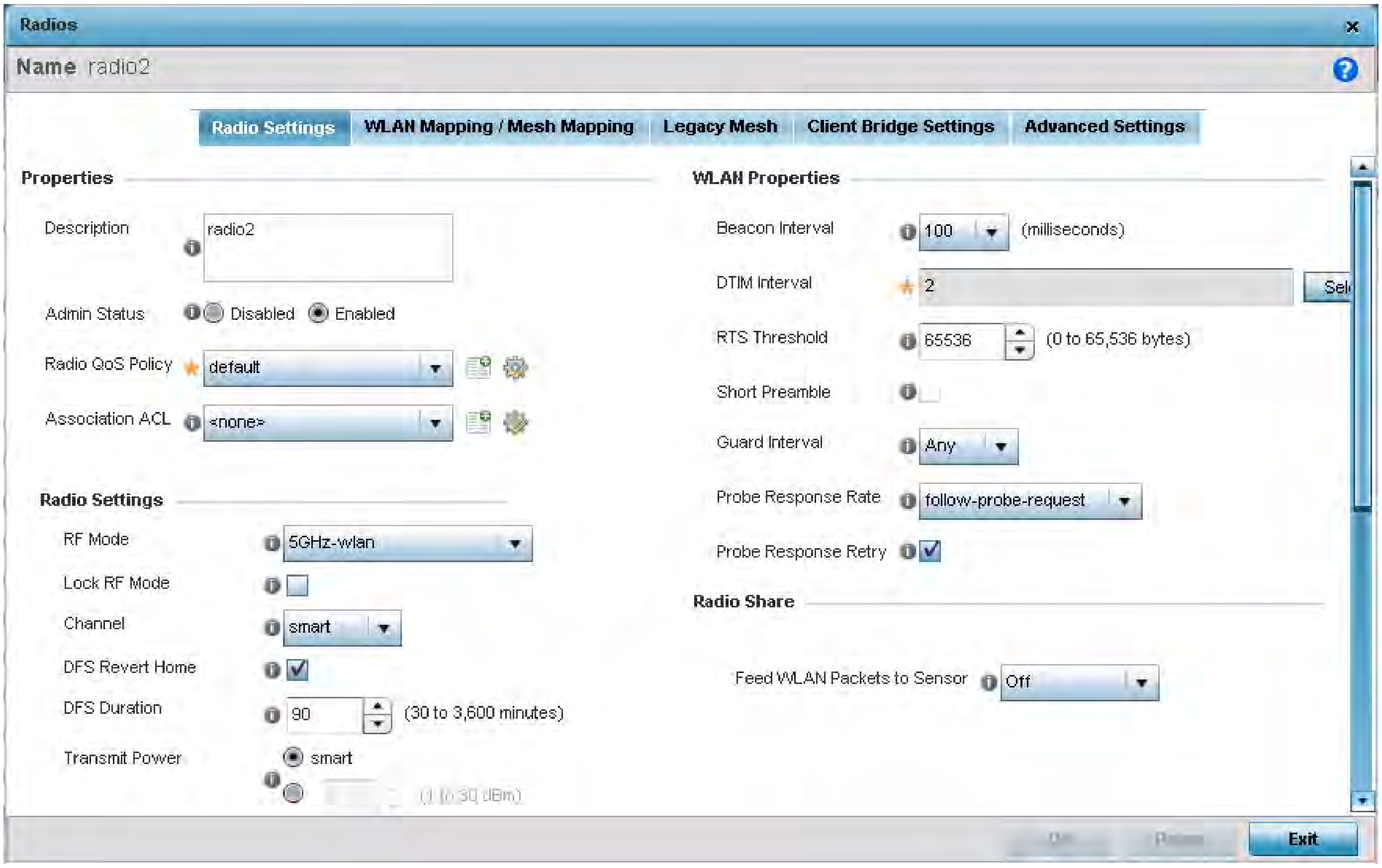
NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

6 Review the following radio configuration data to determine whether a radio configuration requires modification or override to better support the managed network:

Name	Displays whether the reporting radio is the Access Point's radio1, radio2 or radio3.
Type	Displays the type of radio housed by each listed Access Point.
Description	Displays a brief description of the radio provided by the administrator when the radio's configuration was added or modified.
Admin Status	A green check mark defines the listed radio configuration as active and enabled with its supported profile. A red "X" defines the Virtual Interface as currently disabled. The interface status can be modified when a new Virtual Interface is created or an existing one modified.
RF Mode	Displays whether each listed radio is operating in the 802.11an or 802.11bgn radio band. If the radio is a dedicated sensor, it will be listed as a sensor to define the radio as not providing typical WLAN support. If the radio is a client-bridge, it provides a typical bridging function and does not provide WLAN support. The radio band is set from within the Radio Settings tab.

Channel	Lists the channel setting for the radio. Smart is the default setting. If set to smart, the Access Point scans non-overlapping channels listening for beacons from other Access Points. After the channels are scanned, it selects the channel with the fewest Access Points. In the case of multiple access points on the same channel, it will select the channel with the lowest average power level. The column displays smart if set for dynamic Smart RF support.
Transmit Power	Lists the transmit power for each radio displayed as a value in milliwatts. Selecting *smart* allows the radio to perform power adjustments to compensate for failed neighboring radios
Overrides	A Clear link appears for each radio configuration that has an override applied to the profile's configuration. Select *Clear* to revert this specific radio configuration to the profile configuration originally defined by the administrator for this radio.

7 If required, select a radio configuration and select **Edit** to modify or override portions of its configuration.



Name radio2

Properties

Description radio2

Admin Status ○ Disabled ● Enabled

Radio QoS Policy default

Association ACL <none>

Radio Settings

RF Mode 5GHz-wlan

Lock RF Mode □

Channel smart

DFS Revert Home ☑

DFS Duration 90 (30 to 3,600 minutes)

Transmit Power ● smart

○ (1 to 30 dBm)

WLAN Properties

Beacon Interval 100 (milliseconds)

DTIM Interval 2

RTS Threshold 65536 (0 to 65,536 bytes)

Short Preamble □

Guard Interval Any

Probe Response Rate follow-probe-request

Probe Response Retry ☑

Radio Share

Feed WLAN Packets to Sensor Off

Figure 5-53 *Profile Overrides - Access Point Radio Settings tab*

The **Radio Settings** tab displays by default.

8 Define or override the following radio configuration parameters from within the **Properties** field:

Description	Provide or edit a description (1 - 64 characters in length) for the radio that helps differentiate it from others with similar configurations.
Admin Status	Either select the *Enabled* or *Disabled* radio button to define this radio's current status within the network. When enabled, the Access Point is operational and available for client support within the network. The radio is enabled by default and must be manually shutdown.
Radio QoS Policy	Use the drop-down menu to specify an existing QoS policy to apply to the Access Point radio in respect to its intended radio traffic. If there's no existing suiting the radio's intended operation, select the Create icon to define a new QoS policy that can be applied to this profile. For more information, see Radio QoS Policy on page 6-66.
Association ACL	Use the drop-down menu to specify an existing Association ACL policy to apply to the Access Point radio. An Association ACL is a policy-based *Access Control List* (ACL) that either prevents or allows wireless clients from connecting to a managed Access Point radio. An ACL is a sequential collection of permit and deny conditions that apply to controller or service platform packets. When a packet is received on an interface, the controller or service platform compares the fields in the packet against any applied ACLs to verify the packet has the required permissions to be forwarded, based on the criteria specified in the access lists. If a packet does not meet any of the criteria specified in the ACL, the packet is dropped. Select the *Create* icon to define a new Association ACL that can be applied to this profile.

9 Set or override the following profile **Radio Settings** for the selected Access Point radio.

RF Mode	Set the mode to either 2.4 GHz WLAN or 5 GHz WLAN depending on the radio's intended client support requirement. Set the mode to Sensor if using the radio for rogue device detection. To set a radio as a detector, disable sensor support on the other Access Point radio. Set the mode to scan-ahead in DFS aware countries to allow a mesh points secondary radio to scan for an alternative channel for backhaul transmission in the event of a radar event on the principal radio. The secondary radio is continually monitoring the alternate channel, which means the principal radio can switch channels and transmit data immediately without waiting for the channel availability check.
Lock RF Mode	Select this option to lock Smart RF for this radio. The default setting is disabled.
Channel	Use the drop-down menu to select the channel of operation for the radio. Only a trained installation professional should define the radio channel. Select *Smart* for the radio to scan non-overlapping channels listening for beacons from other Access Points. After channels are scanned, the radio selects the channel with the fewest Access Points. In the case of multiple Access Points on the same channel, it selects the channel with the lowest average power level. The default value is Smart. Channels with a "w" appended to them are unique to the 40 MHz band. Channels with a "ww" appended to them are 802.11ac specific, only appear when using an AP8232, and are unique to the 80 MHz band.
DFS Revert Home	Select this option to revert to the home channel after a DFS evacuation period.

DFS Duration	Set the DFS duration between 30 to 3,600 minutes. This is the duration for which the radio stays in the in the new channel. The default value is 90 minutes.
Transmit Power	Set the transmit power of the selected Access Point radio. If using a dual or three radio model Access Point, each radio should be configured with a unique transmit power in respect to its intended client support function. Select the Smart RF option to let Smart RF determine the transmit power. A setting of 0 defines the radio as using Smart RF to determine its output power. 20 dBm is the default value.
Antenna Gain	Set the antenna between 0.00 - 15.00 dBm. The access point’s *Power Management Antenna Configuration File* (PMACF) automatically configures the access point’s radio transmit power based on the antenna type, its antenna gain (provided here) and the deployed country’s regulatory domain restrictions. Once provided, the access point calculates the power range. Antenna gain relates the intensity of an antenna in a given direction to the intensity that would be produced ideally by an antenna that radiates equally in all directions (isotropically), and has no losses. Although the gain of an antenna is directly related to its directivity, its gain is a measure that takes into account the efficiency of the antenna as well as its directional capabilities. Only a professional installer should set the antenna gain. The default value is 0.00.
Antenna Mode	Set the number of transmit and receive antennas on the Access Point. 1x1 is used for transmissions over just the single “A” antenna, 1x3 is used for transmissions over the “A” antenna and all three antennas for receiving. 2x2 is used for transmissions and receipts over two antennas for dual antenna models. The default setting is dynamic based on the Access Point model deployed and its transmit power settings.
Enable Antenna Diversity	Select this option to enable antenna diversity on supported antennas. Antenna diversity uses two or more antennas to increase signal quality and strength. This option is disabled by default.
Adaptivity Recovery	Select this option to switch channels when an Access Point‘s radio is in adaptivity mode. In adaptivity mode, an Access Point monitors interference on its set channel and stops functioning when the radio’s defined interference tolerance level is exceeded. When the defined adaptivity timeout is exceeded, the radio resumes functionality on a different channel. This option is enabled by default.
Adaptivity Timeout	Set the adaptivity timeout from 30 to 3,600 minutes. The default setting is 90 minutes.
Wireless Client Power	Select this option to specify the transmit power on supported wireless clients. If this is enabled set a client power level between 0 to 20 dBm. This option is disabled by default.
Dynamic Chain Selection	Select this option for the radio to dynamically change the number of transmit chains. This option is enabled by default.

Rate	Use the *Select* button to set rate options depending on the 802.11 protocols selected. If the radio band is set to Sensor or Detector, the Data Rates drop-down menu is not enabled, as the rates are fixed and not user configurable. If 2.4 GHz is selected as the radio band, select separate 802.11b, 802.11g and 802.11n rates and define how they are used in combination. If 5 GHz is selected as the radio band, select separate 802.11a and 802.11n rates then define how they are used together. When using 802.11n (in either the 2.4 or 5 GHz band), Set a MCS (modulation and coding scheme) in respect to the radio's channel width and guard interval. A MCS defines (based on RF channel conditions) an optimal combination of 8 data rates, bonded channels, multiple spatial streams, different guard intervals and modulation types. Clients can associate as long as they support basic MCS (as well as non-11n basic rates). If dedicating an AP81XX model radio to either 2.4 or 5 Ghz support, a *Custom Rates* option is available to set a *modulation and coding scheme* (MCS) in respect to the radio's channel width and guard interval. A MCS defines (based on RF channel conditions) an optimal combination of rates, bonded channels, multiple spatial streams, different guard intervals and modulation types. Clients can associate as long as they support basic MCS (as well as non-11n basic rates). If Basic is selected within the 802.11n Rates field, the MCS0-7 option is auto selected as a Supported rate and that option is greyed out. If Basic is not selected, any combination of MCS0-7, MCS8-15 and MCS16-23 can be supported, including a case where MCS0-7 and MCS16-23 are selected and not MCS8-15. The MCS0-7 and MCS8-15 options are available to each support Access Point. However, the MCS16-23 option is only available to AP81XX model Access Points and its ability to provide 3x3x3 MIMO support.
Radio Placement	Use the drop-down menu to specify whether the radio is located *Indoors* or *Outdoors*. The placement should depend on the country of operation selected and its regulatory domain requirements for radio emissions. The default setting is Indoors.
Max Clients	Use the spinner control to set a maximum permissible number of clients to connect with this radio. The available range is from 0 - 256 clients. The default is 256.
Rate Selection Methods	Specify a radio selection method for the radio. The selection methods are: *Standard* - standard monotonic radio selection method will be used. *Opportunistic* - sets opportunistic radio link adaptation (ORLA) as the radio selection method. This mode uses opportunistic data rate selection to provide the best throughput. The ORLA rate selection mode is supported only on the AP7161 and AP8163 model Access Points.

10 Set or override the following profile **WLAN Properties** for the selected Access Point radio:

Beacon Interval	Set the interval between radio beacons in milliseconds (either *50*, *100* or *200*). A beacon is a packet broadcast by adopted radios to keep the network synchronized. Included in a beacon is the WLAN service area, radio address, broadcast destination addresses, a time stamp, and indicators about traffic and delivery (such as a DTIM). Increase the DTIM/ beacon settings (lengthening the time) to let nodes sleep longer and preserve battery life. Decrease these settings (shortening the time) to support streaming-multicast audio and video applications that are jitter-sensitive. The default value is 100 milliseconds.
DTIM Interval	Set a DTIM Interval to specify a period for *Delivery Traffic Indication Messages* (DTIM). A DTIM is periodically included in a beacon frame transmitted from adopted radios. The DTIM indicates broadcast and multicast frames (buffered at the Access Point) are soon to arrive. These are simple data frames that require no acknowledgment, so nodes sometimes miss them. Increase the DTIM/ beacon settings (lengthening the time) to let nodes sleep longer and preserve their battery life. Decrease these settings (shortening the time) to support streaming multicast audio and video applications that are jitter-sensitive.
RTS Threshold	*Specify a Request To Send* (RTS) threshold (between 1 - 65,636 bytes) for use by the WLAN's adopted Access Point radios. RTS is a transmitting station's signal that requests a *Clear To Send* (CTS) response from a receiving client. This RTS/CTS procedure clears the air where clients are contending for transmission time. Benefits include fewer data collisions and better communication with nodes that are hard to find (or hidden) because of other active nodes in the transmission path. Control RTS/CTS by setting an RTS threshold. This setting initiates an RTS/CTS exchange for data frames larger than the threshold, and sends (without RTS/CTS) any data frames smaller than the threshold. Consider the trade-offs when setting an appropriate RTS threshold for the WLAN's Access Point radios. A lower RTS threshold causes more frequent RTS/CTS exchanges. This consumes more bandwidth because of additional latency (RTS/CTS exchanges) before transmissions can commence. A disadvantage is the reduction in data-frame throughput. An advantage is quicker system recovery from electromagnetic interference and data collisions. Environments with more wireless traffic and contention for transmission make the best use of a lower RTS threshold. A higher RTS threshold minimizes RTS/CTS exchanges, consuming less bandwidth for data transmissions. A disadvantage is less help to nodes that encounter interference and collisions. An advantage is faster data-frame throughput. Environments with less wireless traffic and contention for transmission make the best use of a higher RTS threshold.
Short Preamble	If using an 802.11bg radio, select this option to transmit using a short preamble. Short preambles improve throughput. However, some devices (SpectraLink/Polycomm phones) require long preambles. The default value is disabled.

Guard Interval	Use the drop-down menu to specify a *Long* or *Any* guard interval. The guard interval is the space between characters being transmitted. The guard interval eliminates *inter-symbol interference* (ISI). ISI occurs when echoes or reflections from one character interfere with another character. Adding time between transmissions allows echo's and reflections to settle before the next character is transmitted. A shorter guard interval results in shorter character times which reduces overhead and increases data rates by up to 10%. The default value is Long.
Probe Response Rate	Use the drop-down menu to specify the data rate used for the transmission of probe responses. Options include, *highest-basic*, *lowest-basic* and *follow-probe-request* (default setting).
Probe Response Retry	Select this option to retry probe responses if they are not acknowledged by the target wireless client. The default value is enabled.

11 Select a mode from the **Feed WLAN Packets to Sensor** check box in the **Radio Share** section to enable this feature. Select either **Inline** or **Promiscuous** mode to allow the packets the radio is switching to also be used by the WIPS analysis module. This feature can be enabled in two modes: an inline mode where the WIPS sensor receives the packets from the radios with radio operating in normal mode. A promiscuous mode where the radio is configured to a mode where it receives all packets on the channel whether the destination address is the radio or not, and the WIPS module can analyze them.

12 Select the **WLAN Mapping/Mesh Mapping** tab.

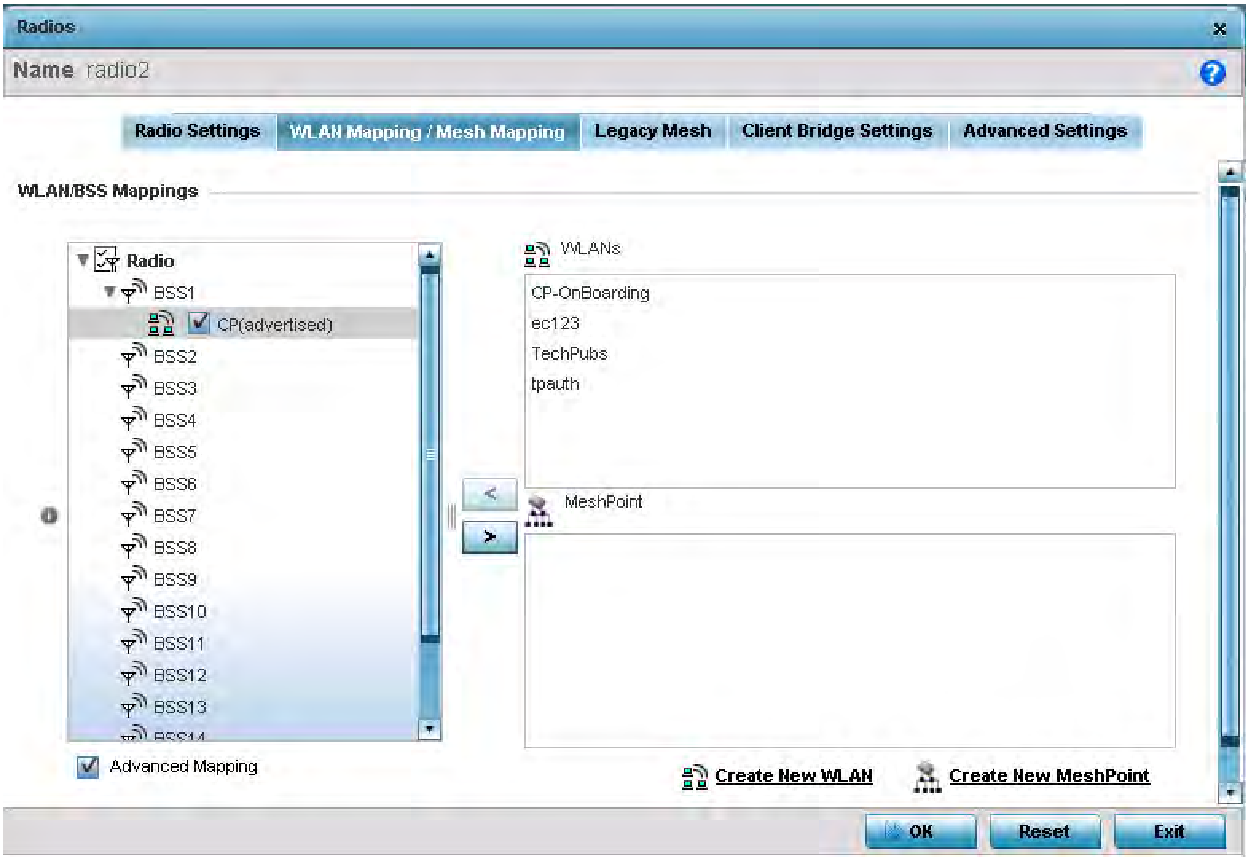


Figure 5-54 *Profile Overrides - Access Point Radio WLAN Mapping tab*

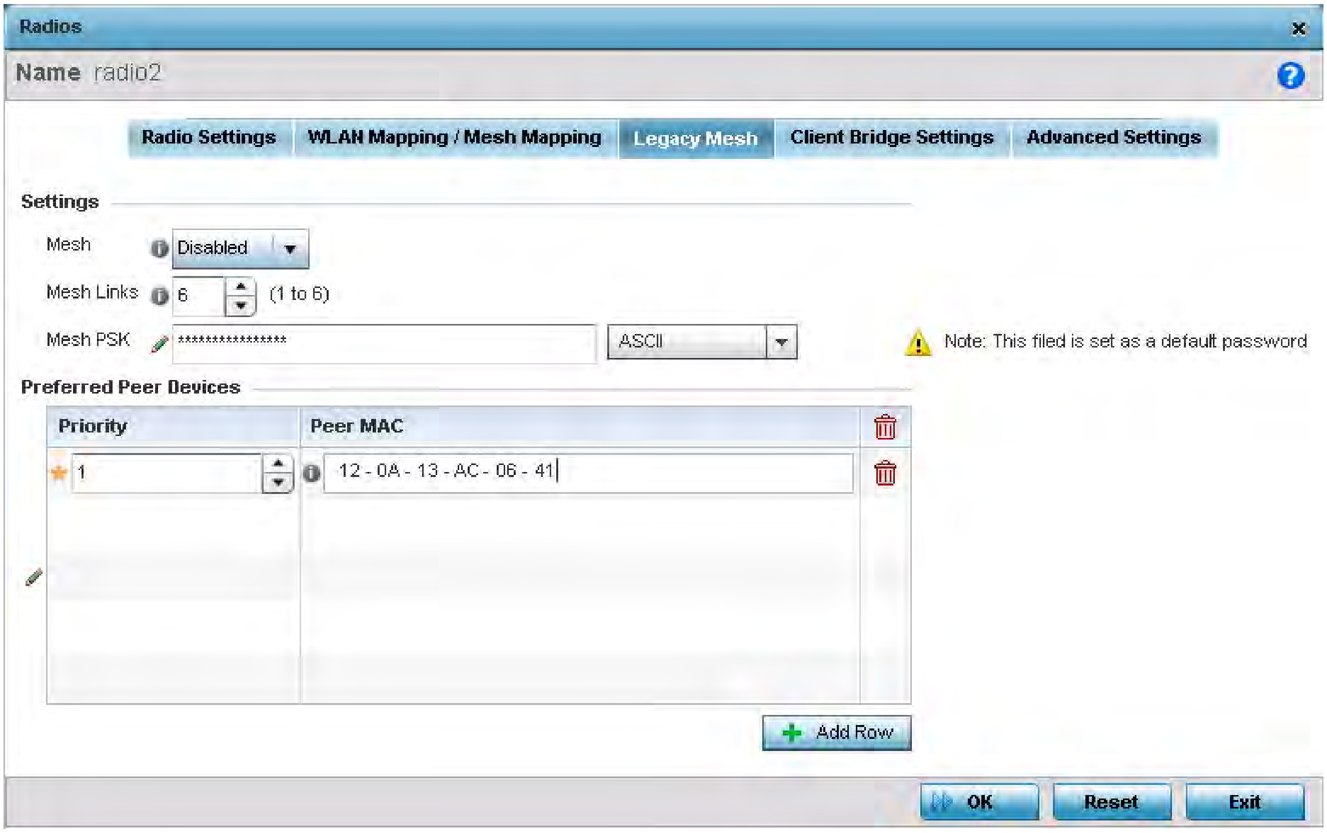
13 Refer to the **WLAN/BSS Mappings** field to set or override WLAN BSSID assignments for an existing Access Point deployment.

Administrators can assign each WLAN its own BSSID. If using a single-radio access point, there are 8 BSSIDs available. If using a dual-radio access point there are 8 BSSIDs for the 802.11b/g/n radio and 8 BSSIDs for the 802.11a/n radio.

14 Select **Advanced Mapping** to enable WLAN mapping to a specific BSS ID.

15 Select **OK** to save the changes and overrides to the WLAN Mapping. Select **Reset** to revert to the last saved configuration.

16 Select the **Legacy Mesh** tab.



Radios

Name radio2

Settings

Mesh: Disabled

Mesh Links: 6 (1 to 6)

Mesh PSK: **************** ASCII

Note: This filed is set as a default password

Preferred Peer Devices

Priority	Peer MAC
1	12 - 0A - 13 - AC - 06 - 41

Figure 5-55 *Profile Overrides - Access Point Legacy Mesh tab*

17 Refer to the **Settings** field to define or override basic mesh settings for the Access Point radio.

Mesh	Use the drop-down to set the mesh mode for this radio. Available options include *Disabled*, *Portal* or *Client*. Setting the mesh mode to Disabled deactivates all mesh activity on this radio. Setting the mesh mode to Portal turns the radio into a mesh portal. This will start the radio beaconing immediately and will accept connections from other mesh nodes. Setting the mesh mode to client enables the radio to operate as a mesh client that scans and connects to mesh portals or nodes connected to portals.

Mesh Links	Specify the number of mesh links allowed by the radio. The radio can have from 1- 6 mesh links when the radio is configured as a Portal.
Mesh PSK	Provide the encryption key in either ASCII or Hex format. Administrators must ensure this key is configured on the Access Point when staged for mesh, added to the mesh client and to the portal Access Point's configuration on the controller or service platform. Select *Show* to expose the characters used in the PSK.

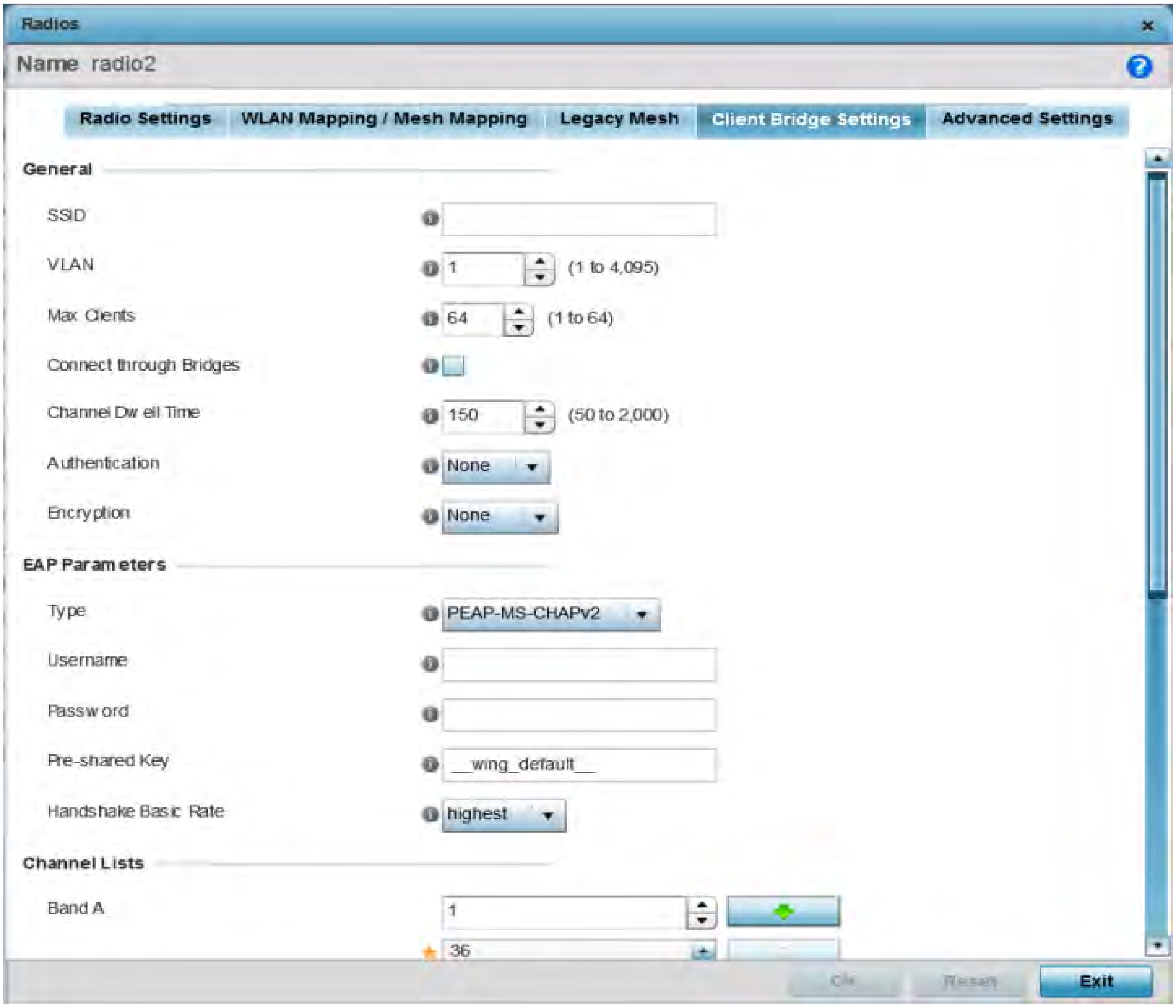
✓ **NOTE:** Only single hop mesh links are supported at this time.

18 Refer to the **Preferred Peer Devices** table to add mesh peers. For each peer being added enter its MAC Address and a Priority from 1 - 6. The lower the priority number assigned, the higher the priority it's given when connecting to the mesh infrastructure.

19 Select the **+ Add Row** button to add preferred peer devices for the radio to connect to in mesh mode.

20 Select the **Client Bridge Settings** tab to configure the selected radio as a client-bridge. Note, before configuring the client-bridge parameters, set the radio's rf-mode to *bridge*.

An Access Point's radio can be configured to form a bridge between its wireless/wired clients and an infrastructure WLAN. The bridge radio authenticates and associates with an infrastructure WLAN Access Point. After successful association, the Access Point switches frames between its bridge radio and wired/wireless client(s) connected either to its GE port(s) or to the other radio, there by providing the clients access to the infrastructure WLAN resources. This feature is supported only on the AP6522, AP6562, AP7602, AP7532, AP7562, AP7602, and AP7622 model Access Points.



Radios

Name radio2

General

- SSID:
- VLAN: 1 (1 to 4,095)
- Max Clients: 64 (1 to 64)
- Connect through Bridges: □
- Channel Dwell Time: 150 (50 to 2,000)
- Authentication: None
- Encryption: None

EAP Parameters

- Type: PEAP-MS-CHAPv2
- Username:
- Password:
- Pre-shared Key: __wing_default__
- Handshake Basic Rate: highest

Channel Lists

- Band A: 1
- 36

Figure 5-56 *Profile - Access Point Client Bridge Settings tab*

21 Refer to the **General** field and define the following configurations:

SSID	Set the infrastructure WLAN's SSID the client-bridge Access Point associates with.
VLAN	Set the VLAN to which the bridged clients' sessions are mapped after successful association with the infrastructure WLAN. Once mapped, the client bridge communicates with permitted hosts over the infrastructure WLAN. Specify the VLAN from 1 to 4095.
Max Clients	Set the maximum number of client-bridge Access Points that can associate with the infrastructure WLAN. Specify a value from 1 to 64. The default value is 64.
Connect through Bridges	Select this option to enable the client-bridge access point radio to associate with the infrastructure WLAN through another client-bridge radio thereby forming a chain. This is referred to as daisy chaining of client-bridge radios. This option is disabled by default.

Channel Dwell Time	Set the channel-dwell time from 50 to 2000 milliseconds. This is the time the client-bridge radio dwells on each channel (configured in the list of channels) when scanning for an infrastructure WLAN. The default is 150 milliseconds.
Authentication	Set the mode of authentication with the infrastructure WLAN. The authentication mode specified here should be the same as that configured on the infrastructure WLAN. The options are *None* and *EAP*. If selecting EAP, specify the EAP authentication parameters. The default setting in None. For information on WLAN authentication, see *Configuring WLAN Security*.
Encryption	Set the packet encryption mode. The encryption mode specified here should be the same as that configured on the infrastructure WLAN. The options are *None*, *CCMP* and *TKIP*. The default setting is None. For information on WLAN encryption, see *Configuring WLAN Security*.

22 Refer to the **EAP Parameters** field and define the following EAP authentication parameters:

Type	Use the drop-down menu to select the EAP authentication method used by the supplicant. The options are TLS and PEAP-MS-CHAPv2. The default EAP type is PEAP-MS-CHAPv2.
Username	Set the 32 character maximum user name for an EAP authentication credential exchange.
Password	Set the 32 character maximum password for the EAP user name specified above.
Pre-shared Key	Set the *pre-shared key* (PSK) used with EAP. Note, the authenticating algorithm and PSK configured should be same as that on the infrastructure WLAN.
Handshake Basic Rate	Set the basic rate of exchange of handshake packets between the client-bridge and infrastructure WLAN Access Points. The options are *highest* and *normal*. The default value is highest.

23 Refer to the **Channel Lists** field and define the list of channels the client-bridge radio scans when scanning for an infrastructure WLAN.

Band A	Define a list of channels for scanning across all the channels in the 5.0 GHz radio band.
Band BG	Define a list of channels for scanning across all the channels in the 2.4 GHz radio band.

24 Refer to the **Keepalive Parameters** field and define the following configurations:

Keepalive Type	Set the keepalive frame type exchanged between the client-bridge and infrastructure Access Points. This is the type of packets exchanged between the client-bridge and infrastructure Access Points, at specified intervals, to keep the client-bridge link up and active. The options are *null-data* and *WNMP* packets. The default value is null-data.

Keepalive Interval	Set the keepalive interval from 0 - 86,400 seconds. This is the interval between two successive keepalive frames exchanged between the client-bridge and infrastructure Access Points. The default value is 300 seconds.
Inactivity Timeout	Set the inactivity timeout for each bridge MAC address from 0 - 8,64,000 seconds. This is the time for which the client-bridge access point waits before deleting a wired/wireless client's MAC address from which a frame has not been received for more than the time specified here. For example, if the inactivity time is set at 120 seconds, and if no frames are received from a client (MAC address) for 120 seconds, it is deleted. The default value is 600 seconds.

25 Refer to the **Radio Link Behaviour** field and define the following configurations:

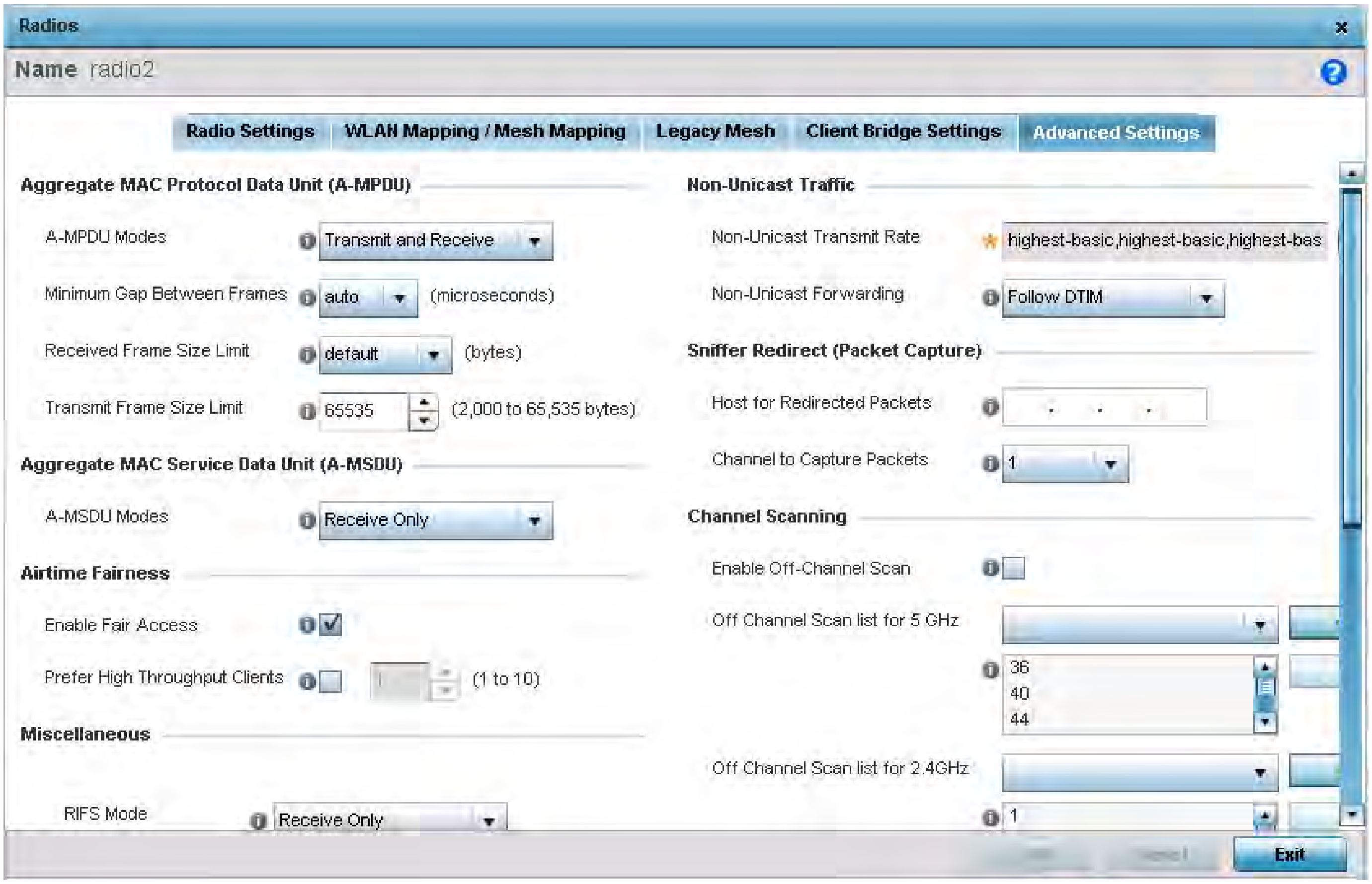
Shutdown Other Radio when Link Goes Down	Select this option to enable shutting down of the *non-client bridge* radio (this is the radio to which wireless-clients associate) when the link between the *client-bridge* and *infrastructure* access points is lost. When enabled, wireless clients associated with the non-client bridge radio are pushed to search for and associate with other access points having backhaul connectivity. This option is disabled by default. If enabling this option, specify the time for which the non-client bridge radio is shut down. Use the spinner to specify a time from 1 - 1,800 seconds.
Refresh VLAN Interface when Link Comes Up	Select this option to enable the SVI to refresh on re-establishing client bridge link to the infrastructure Access Point. And, if using a DHCP assigned IP address, it also causes a DHCP renew. This option is enabled by default.

26 Refer to the **Roam Criteria** field and define the following configuration:

Seconds for Missed Beacons	Set this interval from 0 to 60 seconds. This is the time for which the client-bridge Access Point waits, after missing a beacon from the associated infrastructure WLAN Access Point, before roaming to another infrastructure Access Point. For example, if the *Seconds for Missed Beacon* is set to 30 seconds, and if more than 30 seconds have passed since the last beacon received from the infrastructure Access Point, the client-bridge Access Point resumes scanning for another infrastructure Access Point. The default value s 20 seconds.
Minimum Signal Strength	Set the minimum signal-strength threshold for signals received from the infrastructure Access Point. Specify a value from -128 to -40 dBm. If the RSSI value of signals received from the infrastructure access point falls below the value specified here, the client-bridge access point resumes scanning for another infrastructure access point. The default is -75 dBm.

27 Select **OK** to save or override the changes to the Client Bridge Settings screen. Select **Reset** to revert to the last saved configuration.

28 Select the **Advanced Settings** tab.



Name radio2

Aggregate MAC Protocol Data Unit (A-MPDU)

A-MPDU Modes: Transmit and Receive

Minimum Gap Between Frames: auto (microseconds)

Received Frame Size Limit: default (bytes)

Transmit Frame Size Limit: 65535 (2,000 to 65,535 bytes)

Aggregate MAC Service Data Unit (A-MSDU)

A-MSDU Modes: Receive Only

Airtime Fairness

Enable Fair Access ☑

Prefer High Throughput Clients □ 1 (1 to 10)

Miscellaneous

RIFS Mode: Receive Only

Non-Unicast Traffic

Non-Unicast Transmit Rate: highest-basic,highest-basic,highest-bas

Non-Unicast Forwarding: Follow DTIM

Sniffer Redirect (Packet Capture)

Host for Redirected Packets: . . .

Channel to Capture Packets: 1

Channel Scanning

Enable Off-Channel Scan □

Off Channel Scan list for 5 GHz: 36, 40, 44

Off Channel Scan list for 2.4GHz: 1

Figure 5-57 *Profile Overrides - Access Point Radio Advanced Settings tab*

29 Refer to the **Aggregate MAC Protocol Data Unit (A-MPDU)** field to define or override how MAC service frames are aggregated by the Access Point radio.

A-MPDU Modes	Use the drop-down menu to define the A-MPDU mode supported. Options include *Transmit Only*, *Receive Only*, *Transmit and Receive* and *None*. The default value is Transmit and Receive. Using the default value, long frames can be both sent and received (up to 64 KB). When enabled, define either a transmit or receive limit (or both).
Minimum Gap Between Frames	Use the drop-down menu to define the minimum gap between A-MPDU frames (in microseconds). The default value is 4 microseconds. A value of *auto* designates the gap is set by the system.
Received Frame Size Limit	If a support mode is enabled allowing A-MPDU frames to be received, define an advertised maximum limit for received A-MPDU aggregated frames. Options include 8191, 16383, 32767 or 65535 bytes. The default value is 65535 bytes.
Transmit Frame Size Limit	Use the spinner control to set a limit on transmitted A-MPDU aggregated frames. The available range is from 2,000 - 65,535 bytes. The default value is 65535 bytes.

30 Use the **A-MSDU Modes** drop-down menu in the **Aggregate MAC Service Data Unit (A-MSDU)** section to set or override the supported A-MSDU mode.

Available modes include *Receive Only* and *Transmit and Receive*. Transmit and Receive is the default value. Using Transmit and Receive, frames up to 4 KB can be sent and received. The buffer limit is not configurable.

31 Use the **Airtime Fairness** fields to optionally prioritize wireless access to devices.

Select **Enable Fair Access** to enable this feature and provide equal access client access to radio resources. Select **Prefer High Throughput Clients** to prioritize clients with higher throughput (802.11n clients) over clients with slower throughput (802.11 a/b/g) clients. Use the spinner control to set a weight for the higher throughput clients.

32 Set or override the following **Miscellaneous** advanced radio settings:

RIFS Mode	Define a RIFS mode to determine whether interframe spacing is applied to Access Point transmissions or received packets, both, or neither The default mode is *Transmit and Receive*. Interframe spacing is an interval between two consecutive Ethernet frames to enable a brief recovery between packets and allow target devices to prepare for the reception of the next packet. Consider setting this value to *None* for high priority traffic to reduce packet delay.
STBC Mode	Select a *space-time block coding* (STBC) option to transmit multiple data stream copies across Access Point antennas to improve signal reliability. An Access Point's transmitted signal traverses a problematic environment, with scattering, reflection and refraction all prevalent. The signal can be further corrupted by noise at the receiver. Consequently, some of the received data copies are less corrupt and better than others. This redundancy means there's a greater chance of using one, or more, of the received copies to successfully decode the signal. STBC effectively combines all the signal copies to extract as much information from each as possible.
Transmit Beamforming	Enable beamforming to steer signals to peers in a specific direction to enhance signal strength and improve throughput amongst meshed devices (not clients). Each Access Point radio support up to 16 beamforming capable mesh peers. When enabled, a *beamformer* steers its wireless signals to its peers. A *beamformee* device assists the beamformer with channel estimation by providing a *feedback* matrix. The feedback matrix is a set of values sent by the beamformee to assist the beamformer in computing a *steering* matrix. A steering matrix is an additional set of values used to steer wireless signals at the beamformer so constructive signals arrive at the beamformee for better SNR and throughput. Any beamforming capable mesh peer connecting to a radio whose capacity is exhausted cannot enable beamforming itself. Transmit beamforming is available on AP81XX (AP8122, AP8132 and AP8163) model Access Points only, and is disabled by default.

33 Set or override the following **Aeroscout Properties**:

Forwarding Host	Specify the Aeroscout engine's IP address. When specified, the AP forwards Aeroscout beacons directly to the Aeroscout locationing engine without proxying through the controller or RF Domain manager. **Note:** Aeroscout beacon forwarding is supported only on the AP6532, AP7502, AP7522, AP7532, AP7562, AP8432, AP8533 model Access Points.
Forwarding Port	Use the spinner control to set the port on which the Aeroscout engine is reachable.
MAC to be forwarded	Specify the MAC address to be forwarded.

34 Set or override the following **Ekahau Properties**:

Forward Host	Specify the Ekahau engine IP address. Using Ekahau small, battery powered Wi-Fi tags are attached to tracked assets or carried by people. Ekahau processes locations, rules, messages and environmental data and turns the information into locationing maps, alerts and reports.
Forwarding Port	Use the spinner control to set the Ekahau TZSP port used for processing information from locationing tags.
MAC to be forwarded	Specify the MAC address to be forwarded with location data requests.

35 Set or override the following **Non-Unicast Traffic** values for the profile's supported Access Point radio and its connected wireless clients:

Non-Unicast Transmit Rate	Use the *Select* drop-down menu to launch a sub screen to define the data rate for broadcast and multicast frame transmissions. Seven different rates are available if the not using the same rate for each BSSID, each with a separate menu.
Non-Unicast Forwarding	Define whether client broadcast and multicast packets should always follow DTIM, or only follow DTIM when using Power Save Aware mode. The default setting is Follow DTIM.

36 Refer to the **Sniffer Redirect (Packet Capture)** field to define or override the radio's captured packet configuration.

Host for Redirected Packets	If packets are re-directed from a controller or service platform's connected Access Point radio, define an IP address of a resource (additional host system) used to capture the re- directed packets. This address is the numerical (non DNS) address of the host used to capture the re-directed packets.
Channel to Capture Packets	Use the drop-down menu to specify the channel used to capture re-directed packets. The default value is channel 1.

37 Refer to the **Channel Scanning** field to define or override the radio's captured packet configuration.

Enable Off-Channel Scan	Enable this option to scan across all channels using this radio. Channel scans use Access Point resources and can be time consuming, so only enable when your sure the radio can afford the bandwidth be directed towards to the channel scan and does not negatively impact client support.
Off Channel Scan list for 5GHz	Define a list of channels for off channel scans using the 5GHz Access Point radio. Restricting off channel scans to specific channels frees bandwidth otherwise utilized for scanning across all the channels in the 5GHz radio band.
Off Channel Scan list for 2.4GHz	Define a list of channels for off channel scans using the 2.4GHz Access Point radio. Restricting off channel scans to specific channels frees bandwidth otherwise utilized for scanning across all the channels in the 2.4GHz radio band.
Max Multicast	Set the maximum number (from 0 - 100) of multicast/broadcast messages used to perform off channel scanning. The default setting is four.

Scan Interval	Set the interval (from 2 - 100 dtims) off channel scans occur. The default setting is 20dtims.
Sniffer Redirect	Specify the IP address of the host to which captured off channel scan packets are redirected.

38 If an AP7161 or AP7181 is deployed, refer to the following **AP7161/AP7181** specific values to set outdoor antenna characteristics:

Enable Antenna Downlift	Enable this settings (on AP7181 models only) to allow the Access Point to physically transmit in a downward orientation (ADEPT mode).
Extended Range	Set an extended range (from 1 - 25 kilometers) to allow AP7161 and AP7181 model Access Points to transmit and receive with their clients at greater distances without being timed out.

39 Select **OK** to save or override the changes to the Advanced Settings screen. Select **Reset** to revert to the last saved configuration.

5.2.7.6 WAN Backhaul Override Configuration

Profile Interface Override Configuration

A *Wireless Wide Area Network* (WWAN) card is a specialized network interface card that allows a device to connect, transmit and receive data over a Cellular Wide Area Network. The RFS4000 and RFS6000 each have a PCI Express card slot that supports 3G WWAN cards. The WWAN card uses *point to point protocol* (PPP) to connect to the *Internet Service Provider* (ISP) and gain access to the Internet. PPP is the protocol used for establishing internet links over dial-up modems, DSL connections, and many other types of point-to-point communications. PPP packages your system's TCP/IP packets and forwards them to the serial device where they can be put on the network. PPP is a full-duplex protocol that can be used on various physical media, including twisted pair or fiber optic lines or satellite transmission. It uses a variation of *High Speed Data Link Control* (HDLC) for packet encapsulation.

To define a WAN Backhaul configuration override:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

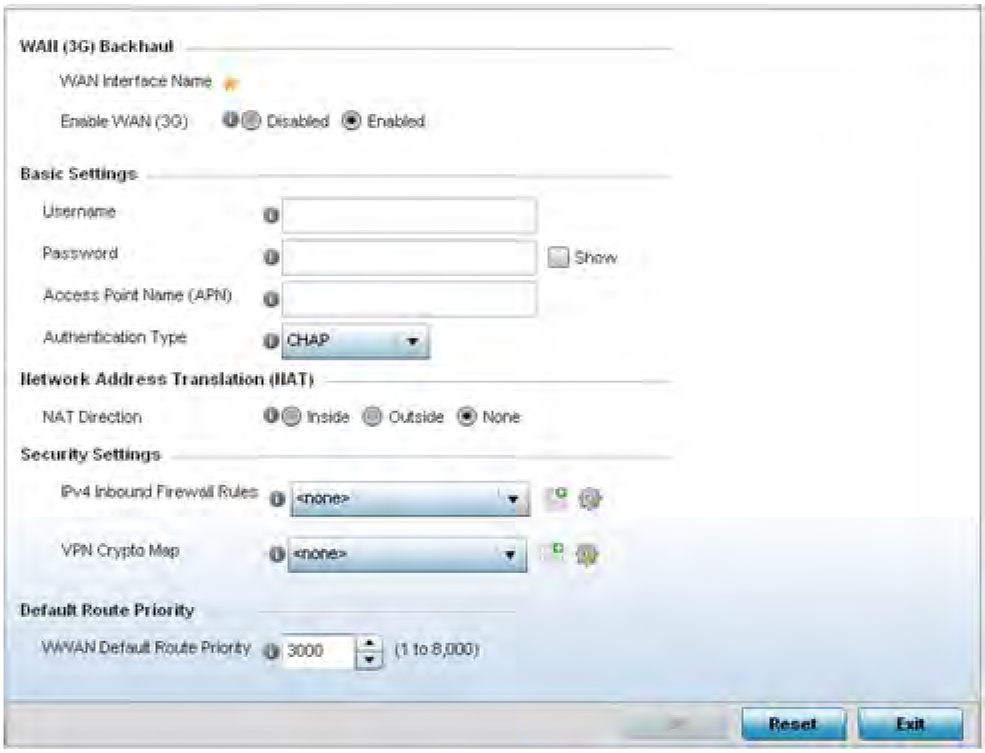
2 Select a target Access Point (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Interface** to expand its sub menu options.

5 Select **WAN Backhaul**.



WAN (3G) Backhaul

WAN Interface Name

Enable WAN (3G) ○ Disabled ● Enabled

Basic Settings

Username

Password □ Show

Access Point Name (APN)

Authentication Type CHAP

Network Address Translation (NAT)

NAT Direction ○ Inside ○ Outside ● None

Security Settings

IPv4 Inbound Firewall Rules <none>

VPN Crypto Map <none>

Default Route Priority

WWAN Default Route Priority 3000 (1 to 8,000)

Figure 5-58 *Profile Overrides -WAN Backhaul screen*

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

6 Refer to the **WAN (3G) Backhaul** configuration to specify WAN card settings:

WAN Interface Name	Displays the WAN Interface name for the WAN 3G Backhaul card.
Reset WAN Card	If the WAN Card becomes unresponsive or is experiencing other errors click the *Reset WAN Card* button to power cycle and reboot the WAN card.
Enable WAN (3G)	Check this box to enable 3G WAN card support on the device. A supported 3G card must be connected to the device for this feature to work properly.

7 Define or override the following authentication parameters from within the **Basic Settings** field:

Username	Provide a username for authentication support by the cellular data carrier.
Password	Provide a password for authentication support by the cellular data carrier.
Access Point **Name (APN)**	Enter the name of the cellular data provider if necessary. This setting is needed in areas with multiple cellular data providers using the same protocols, such as Europe and Asia.
Authentication Type	Use the drop-down menu to specify the authentication type used by the cellular data provider. Supported authentication types are *None*, *PAP*, *CHAP*, *MSCHAP*, and *MSCHAP-v2*.

8 Define or override the following NAT parameters from within the **Network Address Translation (NAT)** field:

NAT Direction	Define the *Network Address Translation* (NAT) direction. Options include: *Inside* - The inside network is transmitting data over the network its intended destination. On the way out, the source IP address is changed in the header and replaced by the (public) IP address. *Outside* - Packets passing through the NAT on the way back to the controller or service platform managed LAN are searched against to the records kept by the NAT engine. There, the destination IP address is changed back to the specific internal private class IP address in order to reach the LAN over the network. *None* - No NAT activity takes place. This is the default setting.

9 Define or override the following security parameters from within the **Security Settings** field:

IPv4 Inbound Firewall Rules	Use the drop-down menu to select an inbound IPv4 ACL to associate with traffic on the WAN backhaul. This setting pertains to IPv4 inbound traffic only and not IPv6. IPv4 operates as a best effort delivery method, as it does not guarantee delivery, and does not ensure proper sequencing or duplicate delivery (unlike (TCP). IPv4 hosts can use link local addressing to provide local connectivity. If an appropriate IP ACL does not exist, select the *Add* button to create a new one.
VPN Crypto Map	If necessary, specify a crypto map for the wireless WAN. A crypto map can be up to 256 characters long. If a suitable crypto map is not available, click the *Create* button to configure a new one.

Define or override the following route parameters from within the **Default Route Priority** field:

WWAN Default Route Priority	Use the spinner control to define a priority from 1 - 8,000 for the default route learned by the wireless WAN. The default value is 3000.

10 Select **OK** to save or override the changes to the Advanced Settings screen. Select **Reset** to revert to the last saved configuration.

5.2.7.7 PPPoE Override Configuration

▸ *Profile Interface Override Configuration*

PPP over Ethernet (PPPoE) is a data-link protocol for dialup connections. PPPoE allows the access point to use a broadband modem (DSL, cable modem, etc.) for access to high-speed data and broadband networks. Most DSL providers support (or deploy) the PPPoE protocol. PPPoE uses standard encryption, authentication, and compression methods as specified by the PPPoE protocol. PPPoE enables controllers, service platforms and Access Points to establish a point-to-point connection to an ISP over existing Ethernet interface.

To provide this point-to-point connection, each PPPoE session learns the Ethernet address of a remote PPPoE client, and establishes a session. PPPoE uses both a discover and session phase to identify a client and establish a point-to-point connection. By using such a connection, a Wireless WAN fail over is available to maintain seamless network access if the access point's Wired WAN were to fail.

NOTE: Devices with PPPoE enabled continue to support VPN, NAT, PBR and 3G fail over on the PPPoE interface. Multiple PPPoE sessions are supported using a single user account user account if RADIUS is configured to allow simultaneous access.

When PPPoE client operation is enabled, it discovers an available server and establishes a PPPoE link for traffic slow. When a wired WAN connection failure is detected, traffic flows through the WWAN interface in fail-over mode (if the WWAN network is configured and available). When the PPPoE link becomes accessible again, traffic is redirected back through the access point's wired WAN link.

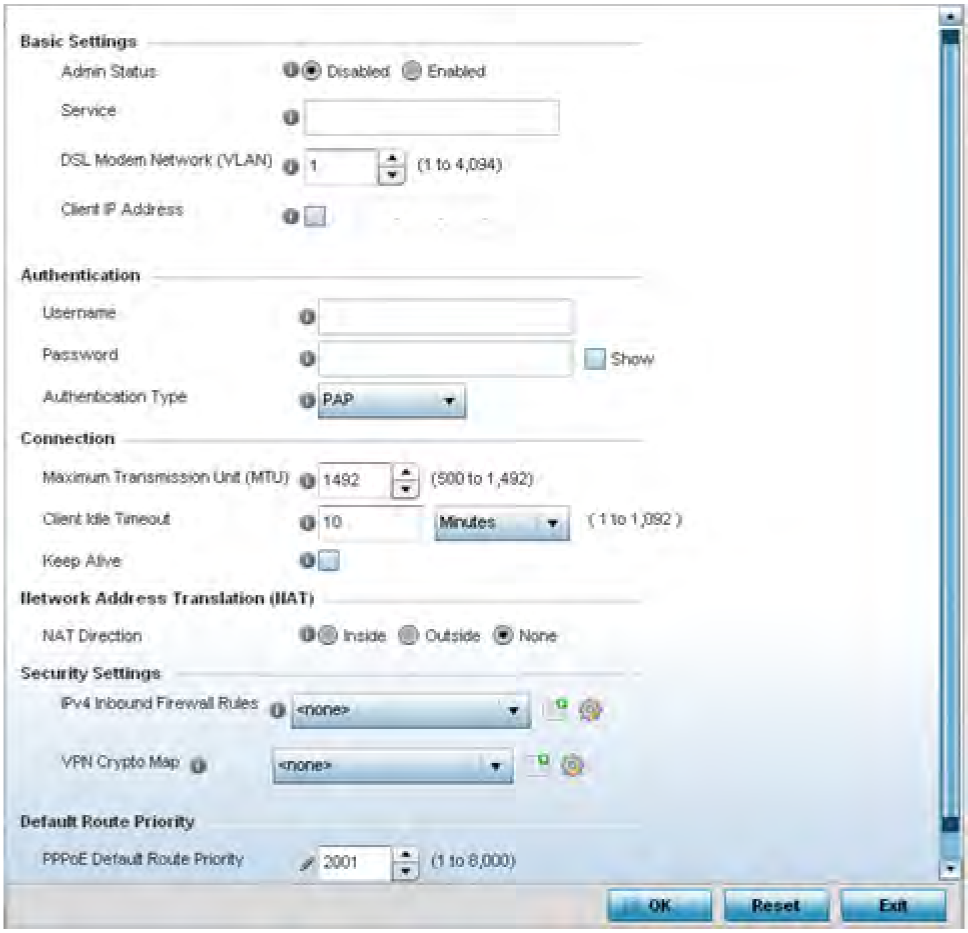
When the access point initiates a PPPoE session, it first performs a discovery to identify the Ethernet MAC address of the PPPoE client and establish a PPPoE session ID. In discovery, the PPPoE client discovers a server to host the PPPoE connection.

To create a PPPoE point-to-point configuration:

1. Select **Devices** from the Configuration tab.

   The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.
2. Select a target Access Point (by double-clicking it) from amongst those displayed within the Device Configuration screen.

   Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.
3. Select **Profile Overrides** from the Device menu to expand it into sub menu options.
4. Select **Interface** to expand its sub menu options.
5. Select **PPPoE**.



Basic Settings

Admin Status ● Disabled ○ Enabled

Service

DSL Modem Network (VLAN) 1 (1 to 4,094)

Client IP Address □

Authentication

Username

Password □ Show

Authentication Type PAP

Connection

Maximum Transmission Unit (MTU) 1492 (500 to 1,492)

Client Idle Timeout 10 Minutes (1 to 1,092)

Keep Alive □

Network Address Translation (NAT)

NAT Direction ○ Inside ○ Outside ● None

Security Settings

IPv4 Inbound Firewall Rules <none>

VPN Crypto Map <none>

Default Route Priority

PPPoE Default Route Priority 2001 (1 to 8,000)

Figure 5-59 *Profile Overrides -PPPoE screen*

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

6 Use the **Basic Settings** field to enable PPPoE and define a PPPoE client

Admin Status	Select *Enable* to support a high speed client mode point-to-point connection using the PPPoE protocol. The default setting is disabled.
Service	Enter the 128 character maximum PPPoE client service name provided by the service provider.
DSL Modem Network (VLAN)	Use the spinner control to set the PPPoE VLAN (client local network) connected to the DSL modem. This is the local network connected to DSL modem. The available range is 1 - 4,094. The default VLAN is VLAN1.
Client IP Address	Provide the numerical (non hostname) IP address of the PPPoE client.

7 Define the following **Authentication** parameters for PPPoE client interoperation:

Username	Provide the 64 character maximum username used for authentication support by the PPPoE client.

Password	Provide the 64 character maximum password used for authentication by the PPPoE client.
Authentication Type	Use the drop-down menu to specify the authentication type used by the PPPoE client, and whose credentials must be shared by its peer access point. Supported authentication options include *None, PAP, CHAP, MSCHAP*, and *MSCHAP-v2*.

8 Define the following **Connection** settings for the PPPoE point-to-point connection with the PPPoE client:

Maximum Transmission Unit (MTU)	Set the PPPoE client *maximum transmission unit* (MTU) from 500 - 1,492. The MTU is the largest physical packet size in bytes a network can transmit. Any messages larger than the MTU are divided into smaller packets before being sent. A PPPoE client should be able to maintain its point-to-point connection for this defined MTU size. The default MTU is 1,492.
Client Idle Timeout	Set a timeout in either *Seconds* (1 - 65,535), *Minutes* (1 - 1,092) or *Hours.* The Access Point uses the defined timeout so it does not sit idle waiting for input from the PPPoE client and server that may never come. The default setting is 10 minutes.
Keep Alive	Select this option to ensure the point-to-point connect to the PPPoE client is continuously maintained and not timed out. This setting is disabled by default.

9 Set the **Network Address Translation (NAT)** direction for the PPPoE configuration.

Network Address Translation (NAT) converts an IP address in one network to a different IP address or set of IP addresses in another network. The access point router maps its local (*Inside*) network addresses to WAN (*Outside*) IP addresses, and translates the WAN IP addresses on incoming packets to local IP addresses. NAT is useful because it allows the authentication of incoming and outgoing requests, and minimizes the number of WAN IP addresses needed when a range of local IP addresses is mapped to each WAN IP address. The default setting is None (neither inside or outside).

10 Define the following **Security Settings** for the PPPoE configuration:

IPV4 Inbound Firewall Rules	Use the drop-down menu to select a firewall (set of IPv4 formatted access connection rules) to apply to the PPPoE client connection. If a firewall rule does not exist suiting the data protection needs of the PPPoE client connection, select the Create icon to define a new rule configuration or the Edit icon to modify an existing rule. For more information, see Configuring IP Firewall Rules on page 10-20.
VPN Crypto Map	Use the drop-down menu to apply an existing crypt map configuration to this PPPoE interface.

11 Use the spinner control to set the **Default Route Priority** for the default route obtained using PPPoE.

Select from 1 - 8,000. The default setting is 2,000.

12 Select **OK** to save the changes to the PPPoE screen. Select **Reset** to revert to the last saved configuration. Saved configurations are persistent across reloads.

5.2.7.8 Bluetooth Configuration

▸ *Profile Interface Override Configuration*

AP-8432 and AP-8533 model Access Points utilize a built in Bluetooth chip for specific Bluetooth functional behaviors in a WiNG managed network. AP-8432 and AP-8533 models support both Bluetooth *classic* and Bluetooth *low energy* technology. These platforms can use their Bluetooth classic enabled radio to sense other Bluetooth enabled devices and report device data (MAC address, RSSI and device calls) to an ADSP server for intrusion detection. If the device presence varies in an unexpected manner, ADSP can raise an alarm.

✓ **NOTE:** AP-8132 model Access Points support an external USB Bluetooth radio providing ADSP Bluetooth classic sensing functionality only, not the Bluetooth low energy beaconing functionality available for AP-8432 and AP-8533 model Access Points described in this section.

AP-8432 and AP-8533 model Access Points support Bluetooth beaconing to emit either iBeacon or Eddystone-URL beacons. The Access Point's Bluetooth radio sends non-connectable, undirected *low-energy* (LE) advertisement packets on a periodic basis. These advertisement packets are short, and sent on Bluetooth advertising channels that conform to already-established iBeacon and Eddystone-URL standards. Portions of the advertising packet are still customizable however.

To define a Bluetooth radio interface configuration:

1 Select **Devices** from the Configuration tab.

2 The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

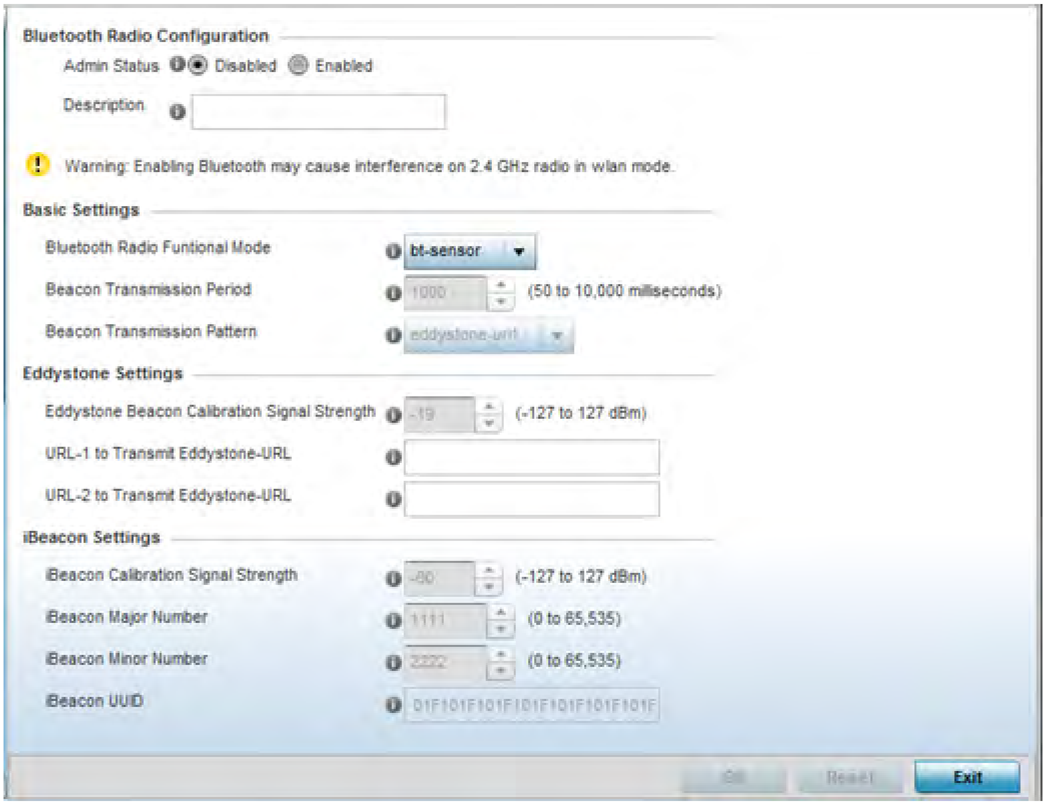
3 Select a target Access Point (by double-clicking it) from amongst those displayed within the Device Configuration screen.

4 Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

5 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

6 Select **Interface** to expand its sub menu options.

7 Select **Bluetooth**.



Bluetooth Radio Configuration

Admin Status ● Disabled ○ Enabled

Description

Warning: Enabling Bluetooth may cause interference on 2.4 GHz radio in wlan mode.

Basic Settings

Bluetooth Radio Funtional Mode: bt-sensor

Beacon Transmission Period: 1000 (50 to 10,000 milliseconds)

Beacon Transmission Pattern: eddystone-url

Eddystone Settings

Eddystone Beacon Calibration Signal Strength: -19 (-127 to 127 dBm)

URL-1 to Transmit Eddystone-URL

URL-2 to Transmit Eddystone-URL

iBeacon Settings

iBeacon Calibration Signal Strength: -60 (-127 to 127 dBm)

iBeacon Major Number: 1111 (0 to 65,535)

iBeacon Minor Number: 2222 (0 to 65,535)

iBeacon UUID: 01F101F101F101F101F101F101F

Figure 5-60 *Profile Overrides - Bluetooth screen*

8 Set the following **Bluetooth Radio Configuration** parameters:

Admin Status	*Enable* or *Disable* Bluetooth support capabilities for AP-8432 or AP-8533 model Access Point Bluetooth radio transmissions. The default value is disabled.
Description	Define a 64 character maximum description for the Access Point's Bluetooth radio to differentiate this radio interface from other Bluetooth supported radio's that may be members of the same RF Domain.

9 Set the following **Basic Settings**:

Bluetooth Radio Functional Mode	Set the Access Point's Bluetooth radio functional mode to either *bt-sensor* or *le-beacon*. Use bt-sensor mode for ADSP Bluetooth classic sensing. Use le-beacon mode to have the Access Point transmit both ibeacon and Eddystone-URL low energy beacons. le-beacon is the default setting.
Beacon Transmission Period	Set the Bluetooth radio's beacon transmission period from 100 - 10,000 milliseconds. The default setting is 1,000 milliseconds.

Beacon Transmission Pattern	When the Bluetooth radio's mode is set to le-beacon, use the enabled drop-down menu to set the beacon's emitted transmission pattern to either *eddystone_url1*, *eddystone_url2* or *ibeacon*. An eddystone-URL frame broadcasts a URL using a compressed encoding scheme to better fit within a limited advertisement packet. Once decoded, the URL can be used by a client for Internet access. iBeacon was created by Apple for use in iOS devices (beginning with iOS version 7.0). There are three data fields Apple has made available to iOS applications, a *UUID* for device identification, a *Major* value for device class and a *Minor* value for more refined information like product category.

10 Define the following Eddystone_Settings if the Beacon Transmission Pattern has been set to either eddystone_url_1 or eddystone_url_2:

Eddystone Beacon Calibration Signal Strength	Set the eddystone beacon measured calibration signal strength, from -127 to 127 dBm, at 0 meters. Mobile devices can approximate their distance to beacons based on received signal strength. However, distance readings can fluctuate since they depend on several external factors. The closer you are to a beacon, the more accurate the reported distance. This setting is the projected calibration signal strength at 0 meters. The default setting is -19 dBm.
URL-1 to Transmit Eddystone-URL	Enter a 64 character maximum eddystone-URL1. The URL must be 18 characters or less once auto-encoding is applied. The encoding process is for getting the URL to fit within the beacon's payload.
URL-2 to Transmit Eddystone-URL	Enter a 64 character maximum eddystone-URL2. The URL must be 18 characters or less once auto-encoding is applied. The encoding process is for getting the URL to fit within the beacon's payload.

11 Define the following **iBeacon_Settings** if the Beacon Transmission Pattern has been set to iBeacon:

iBeacon Calibration Signal Strength	Set the ibeacon measured calibration signal strength, from -127 to 127 dBm, at 1 meter. Mobile devices can approximate their distance to beacons based on received signal strength. However, distance readings can fluctuate since they depend on several external factors. The closer you are to a beacon, the more accurate the reported distance. This setting is the projected calibration signal strength at 1 meter. The default setting is -60 dBm.
iBeacon Major Number	Set the iBeacon Major value from 0 - 65,535. Major values identify and distinguish groups. For example, each beacon on a specific floor in a building could be assigned a unique major value. The default is 1,111.
iBeacon Minor Number	Set the iBeacon Minor value from 0 - 65,535. Minor values identify and distinguish individual beacons. Minor values help identify individual beacons within a group of beacons assigned a major value. The default setting is 2,222.
iBeacon UUID	Define a 32 hex character maximum UUID. The *Universally Unique IDentifier* (UUID) classification contains 32 hexadecimal digits. The UUID distinguishes iBeacons in the network from all other beacons in networks outside of your direct administration.

12 Select **OK** to save the changes to the Bluetooth configuration. Select **Reset** to revert to the last saved configuration. Saved configurations are persistent across reloads.

5.2.8 Overriding a Profile's Network Configuration

▸ *Profile Overrides*

Setting a profile's network configuration is a large task comprised of numerous administration activities. Each of the activities described below can have an override applied to the original profile configuration. Applying an override removes the device from the profile configuration that may be shared by other devices and requires careful administration to ensure this one device still supports the deployment requirements within the managed network.

A profile's network configuration process consists of the following:

- *Overriding a Profile's DNS Configuration*
- *Overriding a Profile's ARP Configuration*
- *Overriding a Profile's L2TPV3 Configuration*
- *Overriding a Profile's GRE Configuration*
- *Overriding a Profile's IGMP Snooping Configuration*
- *Overriding a Profile's MLD Snooping Configuration*
- *Overriding a Profile's Quality of Service (QoS) Configuration*
- *Overriding a Profile's Spanning Tree Configuration*
- *Overriding a Profile's Routing Configuration*
- *Overriding a Profile's Dynamic Routing (OSPF) Configuration*
- *Overriding a Profile's Border Gateway Protocol (BGP) Configuration*
- *Overriding a Profile's Forwarding Database Configuration*
- *Overriding a Profile's Bridge VLAN Configuration*
- *Overriding a Profile's Cisco Discovery Protocol Configuration*
- *Overriding a Profile's Link Layer Discovery Protocol Configuration*
- *Overriding a Profile's Miscellaneous Network Configuration*
- *Overriding a Profile's Network Alias Configuration*
- *Overriding a Profile's IPv6 Neighbor Configuration*

5.2.8.1 Overriding a Profile's DNS Configuration

▸ *Overriding a Profile's Network Configuration*

Domain Naming System (DNS) DNS is a hierarchical naming system for resources connected to the Internet or a private network. Primarily, the controller or service platform's DNS resources translate domain names into IP addresses. If a DNS server doesn't know how to translate a particular domain name, it asks another one until the correct IP address is returned. DNS enables access to resources using human friendly notations. DNS converts human friendly domain names into notations used by networking equipment for locating resources.

As a resource is accessed (using human-friendly hostnames), it's possible to access the resource even if the underlying machine friendly notation name changes. Without DNS you need to remember a series of numbers (123.123.123.123) instead of a domain name (*www.domainname.com*).

Controllers and service platforms maintain their own DNS facility that can assist in domain name translation. A DNS assignment can be overridden as needed, but removes the device configuration from the managed profile that may be shared with other similar device models.

To define the DNS configuration or apply overrides to an existing configuration:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

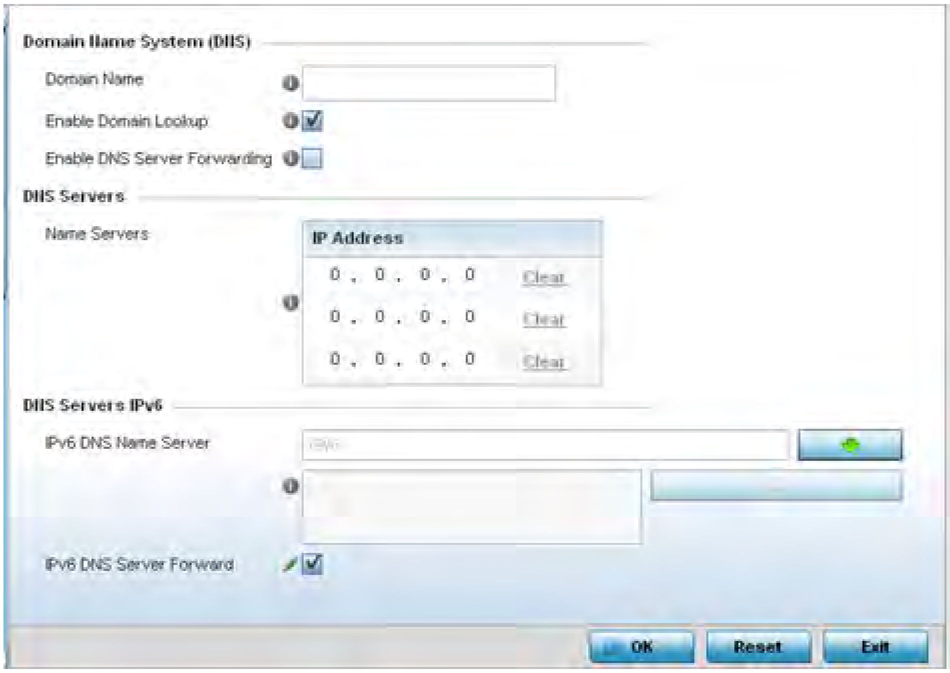
2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **DNS**.



Domain Name System (DNS)

Domain Name

Enable Domain Lookup ☑

Enable DNS Server Forwarding □

DNS Servers

Name Servers

IP Address	
0 . 0 . 0 . 0	Clear
0 . 0 . 0 . 0	Clear
0 . 0 . 0 . 0	Clear

DNS Servers IPv6

IPv6 DNS Name Server

IPv6 DNS Server Forward ☑

Figure 5-61 *Profile Overrides - Network DNS screen*

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

6 Set or override the following **Domain Name System (DNS)** configuration data:

Domain Name	Provide or override the default Domain Name used to resolve DNS names. The name cannot exceed 64 characters.
Enable Domain Lookup	Select this option to enable DNS on the controller or service platform. When enabled, the controller or service platform can convert human friendly domain names into numerical IP destination addresses. This option is selected by default.
Enable DNS Server Forwarding	Click to enable the forwarding of DNS queries to external DNS servers if a DNS query cannot be processed by the controller or service platform's own DNS resources. This feature is disabled by default.

7 Set or override the following **DNS Server** configuration data:

Name Servers	Provide a list of up to three DNS servers to forward DNS queries if the controller or service platform's DNS resources are unavailable. DNS name servers are used to resolve IP addresses. Use the *Clear* link next to each DNS server to clear the DNS name server's IP address from the list.

8 Set the following **DNS Servers IPv6** configuration data when using IPv6:

IPv6 DNS Name Server	Provide the default domain name used to resolve IPv6 DNS names. When an IPv6 host is configured with the address of a DNS server, the host sends DNS name queries to the server for resolution. A maximum of three entries are permitted.
IPv6 DNS Server Forward	Select the check box to enable IPv6 DNS domain names to be converted into numerical IP destination addresses. The setting is disabled by default.

9 Select **OK** to save the changes and overrides made to the DNS configuration. Select **Reset** to revert to the last saved configuration.

5.2.8.2 Overriding a Profile's ARP Configuration

▸ *Overriding a Profile's Network Configuration*

Address Resolution Protocol (ARP) is a protocol for mapping an IP address to a hardware MAC address recognized on the managed network. ARP provides rules for making this correlation and providing address conversion in both directions. ARP assignment s can be overridden as needed, but an override removes the device configuration from the managed profile that may be shared with other similar device models.

When an incoming packet destined for a host arrives at the controller or service platform, the gateway uses ARP to find a physical host or MAC address that matches the IP address. ARP looks in its ARP cache and, if it finds the address, provides it so the packet can be converted to the right packet length and format and sent to the destination. If no entry is found for the IP address, ARP broadcasts a request packet in a special format to all the machines on the LAN to see if one machine knows that it has that IP address associated with it. A machine that recognizes the IP address as its own returns a reply so indicating. ARP updates the ARP cache for future reference and then sends the packet to the MAC address that replied.

To define an ARP supported configuration on a controller or service platform:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

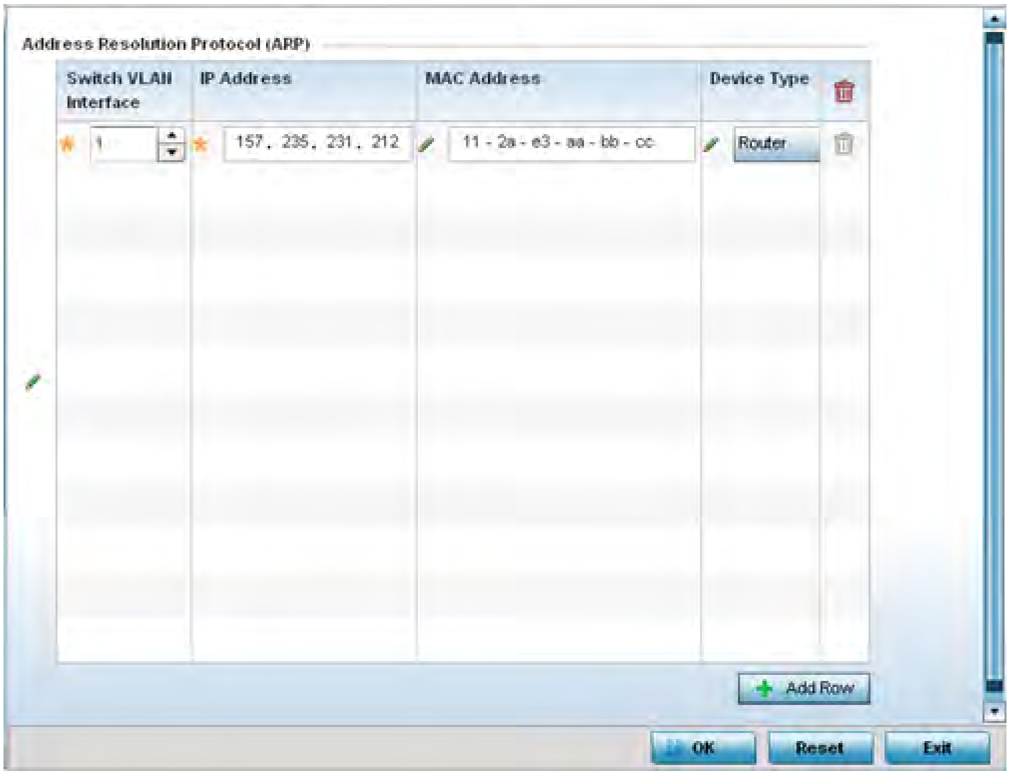
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **ARP.**

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Address Resolution Protocol (ARP)

Switch VLAN Interface	IP Address	MAC Address	Device Type
1	157 . 235 . 231 . 212	11 - 2a - e3 - aa - bb - cc	Router

Figure 5-62 *Profile Overrides - Network ARP screen*

6 Set or override the following parameters to define the controller or service platform's ARP configuration:

Switch VLAN Interface	Use the spinner control to select a VLAN interface (1 - 4094) for an address requiring resolution.
IP Address	Define the IP address used to fetch a MAC address.
MAC Address	Displays the target MAC address that's subject to resolution. This is the MAC used for mapping an IP address to a MAC address that's recognized on the network.
Device Type	Specify the device type the ARP entry supports. Host is the default setting.

7 To add additional ARP overrides click on the **+ Add Row** button and enter the configuration information in the table above.

8 Select the **OK** button to save the changes and overrides to the ARP configuration. Select **Reset** to revert to the last saved configuration.

5.2.8.3 Overriding a Profile's L2TPV3 Configuration

▶ *Overriding a Profile's Network Configuration*

L2TP V3 is a standard used for transporting different types of layer 2 frames in an IP network (and Access Point profile). L2TP V3 defines control and encapsulation protocols for tunneling layer 2 frames between two IP nodes.

Use L2TP V3 to create tunnels for transporting layer 2 frames. L2TP V3 enables controllers, service platforms and Access Points to create tunnels for transporting Ethernet frames to and from bridge VLANs and physical ports. L2TP V3 tunnels can be defined between WING devices and other vendor devices supporting the L2TP V3 protocol.

Multiple pseudowires can be created within an L2TP V3 tunnel. WING supported access points support an Ethernet VLAN pseudowire type exclusively.

☑ **NOTE:** A pseudowire is an emulation of a layer 2 point-to-point connection over a *packet-switching network* (PSN). A pseudowire was developed out of the necessity to encapsulate and tunnel layer 2 protocols across a layer 3 network.

Ethernet VLAN pseudowires transport Ethernet frames to and from a specified VLAN. One or more L2TP V3 tunnels can be defined between tunnel end points. Each tunnel can have one or more L2TP V3 sessions. Each tunnel session corresponds to one pseudowire. An L2TP V3 control connection (a L2TP V3 tunnel) needs to be established between the tunneling entities before creating a session.

For optimal pseudowire operation, both the L2TP V3 session originator and responder need to know the psuedowire type and identifier. These two parameters are communicated during L2TP V3 session establishment. An L2TP V3 session created within an L2TP V3 connection also specifies multiplexing parameters for identifying a pseudowire type and ID.

The working status of a pseudowire is reflected by the state of the L2TP V3 session. If a L2TP V3 session is down, the pseudowire associated with it must be shut down. The L2TP V3 control connection keep-alive mechanism can serve as a monitoring mechanism for the pseudowires associated with a control connection.

☑ **NOTE:** If connecting an Ethernet port to another Ethernet port, the pseudowire type must be *Ethernet port*, if connecting an Ethernet VLAN to another Ethernet VLAN, the pseudowire type must be *Ethernet VLAN*.

To define an L2TPV3 configuration for an Access Point profile:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the *Device Browser* in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Expand the **Network** menu and select **L2TPv3**.

5 The **General** tab displays by default with additional **L2RPv3 Tunnel** and **Manual Session** tabs available.

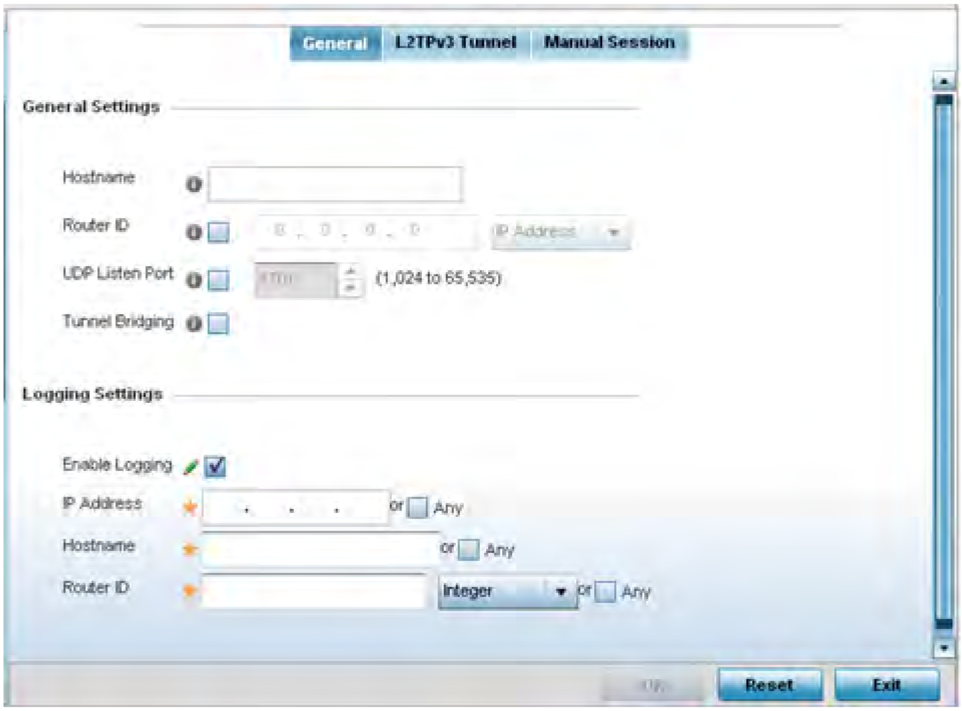


Figure 5-63 *Network - L2TPv3 screen, General tab*

6 Set the following **General Settings** for an L2TPv3 profile configuration:

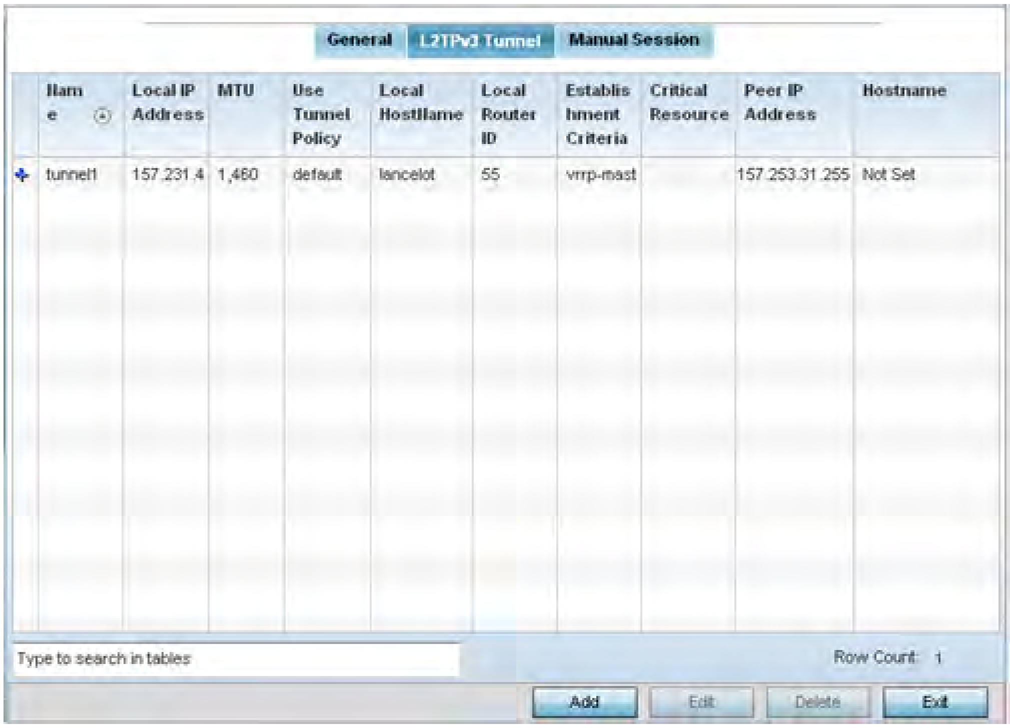
Hostname	Define a 64 character maximum host name to specify the name of the host that's sent tunnel messages. Tunnel establishment involves exchanging 3 message types (SCCRQ, SCCRP and SCCN) with the peer. Tunnel IDs and capabilities are exchanged during the tunnel establishment with the host.
Router ID	Set either the numeric IP address or the integer used as an identifier for tunnel AVP messages. AVP messages assist in the identification of a tunnelled peer.
UDP Listen Port	Select this option to set the port used for listening to incoming traffic. Select a port from 1,024 - 65,535.
Tunnel Bridging	Select this option to *enable* or *disable* bridge packets between two tunnel end points. This setting is disabled by default.

7 Set the following **Logging Settings** for a L2TPv3 profile configuration:

Enable Logging	Select this option to enable the logging of Ethernet frame events to and from bridge VLANs and physical ports on a defined IP address, host or router ID. This setting is disabled by default.
IP Address	Optionally use a peer tunnel ID address to capture and log L2TPv3 events. Use *Any* to log any IP address.
Hostname	If not using an IP address for event logging, optionally use a peer tunnel hostname to capture and log L2TPv3 events. Use *Any* to log any hostname. Hostnames cannot include an underscore character.

Router ID	If not using an IP address or a hostname for event logging, use a router ID to capture and log L2TPv3 events. Use *Any* to log any router ID.

8 Select the **L2TPV3 Tunnel** tab.



	Name	Local IP Address	MTU	Use Tunnel Policy	Local HostName	Local Router ID	Establishment Criteria	Critical Resource	Peer IP Address	Hostname
✦	tunnel1	157.231.4	1,460	default	lancelot	55	vrrp-mast		157.253.31.255	Not Set

Figure 5-64 *Network - L2TPv3 screen, T2TP tunnel tab*

9 Review the following L2TPv3 tunnel configuration data:

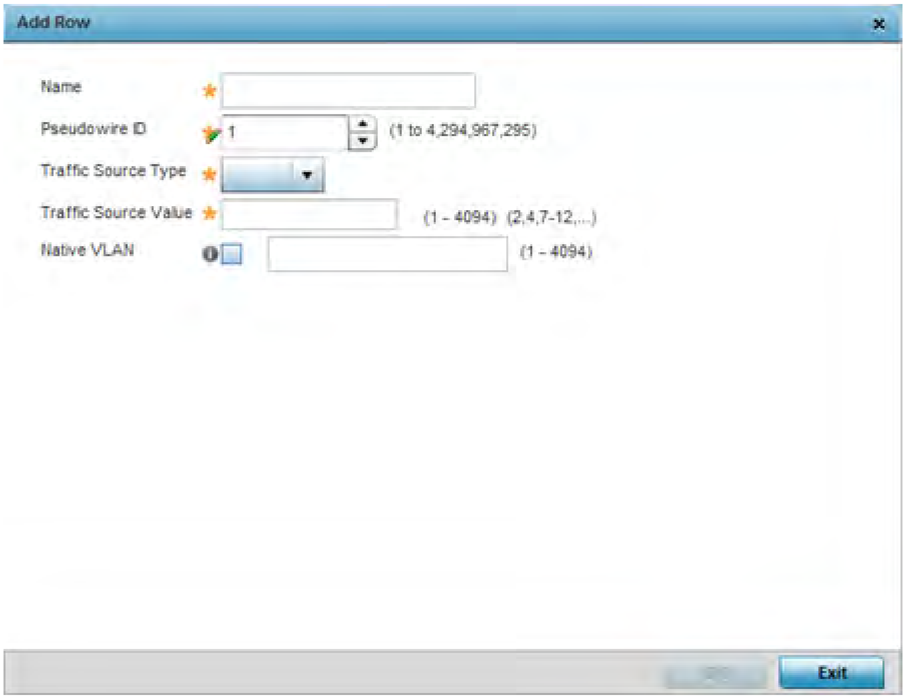
Name	Displays the name of each listed L2TPv3 tunnel assigned upon creation.
Local IP Address	Lists the IP address assigned as the local tunnel end point address, not the interface IP address. This IP is used as the tunnel source IP address. If this parameter is not specified, the source IP address is chosen automatically based on the tunnel peer IP address.
MTU	Displays the *maximum transmission unit* (MTU) size for each listed tunnel. The MTU is the size (in bytes) of the largest protocol data unit that the layer can pass between tunnel peers.
Use Tunnel Policy	Lists the L2TPv3 tunnel policy assigned to each listed tunnel.
Local Hostname	Lists the tunnel specific hostname used by each listed tunnel. This is the host name advertised in tunnel establishment messages.
Local Router ID	Specifies the router ID sent in tunnel establishment messages.
Establishment Criteria	Specifies the criteria required for a tunnel between two peers.

Critical Resource	Specifies the critical resource that should exist for a tunnel between two peers. Critical resources are device IP addresses or interface destinations interopreted as critical to the health of the network. Critical resources allow for the continuous monitoring of these defined addresses. A critical resource, if not available, can result in the network suffering performance degradation. A critical resource can be a gateway, AAA server, WAN interface or any hardware or service on which the stability of the network depends. Critical resources are pinged regularly. If there's a connectivity issue, an event is generated stating a critical resource is unavailable.
Peer IP Address	Specifies the IP address of the tunnel destination peer device.
Hostname	Specifies the administrator assigned hostname of the tunnel.

10 Either select **Add** to create a new L2TPv3 tunnel configuration, **Edit** to modify an existing tunnel configuration or **Delete** to remove a tunnel from those available to this profile.

11 If creating a new tunnel configuration, assign it a 31 character maximum **Name**.

12 Select **+ Add Row** to populate the table with configurable session parameters for this tunnel configuration.



Pseudowire ID: 1 (1 to 4,294,967,295)

Traffic Source Value: (1 - 4094) (2,4,7-12,...)

Native VLAN: □ (1 - 4094)

Figure 5-65 *Network - L2TPv3 screen, Add L2TPv3 Tunnel Configuration*

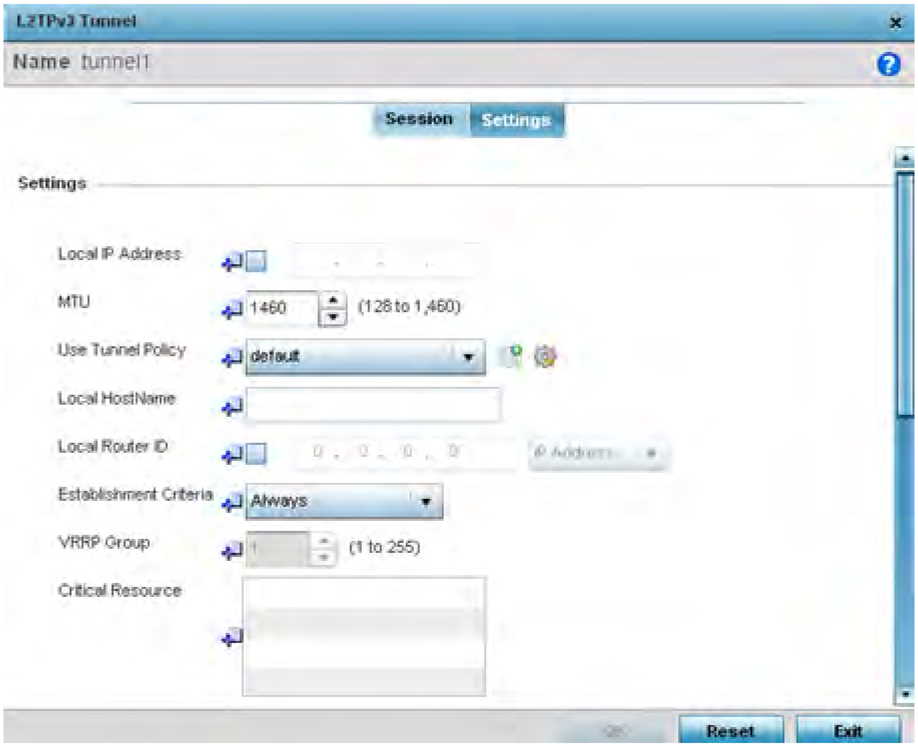
13 Define the following **Session** parameters required for the L2TPv3 tunnel configuration:

Name	Enter a 31 character maximum session name. There is no idle timeout for a tunnel. A tunnel is not usable without a session and a subsequent session name.The tunnel is closed when the last session tunnel session is closed.
Pseudowire ID	Define a psuedowire ID for this session. A pseudowire is an emulation of a layer 2 point-to-point connection over a *packet-switching network* (PSN). A pseudowire was developed out of the necessity to encapsulate and tunnel layer 2 protocols across a layer 3 network.
Traffic Source Type	Lists the type of traffic tunnelled in this session (VLAN etc).

Traffic Source Value	Define a VLAN range to include in the tunnel session.
Native VLAN	Select this option to provide a VLAN ID that will not be tagged in tunnel establishment and packet transfer. Available VLAN ranges are from 1 - 4,094.

14 Select **OK** to save the updates to **Exit** to revert to the last configuration.

15 Select the **Settings** tab.



L2TPv3 Tunnel

Name tunnel1

Session | Settings

Settings

Local IP Address ☐

MTU 1460 (128 to 1,460)

Use Tunnel Policy default

Local HostName

Local Router ID ☐ 0 . 0 . 0 . 0 IP Address

Establishment Criteria Always

VRRP Group 1 (1 to 255)

Critical Resource

Figure 5-66 *Network - L2TPv3 screen, Settings*

16 Define the following **Settings** required for the L2TPv3 tunnel configuration:

Local IP Address	Enter the IP address assigned as the local tunnel end point address, not the interface IP address. This IP is used as the tunnel source IP address. If this parameter is not specified, the source IP address is chosen automatically based on the tunnel peer IP address. This parameter is applicable when establishing the tunnel and responding to incoming tunnel create requests.
MTU	Set the *maximum transmission unit* (MTU). The MTU is the size (in bytes) of the largest protocol data unit the layer can pass between tunnel peers. Define a MTU from 128 - 1,460 bytes. The default setting is 1,460. A larger MTU means processing fewer packets for the same amount of data.
Use Tunnel Policy	Select the L2TPv3 tunnel policy. The policy consists of user defined values for protocol specific parameters which can be used with different tunnels. If none is available, a new policy can be created or an existing one can be modified.
Local Hostname	Provide the tunnel specific hostname used by this tunnel. This is the host name advertised in tunnel establishment messages. Hostnames cannot include an underscore character.

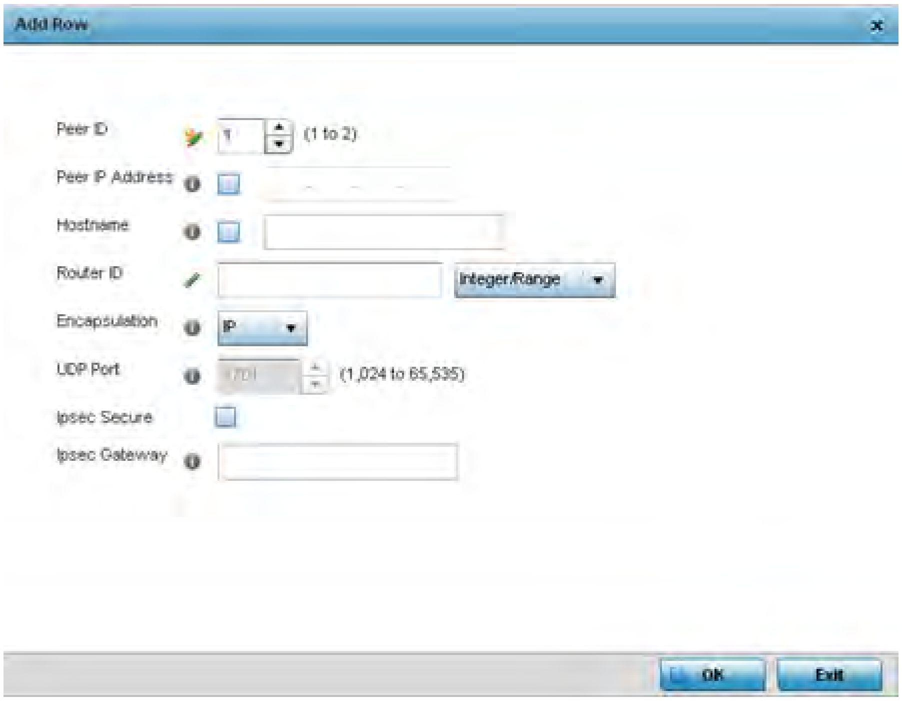
Local Router ID	Specify the router ID sent in tunnel establishment messages with a target peer device.
Establishment Criteria	Specify the establishment criteria for creating a tunnel. The tunnel is only created if this device is one of the following: *vrrp-master* *cluster-master* *rf-domain-manager* The tunnel is always created if *Always* is selected. This indicates the device need not be any one of the above three (3) to establish a tunnel.
VRRP Group	Set the VRRP group ID. VRRP groups is only enabled when the Establishment Criteria is set to vrrp-master.
Critical Resource	The Critical Resources table lists important resources defined for this system. The tunnel is created and maintained only if these critical resources are available. The tunnel is removed if any one of the defined resources goes down or is unreachable.

17 Define the following **Rate Limit** settings for the L2TP tunnel configuration. Rate limiting manages the maximum rate sent to or received from L2TPv3 tunnel members.

Session Name	Use the drop-down menu to select the tunnel session that will have the direction, burst size and traffic rate settings applied.
Direction	Select the direction for L2TPv3 tunnel traffic rate limiting. *Egress* traffic is outbound L2TPv3 tunnel data coming to the controller, service platform or Access Point. *Ingress* traffic is inbound L2TPv3 tunnel data coming to the controller, service platform or Access Point.
Maximum Burst Size	Set the maximum burst size for egress or ingress traffic rate limiting (depending on which direction is selected) on a L2TPv3 tunnel. Set a maximum burst size between 2 - 1024 kbytes. The smaller the burst, the less likely the upstream packet transmission will result in congestion for L2TPv3 tunnel traffic. The default setting is 320 bytes.
Rate	Set the data rate (from 50 - 1,000,000 kbps) for egress or ingress traffic rate limiting (depending on which direction is selected) for an L2TPv3 tunnel. The default setting is 5000 kbps.

18 Refer to the **Peer** table to review the configurations of the peers destinations for tunnel connection.

19 Select **+ Add Row** to populate the table with a maximum of two peer configurations.



Peer ID 1 (1 to 2)

Peer IP Address □

Hostname □

Router ID Integer/Range

Encapsulation IP

UDP Port 1701 (1,024 to 65,535)

Ipsec Secure □

Ipsec Gateway

Figure 5-67 *Network - L2TPv3 screen, Add Peer Configuration*

20 Define the following **Peer** parameters:

Peer ID	Define the primary peer ID used to set the primary and secondary peer for tunnel fail over. If the peer is not specified, tunnel establishment does not occur. However, if a peer tries to establish a tunnel with this Access Point, it creates the tunnel if the hostname and/or Router ID matches.
Peer IP Address	Select this option to enter the numeric IP address used as the destination peer address for tunnel establishment.
Hostname	Assign the peer a hostname that can be used as matching criteria in the tunnel establishment process. Hostnames cannot include an underscore character.
Router ID	Specify the router ID sent in tunnel establishment messages with this specific peer.
Encapsulation	Select either *IP* or *UDP* as the peer encapsulation protocol. The default setting is IP. UDP uses a simple transmission model without implicit handshakes.
IPSec Secure	Enable this option to enable security on the connection between the Access Point and Virtual Controller.
IPSec Gateway	Specify the IP Address of the IPSec Secure Gateway.
UDP Port	If UDP encapsulation is selected, use the spinner control to define the UDP encapsulation port.

21 From back at the **Settings** tab, set the following **Fast Failover** parameters.

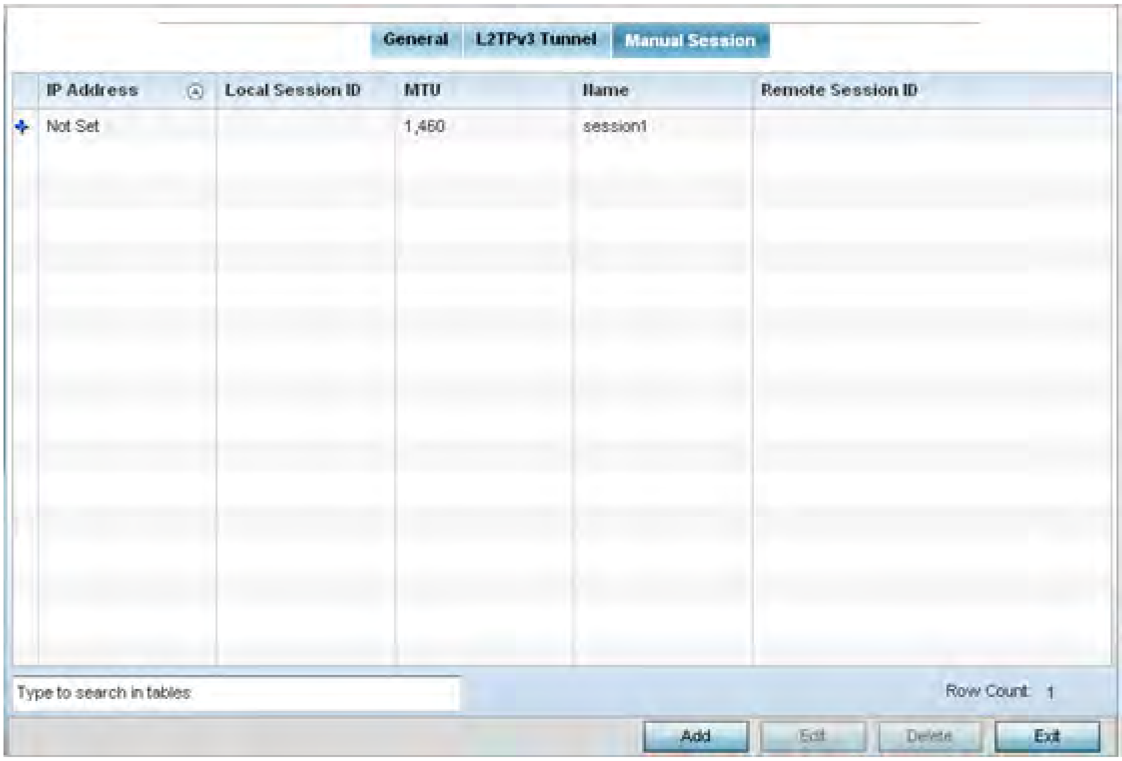
Enable	When enabled, the device starts sending tunnel requests on both peers, and in turn, establishes the tunnel on both peers. If disabled, tunnel establishment only occurs on one peer, with failover and other functionality the same as legacy behavior. If fast failover is enabled after establishing a single tunnel the establishment is restarted with two peers. One tunnels defined as active and the other standby. Both tunnels perform connection health checkups with individual hello intervals. This setting is disabled by default.
Enable Aggressive Mode	When enabled, tunnel initiation hello requests are set to zero. For failure detections, hello attempts are not retried, regardless of defined retry attempts. This setting is disabled by default.

22 Select **OK** to save the peer configuration.

23 Select **OK** to save the changes within the T2TP Tunnel screen. Select **Reset** to revert the screen to its last saved configuration.

24 Select the **Manual Session** tab.

Individual sessions can be created after a successful tunnel connection and establishment. Each session is a single data stream. After successful session establishment, data corresponding to that session (pseudowire) can be transferred. If a session is down, the pseudowire associated with it is shut down as well.



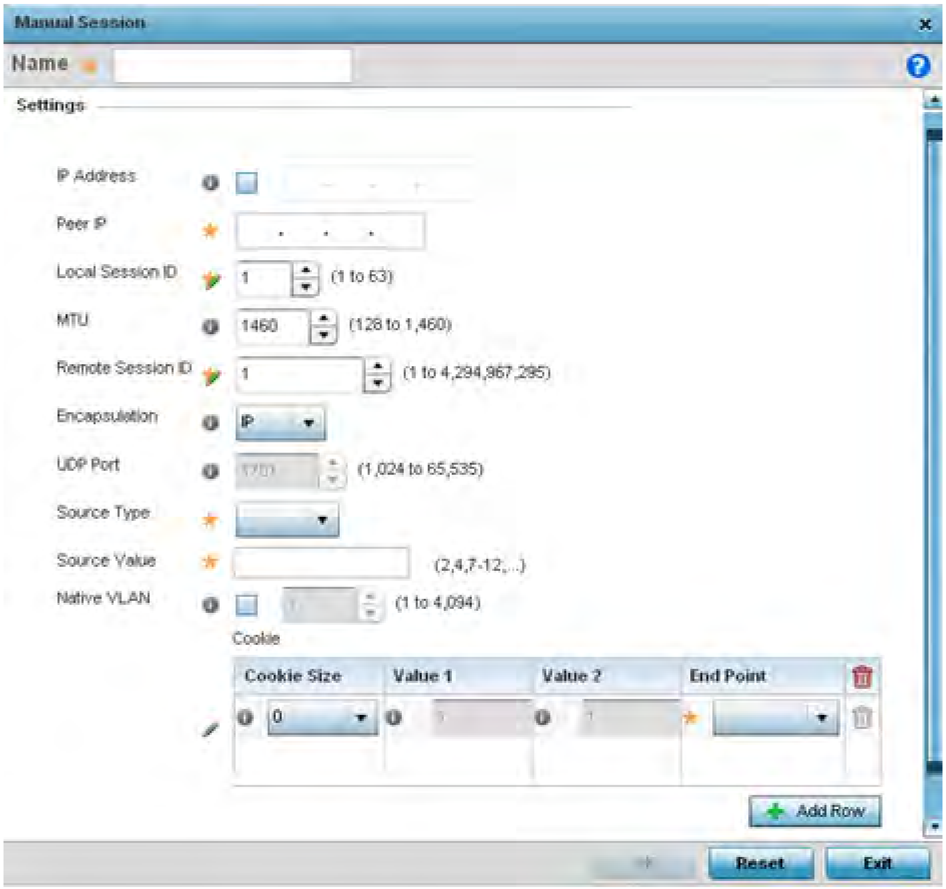
IP Address	Local Session ID	MTU	Name	Remote Session ID
Not Set		1,460	session1	

Figure 5-68 *Network - L2TPv3 screen, Manual Session tab*

25 Refer to the following manual session configurations to determine whether one should be created or modified:

IP Address	Lists the IP address assigned as the local tunnel end point address, not the interface IP address. This IP is used as the tunnel source IP address. If this parameter is not specified, the source IP address is chosen automatically based on the tunnel peer IP address. This parameter is applicable when establishing the session and responding to incoming requests.
Local Session ID	Displays the numeric identifier assigned to each listed tunnel session. This is the pseudowire ID for the session. This pseudowire ID is sent in a session establishment message to the L2TP peer.
MTU	Displays each sessions's *maximum transmission unit* (MTU). The MTU is the size (in bytes) of the largest protocol data unit the layer can pass between tunnel peers in this session. A larger MTU means processing fewer packets for the same amount of data.
Name	Lists the name assigned to each listed manual session.
Remote Session ID	Lists the remote session ID passed in the establishment of the tunnel, used a a unique identifier for this tunnel session.

26 Select **Add** to create a new manual session, **Edit** to modify an existing session configuration or **Delete** to remove a selected manual session.



IP Address □

Peer IP

Local Session ID 1 (1 to 63)

MTU 1460 (128 to 1,460)

Remote Session ID 1 (1 to 4,294,967,295)

Encapsulation IP

UDP Port 1701 (1,024 to 65,535)

Source Type

Source Value (2,4,7-12,...)

Native VLAN □ 1 (1 to 4,094)

Cookie

Cookie Size	Value 1	Value 2	End Point
0	1	1	

Figure 5-69 *Network - L2TPv3 screen, Add T2TP Peer Configuration*

27 Set the following session parameters:

Name	Define a 31 character maximum name of this tunnel session. After a successful tunnel connection and establishment, the session is created. Each session name represents a single data stream.
IP Address	Specify the IP address used to be as tunnel source IP address. If not specified, the tunnel source IP address is selected automatically based on the tunnel peer IP address. This address is applicable only for initiating the tunnel. When responding to incoming tunnel create requests, it would use the IP address on which it had received the tunnel create request.
Peer IP	Set the IP address of an L2TP tunnel destination peer. This is the peer allowed to establish the tunnel.
Local Session ID	Set the numeric identifier for the tunnel session. This is the pseudowire ID for the session. This pseudowire ID is sent in a session establishment message to the L2TP peer.
MTU	Define the session's *maximum transmission unit* (MTU) as the size (in bytes) of the largest protocol data unit the layer can pass between tunnel peers in this session. A larger MTU means processing fewer packets for the same amount of data.
Remote Session ID	Use the spinner control to set the remote session ID passed in the establishment of the tunnel and sed a a unique identifier for this tunnel session. Assign an ID from 1 - 4,294,967,295.
Encapsulation	Select either *IP* or *UDP* as the peer encapsulation protocol. The default setting is IP. UDP uses a simple transmission model without implicit handshakes.
UDP Port	If UDP encapsulation is selected, use the spinner control to define the UDP encapsulation port. This is the port where the L2TP service is running.
Source Type	Select a VLAN as the virtual interface source type.
Source Value	Define the *Source Value* range (1 - 4,094) to include in the tunnel. Tunnel session data includes VLAN tagged frames.
Native VLAN	Select this option to define the native VLAN that's not tagged.

28 Select the **+ Add Row** button to set the following:

Cookie Size	Set the size of the cookie field within each L2TP data packet. Options include *0*, *4* and *8*. The default setting is 0.
Value 1	Set the cookie value first word.
Value 2	Set the cookie value second word.
End Point	Define whether the tunnel end point is *local* or *remote.*

29 Select **OK** to save the changes to the session configuration. Select **Reset** to revert to the last saved configuration.

5.2.8.4 Overriding a Profile’s GRE Configuration

▸ *Overriding a Profile’s Network Configuration*

Generic routing encapsulation (GRE) tunneling can be configured to bridge Ethernet packets between WLANs and a remote WLAN gateway over a GRE tunnel. The tunneling of 802.3 packets using GRE is an alternative to MiNT or L2TPv3. Related features like ACLs for extended VLANs are still available using layer 2 tunneling over GRE.

Using GRE, Access Points map one or more VLANs to a tunnel. The remote endpoint is a user-configured WLAN gateway IP address, with an optional secondary IP address should connectivity to the primary GRE peer be lost. VLAN traffic is expected in both directions in the GRE tunnel. A WLAN mapped to these VLANs can be either open or secure. Secure WLANs require authentication to a remote RADIUS server available within your deployment using standard RADIUS protocols. Access Points can reach both the GRE peer as well as the RADIUS.

Previous releases supported only IPv4 tunnel end points, now support for both IPv4 or IPv6 tunnel endpoints is available. However, a tunnel needs to contain either IPv4 or IPv6 formatted device addresses and cannot be mixed. With the new IPv6 tunnel implementation, all outbound packets are encapsulated with the GRE header, then the IPv6 header. The header source IP address is the local address of the IPv6 address of tunnel interface, and the destination address peer address of the tunnel. All inbound packets are de-capsulated by removing the IPv6 and GRE header before sending it over to the IP stack.

To define a profile’s GRE settings:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

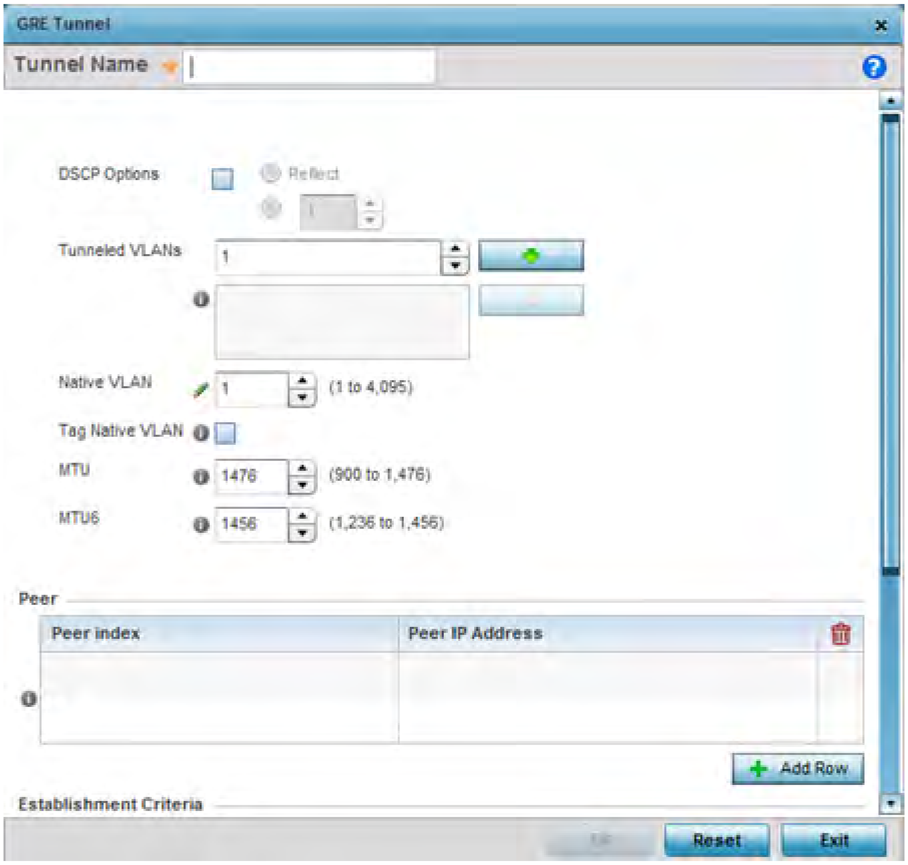
4 Select **Network** to expand its sub menu options.

5 Select **GRE.**

The screen displays existing GRE configurations.

6 Select the **Add** button to create a new GRE tunnel configuration or select an existing tunnel and select **Edit** to modify its current configuration. To remove an existing GRE tunnel, select it from amongst those displayed and select the **Delete** button.

☑ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override, go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



GRE Tunnel

Tunnel Name

DSCP Options □ ○ Reflect ○ 1

Tunneled VLANs 1

Native VLAN 1 (1 to 4,095)

Tag Native VLAN □

MTU 1476 (900 to 1,476)

MTU6 1456 (1,236 to 1,456)

Peer

Peer index	Peer IP Address

Establishment Criteria

Figure 5-70 *Profile Overrides - Network GRE screen*

7 If creating a new GRE configuration, assign it a 32 character maximum name to distinguish its configuration.

8 Define the following settings for the GRE configuration:

DSCP Options	Use the spinner control to set the tunnel DSCP / 802.1q priority value from encapsulated packets to the outer packet IPv4 header.
Tunneled VLANs	Define the VLAN connected clients use to route GRE tunneled traffic within their respective WLANs.
Native VLAN	Set a numerical VLAN ID (1 - 4094) for the native VLAN. The native VLAN allows an Ethernet device to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame. Additionally, the native VLAN is the VLAN untagged traffic is directed over when using a port in trunk mode.

Tag Native VLAN	Select this option to tag the native VLAN. The IEEE 802.1Q specification is supported for tagging frames and coordinating VLANs between devices. IEEE 802.1Q adds four bytes to each frame identifying the VLAN ID for upstream devices that the frame belongs. If the upstream Ethernet device does not support IEEE 802.1Q tagging, it does not interpret the tagged frames. When VLAN tagging is required between devices, both devices must support tagging and be configured to accept tagged VLANs. When a frame is tagged, the 12 bit frame VLAN ID is added to the 802.1Q header so upstream Ethernet devices know which VLAN ID the frame belongs to. The device reads the 12 bit VLAN ID and forwards the frame to the appropriate VLAN. When a frame is received with no 802.1Q header, the upstream device classifies the frame using the default or native VLAN assigned to the Trunk port. The native VLAN allows an Ethernet device to associate untagged frames to a VLAN when no 802.1Q frame is included in the frame. This feature is disabled by default.
MTU	Set an IPv4 tunnel's *maximum transmission unit* (MTU) from 128 - 1,476. The MTU is the largest physical packet size (in bytes) transmittable within the tunnel. Any messages larger than the MTU are divided into smaller packets before being sent. A larger MTU provides greater efficiency because each packet carries more user data while protocol overheads, such as headers or underlying per-packet delays, remain fixed; the resulting higher efficiency means a slight improvement in bulk protocol throughput. A larger MTU results in the processing of fewer packets for the same amount of data. For IPv4, the overhead is 24 bytes (20 bytes IPv4 header + 4 bytes GRE Header), thus the default setting for an IPv4 MTU is 1,476.
MTU6	Set an IPv6 tunnel's MTU from 128 - 1,456. The MTU is the largest physical packet size (in bytes) transmit able within the tunnel. Any messages larger than the MTU are divided into smaller packets before being sent. A larger MTU provides greater efficiency because each packet carries more user data while protocol overheads, such as headers or underlying per-packet delays, remain fixed; the resulting higher efficiency means a slight improvement in bulk protocol throughput. A larger MTU results in the processing of fewer packets for the same amount of data. For IPv6, the overhead is 44 bytes (40 bytes IPv6 header + 4 bytes GRE header), thus the default setting for an IPv6 MTU is 1,456.

9 The **Peer** table lists the credentials of the GRE tunnel end points. Add new table rows as needed to add additional GRE tunnel peers.

Select **+ Add Row** to populate the table with a maximum of two peer configurations.

10 Define the following **Peer** parameters:

Peer Index	Assign a numeric index to each peer to help differentiate tunnel end points.

Peer IP Address	Define the IP address of the added GRE peer to serve as a network address identifier. Designate whether the IP is formatted as an IPv4 or IPv6 address. *IPv4* is a connectionless protocol for packet switched networking. IPv4 operates as a best effort delivery method, as it does not guarantee delivery, and does not ensure proper sequencing or duplicate delivery (unlike TCP). IPv4 hosts can use link local addressing to provide local connectivity. *IPv6* is the latest revision of the Internet Protocol (IP) designed to replace IPv4. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are eight groups of four hexadecimal digits separated by colons.

11 Set the following **Establishment Criteria** for the GRE tunnel configuration:

Criteria	Specify the establishment criteria for creating a GRE tunnel. In a multi-controller within a RF domain, it's always the master node with which the tunnel is established. The tunnel is only created if the tunnel device is designated one of the following: vrrp-master cluster-master rf-domain-manager The tunnel is automatically created if *Always* (default setting) is selected. This indicates the device need not be any one of the above three (3) to establish a tunnel.
VRRP Group	Set the VRRP group ID only enabled when the *Establishment Criteria* is set to *vrrp-master*. A *virtual router redundancy group* (VRRP) enables the creation of a group of routers as a default gateway for redundancy. Clients can point to the IP address of the VRRP virtual router as their default gateway and utilize a different group member if a master becomes unavailable.

12 Define or override the following **Failover** parameters to apply to the GRE tunnel configuration:

Enable Failover	Select this option to periodically ping the primary gateway to assess its availability. If the primary gateway is unreachable.
Ping Interval	Set the duration between two successive pings to the gateway. Define this value in seconds from 1 - 21,600.
Number of Retries	Set the number of ping retries (from 1 - 63) when no response is received before the session is terminated.

13 Select the **OK** button to save the changes and overrides to the GRE configuration. Select **Reset** to revert to the last saved configuration.

5.2.8.5 Overriding a Profile's IGMP Snooping Configuration

▸ *Overriding a Profile's Network Configuration*

The *Internet Group Management Protocol* (IGMP) is used for managing IP multicast group members. The controller or service platform listens to IGMP network traffic and forwards the IGMP multicast packets to radios on which the interested hosts are connected. On the wired side of the network, the controller or service platform floods all the wired interfaces. This feature reduces unnecessary flooding of multicast traffic in the network.

To define a Profile's IGMP settings:

1 Select **Devices** from the Configuration tab.

  The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

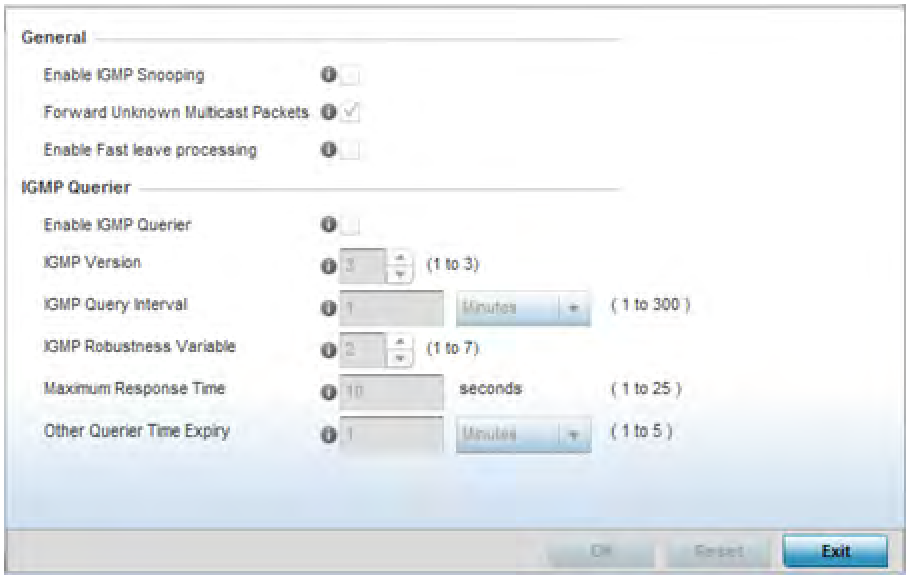
  Devices can also be selected directly from the *Device Browser* in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **IGMP Snooping**.

> ☑ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override, go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



General

Enable IGMP Snooping □

Forward Unknown Multicast Packets ☑

Enable Fast leave processing □

IGMP Querier

Enable IGMP Querier □

IGMP Version 3 (1 to 3)

IGMP Query Interval 1 Minutes (1 to 300)

IGMP Robustness Variable 2 (1 to 7)

Maximum Response Time 10 seconds (1 to 25)

Other Querier Time Expiry 1 Minutes (1 to 5)

Figure 5-71 *Profile Overrides - Network IGMP Snooping*

6 Define or override the following **General IGMP Snooping** parameters for the bridge VLAN configuration:

Enable IGMP Snooping	Select this option to enable IGMP snooping. If disabled, snooping on a per VLAN basis is also disabled. This feature is enabled by default. If disabled, the settings under the bridge configuration are overridden. For example, if IGMP snooping is disabled, but the bridge VLAN is enabled, the effective setting is disabled.

Forward Unknown Multicast Packets	Select this option to enable the forwarding of multicast packets from unregistered multicast groups. If disabled (the default setting), the unknown multicast forward feature is also disabled for individual VLANs.
Enable Fast leave processing	Select this option to remove a Layer 2 LAN interface from the IGMP snooping forwarding table entry without initially sending IGMP group-specific queries to the interface. When receiving a group-specific IGMPv2 leave message, IGMP snooping removes the interface from the Layer 2 forwarding table entry for that multicast group, unless a multicast router was learned on the port. Fast-leave processing enhances bandwidth management for all hosts on the network.

7 Set or override the following **IGMP Querier** parameters for the profile's bridge VLAN configuration:

Enable IGMP Querier	Select this option to enable IGMP querier. IGMP snoop querier is used to keep host memberships alive. It's primarily used in a network where there's a multicast streaming server and hosts subscribed to the server and no IGMP querier present. An IGMP querier sends out periodic IGMP query packets. Interested hosts reply with an IGMP report packet. IGMP snooping is only conducted on wireless radios. IGMP multicast packets are flooded on wired ports. IGMP multicast packet are not flooded on the wired port. IGMP membership is also learnt on it and only if present, then it is forwarded on that port.
IGMP Version	Use the spinner control to set the IGMP version compatibility to either version 1, 2 or 3. IGMPv1 is defined by RFC 1112, IGMPv2 is defined by RFC 2236 and IGMPv3 defined by RFC 4604 which defines both IGMPv3 and MLDv2. IGMPv2 improves over IGMPv1 by adding the ability for a host to signal desire to leave a multicast group. IGMPv3 improves over IGMPv2 by adding the ability to listen to multicast traffic originating from a set of source IP addresses exclusively. The default setting is 3.
IGMP Query Interval	Set the interval IGMP queries are made. Options include *Seconds* (1 - 18,000), *Minutes* (1 - 300) and *Hours* (1 - 5). The default setting is one minute.
IGMP Robustness Variable	IGMP utilizes a robustness value used by the sender of a query. Update the robustness variable to match the most recently received query unless the value is zero.
Maximum Response Time	Specify the maximum interval (from 1 - 25 seconds) before sending a responding report. When no reports are received from a radio, radio information is removed from the snooping table. The controller or service platform only forwards multicast packets to radios present in the snooping table. For IGMP reports from wired ports, the controller or service platform forwards these reports to the multicast router ports. The default setting is 10 seconds.
Other Querier Timer Expiry	Specify an interval in either *Seconds* (60 - 300) or *Minutes* (1 - 5) used as a timeout interval for other querier resource connections. The default setting is 1 minute.

8 Select the **OK** button to save the changes and overrides to the IGMP Snooping tab. Select **Reset** to revert to the last saved configuration.

5.2.8.6 Overriding a Profile's MLD Snooping Configuration

▶ *Overriding a Profile's Network Configuration*

Multicast Listener Discovery (MLD) snooping enables a controller, service platform or Access Point to examine MLD packets and make forwarding decisions based on content. MLD is used by IPv6 devices to discover devices wanting to receive multicast packets destined for specific multicast addresses. MLD uses multicast listener queries and multicast listener reports to identify which multicast addresses have listeners and join multicast groups.

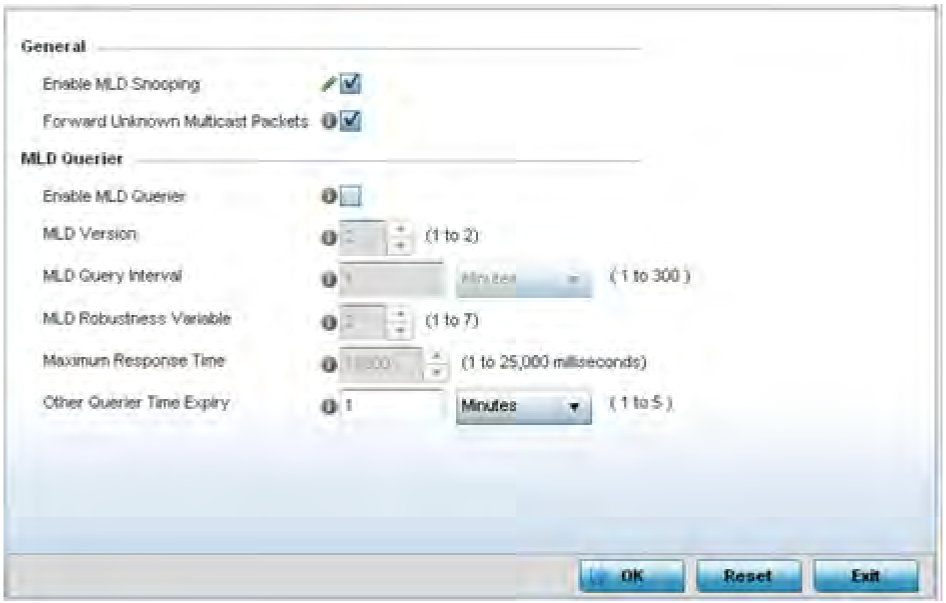
MLD snooping caps the flooding of IPv6 multicast traffic on controller, service platform or Access Point VLANs. When enabled, MLD messages are examined between hosts and multicast routers and to discern which hosts are receiving multicast group traffic. The controller, service platform or Access Point then forwards multicast traffic only to those interfaces connected to interested receivers instead of flooding traffic to all interfaces.

To set an IPv6 MLD snooping configuration for the profile:

1 Select **Configuration** > **Profiles** > **Network**.

2 Expand the Network menu to display its submenu options.

3 Select **MLD Snooping**.



General

Enable MLD Snooping ☑

Forward Unknown Multicast Packets ☑

MLD Querier

Enable MLD Querier □

MLD Version 2 (1 to 2)

MLD Query Interval 1 Minutes (1 to 300)

MLD Robustness Variable 2 (1 to 7)

Maximum Response Time 10000 (1 to 25,000 milliseconds)

Other Querier Time Expiry 1 Minutes (1 to 5)

Figure 5-72 *Profile - Network MLD Snooping screen*

4 Define the following **General** MLD snooping settings:

Enable MLD Snooping	Enable MLD snooping to examine MLD packets and make content forwarding for this profile. Packets delivered to group members are identified by a single multicast group address. Multicast packets are delivered to a group using best-effort reliability, just like IPv6 unicast. MLD snooping is disabled by default.
Forward Unknown Multicast Packets	Use this option to either enable or disable IPv6 unknown multicast forwarding. This setting is enabled by default.

5 Define the following **MLD Querier** settings for the MLD snooping configuration:

Enable MLD Querier	Select the option to enable MLD querier on the controller, service platform or Access Point. When enabled, the device sends query messages to discover which network devices are members of a given multicast group. This setting is disabled by default.
MLD Version	Define whether MLD version *1* or *2* is utilized as the MLD querier. MLD version 1 is based on IGMP version 2 for IPv4. MLD version 2 is based on IGMP version 3 for IPv4 and is fully backward compatible. IPv6 multicast uses MLD version 2. The default MLD version is 2.
MLD Query Interval	Set the interval in which query messages are sent to discover device multicast group memberships. Set an interval in either *Seconds* (1 - 18,000), *Minutes* (1 - 300) or *Hours* (1 - 5). The default interval is 1 minute.
MLD Robustness Variable	Set a MLD IGMP robustness value (1 - 7) used by the sender of a query. The MLD robustness variable enables refinements to account for expected packet loss on a subnet. Increasing the robust count allows for more packet loss, but increases the leave latency of the subnetwork unless the value is zero. The default variable is 2.
Maximum Response Time	Specify the maximum response time (from 1 - 25,000 milliseconds) before sending a responding report. Queriers use MLD reports to join and leave multicast groups and receive group traffic. The default setting is 10 milliseconds.
Other Querier time Expiry	Specify an interval in either *Seconds* (60 - 300) or *Minutes* (1 - 5) used as a timeout interval for other querier resources. The default setting is 1 minute.

6 Select the **OK** button located to save the changes. Select **Reset** to revert to the last saved configuration.

5.2.8.7 Overriding a Profile's Quality of Service (QoS) Configuration

▸ *Overriding a Profile's Network Configuration*

The controller or service platform use different *Quality of Service (QoS)* screens to define WLAN and device radio QoS and traffic shaping configurations for profiles.

Traffic shaping regulates network data transfers to ensure a specific performance level. Traffic shaping delays the flow of packets defined as less important than prioritized traffic streams. Traffic shaping enables traffic control out an interface to match its flow to the speed of a remote target's interface and ensure traffic conforms applied policies. Traffic can be shaped to meet downstream requirements and eliminate network congestion when data rates are in conflict.

QoS values are required to provide priority of service to some packets over others. For example, VoIP packets get higher priority than data packets to provide a better quality of service for high priority voice traffic.

The profile QoS screen maps the 6-bit *Differentiated Service Code Point* (DSCP) code points to the older 3-bit IP Precedent field located in the Type of Service byte of an IP header. DSCP is a protocol for specifying and controlling network traffic by class so that certain traffic types get precedence. DSCP specifies a specific per-hop behavior that is applied to a packet. This QoS assignment can be overridden as needed, but removes the device configuration from the profile that may be shared with other similar device models.

To define an QoS configuration:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

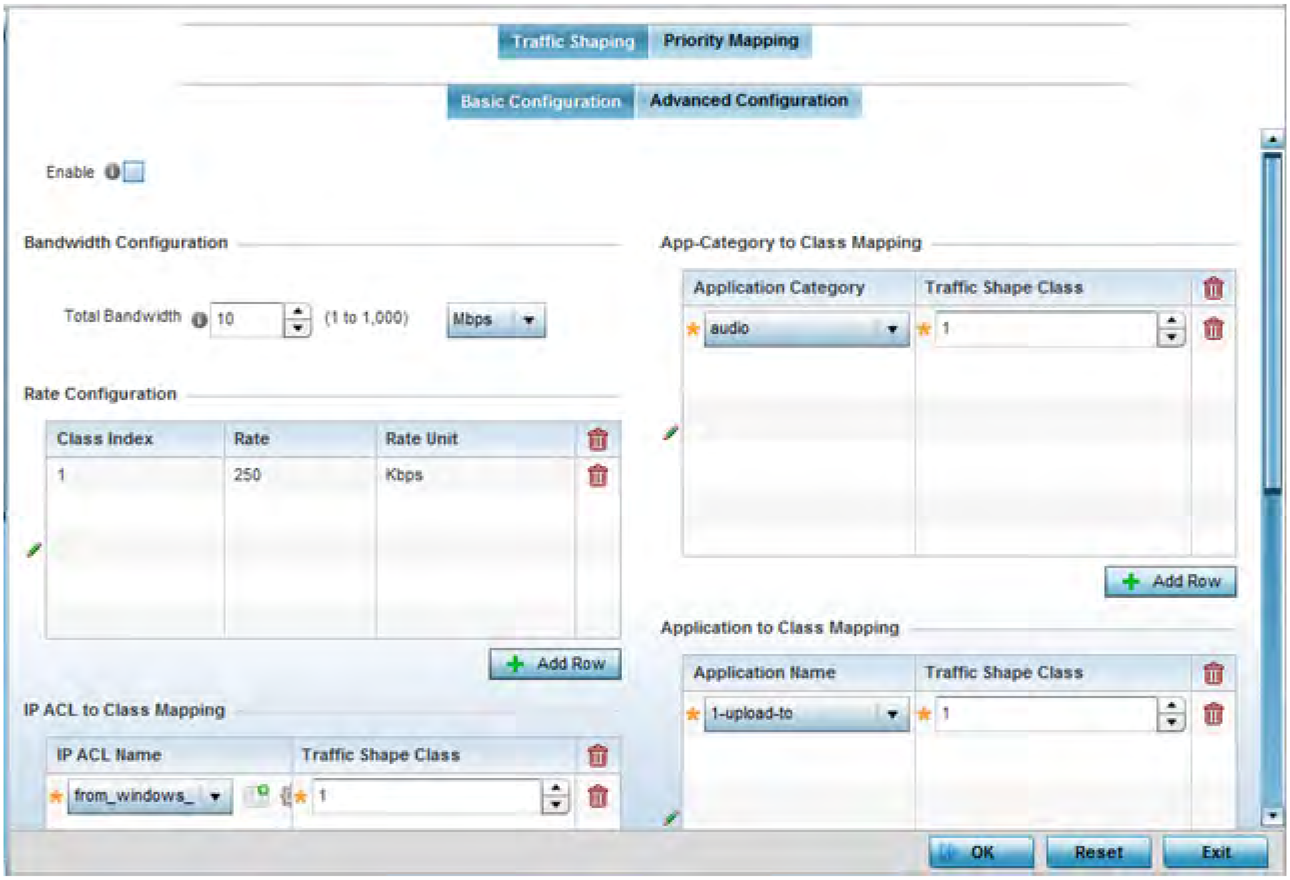
Devices can also be selected directly from the *Device Browser* in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **Quality of Service**.

The **Traffic Shaping** screen displays with the **Basic Configuration** tab displayed by default.



Enable ☐

Bandwidth Configuration

Total Bandwidth 10 (1 to 1,000) Mbps

Rate Configuration

Class Index	Rate	Rate Unit
1	250	Kbps

IP ACL to Class Mapping

IP ACL Name	Traffic Shape Class
from_windows_	1

App-Category to Class Mapping

Application Category	Traffic Shape Class
audio	1

Application to Class Mapping

Application Name	Traffic Shape Class
1-upload-to	1

Figure 5-73 *Profile Overrides - Network QoS Traffic Shaping Basic Configuration screen*

Apply traffic shaping to specific applications to apply application categories. When application and ACL rules are conflicting, applications have priority, followed by application categories, then ACLs.

6 Select **Enable** to provide traffic shaping using the defined bandwidth, rate and class mappings.

7 Set the **Total Bandwidth** configurable for the traffic shaper. Set the value from either 1 - 1,000 Mbps, or from 250 - 1,000,000 Kbps.

8 Select **+ Add Row** within the **Rate Configuration** table to set the **Class Index** and **Rate** (in either Kbps, Mbps or percentage) for the traffic shaper class. Use the rate configuration to control the maximum traffic rate sent or received on the device. Consider this form of rate limiting on interfaces at the edge of a network to limit traffic

into or out of the network. Traffic within the set limit is sent and traffic exceeding the set limit is dropped or sent with a different priority.

9 Refer to the **IP ACL Class Mapping** table and select **+ Add Row** to apply an IPv4 formatted ACL to the shaper class mapping. Select **+ Add Row** to add mappings. For more information on creating IP based firewall rules, refer to Configuring IP Firewall Rules on page 10-20 and Setting an IPv4 or IPv6 Firewall Policy on page 10-21.

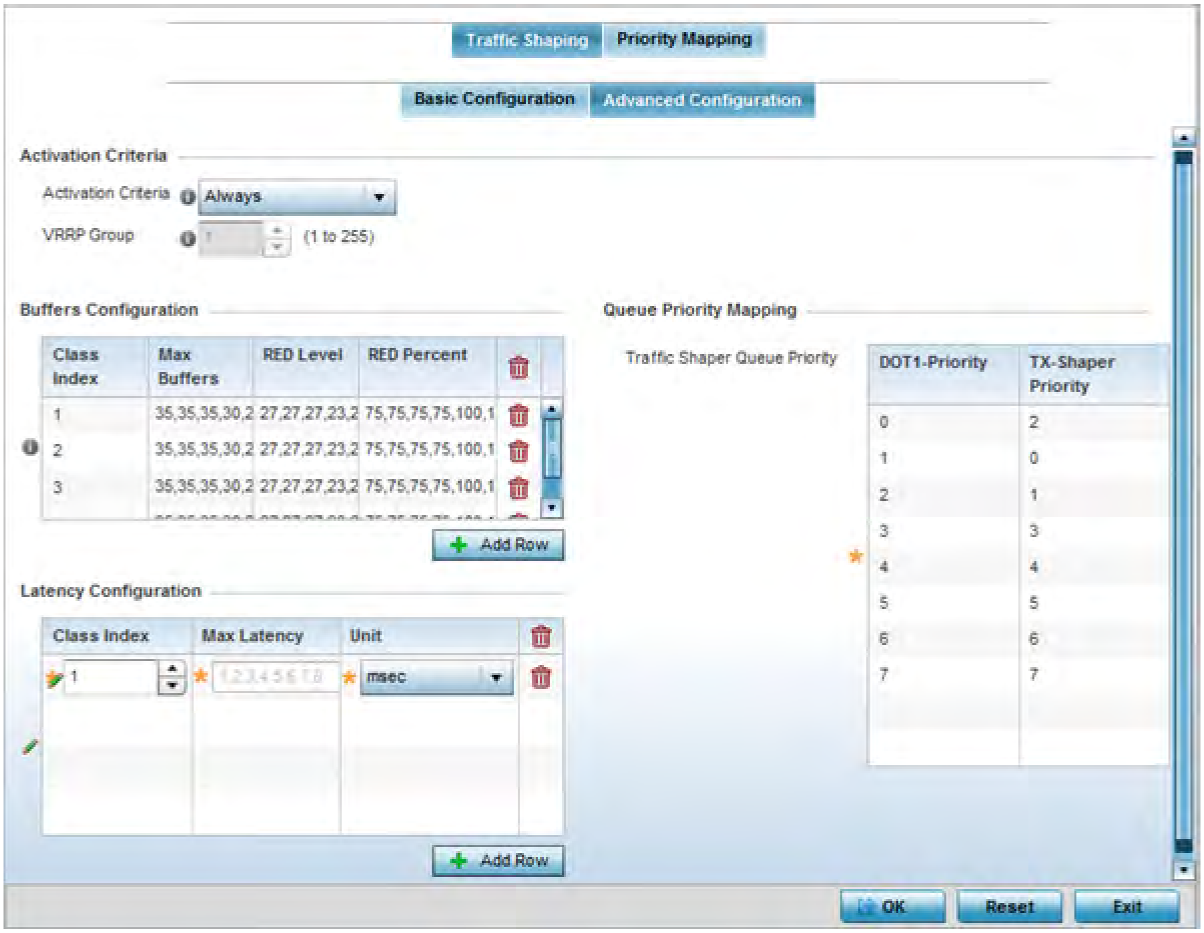
10 Refer to the **IPv6 ACL Class Mapping** table and select **+ Add Row** to apply an IPv6 formatted ACL to the shaper class mapping. Select **+ Add Row** to add mappings. For more information on creating IP based firewall rules, refer to Configuring IP Firewall Rules on page 10-20 and Setting an IPv4 or IPv6 Firewall Policy on page 10-21.

11 Refer to the **App-Category to Class Mapping** table and select **+ Add Row** to apply an application category to shaper class mapping. Select **+ Add Row** to add mappings by selecting the application category and its traffic shaper class. For more information on creating an application category, refer to Application on page 7-58.

12 Refer to the **Application to Class Mapping** table and select **+ Add Row** to apply an application to shaper class mapping. Select **+ Add Row** to add mappings by selecting the application and its traffic shaper class. For more information on creating an application, refer to Application on page 7-58.

13 Select the **OK** button located to save the changes to the traffic shaping basic configuration. Select **Reset** to revert to the last saved configuration.

14 Select the **Advanced Configuration** tab.



Activation Criteria

Activation Criteria: Always

VRRP Group: 1 (1 to 255)

Buffers Configuration

Class Index	Max Buffers	RED Level	RED Percent
1	35,35,35,30,2	27,27,27,23,2	75,75,75,75,100,1
2	35,35,35,30,2	27,27,27,23,2	75,75,75,75,100,1
3	35,35,35,30,2	27,27,27,23,2	75,75,75,75,100,1

Latency Configuration

Class Index	Max Latency	Unit
1	1,2,3,4,5,6,7,8	msec

Queue Priority Mapping

Traffic Shaper Queue Priority

DOT1-Priority	TX-Shaper Priority
0	2
1	0
2	1
3	3
4	4
5	5
6	6
7	7

Figure 5-74 *Profile Overrides - Network QoS Traffic Shaping Advanced Configuration screen*

15 Set the following **Activation Criteria** for traffic shaper activation:

Activation Criteria	Use the drop-down menu to determine when the traffic shaper is invoked. Options include *vrrp-master, cluster-master*, *rf-domain-manager* and *Always*. A *VRRP master* responds to ARP requests, forwards packets with a destination link MAC layer address equal to the virtual router MAC layer address, rejects packets addressed to the IP associated with the virtual router and accepts packets addressed to the IP associated with the virtual router. The solitary *cluster master* is the cluster member elected, using a priority assignment scheme, to provide management configuration and Smart RF data to other cluster members. Cluster requests go through the elected master before dissemination to other cluster members. The RF Domain manager is the elected member capable of storing and provisioning configuration and firmware images for other members of the RF Domain.
VRRP Group	Set the VRRP group ID from 1 - 255. VRRP groups is only enabled when the Establishment Criteria is set to vrrp-master.

16 Select **+ Add Row** within the **Buffers Configuration** table to set the following:

Class Index	Set a class index from 1 - 4.
Max Buffers	Se the *Max Buffers* to specify the queue length limit after which the queue starts to drop packets. Set the maximum queue lengths for packets. The upper length is 400 for Access Points.
RED Level	Set the packet queue length for RED. The upper limit is 400 for Access Points. The rate limiter uses the *random early detection* (RED) algorithm for rate limiting traffic. RED is a queueing technique for congestion avoidance. RED monitors the average queue size and drops or marks packets. If the buffer is near empty, all incoming packets are accepted. When the queue grows, the probability for dropping an incoming packet also grows. When the buffer is full, the probability has reached 1 and all incoming packets are dropped.
RED Percent	Set a percentage (1 - 100) for RED rate limiting at a percentage of maximum buffers.

17 Select **+ Add Row** within the **Latency Configuration** table to set the **Class Index** (1 - 4), **Max Latency** and latency measurement **Unit**. Max latency specifies the time limit after which packets start dropping (maximum packet delay in the queue). The maximum number of entries is 8. Select whether *msec* (default) or *usec* is unit for latency measurement.

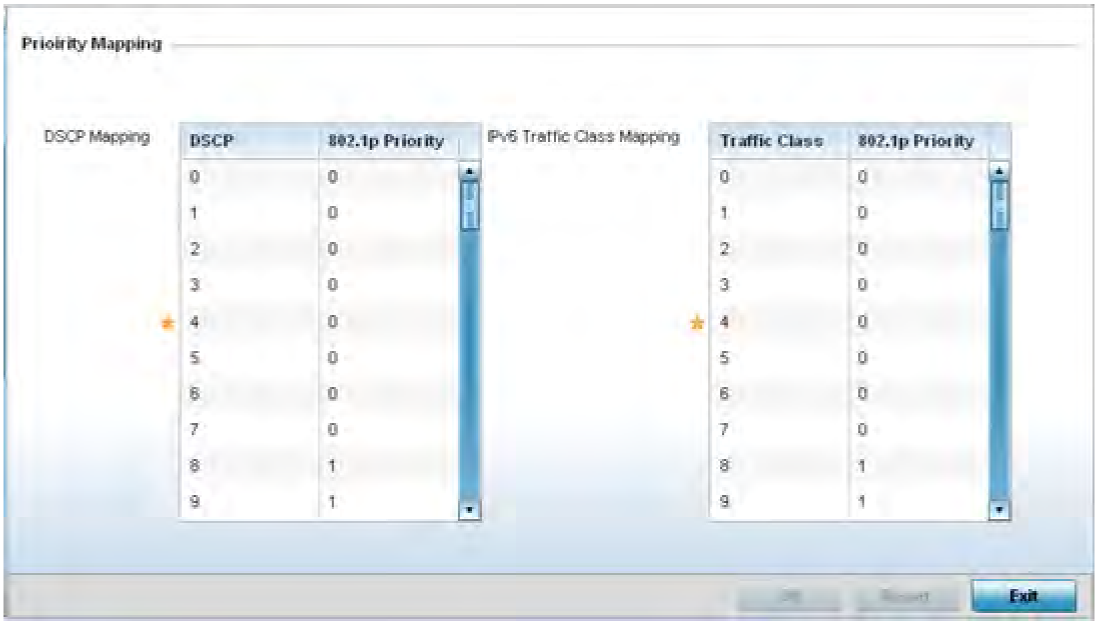
When a new packet arrives it knows how much time to wait in the queue. If a packet takes longer than the latency value it's dropped. By default latency is not set, so packets remain in queue for long time.

18 Refer to the **Que Priority Mapping** table to set the traffic shaper queue priority and specify a particular queue inside a class. There are 8 queues (0 - 7), and traffic is queued in each based on incoming packets mark 802.1p markings.

19 Select the **OK** button located to save the changes to the traffic shaping advanced configuration. Select **Reset** to revert to the last saved configuration.

20 Select the **Priority Mapping** tab.

> **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



DSCP Mapping

DSCP	802.1p Priority
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	1
9	1

IPv6 Traffic Class Mapping

Traffic Class	802.1p Priority
0	0
1	0
2	0
3	0
4	0
5	0
6	0
7	0
8	1
9	1

Figure 5-75 *Profile Overrides - Network QoS screen*

21 Set or override the following parameters for IP **DSCP Mappings** for untagged frames:

DSCP	Lists the DSCP value as a 6-bit parameter in the header of every IP packet used for packet classification.
802.1p Priority	Assign a 802.1p priority as a 3-bit IP precedence value in the Type of Service field of the IP header used to set the priority. The valid values for this field are 0-7. Up to 64 entries are permitted. The priority values are: 0 – *Best Effort* 1 – *Background* 2 – *Spare* 3 – *Excellent Effort* 4 – *Controlled Load* 5 – *Video* 6 – *Voice* 7 – *Network Control*

22 Set or override the following parameters for **IPv6 Traffic Class Mapping** for untagged frames:

Traffic Class	Devices that originate a packet must identify different classes or priorities for IPv6 packets. Devices use the traffic class field in the IPv6 header to set this priority.
802.1p Priority	Assign a 802.1p priority as a 3-bit IPv6 precedence value in the Type of Service field of the IPv6 header used to set the priority. The valid values for this field are 0-7. Up to 64 entries are permitted. The priority values are: 0 – *Best Effort* 1 – *Background* 2 – *Spare* 3 – *Excellent Effort* 4 – *Controlled Load* 5 – *Video* 6 – *Voice* 7 – *Network Control*

23 Use the spinner controls within the **802.1p Priority** field for each DSCP row to change or override the assigned priority value.

24 Select the **OK** button located to save the changes and overrides. Select **Reset** to revert to the last saved configuration.

5.2.8.8 Overriding a Profile's Spanning Tree Configuration

▸ *Overriding a Profile's Network Configuration*

The *Multiple Spanning Tree Protocol* (MSTP) provides an extension to RSTP to optimize the usefulness of VLANs. MSTP allows for a separate spanning tree for each VLAN group, and blocks all but one of the possible alternate paths within each spanning tree topology.

If there's just one VLAN in the Access Point managed network, a single spanning tree works fine. However, if the network contains more than one VLAN, the network topology defined by single STP would work, but it's possible to make better use of the alternate paths available by using an alternate spanning tree for different VLANs or groups of VLANs.

A MSTP supported deployment uses multiple MST regions with *multiple MST instances* (MSTI). Multiple regions and other STP bridges are interconnected using one single *common spanning tree* (CST).

MSTP includes all of its spanning tree information in a single *Bridge Protocol Data Unit* (BPDU) format. BPDUs are used to exchange information bridge IDs and root path costs. Not only does this reduce the number of BPDUs required to communicate spanning tree information for each VLAN, but it also ensures backward compatibility with RSTP. MSTP encodes additional region information after the standard RSTP BPDU as well as a number of MSTI messages. Each MSTI messages conveys spanning tree information for each instance. Each instance can be assigned a number of configured VLANs. The frames assigned to these VLANs operate in this spanning tree instance whenever they are inside the MST region. To avoid conveying their entire VLAN to spanning tree mapping in each BPDU, the Access Point encodes an MD5 digest of their VLAN to an instance table in the MSTP BPDU. This digest is used by other MSTP supported devices to determine if the neighboring device is in the same MST region as itself.

To create or override a profile’s spanning tree configuration:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

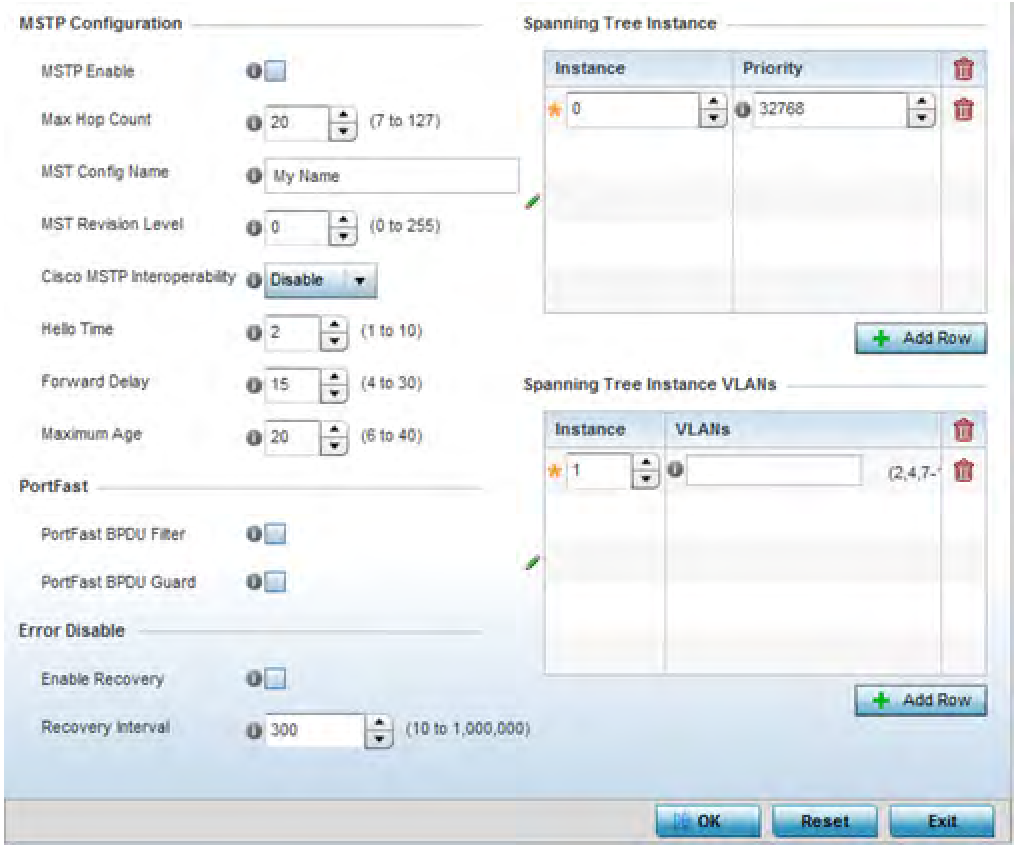
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **Spanning Tree**.

> **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



MSTP Configuration

MSTP Enable ☐

Max Hop Count 20 (7 to 127)

MST Config Name My Name

MST Revision Level 0 (0 to 255)

Cisco MSTP Interoperability Disable

Hello Time 2 (1 to 10)

Forward Delay 15 (4 to 30)

Maximum Age 20 (6 to 40)

PortFast

PortFast BPDU Filter ☐

PortFast BPDU Guard ☐

Error Disable

Enable Recovery ☐

Recovery Interval 300 (10 to 1,000,000)

Spanning Tree Instance

Instance	Priority
0	32768

Spanning Tree Instance VLANs

Instance	VLANs
1	(2,4,7-

Figure 5-76 *Spanning Tree screen*

6 Set the following **MSTP Configuration** parameters:

MSTP Enable	Select this option to enable MSTP for this profile. MSTP is disabled by default, so if requiring different (groups) of VLANs with the profile supported network segment.

Max Hop Count	Define the maximum number of hops the BPDU will consider valid in the spanning tree topology. The available range is from 7 -127. The default setting is 20.
MST Config Name	Define a 64 character maximum name for the MST region as an identifier.
MST Revision Level	Set a numeric revision value ID for MST configuration information. Set a value from 0 - 255. The default setting is 0.
Cisco MSTP Interoperability	Select either the *Enable* or *Disable* radio buttons to enable/disable interoperability with Cisco's version of MSTP, which is incompatible with standard MSTP. This setting is disabled by default.
Hello Time	Set a BPDU hello interval from 1 - 10 seconds. BPDUs are exchanged regularly (every 2 seconds by default) and enable supported devices to keep track of network changes and star/stop port forwarding as required.
Forward Delay	Set the forward delay time from 4 - 30 seconds. When a device is first attached to a port, it does not immediately forward data. It first processes BPDUs and determines the network topology. When a host is attached the port always goes into the forwarding state, after a delay of while it goes through the listening and learning states. The time spent in listening and learning states is set by the forward delay (15 seconds by default).
Maximum Age	Use the spinner control to set the maximum time (in seconds) to listen for the root bridge. The root bridge is the spanning tree bridge with the smallest (lowest) bridge ID. Each bridge has a unique ID and a configurable priority number, the bridge ID contains both. The available range is from 6 - 40 seconds. The default setting is 20 seconds.

7 Set the following **PortFast** parameters for the profile configuration:

PortFast BPDU Filter	Select Enable to invoke a BPDU filter for this portfast enabled port. Enabling the BPDU filter feature ensures this port channel does not transmit or receive any BPDUs. BPDUs are exchanged regularly and enable the Access Point to keep track of network changes and to start and stop port forwarding as required. The default setting is Disabled.
PortFast BPDU Guard	Select Enable to invoke a BPDU guard for the portfast enabled port. Enabling the BPDU Guard feature means this port will shutdown on receiving a BPDU. Thus, no BPDUs are processed. BPDUs are exchanged regularly and enable the Access Point to keep track of network changes and to start and stop port forwarding as required. The default is Disabled.

8 Set the following **Error Disable** parameters for the profile configuration:

Enable Recovery	Select this option to enable a error disable timeout resulting from a BPDU guard. This setting is disabled by default.
Recovery Interval	Define the recovery interval used to enable disabled ports. The available range is from 10 - 1,000,000 seconds with a default setting of 300.

9 Use the **Spanning Tree Instance** table to add indexes to the spanning tree topology.

10 Add up to 16 indexes and use the Priority setting to define the bridge priority used to determine the root bridge. The lower the setting defined, the greater the likelihood of becoming the root bridge in the spanning tree topology.

11 Use the **Spanning Tree Instance VLANs** table to add up to 15 VLAN instance indexes (by numeric ID) and VLANs to the spanning tree topology as virtual route resources.

12 Select the **OK** button located at the bottom right of the screen to save the changes and overrides. Select **Reset** to revert to the last saved configuration.

5.2.8.9 Overriding a Profile's Routing Configuration

▸ *Overriding a Profile's Network Configuration*

Routing is the process of selecting IP paths within the wireless network to route traffic. Use the *Routing* screen to set *Destination IP* and *Gateway* addresses enabling the assignment of static IP addresses for requesting clients without creating numerous host pools with manual bindings. This eliminates the need for a long configuration file and reduces the resource space required to maintain address pools.

Both IPv4 and IPv6 routes are separately configurable using their appropriate tabs. For IPv6 networks, routing is the part of IPv6 that provides forwarding between hosts located on separate segments within a larger IPv6 network where IPv6 routers provide packet forwarding for other IPv6 hosts.

To create or override a profile's static routes:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the *Device Browser* in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **Routing**. The **IPv4 Routing** tab displays by default.

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

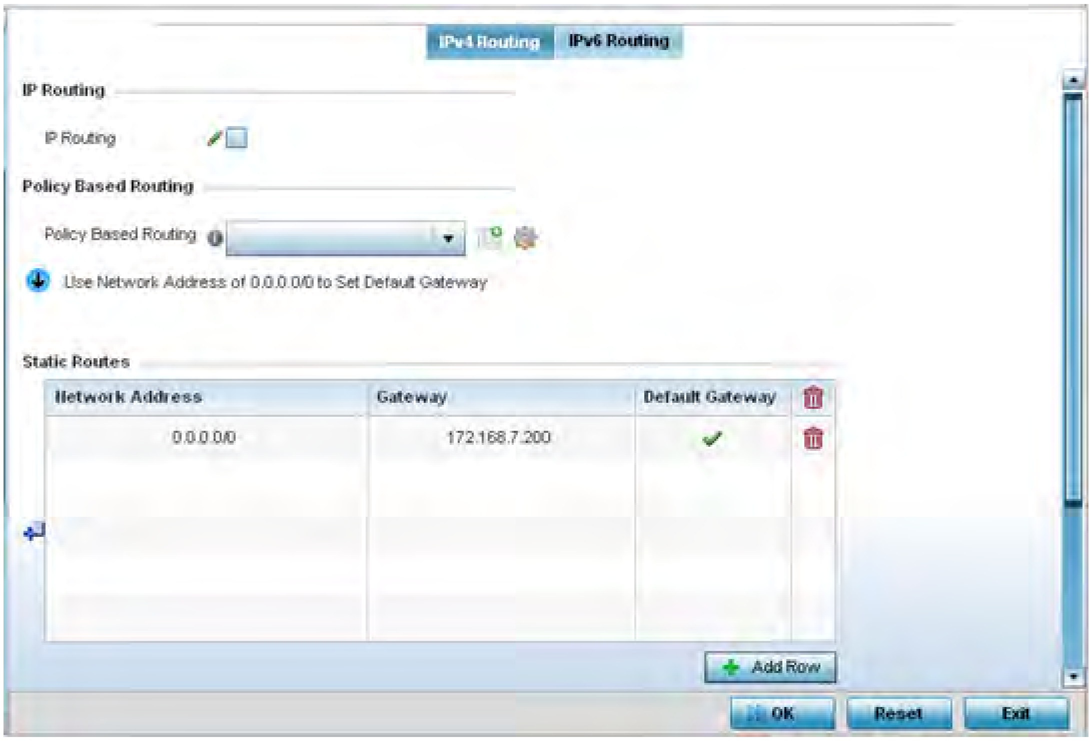


Figure 5-77 *IPv4 Static Routes screen*

6 Select **IP Routing** to enable static routes using IP addresses. This sets Destination IP and Gateway addresses enabling the assignment of static IP addresses for requesting clients. This option is enabled by default.

7 Use the drop-down menu to select a **Policy Based Routing** policy. If a suitable policy is not available, select the Create icon or modify an existing policy-based routing policy by selecting the Edit icon.

Policy-based routing (PBR) is a means of expressing and forwarding (routing) data packets based on policies defined by administrators. PBR provides a flexible mechanism for routing packets through routers, complementing existing routing protocols. PBR is applied to incoming packets. Packets received on an interface with PBR enabled are considered are passed through enhanced packet filters (route maps). Based on the route maps, packets are forwarded/routed to their next hop.

Refer to the **Static Routes** table to set Destination IP and Gateway addresses enabling the assignment of static IP addresses to requesting clients (without creating numerous host pools with manual bindings).

- Add IP addresses and network masks in the **Network Address** column.
- Provide the **Gateway** address used to route traffic.
- Provide an IP address for the **Default Gateway** used to route traffic.

Note, when routing packets, the controller, by default, obtains Default Gateway and Name Servers IP addresses from the DHCP server policy. If manually configuring the Default Gateway for static routing, also configure the Name Server's IP address in the controller's device/profile config contexts. For more information on using the GUI to configure Name Servers, see *Overriding a Profile's DNS Configuration*. If using the CLI, in the device/ profile context, execute the following command: ip name-server <NAME-SERVER-IP-ADDRESS>.

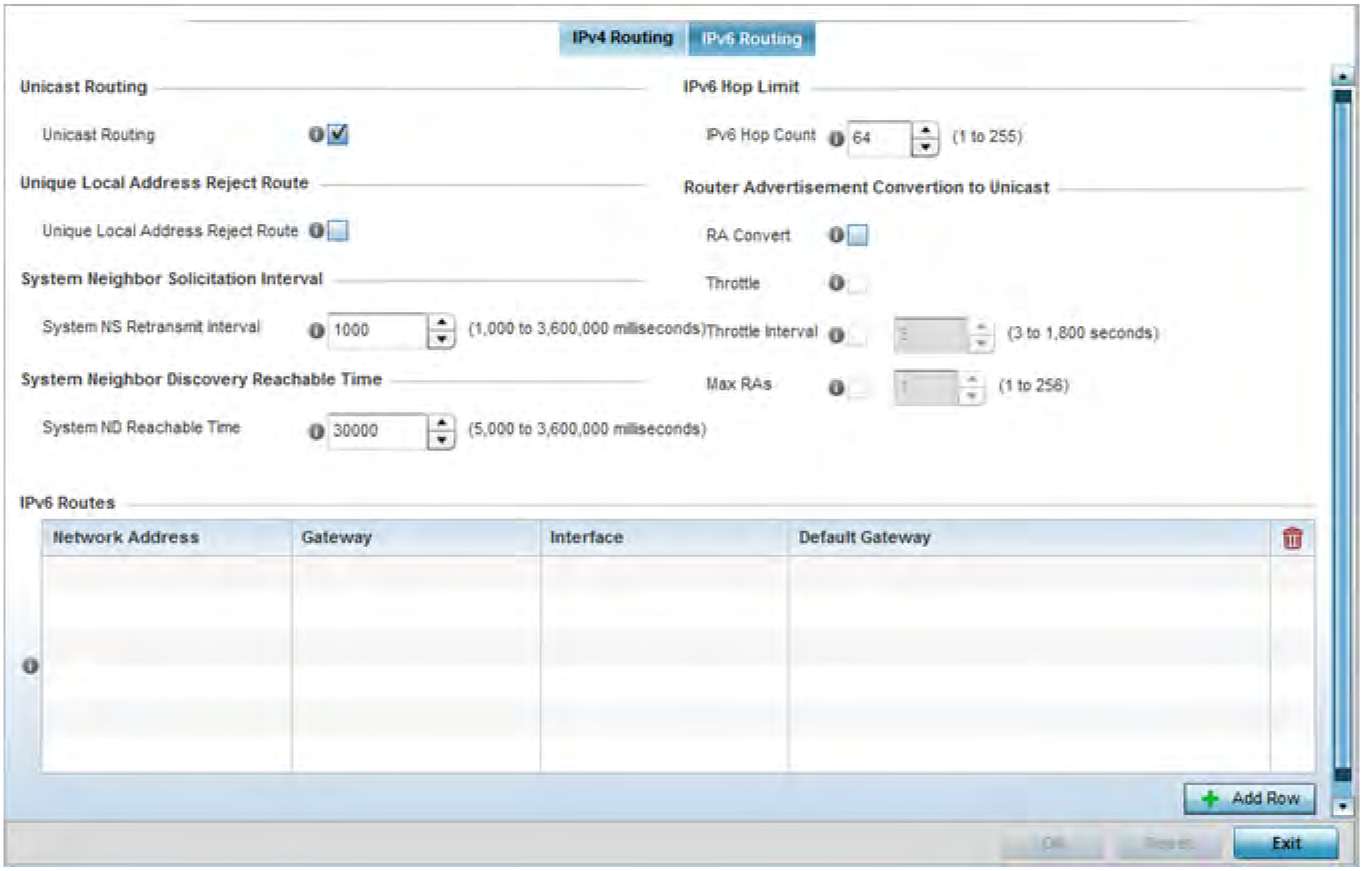
8 Refer to the **Default Route Priority** field and set the following parameters:

Static Default Route Priority	Use the spinner control to set the priority value (1 - 8,000) for the default static route. This is weight (priority) assigned to this route versus others that have been defined. The default setting is 100.

DHCP Client Default Route Priority	Use the spinner control to set the priority value (1 - 8,000) for the default route learnt from the DHCP client. The default setting is 1000.
Enable Routing Failure	When selected, all default gateways are monitored for activity. The system will failover to a live gateway if the current gateway becomes unusable. This feature is enabled by default.

9 Select the **OK** button located at the bottom right of the screen to save the changes to IPv4 routing configuration. Select **Reset** to revert to the last saved configuration.

10 Select the **IPv6 Routing** tab. IPv6 networks are connected by IPv6 routers. IPv6 routers pass IPv6 packets from one network segment to another.



Unicast Routing

Unicast Routing ☑

Unique Local Address Reject Route

Unique Local Address Reject Route □

System Neighbor Solicitation Interval

System NS Retransmit Interval 1000 (1,000 to 3,600,000 milliseconds)

System Neighbor Discovery Reachable Time

System ND Reachable Time 30000 (5,000 to 3,600,000 milliseconds)

IPv6 Hop Limit

IPv6 Hop Count 64 (1 to 255)

Router Advertisement Convertion to Unicast

RA Convert □

Throttle □

Throttle Interval □ 3 (3 to 1,800 seconds)

Max RAs □ 1 (1 to 256)

IPv6 Routes

Network Address	Gateway	Interface	Default Gateway

Figure 5-78 *Static Routes screen, IPv6 Routing tab*

11 Select **Unicast Routing** to enable IPv6 unicast routing for this profile. Keeping unicast enabled allows the profile's neighbor advertisements and solicitations in unicast (as well as multicast) to provide better neighbor discovery. This setting is enabled by default.

12 Select **Unique Local Address Reject Route** to reject *Unique Local Address* (ULA). ULA is an IPv6 address block (fc00::/7) that is an approximate IPv6 counterpart to IPv4 private addresses. When selected, a reject entry is added to the IPv6 routing table to reject packets with Unique Local Address.

13 Set a **System NS Retransmit Interval** (from 1,000 to 3,600,000 milliseconds) as the interval between *neighbor solicitation* (NS) messages. NS messages are sent by a node to determine the link layer address of a neighbor, or verify a neighbor is still reachable via a cached link-layer address. The default is 1,000 milliseconds.

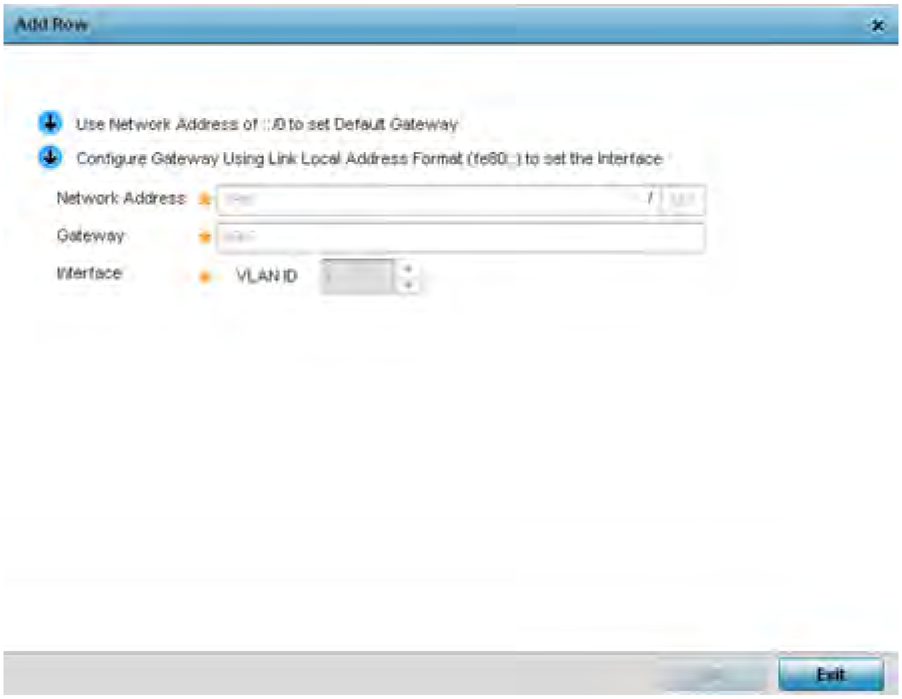
14 Set a **System ND Reachable Time** (from 5,000 to 3,600,000 milliseconds) as the time a neighbor is assumed to be reachable after receiving a receiving a *neighbor discovery* (ND) confirmation for their reachability. The default is 30,000 milliseconds.

15 Set an **IPv6 Hop Count** (from 1 - 255) as the maximum number of hops considered valid when sending IP packets. The default setting is 64.

16 Set the **Router Advertisement Conversion to Unicast** settings:

RA Convert	Select this option to convert multicast *router advertisements* (RA) to unicast router advertisements at the dot11 layer. Unicast addresses identify a single network interface, whereas a multicast address is used by multiple hosts. This setting is disabled by default.
Throttle	Select this option to throttle RAs before converting to unicast. Once enabled, set the throttle interval and maximum number of RAs. This setting is disabled by default.
Throttle Interval	Enable this setting to define the throttle interval (3 - 1,800 seconds). The default setting is 3 seconds.
Max RAs	Enable this setting to define the maximum number of router advertisements per router (1 - 256) during the throttle interval. The default setting is 1.

17 Select **+ Add Row** as needed within the **IPv6 Routes** table to add an additional 256 IPv6 route resources.



Use Network Address of ::/0 to set Default Gateway

Configure Gateway Using Link Local Address Format (fe80::) to set the Interface

Figure 5-79 *Static Routes screen, Add IPv6 Route*

Network Address	Set the IPv6 network address. Other than the length and slightly different look versus an IPv4 address, the IPv6 address concept is same as IPv4.

Gateway	Set the IPv6 route gateway. A network gateway in IPv6 is the same as in IPv4. A gateway address designates how traffic is routed out of the current subnet.
Interface	If using a link local address, set the VLAN (1 - 4,094) used a virtual routing interface for the local address.

18 Select the **OK** button located at the bottom right of the screen to save the changes to the IPv6 routing configuration. Select **Reset** to revert to the last saved configuration.

5.2.8.10 Overriding a Profile’s Dynamic Routing (OSPF) Configuration

▸ *Overriding a Profile’s Network Configuration*

Open Shortest Path First (OSPF) is a link-state *interior gateway protocol* (IGP). OSPF routes IP packets within a single routing domain (autonomous system), like an enterprise LAN. OSPF gathers link state information from neighbor routers and constructs a network topology. The topology determines the routing table presented to the Internet Layer which makes routing decisions based solely on the destination IP address found in IP packets.

OSPF detects changes in the topology, like a link failure, and plots a new loop-free routing structure. It computes the shortest path for each route using a shortest path first algorithm. Link state data is maintained on each router and is periodically updated on all OSPF member routers.

OSPF uses a route table managed by the link *cost* (external metrics) defined for each routing interface. The cost could be the distance of a router (round-trip time), link throughput or link availability. Setting a cost value provides a dynamic way to load balancing traffic between routes of equal cost.

An OSPF network can be subdivided into routing areas to simplify administration and optimize traffic utilization. Areas are logical groupings of hosts and networks, including routers having interfaces connected to an included network. Each area maintains a separate link state database whose information may be summarized towards the rest of the network by the connecting router. Areas are identified by 32-bit IDs, expressed either in decimal, or octet-based dot-decimal notation. Areas can defined as:

stub area - A stub area is an area which does not receive route advertisements external to the autonomous system (AS) and routing from within the area is based entirely on a default route.

totally-stub - A totally stubby area does not allow summary routes and external routes. A default route is the only way to route traffic outside of the area. When there’s only one route out of the area, fewer routing decisions are needed, lowering system resource utilization.

non-stub - A non-stub area imports autonomous system external routes and send them to other areas. However. it still cannot receive external routes from other areas.

nssa - NSSA is an extension of a stub that allows the injection of limited external routes into a stub area. If selecting NSSA, no external routes, except a default route, enter the area.

totally nssa - Totally nssa is an NSSA using 3 and 4 summary routes are not flooded into this type of area. It is also possible to declare an area both totally stubby and not-so-stubby, which means that the area will receive only the default route from area 0.0.0.0, but can also contain an autonomous system boundary router (ASBR) that accepts external routing information and injects it into the local area, and from the local area into area 0.0.0.0.

A router running OSPF sends hello packets to discover neighbors and elect a designated router. The hello packet includes link state information and list of neighbors. OSPF is savvy with layer 2 topologies. If on a *point-to-point* link, OSPF knows it is sufficient, and the link stays *up*. If on a *broadcast* link, the router waits for election before determining if the link is functional.

To define a dynamic routing configuration:

1 Select **Devices** from the Configuration tab.

  The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

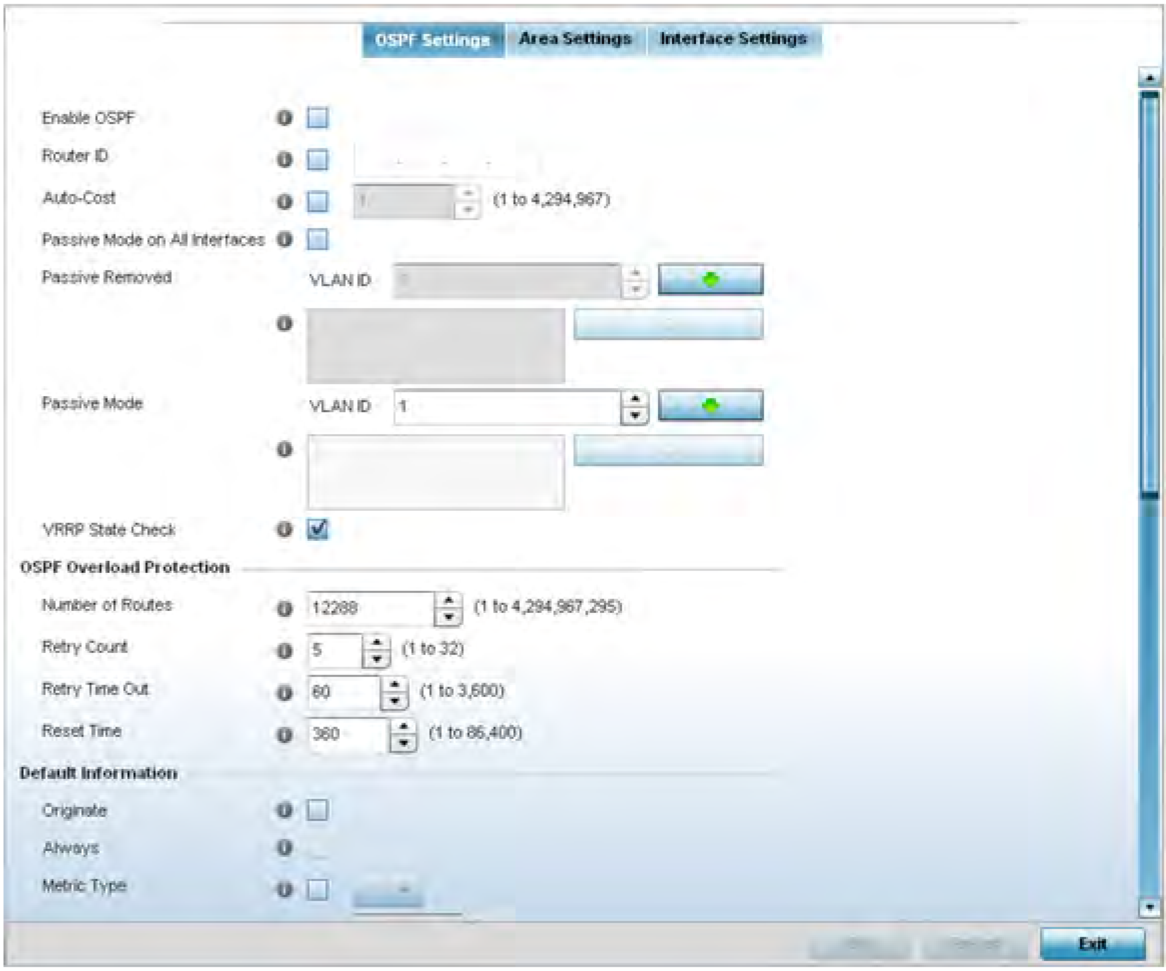
2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

  Devices can also be selected directly from the *Device Browser* in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Expand the **Network** menu and select **OSPF**.

  The **OSPF Settings** tab displays by default, with additional **Area Settings** and **Interface Settings** tabs available.



Enable OSPF □
Router ID □
Auto-Cost □ 1 (1 to 4,294,967)
Passive Mode on All Interfaces □
Passive Removed VLAN ID 1
Passive Mode VLAN ID 1
VRRP State Check ☑

OSPF Overload Protection
Number of Routes 12288 (1 to 4,294,967,295)
Retry Count 5 (1 to 32)
Retry Time Out 60 (1 to 3,600)
Reset Time 360 (1 to 86,400)

Default Information
Originate □
Always
Metric Type □

Figure 5-80 *OSPF Settings screen*

5 Enable/disable OSPF and provide the following dynamic routing settings:

Enable OSPF	Select this option to enable OSPF. OSPF is disabled by default.

Router ID	Select this option to define a router ID (numeric IP address) for this OSPF configuration. This ID must be established in every OSPF instance. If not explicitly configured, the highest logical IP address is duplicated as the router identifier. However, since the router identifier is not an IP address, it does not have to be a part of any routable subnet in the network.
Auto-Cost	Select this option to specify the reference bandwidth (in Mbps) used to calculate the OSPF interface cost if OSPF is either STUB or NSSA. The default setting is 1.
Passive Mode on All Interfaces	When selected, all layer 3 interfaces are set as an OSPF passive interface. This setting is disabled by default.
Passive Removed	If *enabling* Passive Mode on All Interfaces, use the spinner control to select VLANs (by numeric ID) as OSPF *non* passive interfaces. Multiple VLANs can be added to the list.
Passive Mode	If *disabling* Passive Mode on All Interfaces, use the spinner control to select VLANs (by numeric ID) as OSPF passive interfaces. Multiple VLANs can be added to the list.
VRRP State Check	Select this option to use OSPF only if the VRRP interface is not in a backup state. The *Virtual Router Redundancy Protocol* (VRRP) provides automatic assignments of available Internet Protocol (IP) routers to participating hosts. This increases the availability and reliability of routing paths via automatic default gateway selections on an IP subnetwork. This setting is enabled by default.

6 Set the following **OSPF Overload Protection** settings:

Number of Routes	Use the spinner control to set the maximum number of OSPN routes permitted. The available range is from 1 - 4,294,967,295.
Retry Count	Set the maximum number of retries (OSPF resets) permitted before the OSPF process is shut down. The available range is from 1 - 32. The default setting is 5.
Retry Time Out	Set the duration (in seconds) the OSPF process remains off before initiating its next retry. The available range is from 1 - 3,600 seconds. The default is 60 seconds.
Reset Time	Set the reset time (in seconds) that, when exceeded, changes the retry count is zero. The available range is from 1 - 86,400. The default is 360 seconds.

7 Set the following **Default Information**:

Originate	Select this option to make the default route a distributed route. This setting is disabled by default.
Always	Enabling this settings continuously maintains a default route, even when no routes appear in the routing table. This setting is disabled by default.
Metric Type	Select this option to define the exterior metric type (1 or 2) used with the default route.
Route Metric	Select this option to define route metric used with the default route. OSPF uses path cost as its routing metric. It's defined by the speed (bandwidth) of the interface supporting given route.

Refer to the **Route Redistribution** table to set the types of routes that can be used by OSPF.

Select the **+ Add Row** button to populate the table. Set the **Route Type** used to define the redistributed route. Options include *connected*, *kernal* and static.

8 Select the **Metric Type** option to define the exterior metric type (1 or 2) used with the route redistribution. Select the **Metric** option to define route metric used with the redistributed route.

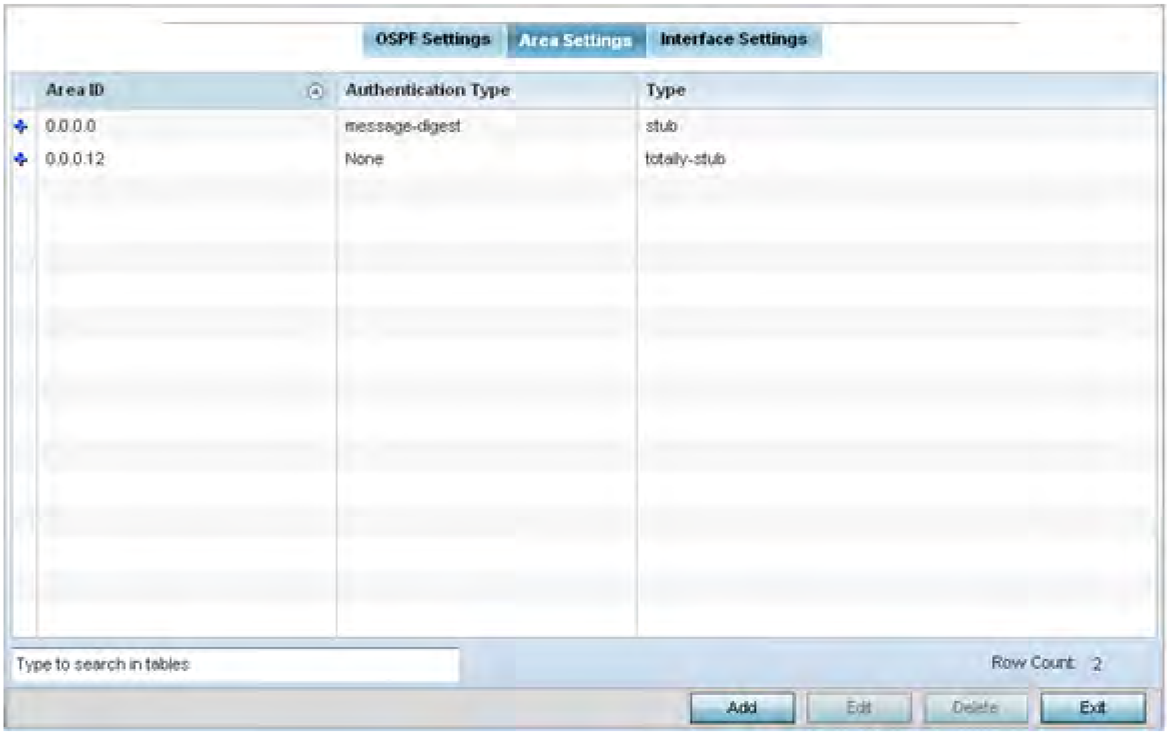
9 Use the **OSPF Network** table to define networks (IP addresses) to connect using dynamic routes.

10 Select the **+ Add Row** button to populate the table. Add the IP address and mask of the **Network(s)** participating in OSPF. Additionally, define the OSPF area (IP address) to which the network belongs.

11 Set an **OSPF Default Route Priority** (1 - 8,000) as the priority of the default route learnt from OSPF. The default setting is 7,000.

12 Select the **Area Settings** tab.

An OSPF *Area* contains a set of routers exchanging *Link State Advertisements* (LSAs) with others in the same area. Areas limit LSAs and encourage aggregate routes.



Area ID	Authentication Type	Type
0.0.0.0	message-digest	stub
0.0.0.12	None	totally-stub

Figure 5-81 *OSPF Area Settings screen*

13 Review existing **Area Settings** configurations:

Area ID	Displays either the IP address or integer representing the OSPF area.
Authentication Type	Lists the authentication schemes used to validate the credentials of each dynamic route connection.
Type	Lists the OSPF area type for each listed configuration.

14 Select **Add** to create a new OSPF configuration, **Edit** to modify an existing configuration or **Delete** to remove a configuration.

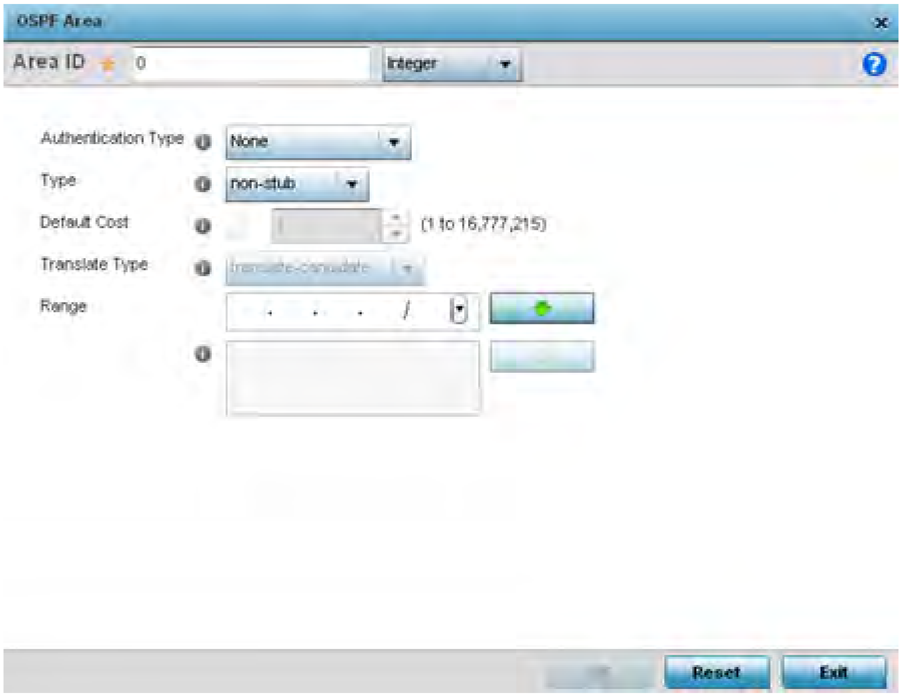


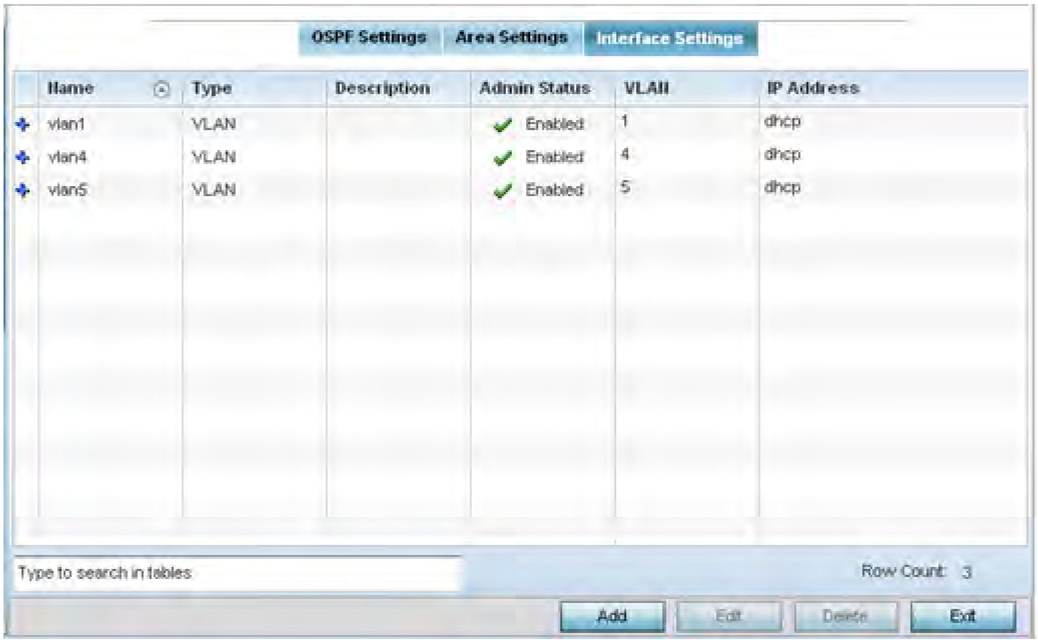
Figure 5-82 *OSPF Area Configuration screen*

15 Set the **OSPF Area** configuration.

Area ID	Use the drop down menu and specify either an IP address or integer for the OSPF area.
Authentication Type	Select either *None*, *simple-password* or *message-digest* as credential validation scheme used with the OSPF dynamic route. The default setting is None.
Type	Set the OSPF area type as either *stub*, *totally-stub*, *nssa*, *totally-nssa* or *non-stub*.
Default Cost	Select this option to set the default summary cost advertised if creating a stub. Set a value from 1 - 16, 777,215.
Translate Type	Define how messages are translated. Options include *translate-candidate*, *translate always* and *translate-never.* The default setting is translate-candidate.
Range	Specify a range of addresses for routes matching address/mask for OSPF summarization.

16 Select the **OK** button to save the changes to the area configuration. Select **Reset** to revert to the last saved configuration.

17 Select the **Interface Settings** tab.



Name	Type	Description	Admin Status	VLAN	IP Address
vlan1	VLAN		✓ Enabled	1	dhcp
vlan4	VLAN		✓ Enabled	4	dhcp
vlan5	VLAN		✓ Enabled	5	dhcp

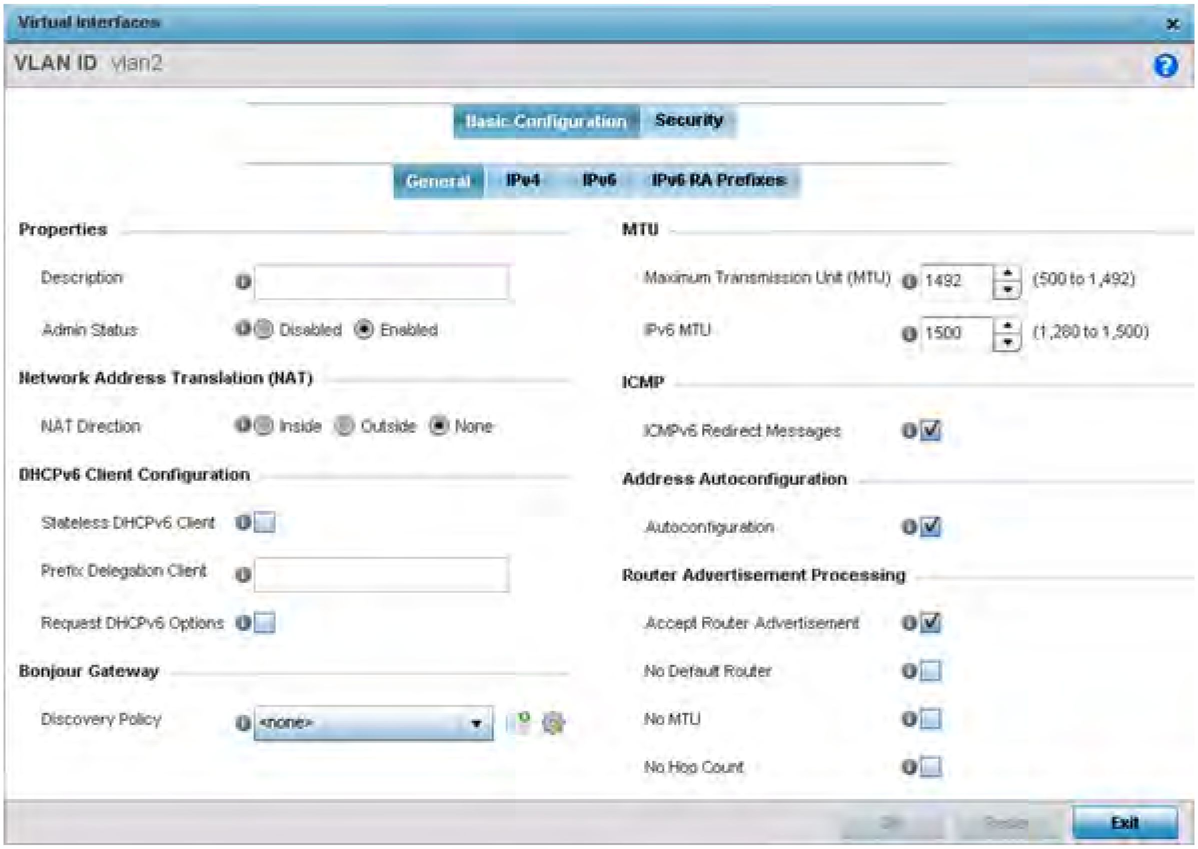
Row Count: 3

Figure 5-83 *OSPF Interface Settings screen*

18 Review the following **Interface Settings**:

Name	Displays the name defined for the interface configuration.
Type	Displays the type of interface.
Description	Lists each interface's 32 character maximum description.
Admin Status	Displays whether admin status privileges have been *enabled* or *disabled* for the OSPF route's virtual interface connection.
VLAN	Lists the VLAN IDs set for each listed OSPF route virtual interface.
IP Address	Displays the IP addresses defined as virtual interfaces for dynamic OSPF routes. Zero config and DHCP can be used to generate route addresses, or a primary and secondary address can be manually provided.

19 Select the **Add** button to define a new set of virtual interface basic settings, or **Edit** to update the settings of an existing virtual interface configuration.



VLAN ID vlan2

Properties

Description

Admin Status ○ Disabled ● Enabled

Network Address Translation (NAT)

NAT Direction ○ Inside ○ Outside ● None

DHCPv6 Client Configuration

Stateless DHCPv6 Client □

Prefix Delegation Client

Request DHCPv6 Options □

Bonjour Gateway

Discovery Policy <none>

MTU

Maximum Transmission Unit (MTU) 1492 (500 to 1,492)

IPv6 MTU 1500 (1,280 to 1,500)

ICMP

ICMPv6 Redirect Messages ☑

Address Autoconfiguration

Autoconfiguration ☑

Router Advertisement Processing

Accept Router Advertisement ☑

No Default Router □

No MTU □

No Hop Count □

Figure 5-84 *OSPF Virtual Interface - Basic Configuration screen - General tab*

20 Within the **Properties** field, enter a 32 character maximum **Description** to help differentiate the virtual interface configuration used with this OSPF route. Enable/disable **Admin Status** as needed. They're enabled by default.

21 Define the **NAT Direction** as either *Inside*, *Outside* or *None*. *Network Address Translation* (NAT), is an Internet standard enabling a *local area network* (LAN) to use IP addresses for internal traffic (inside) and a second set of addresses for external (outside) traffic.

22 Set the following **DHCPv6 Client Configuration**. The *Dynamic Host Configuration Protocol for IPv6* (DHCPv6) provides a framework for passing configuration information.

Stateless DHCPv6 Client	Select this option to request information from the DHCPv6 server using stateless DHCPv6. DHCPv6 is a networking protocol for configuring IPv6 hosts with IP addresses, IP prefixes or other configuration attributes required on an IPv6 network. This setting is disabled by default.
Prefix Delegation Client	Specify a 32 character maximum request prefix for prefix delegation from a DHCPv6 server over this virtual interface.
Request DHCPv6 Options	Select this option to request DHCPv6 options on this virtual interface. DHCPv6 options provide configuration information for a node that must be booted using the network rather than from locally. This setting is disabled by default.

23 Set the following **Bonjour Gateway** settings.Bonjour is Apple's implementation of zero-configuration networking (Zeroconf). Zeroconf is a group of technologies that include service discovery, address assignment and hostname resolution. Bonjour locates devices such as printers, other computers and services that these computers offer over a local network.

Bonjour provides a general method to discover services on a *local area network* (LAN). It allows users to set up a network without any configuration. Services such as printers, scanners and file-sharing servers can be found using Bonjour. Bonjour only works within a single broadcast domain. However, with special DNS configuration, it can be extended to find services across broadcast domains.

From the drop-down, select the Bonjour Gateway discover policy. Select the **Create** icon to define a new Bonjour Gateway policy configuration or select the **Edit** icon to modify an existing Bonjour Gateway policy configuration.

24 Set the following MTU settings for the virtual interface:

Maximum Transmission Unit (MTU)	Set the PPPoE client *maximum transmission unit* (MTU) from 500 - 1,492. The MTU is the largest physical packet size in bytes a network can transmit. Any messages larger than the MTU are divided into smaller packets before being sent. A PPPoE client should be able to maintain its point-to-point connection for this defined MTU size. The default MTU is 1,492.
IPv6 MTU	Set an IPv6 MTU for this virtual interface from 1,280 - 1,500. A larger MTU provides greater efficiency because each packet carries more user data while protocol overheads, such as headers or underlying per-packet delays, remain fixed; the resulting higher efficiency means a slight improvement in bulk protocol throughput. A larger MTU results in the processing of fewer packets for the same amount of data. The default is 1,500.

25 Within the **ICMP** field, define whether ICMPv6 redirect messages are sent. Redirect requests data packets be sent on an alternative route. This setting is enabled by default.

26 Within the **Address Autoconfiguration** field, define whether to configure IPv6 addresses on this virtual interface based on the prefixes received in router advertisement messages. This setting is enabled by default.

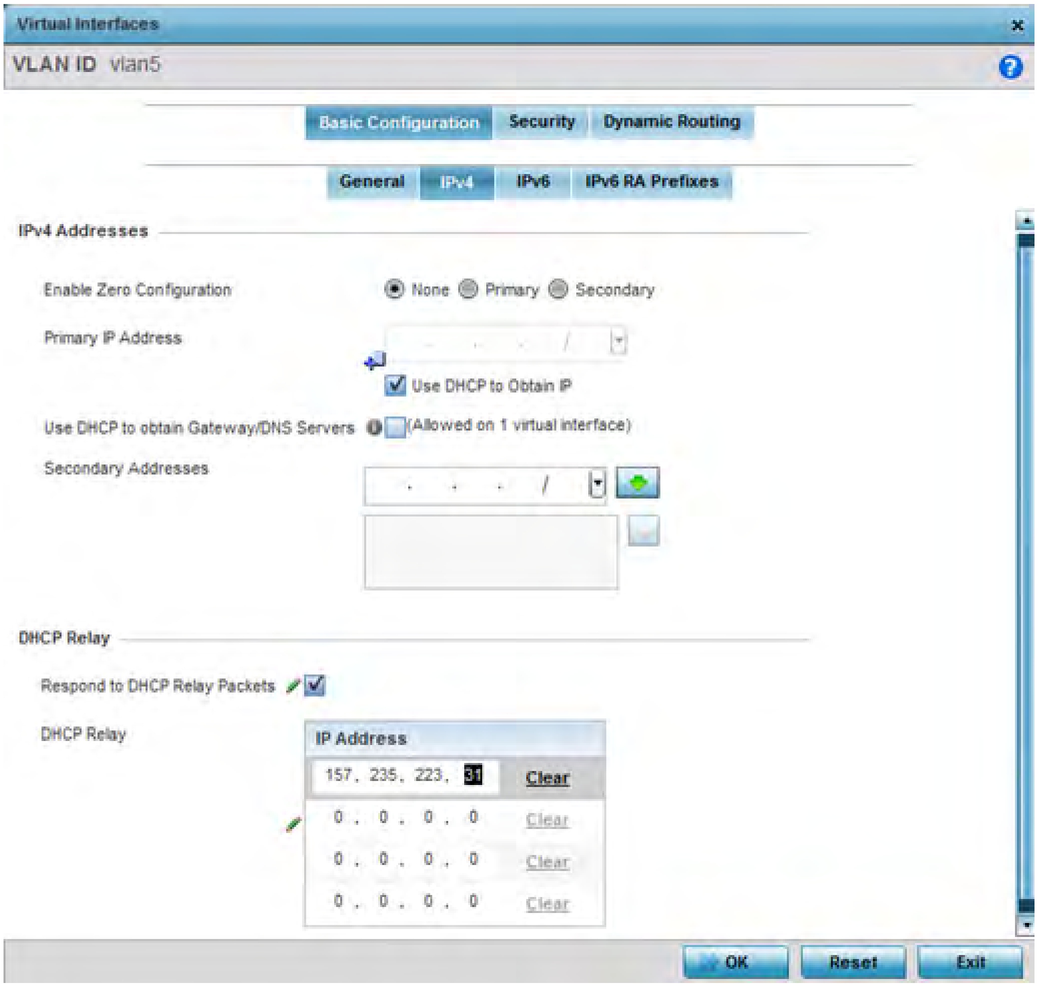
27 Set the following **Router Advertisement Processing** settings for the virtual interface. Router advertisements are periodically sent to hosts or sent in response to solicitation requests. The advertisement includes IPv6 prefixes and other subnet and host information.

Accept RA	Enable this option to allow router advertisements over this virtual interface. IPv6 hosts can configure themselves automatically when connected to an IPv6 network using the neighbor discovery protocol via ICMPv6)router discovery messages. When first connected to a network, a host sends a link-local router solicitation multicast request for its configuration parameters; routers respond to such a request with a router advertisement packet that contains Internet Layer configuration parameters.This setting is enabled by default.
No Default Router	Select this option to not consider routers present on this interface for default router selection. This setting is disabled by default.
No MTU	Select this option to not use the set MTU value for router advertisements on this virtual interface. This setting is disabled by default.
No Hop Count	Select this option to not use the hop count advertisement setting for router advertisements on this virtual interface. This setting is disabled by default.

28 Select **OK** to save the changes. Select Reset to revert to the last saved configuration.

29 Select the **IPv4** tab to set IPv4 settings for this virtual interface.

IPv4 is a connectionless protocol. It operates on a best effort delivery model that does not guarantee delivery or assures proper sequencing or avoidance of duplicate delivery (unlike TCP).



VLAN ID vlan5

IPv4 Addresses

Enable Zero Configuration ● None ○ Primary ○ Secondary

Primary IP Address . . . /

☑ Use DHCP to Obtain IP

Use DHCP to obtain Gateway/DNS Servers □ (Allowed on 1 virtual interface)

Secondary Addresses . . . /

DHCP Relay

Respond to DHCP Relay Packets ☑

DHCP Relay

IP Address	
157 . 235 . 223 . 31	Clear
0 . 0 . 0 . 0	Clear
0 . 0 . 0 . 0	Clear
0 . 0 . 0 . 0	Clear

Figure 5-85 *Virtual Interfaces - Basic Configuration screen - IPv4 tab*

30 Set the following network information from within the **IPv4 Addresses** field:

Enable Zero Configuration	Zero Configuration can be a means of providing a primary or secondary IP addresses for the virtual interface. Zero configuration (or zero config) is a wireless connection utility included with Microsoft Windows XP and later as a service dynamically selecting a network to connect based on a user's preferences and various default settings. Zero config can be used instead of a wireless network utility from the manufacturer of a computer's wireless networking device. This value is set to None by default.
Primary IP Address	Define the IP address for the VLAN associated Virtual Interface.
Use DHCP to Obtain IP	Select this option to allow DHCP to provide the IP address for the Virtual Interface. Selecting this option disables the Primary IP address field.
Use DHCP to obtain Gateway/DNS Servers	Select this option to allow DHCP to obtain a default gateway address, and DNS resource for *one* virtual interface. This setting is disabled by default and only available when the Use DHCP to Obtain IP option is selected.
Secondary Addresses	Use the Secondary Addresses parameter to define additional IP addresses to associate with VLAN IDs. The address provided in this field is used if the primary IP address is unreachable.

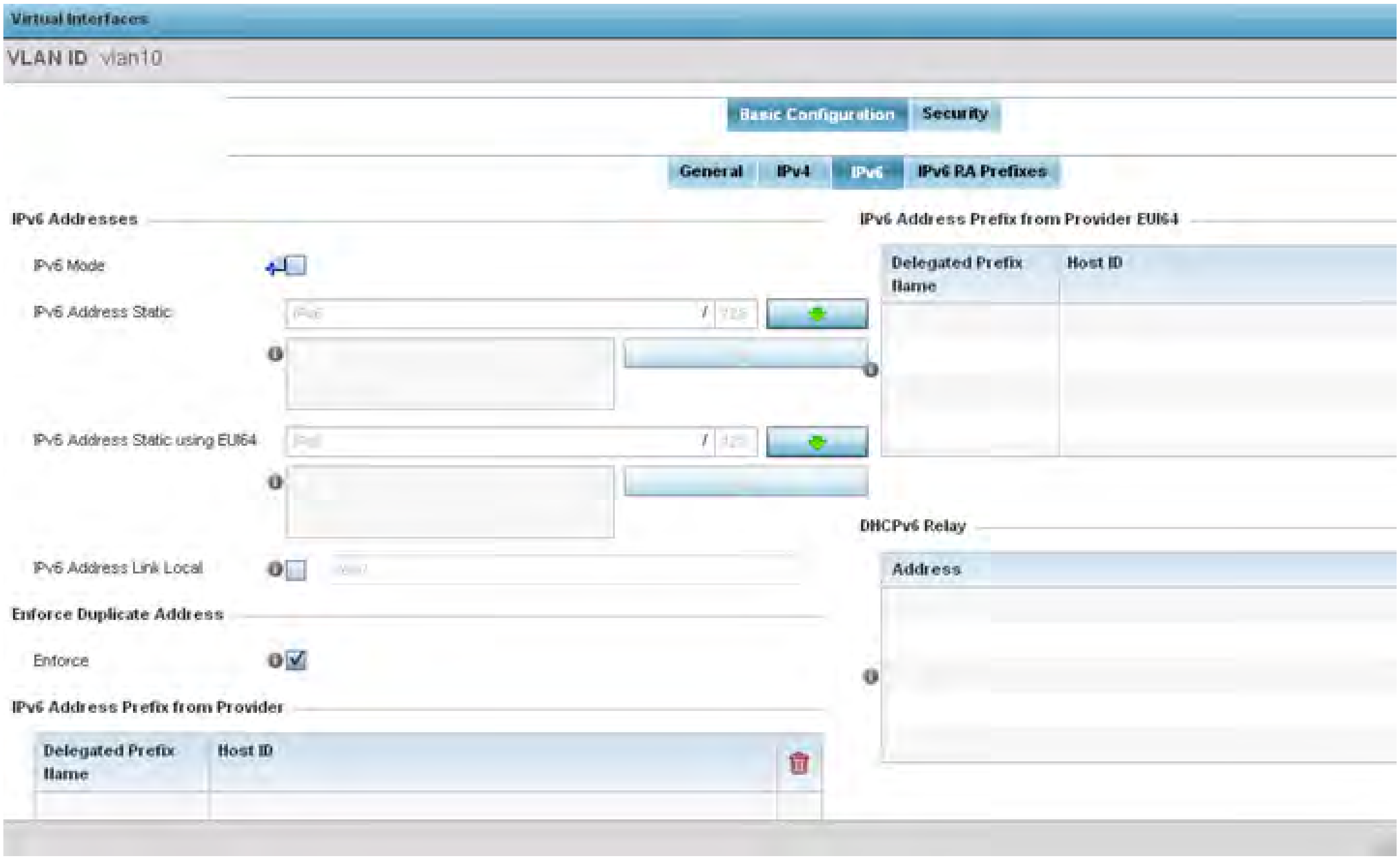
31 Refer to the **DHCP Relay** field to set the DHCP relay server configuration used with the Virtual Interface.

Respond to DHCP Relay Packets	Select this option to allow the onboard DHCP server to respond to relayed DHCP packets on this interface. This setting is disabled by default.
DHCP Relays	Provide IP addresses for DHCP server relay resources. DHCP relays exchange messages between a DHCPv6 server and client. A client and relay agent exist on the same link. When a DHCP request is received from the client, the relay agent creates a relay forward message and sends it to a specified server address. If no addresses are specified, the relay agent forwards the message to all DHCP server relay multicast addresses. The server creates a relay reply and sends it back to the relay agent. The relay agent then sends back the response to the client.

32 Select **OK** to save the changes to the IPv4 configuration. Select **Reset** to revert to the last saved configuration.

33 Select the **IPv6** tab to set IPv6 settings for this virtual interface.

IPv6 is the latest revision of the *Internet Protocol* (IP) designed to replace IPv4. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons. IPv6 hosts can configure themselves automatically when connected to an IPv6 network using the neighbor discovery protocol via ICMPv6 router discovery messages. When first connected to a network, a host sends a link-local router solicitation multicast request for its configuration parameters; routers respond to such a request with a router advertisement packet that contains Internet Layer configuration parameters.



Virtual Interfaces

VLAN ID vlan10

IPv6 Mode □

Enforce ☑

Figure 5-86 *Virtual Interfaces - Basic Configuration screen - IPv6 tab*

34 Refer to the **IPv6 Addresses** field to define how IP6 addresses are created and utilized.

IPv6 Mode	Select this option to enable IPv6 support on this virtual interface.
IPv6 Address Static	Define up to 15 global IPv6 IP addresses that can created statically. IPv6 addresses are represented as eight groups of four hexadecimal digits separated by colons.
IPv6 Address Static using EU164	Optionally set up to 15 global IPv6 IP addresses (in the EUI-64 format) that can created statically. The IPv6 EUI-64 format address is obtained through a 48-bit MAC address. The MAC is initially separated into two 24-bits, with one being an OUI (*Organizationally Unique Identifier*) and the other being client specific. A 16-bit 0xFFFE is then inserted between the two 24-bits for the 64-bit EUI address. IEEE has chosen FFFE as a reserved value which can only appear in EUI-64 generated from the an EUI-48 MAC address.
IPv6 Address Link Local	Provide the IPv6 local link address. IPv6 requires a link local address assigned to every interface the IPv6 protocol is enabled, even when one or more routable addresses are assigned.

35 Enable the **Enforce Duplicate Address** option to enforce duplicate address protection when any wired port is connected and in a forwarding state. This option is enabled by default.

36 Refer to the **IPv6 Address Prefix from Provider** table use prefix abbreviations (in EUI64 format) as shortcuts of the entire character set comprising an IPv6 formatted IP address.

37 Select **+ Add Row** to launch a sub screen wherein a new delegated prefix name and host ID can be defined.

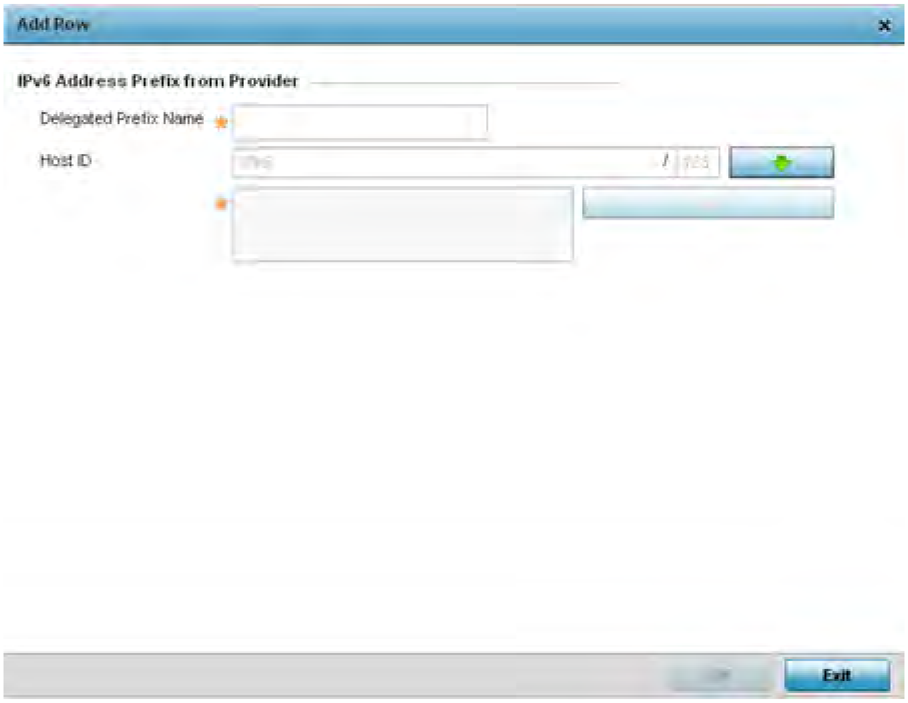


Figure 5-87 *Virtual Interfaces - Basic Configuration screen - IPv6 tab - Add Address Prefix from Provider*

Delegated Prefix Name	Enter a 32 character maximum name for the IPv6 address prefix from provider.
Host ID	Define the subnet ID, host ID and prefix length.

38 Select **OK** to save the changes to the new IPv6 prefix from provider. Select **Exit** to close the screen without saving the updates.

39 Refer to the **IPv6 Address Prefix from Provider EUI64** table to review ISP provided prefix abbreviations.

40 Select **+ Add Row** to launch a sub screen wherein a new delegated prefix name and host ID can be defined in EUI64 format.

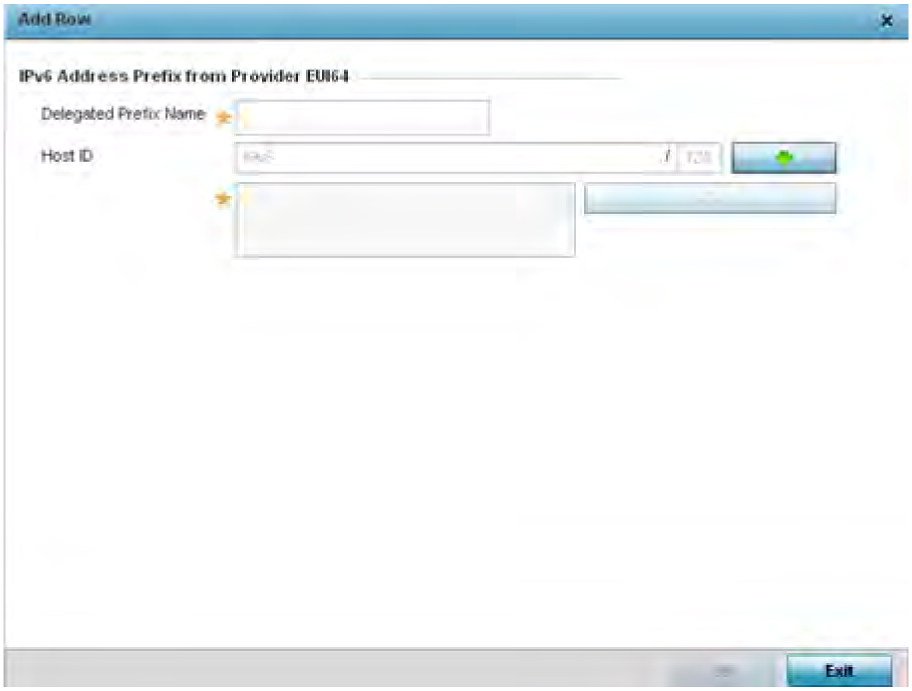


Figure 5-88 *Virtual Interfaces - Basic Configuration screen - IPv6 tab - Add Address Prefix from Provider EUI64*

Delegated Prefix Name	Enter a 32 character maximum name for the IPv6 address prefix from provider in EUI format.
Host ID	Define the subnet ID and prefix length.

41 Select **OK** to save the changes to the new IPv6 prefix from provider in EUI64 format. Select **Exit** to close the screen without saving the updates.

42 Refer to the **DHCPv6 Relay** table to set the address and interface of the DHCPv6 relay.

The DHCPv6 relay enhances an extended DHCP relay agent by providing support in IPv6. DHCP relays exchange messages between a DHCPv6 server and client. A client and relay agent exist on the same link. When A DHCP request is received from the client, the relay agent creates a relay forward message and sends it to a specified server address. If no addresses are specified, the relay agent forwards the message to all DHCP server relay multicast addresses. The server creates a relay reply and sends it back to the relay agent. The relay agent then sends back the response to the client.

43 Select **+ Add Row** to launch a sub screen wherein a new DHCPv6 relay address and interface VLAN ID can be set.

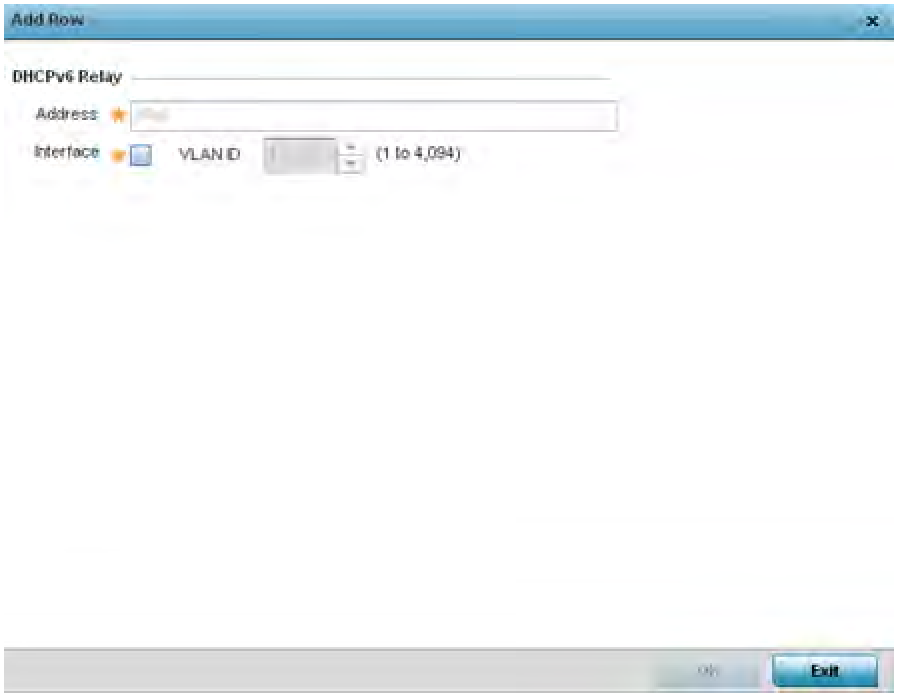
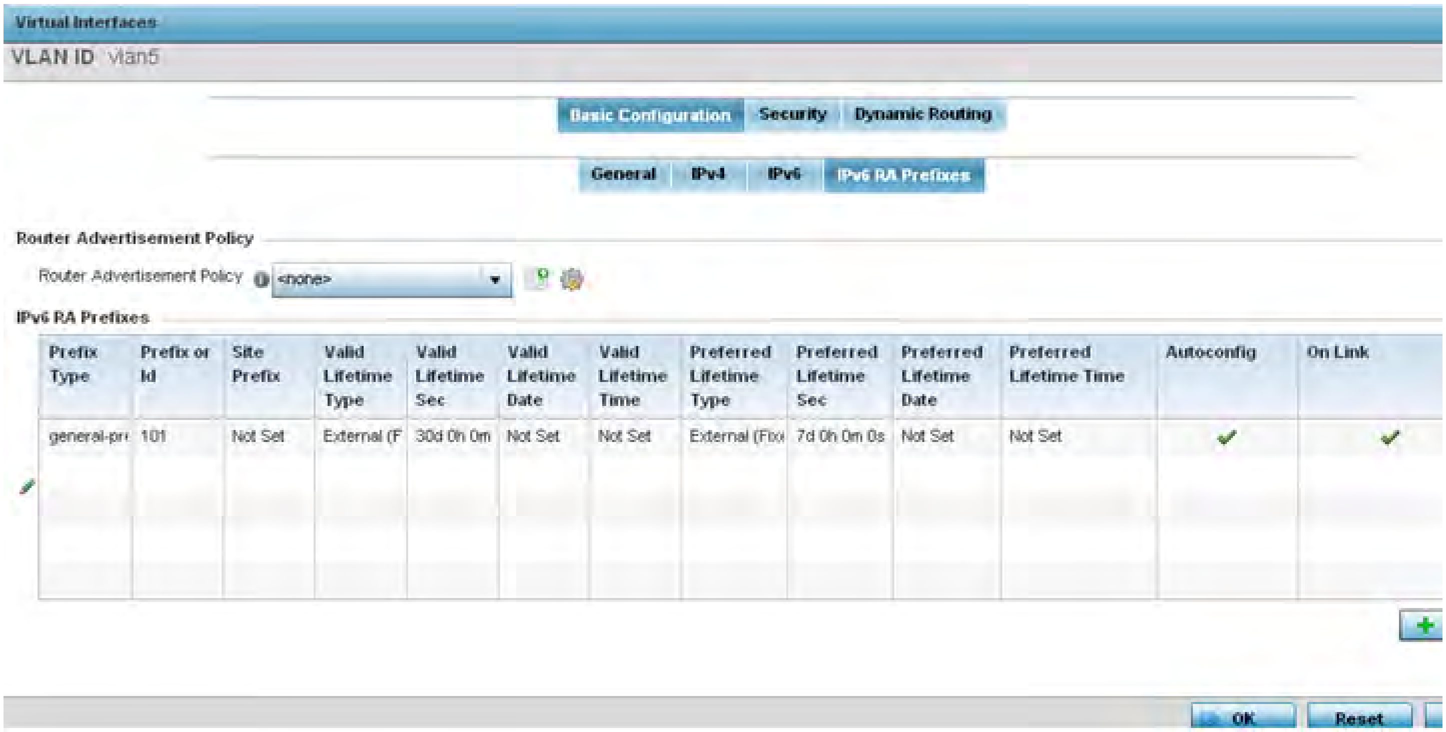


Figure 5-89 *Virtual Interfaces - Basic Configuration screen - IPv6 tab - Add DHCPv6 Relay*

Address	Enter an address for the DHCPv6 relay. These DHCPv6 relay receive messages from DHCPv6 clients and forward them to DHCPv6 servers. The DHCPv6 server sends responses back to the relay, and the relay then sends these responses to the client on the local network link.
Interface	Select this option to enable a spinner control to define a VLAN ID from 1 - 4,094 used as the virtual interface for the DHCPv6 relay. The interface designation is only required for link local and multicast addresses. A local link address is a locally derived address designed for addressing on a single link for automatic address configuration, neighbor discovery or when no routing resources are available.

44 Select **OK** to save the changes to the DHCPv6 relay configuration. Select **Exit** to close the screen without saving the updates.

45 Select the **IPv6 RA Prefixes** tab.



VLAN ID vlan5

Router Advertisement Policy

Router Advertisement Policy <none>

IPv6 RA Prefixes

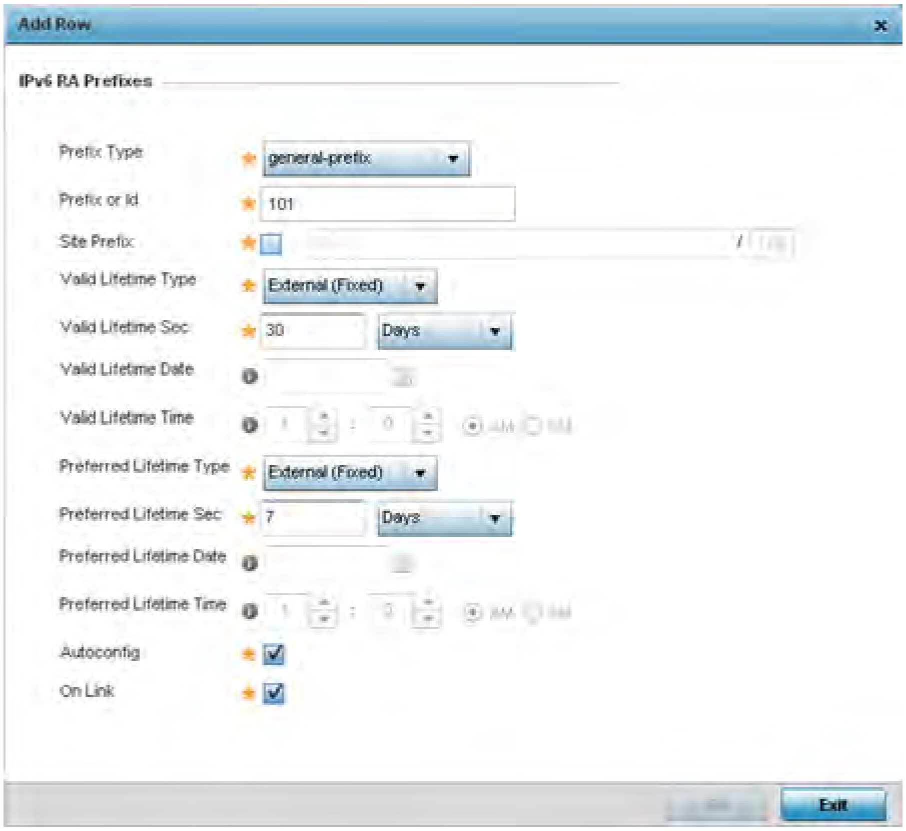
Prefix Type	Prefix or Id	Site Prefix	Valid Lifetime Type	Valid Lifetime Sec	Valid Lifetime Date	Valid Lifetime Time	Preferred Lifetime Type	Preferred Lifetime Sec	Preferred Lifetime Date	Preferred Lifetime Time	Autoconfig	On Link
general-pr	101	Not Set	External (F	30d 0h 0m	Not Set	Not Set	External (Fix	7d 0h 0m 0s	Not Set	Not Set	✓	✓

Figure 5-90 *Virtual Interfaces - Basic Configuration screen - IPv6 RA Prefixes tab*

46 Use the **Router Advertisement Policy** drop-down menu to select and apply a policy to the virtual interface.

Router advertisements are periodically sent to hosts or sent in response to solicitation requests. The advertisement includes IPv6 prefixes and other subnet and host information.

Review the configurations of existing IPv6 advertisement policies. If needed select **+ Add Row** to define the configuration of an additional IPv6 RA prefix.



IPv6 RA Prefixes

Prefix Type	general-prefix
Prefix or Id	101
Site Prefix	☐
Valid Lifetime Type	External (Fixed)
Valid Lifetime Sec	30 Days
Valid Lifetime Date	
Valid Lifetime Time	1 : 0 ● AM ○ PM
Preferred Lifetime Type	External (Fixed)
Preferred Lifetime Sec	7 Days
Preferred Lifetime Date	
Preferred Lifetime Time	1 : 0 ● AM ○ PM
Autoconfig	☑
On Link	☑

Figure 5-91 *Virtual Interfaces - Basic Configuration screen - Add IPv6 RA Prefix*

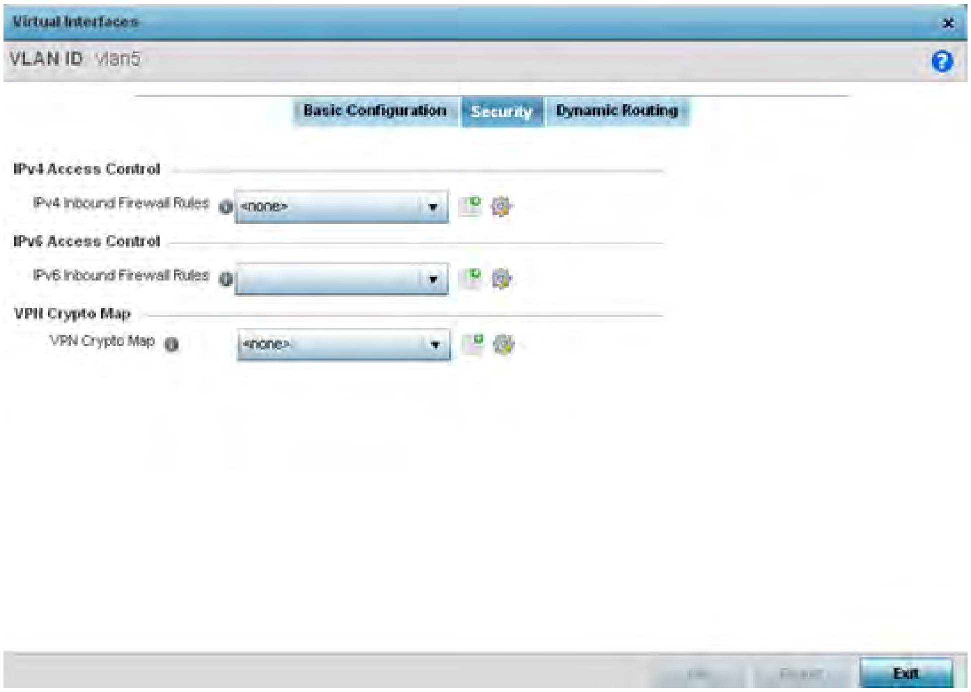
47 Set the following **IPv6 RA Prefix** settings:

Prefix Type	Set the prefix delegation type used with this configuration. Options include, *Prefix,* and *prefix-from-provider.* The default setting is Prefix. A prefix allows an administrator to associate a user defined name to an IPv6 prefix. A provider assigned prefix is made available from an *Internet Service Provider* (ISP) to automate the process of providing and informing the prefixes used.
Prefix or ID	Set the actual prefix or ID used with the IPv6 router advertisement.
Site Prefix	The site prefix is added into a router advertisement prefix. The site address prefix signifies the address is only on the local link.
Valid Lifetime Type	Set the lifetime for the prefix's validity. Options include *External (fixed), decrementing* and *infinite*. If set to External (fixed), just the *Valid Lifetime Sec* setting is enabled to define the exact time interval for prefix validity. If set to decrementing, use the lifetime date and time settings to refine the prefix expiry period. If the value is set for infinite, no additional date or time settings are required for the prefix and the prefix will not expire. The default setting is External (fixed).
Valid Lifetime Sec	If the lifetime type is set to *External (fixed),* set the *Seconds, Minutes, Hours* or *Days* value used to measurement criteria for the prefix's expiration. 30 days, 0 hours, 0 minutes and 0 seconds is the default lifetime.
Valid Lifetime Date	If the lifetime type is set to *External (fixed)*, set the date in MM/DD/YYYY format for the expiration of the prefix.

Valid Lifetime Time	If the lifetime type is set to *decrementing*, set the time for the prefix's validity.
Preferred Lifetime Type	Set the administrator preferred lifetime for the prefix's validity. Options include *External (fixed), decrementing* and *infinite*. If set to External (fixed), just the *Valid Lifetime Sec* setting is enabled to define the exact time interval for prefix validity. If set to decrementing, use the lifetime date and time settings to refine the prefix expiry period. If the value is set for infinite, no additional date or time settings are required for the prefix and the prefix will not expire. The default setting is External (fixed).
Preferred Lifetime Sec	If the administrator preferred lifetime type is set to *External (fixed)*, set the *Seconds, Minutes, Hours* or *Days* value used to measurement criteria for the prefix's expiration. 30 days, 0 hours, 0 minutes and 0 seconds is the default lifetime.
Preferred Lifetime Date	If the administrator preferred lifetime type is set to *External (fixed),* set the date in MM/DD/YYYY format for the expiration of the prefix.
Preferred Lifetime Time	If the preferred lifetime type is set to *decrementing,* set the time for the prefix's validity.
Autoconfig	Autoconfiguration entails generating a link-local address, global addresses via stateless address autoconfiguration and duplicate address detection to verify the uniqueness of the addresses on a link. This setting is enabled by default.
On Link	Select this option to keep the IPv6 RA prefix on the local link. The default setting is enabled.

48 Select **OK** to save the changes to the IPv6 RA prefix configuration. Select **Exit** to close the screen without saving the updates.

49 Select the **Security** tab.



VLAN ID vlan5

IPv4 Access Control

IPv4 Inbound Firewall Rules <none>

IPv6 Access Control

IPv6 Inbound Firewall Rules

VPN Crypto Map

VPN Crypto Map <none>

Figure 5-92 *OSPF Virtual Interface - Security screen*

50 Use the **IPv4 Inbound Firewall Rules** drop down menu to select the IPv4 specific inbound firewall rules to apply to this profile's virtual interface configuration. Select the **Create** icon to define a new IPv4 firewall rule configuration or select the **Edit** icon to modify an existing configuration.

IPv4 is a connectionless protocol for packet switched networking. IPv4 operates as a best effort delivery method, since it does not guarantee delivery, and does not ensure proper sequencing or duplicate delivery (unlike (TCP).

IPv4 and IPv6 are different enough to warrant separate protocols. IPv6 devices can alternatively use stateless address autoconfiguration. IPv4 hosts can use link local addressing to provide local connectivity.

51 Use the **IPv6 Inbound Firewall Rules** drop down menu to select the IPv6 specific inbound firewall rules to apply to this profile's virtual interface configuration. Select the **Create** icon to define a new IPv6 firewall rule configuration or select the **Edit** icon to modify an existing configuration.

IPv6 is the latest revision of the *Internet Protocol* (IP) replacing IPv4. IPV6 provides enhanced identification and location information for systems routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.

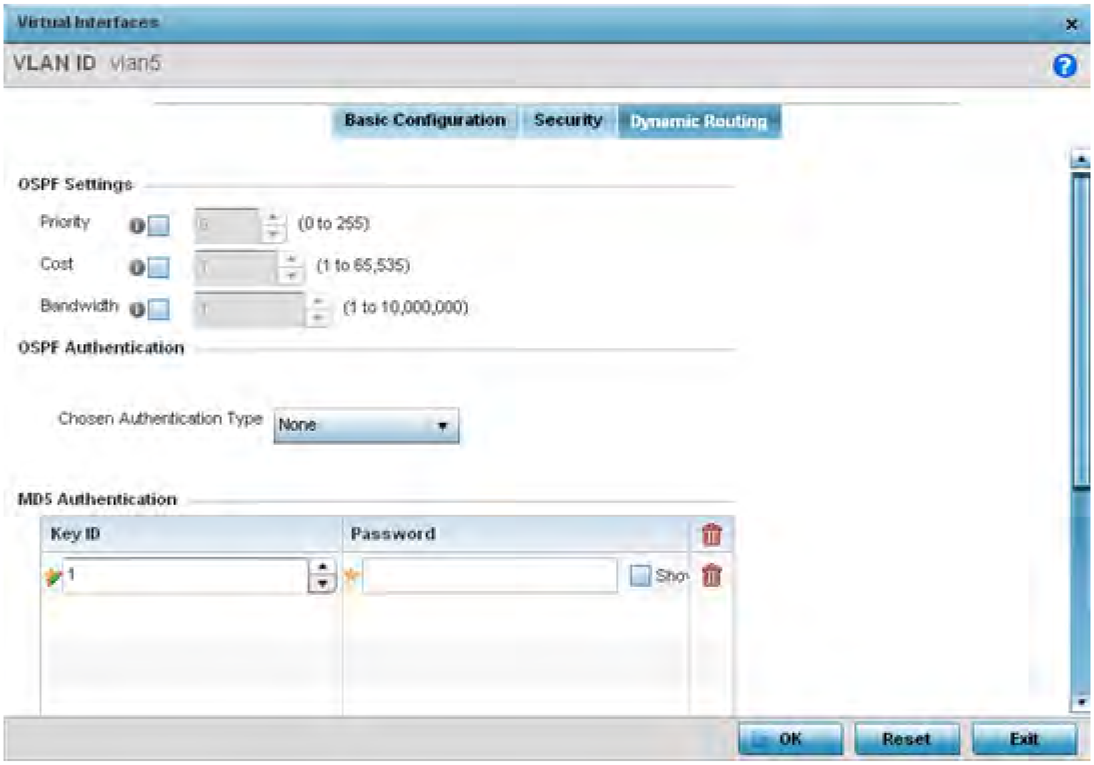
52 Refer to the **VPN Crypto Map** drop down menu to attach an existing crypto map to this virtual interface. New crypto map configuration can be added by selecting the **Create** icon, or existing configurations can be modified by selecting the **Edit** icon.

Crypto Map entries are sets of configuration parameters for encrypting packets that pass through the VPN Tunnel. If a Crypto Map configuration does not exist suiting the needs of this virtual interface, select the **Create** icon to define a new Crypto Map configuration or the **Edit** icon to modify an existing configuration. For more information, see Overriding a Profile's VPN Configuration on page 5-207.

53 Use the **Web Filter** drop-down menu to select or override the **URL Filter** configuration applied to this virtual interface. Web filtering is used to restrict access to resources on the Internet.

54 Select **OK** to save the changes to the configuration. Select **Reset** to revert to the last saved configuration.

55 Select the **Dynamic Routing** tab.



VLAN ID vlan5

OSPF Settings

Priority □ (0 to 255)

Cost □ 1 (1 to 65,535)

Bandwidth □ 1 (1 to 10,000,000)

OSPF Authentication

Chosen Authentication Type None

MD5 Authentication

Key ID	Password
1	□ Show

Figure 5-93 *OSPF Virtual Interface - Dynamic Routing screen*

56 Define or override the following parameters from within the **OSPF Settings** field

Priority	Select this option to set the OSPF priority used to select the network designated route. Use the spinner control to set the value from 0 - 255.
Cost	Select this option to set the cost of the OSPF interface. Use the spinner control to set the value from 1 - 65,535.
Bandwidth	Set the OSPF interface bandwidth (in Kbps) from 1 - 10,000,000.

57 Select the authentication type from the **Chosen Authentication Type** drop-down used to validate credentials within the OSPF dynamic route. Options include *simple-password*, *message-digest*, *null* and *None*. The default is None.

58 Select the **+ Add Row** button at the bottom of the **MD5 Authentication** table to add the Key ID and Password used for an MD5 validation of authenticator credentials. Use the spinner control to set the OSPF message digest authentication key ID. The available range is from 1 - 255. The password is the OSPF key either displayed as series or asterisks or in plain text (by selecting *Show*).

MD5 is a message digest algorithm using a cryptographic hash producing a 128-bit (16-byte) hash value, usually expressed in text as a 32 digit hexadecimal number. MD5 has been utilized in a wide variety of cryptographic applications, and is also commonly used to verify data integrity.

59 Select **OK** to save the changes to the configuration. Select **Reset** to revert to the last saved configuration.

5.2.8.11 Overriding a Profile’s Border Gateway Protocol (BGP) Configuration

▸ *Overriding a Profile’s Network Configuration*

Border Gateway Protocol (BGP) is an inter-ISP routing protocol which establishes routing between ISPs. ISPs use BGP to exchange routing and reachability information between *Autonomous Systems* (AS) on the Internet. BGP makes routing decisions based on paths, network policies and/or rules configured by network administrators. The primary role of a BGP system is to exchange network reachability information with other BGP peers. This information includes information on AS that the reachability information traverses. This information is sufficient to create a graph of AS connectivity from which routing decisions can be created and rules enforced.

An *Autonomous System* (AS) is a set of routers under the same administration that use *Interior Gateway Protocol* (IGP) and common metrics to define how to route packets within the AS. AS uses inter-AS routing to route packets to other ASs. For an external AS, an AS appears to have a single coherent interior routing plan and presents a consistent picture of the destinations reachable through it.

Routing information exchanged through BGP supports only destination based forwarding (it assumes a router forwards packets based on the destination address carried in the IP header of the packet).

BGP uses TCP as its transport protocol. This eliminates the need to implement explicit update fragmentation, retransmission, acknowledgement, and sequencing. BGP listens on TCP port 179. The error notification mechanism used in BGP assumes that TCP supports a *graceful* close (all outstanding data is delivered before the connection is closed).

To define or override a profile’s BGP configuration:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the *Device Browser* in the lower, left-hand, side of the UI.

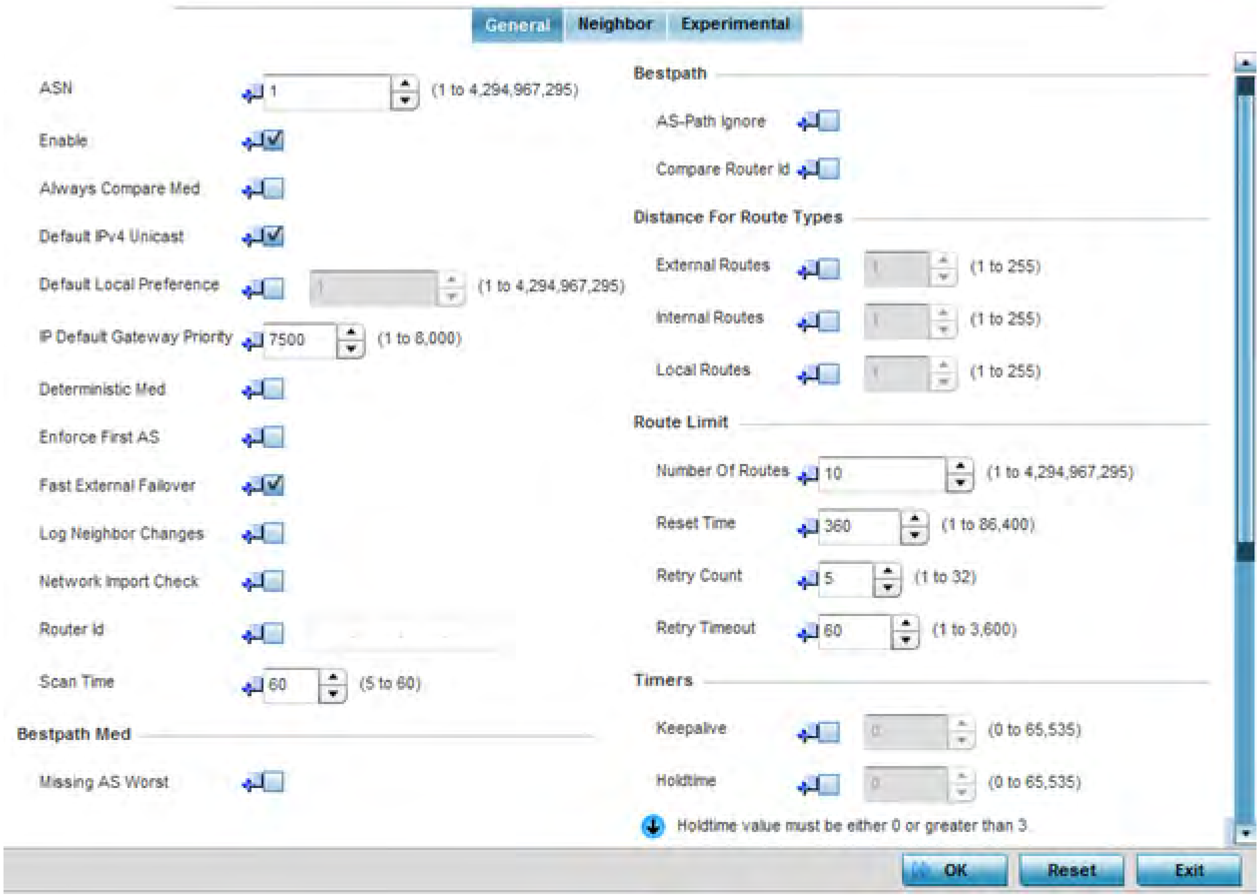
3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **BGP**.

☑ **NOTE:** BGP is only supported on RFS4000, RFS6000 and NX9500 model controllers and service platforms.

The **General** tab displays by default.



ASN 1 (1 to 4,294,967,295)

Enable ☑

Always Compare Med □

Default IPv4 Unicast ☑

Default Local Preference □ 1 (1 to 4,294,967,295)

IP Default Gateway Priority 7500 (1 to 8,000)

Deterministic Med □

Enforce First AS □

Fast External Failover ☑

Log Neighbor Changes □

Network Import Check □

Router Id □

Scan Time 60 (5 to 60)

Bestpath Med

Missing AS Worst □

Bestpath

AS-Path Ignore □

Compare Router Id □

Distance For Route Types

External Routes □ 1 (1 to 255)

Internal Routes □ 1 (1 to 255)

Local Routes □ 1 (1 to 255)

Route Limit

Number Of Routes 10 (1 to 4,294,967,295)

Reset Time 360 (1 to 86,400)

Retry Count 5 (1 to 32)

Retry Timeout 60 (1 to 3,600)

Timers

Keepalive □ 0 (0 to 65,535)

Holdtime □ 0 (0 to 65,535)

Holdtime value must be either 0 or greater than 3

Figure 5-94 *Border Gateway Protocol - General tab*

6 Review the following BGP general configuration parameters to determine whether an override is warranted:

ASN	Define the *Autonomous System Number* (ASN). ASN is a set of routers under the same administration that use *Interior Gateway Protocol* (IGP) and common metrics to define how to route packets. Select a value from 1 - 4,294,967,295.
Enable	Enable to start BGP on this controller or service platform. BGP is only supported on RFS4000, RFS6000and NX9500 model controllers and service platforms. The default is disabled.
Always Compare Med	*Multi-exit Discriminator* (MED) is a value used by BGP peers to select the best route among multiple routes. When enabled, the MED value encoded in the route is always compared when selecting the best route to the host network. A route with a lower MED value is always selected over a route with a higher MED value. BGP does not discriminate between iBGP and eBGP when using MED for route selection. This option is mutually exclusive to the *Deterministic MED* option.
Default IPv4 Unicast	Select this option to enable IPv4 unicast traffic for neighbors. This option is disabled by default.
Default Local Preference	Select this option to enable a local preference for the neighbor. When enabled, set the local preference value (1 - 4,294,967,295).
IP Default Gateway Priority	Set the default priority value for the IP Default Gateway. Set a value from 1 - 8000. The default is 7500.

Deterministic Med	*Multi-exit Discriminator* (MED) is used by BGP peers to select the best route among multiple routes. When enabled, MED route values (from the same AS) are compared to select the best route. This best route is then compared with other routes in the BGP route table to select the best overall route. This option is mutually exclusive to the *Always Compare MED* option.
Enforce First AS	Select this option to deny any updates received from an external neighbor that does not have the neighbor's configured AS at the beginning of the received AS path parameter. This enhances security by not allowing traffic from an unauthorized AS. This setting is disabled by default.
Fast External Failover	Select this option to immediately reset the BGP session on the interface once the BGP connection goes down. Normally, when a BGP connection goes down, the device waits for the expiry of the duration specified in *Holdtime* parameter before bringing down the interface. This setting is enabled by default.
Log Neighbor Changes	Select this option to enable logging of changes in routes to neighbor BGP peers. This enables the logging of only the changes in neighbor routes. All other events must be explicitly turned on using debug commands. This setting is disabled by default.
Network Import Check	Select this option to enable a network import check to ensure consistency in advertisements. This setting is disabled by default.
Router ID	Select this option to manually configure the router ID for this BGP supported controller or service platform. The router ID identifies the device uniquely. When no router ID is specified, the IP address of the interface is considered the router ID. This setting is disabled by default.
Scan Time	Select this option to set the scanning interval for updating BGP routes. This interval is the period between two consecutive scans the BGP device checks for the validity of routes in its routing table. To disable this setting, set the value to Zero (0). The default setting is 60 seconds.

7 Optionally select the **Missing AS Worst** option to treat any path that does not contain a MED value as the least preferable route. This setting is disabled by default.

8 Review the following **Bestpath** parameters:

AS-Path Ignore	Select this option to prevent an AS path from being considered as a criteria for selecting a preferred route. The route selection algorithm uses the AS path as one of the criteria when selecting the best route. When this option is enabled, the AS path is ignored.
Compare Router Id	Select this option to use the router ID as a selection criteria when determining a preferred route. The route selection algorithm uses various criteria when selecting the best route. When this option is enabled, the router ID is used to select the best path between two identical BGP routes. The route with the lower route ID is selected over a route with a higher route id.

9 Set or override the following **Distance for Route Types**. The distance parameter is a rating of route trustworthiness. The greater the distance, the lower the trust rating. The distance can be set for each type of route indicating its trust rating.

External Routes	External routes are those routes learned from a neighbor of this BGP device. Set a value from 1 - 255.

Internal Routes	Internal routes are those routes learned from another router within the same AS. Set a value from 1 - 255.
Local Routes	Local routes are those routes being redistributed from other processes within this BGP router. Set a value from 1 - 255.

10 Set or override the following **Route Limit** parameters:

Number of Routes	Configures the number of routes that can be stored on this BGP router. Set this value based on the available memory on this BGP router. Configure a value from 1 - 4,294,967,295. The default value is 9,216 routes.
Reset Time	Configures the reset time. This is the time limit after which the *Retry Count* value is set to Zero (0). Set a value from 1- 86,400 seconds.
Retry Count	Configures the number of time the BGP process is reset before it is shut down. Once shut down, the BGP process has to be started manually. The BGP process is reset if it is flooded with route entries that exceed its number of routes. Set a value from 1 - 32.
Retry Timeout	Configures the time duration in seconds the BGP process is shutdown temporarily before a reset of the process is attempted. Set a value from 1 - 3,600 seconds.

11 Set or override the following **Timers**:

Keepalive	Set the duration, in seconds, for the keep alive timer used to maintain connections between BGP neighbors. Set a value from 0 - 65,535 seconds.
Holdtime	Set the time duration, in seconds, for the hold (delay) of packet transmissions.

12 Set the following **Aggregate Address** parameters:

Aggregate addresses are used to minimize the size of the routing tables. Aggregation combines the attributes of several different routes and advertises a single route. This creates an aggregation entry in the BGP routing table if more specific BGP routes are available in the specified address range.

IP Prefix	Enter an IP address and mask used as the aggregate address.
Summary Only	Select this option to advertise the IP Prefix route to the BGP neighbor while suppressing the detailed and more specific routes.
As Set	Generates AS set path information. Select to enable. When selected, it creates an aggregate entry advertising the path for this route, consisting of all elements contained in all the paths being summarized. Use this parameter to reduce the size of path information by listing the AS number only once, even if it was included in the multiple paths that were aggregated.

13 Set the following **Distance for IP Source Prefix** fields:

IP Source Prefix	Enter an IP address and mask used as the prefix source address.
Admin Distance	Use the spinner control to set the BGP route's admin distance from 1 - 255.
IP Access List	Provide the IP address used to define the prefix list rule.

14 Configure the following **Network** values.

Network	Configure an IP address to broadcast to neighboring BGP peers. This network can be a single IP address or a range of IP addresses in *A.B.C.D/M* format.
Pathlimit	Configure the maximum path limit for this AS. Set a value from 1 - 255 AS hops.
Backdoor	Select this option to indicate to border devices this network is reachable using a backdoor route. A backdoor network is treated the same as a local network, except it is not advertised. This setting is disabled by default.
Route Map	Select an existing route map as a method of controlling and modifying routing information. The control of route information occurs using route redistribution keys.

15 Configure the following **Route Redistribute** values.

Route Type	Use the drop-down menu to define the route type as either *connected*, *kernal*, *ospf* or *static*.
Metric	Select this option to set a numeric route metric used for route matching and permit designations.
Route Map	Select an existing route map as a method of controlling and modifying routing information. The control of route information occurs using route redistribution keys.

16 Select **OK** to save the changes and overrides. Select **Reset** to revert to the last saved configuration.

17 Select the **Neighbor** tab.

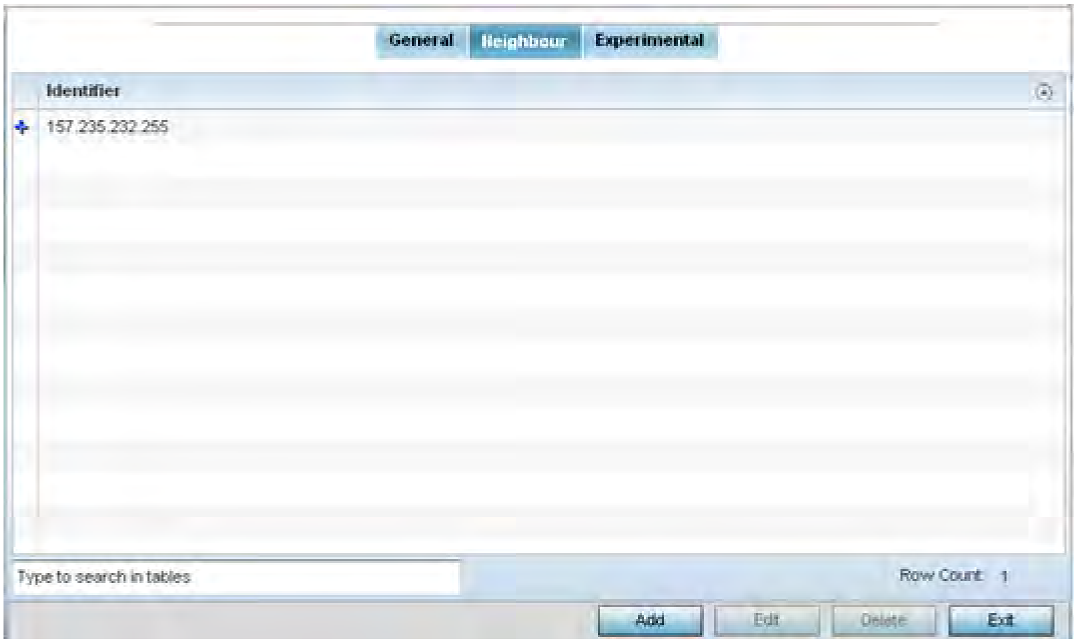
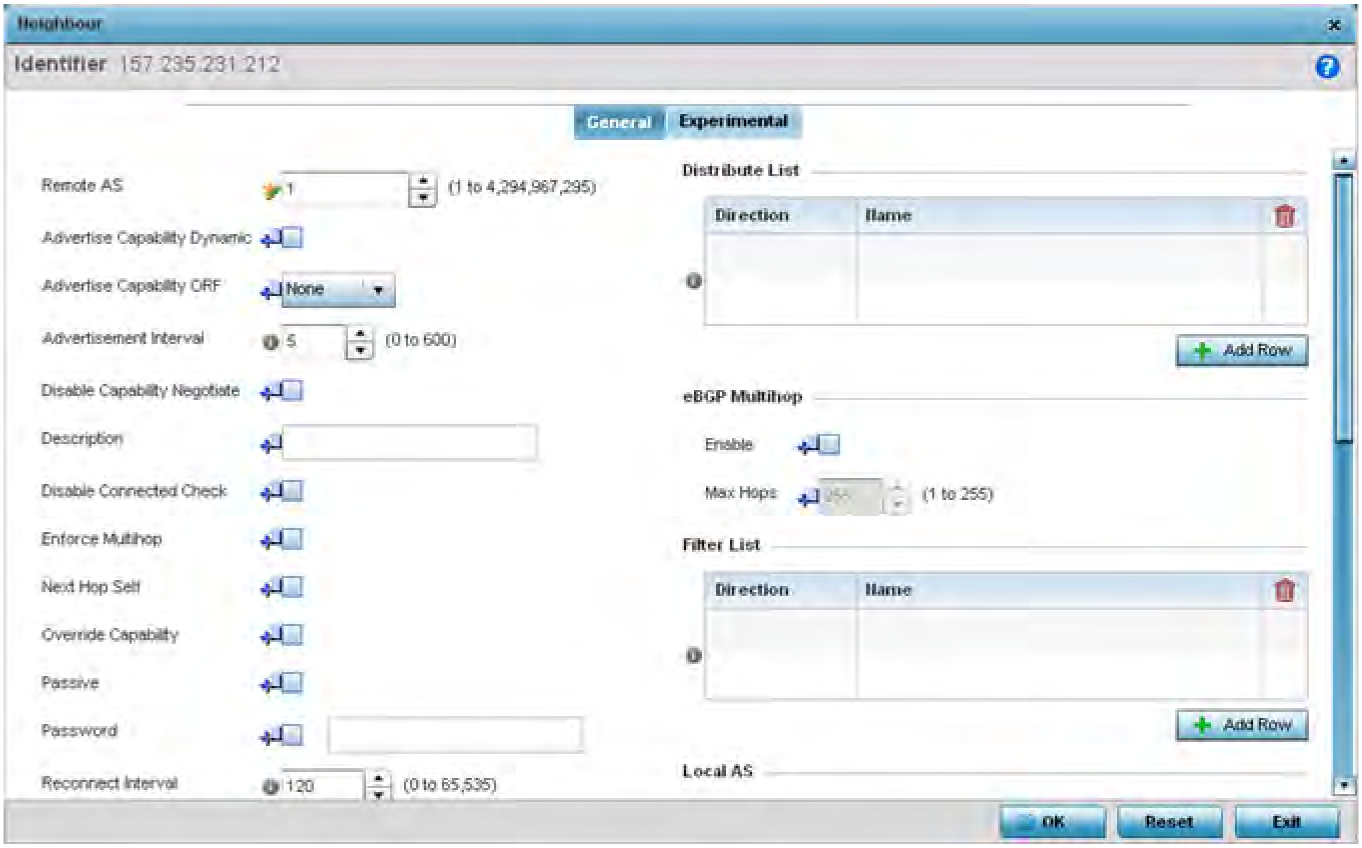


Figure 5-95 *Border Gateway Protocol - Neighbor tab*

The **Neighbor** tab displays a list of configured BGP neighbor devices identified by their IP address.

18 Select **Add** to add a new BGP neighbor configuration or select an existing Identifier and select Edit to modify it. The following screen displays with the General tab displayed by default.



Neighbour

Identifier 157.235.231.212

General | Experimental

Remote AS 1 (1 to 4,294,967,295)

Advertise Capability Dynamic □

Advertise Capability ORF None

Advertisement Interval 5 (0 to 600)

Disable Capability Negotiate □

Description

Disable Connected Check □

Enforce Multihop □

Next Hop Self □

Override Capability □

Passive □

Password □

Reconnect Interval 120 (0 to 65,535)

Distribute List

Direction	Name

eBGP Multihop

Enable □

Max Hops 255 (1 to 255)

Filter List

Direction	Name

Local AS

Figure 5-96 *Border Gateway Protocol - Neighbor tab - Add/Edit screen*

The **General** tab displays the different configuration parameters for the neighbor BGP device.

19 Configure the following common parameters:

Remote AS	Define the *Autonomous System Number* (ASN) for the neighbor BGP device. ASN is a set of routers under the same administration that use *Interior Gateway Protocol* (IGP) and common metrics to define how to route packets within the AS. Set a value from 1 - 4,294,967,295.
Advertise Capability Dynamic	Select this option to show a neighbor device's capability to advertise or withdraw and address capability to other peers in a non-disruptive manner. This setting is disabled by default.
Advertise Capability ORF	Select this option to enable *Outbound Router Filtering* (ORF) and advertise this capability to peer devices. ORFs send and receive capabilities to lessen the number of updates exchanged between BGP peers. By filtering updates, ORF minimizes update generation and exchange overhead. The local BGP device advertises ORF in the *send* mode. The peer BGP device receives the ORF capability in *receive* mode. The two devices exchange updates to maintain the ORF for each router. Only a peer group or an individual BGP router can be configured to be in *receive* or *send* mode. A member of a peer group cannot be configured.

Advertisement Interval	Use the *Advertisement Interval* to set the minimum interval between sending BGP router updates. Sending too many router updates creates flapping of routes leading to possible disruptions. Set a minimum interval so that the BGP routing updates are sent after the set interval in seconds. The default is 5 seconds.
Disable Capability Negotiate	Select to disable capability negotiation with BGP neighbors. This is to allow compatibility with older BGP versions that have no capability parameters used in the *open* messages between peers. This setting id disabled by default.
Description	Provide a 80 character maximum description for this BGP neighbor device.
Disable Connected Check	If utilizing loopback interfaces to connect single-hop BGP peers, enable the neighbor disable connected check before establishing a the BGP peering session.This setting is disabled by default.
Enforce Multihop	A *multihop* route is a route to external peers on indirectly connected networks. Select to enforce neighbors to perform multi-hop check. This setting is disabled by default.
Next Hop Self	Select to enable *Next Hop Self*. Use this to configure this device as the next hop for a BGP speaking neighbor or peer group. This allows the BGP device to change the next hop information that is sent to iBGP peers. The next hop address is set to the IP address of the interface used to communicate with the eBGP neighbor. This setting is disabled by default.
Override Capability	Select this to enable the ability to override capability negotiation result. This setting is disabled by default.
Passive	Select this option to set this BGP neighbor as passive. When a neighbor is set as passive, the local device should not attempt to *open* a connection to this device. This setting is disabled by default
Reconnect Interval	Set a reconnection interval for peer BGP devices from 0 - 65,535 seconds. The default setting is 120 seconds.
Send Community	Select this option to ensure the community attribute is sent to the BGP neighbor. The community attribute groups destinations in a certain community and applies routing decisions based on the community. On receiving community attribute, the BGP router announces it to the neighbor.
Shutdown	Select this option to administratively shutdown this BGP neighbor. This setting is disabled by default.
Soft Reconfiguration Inbound	Select this option to store updates for inbound soft reconfiguration. Soft-reconfiguration can be used in lieu of BGP route refresh capability. Selecting this option enables local storage of all received routes and their attributes. This requires additional memory on the BGP device. When a soft reset (inbound) is performed on the neighbor device, the locally stored routes are reprocessed according to the inbound policy. The BGP neighbor connection is not affected.

Update Source	Select this option to allow internal BGP sessions to use any operational interface for TCP connections. Use *Update Source* in conjunction with any specified interface on the router. The loopback interface is the interface that is most commonly used with this command. The use of loopback interface eliminates a dependency and BGP does not have to rely on the availability of a particular interface for making TCP connections. This setting is disabled by default.
Unsuppress Map	Enable *Unsuppress Map* to selectively advertise more precise routing information to this neighbor. Use this in conjunction with the *Route Aggregate* command. The route aggregate command creates a route map with a IP/mask address that consolidates the subnets under it. This enables a reduction in number of route maps on the BGP device to one entry that encompasses all the different subnets. Use Unsuppress Map to selectively allow/deny a subnet or a set of subnets. Use the *Create* icon to create a new route map. Use the *Edit* icon to edit an existing route map list after selecting it.
Weight	Select to set the weight of all routes learned from this BGP neighbor. Weight is used to decide the preferred route when the same route is learned from multiple neighbors. The highest weight is always chosen.

20 Configure or set the following **Default Originate** parameters. Default originate is used by the local BGP router to send the default route 0.0.0.0 to its neighbor for use as a default route.

Enable	Select to enable *Default* Originate on this BGP neighbor. This setting is disabled by default.
Route Map	Use the drop-down menu to select a route map (enhanced packet filter) to use as the *Default Originate* route.

21 Configure or set the following **Route Map** parameters. This configures how route maps are applied for this BGP neighbor.

Direction	Use the drop-down menu to configure the direction on which the selected route map is applied. Select one from *in*, *out*, *export* or *import.*
Route Map	Use the drop-down menu to select the route map to use with this BGP neighbor. Use the *Create* icon to create a new route map. Use the *Edit* icon to edit an existing route map after selecting it.

22 Configure or set the following **Distribute List** parameters. Up to 2 distribute list entries can be created.

Direction	Use the drop-down menu to configure the direction on which the selected IP access list is applied. Select either *in* or *out.*
Name	Use the drop-down menu to select the route map to use with this BGP neighbor. Use the *Create* icon to create a new IP Access list. Use the *Edit* icon to edit an existing IP Access list after selecting it.

23 Configure or set the following **eBGP Multihop** parameters. This configures the maximum number of hops that can be between eBGP neighbors not directly connected to each other.

Enable	Select to enable *eBGP Multihop* on this BGP neighbor.
Max Hops	Set the maximum number of hops between eBGP neighbors not connected directly. Select a value from 1 - 255.

24 Configure or set the following **Filter List** parameters. Up to 2 filter list entries can be created.

Direction	Use the drop-down menu to configure the direction on which the selected AS Path list is applied. Select either *in* or *out.*
Name	Use the drop-down menu to select the AS Path list to use with this BGP neighbor. Use the *Create* icon to create a new AS Path list. Use the *Edit* icon to edit an existing AS Path list after selecting it.

25 Configure or set the following **Local AS** parameters.

⚠ **CAUTION:** This is an experimental feature and its actual operation may be unpredictable.

AS Number	Specify the local *Autonomous System* (AS) number. Select from 1 - 4,294,967,295.
No Prepend	Select to enable. When enabled, the local AS number is not prepended to route updates from eBGP peers.

26 Configure or set the following **Maximum Prefix** value. This configures the maximum number of prefix that can be received from a BGP neighbor.

Prefix Limit	Sets the maximum number of prefix that can be received from a BGP neighbor. Select from 1 - 4,294,967,295. Once this threshold is reached, the BGP peer connection is reset.
Threshold Percent	Sets the threshold limit for generating a log message. When this percent of the *Prefix Limit* is reached, a log entry is generated. For example if the *Prefix Limit* is set to 100 and *Threshold Percent* is set to 65, then after receiving 65 prefixes, a log entry is created.
Restart Limit	Sets the number of times a reset BGP peer connection is restarted. Select a value from 1 - 65535.
Warning Only	Select to enable. When the number of prefixes specified in *Prefix Limit* field is exceeded, the connection is reset. However, when this option is enabled, the connection is not reset and an event is generated instead. This setting is disabled by default.

27 Configure or set the following **Prefix List** parameters. Up to 2 prefix list entries can be created.

Direction	Use the drop-down menu to configure the direction on which the selected IP prefix list is applied. Select either *in* or *out.*
Name	Use the drop-down menu to select the IP prefix list to use with this BGP neighbor. Use the *Create* icon to create a new IP prefix list or select the *Edit* icon to edit an existing IP prefix list after selecting it.

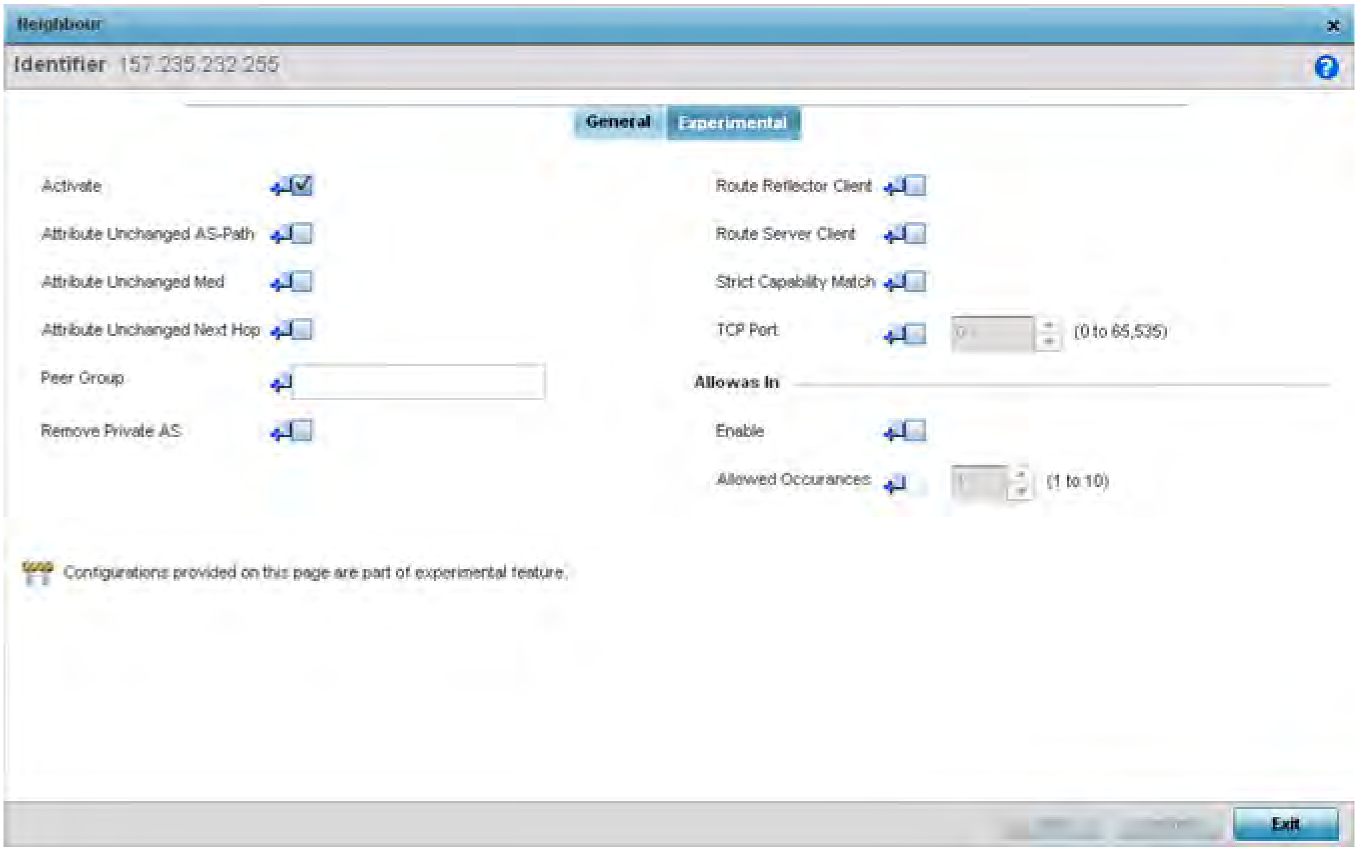
28 Set or override the following **Timers** for this BGP neighbor:

Keepalive	Set the time duration in seconds for keepalive. The keep alive timer is used to maintain connections between BGP neighbors. Set a value from 1 - 65,535 seconds.
Holdtime	Set the time duration in seconds for the hold time.

29 Select **OK** to save the changes and overrides. Select **Reset** to revert to the last saved configuration.

30 Select the **Experimental** tab.

CAUTION: This is an experimental feature and its actual operation may be unpredictable.



Neighbour

Identifier 157.235.232.255

General | Experimental

Activate ☑

Attribute Unchanged AS-Path ☐

Attribute Unchanged Med ☐

Attribute Unchanged Next Hop ☐

Peer Group

Remove Private AS ☐

Route Reflector Client ☐

Route Server Client ☐

Strict Capability Match ☐

TCP Port ☐ 0 (0 to 65,535)

Allowas In

Enable ☐

Allowed Occurances 1 (1 to 10)

Configurations provided on this page are part of experimental feature.

Figure 5-97 *Border Gateway Protocol - Neighbor tab - Experimental tab*

31 Set the following **Experimental** BGP parameters:

Activate	Enable an address family for this neighbor. This setting is enabled by default.
Attribute Unchanged AS-Path	Select to enable propagating AS path BGP attribute unchanged to this neighbor BGP device. This setting is enabled by default.
Attribute Unchanged Med	Select to enable propagating MED BGP attribute unchanged to this neighbor BGP device. This setting is enabled by default.
Attribute Unchanged Next Hop	Select to enable propagating the next hop BGP attribute value unchanged to this neighbor BGP device. This setting is enabled by default.
Peer Group	Set the peer group for this BGP neighbor device. Peer groups are a set of BGP neighbors with the same update policies. This facilitates the updates of various policies, such as, distribute lists and filter lists. The peer group can be configured as a single entity. Any changes made to the peer group is propagated to all members.

Remove Private AS	Select this option to remove the private *Autonomous System* (AS) number from outbound updates. Private AS numbers are not advertised to the Internet. This option is used with external BGP (eBGP) peers only. The router removes the AS numbers only if the update includes private AS numbers. If the update includes both private and public AS numbers, the system treats it as an error.
Route Reflector Client	Select this option to enable this BGP neighbor as a route reflector client for the local router. Route reflectors control large numbers of iBGP peering.Using route reflection, the number of iBGP peers is reduced. This option configures the local BGP device as a route reflector and the neighbor as its route reflector client. This setting is disabled by default.
Route Server Client	Select this option to enable this neighbor BGP device to act as a route server client. This setting is disabled by default.
Strict Capability Match	Select this option to enable a strict capability match before allowing a neighbor BGP peer to open a connection. When capabilities do not match, the BGP connection is closed. This setting is disabled by default.
TCP Port	Select to enable configuration of non-standard BGP port for this BGP neighbor. By default the BGP port number is 179. To configure a non standard port for this BGP neighbor, use the control to set the port number. Select a value from 1 - 65,535.

32 Configure or set the following **Allowas In** parameters.

This configures the Provider Edge (PE) routers to allow the re-advertisement of all prefixes containing duplicate Autonomous System Numbers (ASN). This creates a pair of VPN Routing/Forwarding (VRF) instances on each PE router to receive and re-advertise prefixes. The PE router receives prefixes with ASNs from all PE routers and advertises to its neighbor PE routers on one VRF. The other VRF receives prefixes with ASNs from the Customer Edge (CE) routers and re-advertises them to all PE routers in the configuration.

Enable	Select this option to enable re-advertisement of all prefixes containing duplicate ASNs.
Allowed Occurrences	Set the maximum number of times an ASN is advertised. Select a value in the rage 1 - 10.

33 Select **OK** to save the changes and overrides. Select **Reset** to revert to the last saved configuration. Select **Exit** to close this window and go back to the main screen.

34 Select the **Experimental** tab from the BGP main screen.

⚠ **CAUTION:** This is an experimental feature and its actual operation may be unpredictable.

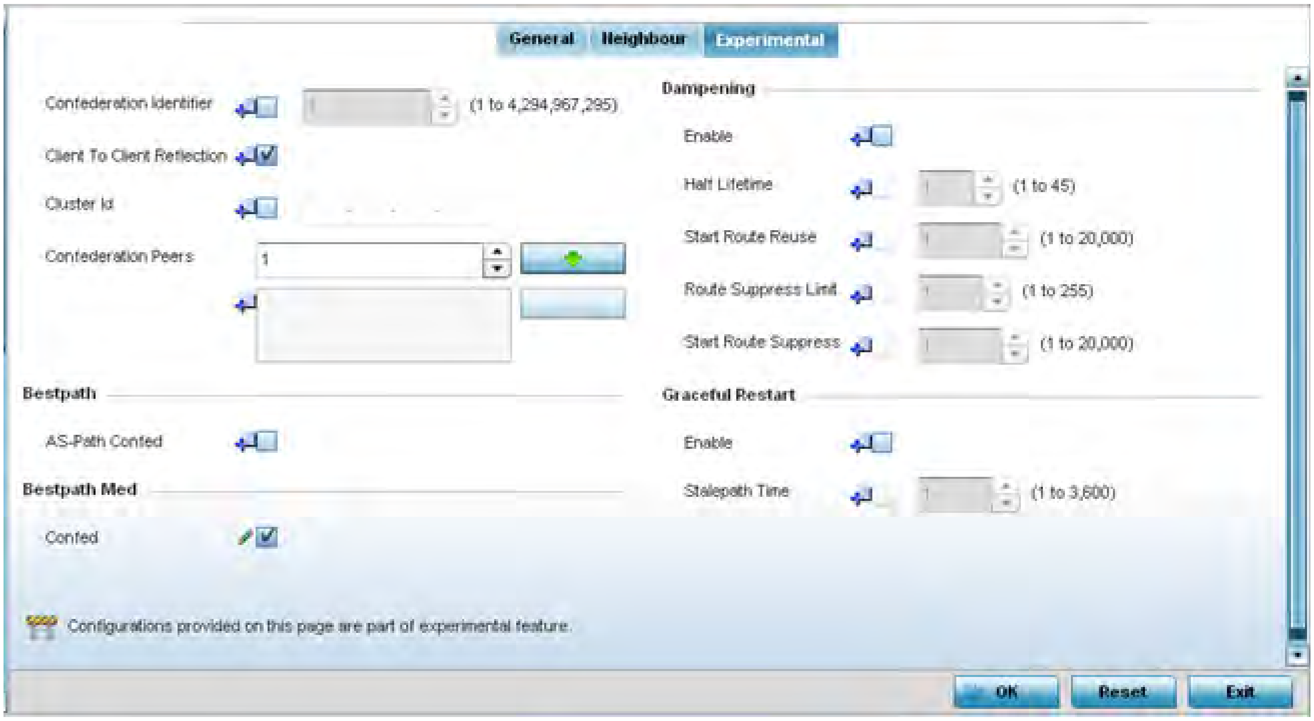


Figure 5-98 *Border Gateway Protocol - Experimental tab*

35 Set the following **Experimental** BGP features:

Confederation Identifier	Enable and set a *confederation identifier* to allow an AS to be divided into several ASs. This confederation is visible to external routers as a single AS. Select a value from 1 - 4,294,967,295.
Client to Client Reflection	Select to enable client-to-client route reflection. Route reflectors are used when all iBGP speakers are not fully meshed. If the clients are fully meshed, the route-reflectors are not required. The default is enabled.
Cluster ID	Select to enable and set a Cluster ID if the BGP cluster has more than one route-reflectors. A cluster generally consists of a single route-reflector and its clients. The cluster is usually identified by the router ID of this single route-reflector. Sometimes, to increase the redundancy, a cluster might have more than one route-reflectors configured. In this case, all route-reflectors in the cluster are identified by the Cluster ID. Select a value from 1 - 4,294,967,295.
Confederation Peers	Use this spinner to select the confederation members. Once selected, select the *Down Arrow* button next to this control to add the AS as a confederation member. Multiple AS configurations can be added to the list of confederation members. To remove an AS as a confederation member, select the AS from the list and select the *Up Arrow* button next to the list.

36 Configure or set the following **Bestpath** parameter:

AS-Path Confed	Select this option to allow the comparison of the confederation AS path length when selecting the best route. This indicates the AS confederation path length must be used, if available, in the BGP path when deciding the best path.

37 Configure or set the following **Bestpath Med** parameter:

Confed	Select to enable. Use this option to allow comparing MED when selecting the best route when learned from confederation peers. This indicates that MED must be used, when available, in the BGP best path when deciding the best path between routes from different confederation peers.

38 Configure or set the following **Dampening** parameters.

Dampening minimizes the instability caused by route flapping. A penalty is added for every flap in the flapping route. As soon as the total penalty reaches the Route Suppress Limit value, the advertisement of this route is suppressed. This penalty is delayed when the time specified in Half Lifetime occurs. Once the penalty becomes lower than the value specified in Start Route Reuse, the advertisement of the route is un-suppressed.

Enable	Select to enable dampening on advertised routes. When this option is selected, other configuration fields in this Dampening field are enabled. This setting is disabled by default.
Half Lifetime	Select to enable and configure the half lifetime value. A penalty is imposed on a route that flaps. This is the time for the penalty to decrease to half its current value. Set a value from 1 - 45 in minutes. The default is 1 second.
Start Route Reuse	Select to enable and configure the route reuse value. When the penalty for a suppressed route decays below the value specified in *Start Route Reuse* field, the route is un-suppressed. Set a value from 1 - 20000.
Route Suppress Limit	Select to enable and configure the maximum duration in minutes a suppressed route is suppressed. This is the maximum duration for which a route remains suppressed before it is reused. Set a value from 1 - 255 minutes.
Start Route Suppress	Select to enable and configure the route suppress value. When a route flaps, a penalty is added to the route. When the penalty reaches or exceeds the value specified in *Route Suppress Limit*, the route is suppressed. Set a value from 1 - 20000.

39 Configure or set the **Graceful Restart** parameters. This provides a graceful restart mechanism for a BGP session reset in which the BGP daemon is not restarted, so that any changes in network configuration that caused the BGP reset does not affect packet forwarding.

Enable	Select to enable a graceful restart on this BGP router. This section is disabled by default.
Stalepath Time	Configure the maximum time to retain stale paths from restarting neighbor. This is the time the paths from a restarting neighbor is preserved. All stale paths, unless reinstated by the neighbor after re-establishment, are deleted at the expiry of this timer value. Set a value from 1 - 3600 seconds.

40 Select **OK** to save the changes and overrides. Select **Reset** to revert to the last saved configuration. Select **Exit** to close this window and go back to the main screen.

5.2.8.12 Overriding a Profile’s Forwarding Database Configuration

▸ *Overriding a Profile’s Network Configuration*

A *Forwarding Database* forwards or filter packets on behalf of the managing controller, service platform or Access Point. The bridge reads the packet’s destination MAC address and decides to either forward the packet or drop (filter) it. If it's determined the destination MAC is on a different network segment, it forwards the packet to the segment. If the destination MAC is on the same network segment, the packet is dropped (filtered). As nodes transmit packets through the bridge, the bridge updates its forwarding database with known MAC addresses and their locations on the network. This information is then used to decide to filter or forward the packet.

This forwarding database assignment can be overridden as needed, but removes the device configuration from the managed profile that may be shared with other similar device models.

To define or override a profile's forwarding database configuration:

1 Select **Devices** from the Configuration tab.

  The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

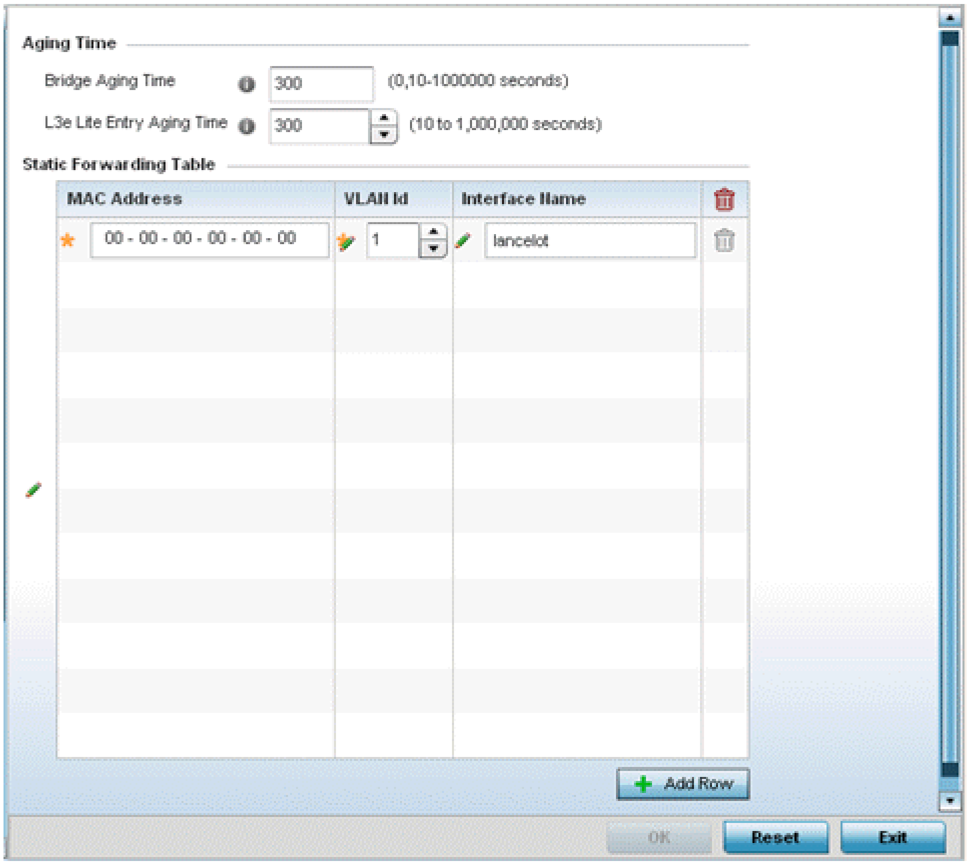
  Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **Forwarding Database**.

☑ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Aging Time

Bridge Aging Time 300 (0,10-1000000 seconds)

L3e Lite Entry Aging Time 300 (10 to 1,000,000 seconds)

Static Forwarding Table

MAC Address	VLAN Id	Interface Name
00 - 00 - 00 - 00 - 00 - 00	1	lancelot

Figure 5-99 *Profile Overrides - Network Forwarding Database screen*

6 Define or override a **Bridge Aging Time** between 0, 10-1,000,000 seconds.

The aging time defines the interval an entry remains in the a bridge's forwarding table before being deleted due to lack of activity. If an entry replenishments a destination generating continuous traffic, this timeout value will never be invoked. However, if the destination becomes idle, the timeout value represents the length of time that must be exceeded before an entry is deleted from the forwarding table. The default setting is 300 seconds.

7 Define or override a **L3e Lite Entry Aging Time** between 10-1,000,000 seconds.

The default setting is 300 seconds. This setting is not available on all device platforms.

8 Use the **+ Add Row** button to create a new row within the **Static Forwarding Table**.

9 Set or override a destination **MAC Address**. The bridge reads the packet's destination MAC address and decides to forward the packet or drop (filter) it. If it's determined the destination MAC is on a different network, it forwards the packet to the segment. If the destination MAC is on the same network segment, the packet is dropped (filtered).

10 Define or override the target **VLAN ID** if the destination MAC is on a different network segment.

11 Provide an **Interface Name** used as the target destination interface for the target MAC address.

12 Select **OK** to save the changes and overrides. Select **Reset** to revert to the last saved configuration.

5.2.8.13 Overriding a Profile’s Bridge VLAN Configuration

▸ *Overriding a Profile’s Network Configuration*

A *Virtual LAN* (VLAN) is separately administrated virtual network within the same physical managed network. VLANs are broadcast domains defined within switches to allow control of broadcast, multicast, unicast, and unknown unicast within a Layer 2 device.

Administrators often need to route traffic to interoperate between different VLANs. Bridging VLANs are only for non-routable traffic, like tagged VLAN frames destined to some other device which will untag it. When a data frame is received on a port, the VLAN bridge determines the associated VLAN based on the port of reception. Using forwarding database information, the Bridge VLAN forwards the data frame on the appropriate port(s). VLAN's are useful to set separate networks to isolate some computers from others, without actually having to have separate cabling and Ethernet switches. Controllers and service platforms can do this on their own, without need for the computer or other gear to know itself what VLAN it's on (this is called port-based VLAN, since it's assigned by port of the switch). Another common use is to put specialized devices like VoIP Phones on a separate network for easier configuration, administration, security, or quality of service.

Two main VLAN bridging modes are available:

- *Tunnel Mode:* In tunnel mode, the traffic at the Access Point is always forwarded through the best path. The Access Point decides the best path to use and appropriately forwards packets. Setting the VLAN to tunnel mode ensures packets are Bridge packets between local Ethernet ports, any local radios, and tunnels to other APs and wireless controller.
- *Local Mode*: Local mode is typically configured in remote branch offices where traffic on remote private LAN segment needs to be bridged locally. Local mode implies that the wired and the wireless traffic are to be bridged locally.

To define a bridge VLAN configuration or override for a device profile:

1. Select **Devices** from the Configuration tab.

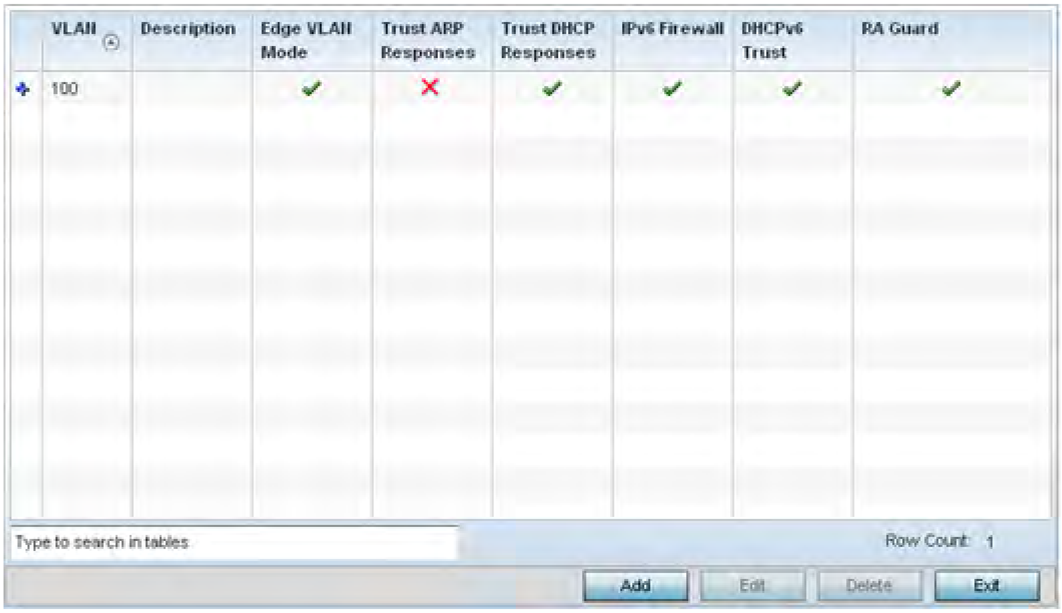
   The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2. Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

   Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3. Select **Profile Overrides** from the Device menu to expand it into sub menu options.
4. Select **Network** to expand its sub menu options.
5. Select **Bridge VLAN**.

✓ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



VLAN	Description	Edge VLAN Mode	Trust ARP Responses	Trust DHCP Responses	IPv6 Firewall	DHCPv6 Trust	RA Guard
100		✓	✗	✓	✓	✓	✓

Type to search in tables

Row Count: 1

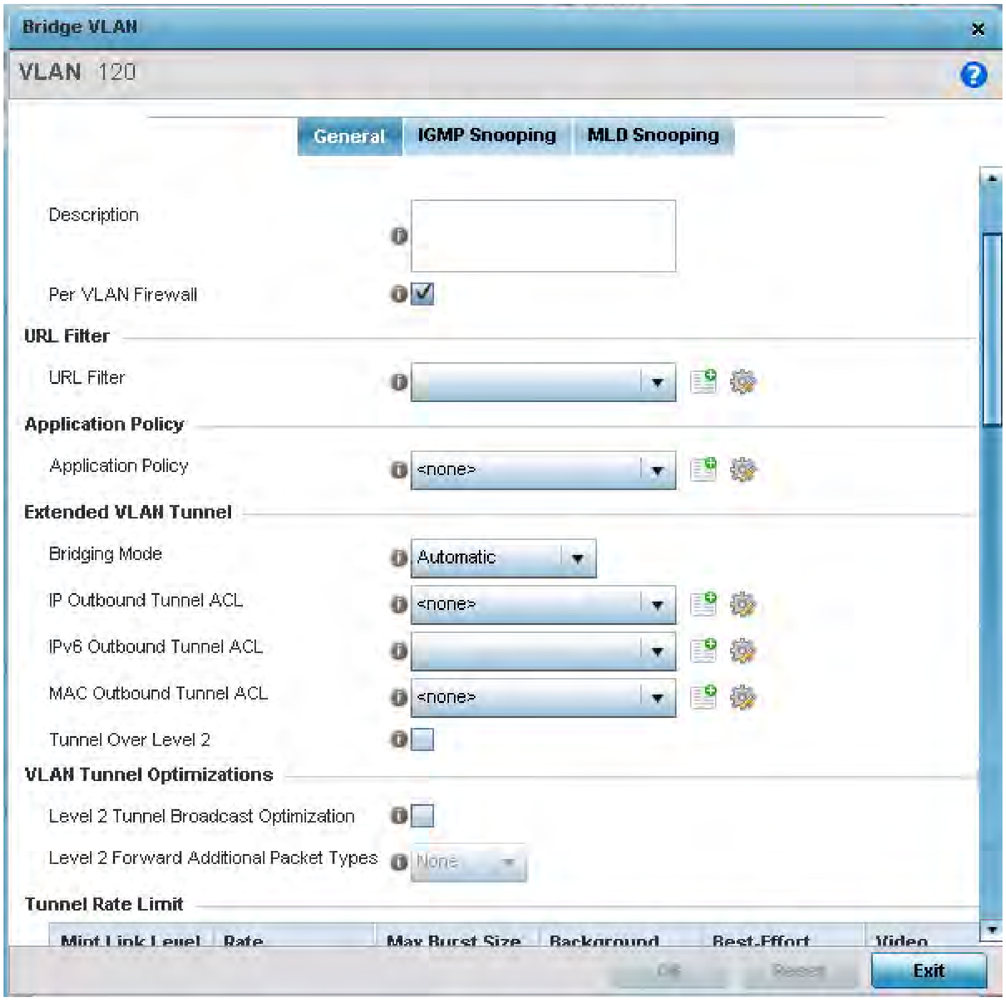
Figure 5-100 *Profile Overrides - Network Bridge VLAN screen*

6 Review the following VLAN configuration parameters to determine whether an override is warranted:

VLAN	Lists the numerical identifier defined for the Bridge VLAN when it was initially created. The available range is from 1 - 495. This value cannot be modified during the edit process.
Description	Lists a VLAN description assigned when the VLAN was created or modified. The description should be unique to the VLAN's specific configuration and help differentiate it from other VLANs with similar configurations.
Edge VLAN Mode	Defines whether the VLAN is currently in edge VLAN mode. A green check mark defines the VLAN as extended. An edge VLAN is the VLAN where hosts are connected. For example, if VLAN 10 is defined with wireless clients, and VLAN 20 is where the default gateway resides, VLAN 10 should be marked as an edge VLAN and VLAN 20 shouldn't be marked as an edge VLAN. When defining a VLAN as edge VLAN, the firewall enforces additional checks on hosts in that VLAN. For example, a host cannot move from an edge VLAN to another VLAN and still keep firewall flows active.
Trust ARP Responses	Trusted ARP packets are used to update the IP-MAC Table to prevent IP spoof and arp-cache poisoning attacks. When ARP trust is enabled, a green check mark displays. When disabled, a red "X" displays.
Trust DHCP Responses	When enabled, DHCP packets from a DHCP server are trusted and permissible. DHCP packets update the DHCP Snoop Table to prevent IP spoof attacks. When DHCP trust is enabled, a green check mark displays. When disabled, a red "X" displays.

IPv6 Firewall	Lists whether IPv6 is enabled on this bridge VLAN. A green checkmark defines this setting as enabled. A red X defines this setting as disabled. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons. IPv6 hosts can configure themselves automatically when connected to an IPv6 network using the neighbor discovery protocol via ICMPv6 router discovery messages. When first connected to a network, a host sends a link-local router solicitation multicast request for its configuration parameters; routers respond to such a request with a router advertisement packet that contains Internet Layer configuration parameters.
DHCPv6 Trust	Lists whether DHCPv6 responses are trusted on this bridge VLAN. A green checkmark defines this setting as enabled. A red X defines this setting as disabled. If enabled, only DHCPv6 responses are trusted and forwarded over the bridge VLAN.
RA Guard	Lists whether *router advertisements* (RA) are allowed on this bridge VLAN. A green checkmark defines this setting as enabled. A red X defines this setting as disabled. RAs are periodically sent to hosts or sent in response to solicitation requests. The advertisement includes IPv6 prefixes and other subnet and host information.

7 Select **Add** to define a new Bridge VLAN configuration, **Edit** to modify or override an existing Bridge VLAN configuration or **Delete** to remove a VLAN configuration.



Description

Per VLAN Firewall ☑

URL Filter

URL Filter

Application Policy

Application Policy <none>

Extended VLAN Tunnel

Bridging Mode Automatic

IP Outbound Tunnel ACL <none>

IPv6 Outbound Tunnel ACL

MAC Outbound Tunnel ACL <none>

Tunnel Over Level 2 □

VLAN Tunnel Optimizations

Level 2 Tunnel Broadcast Optimization □

Level 2 Forward Additional Packet Types None

Tunnel Rate Limit

Mint Link Level	Rate	Max Burst Size	Background	Best-Effort	Video

Figure 5-101 *Profile Overrides - Network Bridge VLAN screen, General tab*

The **General** tab displays by default.

8 If adding a new Bridge VLAN configuration, use the spinner control to define or override a **VLAN** ID between 1 - 4094. This value must be defined and saved before the General tab can become enabled and the remainder of the settings defined. VLAN IDs 0 and 4095 are reserved and unavailable.

9 Set or override the following **General** bridge VLAN parameters:

Description	If creating a new Bridge VLAN, provide a description (up to 64 characters) unique to the VLAN's specific configuration to help differentiate it from other VLANs with similar configurations.
Per VLAN Firewall	Enable this setting to provide firewall allow and deny conditions over the bridge VLAN. This setting is enabled by default.

10 Set or override the following **URL Filter** parameters. URL filters are used to control access to specific resources on the Internet.

URL Filter	Use the drop-down menu to select a URL filter to use with this Bridge VLAN.

11 Use the drop-down to select the appropriate **Application Policy** to use with this Bridge VLAN configuration. An application policy defines the rules or actions executed on recognized HTTP (Facebook), enterprise (Webex) and peer-to-peer (gaming) applications or application-categories.

12 Set or override the following **Extended VLAN Tunnel** parameters:

Bridging Mode	Specify one of the following bridging mode for use on the VLAN. • *Automatic* - Select automatic mode to let the controller or service platform determine the best bridging mode for the VLAN. • *Local* - Select Local to use local bridging mode for bridging traffic on the VLAN. • *Tunnel* - Select Tunnel to use a shared tunnel for bridging traffic on the VLAN. • *Isolated Tunnel* - Select isolated-tunnel to use a dedicated tunnel for bridging traffic on the VLAN.
IP Outbound Tunnel ACL	Select an *IP Outbound Tunnel ACL* for outbound traffic from the drop-down menu. If an appropriate outbound IP ACL is not available, select the *Create* button.
IPv6 Outbound Tunnel ACL	Select an IPv6 Outbound Tunnel ACL for outbound IPv6 traffic from the drop-down menu. If an appropriate outbound IPv6 ACL is not available, select the Create button.
MAC Outbound Tunnel ACL	Select a *MAC Outbound Tunnel ACL* for outbound traffic from the drop-down menu. If an appropriate outbound MAC ACL is not available, select the *Create* button.
Tunnel Over Level 2	Select this option to allow VLAN traffic to be tunneled over level 2 links. This setting is disabled by default.

NOTE: Local and Automatic bridging modes do not work with ACLs. ACLs can only be used with tunnel or isolated-tunnel modes.

13 Select the **Level 2 Tunnel Broadcast Optimization** checkbox to enable broadcast optimization on this bridge VLAN. L2 Tunnel Broadcast Optimization prevents flooding of ARP packets over the virtual interface. Based on the learned information, ARP packets are filtered at the wireless controller level. This option is enabled by default.

14 If enabling L2 tunnel broadcast optimization, set the **Level 2 Forward Additional Packet Types** as *None* or *WNMP* to specify if additional packet types are forwarded or not across the L2 tunnel. By default, L2 tunnel broadcast optimization disables *Wireless Network Management Protocol* (WNMP) packet forwarding also across the L2 tunnel. Use this option to enable the forwarding of only WNMP packets. The default value is None.

15 Set the following **Tunnel Rate Limit** parameters:

Mint Link Level	Select the MINT link level being rate limited for layer 2 from the drop-down menu.
Rate	Define a transmit rate limit between 50 - 1,000,000 kbps. This limit constitutes a threshold for the maximum the number of packets transmitted or received over the bridge VLAN. Traffic that exceeds the defined rate is dropped and a log message is generated. The default setting is 5,000 kbps.
Maximum Burst Size	Set a maximum burst size between 0 - 1024 kbytes. The smaller the burst, the less likely the receive packet transmission will result in congestion. The default burst size is 320 kbytes.
Background	Set the random early detection threshold in % for low priority background traffic. Set a value from 1 - 100%. The default is 50%.
Best-Effort	Set the random early detection threshold in % for low priority best-effort traffic. Set a value from 1 - 100%. The default is 50%.
Video	Set the random early detection threshold in % for high priority video traffic. Set a value from 1 - 100%. The default is 25%.
Voice	Set the random early detection threshold in % for high priority voice traffic. Set a value from 1 - 100%. The default is 25%.

16 Set or override the following **Layer 2 Firewall** parameters:

Trust ARP Response	Select the check box to use trusted ARP packets to update the DHCP Snoop Table to prevent IP spoof and ARP-cache poisoning attacks. This feature is disabled by default.
Trust DHCP Responses	Select the check box to use DHCP packets from a DHCP server as trusted and permissible within the managed network. DHCP packets are used to update the DHCP Snoop Table to prevent IP spoof attacks. This feature is disabled by default.
Edge VLAN Mode	Select the check box to enable edge VLAN mode. When selected, the edge controller or service platform's IP address in the VLAN is not used for normal operations, as its now designated to isolate devices and prevent connectivity. This feature is enabled by default.

17 Set the following **IPv6 Settings**:

IPv6 Firewall	Select this option to enable IPv6 on this bridge VLAN. This setting is enabled by default.
DHCPv6 Trust	Select this option to enable the trust all DHCPv6 responses on this bridge VLAN. DHCPv6 is a networking protocol for configuring IPv6 hosts with IP addresses, IP prefixes or other configuration attributes required on an IPv6 network. This setting is enabled by default.
RA Guard	Select this option to enable router advertisements or ICMPv6 redirects on this bridge VLAN. This setting is enabled by default.

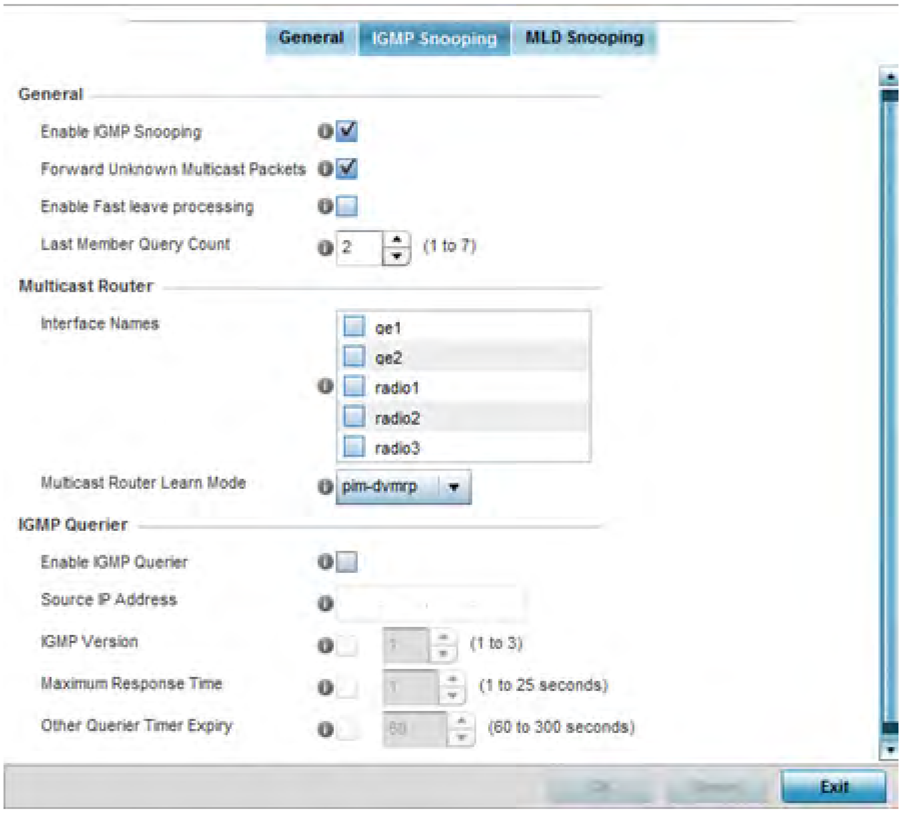
18 Refer to the **Captive Portal** field to select an existing captive portal configuration to apply access restrictions to the bridge VLAN configuration.

A captive portal is an access policy for providing temporary and restrictive access using a standard Web browser. Captive portals provides authenticated access by capturing and re-directing a wireless user's Web browser session to a captive portal login page where the user must enter valid credentials to access to the network. Once logged into the captive portal, additional *Terms and Agreement*, *Welcome*, *Fail* and *No Service* pages provide the administrator with a number of options on captive portal screen flow and user appearance.

If an existing captive portal does not suite the bridge VLAN configuration, either select the **Edit** icon to modify an existing configuration or select the **Create** icon to define a new configuration that can be applied to the bridge VLAN. For information on configuring a captive portal policy, see Configuring Captive Portal Policies on page 11-1.

19 Refer to the **Captive Portal Snoop IPv6 Subnet** field to configure the subnet on which IPv6 snooping is enabled/ disabled for wired captive portal support. Up to 16 excluded addresses are permitted.

20 Select the **IGMP Snooping** tab.



General

Enable IGMP Snooping ☑

Forward Unknown Multicast Packets ☑

Enable Fast leave processing ☐

Last Member Query Count 2 (1 to 7)

Multicast Router

Interface Names ☐ ge1 ☐ ge2 ☐ radio1 ☐ radio2 ☐ radio3

Multicast Router Learn Mode pim-dvmrp

IGMP Querier

Enable IGMP Querier ☐

Source IP Address

IGMP Version 1 (1 to 3)

Maximum Response Time 1 (1 to 25 seconds)

Other Querier Timer Expiry 60 (60 to 300 seconds)

Figure 5-102 *Profile Overrides - Network Bridge VLAN screen, IGMP Snooping tab*

21 Define the following **General** settings:

Enable IGMP Snooping	Select this option to enable IGMP snooping. If disabled, snooping on a per VLAN basis is also disabled. This feature is enabled by default. If disabled, the settings under the bridge configuration are overridden. For example, if IGMP snooping is disabled, but the bridge VLAN is enabled, the setting is disabled.
Forward Unknown Multicast Packets	Select this option to enable the forwarding of multicast packets from unregistered multicast groups. If disabled (the default setting), the unknown multicast forward feature is also disabled for individual VLANs.

Enable Fast leave processing	Select this option to remove a Layer 2 LAN interface from the IGMP snooping forwarding table entry without initially sending IGMP group-specific queries to the interface. When receiving a group specific IGMPv2 leave message, IGMP snooping removes the interface from the Layer 2 forwarding table entry for that multicast group, unless a multicast router was learned on the port. Fast-leave processing enhances bandwidth management for all hosts on the network. This setting is disabled by default.
Last Member Query Count	Specify the number (1 - 7) of group specific queries sent before removing an IGMP snooping entry. The default settings is 2.

22 Define the following **Multicast Router** settings

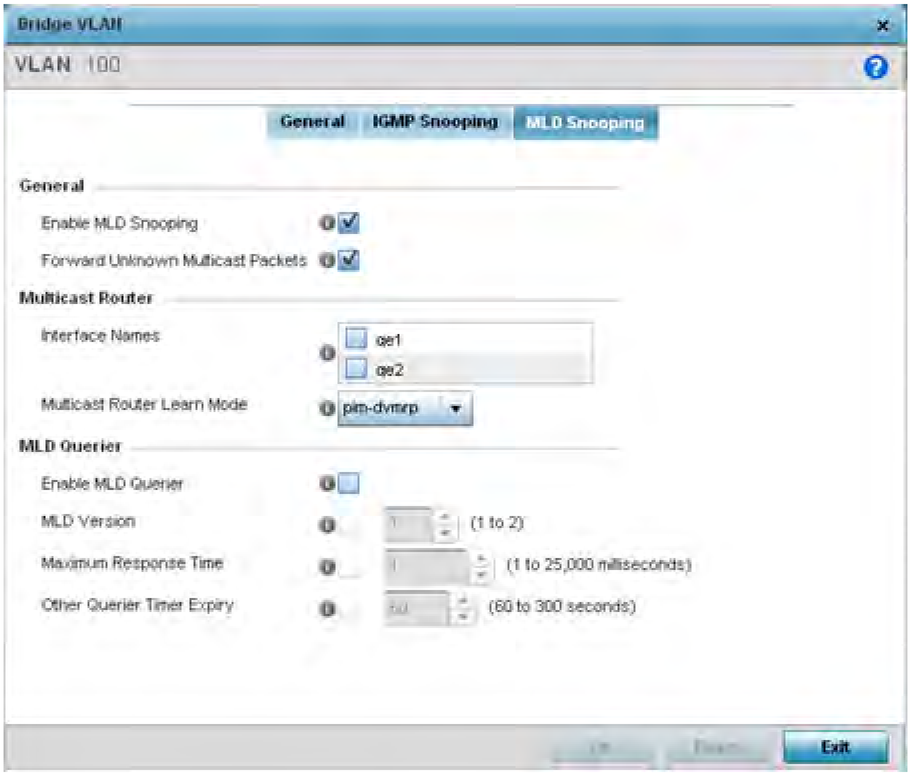
Interface Names	Select the ge1 or radio interfaces used to IGMP snooping over a multicast router.
Multicast Router Learn Mode	Set the pim-dvmrp or static multicast routing learn mode. DVMRP builds a parent-child database using a constrained multicast model to build a forwarding tree rooted at the source of the multicast packets. Multicast packets are initially flooded down this source tree. If redundant paths are on the source tree, packets are not forwarded along those paths.

23 Define the following **IGMP Querier** settings:

Enable IGMP Querier	Select this option to enable IGMP querier. IGMP snoop querier is used to keep host memberships alive. It’s primarily used in a network where there’s a multicast streaming server and hosts subscribed to the server and no IGMP querier present. An IGMP querier sends out periodic IGMP query packets. Interested hosts reply with an IGMP report packet. IGMP snooping is only conducted on wireless radios. IGMP multicast packets are flooded on wired ports. IGMP multicast packet are not flooded on the wired port. IGMP membership is also learnt on it and only if present, then it is forwarded on that port.
Source IP Address	If enabling IGMP querier, set the source IP address used for IGMP snooping over a multicast router.
IGMP Version	Use the spinner control to set the IGMP version compatibility to either version 1, 2 or 3. IGMPv1 is defined by RFC 1112, IGMPv2 is defined by RFC 2236 and IGMPv3 defined by RFC 4604 which defines both IGMPv3 and MLDv2. IGMPv2 improves over IGMPv1 by adding the ability for a host to signal desire to leave a multicast group. IGMPv3 improves over IGMPv2 by adding the ability to listen to multicast traffic originating from a set of source IP addresses exclusively.
Maximum Response Time	Specify the maximum interval (from 1 - 25 seconds) before sending a responding report. When no reports are received from a radio, radio information is removed from the snooping table. The controller or service platform only forwards multicast packets to radios present in the snooping table. For IGMP reports from wired ports, the controller or service platform forwards these reports to the multicast router ports. The default setting is 1 seconds.
Other Querier Timer Expiry	Specify an interval (from 60 - 300 seconds) used as a timeout interval for other querier resources.

24 Select the **OK** button located at the bottom right of the screen to save the changes to the IGMP Snooping tab. Select **Reset** to revert to the last saved configuration.

25 Select the **MLD Snooping** tab.



Bridge VLAN

VLAN 100

General

Enable MLD Snooping ☑

Forward Unknown Multicast Packets ☑

Multicast Router

Interface Names □ ge1 □ ge2

Multicast Router Learn Mode: pim-dvmrp

MLD Querier

Enable MLD Querier □

MLD Version: 1 (1 to 2)

Maximum Response Time: 1 (1 to 25,000 milliseconds)

Other Querier Timer Expiry: 60 (60 to 300 seconds)

Figure 5-103 *Profile Overrides - Network Bridge VLAN screen, MLD Snooping tab*

26 Define the following **General** MLD snooping parameters for the bridge VLAN configuration:

Multicast Listener Discovery (MLD) snooping enables a controller, service platform or Access Point to examine MLD packets and make forwarding decisions based on content. MLD is used by IPv6 devices to discover devices wanting to receive multicast packets destined for specific multicast addresses. MLD uses multicast listener queries and multicast listener reports to identify which multicast addresses have listeners and join multicast groups.

MLD snooping caps the flooding of IPv6 multicast traffic on controller, service platform or Access Point VLANs. When enabled, MLD messages are examined between hosts and multicast routers and to discern which hosts are receiving multicast group traffic. The controller, service platform or Access Point then forwards multicast traffic only to those interfaces connected to interested receivers instead of flooding traffic to all interfaces.

Enable MLD Snooping	Enable MLD snooping to examine MLD packets and support content forwarding on this bridge VLAN. Packets delivered are identified by a single multicast group address. Multicast packets are delivered using best-effort reliability, just like IPv6 unicast. MLD snooping is enabled by default.
Forward Unknown Unicast Packets	Use this option to either enable or disable IPv6 unknown unicast forwarding. This setting is enabled by default.

27 Define the following **Multicast Router** settings

Interface Names	Select the ge or radio interfaces used for MLD snooping.
Multicast Router Learn Mode	Set the *pim-dvmrp* or *static* multicast routing learn mode. DVMRP builds a parent-child database using a constrained multicast model to build a forwarding tree rooted at the source of the multicast packets. Multicast packets are initially flooded down this source tree. If redundant paths are on the source tree, packets are not forwarded along those paths.

28 Set the following **MLD Querier** parameters for the profile's bridge VLAN configuration:

Enable MLD Querier	Select the option to enable MLD querier on the controller, service platform or Access Point. When enabled, the device sends query messages to discover which network devices are members of a given multicast group. This setting is enabled by default.
MLD Version	Define whether MLD version *1* or *2* is utilized with the MLD querier. MLD version 1 is based on IGMP version 2 for IPv4. MLD version 2 is based on IGMP version 3 for IPv4 and is fully backward compatible. IPv6 multicast uses MLD version 2. The default MLD version is 2.
Maximum Response Time	Specify the maximum response time (from 1 - 25,000 milliseconds) before sending a responding report. Queriers use MLD reports to join and leave multicast groups and receive group traffic. The default setting is 1 milliseconds.
Other Querier Timer Expiry	Specify an interval in either *Seconds* (60 - 300) or *Minutes* (1 - 5) used as a timeout interval for other querier resources. The default setting is 60 seconds

29 Select the **OK** button to save the changes and overrides. Select **Reset** to revert to the last saved configuration.

5.2.8.14 Overriding a Profile's Cisco Discovery Protocol Configuration

▸ *Overriding a Profile's Network Configuration*

The *Cisco Discovery Protocol* (CDP) is a proprietary data link layer network protocol implemented in Cisco networking equipment and used to share information about network devices.

To override a CDP configuration:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

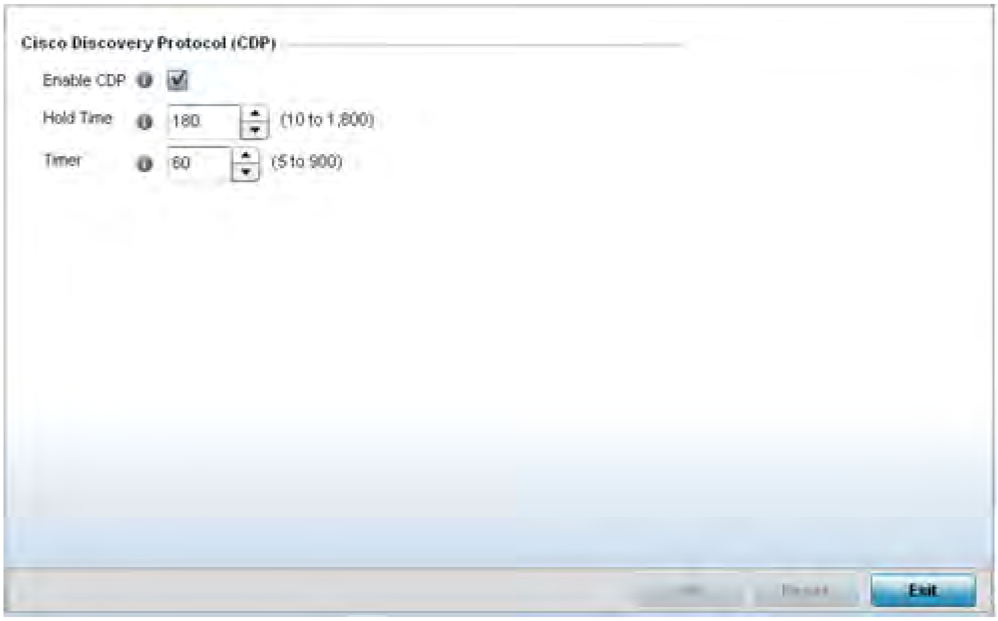
2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **Cisco Discovery Protocol**.



Cisco Discovery Protocol (CDP)

Enable CDP ☑

Hold Time 180 (10 to 1,800)

Timer 60 (5 to 900)

Figure 5-104 *Profile Overrides - Network Cisco Discovery Protocol screen*

✓

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

---

6 Check the **Enable CDP** box to enable CDP on the device.

7 Refer to the **Hold Time** field and use the spinner control to define a hold time between 10 - 1800 seconds for transmitted CDP Packets. The default value is 180 seconds.

8 Refer to the **Timer** field and use the spinner control to define a interval between 5 - 900 seconds to transmit CDP Packets. The default value is 60 seconds.

9 Select the **OK** button to save the changes and overrides. Select **Reset** to revert to the last saved configuration.

5.2.8.15 Overriding a Profile’s Link Layer Discovery Protocol Configuration

▸ *Overriding a Profile’s Network Configuration*

The *Link Layer Discovery Protocol* (LLDP) or IEEE 802.1AB is a vendor-neutral data link layer protocol used by network devices for advertising (announcing) their identity, capabilities, and interconnections

on a IEEE 802 LAN network. The protocol is formally referred to by the IEEE as *Station and Media Access Control Connectivity Discovery*. Both LLDP snooping and ability to generate and transmit LLDP packets will be provided.

Information obtained via CDP and LLDP snooping is available in the UI. In addition, information obtained via CDP / LLDP snooping is provided by an AP during the adoption process, so the L2 switch device name detected by the AP can be used as a criteria in the auto provisioning policy.

To override a LLDP configuration:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

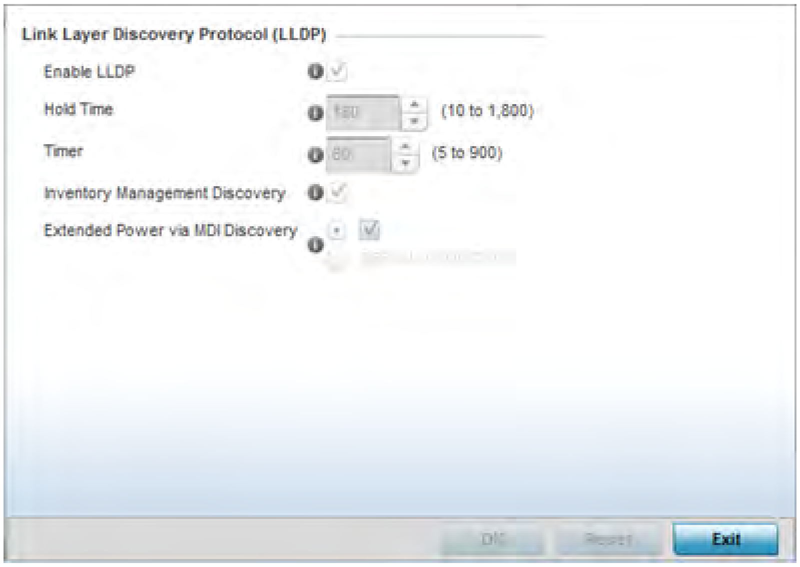
2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **Link Layer Discovery Protocol**.



Link Layer Discovery Protocol (LLDP)

Enable LLDP ☑

Hold Time 180 (10 to 1,800)

Timer 60 (5 to 900)

Inventory Management Discovery ☑

Extended Power via MDI Discovery ● ☑

Figure 5-105 *Profile Overrides - Network Link Layer Discovery Protocol screen*

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

6 Check the **Enable LLDP** box to enable Link Layer Discovery Protocol on the device.

7 Refer to the **Hold Time** field and use the spinner control to define a hold time between 10 - 1800 seconds for transmitted LLDP Packets. The default value is 180 seconds.

8 Refer to the **Timer** field and use the spinner control to define the interval between 5 - 900 seconds to transmit LLDP packets. The default value is 60 seconds.

9 Check the **Inventory Management Discovery** box to enable this feature. Inventory Management Discovery is used to track and identify inventory attributes including manufacturer, model, or software version.

10 Extended Power via MDI Discovery provides detailed power information through end points and other connected devices. Select the **Extended Power via MDI Discovery** box to enable this feature. or select the **Default for Type** option to use a WiNG internal default value.

11 Select the **OK** button to save the changes and overrides. Select **Reset** to revert to the last saved configuration.

5.2.8.16 Overriding a Profile's Miscellaneous Network Configuration

▸ *Overriding a Profile's Network Configuration*

A profile can include a hostname within a DHCP lease for a requesting device. This helps an administrator track the leased DHCP IP address by hostname for the device profile. When numerous DHCP leases are assigned, an administrator can better track the leases when hostnames are used instead of devices.

To include a hostnames in DHCP request:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

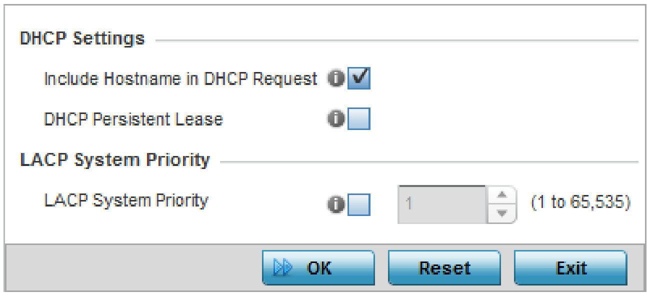
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **Miscellaneous**.

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



DHCP Settings

Include Hostname in DHCP Request ☑

DHCP Persistent Lease □

LACP System Priority

LACP System Priority □ 1 (1 to 65,535)

Figure 5-106 *Profile Overrides - Network Miscellaneous screen*

6 Refer to the DHCP Settings section to configure miscellaneous DHCP Settings.

Include Hostname in DHCP Request	Select the *Include Hostname in DHCP Request* option to include a hostname within a DHCP lease for a requesting device. This feature is enabled by default.
DHCP Persistent Lease	Check this option to enable a persistent DHCP lease for the device. A persistent DHCP lease assigns the same IP Address and other network information to the device each time it renews its DHCP lease.

7 Select the **LACP System Priority** value in the range of 1 - 65,535. The system with a lower number will have a higher priority when setting up a connection with a LACP peer. If a value is not set for this field, the default value of 32768 is used.

Link Aggregation Control Protocol (LACP) enables combining and managing multiple physical connections like Ethernet ports as a single logical channel as defined in the IEEE 802.1ax standard. LACP provides redundancy and increase in throughput for connections between two peers. LACP provides automatic recovery in cases where one or more of the physical links - making up the aggregation - fail. Similarly, LACP also provides a theoretical boost in speed compared to an individual physical link.

☑ **NOTE:** Disable or physically disconnect interfaces that do not use spanning tree to prevent loop formation until LACP is fully configured on both the local WiNG device and the remote device.

8 To enable critical resource monitoring for the device, select a **Critical Resource Policy** from the drop-down menu in the **Critical Resource Monitoring** section. If a new critical resource monitoring policy is needed click the **Create** button and specify the Ping Interval, IP Address, Ping Mode and VLAN for the devices being monitored.

9 Select the **OK** button to save the changes and overrides. Select **Reset** to revert to the last saved configuration.

5.2.8.17 Overriding a Profile’s Network Alias Configuration

▸ *Overriding a Profile’s Network Configuration*

With large deployments, the configuration of remote sites utilizes a set of shared attributes, of which a small set of attributes are unique for each location. For such deployments, maintaining separate configuration (WLANs, profiles, policies and ACLs) for each remote site is complex. Migrating any global change to a particular configuration item to all the remote sites is a complex and time consuming operation.

Also, this practice does not scale gracefully for quick growing deployments.

An alias enables an administrator to define a configuration item, such as a hostname, as an alias once and use the defined alias across different configuration items such as multiple ACLs.

Once a configuration item, such as an ACL, is utilized across remote locations, the Alias used in the configuration item (ACL) is modified to meet local deployment requirement. Any other ACL or other configuration items using the modified alias also get modified, simplifying maintenance at the remote deployment.

Aliases have scope depending on where the Alias is defined. Alias are defined with the following scopes:

- *Global aliases* are defined from the **Configuration** > **Network** > **Alias** screen. Global aliases are available for use globally across all devices, profiles and RF Domains in the system.
- *Profiles aliases* are defined from the **Configuration** > **Devices** > **System Profile** > **Network** > **Alias** screen. Profile aliases are available for use to a specific group of wireless controllers or Access Points. Alias values defined in a profile override the alias values defined within global aliases.
- *RF Domain aliases* are defined from the **Configuration** > **Devices** > **RF Domain** > **Alias** screen. RF Domain aliases are available for use for a site as a RF Domain is site specific. RF Domain alias values override alias values defined in a global alias or a profile alias configuration.
- *Device aliases* are defined from the **Configuration** > **Devices** > **Device Overrides** > **Network** > **Alias** screen. Device aliases are utilized by a singular device only. Device alias values override global, profile or RF Domain alias configurations.

Using an alias, configuration changes made at a remote location override any updates at the management center. For example, if an network alias defines a network range as 192.168.10.0/24 for the entire network, and at a remote deployment location, the local network range is 172.16.10.0/24, the network alias can be overridden at the deployment location to suit the local requirement. For the remote deployment location, the network alias work with the 172.16.10.0/24 network. Existing ACLs using this network alias need not be modified and will work with the local network for the deployment location. This simplifies ACL definition and management while taking care of specific local deployment requirements.

For more information, refer to the following:

- *Basic Alias*
- *Network Group Alias*
- *Network Service Alias*

5.2.8.17.1 Basic Alias

A *basic alias* is a set of configurations consisting of *VLAN*, *Host*, *Network* and *Address Range* alias configurations. A VLAN alias is a configuration for optimal VLAN re-use and management for local and remote deployments. A host alias configuration is for a particular host device's IP address. A network alias configuration is utilized for an IP address on a particular network. An address range alias is a configuration for a range of IP addresses.

To set a network basic alias configuration:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

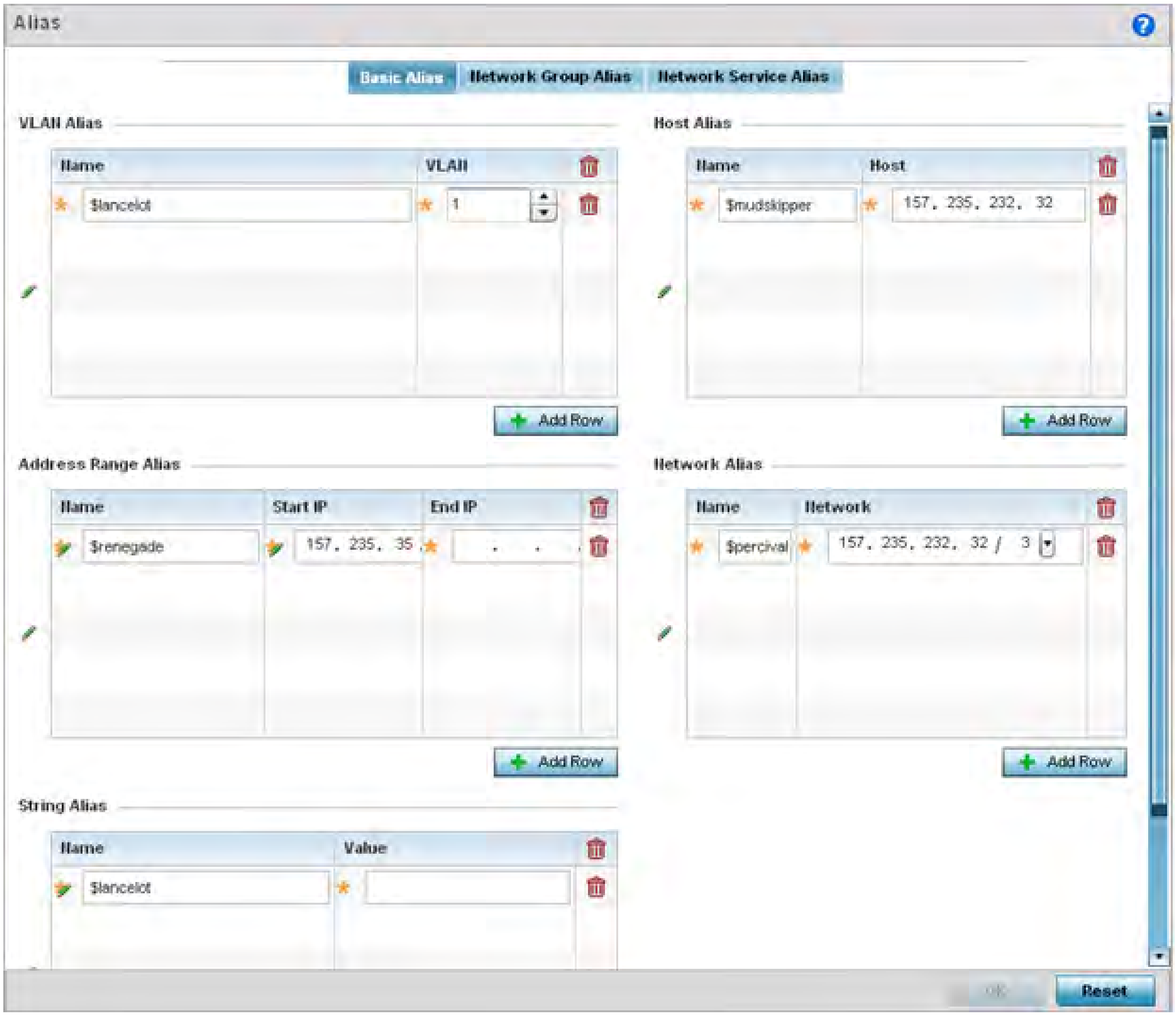
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **Alias.**

The Alias screen displays with the **Basic Alias** tab displayed by default.



Name	VLAN
$lancelot	1

Name	Host
$mudskipper	157. 235. 232. 32

Name	Start IP	End IP
$renegade	157. 235. 35	. . .

Name	Network
$percival	157. 235. 232. 32 / 3

Name	Value
$lancelot	

Figure 5-107 *Network Basic Alias screen*

6 Select **+ Add Row** to define **VLAN Alias** settings:

Use the *VLAN Alias* field to create unique aliases for VLANs that can be utilized at different deployments. For example, if a VLAN ID is set as 10 for the central network, and the VLAN is set as 26 at a remote location, the VLAN can be overridden at the remote location using an alias. At the remote location, the network is functional with an ID of 26, but utilizes the name defined at the central local network. A new VLAN need not be created specifically at the remote location.

Name	If adding a new *VLAN Alias*, provide it a distinguishing name up to 32 characters. The alias name always starts with a dollar sign ($).
Vlan	Use the spinner control to set a numeric VLAN ID from 1 - 4094.

7 Select **+ Add Row** to define **Address Range Alias** settings:

Use the **Address Range Alias** field to create aliases for IP address ranges that can be utilized at different deployments. For example, if an ACL defines a pool of network addresses as 192.168.10.10 through 192.168.10.100 for an entire network, and a remote location's network range is 172.16.13.20 through 172.16.13.110, the remote location's ACL can be overridden using an alias. At the remote location, the ACL works with the 172.16.13.20-110 address range. A new ACL need not be created specifically for the remote deployment location.

Name	If adding a new *Address Alias*, provide it a distinguishing name up to 32 characters. The alias name always starts with a dollar sign ($).
Start IP	Set a starting IP address used with a range of addresses utilized with the address range alias.
End IP	Set an ending IP address used with a range of addresses utilized with the address range alias.

8 Select **+ Add Row** to define **String Alias** settings:

Use the **String Alias** field to create aliases for hosts that can be utilized at different deployments. For example, if the main domain at a remote location is called loc1.domain.com and at another deployment location it is called loc2.domain.com, the alias can be overridden at the remote location to suit the local (but remote) requirement. At one remote location, the alias functions with the loc1.domain.com domain and at the other with the loc2.domain.com domain.

Name	If adding a new *String Alias*, provide it a distinguishing name up to 32 characters. The alias name always starts with a dollar sign ($).
Value	Provide a string value to use in the alias.

9 Select **+ Add Row** to define **Host Alias** settings:

Use the **Host Alias** field to create aliases for hosts that can be utilized at different deployments. For example, if a central network DNS server is set a static IP address, and a remote location's local DNS server is defined, this host can be overridden at the remote location. At the remote location, the network is functional with a local DNS server, but uses the name set at the central network. A new host need not be created at the remote location. This simplifies creating and managing hosts and allows an administrator to better manage specific local requirements.

Name	If adding a new *Host Alias*, provide it a distinguishing name up to 32 characters. The alias name always starts with a dollar sign ($).
Host	Set the IP address of the host machine.

10 Select **+ Add Row** to define **Network Alias** settings:

Use the **Network Alias** field to create aliases for IP networks that can be utilized at different deployments. For example, if a central network ACL defines a network as 192.168.10.0/24, and a remote location's network range is 172.16.10.0/24, the ACL can be overridden at the remote location to suit their local (but remote) requirement. At the remote location, the ACL functions with the 172.16.10.0/24 network. A new ACL need not be created specifically for the remote deployment. This simplifies ACL definition and allows an administrator to better manage specific local requirements.

Name	If adding a new *Network Alias*, provide it a distinguishing name up to 32 characters. The alias name always starts with a dollar sign ($).
Network	Provide a network address in the form of *host/mask*.

11 Select **OK** when completed to update the set of basic alias rules. Select **Reset** to revert the screen back to its last saved configuration.

5.2.8.17.2 Network Group Alias

A *network group alias* is a set of configurations consisting of host and network configurations. Network configurations are complete networks in the form of 192.168.10.0/24 or an IP address range in the form of 192.168.10.10-192.168.10.20. Host configurations are in the form of a single IP address, 192.168.10.23.

A network group alias can contain multiple definitions for a host, network, and IP address range. A maximum of eight (8) Host entries, eight (8) network entries and eight (8) IP addresses range entries can be configured inside a network group alias. A maximum of 32 network group alias entries can be created.

To set a network group alias configuration:

1 Select **Devices** from the Configuration tab.

  The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

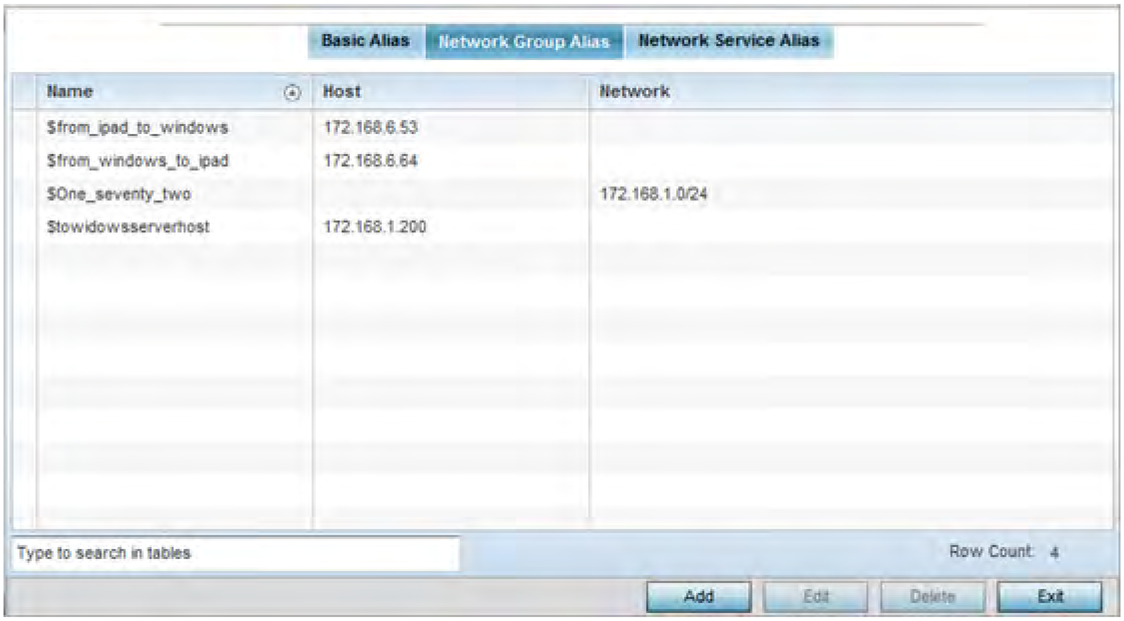
  Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **Alias.**

6 Select the **Network Group Alias** tab. The screen displays the attributes of existing network group alias configurations.



Name	Host	Network
$from_ipad_to_windows	172.168.6.53	
$from_windows_to_ipad	172.168.6.64	
$One_seventy_two		172.168.1.0/24
$towidowsserverhost	172.168.1.200	

Type to search in tables

Row Count: 4

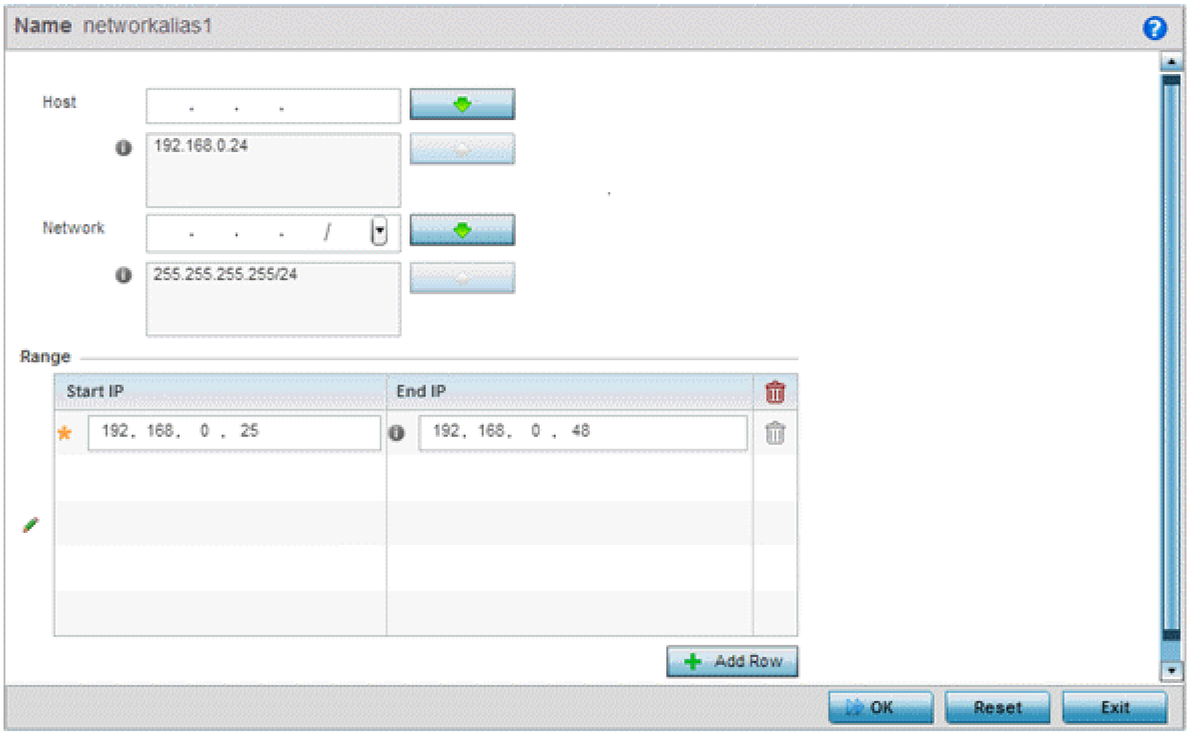
Figure 5-108 *Network Group Alias screen*

Name	Displays the administrator assigned name used with the network group alias.

Host	Displays all the host aliases configured in the listed network group alias. Displays a blank column if no host alias is defined.
Network	Displays all network aliases configured in the listed network group alias. Displays a blank column if no network alias is defined.

7 Select **Add** to create a new policy, **Edit** to modify the attributes of an existing policy or **Delete** to remove obsolete policies.

8 Select the added row to expand it into configurable parameters for defining the network alias rule.



Name networkalias1

Host: 192.168.0.24

Network: 255.255.255.255/24

Range

Start IP	End IP
192.168.0.25	192.168.0.48

Figure 5-109 *Network Group Alias Add screen*

9 If adding a new **Network Alias Rule,** provide it a name up to 32 characters. The network group alias name always starts with a dollar sign ($).

10 Define the following network group alias parameters:

Host	Specify the Host IP address for up to eight IP addresses supporting network aliasing. Select the down arrow to add the IP address to the table.
Network	Specify the netmask for up to eight IP addresses supporting network aliasing. Subnets can improve network security and performance by organizing hosts into logical groups. Applying the subnet mask to an IP address separates the address into a host address and an extended network address. Select the down arrow to add the mask to the table.

11 Within the **Range** table, use the **+ Add Row** button to specify the **Start IP** address and **End IP** address for the alias range or double-click on an existing an alias range entry to edit it.

12 Select **OK** when completed to update the network alias rules. Select **Reset** to revert the screen back to its last saved configuration.

5.2.8.17.3 Network Service Alias

A *network service alias* is a set of configurations that consist of protocol and port mappings. Both source and destination ports are configurable. For each protocol, up to 2 source port ranges and up to 2 destination port ranges can be configured. A maximum of 4 protocol entries can be configured per network service alias.

Use a service alias to associate more than one IP address to a network interface, providing multiple connections to a network from a single IP node.

To define a service alias configuration:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

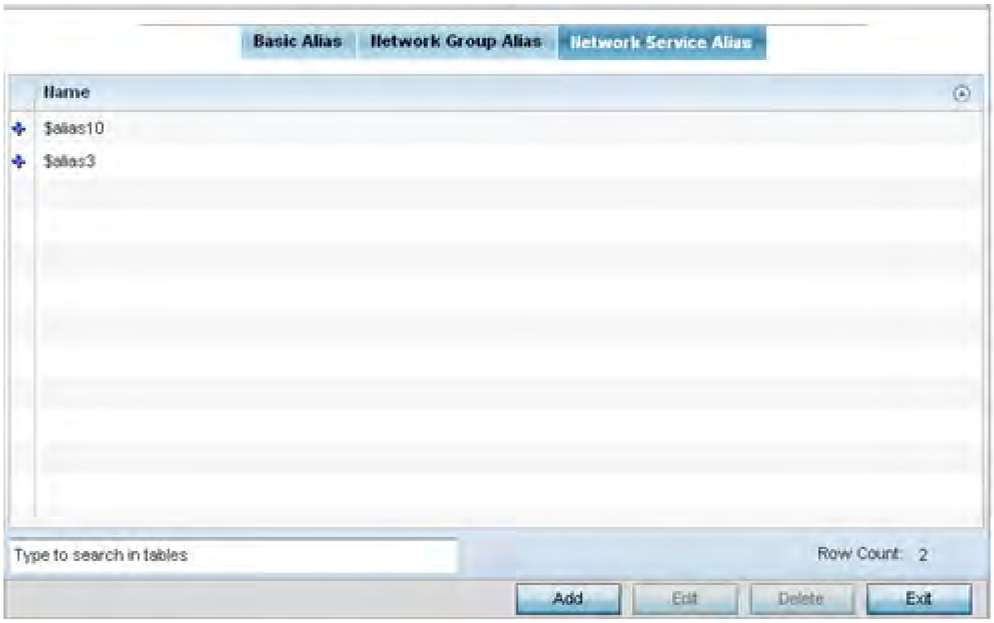
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Network** to expand its sub menu options.

5 Select **Alias.**

6 Select the **Network Service Alias** tab. The screen displays existing network service alias configurations.



Name
$alias10
$alias3

Figure 5-110 *Network Service Alias screen*

7 Select **Add** to create a new policy, **Edit** to modify the attributes of an existing policy or **Delete** to remove obsolete policies.

8 Select the added row to expand it into configurable parameters for defining the service alias rule.

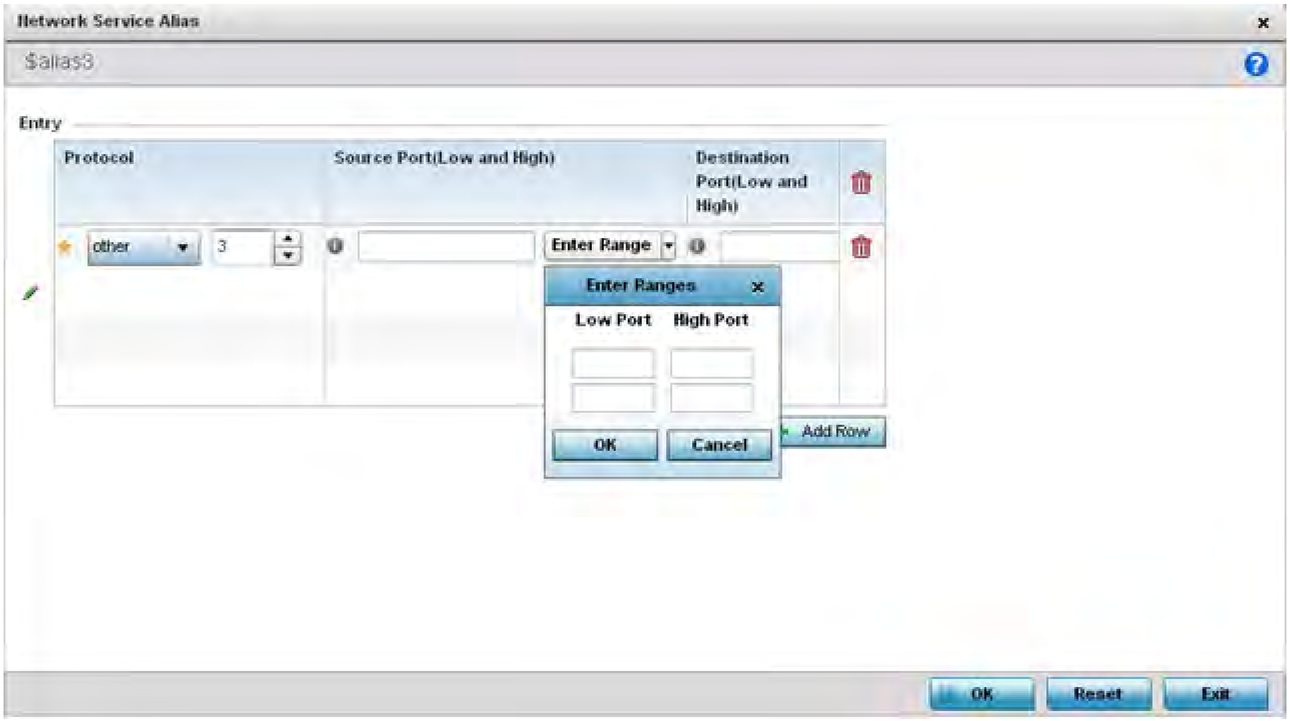


Figure 5-111 *Network Service Alias Add screen*

9 If adding a new **Network Service Alias Rule,** provide it a name up to 32 characters. Ensure a $ precedes the name.

10 Select **+ Add Row** and provide the following configuration parameters:

Protocol	Specify the protocol for which the alias has to be created. Use the drop down to select the protocol from *eigrp, gre, icmp, igmp, ip, vrrp, igp, ospf, tcp* and *udp.* Select *other* if the protocol is not listed. When a protocol is selected, its protocol number is automatically selected.
Source Port (Low and High)	This field is only relevant if the protocol is either *tcp* or *udp.* Specify the source ports for this protocol entry. A range of ports can be specified. Select the *Enter Ranges* button next to the field to enter a lower and higher port range value. Up to eight (8) such ranges can be specified.
Destination Port (Low and High)	This field is only relevant if the protocol is either *tcp* or *udp*. Specify the destination ports for this protocol entry. A range of ports can be specified. Select the *Enter Ranges* button next to the field to enter a lower and higher port range value. Up to eight (8) such ranges can be specified.

11 Within the **Range** field, use the **+ Add Row** button to specify the **Start IP** address and **End IP** address for the service alias range or double-click on an existing service alias range entry to edit it.

12 Select **OK** when completed to update the service alias rules. Select **Reset** to revert the screen back to its last saved configuration.

5.2.8.18 Overriding a Profile’s IPv6 Neighbor Configuration

▸ *Overriding a Profile’s Network Configuration*

IPv6 neighbor discovery uses ICMP messages and solicited multicast addresses to find the link layer address of a neighbor on the same local network, verify the neighbor’s reachability and track neighboring devices.

Upon receiving a neighbor solicitation message, the destination replies with *neighbor advertisement* (NA). The source address in the NA is the IPv6 address of the device sending the NA message. The destination address in the neighbor advertisement message is the IPv6 address of the device sending the neighbor solicitation. The data portion of the NA includes the link layer address of the node sending the neighbor advertisement.

Neighbor solicitation messages also verify the availability of a neighbor once its the link layer address is identified. When a node wants to verify the reachability of a neighbor, the destination address in a neighbor solicitation message is the unicast address of the neighbor.

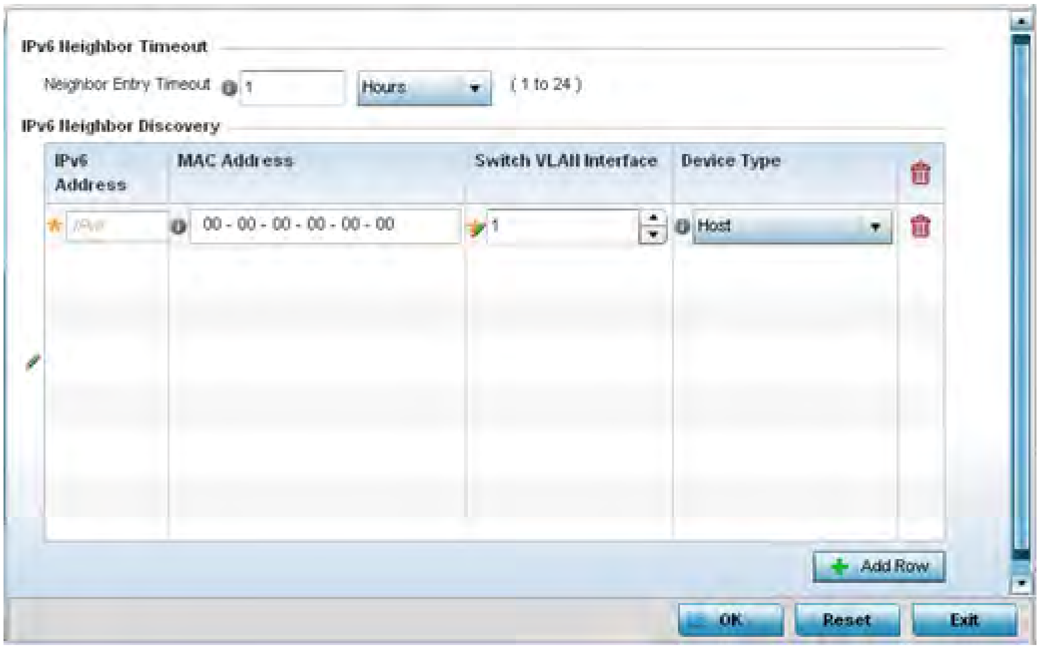
A neighbor is interpreted as reachable when an acknowledgment is returned indicating packets have been received and processed. If packets are reaching the device, they’re also reaching the next hop neighbor, providing a confirmation the next hop is reachable.

To set an IPv6 neighbor discovery configuration:

1 Select **Configuration** > **Profiles** > **Network**.

2 Expand the Network menu to display its submenu options.

3 Select **IPv6 Neighbor**.



IPv6 Neighbor Timeout

Neighbor Entry Timeout: 1 Hours (1 to 24)

IPv6 Neighbor Discovery

IPv6 Address	MAC Address	Switch VLAN Interface	Device Type
IPv6	00 - 00 - 00 - 00 - 00 - 00	1	Host

Figure 5-112 *IPv6 Neighbor screen*

4 Set an IPv6 **Neighbor Entry Timeout** in either *Seconds* (15 - 86,400), *Minutes* (1 - 1,440), *Hours* (1 - 24) or *Days* (1). The default setting is 1 hour.

5 Select **+ Add Row** to define the configuration of **IPv6 Neighbor Discovery** configurations. A maximum of 256 neighbor entries can be defined.

IPv6 Address	Provide a static IPv6 IP address for neighbor discovery. IPv6 hosts can configure themselves automatically when connected to an IPv6 network using the Neighbor Discovery Protocol via *Internet Control Message Protocol version 6* (ICMPv6) router discovery messages. When first connected to a network, a host sends a link-local router solicitation multicast request for its configuration parameters; routers respond to such a request with a router advertisement packet that contains Internet Layer configuration parameters. IPv6 addresses are composed of eight groups of four hexadecimal digits separated by colons.
MAC Address	Enter the hardware encoded MAC addresses of up to 256 IPv6 neighbor devices. A neighbor is interpreted as reachable when an acknowledgment is returned indicating packets have been received and processed. If packets are reaching the device, they're also reaching the next hop neighbor, providing a confirmation the next hop is reachable.
Switch VLAN Interface	Use the spinner control to set the virtual interface (from 1 - 4094) used for neighbor advertisements and solicitation messages.
Device Type	Specify the device type for this neighbor solicitation is for. Options include *Host*, *Router* and *DHCP Server.* The default setting is Host.

6 Select **OK** to save the changes. Select **Reset** to revert to the last saved configuration.

5.2.9 Overriding a Profile's Security Configuration

▸ *Profile Overrides*

A profile can have its own firewall policy, wireless client role policy, WEP shared key authentication, NAT policy and VPN policy (controllers and service platforms only) applied. If an existing firewall, client role or NAT policy is unavailable, an administrator can be navigated from the **Profiles** section of the UI to the **Configuration** > **Security** portion of the UI to create the required security policy configuration. Once created, a policy's configuration can have an override applied to meet the changing data protection requirements of a device's environment. However, in doing so the device must now be managed separately from the profile configuration shared by other devices within the managed network.

For more information on applying an override to an existing device profile, refer to the following sections:

- *Overriding a Profile's General Security Settings*
- *Overriding a Profile's Certificate Revocation List (CRL) Configuration*
- *Overriding a Profile's RADIUS Trustpoint Configuration*
- *Overriding a Profile's VPN Configuration*
- *Overriding a Profile's Auto IPSec Tunnel Configuration*
- *Overriding a Profile's NAT Configuration*
- *Overriding a Profile's Bridge NAT Configuration*
- *Overriding a Profile's Application Visibility Settings*

5.2.9.1 Overriding a Profile's General Security Settings

▸ *Overriding a Profile's Security Configuration*

A profile can leverage existing firewall, wireless client role and WIPS policies and apply them to the profile's configuration. This affords each profile a truly unique combination of data protection policies best meeting the data protection requirements the profile supports. However, as deployment requirements arise, an individual device may need some or all of its general security configuration overridden from the profile's settings.

To configure a profile's security settings and overrides:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

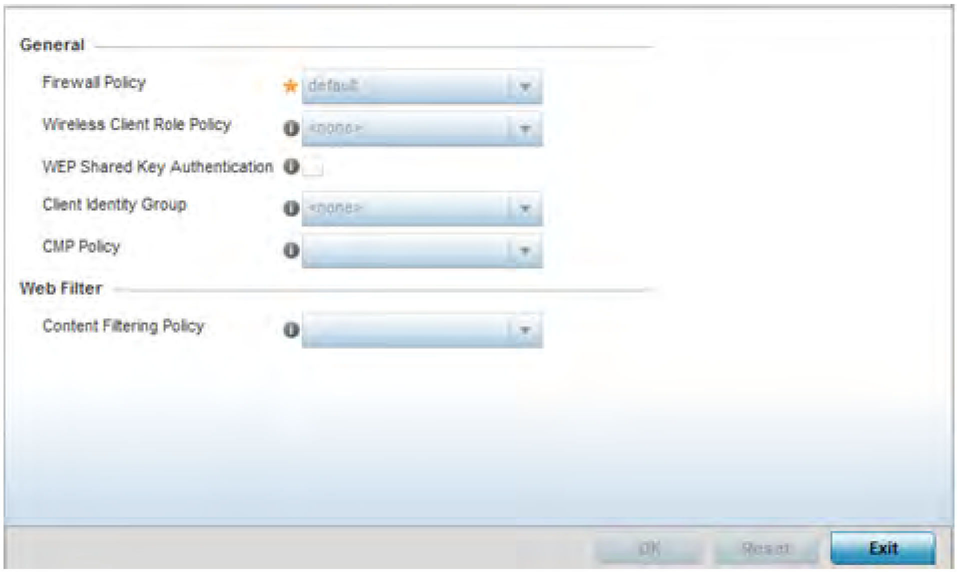
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Security** to expand its sub menu options.

5 Select **Settings.**

✓ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



General

Firewall Policy: default

Wireless Client Role Policy: <none>

WEP Shared Key Authentication: □

Client Identity Group: <none>

CMP Policy:

Web Filter

Content Filtering Policy:

Figure 5-113 *Profile Overrides - General Security screen*

6 Refer to the **General** field to assign or override the following:

Firewall Policy	Use the drop-down menu to select an existing Firewall Policy to use as an additional security mechanism with this profile. All devices using this profile must meet the requirements of the firewall policy to access the network. A firewall is a mechanism enforcing access control, and is considered a first line of defense in protecting proprietary information within the network. The means by which this is accomplished varies, but in principle, a firewall can be thought of as mechanisms both blocking and permitting data traffic within the network. If an existing Firewall policy does not meet your requirements, select the *Create* icon to create a new firewall policy that can be applied to this profile. An existing policy can also be selected and edited as needed using the *Edit* icon.
Wireless Client Role Policy	Use the drop-down menu to select a client role policy used to strategically filter client connections based on a pre-defined set of filter rules and connection criteria. If an existing Wireless Client Role policy does not meet your requirements, select the *Create* icon to create a new configuration that can be applied to this profile. An existing policy can also be selected and edited as needed using the *Edit* icon.
WEP Shared Key Authentication	Select this option to require devices to use a WEP key to access the network using this profile. The controller or service platform use the key algorithm to convert an ASCII string to the same hexadecimal number. Clients without adapters need to use WEP keys manually configured as hexadecimal numbers. This option is disabled by default.
Client Identity Group	Select the client identity group to apply to this device profile. Client identity is a set of unique fingerprints used to identify a class of devices. A *Client identity group* is a set of client attributes that identify devices and apply specific permissions and restrictions on them.The information is used to configure permissions and access rules for that device class and can assist administrators by applying permissions and rules to multiple devices simultaneously.
CMP Policy	Use the drop down-menu to assign a CMP policy to allow a device to communicate to a CMP supported CA server, initiate a certificate request and download the required certificates from the CA server. CMP supports multiple request options through for device communicating to a CMP supported CA server. The device can initiate a request for getting the certificates from the server. It can also auto update the certificates which are about to expire.

7 Use the **Web Filter** drop-down menu to select or override the URL Filter configuration applied to this virtual interface.

Web filtering is used to restrict access to resources on the Internet.

8 Select **OK** to save the changes or overrides. Select **Reset** to revert to the last saved configuration.

5.2.9.2 Overriding a Profile’s Certificate Revocation List (CRL) Configuration

▸ *Overriding a Profile’s Security Configuration*

A *certificate revocation list* (CRL) is a list of revoked certificates that are no longer valid. A certificate can be revoked if the *certificate authority* (CA) had improperly issued a certificate, or if a private-key is compromised. The most common reason for revocation is the user no longer being in sole possession of the private key.

To define a Certificate Revocation configuration or override:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points within the managed network.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

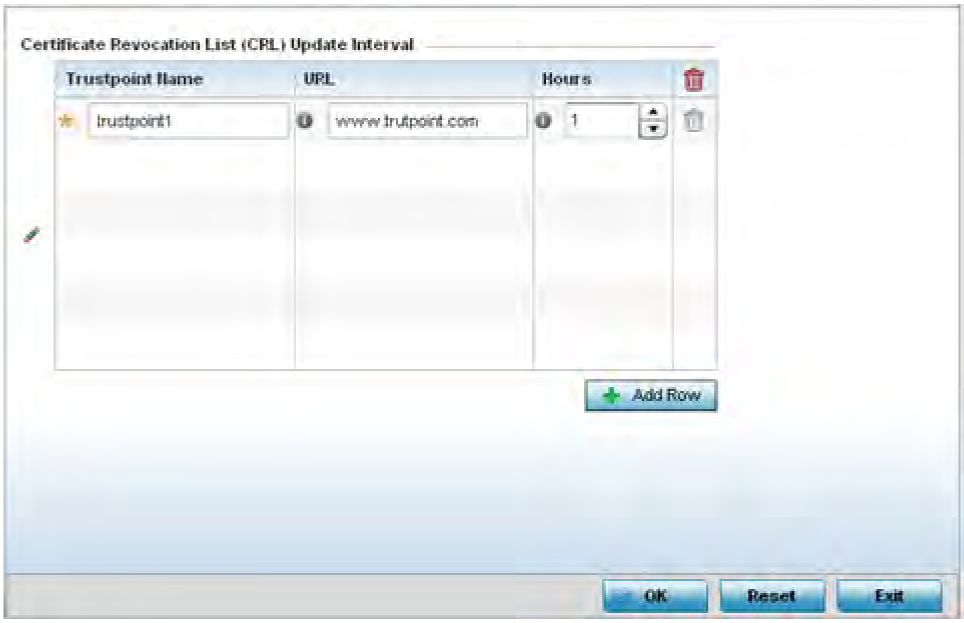
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Security** to expand its sub menu options.

5 Select **Certificate Revocation**.

☑ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Certificate Revocation List (CRL) Update Interval

Trustpoint Name	URL	Hours
trustpoint1	www.trutpoint.com	1

Figure 5-114 *Profile Overrides - Certificate Revocation screen*

6 Select the **+ Add Row** button to add a column within the **Certificate Revocation List (CRL) Update Interval** table to quarantine certificates from use in the managed network.

Additionally, a certificate can be placed on hold for a user defined period. If, for instance, a private key was found and nobody had access to it, its status could be reinstated.

a Provide the name of the trustpoint in question within the **Trustpoint Name** field. The name cannot exceed 32 characters.

b Enter the resource ensuring the trustpoint’s legitimacy within the **URL** field.

c Use the spinner control to specify an interval (in hours) after which a device copies a CRL file from an external server and associates it with a trustpoint.

7 Select **OK** to save the changes and overrides made within the Certificate Revocation screen. Select **Reset** to revert to the last saved configuration.

5.2.9.3 Overriding a Profile's RADIUS Trustpoint Configuration

▸ *Overriding a Profile's Security Configuration*

A RADIUS certificate links identity information with a public key enclosed in the certificate. A *certificate authority* (CA) is a network authority that issues and manages security credentials and public keys for message encryption. The CA signs all digital certificates it issues with its own private key. The corresponding public key is contained within the certificate and is called a CA certificate.

To define a RADIUS Trustpoint configuration, utilize an existing stored trustpoint or launch the certificate manager to create a new one:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points within the managed network.

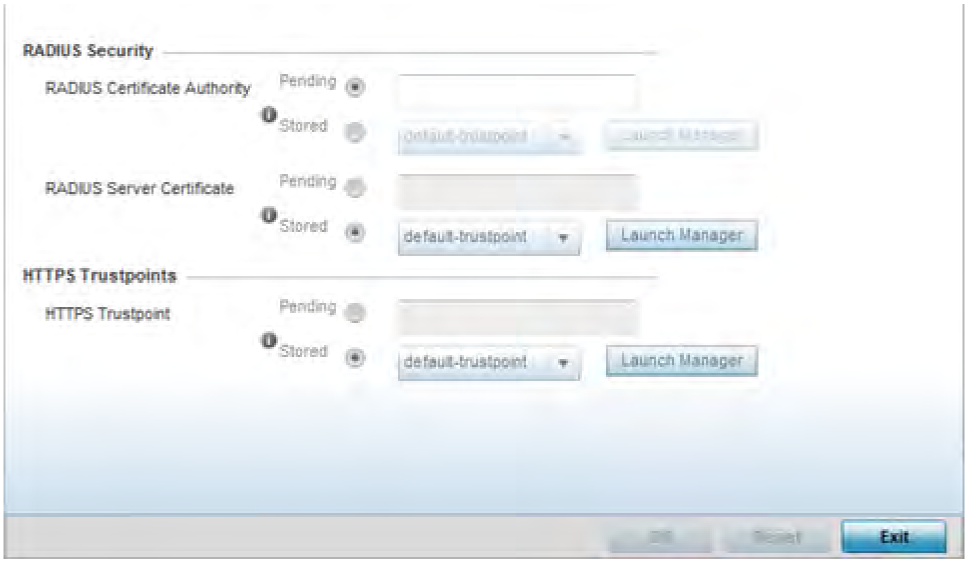
2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Security** to expand its sub menu options.

5 Select **Trustpoints**.



RADIUS Security

RADIUS Certificate Authority: Pending ● | Stored ○ default-trustpoint | Launch Manager

RADIUS Server Certificate: Pending ○ | Stored ● default-trustpoint | Launch Manager

HTTPS Trustpoints

HTTPS Trustpoint: Pending ○ | Stored ● default-trustpoint | Launch Manager

Figure 5-115 *Profile Overrides - Trustpoints screen*

6 Set the following **RADIUS Security** certificate settings:

RADIUS Certificate Authority	Either use the default-trustpoint or select the *Stored* radio button to enable a drop-down menu where an existing certificate can be leveraged. To leverage an existing certificate, select the *Launch Manager* button.
RADIUS Server Certificate	Either use the default-trustpoint or select the *Stored* radio button to enable a drop-down menu where an existing certificate/trustpoint can be used. To leverage an existing trustpoint, select the *Launch Manager* button.

7 Set the following **HTTPS Trustpoints**:

HTTPS Trustpoint	Either use the default trustpoint or select the Stored radio button to enable a drop-down menu where an existing certificate/trustpoint can be utilized. To use an existing certificate for this device, select the *Launch Manager* button. For more information, see *Certificate Management*.

8 Select **OK** to save the changes made within the RADIUS Trustpoints screen. Select **Reset** to revert to the last saved configuration.

5.2.9.4 Overriding a Profile's VPN Configuration

▶ *Overriding a Profile's Security Configuration*

IPSec VPN provides a secure tunnel between two networked peer devices. Administrators can define which packets are sent within the tunnel, and how they're protected. When a tunnelled peer sees a sensitive packet, it creates a secure tunnel and sends the packet through the tunnel to its remote peer destination.

Tunnels are sets of *security associations* (SA) between two peers. SAs define the protocols and algorithms applied to sensitive packets and specify the keying mechanisms used by tunneled peers. SAs are unidirectional and exist in both the inbound and outbound direction. SAs are established per the rules and conditions of defined security protocols (AH or ESP).

Use *crypto maps* to configure IPSec VPN SAs. Crypto maps combine the elements comprising IPSec SAs. Crypto maps also include *transform sets*. A transform set is a combination of security protocols, algorithms and other settings applied to IPSec protected traffic. One crypto map is utilized for each IPSec peer, however for remote VPN deployments one crypto map is used for all the remote IPSec peers.

Internet Key Exchange (IKE) protocol is a key management protocol standard used in conjunction with IPSec. IKE enhances IPSec by providing additional features, flexibility, and configuration simplicity for the IPSec standard. IKE automatically negotiates IPSec SAs, and enables secure communications without time consuming manual pre-configuration.

To define a profile's VPN settings:

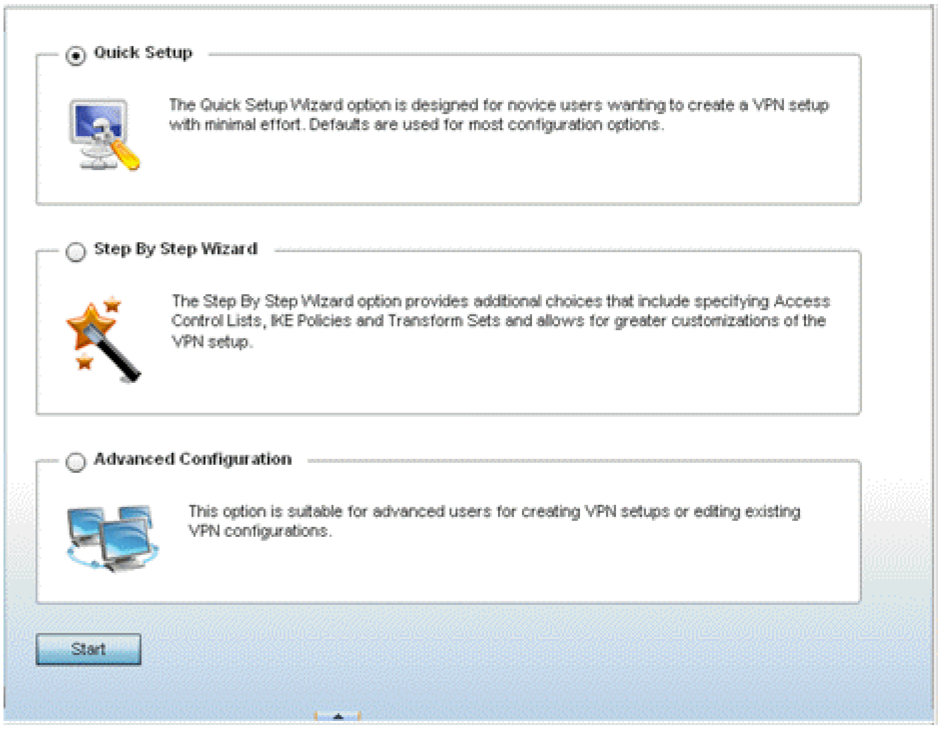
1 Select **Devices** from the Configuration tab.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Expand the **Security** menu and select **VPN**.

The profile's VPN configuration can be set or overridden using either a VPN setup wizard or by manually configuring the required advanced settings. WiNG provides two (2) wizards providing either minimal or more thorough administration.



● Quick Setup

The Quick Setup Wizard option is designed for novice users wanting to create a VPN setup with minimal effort. Defaults are used for most configuration options.

○ Step By Step Wizard

The Step By Step Wizard option provides additional choices that include specifying Access Control Lists, IKE Policies and Transform Sets and allows for greater customizations of the VPN setup.

○ Advanced Configuration

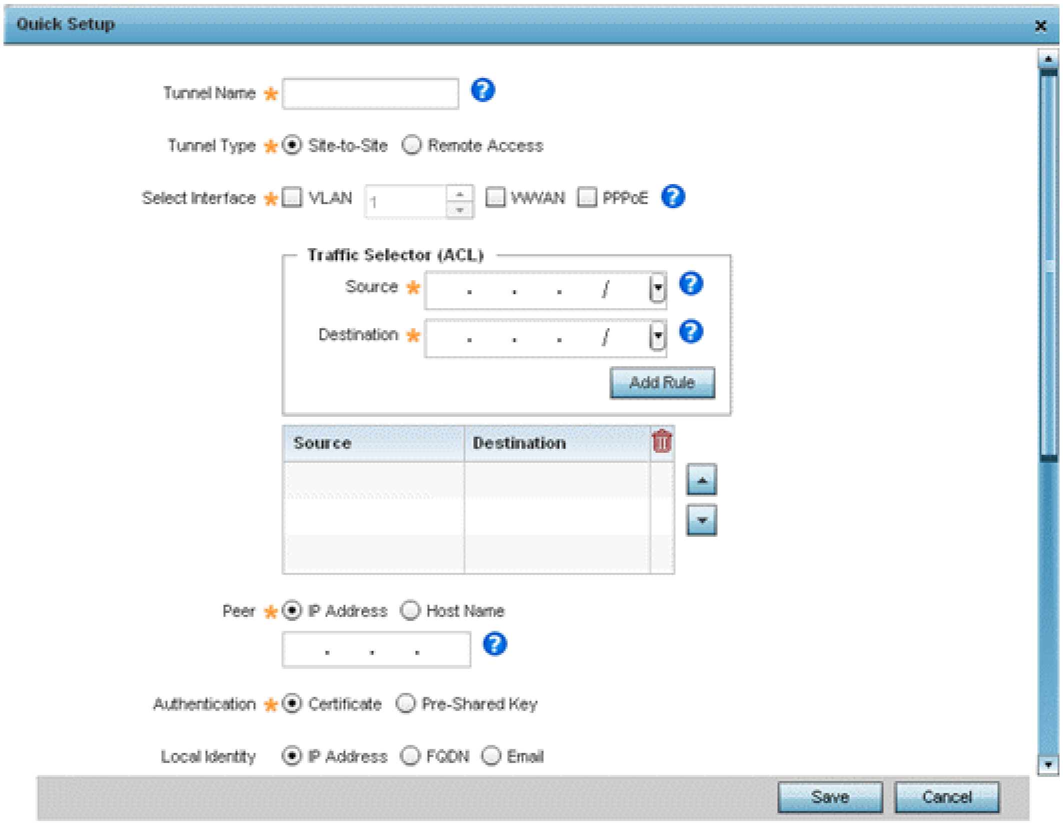
This option is suitable for advanced users for creating VPN setups or editing existing VPN configurations.

Figure 5-116 *VPN Setup Wizard*

- *Quick Setup Wizard* - Use the quick setup wizard to set a minimum number of basic VPN tunnel values. This wizard is designed for novice users, and enables them to setup a VPN configuration with minimum effort. This wizard uses default values for most parameters.
- *Step By Step Wizard* - Use the step-by-step wizard to create a VPN tunnel using settings updated from their minimum default values. This wizard is designed for intermediate users who require some VPN customization.
- *Advanced VPN Configuration* - The advanced VPN configuration option does not utilize a setup wizard. Rather, it utilizes and its own screen flow where just about every facet of a VPN tunnel configuration can be set by a qualified network administrator. For more information, see Setting the Profile’s VPN Configuration on page 8-168.

5.2.9.4.4 Quick Setup Wizard

The *Quick Setup Wizard* creates a VPN configuration with minimum administration. Default values are retained for most parameters.



Quick Setup

Tunnel Name *

Tunnel Type * ● Site-to-Site ○ Remote Access

Select Interface * □ VLAN 1 □ WWAN □ PPPoE

Traffic Selector (ACL)

Source * . . . /

Destination * . . . /

Add Rule

Source	Destination

Peer * ● IP Address ○ Host Name

Authentication * ● Certificate ○ Pre-Shared Key

Local Identity ● IP Address ○ FQDN ○ Email

Save Cancel

Figure 5-117 *VPN Quick Setup Wizard*

1 Select **Quick Setup** from the VPN Wizard screen.

2 Provide the following quick setup information to configure a VPN tunnel:

Tunnel Name	Provide a name for the tunnel. Tunnel name identifies the tunnel uniquely.
Tunnel Type	Configure the type of the tunnel. Tunnel can be one of the following types: • *Site-to-Site* – This tunnel provides a secured connection between two sites (default setting). • *Remote Access* – This tunnel provides access to a network to remote devices.
Select Interface	Configure the interface to use for creating the tunnel. The following options are available: • *VLAN* – Configure the tunnel over a Virtual LAN interface. Use the spinner to configure the VLAN number. • *WWAN* – Configure the tunnel over the WAN interface. • *PPPoE* – Configure the tunnel over the PPPoE interface.
Traffic Selector (ACL)	Configure ACLs that manage the traffic passing through the VPN tunnel. The following options are available: • *Source* – Provide the source network along with its mask • *Destination* – Provide the destination network along with its mask.

Peer	Configure the peer for this tunnel. The peer device can be specified either by its hostname or by its IP address.
Authentication	Set the authentication used to identify the peers with each other on opposite ends of the VPN tunnel connection. The following can be configured: • *Certificate* – Use a certificate to authenticate (default value). • *Pre-Shared Key* – Use a pre-shared key to authenticate. Enter the secret key in the space provided for it.
Local Identity	Configure the local identity used with this peer configuration for an IKE exchange with the target VPN IPSec peer. Options include *IP Address*, *Distinguished Name*, *FQDN*, *email* and *string*. The default setting is string.
Remote Identity	Configure the Access Point remote identifier used with this peer configuration for an IKE exchange with the target VPN IPSec peer. Options include *IP Address*, *Distinguished Name*, *FQDN*, *email* and *string*. The default setting is string.
IKE Policy	Configure the IKE policy to use. IKE is used to exchange authentication keys. Select from one of the following: • *All* – Use any IKE policy (default value). • *IKE1* – Use IKE 1 only • *IKE2* – Use IKE 2 only
Transform Set	Configure the transform set used to specify how traffic is protected within the crypto ACL defining the traffic that needs to be protected. Select the appropriate traffic set from the drop-down list.

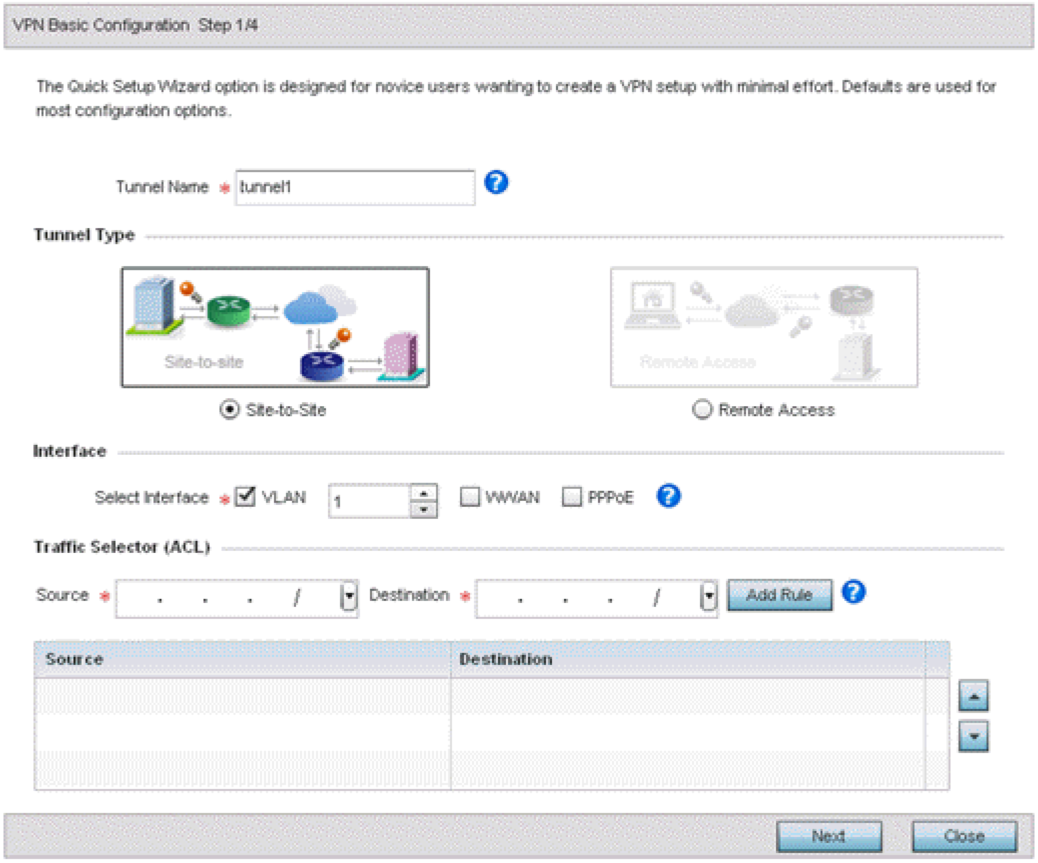
3 Select **Save** to save the VPN quick setup tunnel configuration. To exit without saving, select **Cancel**.

5.2.9.4.5 Step By Step Wizard

The Step-By-Step wizard creates a VPN connection with more manual configuration than the Quick Setup Wizard. Use this wizard to manually configure *Access Control Lists*, *IKE Policy,* and *Transform Sets* to customize the VPN Tunnel.

1 Select the **Step-By-Step Wizard** option from the VPN screen.

2 Select the **Start** button.



VPN Basic Configuration Step 1/4

The Quick Setup Wizard option is designed for novice users wanting to create a VPN setup with minimal effort. Defaults are used for most configuration options.

Tunnel Name * tunnel1

Tunnel Type

● Site-to-Site ○ Remote Access

Interface

Select Interface * ☑ VLAN 1 □ WWAN □ PPPoE

Traffic Selector (ACL)

Source * . . . / Destination * . . . / Add Rule

Source	Destination

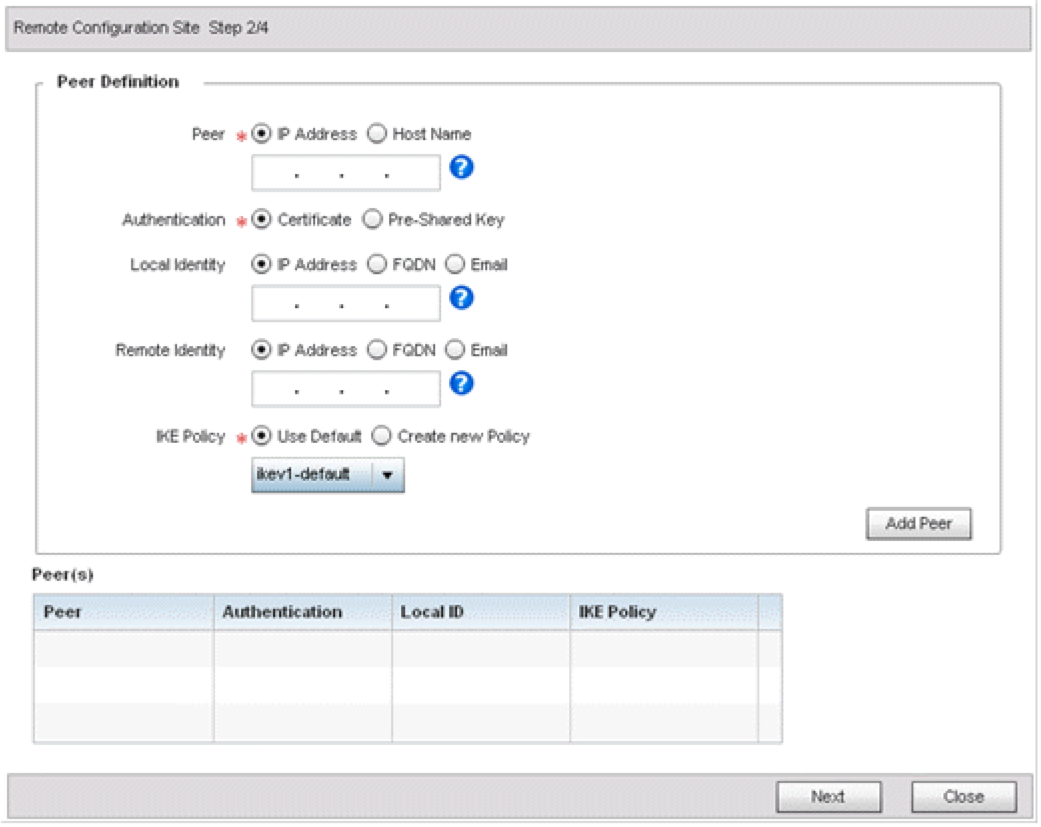
Figure 5-118 *VPN Step-By-Step Wizard - Step 1*

3 Set the following VPN values for step 1:

Tunnel Name	Provide a name for the tunnel in the *Tunnel Name* field.
Tunnel Type	Select the tunnel type being created. Two types of tunnels can be created. *Site to Site* (the default setting) is used to create a tunnel between two remote sites. *Remote Access* is used to create a tunnel between an user device and a network.
Interface	Select the interface to use. Interface can be a Virtual LAN (VLAN) or WWAN or PPPoE depending on the interfaces available on the device.
Traffic Selector	This field creates the *Access Control List* (ACL) that is used to control who uses the network. Provide the *Source* and *Destination* IP address ranges with their net mask. Click the *Add Rule* button to add the rule into the ACL.

4 Select the **Next** button to proceed to step 2.

If any of the required values within the step 1 screen are not set properly, the second wizard screen will not display until they are properly set.



Remote Configuration Site Step 2/4

Peer Definition

Peer * ● IP Address ○ Host Name

Authentication * ● Certificate ○ Pre-Shared Key

Local Identity ● IP Address ○ FQDN ○ Email

Remote Identity ● IP Address ○ FQDN ○ Email

IKE Policy * ● Use Default ○ Create new Policy

ikev1-default

Peer(s)

Peer	Authentication	Local ID	IKE Policy

Figure 5-119 *VPN Step-By-Step Wizard - Step 2*

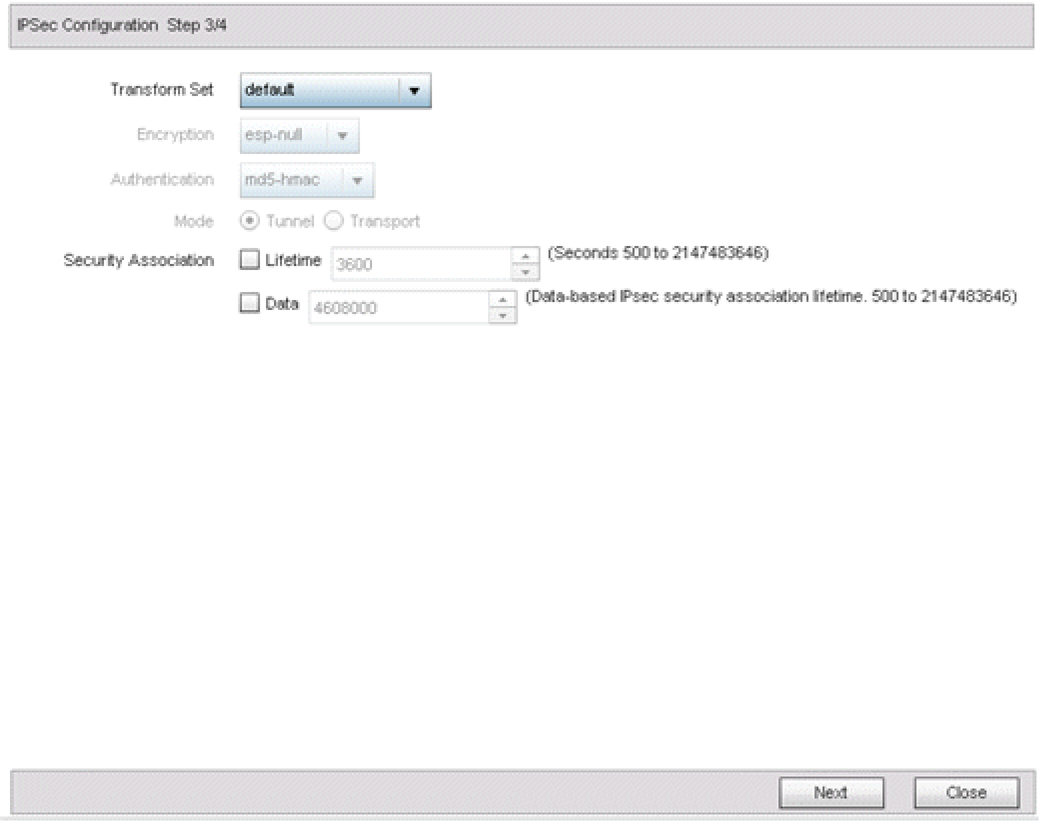
5 Set the following VPN quick setup values for step 2:

Peer	Select the type of peer for this device when forming a tunnel. Peer information can be either an *IP Address* (default value) or *hostname*. Provide the IP address or the host name of the peer device.
Authentication	Configure how devices authenticate on opposite ends of the tunnel connection. • *Certificate* – The devices use certificates to authenticate with each other (default value). • *Pre-Shared Key* – The devices use pre-shared key to authenticate.
Local Identity	Configure the local identity for the VPN tunnel. • *IP Address* – The local identity is an IP address (default value). • *FQDN* – The local identity is a *Fully Qualified Domain Name* (FQDN). • *Email* – The local identity is an E-mail address.
Remote Identity	Configure the remote identity for the VPN tunnel. • *IP Address* – The remote identity is an IP address (default value). • *FQDN* – The remote identity is a FQDN. • *Email* – The remote identity is an E-mail address.
IKE Policy	Configure an IKE policy to use when creating this VPN Tunnel. The following options are available: • *Use Default* – Select this option to use the default IKE profiles. • *Create new Policy* – Select this option to create a new IKE policy.

6 Click the **Add Peer** button to add the tunnel peer information into the *Peer(s)* table. This table lists all the peers set for the VPN Tunnel.

7 Select **Next** to proceed to the step 3 screen. Use the **Back** button to go to the previous step.

If any of the required values within the step 2 screen are not set properly, the third wizard screen will not display until they are properly set.



IPSec Configuration Step 3/4

Transform Set: default

Encryption: esp-null

Authentication: md5-hmac

Mode: ● Tunnel ○ Transport

Security Association: □ Lifetime 3600 (Seconds 500 to 2147483646)

□ Data 4608000 (Data-based IPsec security association lifetime. 500 to 2147483646)

Figure 5-120 *VPN Step-By-Step Wizard - Step 3*

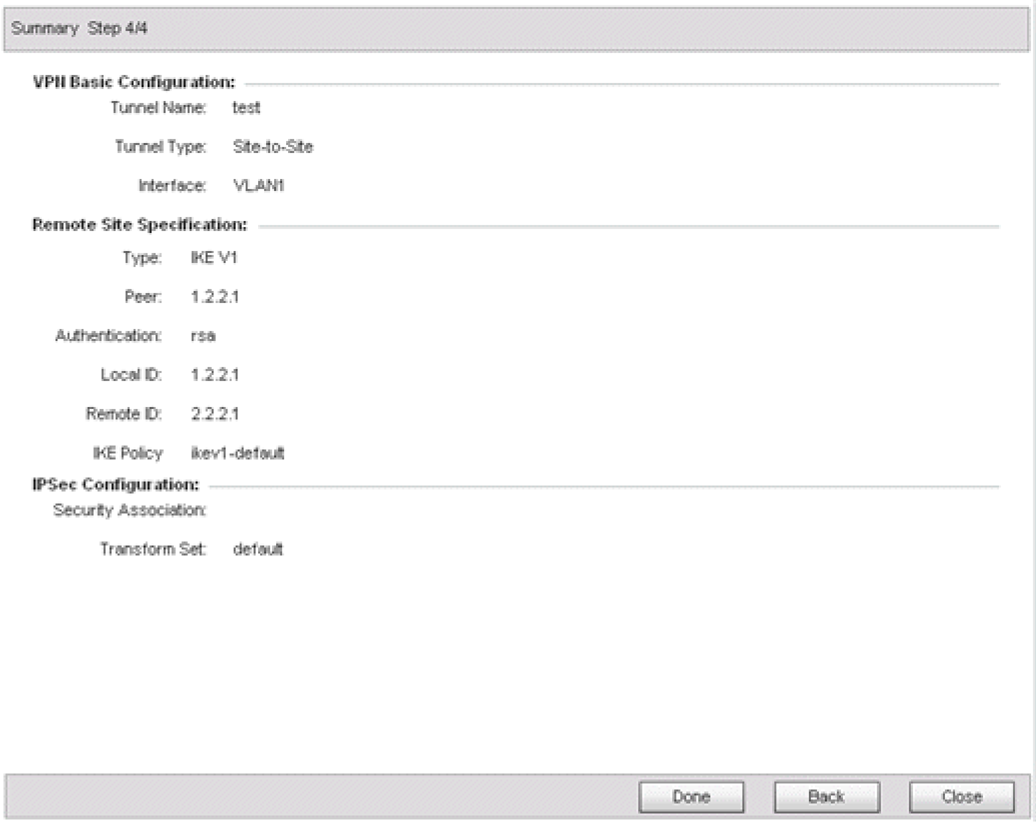
8 Set the following IPSec VPN values for step 3:

Transform Set	The transform set is a set of configurations for creating the VPN tunnel and imposes a security policy on the tunnel. Primarily, the transform set comprises the following: • *Encryption* – The encryption used for creating the tunnel. • *Authentication* – The authentication used to identify tunnel peers • *Mode* – The mode of the tunnel. This is the tunnel's operational mode. From the drop-down, select any pre-configured Transform Set or select *Create New Policy* to create a new transform set.
Encryption	This field is enabled when *Create New Policy* is selected in Transform Set field. This is the encryption used on data traversing through the tunnel. Select either *esp-null*, *des, 3des, aes, aes-192* or aes-*256*.
Authentication	This field is enabled when *Create New Policy* is selected in Transform Set field. This is how peers authenticate as the source of the packet to the other peers after a VPN tunnel has been created. Select either *MD5*, *SHA, SHA256 or AES-XCBC-HMAC-128.*

Mode	This field is enabled when *Create New Policy* is selected in *Transform Set* field. This indicates how packets are transported through the tunnel. • *Tunnel* – Use this mode when the Tunnel is between two routers or servers. • *Transport* – Use this mode when the Tunnel is created between a client and a server.
Security Association	Configures the lifetime of a security association (SA). Keys and SAs should be periodically renewed to maintain security of the tunnel. The field defines the parameters that set the lifetime of a security association. • *Lifetime* – Set the duration (in seconds) after which the keys should be changed. Set a value from 500-2,147,483,646 seconds. • *Data* – This is the amount of data in KBs the key can use. The key is changed after this quantity of data has be encrypted/decrypted. Set a value from 500-2,147,483,646 KBs.

9 Select **Next** to proceed to the fourth configuration screen. Use the **Back** button to navigate to the previous step.

If any of the required values within the step 3 screen are not set properly, the fourth wizard screen will not display until they are properly set.



Summary Step 4/4

VPN Basic Configuration:

Tunnel Name: test

Tunnel Type: Site-to-Site

Interface: VLAN1

Remote Site Specification:

Type: IKE V1

Peer: 1.2.2.1

Authentication: rsa

Local ID: 1.2.2.1

Remote ID: 2.2.2.1

IKE Policy ikev1-default

IPSec Configuration:

Security Association:

Transform Set: default

Figure 5-121 *VPN Step-By-Step Wizard - Step 4*

10 Review the configuration and select **Done** initiate the creation of the VPN tunnel. Use the **Back** button to navigate to the previous screen. Select **Close** to close the wizard without creating a VPN Tunnel.

5.2.9.4.6 Advanced VPN Configuration

The advanced VPN configuration option does not utilize a setup wizard. Rather, it utilizes and its own screen flow where just about every facet of a VPN tunnel configuration can be set by a qualified network administrator.

For detailed information on creating a VPN tunnel configuration, refer to Setting the Profile's VPN Configuration on page 8-168.

5.2.9.5 Overriding a Profile's Auto IPSec Tunnel Configuration

▸ *Overriding a Profile's Security Configuration*

Auto IPSec tunneling provides a secure tunnel between two networked peer controllers or service platforms and associated Access Points which are within a range of valid IP addresses. Administrators can define which packets are sent within the tunnel, and how they're protected. When a tunnelled peer sees a sensitive packet, it creates a secure tunnel and sends the packet through the tunnel to its remote peer destination or associated Access Point

Tunnels are sets of *security associations* (SA) between two peers. SAs define the protocols and algorithms applied to sensitive packets and specify the keying mechanisms used by tunnelled peers. SAs are unidirectional and exist in both the inbound and outbound direction. SAs are established per the rules and conditions of defined security protocols (*AH* or *ESP*).

Internet Key Exchange (IKE) protocol is a key management protocol standard used in conjunction with IPSec. IKE enhances IPSec by providing additional features, flexibility, and configuration simplicity for the IPSec standard. IKE enables secure communications without time consuming manual pre-configuration for auto IPSec tunneling.

To define an Auto IPSec Tunnel configuration or override that can be applied to a profile:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

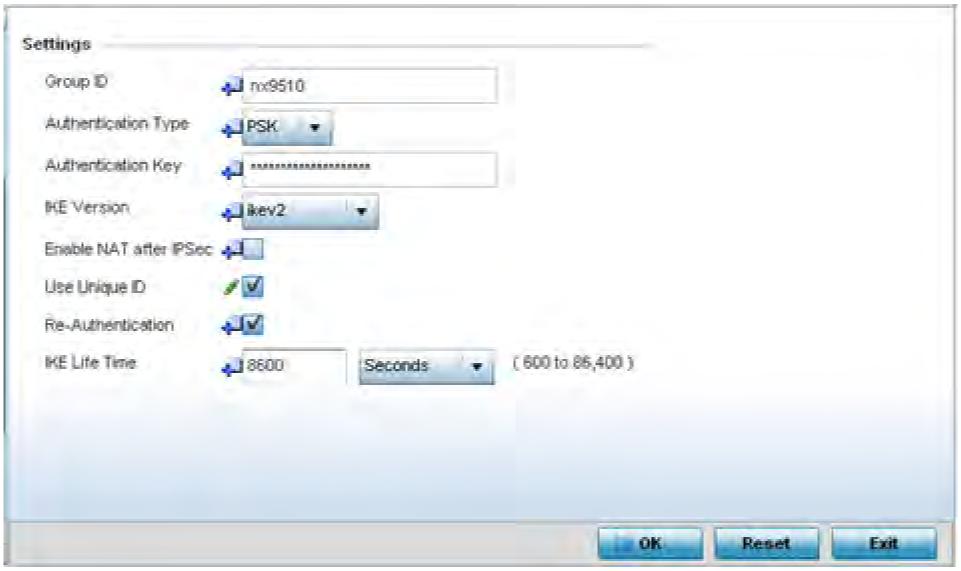
2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Security** to expand its sub menu options.

5 Select **Auto IPSec Tunnel**.



Settings

Group ID: nx9510

Authentication Type: PSK

Authentication Key: ********************

IKE Version: ikev2

Enable NAT after IPSec: □

Use Unique ID: ☑

Re-Authentication: ☑

IKE Life Time: 8600 Seconds (600 to 86,400)

Figure 5-122 *Profile Overrides - Auto IPSec Tunnel screen*

The **Settings** field lists those Auto IPSec tunnel policies created thus far. Any of these policies can be selected and applied to a profile.

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

Group ID	Define a 1 - 64 character identifier for an IKE exchange supporting auto IPSec tunnel secure peers.
Authentication Type	Use the drop-down menu to select either RSA or PSK (Pre Shared Key) as the authentication type for secure peer authentication on the auto IPSec secure tunnel. Rivest, Shamir, and Adleman (RSA) is an algorithm for public key cryptography. It's the first algorithm known to be suitable for signing, as well as encryption. The default setting is RSA.
Authentication Key	Enter the 8 - 21 character shared key (password) used for auto IPSec tunnel secure peer authentication.
IKE Version	Use the drop-down menu to select the IKE version used for auto IPSec tunnel secure authentication with the IPSec gateway. IKEv2 is the default setting.
Enable NAT after IPSec	Select the checkbox to enable internal source port NAT on the auto IPSec secure tunnel.
Use Unique ID	Select this option to use a unique ID with auto IPSec secure authentication for the IPSec remote gateway (appending the MiNT ID). This setting is disabled by default.
Re-Authentication	Select this option to re-authenticate the key on a IKE rekey. This setting is enabled by default.
IKE Life Time	Set a lifetime in either *Seconds* (600 - 86,400), *Minutes* (10 - 1,440), *Hours* (1 - 24) or *Days* (1) for IKE security association duration. The default setting is 8600 seconds.

6 Select **OK** to save the changes made to the auto IPSec tunnel configuration. Select **Reset** to revert to the last saved configuration.

5.2.9.6 Overriding a Profile's NAT Configuration

▸ *Overriding a Profile's Security Configuration*

Network Address Translation (NAT) is a technique to modify network address information within IP packet headers in transit. This enables mapping one IP address to another to protect wireless controller managed network address credentials. With typical deployments, NAT is used as an IP masquerading technique to hide private IP addresses behind a single, public facing, IP address.

Additionally, NAT is a process of modifying network address information in IP packet headers while in transit across a traffic routing device for the purpose of remapping one IP address to another. In most deployments NAT is used in conjunction with IP masquerading which hides RFC1918 private IP addresses behind a single public IP address.

NAT can provide a profile outbound Internet access to wired and wireless hosts connected to either an Access Point or a wireless controller. Many-to-one NAT is the most common NAT technique for outbound Internet access.

Many-to-one NAT allows an Access Point or wireless controller to translate one or more internal private IP addresses to a single, public facing, IP address assigned to a 10/100/1000 Ethernet port or 3G card.

To define a NAT configuration or override that can be applied to a profile:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points within the managed network.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Security** to expand its sub menu options.

5 Select **NAT**.

✓ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

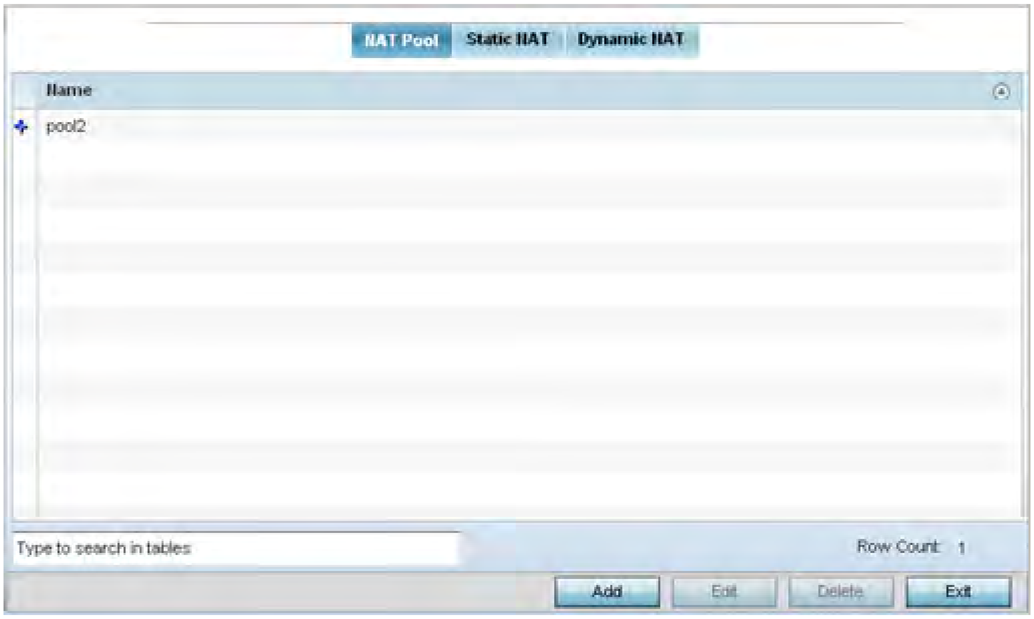


Figure 5-123 *Profile Overrides - NAT Pool screen*

The **NAT Pool** screen displays by default. The NAT Pool screen lists those NAT policies created thus far. Any of these policies can be selected and applied to a profile.

✓ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

6 Select **Add** to create a new NAT policy that can be applied to a profile. Select **Edit** to modify or override the attributes of a existing policy or select **Delete** to remove obsolete NAT policies from the list of those available to a profile.

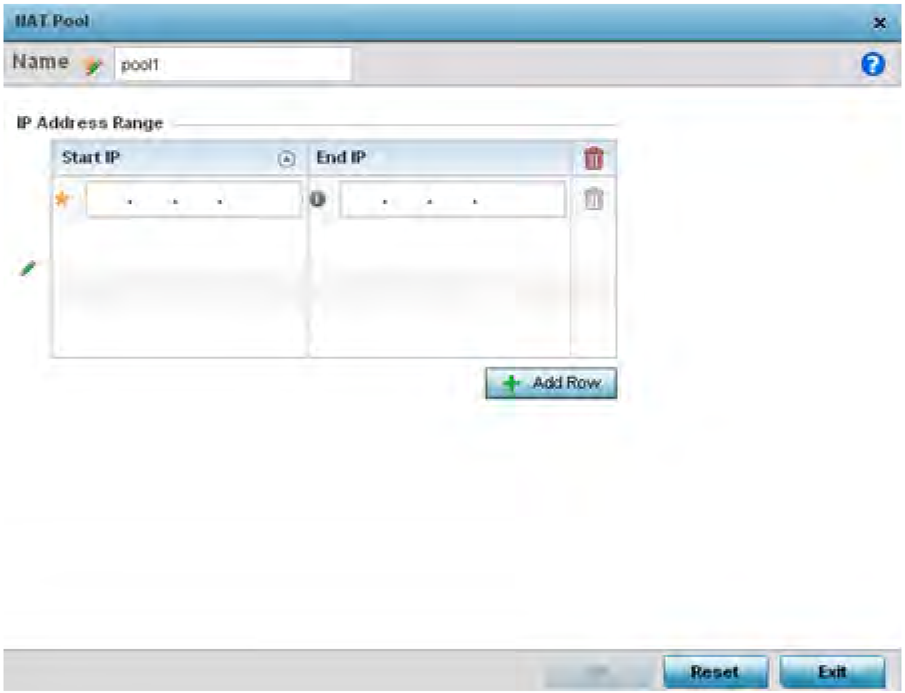


Figure 5-124 *NAT Pool screen*

7 If adding a new NAT policy or editing the configuration of an existing policy, define the following parameters:

Name	If adding a new NAT policy, provide a name to help distinguish it from others with similar configurations. The length cannot exceed 64 characters.
IP Address Range	Define a range of IP addresses that are hidden from the public Internet. NAT modifies network address information in the defined IP range while in transit across a traffic routing device. NAT only provides IP address translation and does not provide a firewall. A branch deployment with NAT by itself will not block traffic from being potentially routed through a NAT device. Consequently, NAT should be deployed with a stateful firewall.

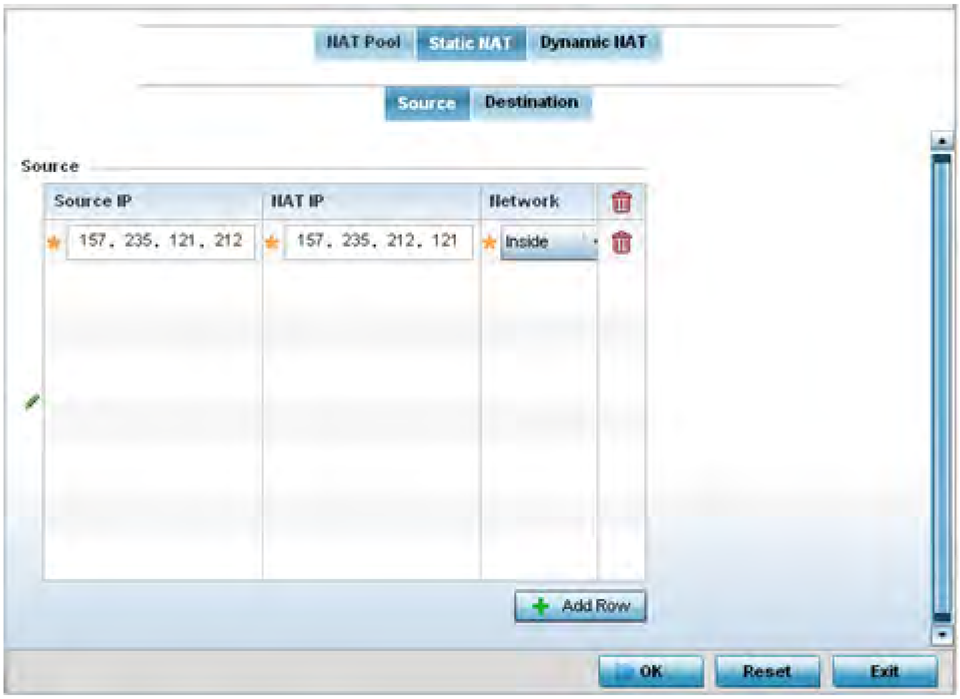
8 Select the **+ Add Row** button as needed to append additional rows to the IP Address Range table.

9 Select **OK** to save the changes or overrides made to the profile’s NAT Pool configuration. Select **Reset** to revert to the last saved configuration.

10 Select the **Static NAT** tab.

The Source tab displays by default and lists existing static NAT configurations. Existing static NAT configurations are not editable, but new configurations can be added or existing ones deleted as they become obsolete.

Static NAT creates a permanent, one-to-one mapping between an address on an internal network and a perimeter or external network. To share a Web server on a perimeter interface with the Internet, use static address translation to map the actual address to a registered IP address. Static address translation hides the actual address of the server from users on insecure interfaces. Casual access by unauthorized users becomes much more difficult. Static NAT requires a dedicated address on the outside network for each host.



Source

Source IP	NAT IP	Network
157. 235. 121. 212	157. 235. 212. 121	Inside

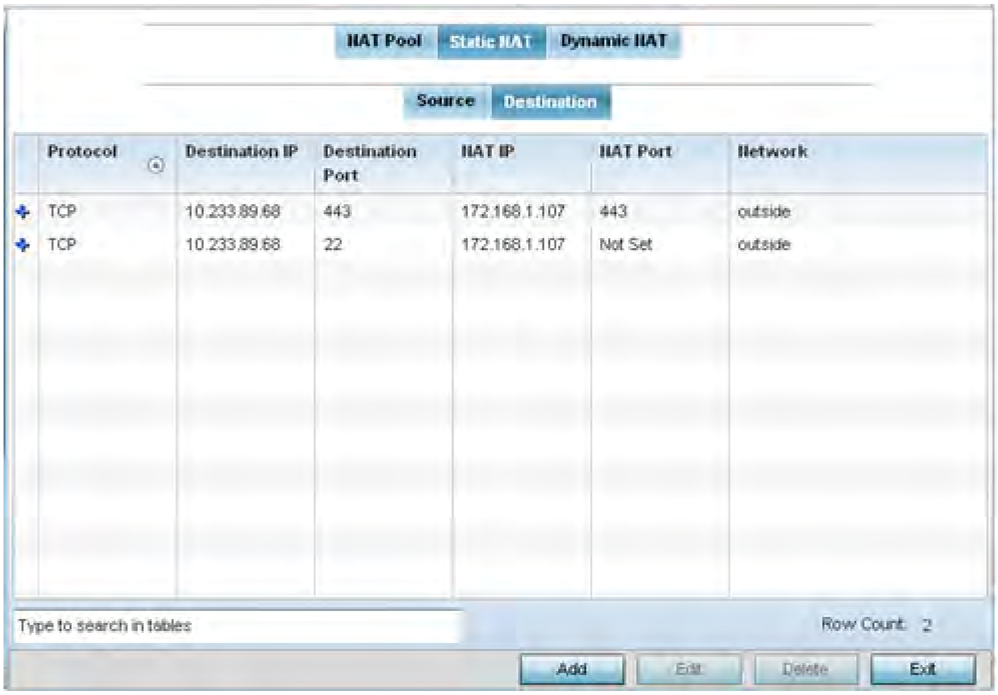
Figure 5-125 *Profile Overrides - Static NAT screen*

11 Select **+ Add Row** to create a new static NAT configuration**.**

12 Set or override the following **Source** configuration parameters:

Source IP	Enter the local address used at the origination of the static NAT configuration. This address (once translated) is not exposed to the outside world when the translation address is used to interact with the remote destination.
NAT IP	Enter the IP address of the matching packet to the specified value. The IP address modified can be either source or destination based on the direction specified.
Network	Select *Inside* or *Outside* NAT as the network direction. Select Inside to create a permanent, one-to-one mapping between an address on an internal network and a perimeter or external network. To share a Web server on a perimeter interface with the Internet, use static address translation to map the actual address to a registered IP address. Static address translation hides the actual address of the server from users on insecure interfaces. Casual access by unauthorized users becomes much more difficult. Static NAT requires a dedicated address on the outside network for each host. Inside NAT is the default setting.Inside is the default setting.

13 Select the **Destination** tab to view destination NAT configurations and define packets passing through the NAT on the way back to the managed LAN are searched against to the records kept by the NAT engine. The destination IP address is changed back to the specific internal private class IP address to reach the LAN over the managed network.

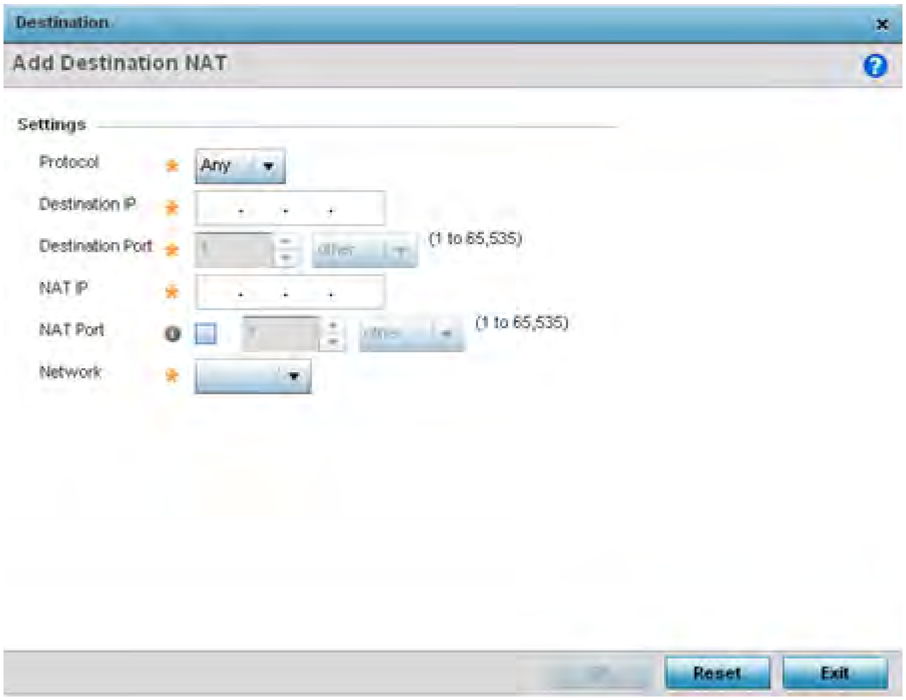


Protocol	Destination IP	Destination Port	NAT IP	NAT Port	Network
TCP	10.233.89.68	443	172.168.1.107	443	outside
TCP	10.233.89.68	22	172.168.1.107	Not Set	outside

Row Count: 2

Figure 5-126 *NAT Destination screen*

14 Select **Add** to create a new NAT destination configuration or **Delete** to permanently remove a NAT destination. Existing NAT destinations cannot be edited.



Protocol	Any	
Destination IP	. . .	
Destination Port	1 other	(1 to 65,535)
NAT IP	. . .	
NAT Port	□ 1 other	(1 to 65,535)
Network		

Figure 5-127 *NAT Destination Add screen*

15 Set or override the following **Destination** configuration parameters:

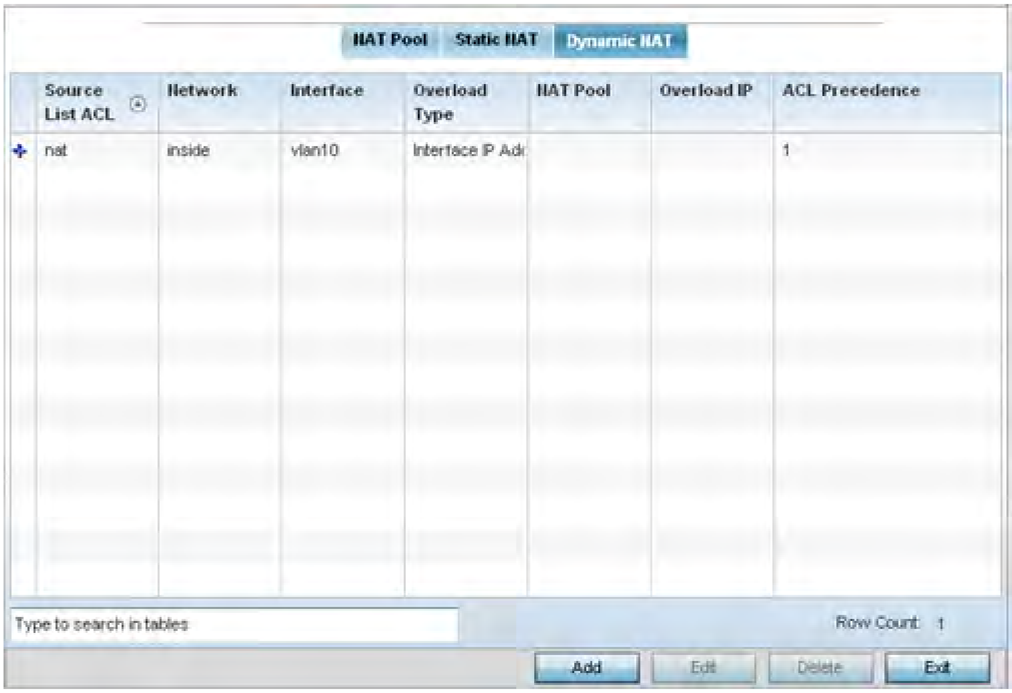
Static NAT creates a permanent, one-to-one mapping between an address on an internal network and a perimeter or external network. To share a Web server on a perimeter interface with the Internet, use static address translation to map the actual address to a registered IP address. Static address translation hides the actual address of the server from users on insecure interfaces. Casual access by unauthorized users becomes much more difficult. Static NAT requires a dedicated address on the outside network for each host.

Protocol	Select the protocol for use with static translation (*TCP, UDP* and *Any* are available options). TCP is a transport layer protocol used by applications requiring guaranteed delivery. It's a sliding window protocol handling both time outs and retransmissions. TCP establishes a full duplex virtual connection between two endpoints. Each endpoint is defined by an IP address and a TCP port number. The *User Datagram Protocol* (UDP) offers only a minimal transport service, non-guaranteed datagram delivery, and provides applications direct access to the datagram service of the IP layer. UDP is used by applications not requiring the level of service of TCP, or are using communications services (multicast or broadcast delivery) not available from TCP. The default setting is Any.
Destination IP	Enter the local address used at the (source) end of the static NAT configuration. This address (once translated) is not exposed to the outside world when the translation address is used to interact with the remote destination.
Destination Port	Use the spinner control to set the local port number used at the (source) end of the static NAT configuration. The default value is port 1.
NAT IP	Enter the IP address of the matching packet to the specified value. The IP address modified can be either source or destination based on the direction specified.
NAT Port	Enter the port number of the matching packet to the specified value. This option is valid only if the direction specified is destination.
Network	Select *Inside* or *Outside* NAT as the network direction. Inside is the default setting.

16 Select **OK** to save the changes or overrides made to the static NAT configuration. Select **Reset** to revert to the last saved configuration.

17 Select the **Dynamic NAT** tab.

Dynamic NAT configurations translate the IP address of packets going out from one interface to another interface based on configured conditions. Dynamic NAT requires packets be switched through a NAT router to generate translations in the translation table.



Source List ACL	Network	Interface	Overload Type	NAT Pool	Overload IP	ACL Precedence
nat	inside	vlan10	Interface IP Adc			1

Figure 5-128 *Profile Overrides - Dynamic NAT screen*

18 Refer to the following to determine whether a new Dynamic NAT configuration requires creation, edit or deletion:

Source List ACL	Lists an ACL name to define the packet selection criteria for the NAT configuration. NAT is applied only on packets which match a rule defined in the access list. These addresses (once translated) are not exposed to the outside world when the translation address is used to interact with the remote destination.
Network	Displays *Inside* or *Outside* NAT as the network direction for the dynamic NAT configuration.
Interface	Lists the VLAN (from 1 - 4094) used as the communication medium between the source and destination points within the NAT configuration.
Overload Type	Displays the Overload Type utilized when several internal addresses are NATed to only one or a few external addresses. Options include *NAT Pool*, *One Global Address* and *Interface IP Address*. Interface IP Address is the default setting.
NAT Pool	Displays the name of an existing NAT pool used with the dynamic NAT configuration.
Overload IP	If One Global IP Address is selected as the Overload Type, define an IP address used a filter address for the IP ACL rule.
ACL Precedence	Lists the administrator assigned priority set for the listed source list ACL. The lower the value listed the higher the priority assigned to these ACL rules.

19 Select **Add** to create a new Dynamic NAT configuration, **Edit** to modify or override an existing configuration or **Delete** to permanently remove a configuration.

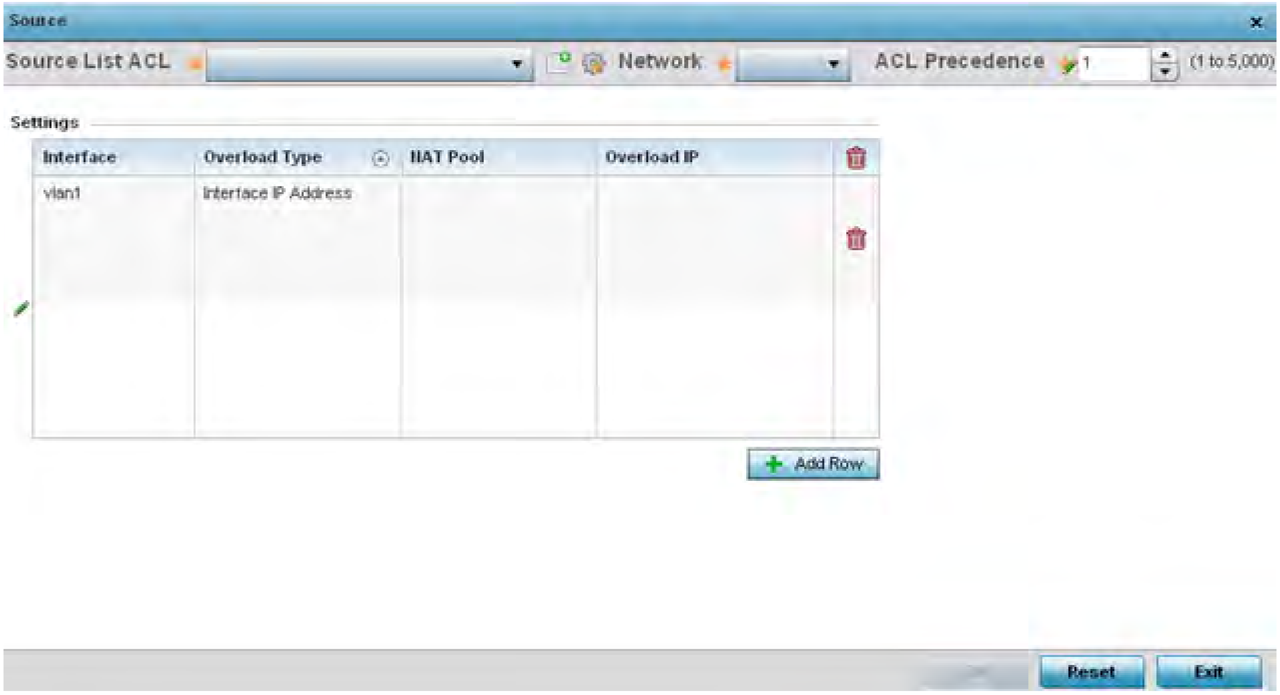


Figure 5-129 *Dynamic NAT Add screen*

20 Set or override the following to define the Dynamic NAT configuration:

Source List ACL	Use the drop-down menu to select an ACL name to define the packet selection criteria for NAT. NAT is applied only to packets which match a rule defined in the access list. These addresses (once translated) are not exposed to the outside world when the translation address is used to interact with a remote destination.
Network	Select *Inside* or *Outside* NAT as the network direction for the dynamic NAT configuration. Inside is the default setting.
ACL Precedence	Set the priority (from 1 - 5000) for the source list ACL. The lower the value, the higher the priority assigned to these ACL rules.
Interface	Use the drop-down menu to select the wireless WAN or VLAN ID (1 - 4094) used as the communication medium between the source and destination points within the NAT configuration. Ensure the VLAN selected represents the intended network traffic within the NAT supported configuration. VLAN1 is available by default.
Overload Type	Define the Overload Type utilized when several internal addresses are NATed to only one or a few external addresses. Options include *NAT Pool*, *One Global Address* and *Interface IP Address*. Interface IP Address is the default setting.
NAT Pool	Provide the name of an existing NAT pool for use with the dynamic NAT configuration.
Overload IP	If One Global IP Address is selected as the Overload Type, define an IP address used a filter address for the IP ACL rule.

21 Select **OK** to save the changes or overrides made to the dynamic NAT configuration. Select **Reset** to revert to the last saved configuration.

5.2.9.7 Overriding a Profile's Bridge NAT Configuration

▶ *Overriding a Profile's Security Configuration*

Use *Bridge NAT* to manage Internet traffic originating at a remote site. In addition to traditional NAT functionality, Bridge NAT provides a means of configuring NAT for bridged traffic through an access point. NAT rules are applied to bridged traffic through the access point, and matching packets are NATed to the WAN link instead of being bridged on their way to the router.

Using Bridge NAT, a tunneled VLAN (extended VLAN) is created between the NoC and a remote location. When a remote client needs to access the Internet, Internet traffic is routed to the NoC, and from there routed to the Internet. This increases the access time for the end user on the client.

To resolve latency issues, Bridge NAT identifies and segregates traffic heading towards the NoC and outwards towards the Internet. Traffic towards the NoC is allowed over the secure tunnel. Traffic towards the Internet is switched to a local WLAN link with access to the Internet.

To define a NAT configuration or override that can be applied to a profile:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

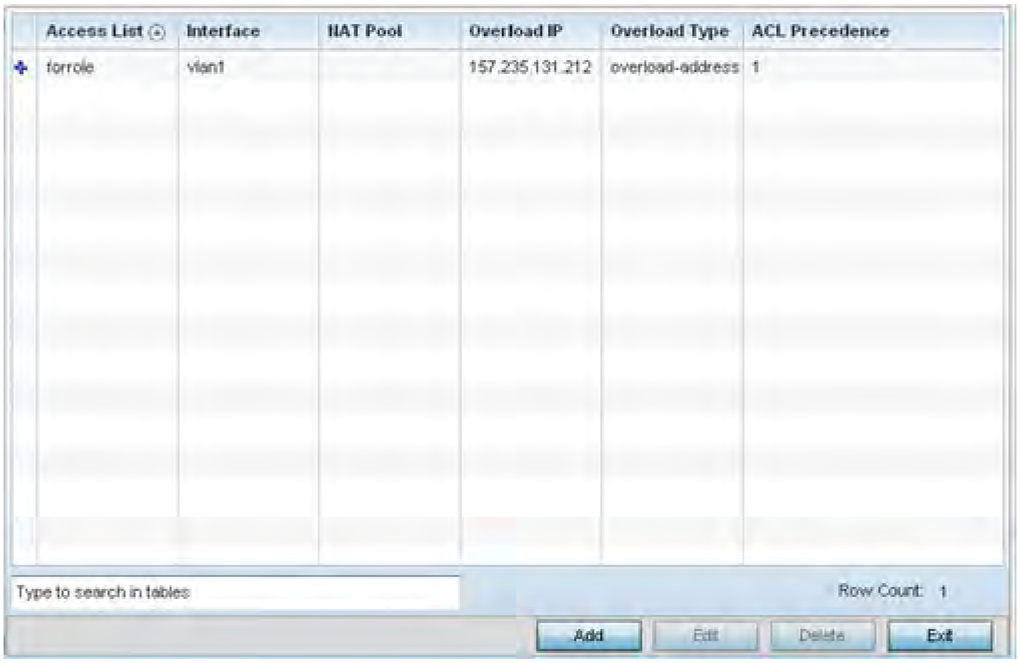
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Security** to expand its sub menu options.

5 Select **Bridge NAT**.

☑ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



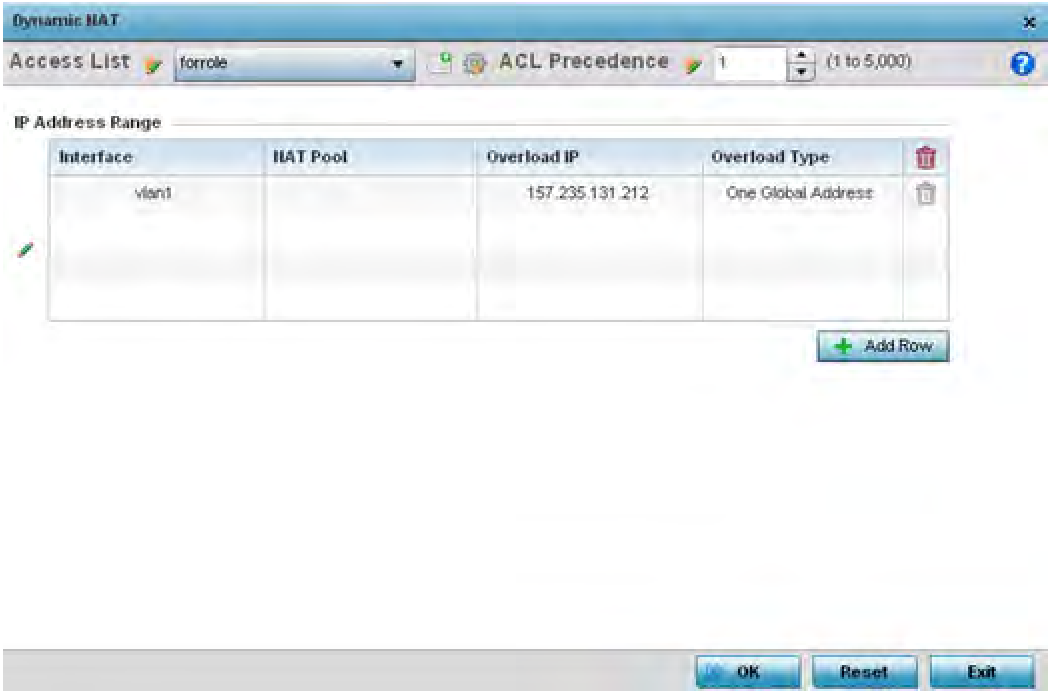
Access List	Interface	NAT Pool	Overload IP	Overload Type	ACL Precedence
forrole	vlan1		157.235.131.212	overload-address	1

Figure 5-130 *Security Bridge NAT screen*

6 Review the following **Bridge NAT** configurations to determine whether a new Bridge NAT configuration requires creation or an existing configuration modified or removed.

Access List	Displays the access list applying IP address access/deny permission rules to the Bridge NAT configuration.
Interface	Lists the communication medium (outgoing layer 3 interface) between source and destination points. This is either the Access Point’s *pppoe1* or *wwan1* interface or the VLAN used as the redirection interface between the source and destination.
NAT Pool	Lists the names of existing NAT pools used with the Bridge NAT configuration. This displays only when *Overload Type* is NAT Pool.
Overload IP	Lists the address used globally for numerous local addresses.
Overload Type	Define the overload type utilized when several internal addresses are NATed to only one or a few external addresses. Set as either *NAT Pool*, *One Global Address* or *Interface IP Address*.
ACL Precedence	Lists the administrator assigned priority set for the ACL. The lower the value listed the higher the priority assigned to these ACL rules.

7 Select **Add** to create a new Bridge VLAN configuration, **Edit** to modify an existing configuration or **Delete** to remove a configuration.


Dynamic NAT

Access List: forrole

ACL Precedence: 1 (1 to 5,000)

IP Address Range

Interface	NAT Pool	Overload IP	Overload Type
vlan1		157.235.131.212	One Global Address

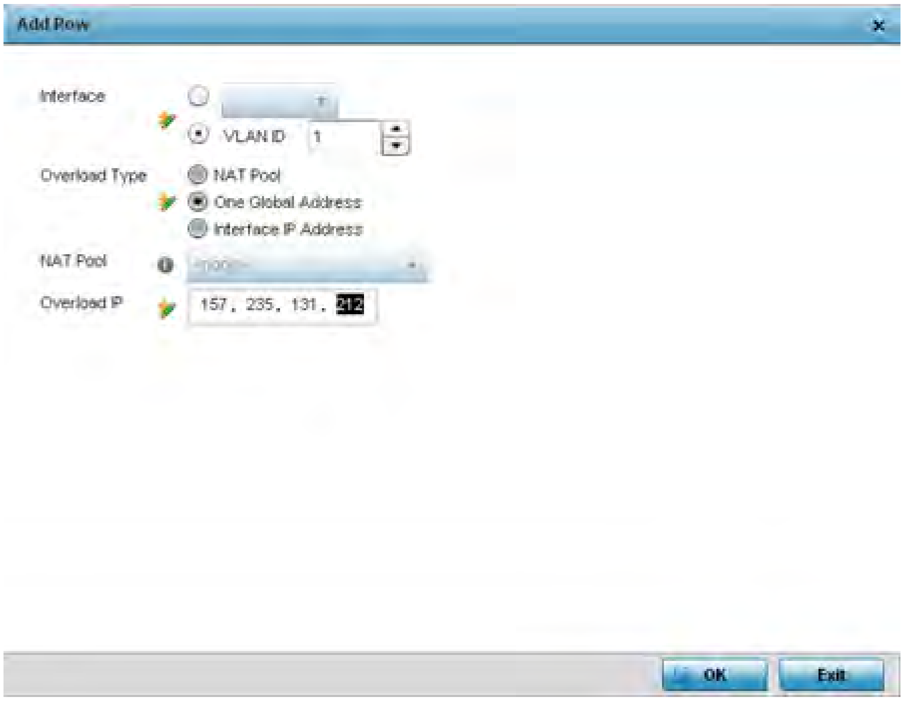
Figure 5-131 *Security Source Dynamic NAT screen*

8 Select the **ACL** whose IP rules are applied to the policy based forwarding rule. A new ACL can be defined by selecting the **Create** icon, or an existing set of IP ACL rules can be modified by selecting the **Edit** icon.

9 Use the **IP Address Range** table to configure IP addresses and address ranges that can used to access the Internet.

ACL Precedence	Set the priority (from 1 - 5000) for the ACL. The lower the value, the higher the priority assigned to these ACL rules.
Interface	Lists the outgoing layer 3 interface on which traffic is re-directed. The interface can be an Access Point *wwan* or *pppoe* interface. Traffic can also be redirected to a designated VLAN.
NAT Pool	Displays the NAT pool used by this Bridge NAT entry. A value is only displayed only when Overload Type has been set to *NAT Pool*.
Overload IP	Lists the single global address supporting numerous local addresses.
Overload Type	Lists the overload type utilized when several internal addresses are NATed to only one or a few external addresses. Options include *NAT Pool*, *One Global Address* and *Interface IP Address*. Interface IP Address is the default setting.

10 Select **+ Add Row** to set the interface, overload and NAT pool settings for the Bridge NAT configuration.



Interface ○ ● VLAN ID 1

Overload Type ○ NAT Pool ● One Global Address ○ Interface IP Address

NAT Pool <none>

Overload IP 157 . 235 . 131 . 212

Figure 5-132 *Security Source Dynamic NAT screen*

11 Select **OK** to save the changes made within the Add Row and Source Dynamic NAT screen. Select **Reset** to revert to the last saved configuration.

5.2.9.8 Overriding a Profile's Application Visibility Settings

▸ *Overriding a Profile's Security Configuration*

Deep Pocket Inspection (DPI) is an advanced packet analysis technique, which analyzes packet and packet content headers to determine the nature of network traffic. When DPI is enabled, packets of all flows are subjected to DPI to get accurate results. DPI identifies applications (such as, Netflix, Twitter, Facebook, etc.) and extracts metadata (such as, host name, server name, TCP-RTT, etc.) for further use by the WiNG firewall.

To configure a profile's application visibility settings and overrides:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

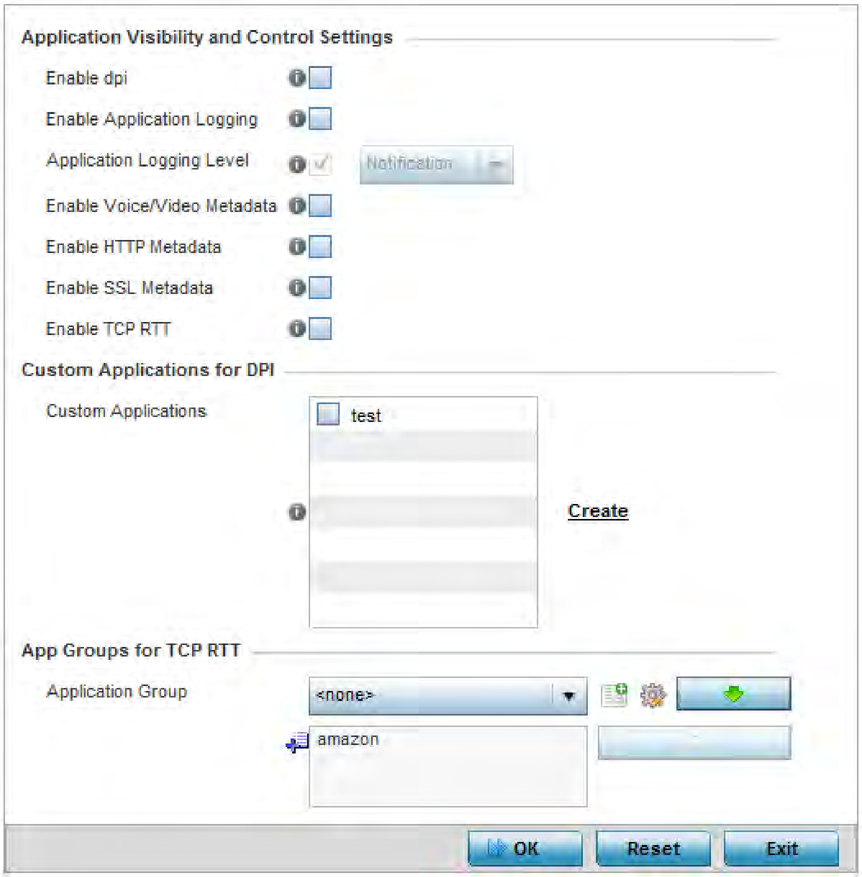
Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Security** to expand its sub menu options.

5 Select **Application Visibility.**

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Application Visibility and Control Settings

Enable dpi □

Enable Application Logging □

Application Logging Level ☑ Notification

Enable Voice/Video Metadata □

Enable HTTP Metadata □

Enable SSL Metadata □

Enable TCP RTT □

Custom Applications for DPI

Custom Applications □ test

App Groups for TCP RTT

Application Group <none>

amazon

Figure 5-133 *Profile Overrides - Application Visibility screen*

6 Refer the following **Application Visibility and Control Settings**:

Enable dpi	Enable this setting to provide deep-packet inspection. When enabled, network flows are inspected at a granular level to identify applications (such as, Netflix, Twitter, Facebook, etc.) and extract metadata (such as, host name, server name, TCP-RTT, etc.) for further use by the WiNG firewall.
Enable Applications Logging	Select this option to enable event logging for DPI application recognition. This setting is disabled by default.
Application Logging Level	If enabling DPI application recognition event logging, set the logging level. Severity levels include *Emergency, Alert, Critical, Errors, Warning, Notice, Info* and *Debug*. The default logging level is Notification.
Enable Voice/Video Metadata	Select this option to enable the metadata extraction from voice and video classified flows. The default setting is disabled.

Enable HTTP Metadata	Select this option to enable the metadata extraction from HTTP flows. The default setting is disabled.
Enable SSL Metadata	Select this option to enable the metadata extraction from SSL flows. The default setting is disabled.
Enable TCP RTT	Select this option to enable extraction of RTT information from TCP flows. The default setting is disabled.

7 Review the **Custom Applications for DPI** field to select the custom applications available for this device profile.

For information on creating custom applications and their categories, see Application on page 7-58.

8 If enabling TCP-RTT metadata collection, in the **App Groups for TCP RTT** field, specify the application groups for which TCP-RTT metadata collection is to be enabled. Select the *Application Groups* from the drop-down menu and use the green, down arrow to move the selection to the box below. Note, you can add maximum of 8 (eight) groups to the list. If the desired application group is not available, select the **Create** icon to define a new application group configuration or select the **Edit** icon to modify an existing application group. For information on creating custom application groups, see Application on page 7-58.

9 Select **OK** to save the changes or overrides. Select **Reset** to revert to the last saved configuration.

5.2.9.9 Overriding a Profile’s VRRP Configuration

▸ *Profile Overrides*

A default gateway is a critical resource for connectivity. However, it’s prone to a single point of failure. Thus, redundancy for the default gateway is required by the access point. If WAN backhaul is available, and a router failure occurs, then the Access Point should act as a router and forward traffic on to its WAN link.

Define an external *Virtual Router Redundancy Protocol* (VRRP) configuration when router redundancy is required in a wireless network requiring high availability.

The election of a VRRP master is central to the configuration of VRRP. A VRRP master (once elected) performs the following functions:

- Responds to ARP requests
- Forwards packets with a destination link layer MAC address equal to the virtual router MAC address
- Rejects packets addressed to the IP address associated with the virtual router, if it is not the IP address owner
- Accepts packets addressed to the IP address associated with the virtual router, if it is the IP address owner or accept mode is true.

Nodes losing the election process enter a backup state where they monitor the master for any failures, and in case of a failure, one of the backups become the master and assumes the management of the designated virtual IPs. A backup does not respond to an ARP request, and discards packets destined for a virtual IP resource.

To define the configuration of a VRRP group:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of managed devices or peer controllers, service platforms or Access Points.

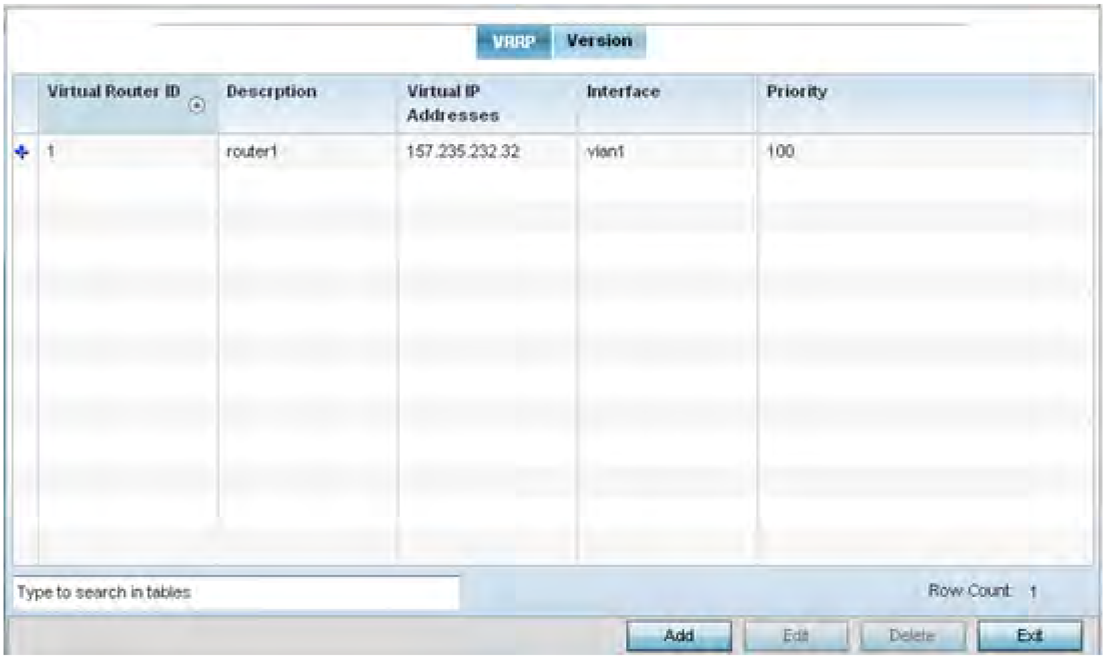
2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **VRRP**.

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



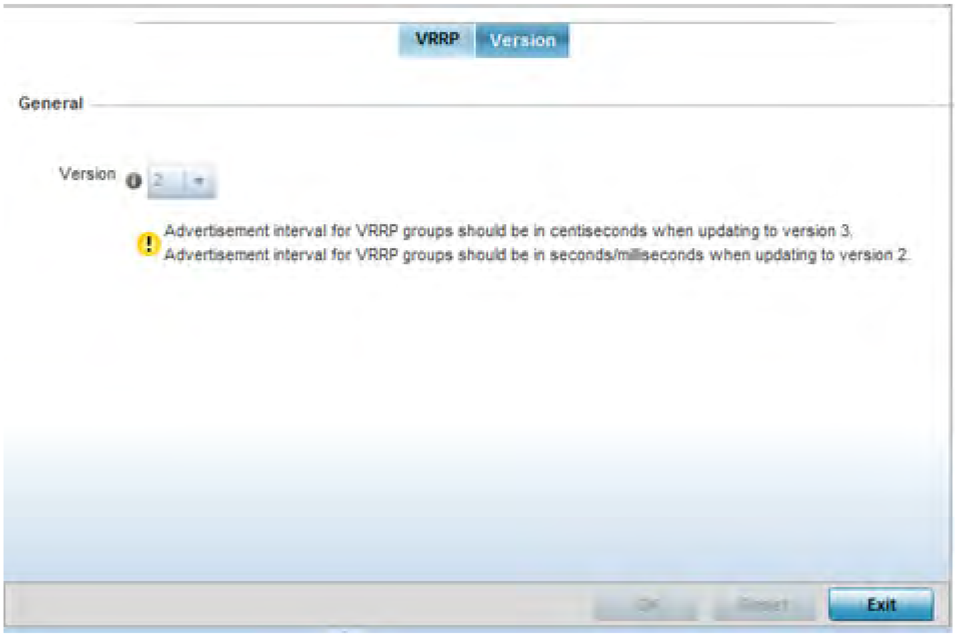
	Virtual Router ID	Description	Virtual IP Addresses	Interface	Priority
✚	1	router1	157.235.232.32	vlan1	100

Figure 5-134 *Profile Overrides - VRRP screen*

5 Review the following VRRP configuration data to assess if a new VRRP configuration is required of is an existing VRRP configuration requires modification or removal:

Virtual Router ID	Lists a numerical index (1 - 255) used to differentiate VRRP configurations. The index is assigned when a VRRP configuration is initially defined. This ID identifies the virtual router a packet is reporting status for.
Description	Displays a description assigned to the VRRP configuration when it was either created or modified. The description is implemented to provide additional differentiation beyond the numerical virtual router ID.
Virtual IP Addresses	Lists the virtual interface IP address used as the redundant gateway address for the virtual route.
Interface	Displays the interfaces selected on the Access Point to supply VRRP redundancy fail over support.
Priority	Lists a numerical value (from 1 - 254) used for the virtual router master election process. The higher the numerical value, the higher the priority in the election process.

6 Select the **Version** tab to define the VRRP version scheme used with the configuration.

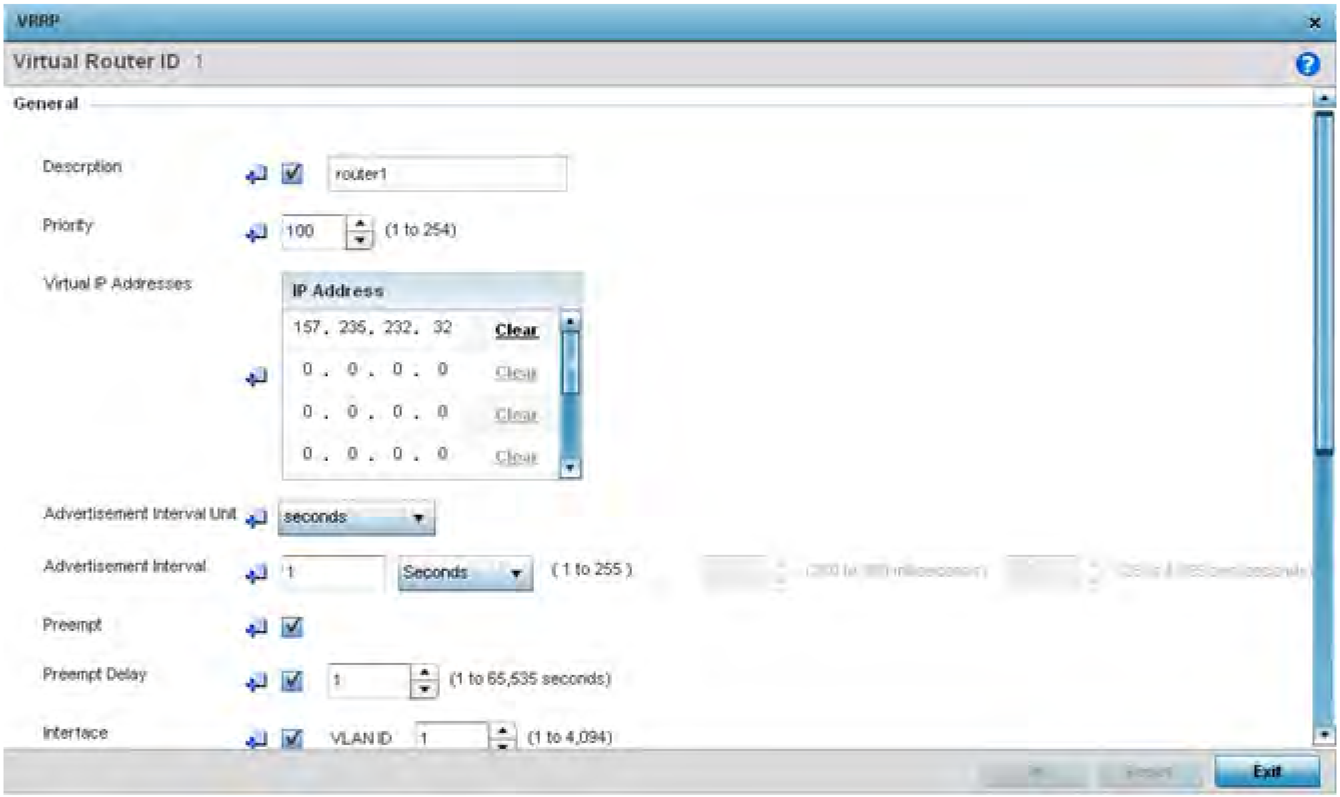


Advertisement interval for VRRP groups should be in centiseconds when updating to version 3.
Advertisement interval for VRRP groups should be in seconds/milliseconds when updating to version 2.

Figure 5-135 *VRRP screen - Version tab*

VRRP version 3 (RFC 5798) and 2 (RFC 3768) are selectable to set the router redundancy. Version 3 supports sub-second (centisecond) VRRP failover and support services over virtual IP. For more information on the VRRP protocol specifications (available publicly) refer to http://www.ietf.org/rfc/rfc3768.txt (version 2) and http://www.ietf.org/rfc/rfc5798.txt (version 3).

7 From within VRRP tab, select **Add** to create a new VRRP configuration or **Edit** to modify the attributes of an existing VRRP configuration. If necessary, existing VRRP configurations can be selected and permanently removed by selecting **Delete**.



VRRP

Virtual Router ID 1

General

Description ☑ router1

Priority 100 (1 to 254)

Virtual IP Addresses

IP Address	
157 . 235 . 232 . 32	Clear
0 . 0 . 0 . 0	Clear
0 . 0 . 0 . 0	Clear
0 . 0 . 0 . 0	Clear

Advertisement Interval Unit seconds

Advertisement Interval 1 Seconds (1 to 255)

Preempt ☑

Preempt Delay ☑ 1 (1 to 65,535 seconds)

Interface ☑ VLAN ID 1 (1 to 4,094)

Figure 5-136 *VRRP screen*

8 If creating a new VRRP configuration, assign a **Virtual Router ID** from (1 - 255). In addition to functioning as numerical identifier, the ID identifies the virtual router a packet is reporting status for.

9 Define the following VRRP **General** parameters:

Description	In addition to an ID assignment, a virtual router configuration can be assigned a textual description (up to 64 characters) to further distinguish it from others with a similar configuration.
Priority	Use the spinner control to set a VRRP priority setting from 1 - 254. The controller or service platform uses the defined setting as criteria in selection of a virtual router master. The higher the value, the greater the likelihood of this virtual router ID being selected as the master.
Virtual IP Addresses	Provide up to 8 IP addresses representing the Ethernet switches, routers or security appliances defined as virtual router resources.
Advertisement Interval Unit	Select either *seconds*, *milliseconds* or *centiseconds* as the unit used to define VRRP advertisements. Once an option is selected, the spinner control becomes enabled for that *Advertisement Interval* option. The default interval unit is seconds. If changing the VRRP group version from 2 to 3, ensure the advertisement interval is in centiseconds. Use VRRP group version 2 when the advertisement interval is either in seconds or milliseconds.
Advertisement Interval	Once an *Advertisement Interval* unit has been selected, use the spinner control to set the interval the VRRP master sends out advertisements on each of its configured VLANs. The default setting is 1 second.

Preempt	Select this option to ensure a high priority backup router is available to preempt a lower priority backup router resource. The default setting is enabled. When selected, the *Preempt Delay* option becomes enabled to set the actual delay interval for pre-emption. This setting determines if a node with a higher priority can take over all the Virtual IPs from the nodes with a lower priority.
Preempt Delay	If the Preempt option is selected, use the spinner control to set the delay interval (in seconds) for pre-emption.
Interface	Select this value to enable/disable VRRP operation and define the VLAN (1 - 4,094) interface where VRRP will be running. These are the interfaces monitored to detect a link failure.

10 Refer to the **Protocol Extension** field to define the following:

Sync Group	Select the option to assign a VRRP sync group to this VRRP ID's group of virtual IP addresses. This triggers VRRP fail over if an advertisement is not received from the virtual masters that are part of this VRRP sync group. This setting is disabled b y default.
Network Monitoring: Local Interface	Select *wwan1*, *pppoe1* and *VLAN ID(s)* as needed to extend VRRP monitoring to these local Access Point interfaces. Once selected, these interfaces can be assigned an increasing or decreasing level or priority for virtual routing within the VRRP group.
Network Monitoring: Critical Resource	Assign the priority level for the selected local interfaces. Backup virtual routers can increase or decrease their priority in case the critical resources connected to the master router fail, and then transition to the master state themselves. Additionally, the master virtual router can lower its priority if the critical resources connected to it fails, so the backup can transition to the master state. This value can only be set on the backup or master router resource, not both. Options include *None*, *increment-priority*, *decrement priority*.
Network Monitoring: Critical Resource Name	Select each critical resource needed for monitoring. The action specified in the critical resource drop-down menu is applied to each selected critical resource.
Network Monitoring: Delta Priority	Use this setting to decrement the configured priority (by the set value) when the monitored interface is down. When critical resource monitoring, the value is incremented by the setting defined.

11 Select **OK** to save the changes made to the VRRP configuration. Select **Reset** to revert to the last saved configuration.

5.2.9.10 Overriding a Profile's Critical Resource Configuration

▸ *Profile Overrides*

Critical resources are device IP addresses or destinations interopreted as critical to the health of the network. The critical resource feature allows for the continuous monitoring of these defined addresses. A critical resource, if not available, can result in the network suffering performance degradation. A critical resource can be a gateway, AAA server, WAN interface or any hardware or service on which the stability of the network depends. Critical resources are pinged regularly. If there's a connectivity issue, an event is generated stating a critical resource is unavailable. By default, there's no enabled critical resource policy and one needs to be created and implemented.

Critical resources can be monitored directly through the interfaces on which they're discovered. For example, a critical resource on the same subnet as the access point can be monitored by its IP address. However, a critical resource located on a VLAN must continue to monitored on that VLAN.

Critical resource can be configured for Access Points and wireless controllers using their respective profiles.

To define critical resources:

1 Select **Devices** from the Configuration tab.

 The Device Configuration screen displays a list of devices or peer controllers, service platforms or Access Points.

2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

 Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Critical Resources**.

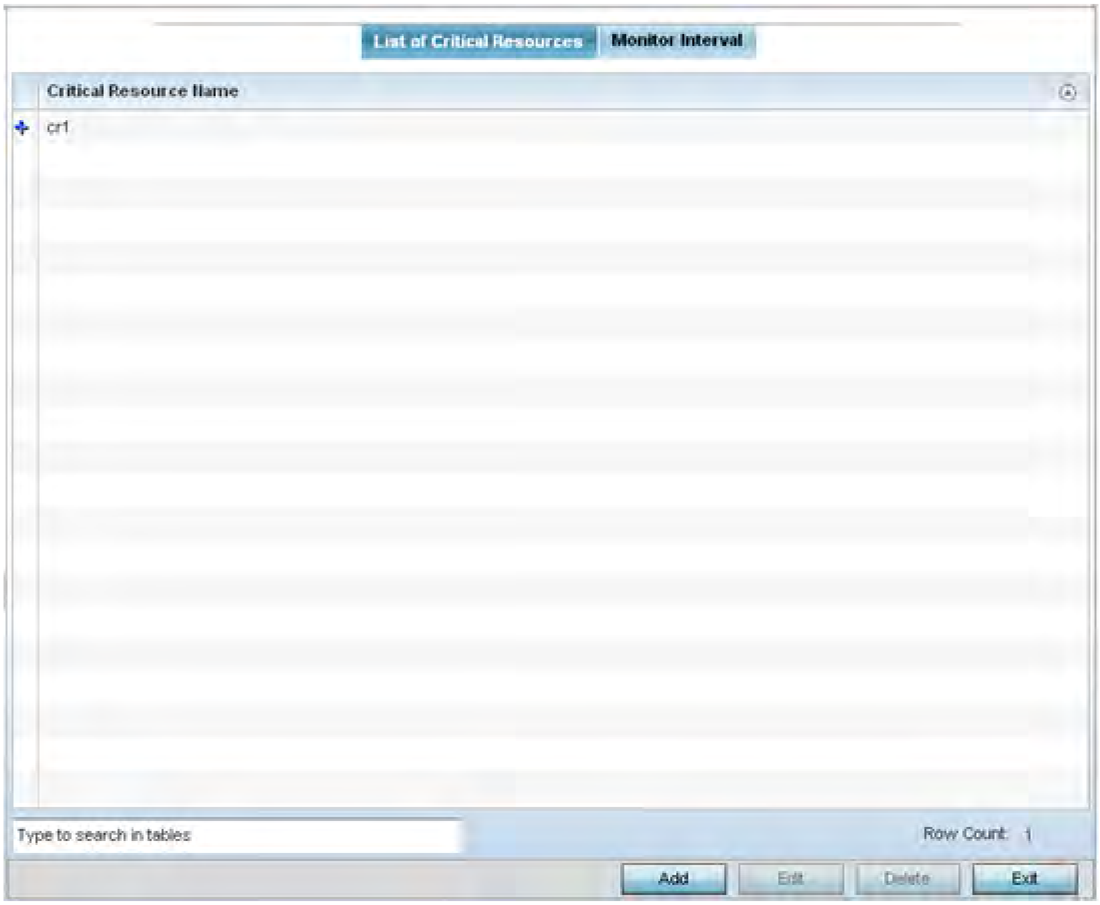
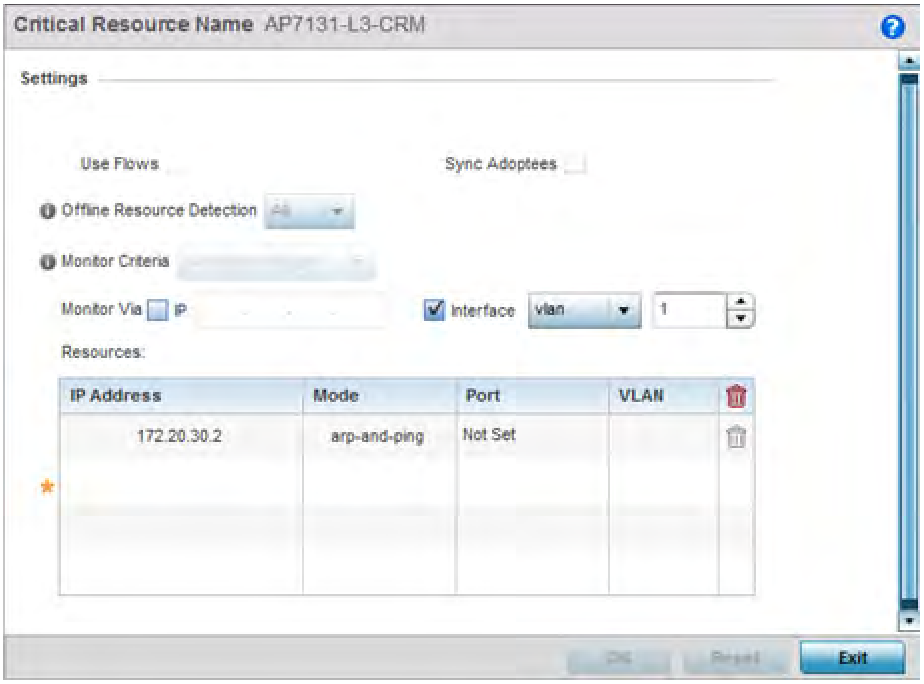


Figure 5-137 *Critical Resources screen - List of Critical Resources tab*

The screen lists the destination IP addresses or interfaces (VLAN, WWAN, or PPPoE) used for critical resource connection. IP addresses can be monitored directly by the controller, service platform or Access Point whereas a VLAN, WWAN or PPPoE must be monitored behind an interface.

5 The **Critical Resource Name** table displays the name of the resource(s) configured on this device.

6 Click the **Add** button at the bottom of the screen to add a new critical resource and connection method, or select an existing resource and select **Edit** to update the resource’s configuration. If adding a new critical resource, assign it a name up to 32 characters.



Critical Resource Name AP7131-L3-CRM

Settings

Use Flows

Sync Adoptees □

Offline Resource Detection All

Monitor Criteria

Monitor Via □ IP

☑ Interface vlan 1

Resources:

IP Address	Mode	Port	VLAN
172.20.30.2	arp-and-ping	Not Set	

Figure 5-138 *Critical Resources screen - Adding a Critical Resource*

7 Select **Use Flows** to configure the critical resource to monitor using firewall flows for DHCP or DNS instead of ICMP or ARP packets to reduce the amount of traffic on the network. Select **Sync Adoptees** to sync adopted devices to state changes with a resource-state change message. These settings are disabled by default.

8 Use the **Offline Resource Detection** drop-down menu to define how critical resource event messages are generated. Options include *Any* and *All*. If selecting **Any**, an event is generated when the state of any single critical resource changes. If selecting **All**, an event is generated when the state of all monitored critical resources change.

9 Use the **Monitor Criteria** drop-down menu to select either *rf-domain-manager*, *cluster-master* or *All* as the resource for monitoring critical resources by one device and updating the rest of the devices in a group.

If selecting **rf-domain-manager**, the current rf-domain manager performs resource monitoring, and the rest of the devices do not. The RF-domain-manager updates any state changes to the rest of the devices in the RF Domain. With the **cluster-master** option, the cluster master performs resource monitoring and updates the cluster members with state changes. With a controller managed RF Domain, Monitoring Criteria should be set tor **All**, since the controller might not know the VLAN bridged locally by the devices in the RF Domain monitoring DHCP.

10 Select the **IP** option (within the **Monitor Via** field at the top of the screen) to monitor a critical resource directly (within the same subnet) using the provided IP address as a network identifier.

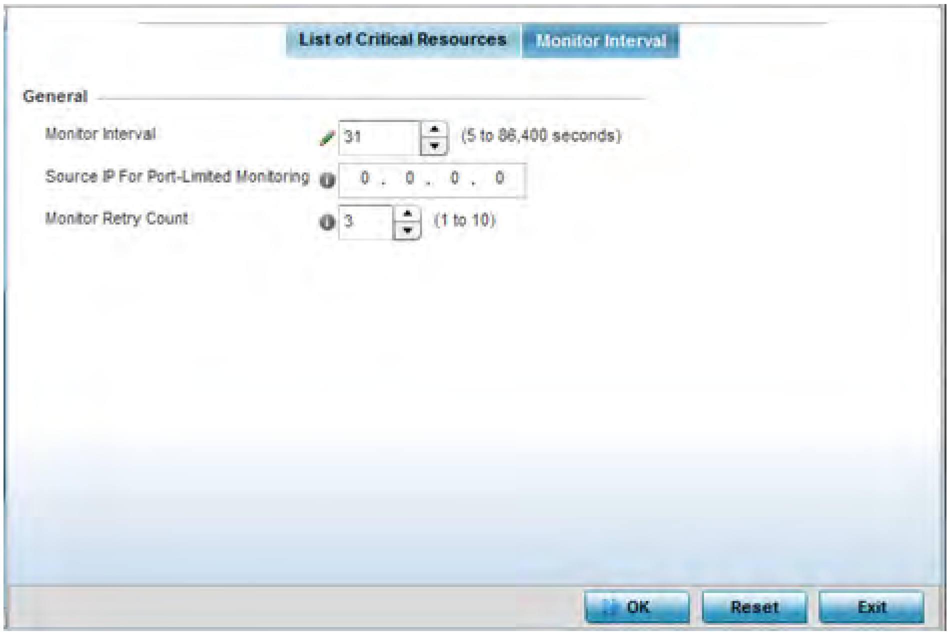
11 Select the **Interface** check box (within the Monitor Via field at the top of the screen) to monitor a critical resource using either the critical resource's VLAN, WWAN1 or PPPoE1 interface. If VLAN is selected, a spinner control is enabled to define the destination VLAN ID used as the interface for the critical resource.

12 Select **+ Add Row** to define the following for critical resource configurations:

IP Address	Provide the IP address of the critical resource. This is the address used by the Access Point to ensure the critical resource is available. Up to four addresses can be defined.

Mode	Set the ping mode used when the availability of a critical resource is validated. Select from: *arp-only* – Use the *Address Resolution Protocol* (ARP) for only pinging the critical resource. ARP is used to resolve hardware addresses when only the network layer address is known. *arp-and-ping* – Use both ARP and *Internet Control Message Protocol* (ICMP) for pining the critical resource and sending control messages (device not reachable, requested service not available, etc.).
Port	Define the interface on which to monitor critical resource. This field lists the available hardware interfaces. This option is only available if the selected mode is ARP Only.
VLAN	Define the VLAN on which the critical resource is available using the spinner control.

13 Select the **Monitor Interval** tab.



General

Monitor Interval 31 (5 to 86,400 seconds)

Source IP For Port-Limited Monitoring 0 . 0 . 0 . 0

Monitor Retry Count 3 (1 to 10)

Figure 5-139 *Critical Resources screen - Monitor Interval tab*

Set **Monitor Interval** as the duration between two successive pings to the critical resource. Define this value in seconds from 5 - 86,400. The default setting is 30 seconds.

14 Set the **Source IP for Port-Limited Monitoring** to define the IP address used as the source address in ARP packets used to detect a critical resource on a layer 2 interface. Generally, the source address 0.0.0.0 is used in the APR packets used to detect critical resources. However, some devices do not support the above IP address and drop the ARP packets. Use this field to provide an IP address specifically used for this purpose. The IP address used for Port-Limited Monitoring must be different from the IP address configured on the device.

15 Set the **Monitoring Retries before Marking Resource as DOWN** for the number of retry connection attempts (1 - 10) permitted before this device connection is defined as down (offline). The default setting is three connection attempts.

16 Select **OK** to save the changes to the critical resource configuration and monitor interval. Select **Reset** to revert to the last saved configuration.

5.2.9.11 Overriding a Profile's Services Configuration

▸ *Profile Overrides*

A profile can contain specific guest access (captive portal), DHCP server and RADIUS server configurations supported by the controller, service platform or Access Point's own internal resources. These access, IP assignment and user authorization resources can be defined uniquely as profile requirements dictate.

To define or override a profile's services configuration:

1 Select **Devices** from the Configuration tab.

The *Device Configuration* screen displays a list of devices or peer controllers, service platforms or Access Points.

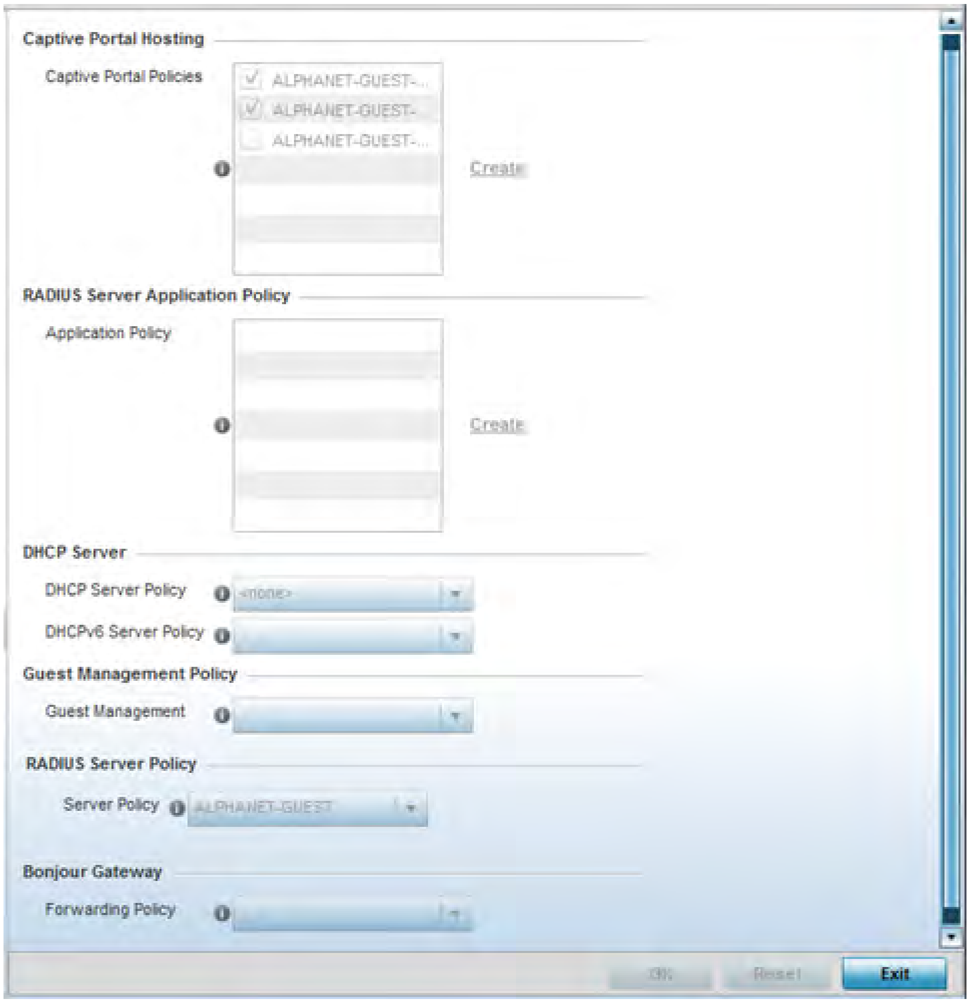
2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Select **Services**.

☑ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Captive Portal Hosting

Captive Portal Policies: ☑ ALPHANET-GUEST-... ☑ ALPHANET-GUEST- □ ALPHANET-GUEST-... Create

RADIUS Server Application Policy

Application Policy: Create

DHCP Server

DHCP Server Policy: <none>

DHCPv6 Server Policy:

Guest Management Policy

Guest Management:

RADIUS Server Policy

Server Policy: ALPHANET-GUEST

Bonjour Gateway

Forwarding Policy:

Figure 5-140 *Profile Overrides - Services screen*

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

5 Refer to the **Captive Portal Hosting** field to set or override the guest access configuration (captive portal) for this profile.

A *captive portal* is an access policy for providing guests temporary and restrictive access to the wireless network.

A captive portal configuration provides secure authenticated controller or service platform access using a standard Web browser. Hotspots provides authenticated access by capturing and re-directing a wireless user's Web browser session to a captive portal login page where the user must enter valid credentials to access to the wireless network. Once logged into the captive portal additional *Agreement*, *Welcome* and *Fail* pages provide the administrator with a number of options on the hotspot's screen flow and user appearance.

Either select an existing captive portal policy, use the default captive portal policy or select the **Create** link to create a new configuration that can be applied to this profile. For more information, see Configuring Captive Portal Policies on page 11-1.

6 Use the **RADIUS Server Application Policy** drop-down menu to select an application policy to authenticate users and authorize access to the network. A RADIUS policy provides the centralized management of authentication data (usernames and passwords). When an client attempts to associate, the controller or service platform sends the authentication request to the RADIUS server.

If an existing RADIUS server policy does not meet your requirements, select the **Create** link to create a new policy.

7 Use the **DHCP Server Policy** drop-down menu assign this profile a DHCP server policy. If an existing DHCP policy does not meet the profile's requirements, select the Create icon to create a new policy configuration that can be applied to this profile or the Edit icon to modify the parameters of an existing DHCP Server policy.

Dynamic Host Configuration Protocol (DHCP) allows hosts on an IP network to request and be assigned IP addresses as well as discover information about the network where they reside. Each subnet can be configured with its own address pool. Whenever a DHCP client requests an IP address, the DHCP server assigns an IP address from that subnet's address pool. When the onboard DHCP server allocates an address for a DHCP client, the client is assigned a lease, which expires after an pre-determined interval. Before a lease expires, wireless clients (to which leases are assigned) are expected to renew them to continue to use the addresses. Once the lease expires, the client is no longer permitted to use the leased IP address. The profile's DHCP server policy ensures all IP addresses are unique, and no IP address is assigned to a second client while the first client's assignment is valid (its lease has not expired).

8 Use the **DHCPv6 Server Policy** drop-down menu assign this profile a DHCPv6 server policy. If an existing DHCP policy for IPv6 does not meet the profile's requirements, select the Create icon to create a new policy configuration that can be applied to this profile or the Edit icon to modify the parameters of an existing DHCP Server policy.

DHCPv6 is a networking protocol for configuring IPv6 hosts with IP addresses, IP prefixes or other configuration attributes required on an IPv6 network. DHCP in IPv6 works in with IPv6 router discovery. With the proper RA flags, DHCPv6 works like DHCP for IPv4. The central difference is the way a device identifies itself if assigning addresses manually instead of selecting addresses dynamically from a pool.

For more information, see Configuring a Captive Portal Policy on page 11-2.

9 Use the **Guest Management Policy** drop-down menu to select an existing Guest Management policy to use as a mechanism to manage guest users with this profile.

10 Use the **RADIUS Server Policy** drop-down menu to select an existing RADIUS server policy to use as a user validation security mechanism with this profile.

A profile can have its own unique RADIUS server policy to authenticate users and authorize access to the network. A profile's RADIUS policy provides the centralized management of controller or service platform authentication data (usernames and passwords). When an client attempts to associate, an authentication request is sent to the RADIUS server.For more information, see Configuring RADIUS Server Policies on page 11-57.

11 Set **Bonjour Gateway** settings. Bonjour is Apple's implementation of zero-configuration networking (Zeroconf). Zeroconf is a group of technologies that include service discovery, address assignment and hostname resolution. Bonjour locates devices such as printers, other computers and services that these computers offer over a local network.

Bonjour provides a general method to discover services on a local area network (LAN). It allows users to set up a network without any configuration. Services such as printers, scanners and file-sharing servers can be found using Bonjour. Bonjour only works within a single broadcast domain. However, with special DNS configuration, it can be extended to find services across broadcast domains.

12 From the **Forwarding Policy** drop-down, select the Bonjour Gateway forwarding policy. n.

13 Select **OK** to save the changes or overrides made to the profile's services configuration. Select **Reset** to revert to the last saved configuration.

5.2.9.12 Overriding a Profile's Management Configuration

▸ *Profile Overrides*

Controllers and service platforms have mechanisms to allow/deny management access to the network for separate interfaces and protocols (*HTTP*, *HTTPS*, *Telnet*, *SSH* or *SNMP*). These management access configurations can be applied strategically to profiles as resource permissions dictate. Additionally, overrides can be applied to customize a device's management configuration, if deployment requirements change an a devices configuration must be modified from its original device profile configuration.

Additionally, an administrator can define a profile with unique configuration file and device firmware upgrade support. In a clustered environment, these operations can be performed on one controller or service platform, then propagated to each member of the cluster and onwards to devices managed by each cluster member.

To define or override a profile's management configuration:

1 Select **Devices** from the Configuration tab.

The Device Configuration screen displays a list of devices or peer controllers, service platforms or Access Points.

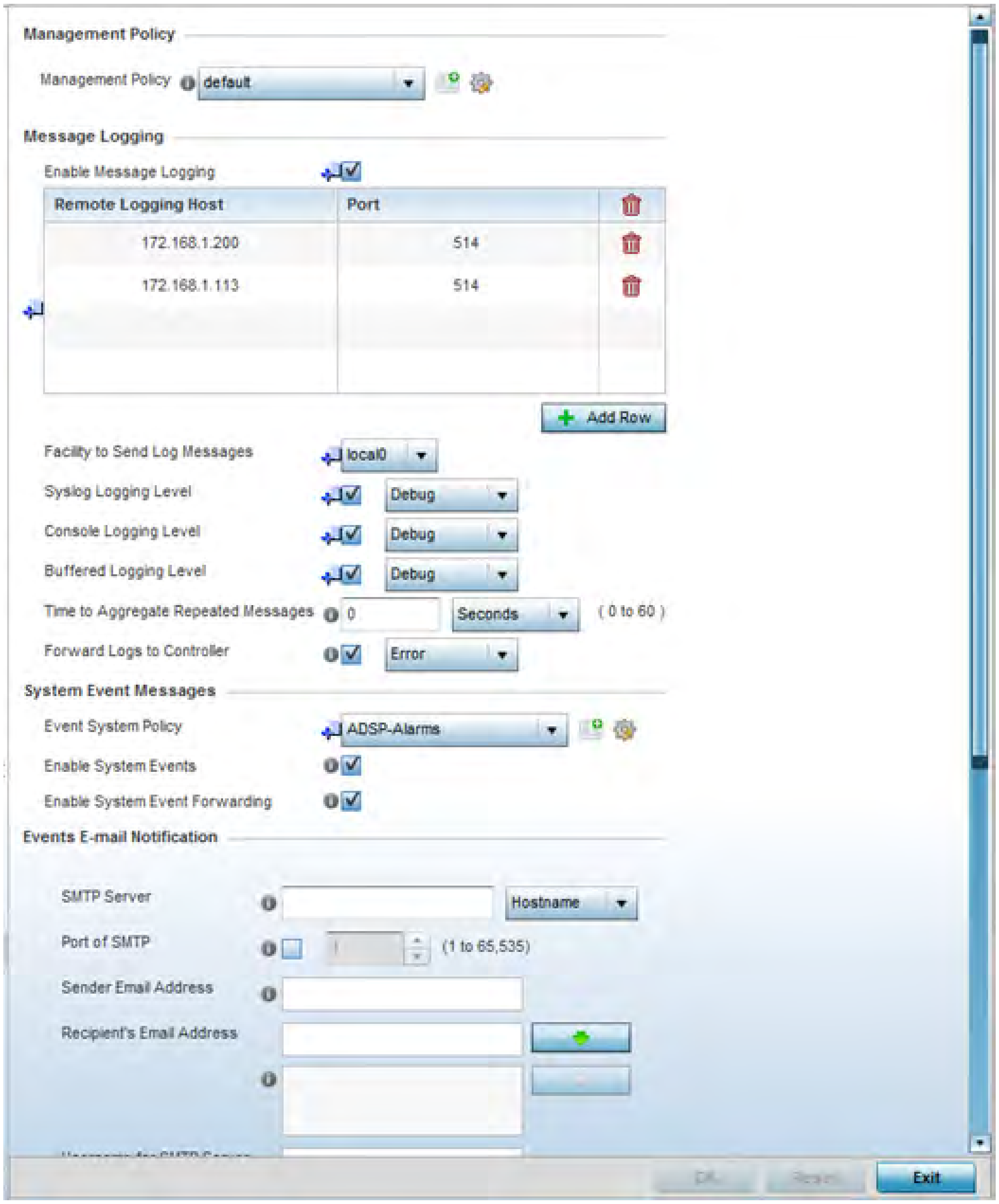
2 Select a target device (by double-clicking it) from amongst those displayed within the Device Configuration screen.

Devices can also be selected directly from the Device Browser in the lower, left-hand, side of the UI.

3 Select **Profile Overrides** from the Device menu to expand it into sub menu options.

4 Expand the **Management** menu item and select **Settings**.

☑ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



Management Policy

Management Policy: default

Message Logging

Enable Message Logging ☑

Remote Logging Host	Port
172.168.1.200	514
172.168.1.113	514

Facility to Send Log Messages: local0

Syslog Logging Level ☑ Debug

Console Logging Level ☑ Debug

Buffered Logging Level ☑ Debug

Time to Aggregate Repeated Messages: 0 Seconds (0 to 60)

Forward Logs to Controller ☑ Error

System Event Messages

Event System Policy: ADSP-Alarms

Enable System Events ☑

Enable System Event Forwarding ☑

Events E-mail Notification

SMTP Server: Hostname

Port of SMTP ☐ 1 (1 to 65,535)

Sender Email Address

Recipient's Email Address

Figure 5-141 *Profile Overrides - Management Settings screen*

NOTE: A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.

5 Refer to the **Management Policy** field to set or override a management configuration for this profile. A default management policy is also available if no existing policies are usable.

Use the drop-down menu to select an existing management policy to apply to this profile. If no management policies exist meeting the data access requirements of this profile, select the **Create** icon to access screens used to define administration, access control and SNMP configurations. Select an existing policy and select the

Edit icon to modify the configuration of an existing management policy. For more information, see Viewing Management Access Policies on page 12-1.

6 Refer to the **Message Logging** field to define how the profile logs system events. It's important to log individual events to discern an overall pattern potentially impacting performance.

Enable Message Logging	Select this option to enable the profile to log system events to a log file or a syslog server. Selecting this check box enables the rest of the parameters required to define the profile's logging configuration. This option is disabled by default.
Remote Logging Host	Use this table to define numerical (non DNS) IP addresses for up to three external resources where logged system events can be sent on behalf of the profile. Select the *Delete* icon as needed to remove an IP address.
Facility to Send Log Messages	Use the drop-down menu to specify the local server (if used) for profile event log transfers.
Syslog Logging Level	Event severity coincides with the syslog logging level defined for the profile. Assign a numeric identifier to log events based on criticality. Severity levels include 0 - *Emergency,* 1 - *Alert*, 2 - *Critical*, 3 - *Errors*, 4 - *Warning*, 5 - *Notice*, 6 - *Info* and 7 - *Debug*. The default logging level is 4.
Console Logging Level	Event severity coincides with the syslog logging level defined for the profile. Assign a numeric identifier to log events based on criticality. Severity levels include 0 - *Emergency,* 1 - *Alert*, 2 - *Critical*, 3 - *Errors*, 4 - *Warning*, 5 - *Notice*, 6 - *Info* and 7 - *Debug*. The default logging level is 4.
Buffered Logging Level	Event severity coincides with the syslog logging level defined for the profile. Assign a numeric identifier to log events based on criticality. Severity levels include 0 - *Emergency,* 1 - *Alert*, 2 - *Critical*, 3 - *Errors*, 4 - *Warning*, 5 - *Notice*, 6 - *Info* and 7 - *Debug*. The default logging level is 4.
Time to Aggregate Repeated Messages	Define the increment (or interval) system events are logged on behalf of the profile. The shorter the interval, the sooner the event is logged. Either define an interval in *Seconds* (0 - 60) or *Minutes* (0 -1). The default value is 0 seconds.
Forward Logs to Controller	Select the check box to define a log level for forwarding event logs. Log levels include *Emergency, Alert*, *Critical*, *Error*, *Warning*, *Notice*, *Info* and *Debug*. The default logging level is Error.

7 Refer to the **System Event Messages** section to define or override how controller or service platform system messages are logged and forwarded on behalf of the profile.

Event System Policy	Select an *Event System Policy* from the drop-down menu. If an appropriate policy does not exist, select the *Create* button to make a new policy.
Enable System Events	Select the *Enable System Events* check box to allow the profile to capture system events and append them to a log file. It's important to log individual events to discern an overall pattern that may be negatively impacting controller or service platform performance. This setting is enabled by default.
Enable System Event Forwarding	Select the *Enable System Event Forwarding* radio button to forward system events to another controller, service platform or cluster member. This setting is enabled by default.

8 Refer to the **Events E-mail Notification** section to define or override how system event notification Emails are sent.

SMTP Server	Specify either the *Hostname* or *IP Address* of the outgoing SMTP server where notification Emails are originated. Hostnames cannot include an underscore character.
Port of SMTP	If a non-standard SMTP port is used on the outgoing SMTP server, select this option and specify a port from 1 - 65,535 for the outgoing SMTP server to use.
Sender E-mail Address	Specify the Email address from which notification Email is originated. This is the *from* address on notification Email.
Recipient's E-mail Address	Specify up to 6 Email addresses to be the recipient's of event Email notifications.
Username for SMTP Server	Specify the sender username on the outgoing SMTP server. Many SMTP servers require users to authenticate with a *username* and *password* before sending Email through the server.
Password for SMTP Server	Specify the password associated with the username of the sender on the outgoing SMTP server. Many SMTP servers require users to authenticate with a *username* and *password* before sending Email through the server.

9 Refer to the **Persist Configurations Across Reloads** section to define or override how configuration settings are handled after reloads.

Configure	Use the drop-down menu to configure whether configuration overrides should persist when the device configuration is reloaded. Available options are *Enabled*, *Disabled* and *Secure*.

10 Refer to the **HTTP Analytics** field to define analytic compression settings and update intervals.

Compress	Select this option to use compression to when sending updates to the controller. This option is disabled by default.
Update Interval	Define an interval in either *Seconds* (1 - 3,600), *Minutes* (1 - 60) or *Hours* (1) for interval to push buffered packets. The default setting in 1 minute.

11 Refer to the **External Analytics Engine** section to define or override analytics engine login information for an external host.

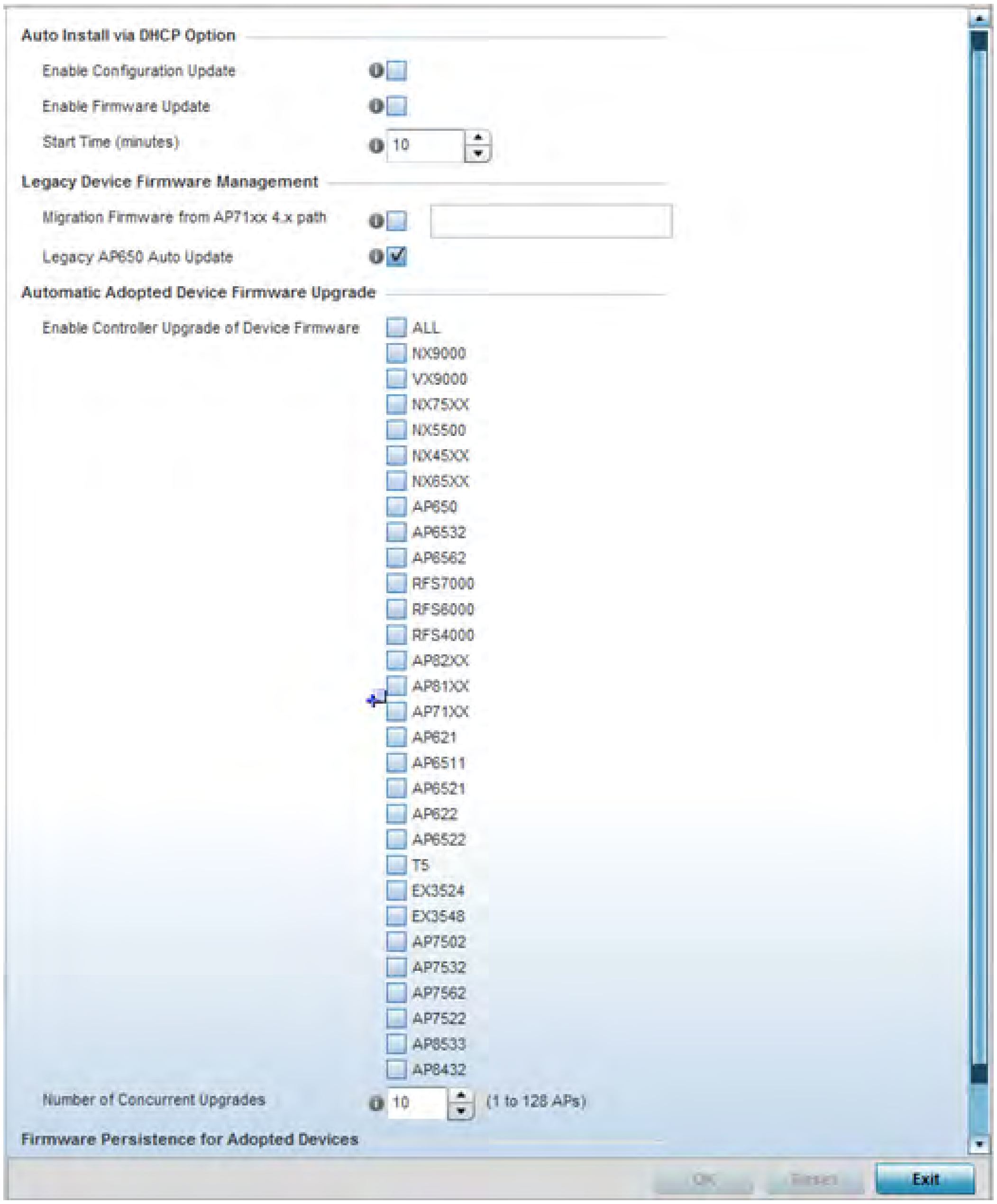
The Guest Access & Analytics software module is a site-wide Enterprise License available only on service platforms. When a customer visits a store, they connect to the Wireless LAN via guest access using a mobile device. The user needs to authenticate only on their first visit, and will automatically connect to the network for subsequent visits. The Analytics module helps gather data about customer behavior such as web sites visited, search terms used, mobile device types, number of new users vs. repeat users. This data provides a better understanding of pricing strategies and promotions being run by competitors. The data can be exported for additional in-depth analysis.

Controller	Select this option to provide service platform analytics to a local device. This setting is enabled by default.
URL	When using an external analytics engine with a NX9000 series service platform, enter the IP address or *uniform resource locator* (URL) for the system providing external analytics functions.
User Name	Enter the user name needed to access the external analytics engine.

Password	Enter the password associated with the username on the external analytics engine.
Update Interval	Set the interval in either *Seconds* (1 - 3,600), *Minutes* (1 - 60) or *Hours* (1) to forward buffered information to an external server resource, even when the buffers are not full. The default setting in 1 minute.

12 Select **OK** to save the changes and overrides made to the profile’s Management Settings. Select **Reset** to revert to the last saved configuration.

13 Select **Firmware** from the Management menu.



Auto Install via DHCP Option

Enable Configuration Update ☐

Enable Firmware Update ☐

Start Time (minutes) 10

Legacy Device Firmware Management

Migration Firmware from AP71xx 4.x path ☐

Legacy AP650 Auto Update ☑

Automatic Adopted Device Firmware Upgrade

Enable Controller Upgrade of Device Firmware

☐ ALL
☐ NX9000
☐ VX9000
☐ NX75XX
☐ NX5500
☐ NX45XX
☐ NX65XX
☐ AP650
☐ AP6532
☐ AP6562
☐ RFS7000
☐ RFS6000
☐ RFS4000
☐ AP82XX
☐ AP81XX
☐ AP71XX
☐ AP621
☐ AP6511
☐ AP6521
☐ AP622
☐ AP6522
☐ T5
☐ EX3524
☐ EX3548
☐ AP7502
☐ AP7532
☐ AP7562
☐ AP7522
☐ AP8533
☐ AP8432

Number of Concurrent Upgrades 10 (1 to 128 APs)

Firmware Persistence for Adopted Devices

Figure 5-142 *Profile Overrides - Management Firmware screen*

14 Refer to the **Auto Install via DHCP Option** field to configure automatic configuration file and firmware updates.

Enable Configuration Update	Select *Enable Configuration Update* (from within the Automatic Configuration Update field) to enable automatic profile configuration file updates from an external location. If enabled (the setting is disabled by default), provide a complete path to the target configuration file used in the update.
Enable Firmware Update	Select this option to enable automatic firmware upgrades (for this profile) from a user defined remote location. This value is disabled by default.
Start Time (minutes)	Use the spinner control to set the number of minutes to delay the start of an auto upgrade operation. Stagger the start of an upgrade operation as needed in respect to allowing an Access Point to complete its current client support activity before being rendered offline during the update operation. The default setting is 10 minutes.

15 Refer to the parameters within the **Legacy Device Firmware Management** field to set legacy Access Point firmware provisions:

Migration Firmware from AP71xx 4.x path	Provide a path to a firmware image used to provision AP71xx model Access Points currently utilizing a 4.x version legacy firmware file. Once a valid path is provided, the update is enabled to the version maintained locally for AP71xx models.
Legacy AP650 Auto Update	Select this option to provision AP650 model Access Points from their legacy firmware versions to the version maintained locally for that model. This setting is enabled by default, making updates to AP650 models automatic if a newer AP650 image is maintained locally.

16 Use the parameters within the **Automatic Adopted AP Firmware Upgrade** section to define an automatic firmware upgrade from a local file.

Enable Controller Upgrade of Device Firmware	Select the device model to upgrade using the most recent firmware file on the controller, service platform or Virtual Controller AP. This parameter is enabled by default. Select All to update all the listed device types
Number of Concurrent Upgrades	Use the spinner control to define the maximum number (1 - 128) of adopted APs that can receive a firmware upgrade at the same time. The default value is 10. Keep in mind that during a firmware upgrade, the Access Point is offline and unable to perform its normal client support role until the upgrade process is complete.

17 Select the **Persist AP Images on Controller** button (from within the **Firmware Persistence for Adopted Devices** field) to enable the RF domain manager to retain and store the new image of an Access Point selected for a firmware update. The image is only stored on the RF domain manager when there's space to accommodate it.

The upgrade sequence is different depending on whether the designated RF domain manager is a controller/ service platform or Access Point.

- *When the RF domain manager is an Access Point* - The NOC uploads a provisions an Access Point model's firmware on to the Access Point RF domain manager. The NOC initiates an auto-update for Access Points using that model's firmware. If the **Persist Image on Controller** option is selected, the RF domain manager retains the image for that model. The NOC then provisions the firmware of the next Access Point type to the RF domain manager. The auto-update process is then repeated for that model. Once all the selected models have been updated, the RF domain manager's model is updated last.
- *When the RF domain manager is a controller or service platform* - The NOC adopts controllers to the NOC's cluster within its RF domain. The NOC triggers an update on active controllers or service platforms and reboots them as soon as the update is complete. As soon as the active nodes come back up, the NOC

triggers an update on standby controllers or service platforms and reboots them as soon as the update is complete. When the standby controllers or service platforms come back up the following conditions apply:

- *If the reboot is not scheduled* - The Access Points adopted to RF domain members are not updated. It's expected the controllers and service platforms have auto-upgrade enabled which will update the Access Points when re-adopted.
- *If the reboot is scheduled* - The NOC pushes the first Access Point model's firmware to the RF domain manager. The NOC initiates an Access Point upgrade on all Access Points on the RF domain manager for that model. If the **Persist Image on Controller** option is selected, the RF domain manager retains the image for that model. The NOC then provisions the firmware of the next Access Point type to the RF domain manager. This process is repeated until each selected Access Point model is updated.

The Firmware Persistence feature is *enabled* for all controller and service platform RF domain managers with the flash memory capacity to store firmware images for the selected Access Point models they provision. This feature is *disabled* for Access Point RF Domain managers that do not typically have the flash memory capacity needed.

18 Select **Heartbeat** from the Management menu. Select the **Service Watchdog** option to implement heartbeat messages to ensure associated devices are up and running and capable of effectively interoperating. The Service Watchdog is enabled by default.

19 Select OK to save the changes and overrides made to the profile's configuration. Select Reset to revert to the last saved configuration.

5.2.9.13 Overriding a Profile's Mesh Point Configuration

▸ *Profile Overrides*

Mesh points are Access Points dedicated to mesh network support. Mesh networking enables users to access broadband applications anywhere (including moving vehicles).

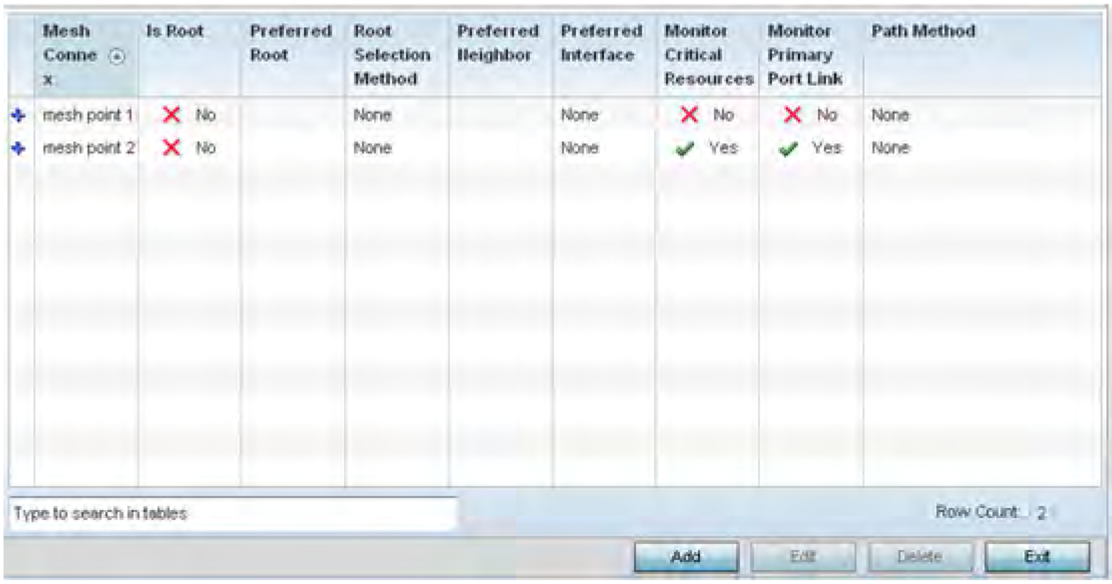
To set or override an Access Point profile's Mesh Point configuration:

1 Select **Devices** from the Web UI.

2 Select **Device Configuration** to expand its menu items.

3 Select **Mesh Point**.

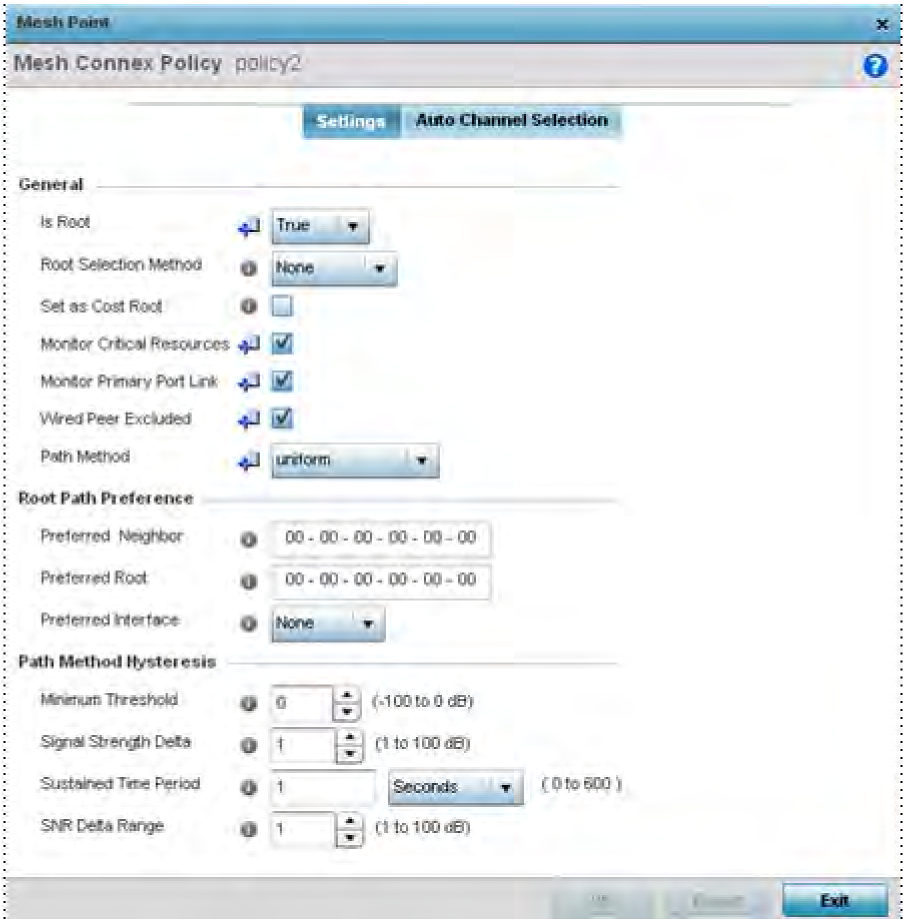
> ✓ **NOTE:** A blue override icon (to the left of a parameter) defines the parameter as having an override applied. To remove an override go to the **Basic Configuration** section of the device and click the **Clear Overrides** button. This removes all overrides from the device.



	Mesh Connex	Is Root	Preferred Root	Root Selection Method	Preferred Neighbor	Preferred Interface	Monitor Critical Resources	Monitor Primary Port Link	Path Method
✚	mesh point 1	✗ No		None		None	✗ No	✗ No	None
✚	mesh point 2	✗ No		None		None	✓ Yes	✓ Yes	None

Figure 5-143 *Profile Overrides - Mesh Point screen*

4 Refer to the **Mesh Point** screen to view existing Mesh Point overrides. If an existing Mesh Point override does not meet your requirements, select the **Add** button to create a new override or the **Edit** button to modify the parameters of an existing override. The Mesh Point screen displays the **Settings** tab by default.



Mesh Connex Policy policy2

General

Is Root	True
Root Selection Method	None
Set as Cost Root	□
Monitor Critical Resources	☑
Monitor Primary Port Link	☑
Wired Peer Excluded	☑
Path Method	uniform

Root Path Preference

Preferred Neighbor	00 - 00 - 00 - 00 - 00 - 00
Preferred Root	00 - 00 - 00 - 00 - 00 - 00
Preferred Interface	None

Path Method Hysteresis

Minimum Threshold	0	(-100 to 0 dB)
Signal Strength Delta	1	(1 to 100 dB)
Sustained Time Period	1 Seconds	(0 to 600)
SNR Delta Range	1	(1 to 100 dB)

Figure 5-144 *Mesh Point - Settings Screen*

5 Define the following settings from within the **General** field:

MeshConnex Policy	If adding a new policy, specify a name for the MeshConnex Policy. The name cannot be edited later with other configuration parameters. Until a viable name is provided, the Settings tab cannot be enabled for configuration.
Is Root	Select the root behavior of this mesh point. Select *True* to indicate this mesh point is a root node for this mesh network. Select *False* to indicate this mesh point is not a root node for this mesh network.
Root Selection Method	Use the drop-down menu to determine whether this meshpoint is the root or non-root meshpoint. Select either *None, auto-mint* or *auto-proximity*. The default setting is None. When auto-mint is selected, root selection is based on the total cost to the root. Cost to the root is measured as total cost through hops to the root node. Root selection occurs for the root with the least path cost. When auto-proximity is selected, root selection is based on signal strength of candidate roots. None indicates no preference in root selection.
Set as Cost Root	Select this option to set the mesh point as the cost root for meshpoint root selection. This setting is disabled by default.
Monitor Critical Resources	Enable this feature to allow dynamic conversion of a mesh point from root to non-root when there is a critical resource failure. This option is disabled by default.
Monitor Primary Port Link	Enable this feature to allow dynamic conversion of a mesh point from root to non-root during a link down event. This option is disabled by default.
Wired Peer Excluded	Select this option to exclude a mesh from forming a link with another mesh device that's a wired peer. This option is disabled by default.
Path Method	From the drop-down menu, select the method to use for path selection in a mesh network. The available options are: *None* – Select this to indicate no criteria used in root path selection. *uniform* – Select this to indicate that the path selection method is uniform. When selected, two paths will be considered equivalent if the average value is the same for these paths. *mobile-snr-leaf* – Select this if this Access Point is mounted on a vehicle or a mobile platform (AP7161 models only). When selected, the path to the route will be selected based on the *Signal To Noise Ratio* (SNR) to the neighbor device. *snr-leaf* – Select this to indicate the path with the best signal to noise ratio is always selected. *bound-pair* – Select this option to bind one mesh point connection at a time. Once established, other mesh point connection requests are denied.

✓ **NOTE:** An AP7161 model Access Point can be deployed as a *vehicular mounted modem* (VMM) to provide wireless network access to a mobile vehicle (car, train etc.). A VMM provides layer 2 mobility for connected devices. VMM does not provide layer 3 services, such as IP mobility. For VMM deployment considerations, see Vehicle Mounted Modem (VMM) Deployment Considerations on page 5-253.

✓ **NOTE:** When using 4.9GHz, the root preferences selection for the radio’s preferred interface still displays as 5GHz.

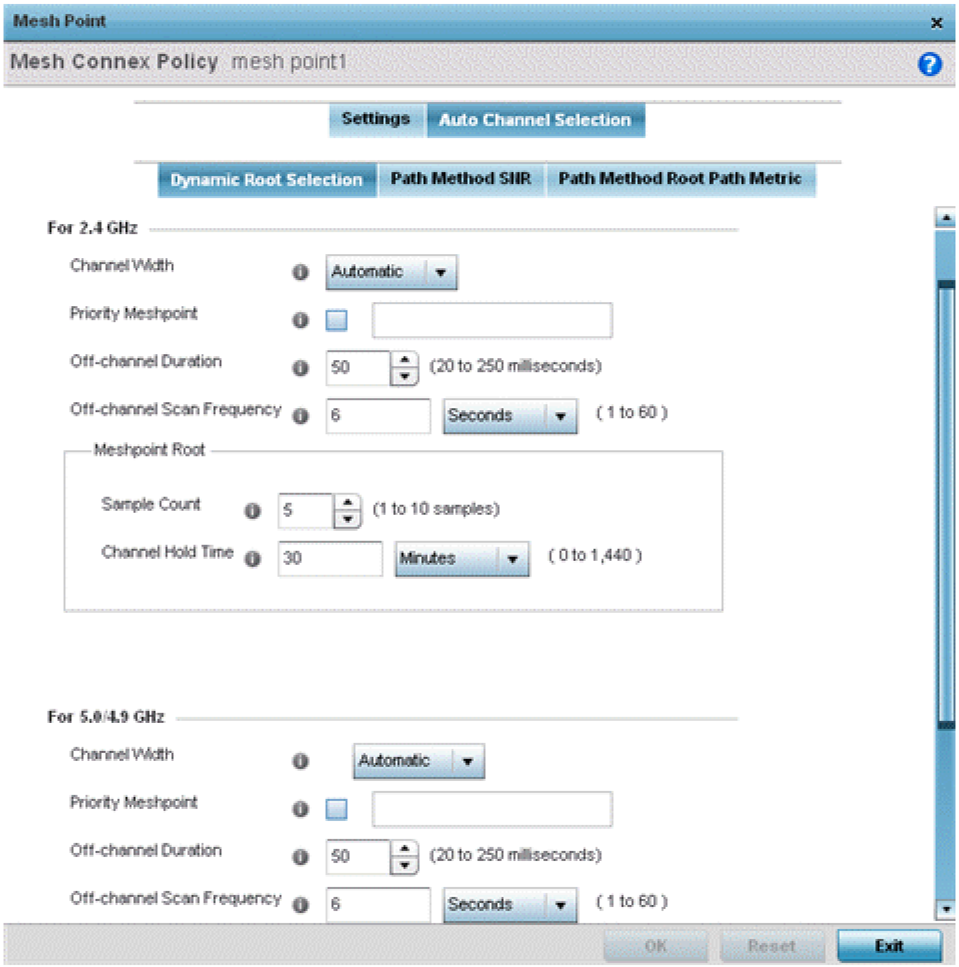
6 Set the following **Root Path Preference** values:

Preferred Neighbor	Specify the MAC address of a preferred neighbor to override mesh point settings.
Preferred Root	Specify the MAC address of a a preferred root device to override mesh point settings.
Preferred Interface	Use the drop-down menu to override the preferred mesh point interface to *2.4GHz*, *4.9 GHz* or *5.0GHz*. None defines the interface as open to any radio band.

7 Set the following **Path Method Hysteresis**:

Minimum Threshold	Enter the minimum value for SNR above which a candidate for the next hop in a dynamic mesh network is considered for selection. This field along with *Signal Strength Delta* and *Sustained Time Period* are used to dynamically select the next hop in a dynamic mesh network. The default setting is 0 dB.
Signal Strength Delta	Enter a delta value in dB. A candidate for selection as a next hop in a dynamic mesh network must have a SNR value that is higher than the value configured here. This field along with the *Minimum Threshold* and *Sustained Time Period* are used to dynamically select the next hop in a dynamic mesh network. The default setting is 1 dB.
Sustained Time Period	Enter the duration (in seconds or minutes) for the duration a signal must sustain the constraints specified in the *Minimum Threshold* and *Signal Strength Delta* path hysteresis values. These values are used to dynamically select the next hop in a dynamic mesh network. The default setting is 1 second.
SNR Delta Range	Select the root selection method hysteresis (from 1 - 100dB) SNR delta range a candidate must sustain. The default setting is 1 dB.

8 Select the **Auto Channel Selection** tab.



For 2.4 GHz

Channel Width: Automatic

Priority Meshpoint: □

Off-channel Duration: 50 (20 to 250 milliseconds)

Off-channel Scan Frequency: 6 Seconds (1 to 60)

Meshpoint Root

Sample Count: 5 (1 to 10 samples)

Channel Hold Time: 30 Minutes (0 to 1,440)

For 5.0/4.9 GHz

Channel Width: Automatic

Priority Meshpoint: □

Off-channel Duration: 50 (20 to 250 milliseconds)

Off-channel Scan Frequency: 6 Seconds (1 to 60)

Figure 5-145 *Mesh Point Auto Channel Selection - Dynamic Root Selection screen*

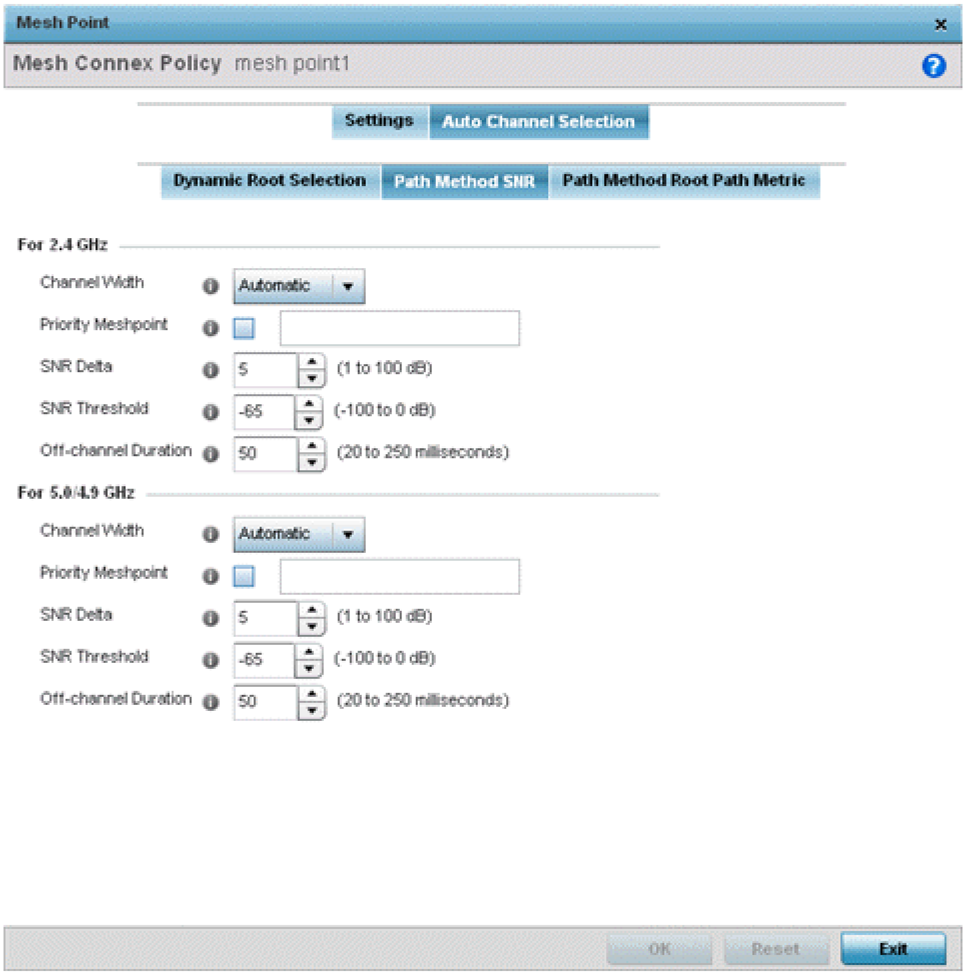
The **Dynamic Root Selection** screen displays by default. The Dynamic Root Selection screen provides configuration for the 2.4 GHz and 5.0/4.9 GHz frequencies.

9 Refer to the following. These descriptions are common for configuring either the 2.4 GHZ and 5.0/4.9 GHz frequencies

Channel Width	Set the channel width the meshpoint's automatic channel scan assigns to the selected radio. Available options include: • *Automatic* – Defines the channel width is calculated automatically. This is the default value. • *20 MHz* – Sets the width between two adjacent channels as 20 MHz. • *40 MHz* – Sets the width between two adjacent channels as 40 MHz. • *80 MHz* – Utilized for 802.11ac Access Points in the 5 GHz frequency.
Priority Meshpoint	Configure the meshpoint monitored for automatic channel scans. This is the meshpoint assigned priority over other available mesh points. When configured, a mesh connection is established with this mesh point. If not configured, a meshpoint is automatically selected. This setting is disabled by default.
Off-channel Duration	Set the duration (from 20 - 250 milliseconds) the scan dwells on each channel when performing an off channel scan. The default is 50 milliseconds.

Off-channel Scan Frequency	Set the duration (from 1- 60 seconds) between two consecutive off channel scans. The default is 6 seconds.
Meshpoint Root: Sample Count	Configure the number of scan samples (from 1- 10) for data collection before a mesh channel is selected. The default is 5.
Meshpoint Root: Channel Hold Time	Configure the duration (from 0 - 1440 minutes) to remain on a channel before channel conditions are reassessed for a possible channel change. Set this value to zero (0) to prevent an automatic channel selection from occurring. The default setting is 30 minutes.

10 Select the **Path Method SNR** tab to configure *signal to noise* (SNR) ratio values when selecting the path to the meshpoint root.



Mesh Point

Mesh Connex Policy mesh point1

Settings | Auto Channel Selection

Dynamic Root Selection | Path Method SNR | Path Method Root Path Metric

For 2.4 GHz

Channel Width: Automatic

Priority Meshpoint: □

SNR Delta: 5 (1 to 100 dB)

SNR Threshold: -65 (-100 to 0 dB)

Off-channel Duration: 50 (20 to 250 milliseconds)

For 5.0/4.9 GHz

Channel Width: Automatic

Priority Meshpoint: □

SNR Delta: 5 (1 to 100 dB)

SNR Threshold: -65 (-100 to 0 dB)

Off-channel Duration: 50 (20 to 250 milliseconds)

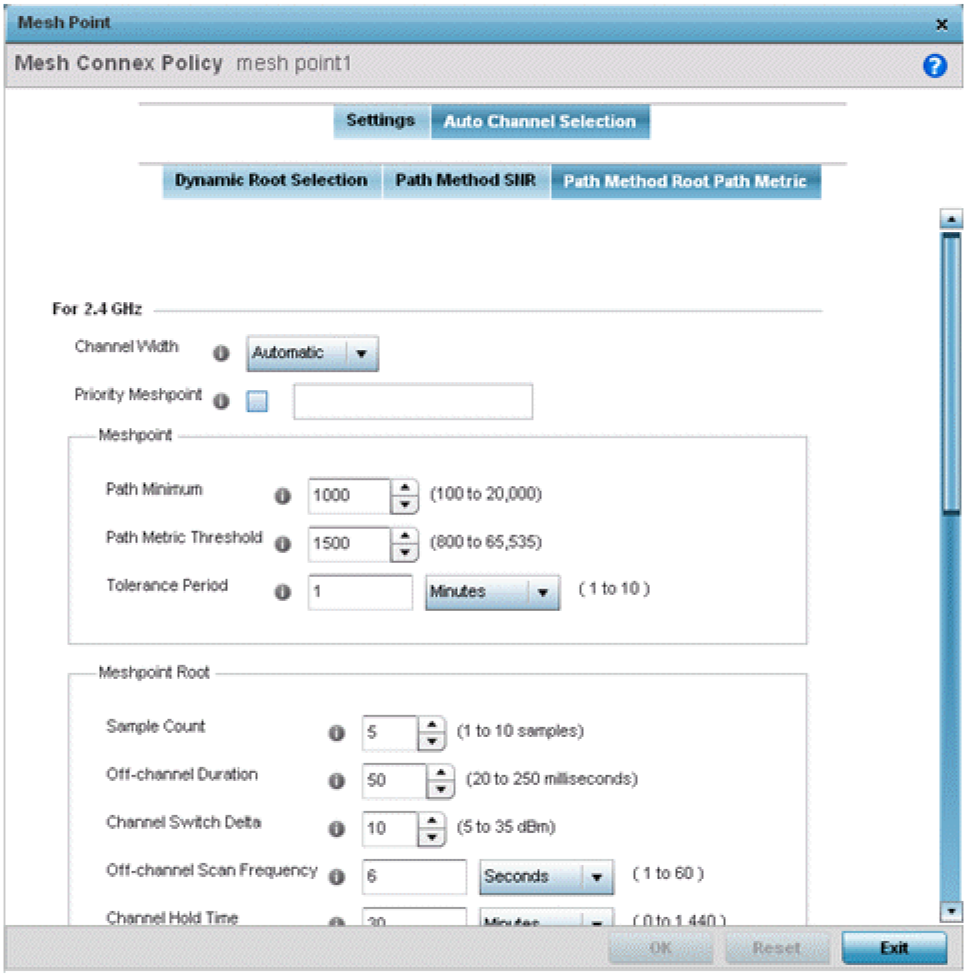
Figure 5-146 *Mesh Point Auto Channel Selection - Path Method SNR screen*

11 Set the following **2.4 GHz** and **5.0/4.9 GHz** path method SNR data:

Channel Width	Set the channel width the meshpoint automatic channel scan assigns to the selected radio. Available options include: • *Automatic* – Defines the channel width calculation automatically. This is the default value. • *20 MHz* – Sets the width between two adjacent channels as 20 MHz. • *40 MHz* – Sets the width between two adjacent channels as 40 MHz. • *80 MHz* – Utilized for 802.11ac Access Points in the 5 GHz frequency.

Priority Meshpoint	Set the meshpoint monitored for automatic channel scans. This is the meshpoint assigned priority over other available mesh points. When configured, a mesh connection is established with this mesh point. If not configured, a meshpoint is automatically selected. This setting is disabled by default.
SNR Delta	Set the *signal to noise* (SNR) ratio delta (from 1 - 100 dB) for mesh path selections. When path selection occurs, the defined value is utilized for selecting the optimal path. A better candidate, on a different channel, must have a signal strength that exceeds this delta value when compared to the signal strength of the next hop in the mesh network. The default setting is 5 dB.
SNR Threshold	Set the SNR threshold for mesh path selections (from -100 to 0 dB). If the signal strength of the next mesh hop falls below this set value, a scan is triggered to select a better next hop. the default setting is -65 dB.
Off-channel Duration	Configure the duration (from 20 - 250 milliseconds) for scan dwells on each channel, when performing an off channel scan. The default setting is 50 milliseconds.

12 Select the **Path Method Root Path Metric** tab to calculate root path metrics.



Mesh Point

Mesh Connex Policy mesh point1

Settings | Auto Channel Selection

Dynamic Root Selection | Path Method SNR | Path Method Root Path Metric

For 2.4 GHz

Channel Width: Automatic

Priority Meshpoint: □

Meshpoint

Path Minimum: 1000 (100 to 20,000)

Path Metric Threshold: 1500 (800 to 65,535)

Tolerance Period: 1 Minutes (1 to 10)

Meshpoint Root

Sample Count: 5 (1 to 10 samples)

Off-channel Duration: 50 (20 to 250 milliseconds)

Channel Switch Delta: 10 (5 to 35 dBm)

Off-channel Scan Frequency: 6 Seconds (1 to 60)

Channel Hold Time: 30 Minutes (0 to 1,440)

Figure 5-147 *Mesh Point Auto Channel Selection - Root Path Metric screen*

13 Set the following **Path Method Root Path Metrics** (applying to both the 2.4 GHz and 5.0/4.9 GHz frequencies):

Channel Width	Set the channel width meshpoint automatic channel scan should assign to the selected radio. The available options are: • *Automatic* – Defines the channel width as calculated automatically. This is the default value. • *20 MHz* – Set the width between two adjacent channels as 20 MHz. • *40 MHz* – Set the width between two adjacent channels as 40 MHz • *80 MHz* – Utilized for 802.11ac Access Points in the 5 GHz frequency.
Priority Meshpoint	Define the meshpoint assigned priority over other available mesh points. When configured, a mesh connection is established with this mesh point. If not configured, a meshpoint is automatically selected.
Meshpoint: Path Minimum	Set the minimum path metric (from 100 - 20,000) for mesh connection establishment. The default setting is 1000.
Meshpoint: Path Metric Threshold	Configure a minimum threshold (from 800 - 65535) for triggering an automatic channel selection for meshpoint selection. The default is 1500.
Meshpoint: Tolerance Period	Configure a duration to wait before triggering an automatic channel selection for the next mesh hop. The default is one minute.
Meshpoint Root: Sample Count	Set the number of scans (from 1- 10) for data collection before a mesh point root is selected. The default is 5.
Meshpoint Root: Off-channel Duration	Configure the duration in the range of 20 - 250 milliseconds for the *Off Channel Duration* field. This is the duration the scan dwells on each channel when performing an off channel scan. The default is 50 milliseconds.
Meshpoint Root: Channel Switch Delta	Configure the delta (from 5 - 35 dBm) that triggers a meshpoint root automatic channel selection when exceeded. The default is 10 dBm.
Meshpoint Root: Off-channel Scan Frequency	Configure the duration (from 1 -60 seconds) between two consecutive off channel scans for meshpoint root. The default is 6 seconds.
Meshpoint Root: Channel Hold Time	Set the minimum duration (from 0 - 1440 minutes) to remain on a selected channel before channel conditions are reassessed for a possible channel change. Set this value to zero (0) to prevent an automatic channel selection from occurring. The default is 30 minutes.

14 Select **OK** to save the updates or overrides to the Mesh Point configuration. Select **Reset** to revert to the last saved configuration.

5.2.9.13.7 Vehicle Mounted Modem (VMM) Deployment Considerations

Before defining a VMM configuration (mounting an AP7161 mesh point on a moving vehicle), refer to the following deployment guidelines to ensure the configuration is optimally effective:

- Disable layer 2 stateful packet inspection from the firewall policy. For more information, see Firewall Policy Advanced Settings on page 10-10.
- Set the RTS threshold value to 1 on all mesh devices. The default is 2347. For more information on defining radio settings, refer to Access Point Radio Configuration on page 8-55.
- Use *Opportunistic* as the rate selection setting for the AP7161 radio. The default is Standard. For more information on defining this setting, see *Radio Override Configuration*.
- Disable Dynamic Chain Selection (radio setting). The default is enabled. This setting can be disabled in the CLI using the dynamic-chain-selection command, or in the UI (refer to *Radio Override Configuration*).

- Disable A-MPDU Aggregation if the intended vehicular speed is greater than 30 mph. For more information, see *Radio Override Configuration*.
- Set a misconfiguration recovery time for the non-root AP profile. This configuration should delay the rejection of the newest configuration push from the controller, potentially causing adoption loss.

  The additional delay is to support cases when the new configuration from the controller causes the root AP to move from current channel to other channels, resulting in a mesh link going down, and in turn non-root APs losing adoption. This delay accommodates the time needed for the non-root AP to scan all channels and finding the best root node. The non-root AP can begin operating on the new channel, and establish the mesh link re-adopt to the controller. (For countries using DFS, the scan time is also factored in for the configured value). If the AP fails to find a suitable root node within this time, this new config is a misconfigured and the device would reject the latest config.

  For outdoor APs, it is recommended the misconfiguration-recovery-time be disabled. This can be accomplished by setting the value to 0. Update non root ap71xx profiles on the controller to include this change.

  Using an appropriate console terminal and or connection to your device log on to the CLI and follow these steps:

  ```
  rfs6000-xxxxxx>enable
  rfs6000-xxxxxx #configure terminal
  Enter configuration commands, one per line. End with CNTL/Z.
  rfs6000-xxxxxx (config)#profile ap71xx Non-Root-AP71xx
  rfs6000-xxxxxx (config-profile-Non-Root-AP71xx)#misconfiguration-recovery-time
  0
  rfs6000-xxxxxx (config-profile-Non-Root-AP71xx)#
  ```

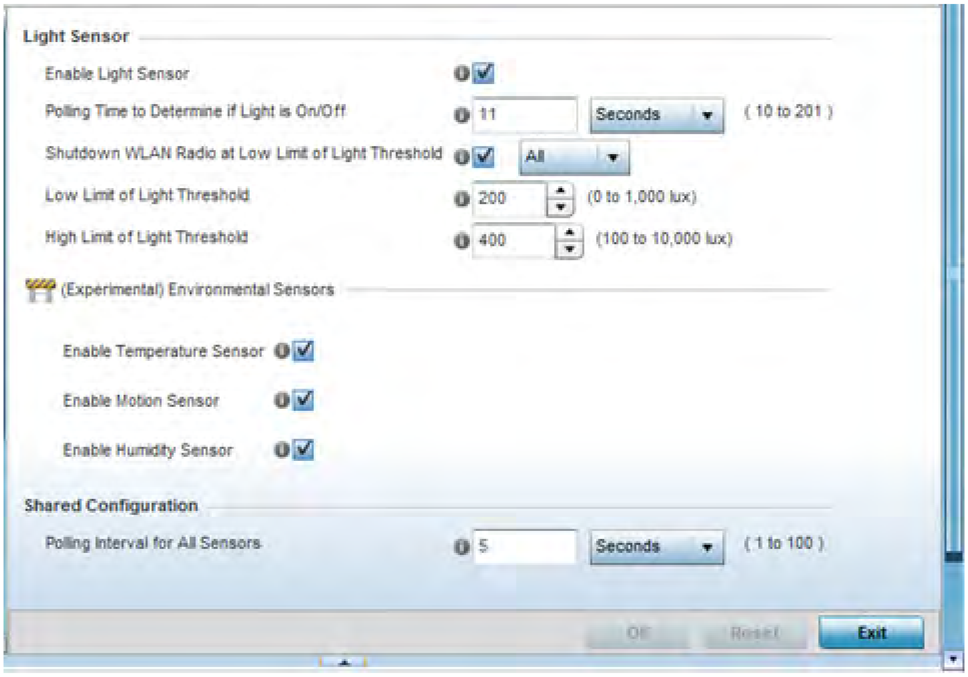
5.2.9.14 Overriding a Profile’s Environmental Sensor Configuration (AP8132 Only)

▸ *Profile Overrides*

A sensor module is a USB environmental sensor extension to an AP8132 model Access Point. It provides a variety of sensing mechanisms, allowing the monitoring and reporting of the Access Point’s radio coverage area. The output of the sensor's detection mechanisms are viewable using either the Environmental Sensor screen.

To set or override an environmental sensor configuration for an AP8132 model Access Point:

1. Select the **Configuration** > **Devices** from the Web UI.
2. Select **Profile Overrides** to expand its menu items
3. Select **Environmental Sensor**.



Light Sensor

Enable Light Sensor ☑

Polling Time to Determine if Light is On/Off 11 Seconds (10 to 201)

Shutdown WLAN Radio at Low Limit of Light Threshold ☑ All

Low Limit of Light Threshold 200 (0 to 1,000 lux)

High Limit of Light Threshold 400 (100 to 10,000 lux)

(Experimental) Environmental Sensors

Enable Temperature Sensor ☑

Enable Motion Sensor ☑

Enable Humidity Sensor ☑

Shared Configuration

Polling Interval for All Sensors 5 Seconds (1 to 100)

Figure 5-148 *Profile Overrides - Environmental Sensor screen*

4 Set the following **Light Sensor** settings for the sensor module:

Enable Light Sensor	Select this option to enable the light sensor on the module. This setting is enabled by default. The light sensor reports whether the deployment location has its lights powered on or off.
Polling Time to Determine if Light is On/Off	Define an interval in *Seconds* (2 - 201) or *Minutes* (1 - 4) for the sensor module to poll its environment to assess light intensity to determine whether lighting is on or off. The default polling interval is 11 seconds. Light intensity is used to determine whether the Access Point’s deployment location is currently populated with clients.
Shutdown WLAN Radio at Low Limit of Light Threshold	Select this option to power off the Access Point’s radio if the light intensity dims below the set threshold. If enabled, select *All* (both radios), *radio-1* or *radio-2*.
Low Limit of Light Threshold	Set the low threshold limit (from 0 - 1,000 lux) to determine whether the lighting is off in the Access Point’s deployment location. The default is 200. In daytime, the light sensor's value is between 350-450. The default values for the low threshold is 200, i.e., the radio is turned off if the average reading value is lower than 200.
High Limit of Light Threshold	Set the upper threshold limit (from 100 - 10,000 lux) to determine whether the lighting is on in the Access Point’s deployment location. The default high threshold is 400. The radios are turned on when the average value is higher than 400.

5 Enable or disable the following **Environmental Sensors**:

Enable Temperature Sensor	Select this option to enable the module's temperature sensor. Results are reported back to the Access Point's Environment screens within the Statistics node. This setting is enabled by default.
Enable Motion Sensor	Select this option to enable the module's motion sensor. Results are reported back to the Access Point's Environment screens within the Statistics node. This setting is enabled by default.
Enable Humidity Sensor	Select this option to enable the module's humidity sensor. Results are reported back to the Access Point's Environment screens within the Statistics node. This setting is enabled by default.

6 Define or override the following **Shared Configuration** settings:

Polling Interval for All Sensors	Set an interval in either *Seconds* (1 - 100) or *Minutes* (1 - 2) for the time between sensor environmental polling (both light and environment). The default setting is 5 seconds.

7 Select **OK** to save the changes and overrides made to the environmental sensor screen. Select **Reset** to revert to the last saved configuration.

5.2.9.15 Overriding a Profile's Advanced Configuration

▶ *Profile Overrides*

Refer to profile's advanced set of configuration screens to set client load balance calculations and ratios, set a MiNT configuration and set other miscellaneous settings. For more information, refer to the following:

- *Advanced Profile Client Load Balance Configuration*
- *Advanced MiNT Protocol Configuration*
- *Advanced Profile Miscellaneous Configuration*

5.2.9.15.8 Advanced Profile Client Load Balance Configuration

▶ *Overriding a Profile's Advanced Configuration*

Set a the ratios and calculation values used by Access Points to distribute client loads both amongst neighbor devices and the 2.4 and 5 GHz radio bands.

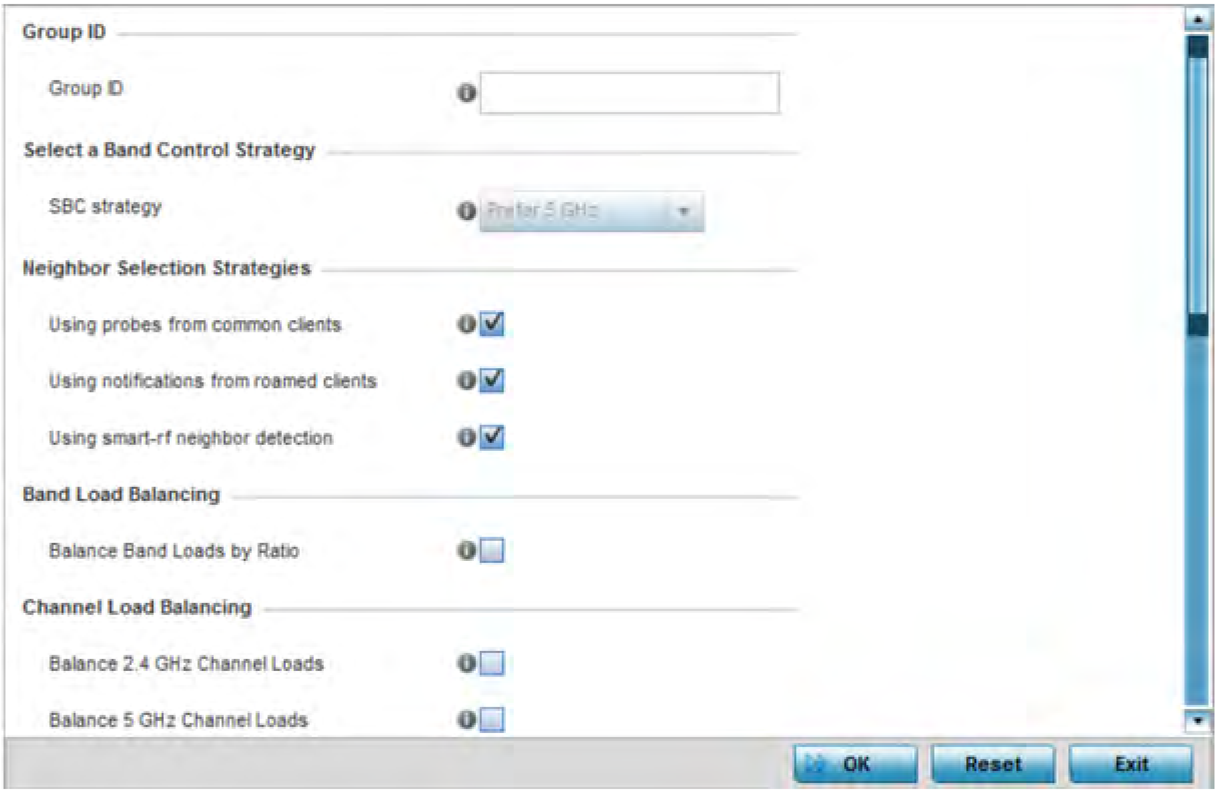
To define Access Point client load balance algorithms:

1 Select the **Configuration** > **Devices** from the Web UI.

2 Select **Profile Overrides** to expand its menu items

3 Select **Advanced** to expand its sub menu items.

4 Select **Client Load Balancing** from the Advanced menu item.



Group ID

Group ID

Select a Band Control Strategy

SBC strategy: Prefer 5 GHz

Neighbor Selection Strategies

Using probes from common clients ☑

Using notifications from roamed clients ☑

Using smart-rf neighbor detection ☑

Band Load Balancing

Balance Band Loads by Ratio □

Channel Load Balancing

Balance 2.4 GHz Channel Loads □

Balance 5 GHz Channel Loads □

Figure 5-149 *Advanced Profile Overrides - Client Load Balancing screen*

5 Use the **Group ID** field to define a group ID of up to 32 characters to differentiate the ID from others with similar configurations.

6 Select the **SBC strategy** from the drop-down menu to determine how band steering is conducted.

Band steering directs 5 GHz-capable clients to that band. When an Access Point hears a request from a client to associate on both the 2.4 GHz and 5 GHz bands, it knows the client is capable of operation in 5 GHz. Band steering steers the client by responding only to the 5 GHz association request and not the 2.4 GHz request. The client only associates in the 5 GHz band.

7 Set the following **Neighbor Selection Strategies**:

Using probes from common clients	Select this option to select neighbors (peer devices) using probes from common clients. This setting is enabled by default.
Using notifications from roamed clients	Select this option to select neighbors (peer devices) using roam notifications from roamed clients. This setting is enabled by default.
Using smart-rf neighbor detection	Select this option to select neighbors (peer devices) using Smart RF. This setting is enabled by default.

8 Enable **Balance Band Loads by Radio** (within the **Band Load Balancing** field) to distribute an Access Points client traffic load across both the 2.4 and 5 GHz radio bands.

9 Set the following **Channel Load Balancing** settings:

Balance 2.4 GHz Channel Loads	Select this option to balance an Access Point's 2.4 GHz client load across all channels. This setting is enabled by default.
Balance 5 GHz Channel Loads	Select this option to balance an Access Point's 5 GHz client load across all channels. This setting is enabled by default.

10 Enable **Balance AP Loads** (within the **AP Load Balancing** field) to distribute client traffic evenly amongst neighbor Access Points.

11 Set the following **Advanced Parameters for** client load balancing:

Max. 2.4 GHz Difference Considered Equal	Set the maximum load difference (from 1 - 100%) considered equal when comparing 2.4 GHz client loads. The default setting is 1%.
Min. Value to Trigger 2.4 Ghz Channel Balancing	Set the threshold (from 1 - 100%) beyond which channel load balancing is triggered in the 2.4 GHz radio band. The default setting is 5%.
Weightage given to Client Count	Set the weightage (from 1- 100%) applied to client count calculations in the 2.4 GHz radio band. The default setting is 90%.
Weightage given to Throughput	Set the weightage (from 1- 100%) applied to client throughput calculations in the 2.4 GHz radio band. The default setting is 10%.
Max. 5 GHz Difference Considered Equal	Set the maximum load difference (from 1 - 100%) considered equal when comparing 5 GHz client loads. The default setting is 1%.
Min. Value to Trigger 5 Ghz Channel Balancing	Set the threshold (from 1 - 100%) beyond which channel load balancing is triggered in the 5 GHz radio band. The default setting is 5%.
Weightage given to Client Count	Set the weightage (from 1- 100%) applied to client count calculations in the 5 GHz radio band. The default setting is 90%.
Weightage given to Throughput	Set the weightage (from 1- 100%) applied to client throughput calculations in the 5 GHz radio band. The default setting is 10%.

12 Define the following **AP Load Balancing** settings:

Min. Value to Trigger Balancing	Set a value (from 1 - 100%) used to trigger client load balancing when exceeded. The default setting is 5%.
Max. AP Load Difference Considered Equal	Set the maximum load balance differential (from 1 - 100%) considered equal when comparing neighbor Access Point client loads. The default setting is 1%.
Weightage given to Client Count	Set the weightage (from 1- 100%) applied to client count in an Access Point’s overall load calculation. The default setting is 90%.
Weightage given to Throughput	Set the weightage (from 1- 100%) applied to client throughput in an Access Point’s overall load calculation. The default setting is 10%.

13 Set the following **Band Control** values:

Max. Band Load Difference Considered Equal	Set the maximum load difference (from 1 - 100%) considered equal when comparing band loads. The default setting is 1%.
Band Ratio (2.4 GHz)	Set the relative load for the 2.4 GHz radio band as a leveled ratio from 1 - 10. The default setting is 0.
Band Ratio (5 GHz)	Set the relative load for the 5 GHz radio band as a leveled ratio from 1 - 10. The default setting is 0.
5 GHz load at which both bands enabled	Define the 5 GHz radio load value (from 1 - 100%) above which the 5 GHz radio is equally preferred in the overall load balance distribution. The default is 75%.
2.4 GHz load at which both bands enabled	Define the 2.4 GHz radio load value (from 1 - 100%) above which the 2.4 GHz radio is equally preferred in the overall load balance distribution. The default is 75%.

14 Define the following **Neighbor Selection** settings

Minimal signal strength for common clients	Define the minimum signal strength value (from -100 to 30 dBm) that must be exceeded for an Access Point's detected client to be considered a common client. The default setting is -100 dBi.
Minimum number of clients seen	Set the minimum number of clients (from 0 - 256) that must be common to two or more Access Points for the Access Points to regard one another as neighbors using the common client neighbor detection strategy. The default setting is 0.
Max confirmed neighbors	Set the maximum number (from 1 - 16) of neighbor Access Points that must be detected amongst peer Access Point to initiate load balancing. The default setting is 16.
Minimum signal strength for smart-rf neighbors	Set the minimal signal strength value (from -100 to 30 dBm) for an Access Point detected using Smart RF to qualify as a neighbor Access Point. The default setting is - 65 dBm.

15 Select **OK** to save the changes made to the profile's Advanced client load balance configuration. Select **Reset** to revert to the last saved configuration.

5.2.9.15.9 Advanced MiNT Protocol Configuration

Overriding a Profile's Advanced Configuration

MINT provides the means to secure profile communications at the transport layer. Using MINT, a device can be configured to only communicate with other authorized (MINT enabled) devices. Keys can also be generated externally using any application (like openssl). These keys must be present on the device managing the domain for key signing to be integrated with the UI. A device needing to communicate with another first negotiates a security context with that device.

The security context contains the transient keys used for encryption and authentication. A secure network requires users to know about certificates and PKI. However, administrators do not need to define security parameters for Access Points to be adopted (secure WISPe being an exception, but that isn't a commonly used feature). Also, users can replace any device on the network or move devices around and they continue to work. Default security parameters for MiNT are such that these scenarios continue to function as expected, with minimal user intervention required only when a new network is deployed

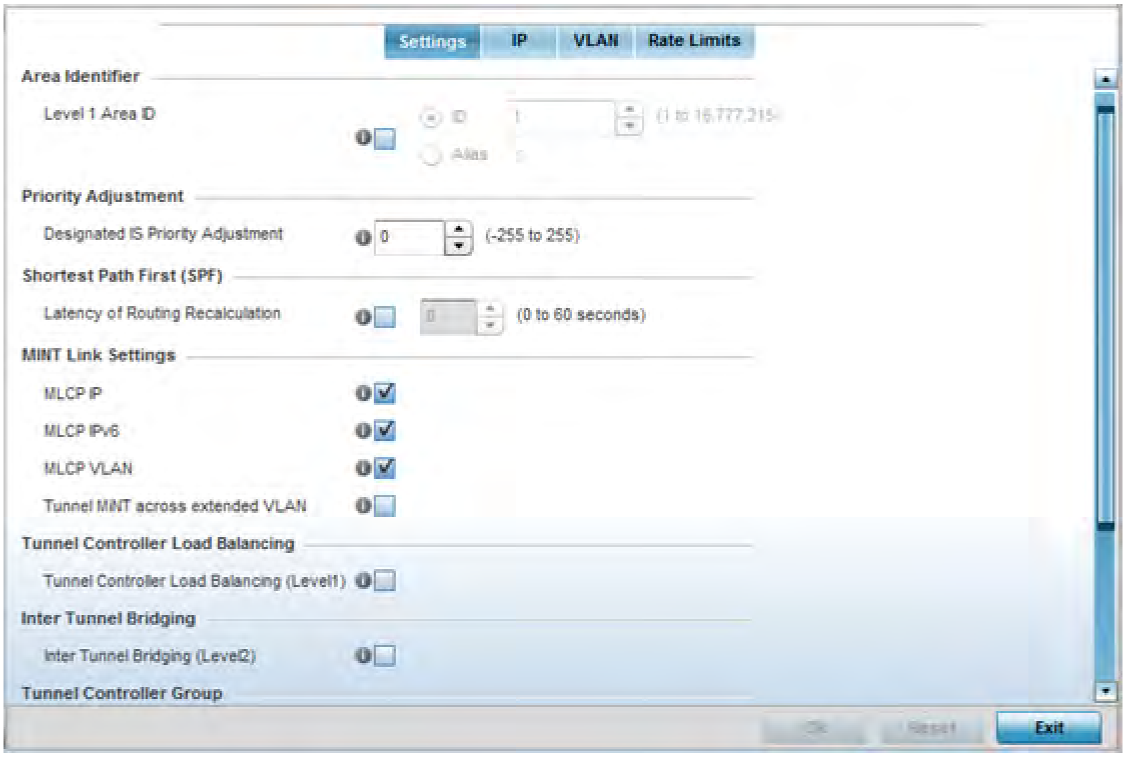
To define or override a profile's MINT configuration:

1 Select the **Configuration** > **Devices** from the Web UI.

2 Select **Profile Overrides** to expand its menu items

3 Select **Advanced** to expand its sub menu items.

4 Select **MINT Protocol** from the Advanced menu item.



Area Identifier

Level 1 Area ID □ ● ID 1 (1 to 16,777,215) ○ Alias

Priority Adjustment

Designated IS Priority Adjustment 0 (-255 to 255)

Shortest Path First (SPF)

Latency of Routing Recalculation □ 0 (0 to 60 seconds)

MINT Link Settings

MLCP IP ☑

MLCP IPv6 ☑

MLCP VLAN ☑

Tunnel MINT across extended VLAN □

Tunnel Controller Load Balancing

Tunnel Controller Load Balancing (Level1) □

Inter Tunnel Bridging

Inter Tunnel Bridging (Level2) □

Tunnel Controller Group

Figure 5-150 *Advanced Profile Overrides MINT screen - Settings tab*

The **Settings** tab displays by default.

5 Refer to the **Area Identifier** field to define or override the Level 1 and Level 2 Area IDs used by the profile's MINT configuration.

Level 1 Area ID	Select this option to either use a spinner control for setting the Level 1 Area ID (1 - 16,777,215) or create an alias for the ID. An alias enables an administrator to define a configuration item, such as a this area ID, as an alias once and use the alias across different configuration items. The default value is disabled.

6 Define or override the following **Priority Adjustment** in respect to devices supported by the profile:

Designated IS Priority Adjustment	Use the spinner control to set a *Designated IS Priority Adjustment* setting. This is the value added to the base level DIS priority to influence the *Designated IS* (DIS) election. A value of +1 or greater increases DISiness. The default setting is 0.

7 Select the **Latency of Routing Recalculation** option (within the **Shortest Path First (SPF)** field) to enable the spinner control used for defining or overriding a latency period (from 0 - 60 seconds). The default setting is disabled.

8 Define or override the following **MINT Link Settings** in respect to devices supported by the profile:

MLCP IP	Check this box to enable *MINT Link Creation Protocol* (MLCP) by IP Address. MLCP is used to create one UDP/IP link from the device to a neighbor. The neighboring device does not need to be a controller or service platform, it can be another Access Point with a path to the controller or service platform. This setting is enabled by default.
MLCP IPv6	Check this box to enable MLCP for automated MiNT UDP/IP link creation. This setting is enabled by default.

MLCP VLAN	Check this box to enable MLCP by VLAN. MLCP is used to create one VLAN link from the device to a neighbor. That neighboring device does not need to be a controller or service platform, it can be another Access Point with a path to the controller or service platform. This setting is enabled by default.
Tunnel MiNT across extended VLAN	Select this option to tunnel MiNT protocol packets across an extended VLAN. This setting is disabled by default.

9 Select **Tunnel Controller Load Balancing (Level 1)** to enable load balance distribution via a WLAN tunnel controller. This setting is disabled by default.

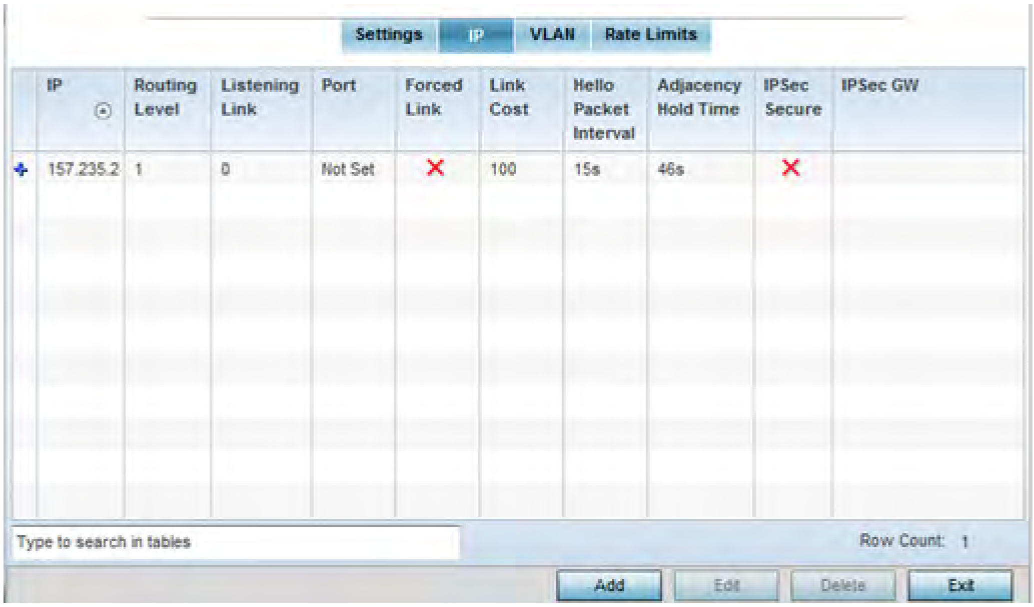
10 Select **Inter Tunnel Bridging (Level 2)** to enable inter tunnel bridging. This setting is disabled by default.

11 Enter a 64 character maximum **Tunnel Controller Name** for this tunneled-WLAN-controller interface.

12 Enter a 64 character maximum **Preferred Tunnel Controller Name** this Access Point prefers to tunnel traffic to via an extended VLAN.

13 Select **OK** to save the updates and overrides to the MINT Protocol configuration. Select **Reset** to revert to the last saved configuration.

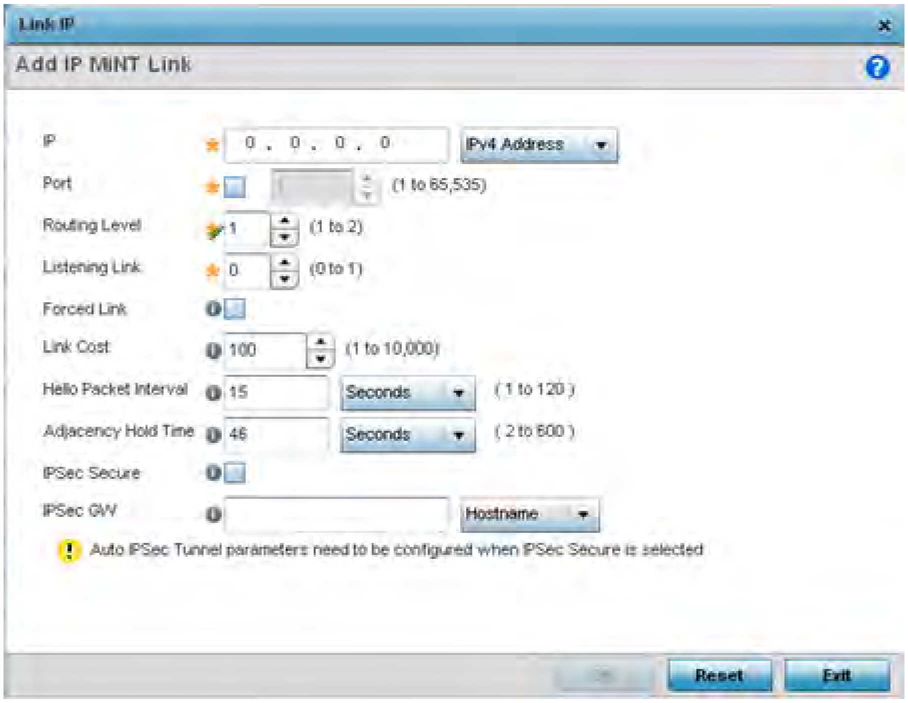
14 Select the **IP** tab to display the link IP network address information shared by the devices managed by the MINT configuration.



IP	Routing Level	Listening Link	Port	Forced Link	Link Cost	Hello Packet Interval	Adjacency Hold Time	IPSec Secure	IPSec GW
157.235.2	1	0	Not Set	✗	100	15s	46s	✗	

Figure 5-151 *Advanced Profile MINT screen - IP tab*

15 The IP tab displays the **IP** address, **Routing Level**, **Listening Link**, **Port**, **Forced Link**, **Link Cost**, **Hello Packet Interval**, **Adjacency Hold Time** and IPSec Secure, and IPSec GW settings that devices use to securely communicate amongst one another. Select **Add** to create a new Link IP configuration or **Edit** to override an existing MINT configuration.



IP ☐ 0 . 0 . 0 . 0 IPv4 Address

Port ☐ (1 to 65,535)

Routing Level 1 (1 to 2)

Listening Link 0 (0 to 1)

Forced Link ☐

Link Cost 100 (1 to 10,000)

Hello Packet Interval 15 Seconds (1 to 120)

Adjacency Hold Time 46 Seconds (2 to 600)

IPSec Secure ☐

IPSec GW Hostname

Auto IPSec Tunnel parameters need to be configured when IPSec Secure is selected

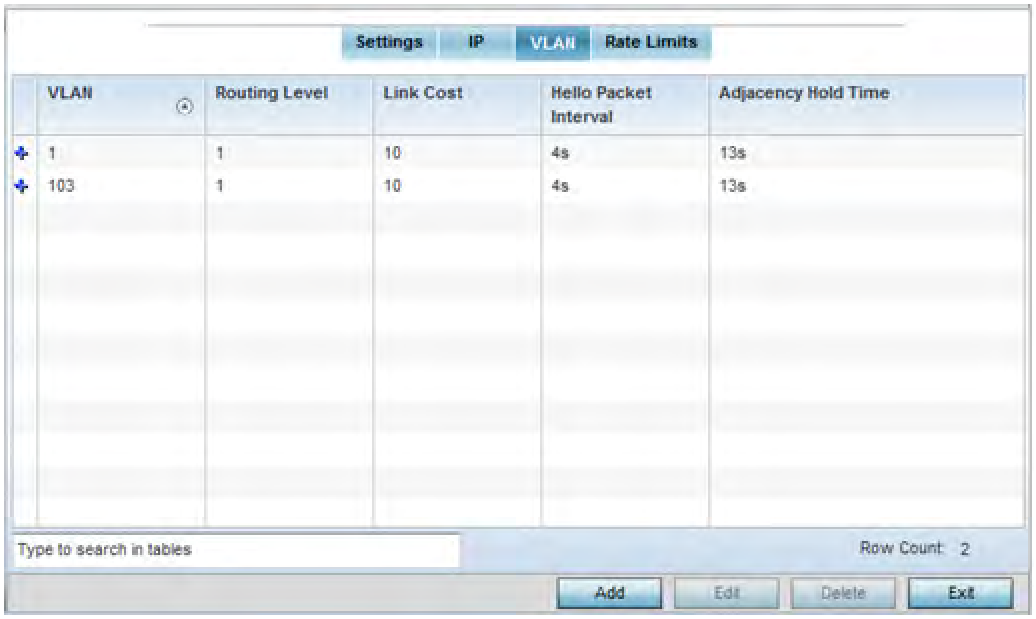
Figure 5-152 *Advanced Profile MINT screen - Link IP tab*

16 Set the following **Link IP** parameters to complete the MINT network address configuration:

IP	Define or override the IP address used by peers for interoperation when supporting the MINT protocol. Use the drop-down to select the type of IP address provided. The available choices are *IPv4 Address* and *IPv6 Address*.
Port	To specify a custom port for MiNT links, select this option and use the spinner control to define or override the port number (1 - 65,535).
Routing Level	Use the spinner control to define or override a routing level of either *1* or *2*.
Listening Link	Specify a listening link of either 0 or 1. UDP/IP links can be created by configuring a matching pair of links, one on each end point. However, that is error prone and doesn't scale. So UDP/IP links can also listen (in the TCP sense), and dynamically create connected UDP/IP links when contacted. The typical configuration is to have a listening UDP/IP link on the IP address S.S.S.S, and for all the APs to have a regular UDP/IP link to S.S.S.S.
Forced Link	Check this box to specify the MiNT link as a forced link.
Link Cost	Use the spinner control to define or override a link cost from 1 - 10,000. The default value is 100.
Hello Packet Interval	Set or override an interval in either *Seconds* (1 - 120) or *Minutes* (1 - 2) for the transmission of hello packets. The default interval is 15 seconds.
Adjacency Hold Time	Set or override a hold time interval in either *Seconds* (2 - 600) or *Minutes* (1 - 10) for the transmission of hello packets. The default interval is 46 seconds.
IPSec Secure	Enable this option to provide IPSec secure peer authentication on the MiNT connection (link). This option is disabled by default.
IPSec GW	Select the numerical IP address or administrator defined hostname of the IPSec gateway. Hostnames cannot include an underscore character.

17 Select **OK** to save the updates and overrides to the MINT Protocol's network address configuration. Select **Reset** to revert to the last saved configuration.

18 Select the **VLAN** tab to display link IP VLAN information shared by the devices managed by the MINT configuration.



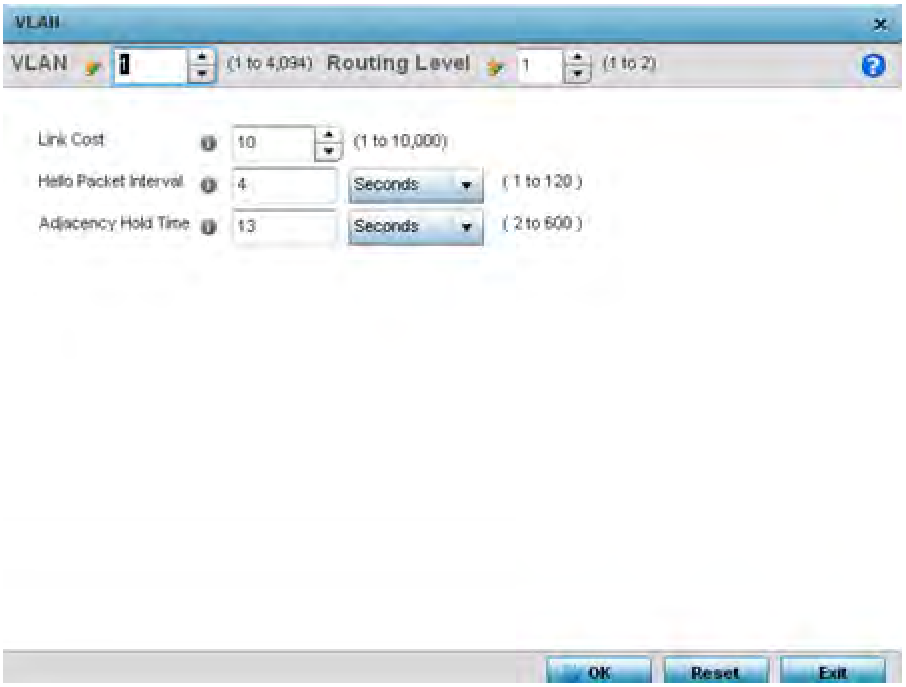
VLAN	Routing Level	Link Cost	Hello Packet Interval	Adjacency Hold Time
1	1	10	4s	13s
103	1	10	4s	13s

Type to search in tables

Row Count: 2

Figure 5-153 *Advanced Profile MINT screen - VLAN tab*

The VLAN tab displays the **VLAN**, **Routing Level**, **Link Cost**, **Hello Packet Interval** and **Adjacency Hold Time** devices use to securely communicate amongst one another. Select **Add** to create a new VLAN link configuration or **Edit** to override an existing MINT VLAN configuration.



VLAN

VLAN 1 (1 to 4,094) Routing Level 1 (1 to 2)

Link Cost 10 (1 to 10,000)

Hello Packet Interval 4 Seconds (1 to 120)

Adjacency Hold Time 13 Seconds (2 to 600)

Figure 5-154 *Advanced Profile MINT screen - Add/Edit VLAN*

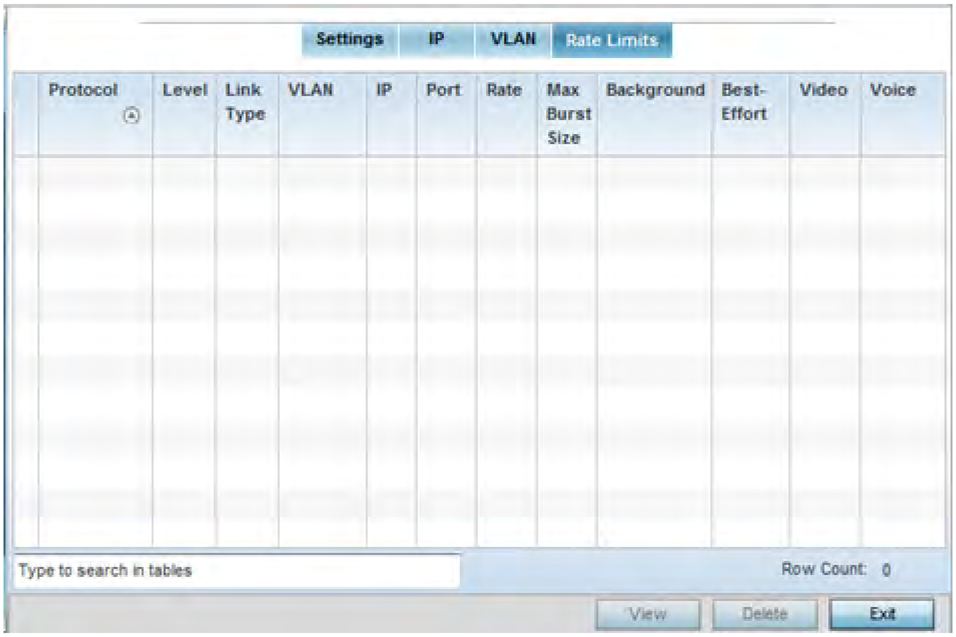
19 Set the following **VLAN** parameters for the MINT configuration:

VLAN	Define a VLAN ID from 1 - 4,094 used by peers for interoperation when supporting the MINT protocol.
Routing Level	Use the spinner control to define or override a routing level of either *1* or *2*.
Link Cost	Use the spinner control to define or override a link cost from 1 - 10,000. The default value is 100.
Hello Packet Interval	Set or override an interval in either *Seconds* (1 - 120) or *Minutes* (1 - 2) for the transmission of hello packets. The default interval is 15 seconds.
Adjacency Hold Time	Set or override a hold time interval in either *Seconds* (2 - 600) or *Minutes* (1 - 10) for the transmission of hello packets. The default interval is 46 seconds.

20 Select **OK** to save the updates and overrides to the MINT Protocol configuration. Select **Reset** to revert to the last saved configuration.

21 Select the **Rate Limits** tab to display data rate limits configured on extended VLANs and optionally add or edit rate limit configurations.

Excessive traffic can cause performance issues on an extended VLAN. Excessive traffic can be caused by numerous sources including network loops, faulty devices or malicious software such as a worm or virus that has infected on one or more devices. Rate limiting reduces the maximum rate sent or received per wireless client. It prevents any single user from overwhelming the wireless network. It can also provide differential service for service providers. Uplink and downlink rate limits are usually configured on a RADIUS server using vendor specific attributes. Rate limits are extracted from the RADIUS server's response. When such attributes are not present, the settings defined on the controller, service platform or Access Point are applied. An administrator can set separate QoS rate limit configurations for data types transmitted from the network (upstream) and data transmitted from a wireless clients back to associated radios (downstream).

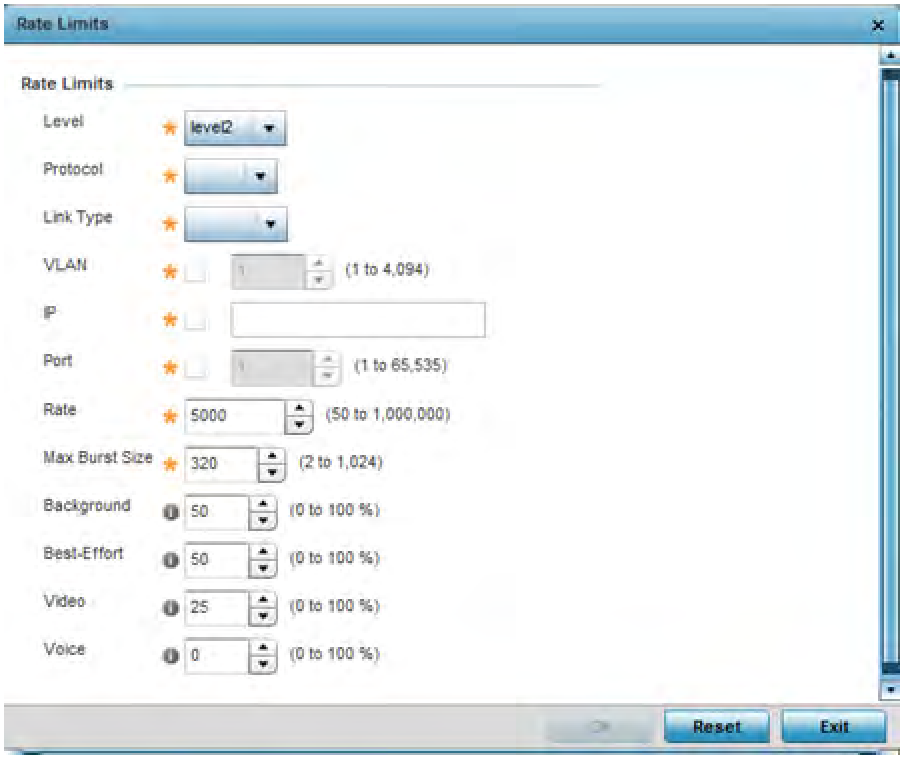


Protocol	Level	Link Type	VLAN	IP	Port	Rate	Max Burst Size	Background	Best-Effort	Video	Voice

Figure 5-155 *Advanced Profile MINT screen - Rate Limit tab*

Existing rate limit configurations display along with their virtual connection protocols and data traffic QoS customizations.

22 Select **Add** to create a new rate limit configuration.



Rate Limits

Rate Limits

Level	level2
Protocol	
Link Type	
VLAN	□ 1 (1 to 4,094)
IP	□
Port	□ 1 (1 to 65,535)
Rate	5000 (50 to 1,000,000)
Max Burst Size	320 (2 to 1,024)
Background	50 (0 to 100 %)
Best-Effort	50 (0 to 100 %)
Video	25 (0 to 100 %)
Voice	0 (0 to 100 %)

Figure 5-156 *Advanced Profile MINT screen - Add/Edit Rate Limit*

23 Set the following **Rate Limits** to complete the MINT configuration:

Level	Select *level2* to apply rate limiting for all links on level2.
Protocol	Select either *mlcp* or *link* as this configuration's rate limit protocol. *Mint Link Creation Protocol* (MLCP) creates a UDP/IP link from the device to a neighbor. The neighboring device does not need to be a controller or service platform, it can be an Access Point with a path to the controller or service platform. Select *link* to rate limit using statically configured MiNT links.
Link Type	Select either *VLAN*, to configure a rate limit configuration on a specific virtual LAN, or *IP* to set rate limits on a static IP address/Port configuration.
VLAN	When the Protocol is set to *link* and the Link Type is set to *VLAN*, use the spinner control to select a virtual LAN from 1 - 4094 to refine the rate limiting configuration to a specific VLAN.
IP	When the Protocol is set to *link* and the Link Type is set to *VLAN*, enter the IP address as the network target for rate limiting.
Port	When the Protocol is set to *link* and the Link Type is set to *VLAN*, use the spinner control to set the virtual port (1 - 65,535) used for rate limiting traffic.
Rate	Define a rate limit between 50 - 1,000,000 kbps. This limit constitutes a threshold for the maximum the number of packets transmitted or received (from all access categories). Traffic that exceeds the defined rate is dropped and a log message is generated. The default setting is 5000 kbps.

Max Burst Size	Use the spinner to set the maximum burst size from 0 - 1024 kb. The smaller the burst, the less likely the upstream packet transmission will result in congestion for the WLAN's client destinations. By trending the typical number of ARP, broadcast, multicast and unknown unicast packets over a period of time, the average rate for each access category can be obtained. Once a baseline is obtained, administrators should add a 10% margin (minimally) to allow for traffic bursts. The default burst size is 320 kbytes.
Background	Configures the random early detection threshold (as a percentage) for low priority background traffic. Background packets are dropped and a log message generated if the rate exceeds the set value. Background traffic consumes the least bandwidth of any access category, so this value can be set to a lower value once a general upstream rate is known by the network administrator (using a time trend analysis). The default setting is 50%.
Best-Effort	Configures the random early detection threshold (as a percentage) for low priority best-effort traffic. Best-effort packets are dropped and a log message generated if the rate exceeds the set value. Best effort traffic consumes little bandwidth, so this value can be set to a lower value once a general upstream rate is known by the network administrator (using a time trend analysis).The default setting is 50%.
Video	Configures the random early detection threshold (as a percentage) for high priority video traffic. Video packets are dropped and a log message generated if the rate exceeds the set value. Video traffic consumes significant bandwidth, so this value can be set to a higher value once a general upstream rate is known by the network administrator (using a time trend analysis).The default setting is 25%.
Voice	Configures the random early detection threshold (as a percentage) for high priority voice traffic. Voice packets are dropped and a log message generated if the rate exceeds the set value. Voice applications consume significant bandwidth, so this value can be set to a higher value once a general upstream rate is known by the network administrator (using a time trend analysis).The default setting is 0%.

24 Select **OK** to save the updates and overrides to the MINT Protocol's rate limit configuration. Select **Reset** to revert to the last saved configuration.

5.2.9.15.10 Advanced Profile Miscellaneous Configuration

▸ *Overriding a Profile's Advanced Configuration*

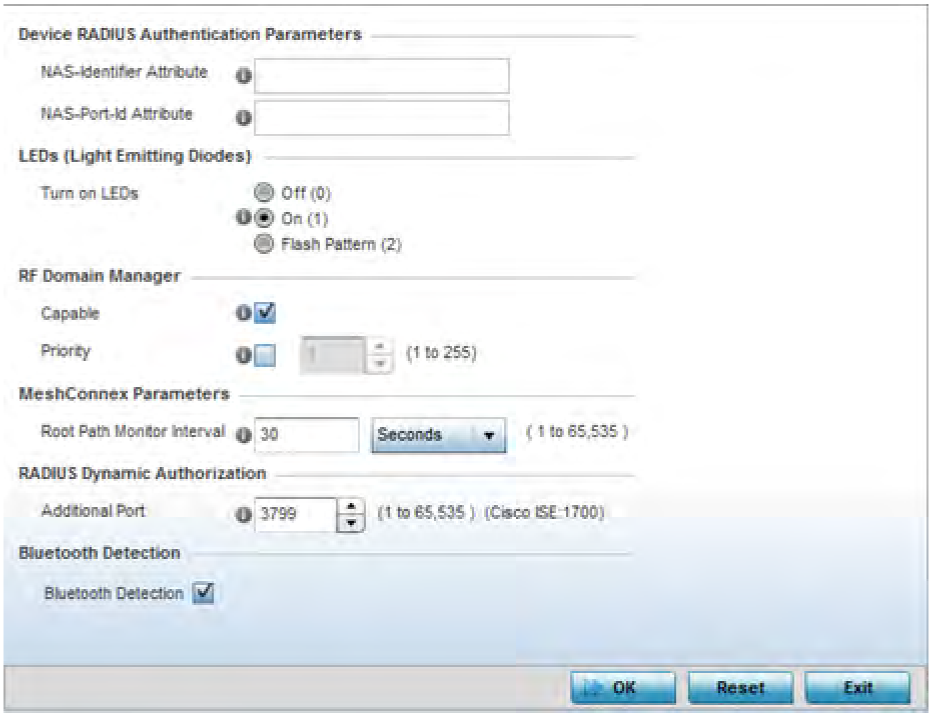
Refer to the advanced profile's Miscellaneous menu item to set or override a profile's NAS configuration. The profile database on the RADIUS server consists of user profiles for each connected *network access server* (NAS) port. Each profile is matched to a username representing a physical port. When the wireless controller authorizes users, it queries the user profile database using a username representative of the physical NAS port making the connection. Access Point LED behavior and RF Domain management can also be defined from within the Miscellaneous screen.

1 Select the **Configuration** > **Devices** from the Web UI.

2 Select **Profile Overrides** to expand its menu items

3 Select **Advanced** to expand its sub menu items.

4 Select **Miscellaneous** from the Advanced menu item.



Device RADIUS Authentication Parameters

NAS-Identifier Attribute

NAS-Port-Id Attribute

LEDs (Light Emitting Diodes)

Turn on LEDs ○ Off (0) ● On (1) ○ Flash Pattern (2)

RF Domain Manager

Capable ☑

Priority □ 1 (1 to 255)

MeshConnex Parameters

Root Path Monitor Interval 30 Seconds (1 to 65,535)

RADIUS Dynamic Authorization

Additional Port 3799 (1 to 65,535) (Cisco ISE:1700)

Bluetooth Detection

Bluetooth Detection ☑

Figure 5-157 *Advanced Profile Overrides - Miscellaneous screen*

5 Set a **NAS-Identifier Attribute** up to 253 characters in length.

6 This is the RADIUS NAS-Identifier attribute that typically identifies the controller, service platform or Access Point where a RADIUS message originates.

7 Set a **NAS-Port-Id Attribute** up to 253 characters in length.

8 This is the RADIUS NAS port ID attribute which identifies the device port where a RADIUS message originates.

9 Select the **Turn on LEDs** option (within the **LEDs (Light Emitting Diodes)** section) to enable the LEDs on Access Point. This parameter is not available for controllers or service platforms.

Select the **Flash Pattern(2)** option (within the **LEDs (Light Emitting Diodes)** field) to flash an Access Point's LED's in a distinct manner (different from its operational LED behavior) to allow an administrator to validate an Access Point has received its configuration from its managing controller or service platform.

Enabling this feature allows an administrator to validate an Access Point has received its configuration (perhaps remotely at the site of deployment) without having to log into the managing controller or service platform. This feature is disabled by default.

10 Select the **Capable** check box (within the **RF Domain Manager** section) to designate this specific device as being the RF Domain manager for a particular RF Domain. The default value is enabled.

11 Select the **Priority** check box (within the **RF Domain Manager** section) to set a priority value for this specific profile managed device. Once enabled, use the spinner control to set a device priority between 1 - 255. The higher the number set, the higher the priority in the RF Domain manager election process.

12 Configure a **Root Path Monitor Interval** (from1 - 65,535 seconds) to specify how often to check if the mesh point is up or down.

13 Set the **Additional Port** value (within the **RADIUS Dynamic Authorization** field) from 1-65,535 to enable a CISCO *Identity Services Engine* (ISE) *Authentication, Authorization and Accounting* (AAA) server to dynamically authenticate a client.

When a client requests access to a CISCO ISE RADIUS server supported network, the server presents the client with a URL where a device's compliance is checked for definition file validity (this form of file validity checking is called *posture*). If the client device complies, it is allowed access to the network.

14 Enable **Bluetooth Detection** to scan for Bluetooth devices over the WiNG managed 2.4 GHz Access Point radio. Bluetooth is a technology for exchanging data over short distances using short-wavelength UHF radio waves in the 2.4 GHz band from mobile wireless clients.

✓ **NOTE:** Enabling Bluetooth detection results in interference on the Access Point's 2.4 GHz radio when in WLAN mode. WLANs are susceptible to sources of interference by Bluetooth devices.

15 Select **OK** to save the changes made to the profile's Advanced Miscellaneous configuration. Select **Reset** to revert to the last saved configuration.

5.3 Auto Provisioning Policies

Device Configuration

Wireless devices can adopt other wireless devices. For example, a wireless controller can adopt an number of Access Points. When a device is adopted, the device configuration is determined by the adopting device. Since multiple configuration policies are supported, an adopting device needs to determine which configuration policies should be used for a given adoptee. Auto Provisioning Policies determine which configuration policies are used for an adoptee based on some of its properties. For example, a configuration policy could be assigned based on MAC address, IP address, CDP snoop strings, etc.

Once created an auto provisioning policy can be used in profiles or device configuration objects. An auto provisioning policy contains a set of ordered by precedence rules that either *deny* or *allow* adoption based on potential adoptee properties and a catch-all variable that determines if the adoption should be allowed when none of the rules is matched. All rules (both deny and allow) are evaluated sequentially starting with the rule with the lowest precedence. The evaluation stops as soon as a rule has been matched, no attempt is made to find a better match further down in the set.

The evaluation is performed using various matching criteria. The matching criteria supported include:

MAC	Matches the MAC address of a device attempting to be adopted. Either a single MAC address or a range of MAC addresses can be specified.
VLAN	Matches when adoption over a Layer 2 link matches the VLAN ID of an adoption request. Note that this is a VLAN ID as seen by the recipient of the request, in case of multiple hops over different VLANs this may different from VLAN ID set by the sender. A single VLAN ID is specified in the rule. This rule is ignored for adoption attempts over Layer 3.
IP Address	Matches when adoption is using a Layer 3 link matches the source IP address of an adoption request. In case of NAT the IP address may be different from what the sender has used. A single IP, IP range or IP/mask is specified in the rule. This rule is ignored for adoption attempts over Layer 2.
Serial Number	Matches exact serial number (case insensitive).
Model	Matches exact model name (case insensitive).

DHCP Option	Matches the value found in DHCP vendor option 191 (case insensitive). DHCP vendor option 191 can be setup to communicate various configuration parameters to an AP. The value of the option in a string in the form of tag=value separated by a semicolon, e.g.'tag1=value1;tag2=value2;tag3=value3'. The access point includes the value of tag'rf-domain', if present. This value is matched against the auto provisioning policy.
FQDN	Matches a substring to the FQDN of a device (case insensitive).
CDP	Matches a substring in a list of CDP snoop strings (case insensitive). For example, if an Access Point snooped 3 devices: controller1.extremenetworks.com, controller2.extremenetworks.com and controller3.extremenetworks.com,'controller1','extremenetworks', 'extremenetworks.com', are examples of the substrings that will match.
LLDP	Matches a substring in a list of LLDP snoop strings (case insensitive). For example, if an Access Point snooped 3 devices: controller1.extremenetworks.com, controller2.extremenetworks.com and controller3.extremenetworks.com,'controller1', 'extremenetworks', 'extremenetworks.com', are substrings match.

Auto Provisioning is the process to discover controllers or service platforms available in the network, pick the most desirable controller or service platform, establish an association, optionally obtain an image upgrade and obtain its configuration.

At adoption, an Access Point solicits and receives multiple adoption responses from controllers and service platforms available on the network. These adoption responses contain loading policy information the Access Point uses to select the optimum controller or service platform for adoption. By default, an auto provisioning policy generally distributes AP adoption evenly amongst available controller or service platform. Modify existing adoption policies or create a new one as needed to meet the adoption requirements of a device and their assigned profile.

☑ **NOTE:** A device configuration does not need to be present for an auto provisioning policy to take effect. Once adopted, and the device's configuration is defined and applied by the controller or service platform, the auto provisioning policy mapping does not have impact on subsequent adoptions by the same device.

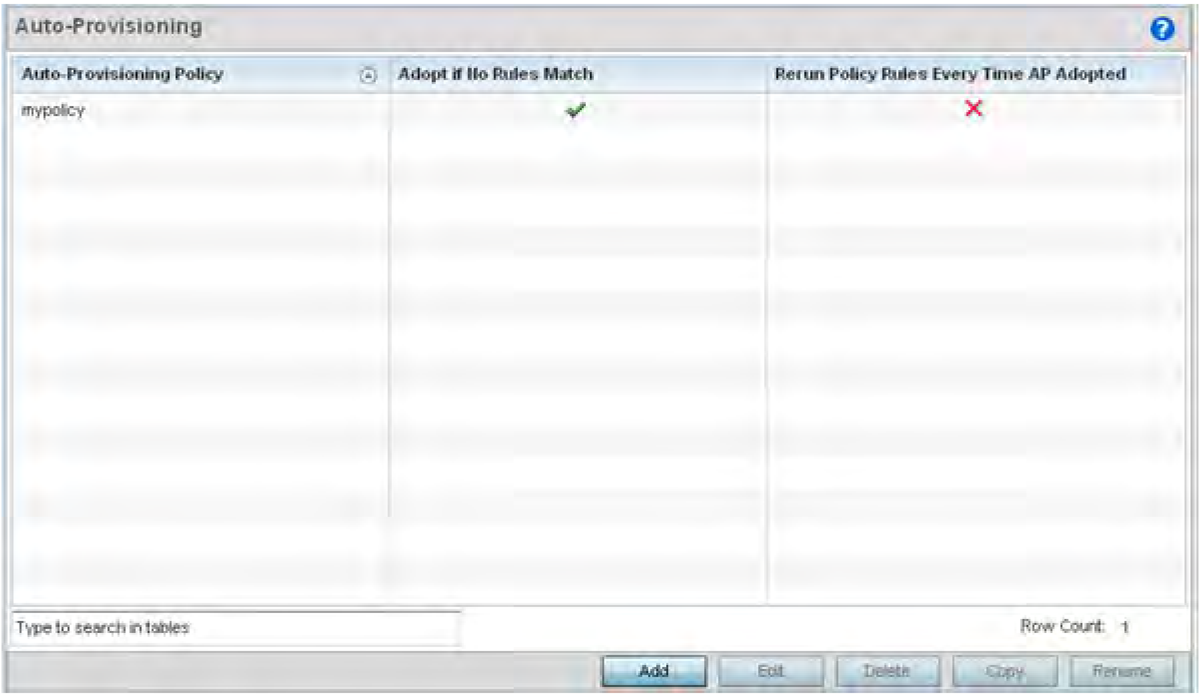
An auto provisioning policy enables an administrator to define adoption rules an Access Point's adoption by a wireless controller.

Auto provisioning policies set the different restrictions on how an Access Point gets adopted to a wireless controller.

To review existing Auto Provisioning Policy configurations:

1 Select **Configuration** > **Devices** > **Auto Provisioning Policy**.

2 The **Auto-Provisioning** screen displays by default.



Auto-Provisioning

Auto-Provisioning Policy	Adopt if No Rules Match	Rerun Policy Rules Every Time AP Adopted
mypolicy	✓	✗

Figure 5-158 *Auto-Provisioning screen*

Use the **Auto-Provisioning** screen to determine whether an existing policy can be used as is, a new Auto Provisioning Policy requires creation or an existing policy requires edit or deletion.

3 Review the following **Auto-Provisioning** parameters:

Auto-Provisioning Policy	Lists the name of each policy when it was created. It cannot be modified as part of the Auto Provisioning Policy's edit process.
Adopt if No Rules Match	Displays whether this policy will adopt devices if no adoption rules apply. Double-click within this column to launch the edit screen where rules can be defined for device adoption. This feature is disabled by default.
Rerun Policy Rules Every Time AP Adopted	Displays whether this policy will be run every time an AP is adopted. Double-click within this column to launch the edit screen where this option can be modified. This feature is disabled by default.

4 Select **Add** to create a new Auto Provisioning Policy, **Edit** to revise an existing Auto Provisioning Policy or **Delete** to permanently remove a policy. For instructions on either adding or editing an Auto Provisioning Policy, see Configuring an Auto-Provisioning Policy on page 5-270.

5.3.1 Configuring an Auto-Provisioning Policy

▸ *Cluster Configuration Overrides (Controllers and Service Platforms Only)*

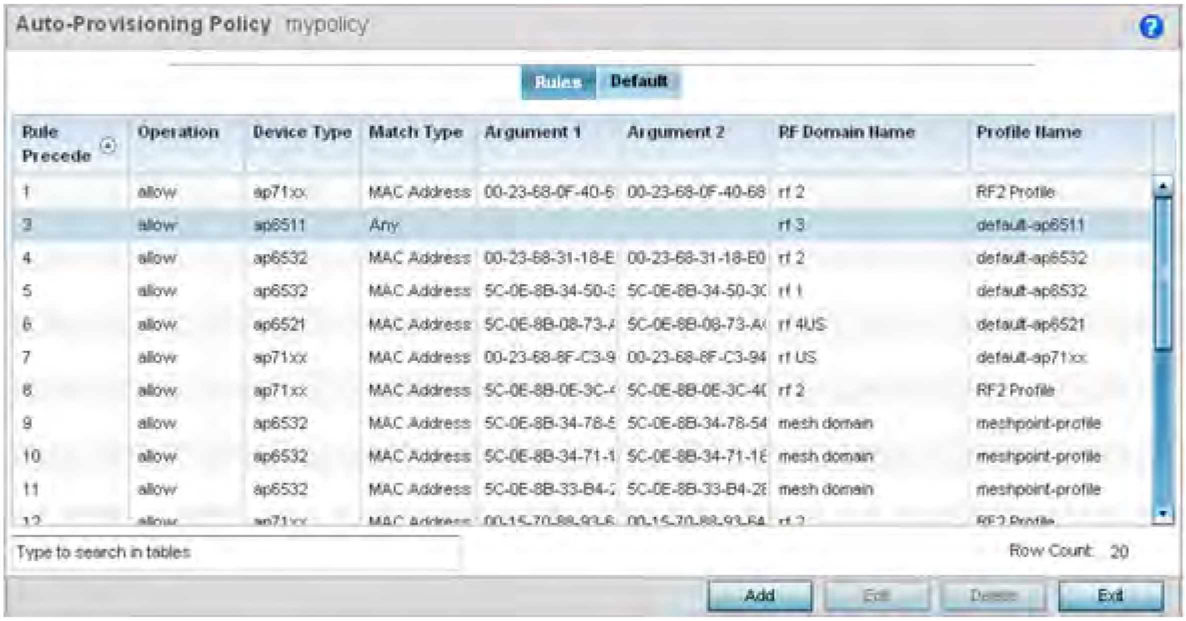
Auto-Provisioning Policies can be created or refined as unique deployment requirements dictate changes in the number of Access Point radios within a specific radio coverage area.

To add a new Auto Provisioning Policy or edit an existing Auto-Provisioning Policy configuration:

1 From the **Adoption** screen, either select **Add** or select an existing Auto-Provisioning Policy and select **Edit**.

2 If adding a new Auto-Provisioning Policy, provide a name in the **Auto-Provisioning Policy** field. The name must not exceed 32 characters. Select **Continue** to enable the remaining parameters of the Auto-Provisioning Policy screen.

The **Rules** tab displays by default.



Auto-Provisioning Policy mypolicy

Rule Precede	Operation	Device Type	Match Type	Argument 1	Argument 2	RF Domain Name	Profile Name
1	allow	ap71xx	MAC Address	00-23-68-0F-40-6	00-23-68-0F-40-68	rf 2	RF2 Profile
3	allow	ap6511	Any			rf 3	default-ap6511
4	allow	ap6532	MAC Address	00-23-68-31-18-E	00-23-68-31-18-E0	rf 2	default-ap6532
5	allow	ap6532	MAC Address	5C-0E-8B-34-50-3	5C-0E-8B-34-50-3C	rf 1	default-ap6532
6	allow	ap6521	MAC Address	5C-0E-8B-08-73-A	5C-0E-8B-08-73-A	rf 4US	default-ap6521
7	allow	ap71xx	MAC Address	00-23-68-8F-C3-9	00-23-68-8F-C3-94	rf US	default-ap71xx
8	allow	ap71xx	MAC Address	5C-0E-8B-0E-3C-4	5C-0E-8B-0E-3C-4C	rf 2	RF2 Profile
9	allow	ap6532	MAC Address	5C-0E-8B-34-78-5	5C-0E-8B-34-78-54	mesh domain	meshpoint-profile
10	allow	ap6532	MAC Address	5C-0E-8B-34-71-1	5C-0E-8B-34-71-18	mesh domain	meshpoint-profile
11	allow	ap6532	MAC Address	5C-0E-8B-33-B4-2	5C-0E-8B-33-B4-28	mesh domain	meshpoint-profile
12	allow	ap71xx	MAC Address	00-15-70-88-93-6	00-15-70-88-93-64	rf 2	RF2 Profile

Type to search in tables

Row Count: 20

Figure 5-159 *Auto-Provisioning Policy screen - Rules tab*

3 Review the following **Auto-Provisioning Policy** rule data to determine whether a rule can be used as is, requires edit or whether new rules need to be defined:

Rule Precedence	Displays the precedence (sequence) the Adoption Policies rules are applied. Rules with the lowest precedence receive the highest priority. This value is set (from 1 - 1000) when adding a new Auto Provisioning Policy rule configuration.
Operation	Lists the operation taken upon receiving an adoption request from an Access Point: The following operations are available: *allow* – Allows the normal provisioning of connected Access Points upon request. *deny* – Denies (prohibits) the provisioning of connected Access Point upon request. *redirect* – When selected, an Access Point seeks a steering controller (upon adoption request), that will forward the network credentials of a designated controller resource that initiates the provisioning process. *upgrade* – Conducts the provisioning of requesting Access Points from this controller resource.
Device Type	Sets the Access Point model for which this policy applies. Adoption rules are specific to the selected model.

Match Type	Lists the matching criteria used in the policy. This is like a filter and further refines the APs that can be adopted. The Match Type can be one of the following: *MAC Address* – The filter type is a MAC Address of the selected Access Point model. *IP Address* – The filter type is the IP address of the selected Access Point model. *VLAN* – The filter type is a VLAN. *Serial Number* – The filter type is the serial number of the selected Access Point model. *Model Number* – The filter type is the Access Point model number. *DHCP Option* – The filter type is the DHCP option value of the selected Access Point model.
Argument 1	The number of arguments vary on the Match Type. This column lists the first argument value. This value is not set as part of the rule creation or edit process.
Argument 2	The number of arguments vary on the Match Type. This column lists the second argument value. This value is not set as part of the rule creation or edit process.
RF Domain Name	Sets the name of the RF Domain to which the device is adopted automatically. Select the *Create* icon to define a new RF Domain configuration or select the *Edit* icon to revise an existing configuration.
Profile Name	Defines the name of the profile used when the Auto Provisioning Policy is applied to a device. Select the *Create* icon to define a new Profile configuration or the *Edit* icon to revise an existing configuration. For more information, see General Profile Configuration on page 8-5.

4 If a rule requires addition or modification, select either **Add** or **Edit** to define the required parameters using the Rule screen.

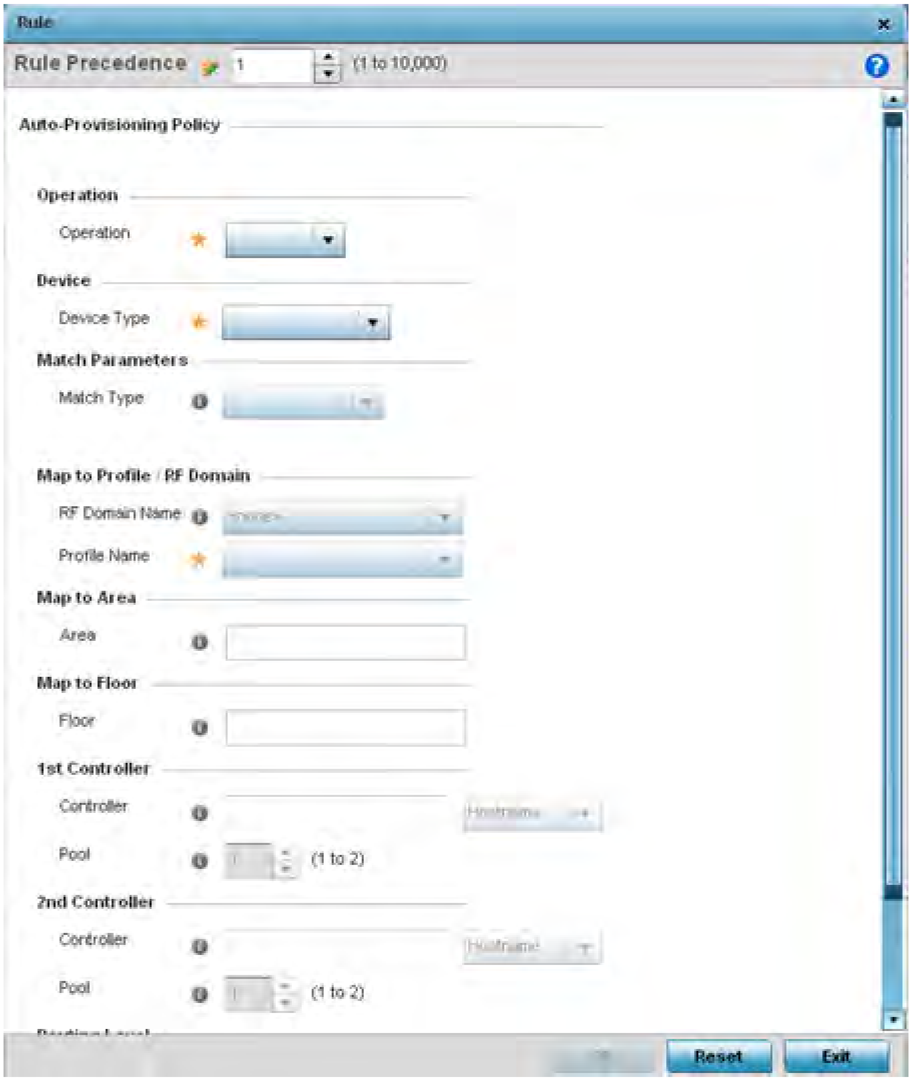


Figure 5-160 *Auto Provisioning Policy Rule screen*

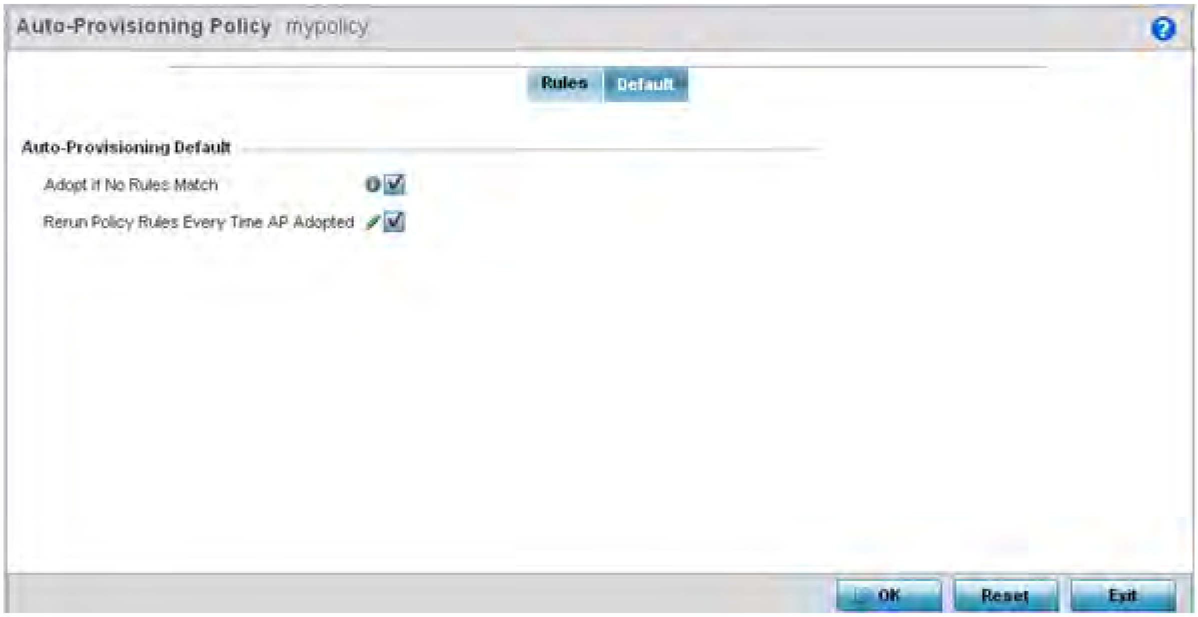
5 Specify the following parameters in the **Rule** screen:

Rule Precedence	Assign a priority from 1 - 10,000 for the application of the auto-provisioning policy rule. Rules with thlowest value have priority.
Operation	Define the operation taken upon receiving an adoption request from an Access Point: the following operations are available: *Allow* – Allows the normal provisioning of connected Access Points upon request. *Deny* – Denies (prohibits) the provisioning of connected Access Point upon request. *Redirect* – When selected, an Access Point seeks a steering controller (upon adoption request), that will forward the network credentials of a designated controller resource that initiates the provisioning process. *Upgrade* – Conducts the provisioning of requesting Access Points from this controller resource.
Device Type	Set the Access Point model for which this policy applies. Adoption rules are specific to the selected model, as radio configurations are often unique to specific models.

Match Type	Set the matching criteria used in the policy. This is like a filter and further refines Access Points capable of adoption. The Match Type can be one of the following: *MAC Address* – The filter type is a MAC Address of the selected Access Point model. *IP Address* – The filter type is the IP address of the selected Access Point model. *VLAN* – The filter type is a VLAN. *Serial Number* – The filter type is the serial number of the selected Access Point model. *Model Number* – The filter type is the Access Point model number. *DHCP Option* – The filter type is the DHCP option value of the selected Access Point model.
RF Domain Name	Set the RF Domain to which the device is adopted automatically. Select the *Create* icon to define a new RF Domain configuration or select the *Edit* icon to revise an existing configuration. For more information, see to General Profile Configuration on page 8-5.
Profile Name	Define the profile used when an Auto Provisioning Policy is applied to a device. Select the *Create* icon to define a new Profile configuration or select the *Edit* icon to revise an existing configuration. For more information, see General Profile Configuration on page 8-5.
Area	Enter a 64 character maximum deployment area name assigned to this policy.
Floor	Enter a 32 character maximum deployment floor name assigned to this policy.
1st Controller	When *redirect* is selected as the operation, provide a 1st choice steering controller *Hostname* or *IP Address* and port to forward network credentials for a controller resource to initiate the provisioning process.
2nd Controller	When *redirect* is selected as the operation, provide a 2nd choice steering controller *Hostname* or *IP Address* and port to forward network credentials for a controller resource to initiate the provisioning process.
Routing Level	When *redirect* is selected as the operation, specify the routing level as *1* or *2.*

6 Select **OK** to save the updates and overrides to the Auto-Provisioning policy rule configuration. Select **Reset** to revert to the last saved configuration.

7 Select the **Default** tab to define the Auto Provisioning Policy’s rule matching adoption configuration.



Auto-Provisioning Default

Adopt if No Rules Match ☑

Rerun Policy Rules Every Time AP Adopted ☑

Figure 5-161 *Auto Provisioning Policy screen - Default tab*

8 Select **Adopt if No Rules Match** to adopt when no matching filter rules apply. This setting is disabled by default.

9 Select **Rerun Policy Rules Every Time AP Adopted** to run this policy and apply its rule set every time an Access Point is adopted. This setting is disabled by default.

10 Select **OK** to save the updates to the screen. Selecting **Reset** reverts the screen to the last saved configuration.

5.4 Managing an Event Policy

▸ *Device Configuration*

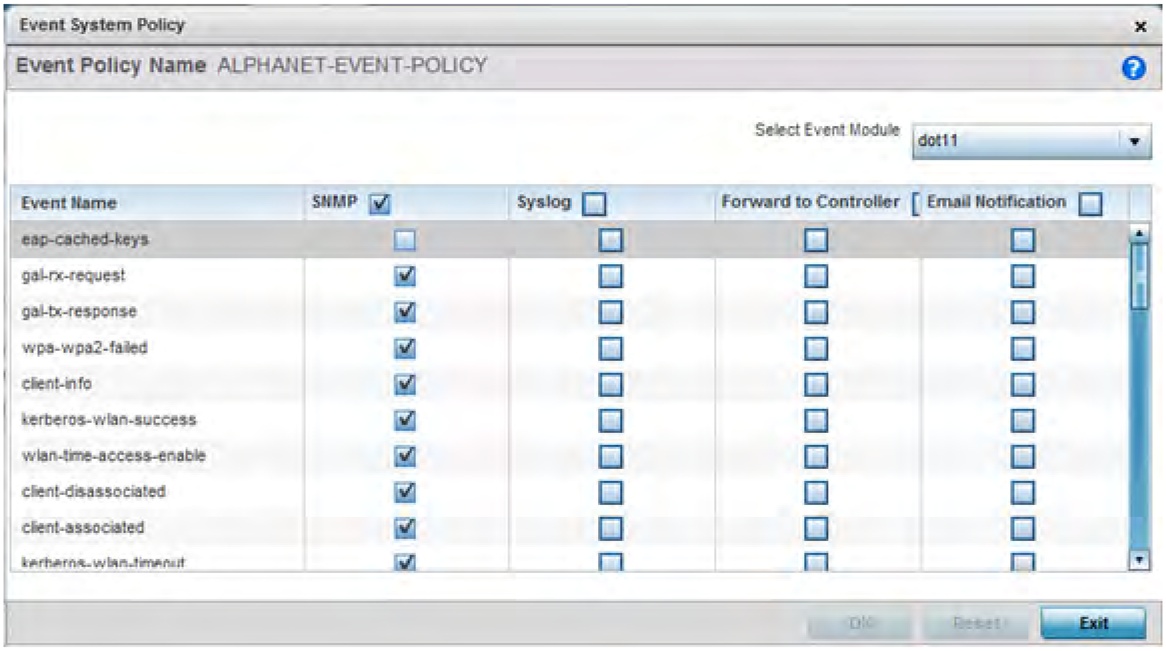
Event Policies enable an administrator to create specific notification mechanisms using one, some or all of the SNMP, syslog, forwarding or e-mail notification options available to the controller or service platform. Each listed event can have customized notification settings defined and saved as part of an event policy. Thus, policies can be configured and administrated in respect to specific sets of client association, authentication/encryption and performance events. Once policies are defined, they can be mapped to device profiles strategically as the likelihood of an event applies to particular devices. By default, there’s no enabled event policy and one needs to be created and implemented.

When initially displayed, the Event Policy screen lists interfaces. Existing policies can have their event notification configurations modified as device profile requirements warrant.

To define an event policy:

1 Select **Configuration** > **Devices** > **Event Policy**.

2 Select **Add** to create a new event policy or **Edit** to modify an existing policy. Use the **Delete** button to remove existing event policy.



Event System Policy

Event Policy Name ALPHANET-EVENT-POLICY

Select Event Module dot11

Event Name	SNMP ☑	Syslog ☐	Forward to Controller [	Email Notification ☐
eap-cached-keys	☐	☐	☐	☐
gal-rx-request	☑	☐	☐	☐
gal-tx-response	☑	☐	☐	☐
wpa-wpa2-failed	☑	☐	☐	☐
client-info	☑	☐	☐	☐
kerberos-wlan-success	☑	☐	☐	☐
wlan-time-access-enable	☑	☐	☐	☐
client-disassociated	☑	☐	☐	☐
client-associated	☑	☐	☐	☐
kerberos-wlan-timeout	☑	☐	☐	☐

Figure 5-162 *Event Policy screen*

3 Ensure the button is selected to enable the screen for configuration for a specific event category. This option needs to remain selected to apply the event policy configuration to the profile.

4 Refer to the **Select Event Module** drop-down menu on the top right-hand side of the screen and select an event module used to track the occurrence of each list event.

5 Review each event and select (or deselect) the *SNMP*, *Syslog*, *Forward to Controller* or *Email Notification* option as required for the event. Map an existing policy to a device profile as needed. Select Profile from the Map drop-down menu in the lower-left hand side of the screen. Expand the list of device profiles available, and apply the event policy as required.

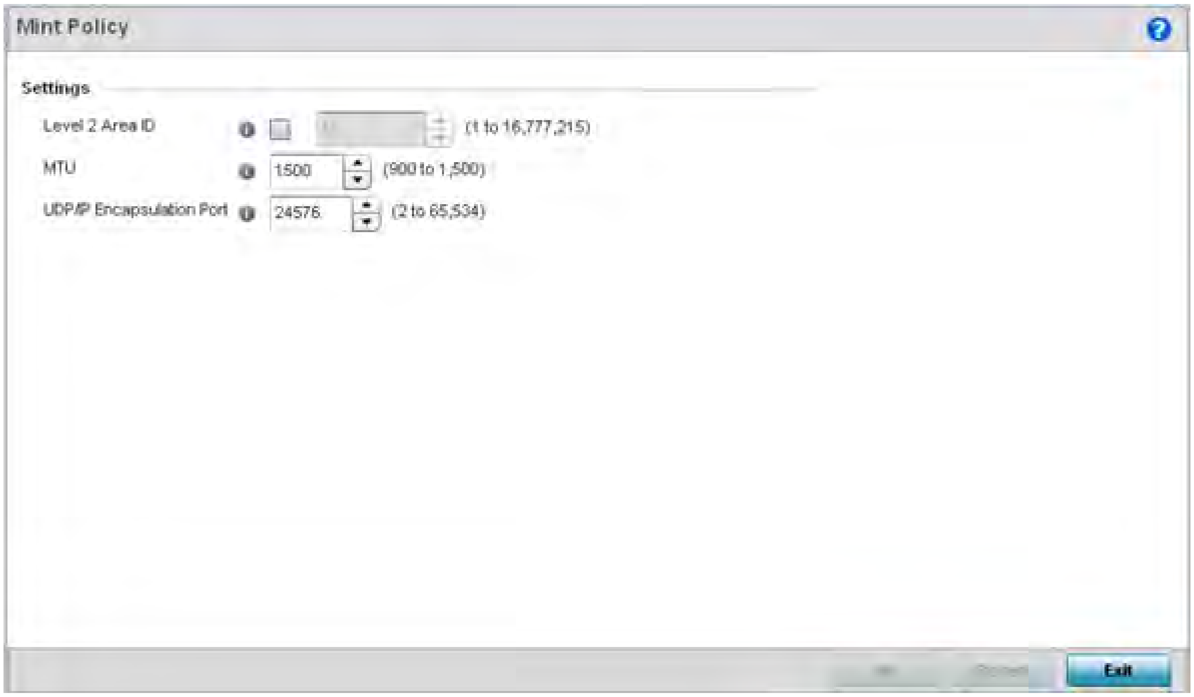
6 Select **OK** to save the changes. Select **Reset** to revert to the last saved configuration. **Delete** obsolete rows as needed.

5.5 Managing MINT Policies

▸ *Device Configuration*

To add or modify a MINT Policy:

1 Select **Configuration** > **Devices > MINT Policy** to display the MINT Policy screen.



Mint Policy

Settings

Level 2 Area ID ☐ (1 to 16,777,215)

MTU 1500 (900 to 1,500)

UDP/IP Encapsulation Port 24576 (2 to 65,534)

Figure 5-163 *MINT Policy Configuration screen*

2 Configure the following parameters to configure the MINT policy:

Level 2 Area ID	Define a Level 2 Area ID for the Mint Policy. The Level 2 Area ID is the global mint area identifier. This area identifier separates two overlapping mint networks and need only be configured if the administrator has two mint networks that share the same packet broadcast domain.
MTU	Specify a MTU value for the mint policy between 900 and 1,500. The MTU setting specifies the maximum packet size that will be used for mint packets. Larger packets will be fragmented so they fit within this packet size limit. The administrator may want to configure this parameter if the mint backhaul network requires or recommends smaller packet sizes. The default value is 1500.
UDP/IP Encapsulation Port	Specify the port to use for UDP/IP encapsulation between 2 and 65,534. This value specifies an alternate UDP port to be used by mint packets and must be an even number. This port number will be used by mint control packets, and this port value plus 1 will be used to carry mint data packets. The default value is 24576.

3 Select **OK** to save the changes. Select **Reset** to revert to the last saved configuration.

6 Wireless Configuration

A *Wireless Local Area Network* (WLAN) is a data-communications system and wireless local area network that flexibly extends the functionalities of a wired LAN. A WLAN links two or more computers or devices using spread-spectrum or OFDM modulation based technology. A WLAN does not require lining up devices for line-of-sight transmission, and are thus, desirable for wireless networking. Roaming users can be handed off from one wireless controller connected Access Point to another, like a cellular phone system. WLANs can therefore be configured around the needs of specific user groups, even when they are not in physical proximity.

WLANs can be used to provide an abundance of services, including data communications (allowing mobile devices to access applications), E-mail, file and print services or even specialty applications (such as guest access control and asset tracking).

Each wireless controller WLAN configuration contains encryption, authentication and QoS policies and conditions for user connections. Connected Access Point radios transmit periodic beacons for each BSS. A beacon advertises the SSID, security requirements, supported data rates of the wireless network to enable clients to locate and connect to the WLAN.

WLANs are mapped to radios on each connected Access Point. A WLAN can be advertised from a single Access Point radio or can span multiple Access Points and radios. WLAN configurations can be defined to only provided service to specific areas of a site. For example a guest access WLAN may only be mapped to a 2.4GHz radio in a lobby or conference room providing limited coverage while a data WLAN is mapped to all 2.4GHz and 5GHz radios at the branch site providing complete coverage.

RFS4000 and RFS6000 series wireless controllers support a maximum of 32 WLANs. The NX7500 service platforms support up to 256 WLANs. NX9000 series service platforms support up to 1000 WLANs.

The wireless configuration is comprised the following policies:

- *Wireless LAN Policy*
- *Configuring WLAN QoS Policies*
- *Radio QoS Policy*
- *Association ACL*
- *Smart RF Policy*
- *MeshConnex Policy*
- *Mesh QoS Policy*
- *Passpoint Policy*
- *Sensor Policy*

These policies can be separately selected within the **Configuration > Wireless** pane located in top, left-hand, side of the UI.

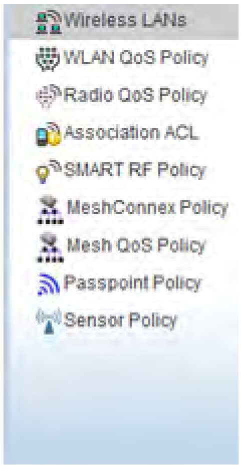
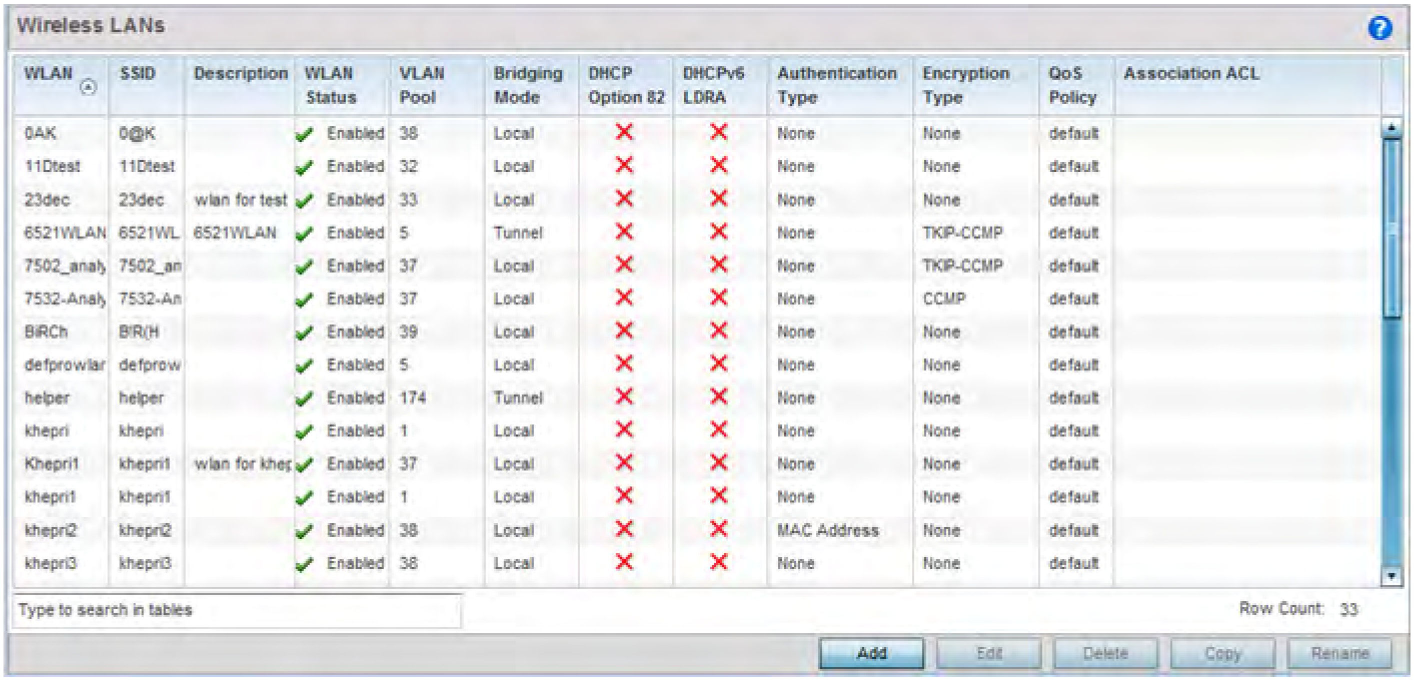


Figure 6-1 *Configuration > Wireless pane*

6.1 Wireless LAN Policy

To review the attributes of existing WLANs and, if necessary, modify their configurations:

1 Select **Configuration** > **Wireless** > **Wireless LANs** to display a high-level display of the existing WLANs.



WLAN	SSID	Description	WLAN Status	VLAN Pool	Bridging Mode	DHCP Option 82	DHCPv6 LDRA	Authentication Type	Encryption Type	QoS Policy	Association ACL
0AK	0@K		✓ Enabled	38	Local	✗	✗	None	None	default	
11Dtest	11Dtest		✓ Enabled	32	Local	✗	✗	None	None	default	
23dec	23dec	wlan for test	✓ Enabled	33	Local	✗	✗	None	None	default	
6521WLAN	6521WL	6521WLAN	✓ Enabled	5	Tunnel	✗	✗	None	TKIP-CCMP	default	
7502_analy	7502_an		✓ Enabled	37	Local	✗	✗	None	TKIP-CCMP	default	
7532-Analy	7532-An		✓ Enabled	37	Local	✗	✗	None	CCMP	default	
BIRCh	B!R(H		✓ Enabled	39	Local	✗	✗	None	None	default	
defprowlar	defprow		✓ Enabled	5	Local	✗	✗	None	None	default	
helper	helper		✓ Enabled	174	Tunnel	✗	✗	None	None	default	
khepri	khepri		✓ Enabled	1	Local	✗	✗	None	None	default	
Khepri1	khepri1	wlan for khep	✓ Enabled	37	Local	✗	✗	None	None	default	
khepri1	khepri1		✓ Enabled	1	Local	✗	✗	None	None	default	
khepri2	khepri2		✓ Enabled	38	Local	✗	✗	MAC Address	None	default	
khepri3	khepri3		✓ Enabled	38	Local	✗	✗	None	None	default	

Figure 6-2 *Wireless LANs screen*

2 Refer to the following (read only) information to assess the attributes of the each WLAN available to the wireless controller:

WLAN	Displays the name of each available WLAN. Individual WLANs can selected and their SSID and client management properties modified. RFS4000 and RFS6000 series wireless controllers support a maximum of 32 WLANs. The NX7500 service platforms support up to 256 WLANs. NX9000 series service platforms support up to 1000 WLANs.
SSID	Displays the name of the SSID assigned to the WLAN when created or last modified. Optionally, select a WLAN and click the *Edit* button to update the WLAN's SSID.
Description	Displays the brief description set for each listed WLAN when it was either created or modified.
WLAN Status	Lists each WLAN's current status as either *Active* or *Shutdown*. A green check mark defines the WLAN as available to clients on all radios where it has been mapped. A red "X" defines the WLAN as shutdown, meaning even if the WLAN is mapped to radios, it's not available for clients to associate.
VLAN Pool	Lists each WLAN's current VLAN mapping. The wireless controller permits mapping a WLAN to more than one VLANs. When a client associates with a WLAN, the client is assigned a VLAN by load balance distribution. The VLAN is picked from a pool assigned to the WLAN. Keep in mind however, typical deployments only map a single VLAN to a WLAN. The use of a pool is strictly optional.
Bridging Mode	Displays the bridging mode used by each WLAN. Available bridging modes are Local and Tunnel.
DHCP Option 82	DHCP Option 82 is commonly used in large enterprise deployments to provide client physical attachment information. Option 82 is used in distributed DHCP server/relay environments, where relays insert additional information to identify the client's point of attachment. A red "X" defines DHCP option 82 as disabled, a green check means its enabled.
DHCPv6 LDRA	*Lightweight DHCPv6 Relay Agent* (LDRA) is used to insert relay-agent options in DHCPv6 message exchanges that identify client-facing interfaces. These relay agents are deployed to forward DHCPv6 messages between clients and servers when they are not on the same IPv6 link. A red "X" indicates this WLAN acts as a DHCPv6 LDRA.
Authentication Type	Displays the name of the authentication scheme this WLAN is using to secure its client membership transmissions. *None* is listed if authentication is not used within this WLAN. Refer to the Encryption type column if no authentication is used to verify there is some sort of data protection used with the WLAN or risk no protection at all.
Encryption Type	Displays the name of the encryption scheme this WLAN is using to secure its client membership transmissions. *None* is listed if encryption is not used within this WLAN. Refer to the Authentication type column if no encryption is used to verify there is some sort of data protection used with the WLAN or risk using this WLAN with no protection at all.
QoS Policy	Lists the QoS policy applied to each listed WLAN. A QoS policy needs to be custom selected (or created) for each WLAN in respect to the WLAN's intended client traffic and the voice, video or normal data traffic it supports.

Association ACL	Lists the Association ACL policy applied to each listed WLAN. An Association ACL is a policy-based *Access Control List* (ACL) that either prevents or allows wireless clients from connecting to a WLAN. The mapping of an Association ACL is strictly optional.

Use the sequential set of WLAN screens to define a unique configuration for each WLAN. Refer to the following to set WLAN configurations:

- *Basic WLAN Configuration*
- *Configuring WLAN Security*
- *Configuring WLAN Firewall Support*
- *Configuring Client Settings*
- *Configuring WLAN Accounting Settings*
- *Configuring WLAN Service Monitoring Settings*
- *Configuring Client Load Balancing Settings*
- *Configuring Advanced WLAN Settings*
- *Configuring Auto Shutdown Settings*

6.1.1 Basic WLAN Configuration

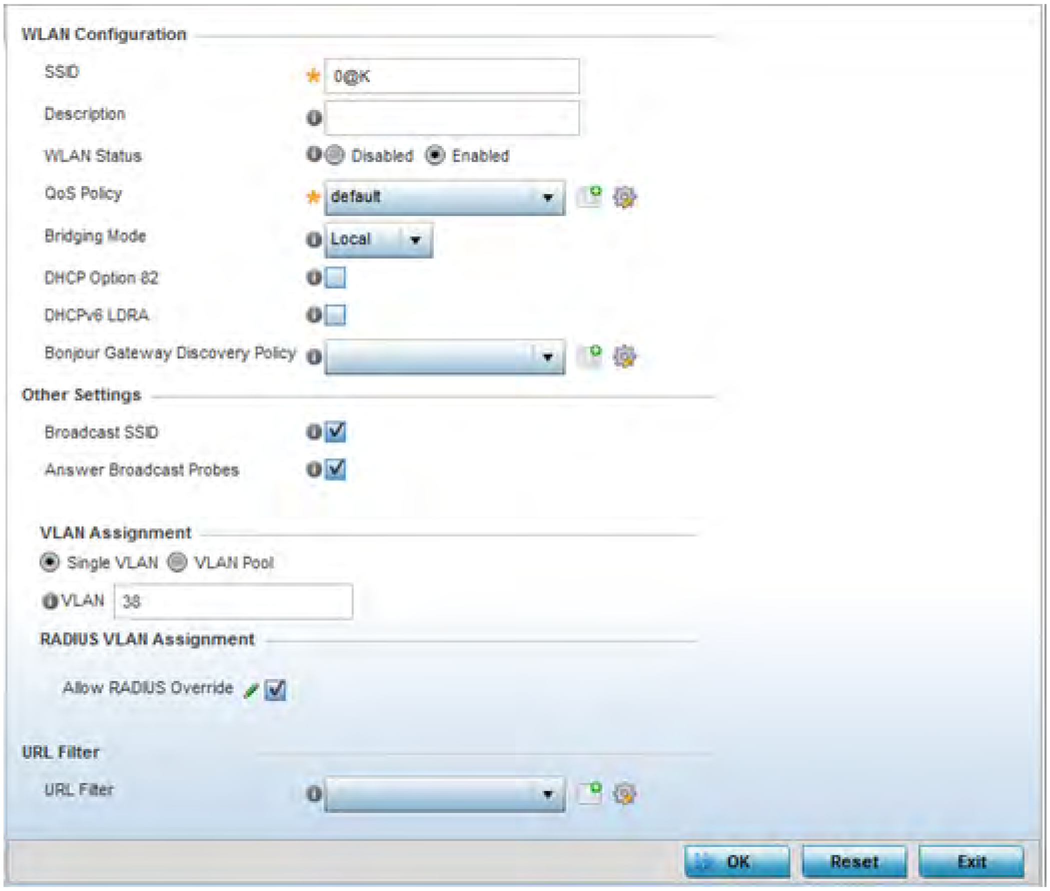
▸ *Wireless LAN Policy*

When creating or modifying a WLAN, the Basic Configuration screen is the first screen that displays as part of the WLAN configuration screen flow. is the Use this screen to enable a WLAN and define its SSID, client behavior and VLAN assignments.

1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display a high-level display of the existing WLANs.

2 Select the **Add** button to create an additional WLAN, or select an existing WLAN then **Edit** to modify its properties.

RFS4000 and RFS6000 model wireless controllers support a maximum of 32 WLANs. The NX7500 service platform support up to 256 WLANs. The NX9000 Series supports up to 1000 WLANs.



WLAN Configuration

SSID * 0@K

Description

WLAN Status ○ Disabled ● Enabled

QoS Policy * default

Bridging Mode Local

DHCP Option 82 □

DHCPv6 LDRA □

Bonjour Gateway Discovery Policy

Other Settings

Broadcast SSID ☑

Answer Broadcast Probes ☑

VLAN Assignment

● Single VLAN ○ VLAN Pool

VLAN 38

RADIUS VLAN Assignment

Allow RADIUS Override ☑

URL Filter

URL Filter

Figure 6-3 *WLAN Policy Basic Configuration screen*

3 Refer to the **WLAN Configuration** field to define the following:

WLAN	If adding a new WLAN, enter its name in the space provided. Spaces between words are not permitted. The name could be a logical representation of the WLAN coverage area (engineering, marketing etc.). If editing an existing WLAN, the WLAN's name appears at the top of the screen and cannot be modified. The name cannot exceed 32 characters.
SSID	Enter or modify the *Services Set Identification* (SSID) associated with the WLAN. The maximum number of characters that can be used for the SSID is 32.
Description	Provide a textual description for the WLAN to help differentiate it from others with similar configurations. The description can be up to 64 characters.
WLAN Status	Select the *Enabled* radio button to make this WLAN active and available to clients on all radios where it has been mapped. Select the *Disabled* radio button to make this WLAN inactive, meaning even if the WLAN is mapped to radios, it's not available for clients to associate and use.

QoS Policy	Use the drop-down menu to assign an existing QoS policy to the WLAN or select the *Create* icon to define a new QoS policy or select the *Edit* icon to modify the configuration of the selected QoS Policy. QoS helps ensure each WLAN receives a fair share of the overall bandwidth, either equally or per the proportion configured. For information on creating a QoS policy that can be applied to WLAN, see *Configuring WLAN QoS Policies*.
Bridging Mode	Use the drop-down menu to specify a bridging mode for the WLAN. Available bridging policy modes are *Local*, *Tunnel* or *split-tunnel*.
DHCP Option 82	Select this option to enable DHCP option 82. DHCP Option 82 provides client physical attachment information. This setting is disabled by default.
DHCPv6 LDRA	Select this option to enable the DHCPv6 relay agent. The DHCPv6 LDRA (*Lightweight DHCP Relay Agent*) allows for DHCPv6 messages to be transmitted on existing networks that do not currently support IPv6 or DHCPv6.
Bonjour Gateway Discovery Policy	Select an existing Bonjour configuration to apply to the WLAN configuration. Bonjour provides a method to discover services on a WLAN. Bonjour allows users to set up a network without any configuration. Services such as printers, scanners and file-sharing servers can be found using Bonjour. Bonjour only works within a single broadcast domain. However, with a special DNS configuration, it can be extended to find services across broadcast domains.

4 Refer to the **Other Settings** field to define broadcast behavior within this specific WLAN.

Broadcast SSID	Select this check box to enable the wireless controller to broadcast SSIDs within beacons. If a hacker tries to isolate and hack a client SSID via a client, the ESSID will display since the ESSID is in the beacon. This feature is enabled by default.
Answer Broadcast Probes	Select this check box to associate a client with a blank SSID (regardless of which SSID the wireless controller is currently using). This feature is enabled by default.

5 Refer to the **VLAN Assignment** field to add or remove VLANs for the selected WLAN, and define the number of clients permitted. Remember, users belonging to separate VLANs can share the same WLAN. It's not necessary to create a new WLAN for every VLAN in the network.

Single VLAN	Select the *Single VLAN* radio button to assign just one VLAN to this WLAN. Enter the name of the VLAN within the VLAN parameter field when the Single VLAN radio button is selected. Utilizing a single VLAN per WLAN is a more typical deployment scenario than using a VLAN pool.
VLAN Pool	Select the *VLAN Pool* radio button to display a table with VLAN and wireless client columns (representing configurable options). Define the VLANs available to this WLAN. Additionally, define the number of wireless clients supported by each VLAN. Use the radio button's on the left-hand side of the table to enable or disable each VLAN and wireless client configuration for the WLAN. Select the *+ Add Row* button to add additional VLANs to the WLAN.

6 Select the **Allow Radius Override** check box in the RADIUS VLAN Assignment to allow an override to the WLAN configuration. If, as part of the authentication process, the RADIUS server returns a client's VLAN-ID in a

RADIUS Access-Accept packet, and this feature is enabled, all client traffic is forward on that VLAN. If disabled, the RADIUS server returned VLAN-ID is ignored and the VLAN configuration (defined above) is used.

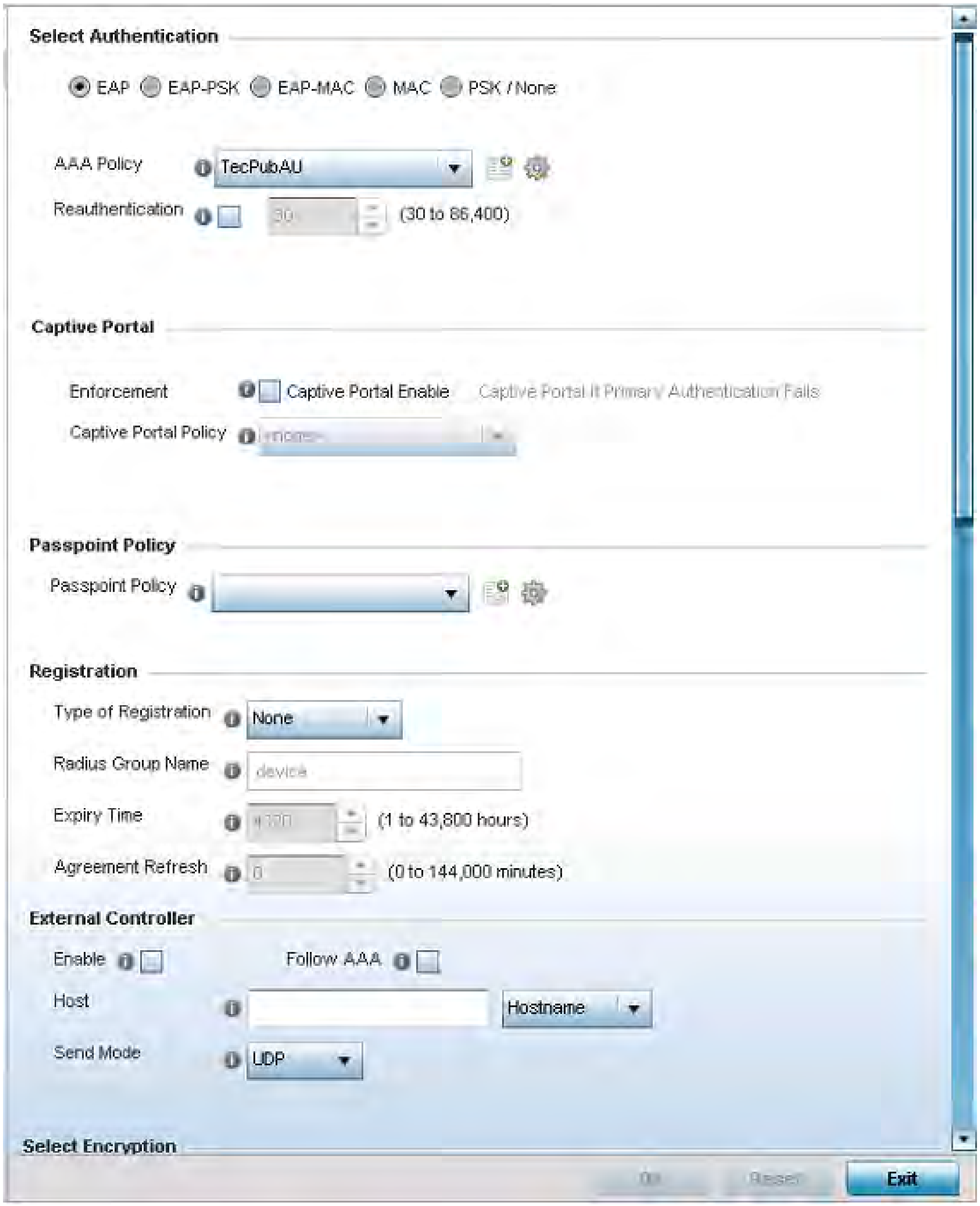
7 Use the **URL Filter** field to configure user access restrictions to resources on the controller or service platform managed Internet. User access is controlled with URL Filters. Use the **URL Filter** drop down menu to select a preconfigured URL Filter. To create a new URL Filter, use the **Create** button. To edit an existing URL Filter, use the **Edit** button.

8 Select **OK** when completed to update the WLAN's basic configuration. Select **Reset** to revert the screen back to the last saved configuration.

6.1.2 Configuring WLAN Security

▸ *Wireless LAN Policy*

A WLAN can be assigned a security policy supporting authentication, captive portal (hotspot) or encryption schemes.



Select Authentication

● EAP ○ EAP-PSK ○ EAP-MAC ○ MAC ○ PSK / None

AAA Policy: TecPubAU

Reauthentication: □ 30 (30 to 86,400)

Captive Portal

Enforcement: □ Captive Portal Enable □ Captive Portal if Primary Authentication Fails

Captive Portal Policy: <none>

Passpoint Policy

Passpoint Policy:

Registration

Type of Registration: None

Radius Group Name: device

Expiry Time: 4320 (1 to 43,800 hours)

Agreement Refresh: 0 (0 to 144,000 minutes)

External Controller

Enable □ Follow AAA □

Host: Hostname

Send Mode: UDP

Select Encryption

Figure 6-4 *WLAN Policy Security screen*

Authentication ensures only known and trusted users or devices access a WLAN. Authentication is enabled per WLAN to verify the identity of both users and devices. Authentication is a challenge and response procedure for validating user credentials such as username, password and sometimes secret-key information.

A client must authenticate to an Access Point to receive resources from the network. Controllers and service platforms support *EAP*, *EAP PSK, EAP-MAC, MAC* and PSK/None authentication options.

Refer to the following to configure an authentication scheme for a WLAN:

- *802.1x EAP, EAP-PSK and EAP MAC*
- *MAC Authentication*
- *PSK / None*

Secure guest access to the network is referred to as *captive portal* access. A captive portal is guest access policy for providing guests temporary and restrictive access to the wireless network. Existing captive portal policies can be applied to a WLAN to provide secure guest access as needed.

A captive portal configuration provides secure authenticated access using a standard Web browser. Captive portals provide authenticated access by capturing and re-directing a wireless user's Web browser session to a captive portal login page where the user must enter valid credentials to access to the network. Once logged into captive portal, additional *Agreement, Welcome* and *Fail* pages provide the administrator with a number of options on captive portal screen flow and user appearance. Refer to *Captive Portal on page 6-13* for information on assigning a captive portal policy to a WLAN.

A *passpoint* policy provides an interoperable platform for streamlining Wi-Fi access to Access Points deployed as public hotspots. Passpoint is supported across a wide range of wireless network deployment scenarios and client devices. For more information, see *Passpoint Policy*.

Encryption is central for WLAN security, as it provides data privacy for traffic forwarded over a WLAN. When the 802.11 specification was introduced, Wired Equivalent Privacy (WEP) was the primary encryption mechanism. WEP has since been interpreted as flawed in many ways, and is not considered an effective standalone encryption scheme for securing a wireless controller WLAN. WEP is typically used WLAN deployments designed to support legacy clients. New device deployments should use either WPA or WPA2 encryption.

Encryption applies a specific algorithm to alter its appearance and prevent unauthorized hacking. Decryption applies the algorithm in reverse, to restore the data to its original form. A sender and receiver must employ the same encryption/decryption method to interoperate. When both TKIP and CCMP are both enabled a mix of clients are allowed to associate with the WLAN. Some use TKIP, others use CCMP. Since broadcast traffic needs to be understood by all clients, the broadcast encryption type in this scenario is TKIP.

TKIP-CCMP, WPA2-CCMP, WEP 64, WEP 128 and Keyguard encryption options are supported.

Refer to the following to configure an encryption scheme for a WLAN:

- *TKIP-CCMP*
- *WPA2-CCMP*
- *WEP 64*
- *WEP 128*
- *Keyguard*
- *T5 Controller Security*

6.1.2.1 802.1x EAP, EAP-PSK and EAP MAC

▶ *Configuring WLAN Security*

The *Extensible Authentication Protocol* (EAP) is the de-facto standard authentication method used to provide secure authenticated access to WLANs. EAP provides mutual authentication, secured credential exchange, dynamic keying and strong encryption. 802.1X EAP can be deployed with WEP, WPA or WPA2 encryption schemes to further protect user information forwarded over WLANs.

The EAP process begins when an unauthenticated supplicant (client device) tries to connect with an authenticator (in this case, the authentication server). An Access Point passes EAP packets from the client to an authentication server on the wired side of the Access Point. All other packet types are blocked until the authentication server (typically, a RADIUS server) verifies the client's identity.

802.1X EAP provides mutual authentication over the WLAN during authentication. The 802.1X EAP process uses credential verification to apply specific policies and restrictions to WLAN users to ensure access is only provided to specific wireless controller resources.

802.1X requires a 802.1X capable RADIUS server to authenticate users and a 802.1X client installed on each devices accessing the EAP supported WLAN. An 802.1X client is included with most commercial operating systems, including Microsoft Windows, Linux and Apple OS X.

The RADIUS server authenticating 802.1X EAP users can reside either internally or externally to a controller, service platform or Access Point. User account creation and maintenance can be provided centrally using ADSP or individually maintained on each device. If an external RADIUS server is used, EAP authentication requests are forwarded.

When using PSK with EAP, the controller, service platform or Access Point sends a packet requesting a secure link using a pre-shared key. The authenticating device must use the same authenticating algorithm and passcode during authentication. EAP-PSK is useful when transitioning from a PSK network to one that supports EAP. The only encryption types supported with this are TKIP, CCMP and TKIP-CCMP.

To configure EAP on a WLAN:

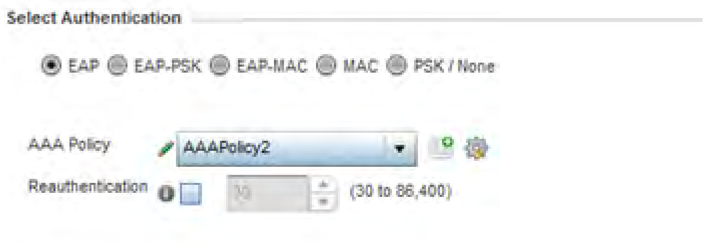
1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN, or select and existing WLAN and **Edit** to modify the security properties of an existing WLAN.

3 Select **Security**.

4 Select **EAP, EAP-PSK** or **EAP-MAC** as the authentication type.

Either option enables the radio buttons for various encryption mechanisms as an additional measure of security with the WLAN.



Select Authentication

● EAP ○ EAP-PSK ○ EAP-MAC ○ MAC ○ PSK / None

AAA Policy AAAPolicy2

Reauthentication □ 30 (30 to 86,400)

Figure 6-5 *EAP, EAP-PSK or EAP MAC Authentication screen*

5 Either select an existing **AAA Policy** from the drop-down menu or select the **Create** icon to the right of the AAA Policy parameter to display a screen where new AAA policies can be created. Select the **Edit** icon to modify the configuration of the selected AAA policy.

Authentication, authorization, and *accounting* (AAA) is a framework for intelligently controlling access to the network, enforcing user authorization policies and auditing and tracking usage. These combined processes are central for securing wireless client resources and wireless network data flows.

6 Select the **Reauthentication** check box to force EAP supported clients to reauthenticate. Use the spinner control set the number of seconds (from 30 - 86,400) that, once exceeded, forces the EAP supported client to reauthenticate to use the resources supported by the WLAN.

7 Select **OK** when completed to update the WLAN's EAP configuration. Select **Reset** to revert back to the last saved configuration.

EAP, EAP-PSK and EAP MAC Deployment Considerations

▸ *802.1x EAP, EAP-PSK and EAP MAC*

Before defining a 802.1x EAP, EAP-PSK or EAP MAC supported configuration on a WLAN, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- A valid certificate should be issued and installed on devices providing 802.1X EAP. The certificate should be issued from an Enterprise or public certificate authority to allow 802.1X clients to validate the identity of the authentication server prior to forwarding credentials.
- If using an external RADIUS server for EAP authentication, the round trip delay over the WAN should not exceed 150ms. Excessive delays over a WAN can cause authentication and roaming issues and impact wireless client performance. If experiencing excessive delays, consider using local RADIUS resources.

6.1.2.2 MAC Authentication

▸ *Configuring WLAN Security*

MAC is a device level authentication method used to augment other security schemes when legacy devices are deployed using static WEP.

MAC authentication can be used for device level authentication by permitting WLAN access based on device MAC address. MAC authentication is typically used to augment WLAN security options that do not use authentication (such as static WEP, WPA-PSK and WPA2-PSK) MAC authentication can also be used to assign VLAN memberships, Firewall policies and time and date restrictions.

MAC authentication can only identify devices, not users. MAC authentication only references a client wireless interface card MAC address when authenticating the device, it does not distinguish the device's user credentials. MAC authentication is somewhat poor as a standalone data protection technique, as MAC addresses can be easily spoofed by hackers who can provide a device MAC address to mimic a trusted device within the network.

MAC authentication is enabled per WLAN profile, augmented with the use of a RADIUS server to authenticate each device. A device's MAC address can be authenticated against the local RADIUS server built into the device or centrally (from a datacenter). For RADIUS server compatibility, the format of the MAC address can be forwarded to the RADIUS server in non-delimited and or delimited formats:

To configure MAC on a WLAN:

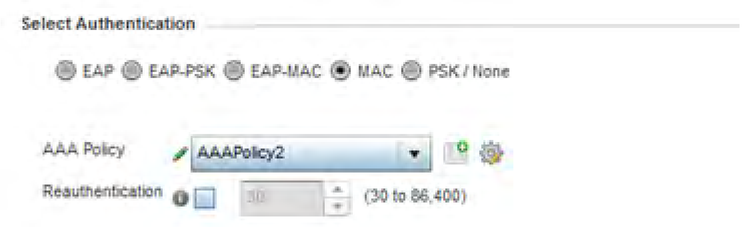
1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN, or select and existing WLAN and **Edit** to modify the security properties of an existing WLAN.

3 Select **Security**.

4 Select **MAC** as the Authentication Type.

Selecting MAC enables the radio buttons for each encryption option as an additional measure of security for the WLAN.



Select Authentication

○ EAP ○ EAP-PSK ○ EAP-MAC ● MAC ○ PSK / None

AAA Policy: AAAPolicy2

Reauthentication □ 30 (30 to 86,400)

Figure 6-6 *MAC Authentication screen*

5 Either select an existing AAA Policy from the drop-down menu or select the **Create** icon to the right of the AAA Policy parameter to display a screen where new AAA policies can be created. A default AAA policy is also available if configuring a WLAN for the first time and there's no existing policies. Select the **Edit** icon to modify the configuration of a selected AAA policy.

Authentication, authorization, and *accounting* (AAA) is a framework for intelligently controlling access to the wireless client, enforcing user authorization policies and auditing and tracking usage. These combined processes are central for securing wireless client resources and wireless network data flows.

6 Select the **Reauthentication** option to force MAC supported clients to reauthenticate. Use the spinner control set the number of minutes (30 - 86,400) that, once exceeded, forces the EAP supported client to reauthenticate in order to use the resources supported by the WLAN.

7 Select **OK** when completed to update the WLAN's MAC configuration. Select **Reset** to revert the screen back to the last saved configuration.

MAC Authentication Deployment Considerations

▸ *MAC Authentication*

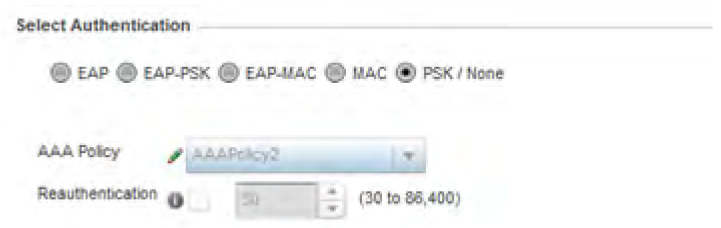
Before defining a MAC authentication configuration on a WLAN, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- MAC authentication can only be used to identify end-user devices, not the users themselves.
- MAC authentication is somewhat poor as a standalone data protection technique, as MAC addresses can be easily spoofed by hackers who can provision a MAC address on their device to mimic a trusted device.

6.1.2.3 PSK / None

▸ *Configuring WLAN Security*

Open-system authentication can be referred to as no authentication, since no actual authentication and user credential validation takes place. A client user requests (and is granted) authentication with no credential exchange.



Select Authentication

○ EAP ○ EAP-PSK ○ EAP-MAC ○ MAC ● PSK / None

AAA Policy: AAAPolicy2

Reauthentication □ 30 (30 to 86,400)

Figure 6-7 *PSK / None Settings screen*

NOTE: Although *None* implies no authentication, this option is also used when pre-shared keys are used for encryption (thus the PSK in the description).

6.1.2.4 Captive Portal

▸ *Configuring WLAN Security*

A *captive portal* is an access policy for providing guests temporary and restrictive access to the controller, service platform or Access Point managed network. For an overview of the Captive Portal process and information on how to define a captive portal policy, see *Configuring Captive Portal Policies on page 11-1*.

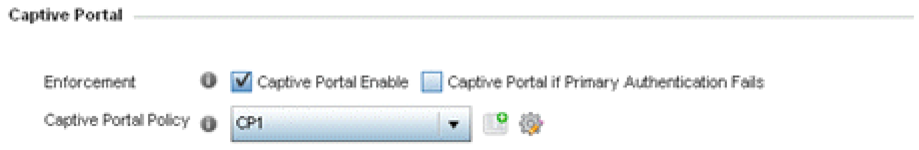
To assign a captive portal policy to a WLAN:

1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select an existing WLAN and select **Edit** to modify the properties of an existing wireless controller WLAN.

3 Select **Security**.

4 Refer to the **Captive Portal** field within the WLAN Policy security screen.



Captive Portal

Enforcement: ☑ Captive Portal Enable □ Captive Portal if Primary Authentication Fails

Captive Portal Policy: CP1

Figure 6-8 *WLAN Policy Security screen - Captive Portal Field*

5 Select the **Captive Portal Enable** option if authenticated guest access is required with the selected WLAN. This feature is disabled by default.

6 Select the **Captive Portal if Primary Authentication Fails** checkbox to enable the captive portal policy if the primary authentication is unavailable. This option is only enabled when **Captive Portal Enable** is selected.

7 Select the **Captive Portal Policy** to use with the WLAN from the drop-down menu. If no relevant policies exist, select the **Create** icon to define a new policy to use with this WLAN or the **Edit** icon to update the configuration of an existing Captive Portal policy. For more information, see *Configuring Captive Portal Policies on page 11-1*.

8 Select **OK** when completed to update the Captive Portal configuration. Select **Reset** to revert the WLAN Policy Security screen back to the last saved configuration.

6.1.2.5 Passpoint

▸ *Configuring WLAN Security*

A *passpoint* policy provides an interoperable platform for streamlining Wi-Fi access to Access Points deployed as public hotspots (captive portals). Passpoint is supported across a wide range of wireless network deployment scenarios and client devices.

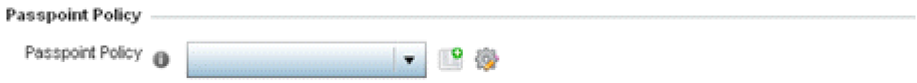
To assign a passpoint policy to a WLAN:

1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select an existing WLAN and select **Edit** to modify the properties of an existing wireless controller WLAN.

3 Select **Security**.

4 Refer to the **Passpoint** field within the WLAN Policy security screen.



Passpoint Policy

Passpoint Policy

Figure 6-9 *WLAN Policy Security screen - Passpoint Policy*

5 Select an existing **Passpoint Policy** from the drop down menu to apply it to the WLAN. If no relevant policies exist, select the **Create** icon to define a new policy to use with this WLAN or the **Edit** icon to update the configuration of an existing passpoint policy. For more information, see *Passpoint Policy on page 6-104*.

6 Select **OK** when completed to update the Captive Portal configuration. Select **Reset** to revert the WLAN Policy Security screen back to the last saved configuration.

6.1.2.6 Registration

▸ *Configuring WLAN Security*

Registration requires the validation of devices by address to continue the authentication process.

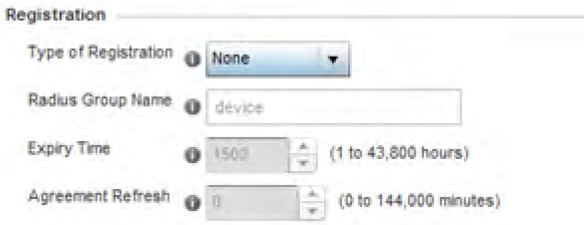
To assign a Registration to a WLAN:

1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select an existing WLAN and select **Edit** to modify the properties of an existing wireless controller WLAN.

3 Select **Security**.

4 Refer to the **Registration** section within the WLAN Policy security screen.



Registration

Type of Registration: None

Radius Group Name: device

Expiry Time: 1500 (1 to 43,800 hours)

Agreement Refresh: 0 (0 to 144,000 minutes)

Figure 6-10 *WLAN Policy Security screen - MAC Registration*

5 Use the **Type of Registration** drop-down menu to set the self-registration type for the selected WLAN. Options include *None, device, user* and *device-OTP*.

When captive portal guest users are authenticating using their User ID (Email Address/Mobile Number/ Member ID) and the received pass code in order to complete the registration process. The WLAN authentication type should be MAC-Authentication and the WLAN registration type should be configured as **device-OTP**.

When captive portal device registration is through social media, the WLAN registration type should be set as **device** registration, and the captive portal needs to be configured for guest user social authentication.

Enter a 64 character maximum **RADIUS Group Name** to which the registering user associates. When left blank, users are not associated with a RADIUS group.

Use the **Expiry Time** spinner control to set the amount of time (from 1 - 43,800 hours) before registration addresses expire and must be re-entered.

Set the **Agreement Refresh** as the amount of time (from 0 - 144,000 minutes) before the agreement page is displayed if the user has not been logged during the specified period. The default setting is 0 days.

6 Select **OK** when completed to update the Registration settings. Select **Reset** to revert the WLAN Policy Security screen back to the last saved configuration.

6.1.2.7 External Controller

▶ *Configuring WLAN Security*

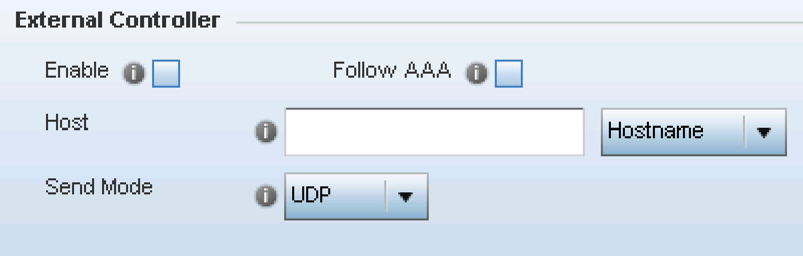
To set the WLAN’s external controller or service platform security configuration:

1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select an existing WLAN and select **Edit** to modify its properties.

3 Select **Security**.

4 Refer to the **External Controller** section within the WLAN Policy security screen



External Controller

Enable □ Follow AAA □

Host Hostname

Send Mode UDP

Figure 6-11 *WLAN Policy Security screen - External Controller Field*

5 Select the **Enable** option if WLAN authentication is handled using an external resource. This feature is disabled by default.

Select the **Follow AAA** option if the resource handling WLAN authentication and accounting is an external RADIUS server specified within an AAA policy. However, ensure that an AAA policy identifying the authentication and accounting server exists and is associated with the WLAN.

Note, in case of EGuest deployment, the authenticating and accounting server specified in the AAA policy should point to the EGuest server host.

6 If using an external resource, other than the AAA RADIUS server, use the drop-down menu to select either **Hostname** or **IP Address** and enter the server information in the **Host** field. Hostnames cannot include an underscore character.

7 Select the **Send Mode** as either **UDP**, **HTTP** or **HTTPS**. The default setting is **UDP**.

8 Select **OK** when completed to update the **External Controller** configuration. Select **Reset** to revert the WLAN Policy Security screen back to the last saved configuration.

6.1.2.8 TKIP-CCMP

▸ *Configuring WLAN Security*

CCMP is a security standard used by the *Advanced Encryption Standard* (AES). AES serves the same function TKIP does for WPA-TKIP. CCMP computes a *Message Integrity Check* (MIC) using the proven *Cipher Block Chaining* (CBC) technique. Changing just one bit in a message produces a totally different result.

The encryption method is *Temporal Key Integrity Protocol* (TKIP). TKIP addresses WEP's weaknesses with a re-keying mechanism, a per-packet mixing function, a message integrity check and an extended initialization vector. However TKIP also has vulnerabilities.

To configure TKIP-CCMP encryption on a WLAN:

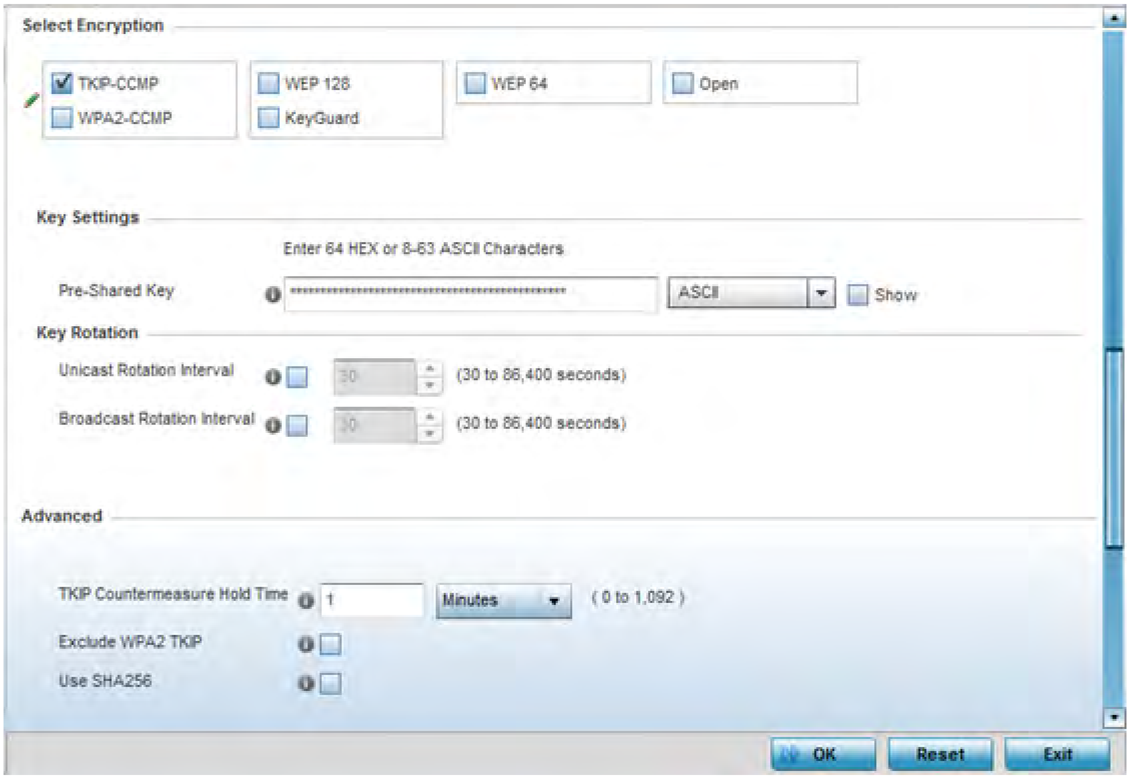
1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select an existing WLAN and **Edit** to modify its properties.

3 Select **Security**.

4 Select the **TKIP-CCMP** radio button from within the Select Encryption field.

The screen populates with the parameters required to define a WLAN's TKIP-CCMP configuration for the new or existing WLAN.



Select Encryption

☑ TKIP-CCMP ☐ WPA2-CCMP ☐ WEP 128 ☐ KeyGuard ☐ WEP 64 ☐ Open

Key Settings

Enter 64 HEX or 8-63 ASCII Characters

Pre-Shared Key: ** ASCII ☐ Show

Key Rotation

Unicast Rotation Interval ☐ 30 (30 to 86,400 seconds)

Broadcast Rotation Interval ☐ 30 (30 to 86,400 seconds)

Advanced

TKIP Countermeasure Hold Time: 1 Minutes (0 to 1,092)

Exclude WPA2 TKIP ☐

Use SHA256 ☐

Figure 6-12 *TKIP-CCMP screen*

5 Define **Key Settings**.

Pre-Shared Key	Enter either an alphanumeric string of 8 to 63 ASCII characters or 64 HEX characters as the primary string both transmitting and receiving authenticators must share. The alphanumeric string allows character spaces. The string is converted into a numeric value. This passphrase saves the administrator from entering the 256-bit key each time keys are generated.

6 Define **Key Rotation** values.

Unicast messages are addressed to a single device on the network. *Broadcast* messages are addressed to multiple devices. When using WPA2, a wireless client can use 2 keys, one unicast key, for its own traffic to and from an Access Point, and one broadcast key, the common key for all the clients in that subnet.

Rotating the keys is recommended the keys so a potential hacker would not have enough data using a single key to attack the deployed encryption scheme.

Unicast Rotation Interval	Define an interval for unicast key transmission in seconds (30 -86,400). Some clients have issues using unicast key rotation, so ensure you know which kind of clients are impacted before using unicast keys. This feature is disabled by default.
Broadcast Rotation Interval	When enabled, the key indices used for encrypting/decrypting broadcast traffic are alternatively rotated based on the defined interval. Define an interval for broadcast key transmission in seconds (30-86,400). Key rotation enhances the broadcast traffic security on the WLAN. This feature is disabled by default.

7 Set the following **Advanced** settings for the WPA/WPA2-TKIP encryption scheme

TKIP Countermeasure Hold Time	The TKIP countermeasure hold-time is the time during which the use of the WLAN is disabled if TKIP countermeasures have been invoked on the WLAN. Use the drop-down menu to define a value in either *Hours* (0-18), *Minutes* (0-1,093) or *Seconds* (0-65,535). The default setting is 1 second.
Exclude WPA2 TKIP	Select this option for an Access Point to advertise and enable support for only WPA-TKIP. This option can be used if certain older clients are not compatible with the newer WPA2-TKIP information elements. Enabling this option allows backwards compatibility for clients that support WPA-TKIP and WPA2-TKIP but do not support WPA2-CCMP. Enabling this feature is recommended if WPA-TKIP or WPA2-TKIP supported clients operate in a WLAN populated by WPA2-CCMP enabled clients. This feature is disabled by default.
Use SHA256	Select to enable use of the SHA-256 hash algorithms with WPA2. This is optional when using WPA2 without 802.11w Protected Management Frames (PMF) enabled. This is mandatory when PMF is enabled.

8 Select **OK** when completed to update the WLAN's TKIP-CCMP encryption configuration. Select **Reset** to revert the screen back to its last saved configuration.

6.1.2.8.1 TKIP-CCMP Deployment Considerations

Before defining a TKIP-CCMP supported configuration on a WLAN, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- TKIP-CCMP should only be enabled for legacy device support when WPA2-CCMP support is not available.
- Though TKIP offers better security than WEP, it can be vulnerable to certain attacks.

- When both TKIP and CCMP are both enabled a mix of clients are allowed to associate with the WLAN. Some use TKIP, others use CCMP. Since broadcast traffic needs to be understood by all clients, the broadcast encryption type in this scenario is TKIP.

6.1.2.9 WPA2-CCMP

▸ *Configuring WLAN Security*

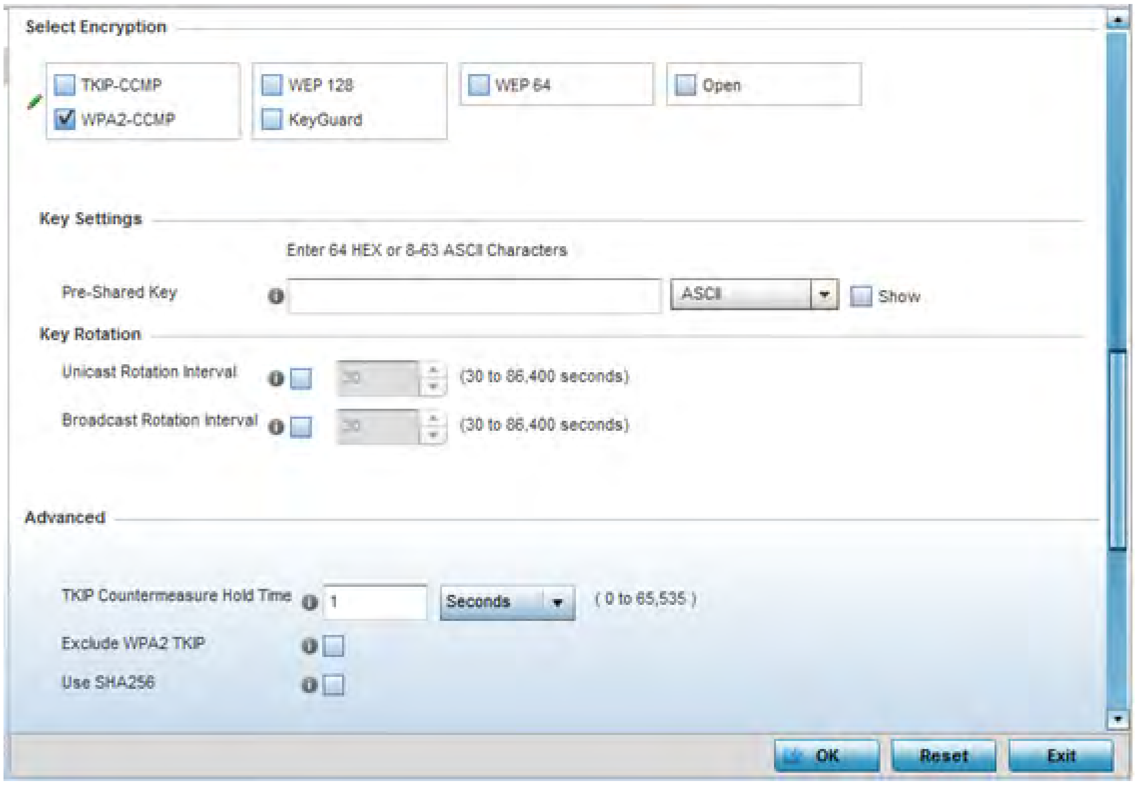
WPA2 is a newer 802.11i standard that provides even stronger wireless security than *Wi-Fi Protected Access* (WPA) and WEP. CCMP is the security standard used by the *Advanced Encryption Standard* (AES). AES serves the same function TKIP does for WPA-TKIP. CCMP computes a *Message Integrity Check* (MIC) using the proven *Cipher Block Chaining* (CBC) technique. Changing just one bit in a message produces a totally different result.

WPA2/CCMP is based on the concept of a *Robust Security Network* (RSN), which defines a hierarchy of keys with a limited lifetime (similar to TKIP). Like TKIP, the keys the administrator provides are used to derive other keys. Messages are encrypted using a 128-bit secret key and a 128-bit block of data. The end result is an encryption scheme as secure as any the wireless controller provides for its associated clients.

To configure WPA2-CCMP encryption on a WLAN:

1. Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.
2. Select the **Add** button to create an additional WLAN or select an existing WLAN and choose **Edit** to modify the properties of an existing WLAN.
3. Select **Security**.
4. Select the **WPA2-CCMP** check box from within the select Select Encryption field.

   The screen populates with the parameters required to define a WPA2-CCMP configuration for the new or existing WLAN.



Select Encryption

□ TKIP-CCMP
☑ WPA2-CCMP
□ WEP 128
□ KeyGuard
□ WEP 64
□ Open

Key Settings

Enter 64 HEX or 8-63 ASCII Characters

Pre-Shared Key ASCII □ Show

Key Rotation

Unicast Rotation Interval □ 30 (30 to 86,400 seconds)

Broadcast Rotation Interval □ 30 (30 to 86,400 seconds)

Advanced

TKIP Countermeasure Hold Time 1 Seconds (0 to 65,535)

Exclude WPA2 TKIP □

Use SHA256 □

Figure 6-13 *WPA2-CCMP screen*

5 Define **Key Settings**.

Pre-Shared Key	Enter either an alphanumeric string of 8 to 63 ASCII characters or 64 HEX characters as the primary string both transmitting and receiving authenticators must share. The alphanumeric string allows character spaces. The string is converted to a numeric value. This passphrase saves the administrator from entering the 256-bit key each time keys are generated.

6 Define **Key Rotation** values.

Unicast messages are addressed to a single device on the network. *Broadcast* messages are addressed to multiple devices. When using WPA2-CCMP, a wireless client can use 2 keys: one unicast key, for its own traffic to and from an Access Point, and one broadcast key, the common key for all the clients in that subnet.

Rotating these keys is recommended so a potential hacker will not have enough data using a single key to attack the deployed encryption scheme.

Unicast Rotation Interval	Define an interval for unicast key transmission in seconds (30 -86,400). Some clients have issues using unicast key rotation, so ensure you know which clients are impacted before using unicast keys. This value is disabled by default.
Broadcast Rotation Interval	When enabled, the key indices used for encrypting/decrypting broadcast traffic are alternatively rotated based on the defined interval. Define an interval for broadcast key transmission in seconds (30-86,400). Key rotation enhances the broadcast traffic security on the WLAN. This value is disabled by default.

7 Set the following **Advanced** for the WPA2-CCMP encryption scheme.

TKIP Countermeasure Hold Time	The TKIP countermeasure hold-time is the time during which the use of the WLAN is disabled if TKIP countermeasures have been invoked on the WLAN. Use the drop-down menu to define a value in either *Hours* (0-18), *Minutes* (0-1,092) or *Seconds* (0-65,535). The default setting is 60 seconds.
Exclude WPA2-TKIP	Select this option for an Access Point to advertise and enable support for only WPA-TKIP. Select this option if certain older clients are not compatible with the newer WPA2-TKIP information elements. Enabling this option allows backwards compatibility for clients that support WPA-TKIP and WPA2-TKIP but do not support WPA2-CCMP. Consider enabling this feature if WPA-TKIP or WPA2-TKIP supported clients operate in a WLAN populated by WPA2-CCMP enabled clients. This feature is disabled by default.
Use SHA256	Select this option for an Access Point to advertise and enable support for only WPA-TKIP. Select this option if certain older clients are not compatible with the newer WPA2-TKIP information elements. Enabling this option allows backwards compatibility for clients that support WPA-TKIP and WPA2-TKIP but do not support WPA2-CCMP. Consider enabling this feature if WPA-TKIP or WPA2-TKIP supported clients operate in a WLAN populated by WPA2-CCMP enabled clients. This feature is disabled by default.

8 Select **OK** when completed to update the WLAN's WPA2-CCMP encryption configuration. Select **Reset** to revert back to its last saved configuration.

WPA2-CCMP Deployment Considerations

▸ *WPA2-CCMP*

Before defining a WPA2-CCMP supported configuration on a wireless controller WLAN, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- WPA2-CCMP should be configured for all new (non visitor) WLANs requiring encryption, as it's supported by the majority of the hardware and client vendors using wireless networking equipment.
- WPA2-CCMP supersedes WPA-TKIP and implements all the mandatory elements of the 802.11i standard. WPA2-CCMP introduces a new AES-based algorithm called CCMP which replaces TKIP and WEP and is considered significantly more secure.

6.1.2.10 WEP 64

▸ *Configuring WLAN Security*

Wired Equivalent Privacy (WEP) is a security protocol specified in the IEEE *Wireless Fidelity* (Wi -Fi) standard. WEP is designed to provide a WLAN with a level of security and privacy comparable to that of a wired LAN.

WEP can be used with open, shared, MAC and 802.1 X EAP authentications. WEP is optimal for WLANs supporting legacy deployments when also used with 802.1X EAP authentication to provide user and device authentication and dynamic WEP key derivation and periodic key rotation. 802.1X provides authentication for devices and also reduces the risk of a single WEP key being deciphered. If 802.1X support is not available on the legacy device, MAC authentication should be enabled to provide device level authentication.

WEP 64 uses a 40 bit key concatenated with a 24-bit initialization vector (IV) to form the RC4 traffic key. WEP 64 is a less robust encryption scheme than WEP 128 (containing a shorter WEP algorithm for a hacker to potentially duplicate), but networks that require more security are at risk from a WEP flaw. WEP is only recommended if there are client devices incapable of using higher forms of security. The existing 802.11 standard alone offers administrators no effective method to update keys.

To configure WEP 64 encryption on a WLAN:

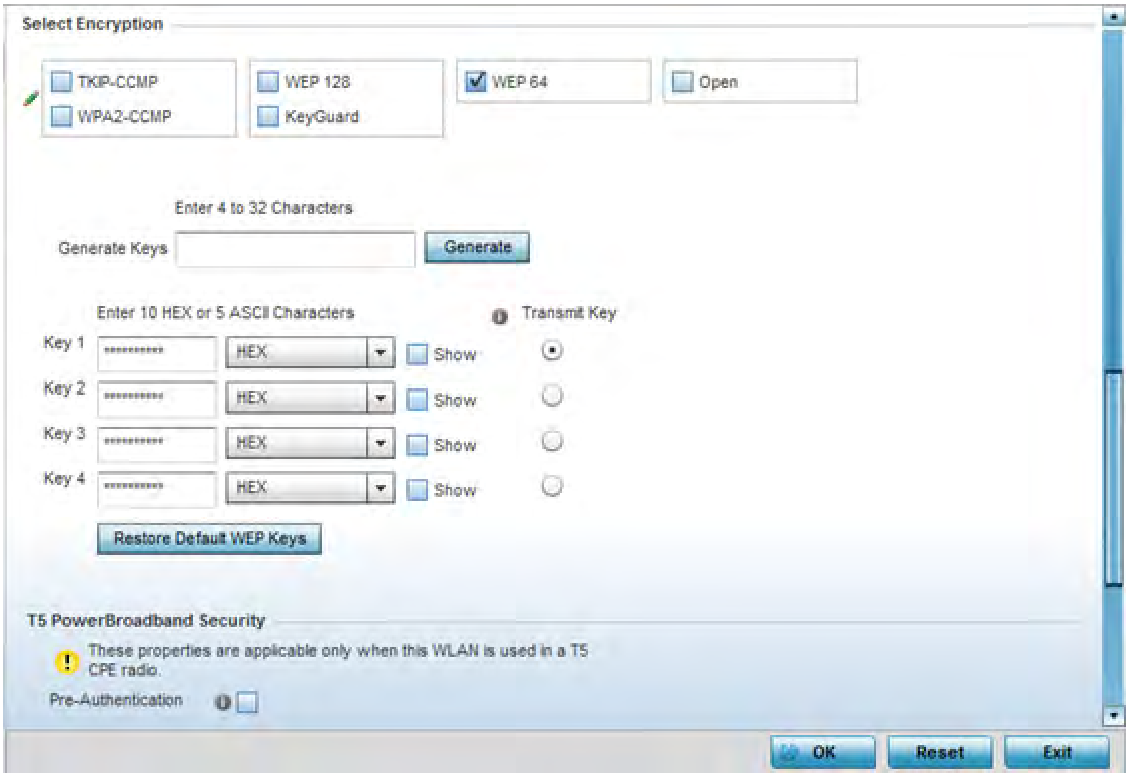
1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select **Edit** to modify the properties of an existing WLAN.

3 Select **Security**.

4 Select the **WEP 64** check box from within the Select Encryption field.

The screen populates with the parameters required to define a WEP 64 configuration for the WLAN.



Select Encryption

☐ TKIP-CCMP ☐ WPA2-CCMP ☐ WEP 128 ☐ KeyGuard ☑ WEP 64 ☐ Open

Enter 4 to 32 Characters

Generate Keys

Enter 10 HEX or 5 ASCII Characters

Transmit Key

Key 1 *********** HEX ☐ Show ●

Key 2 *********** HEX ☐ Show ○

Key 3 *********** HEX ☐ Show ○

Key 4 *********** HEX ☐ Show ○

T5 PowerBroadband Security

These properties are applicable only when this WLAN is used in a T5 CPE radio.

Pre-Authentication ☐

Figure 6-14 *WEP 64 screen*

5 Configure the following WEP 64 settings:

Generate Keys	Specify a 4 to 32 character Pass Key and click the *Generate* button. The pass key can be any alphanumeric string. Wireless devices and their connected clients use the algorithm to convert an ASCII string to the same hexadecimal number. Clients without adapters need to use WEP keys manually configured as hexadecimal numbers.
Keys 1-4	Use the Key #1-4 fields to specify key numbers. For WEP 64 (40-bit key), the keys are 10 hexadecimal characters in length. Select one of these keys for default activation by clicking its radio button. Selecting *Show* displays a key in exposed plain text.
Restore Default WEP Keys	If you feel it necessary to restore the WEP algorithm back to its default settings, click the *Restore Default WEP Keys* button.

Default WEP 64 keys are as follows:

- Key 1 1011121314
- Key 2 2021222324
- Key 3 3031323334
- Key 4 4041424344

6 Select **OK** when completed to update the WLAN's WEP 64 encryption configuration. Select **Reset** to revert the screen back to its last saved configuration.

WEP 64 Deployment Considerations

Before defining a WEP 64 supported configuration on a wireless controller WLAN, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- Additional layers of security (beyond WEP) should be enabled to minimize the likelihood of data loss and security breaches. WEP enabled WLANs should be mapped to an isolated VLAN with firewall policies restricting access to hosts and suspicious network applications.
- WEP enabled WLANs should only be permitted access to resources required by legacy devices.
- If WEP support is needed for WLAN legacy device support, 802.1X EAP authentication should be also configured in order for the WLAN to provide authentication and dynamic key derivation and rotation.

6.1.2.11 WEP 128

▶ *Configuring WLAN Security*

Wired Equivalent Privacy (WEP) is a security protocol specified in the IEEE *Wireless Fidelity* (Wi -Fi) standard. WEP is designed to provide a WLAN with a level of security and privacy comparable to that of a wired LAN.

WEP can be used with open, shared, MAC and 802.1 X EAP authentications. WEP is optimal for WLANs supporting legacy deployments when also used with 802.1X EAP authentication to provide user and device authentication and dynamic WEP key derivation and periodic key rotation. 802.1X provides authentication for devices and also reduces the risk of a single WEP key being deciphered. If 802.1X support is not available on the legacy device, MAC authentication should be enabled to provide device level authentication.

WEP 128 uses a 104 bit key which is concatenated with a 24-bit initialization vector (IV) to form the RC4 traffic key. WEP may be all a small-business user needs for the simple encryption of wireless data. However, networks that require more security are at risk from a WEP flaw. WEP is only recommended if there are client devices incapable of using higher forms of security. The existing 802.11 standard alone offers administrators no effective method to update keys.

WEP 128 provides a more robust encryption algorithm than WEP 64 by requiring a longer key length and pass key. Thus, making it harder to hack through the replication of WEP keys.

To configure WEP 128 encryption on a WLAN:

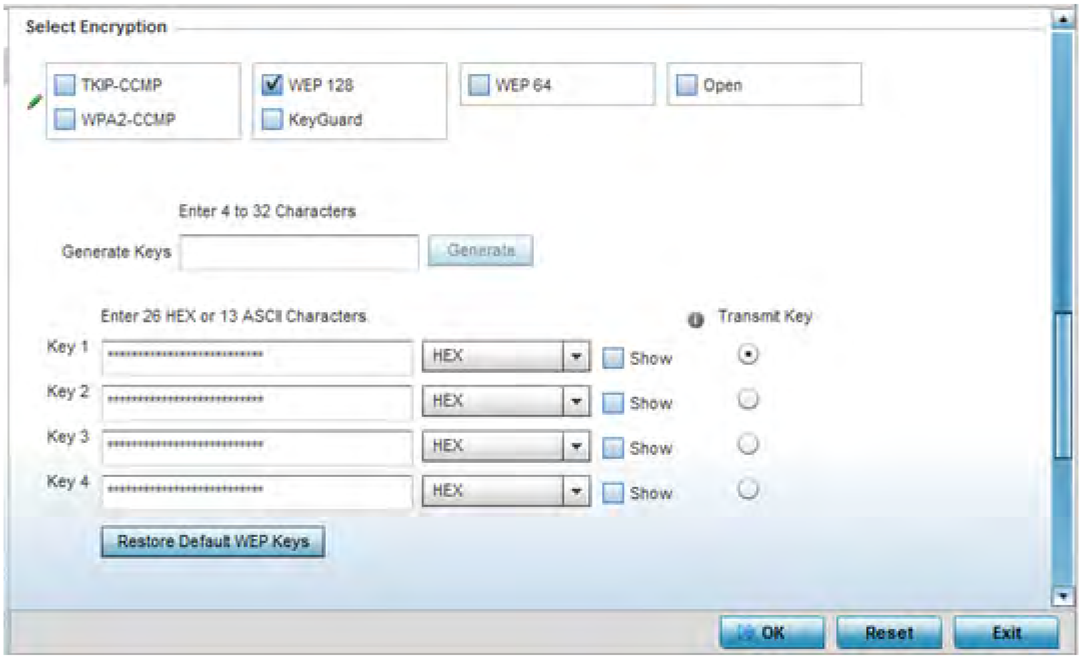
1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select **Edit** to modify the properties of an existing WLAN.

3 Select **Security**.

4 Select the **WEP 128** check box from within the Select Encryption field.

The screen populates with the parameters required to define a WEP 128 configuration for the WLAN.



Select Encryption

☐ TKIP-CCMP ☐ WPA2-CCMP ☑ WEP 128 ☐ KeyGuard ☐ WEP 64 ☐ Open

Enter 4 to 32 Characters

Generate Keys [ ] Generate

Enter 26 HEX or 13 ASCII Characters — Transmit Key

Key 1	******************************	HEX	☐ Show	●
Key 2	******************************	HEX	☐ Show	○
Key 3	******************************	HEX	☐ Show	○
Key 4	******************************	HEX	☐ Show	○

Figure 6-15 *WEP 128 screen*

5 Configure the following WEP 128 settings:

Generate Keys	Specify a 4 to 32 character Pass Key and click the *Generate* button. The pass key can be any alphanumeric string. Wireless devices and their connected clients use the algorithm to convert an ASCII string to the same hexadecimal number. Clients without adapters need to use WEP keys manually configured as hexadecimal numbers.
Keys 1-4	Use the Key #1-4 areas to specify key numbers. For WEP 128 (104-bit key), the keys are 26 hexadecimal characters in length. Select one of these keys for default activation by clicking its radio button. Selecting *Show* displays a key in exposed plain text.
Restore Default WEP Keys	If you feel it necessary to restore the WEP algorithm back to its default settings, click the *Restore Default WEP Keys* button.

Default WEP 128 keys are as follows:

- Key 1 101112131415161718191A1B1C
- Key 2 202122232425262728292A2B2C
- Key 3 303132333435363738393A3B3C
- Key 4 404142434445464748494A4B4C

6 Select **OK** when completed to update the WLAN’s WEP 128 encryption configuration. Select **Reset** to revert the screen back to its last saved configuration.

WEP 128 Deployment Considerations

▸ *WEP 128*

Before defining a WEP 128 supported configuration on a WLAN, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- Additional layers of security (beyond WEP) should be enabled to minimize the likelihood of data loss and security breaches. WEP enabled WLANs should be mapped to an isolated VLAN with firewall policies restricting access to hosts and suspicious network applications.
- WEP enabled WLANs should only be permitted access to resources required by legacy devices.
- If WEP support is needed for WLAN legacy device support, 802.1X EAP authentication should be also configured in order for the WLAN to provide authentication and dynamic key derivation and rotation.

6.1.2.12 Keyguard

▸ *Configuring WLAN Security*

Keyguard is a form of WEP, and could be all a small business needs for the simple encryption of wireless data.

KeyGuard is a proprietary encryption method, and an enhancement to WEP encryption, and was developed before the finalization of WPA-TKIP. The Keyguard encryption implementation is based on the IEEE Wi-Fi standard, 802.11i.

To configure Keyguard encryption on a WLAN:

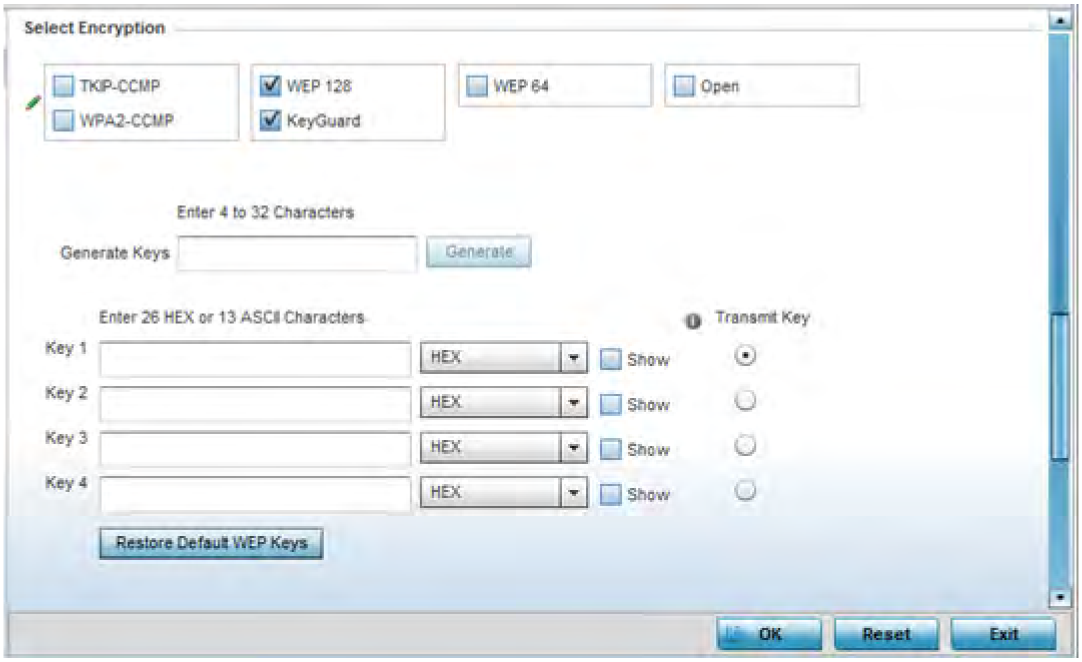
1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select **Edit** to modify the properties of an WLAN.

3 Select **Security**.

4 Select the **Keyguard** check box from within the Select Encryption field.

The screen populates with the parameters required to define a KeyGuard configuration for the WLAN.



Select Encryption

□ TKIP-CCMP
□ WPA2-CCMP
☑ WEP 128
☑ KeyGuard
□ WEP 64
□ Open

Enter 4 to 32 Characters

Generate Keys

Enter 26 HEX or 13 ASCII Characters

Key 1 HEX □ Show ● Transmit Key
Key 2 HEX □ Show ○
Key 3 HEX □ Show ○
Key 4 HEX □ Show ○

Figure 6-16 *WLAN KeyGuard Configuration screen*

5 Configure the following Keyguard settings:

Generate Keys	Specify a 4 to 32 character Pass Key and click the *Generate* button. The pass key can be any alphanumeric string. Clients use the algorithm to convert an ASCII string to the same hexadecimal number. Clients without adapters need to use keys manually configured as hexadecimal numbers.

Keys 1-4	Use the Key #1-4 areas to specify key numbers. For Keyguard (104-bit key), the keys are 26 hexadecimal characters in length. Select one of these keys for default activation by clicking its radio button. Selecting *Show* displays a key in exposed plain text.
Restore Default WEP Keys	If you feel it necessary to restore the Keyguard algorithm back to its default settings, click the *Restore Default WEP Keys* button. This may be the case if the latest defined algorithm has been compromised and no longer provides its former measure of data security.

Default WEP Keyguard keys are as follows:

- Key 1 101112131415161718191A1B1C
- Key 2 202122232425262728292A2B2C
- Key 3 303132333435363738393A3B3C
- Key 4 404142434445464748494A4B4C

6 Select **OK** when completed to update the WLAN's Keyguard encryption configuration. Select **Reset** to revert the screen back to its last saved configuration.

KeyGuard Deployment Considerations

Keyguard

Before defining a Keyguard configuration on a WLAN, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- Authentication techniques can also be enabled on WLANs supporting other proprietary techniques, such as KeyGuard.
- A WLAN using KeyGuard to support legacy devices should also use largely limited to the support of just those legacy clients using KeyGuard.

6.1.2.13 T5 Controller Security

Configuring WLAN Security

A T5 controller, once enabled as a supported external device, can provide data to WiNG to assist in a T5's management within a WiNG supported subnet populated by both types of devices. The *Customer Premises Equipment* (CPEs) are the T5 controller managed radio devices. These CPEs use *Digital Subscriber Line* (DSL) as their high speed Internet access mechanism using the CPE's physical wallplate connection and phone jack.

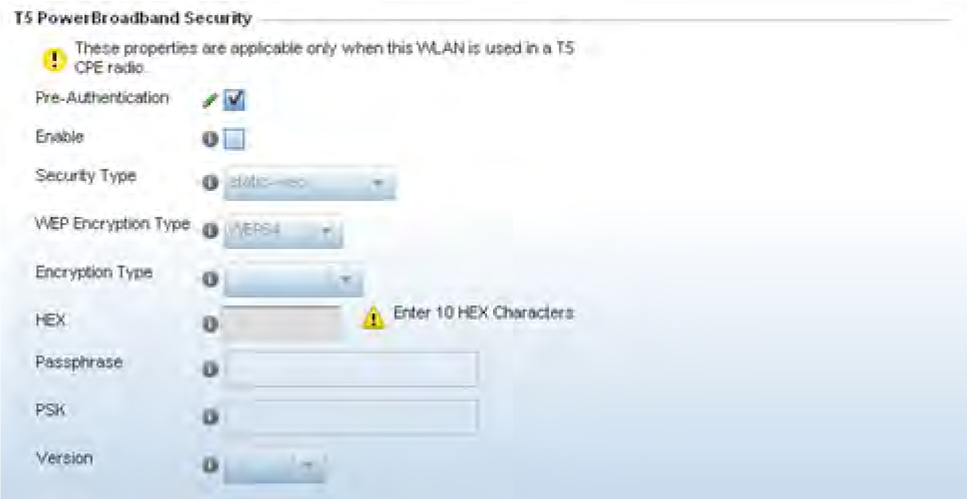
To configure WLAN security settings for a T5 controller and its connected CPEs:

1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select **Edit** to modify the properties of an WLAN.

3 Select **Security**.

4 Refer to the **T5 PowerBroadband Security** field at the bottom of the screen.



T5 PowerBroadband Security

These properties are applicable only when this WLAN is used in a T5 CPE radio.

Pre-Authentication ☑

Enable □

Security Type static-wep

WEP Encryption Type WEP64

Encryption Type

HEX

Enter 10 HEX Characters

Passphrase

PSK

Version

Figure 6-17 *T5 PowerBroadband Security screen*

5 Configure the following **T5 PowerBroadband Security** settings (available only when the WLAN supports T5 controllers and their connected CPEs radio devices):

Pre-Authentication	Select this option to invoke the use of pre-authentication 802.11i fast roaming. This setting is disabled by default.
Enable	Select this option to enable the *Security Type* and *WEP Encryptions Type* drop-down menus used to define and apply different encryption and authentication settings to the T5 WLAN security configuration.
Security Type	Use the drop-down menu to select the security type to apply to the WLAN. Options include *static-wep* (default), *wpa-enterprise* and *wpa-personal*.
WEP Encryption Type	If *static-wep* is selected as the Encryption Type, use this setting to apply either a WEP64 or WEP128 encryption algorithm to the T5 support WLAN configuration.
Encryption Type	If *wpa-enterprise* or *wpa-personal* are selected as the Encryption Type, use this setting to apply either a CCMP, TKIP or TKIP-CCMP encryption algorithm to the T5 controller WLAN security configuration.
HEX	If using *static-wep,* provide the 10-26 character Hex password used to derive the security key.
Passphrase	If using *static-wep,* enter either an alphanumeric string of 8 to 63 ASCII characters or 64 HEX characters as the primary string both transmitting and receiving authenticators must share. The alphanumeric string allows character spaces. The string is converted into a numeric value. This passphrase saves the administrator from entering the 256-bit key each time keys are generated.
PSK	Enter either an alphanumeric string as the primary string both transmitting and receiving authenticators must share. The alphanumeric string allows character spaces. The string is converted into a numeric value. This passphrase saves the administrator from entering the 256-bit key each time keys are generated.
Version	If *wpa-enterprise* or *wpa-personal* are selected as the Encryption Type, use this setting to apply a WPA or WPA2 encryption scheme to the T5 support WLAN configuration.

6 Select **OK** when completed to update the T5 PowerBroadband Security configuration. Select **Reset** to revert the screen back to its last saved configuration.

6.1.3 Configuring WLAN Firewall Support

▸ *Wireless LAN Policy*

A firewall is a mechanism enforcing access control, and is considered a first line of defense in protecting proprietary information within the network. The means by which this is accomplished varies, but in principle, a firewall can be thought of as mechanisms both blocking and permitting data traffic. For an overview of firewalls, see *Wireless Firewall on page 10-1*.

WLANs use firewalls like *Access Control Lists* (ACLs) to filter/mark packets based on the WLAN from which they arrive, as opposed to filtering packets on Layer 2 ports. An ACL contains an ordered list of *Access Control Entries* (ACEs). Each ACE specifies an action and a set of conditions (rules) a packet must satisfy to match the ACE. The order of conditions in the list is critical since filtering is stopped after the first match.

IPv4 and IPv6 based firewall rules are specific to source and destination IP addresses and the unique rules and precedence orders assigned. Both IP and non-IP traffic on the same Layer 2 interface can be filtered by applying both an IP ACL and a MAC.

Additionally, administrators can filter Layer 2 traffic on a physical Layer 2 interface using MAC addresses. A MAC firewall rule uses source and destination MAC addresses for matching operations, where the result is a typical allow, deny or mark designation to WLAN packet traffic.

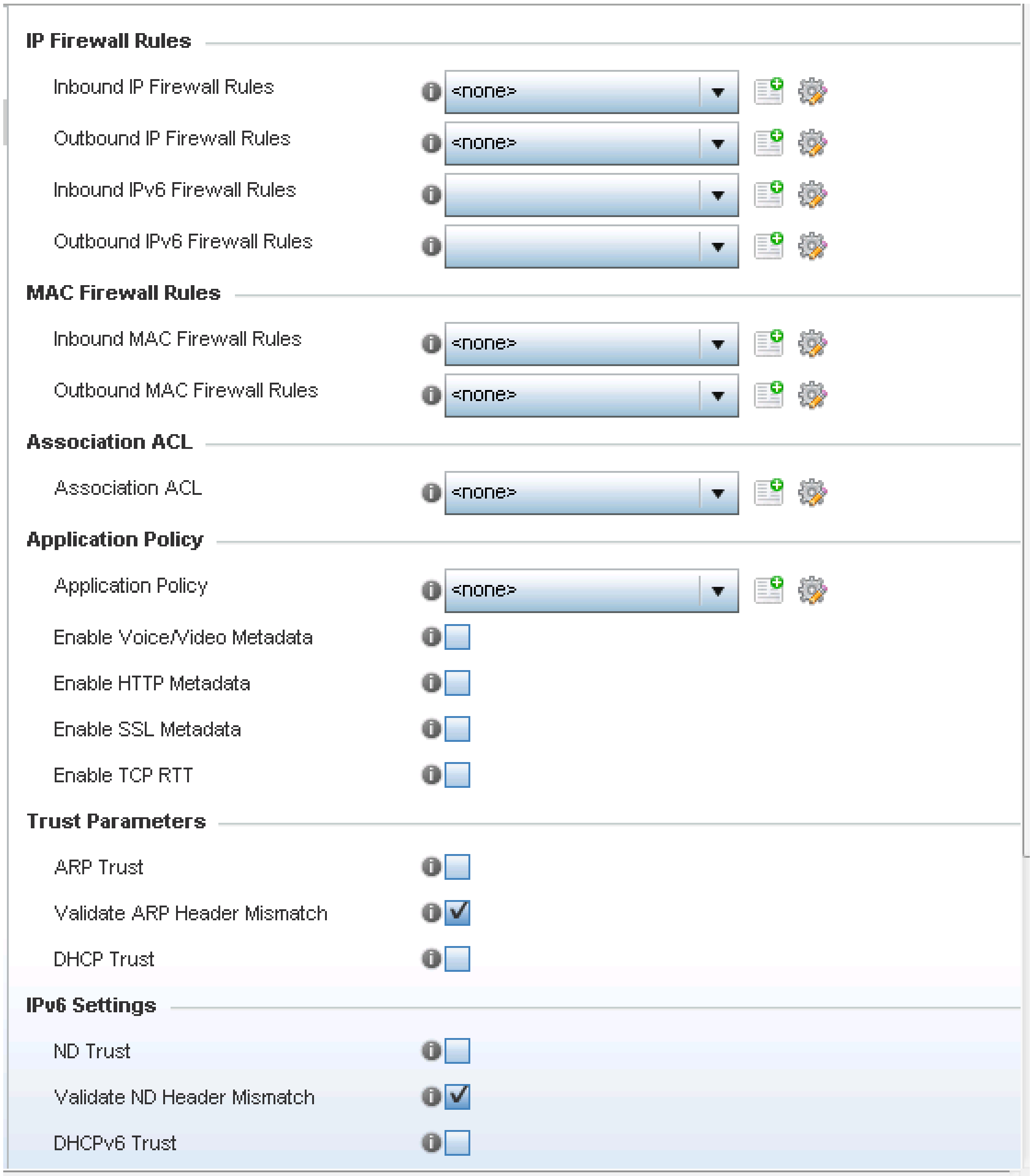
Keep in mind IP and non-IP traffic on the same Layer 2 interface can be filtered by applying both an IP ACL and a MAC ACL to the interface.

To review access policies, create a new policy or edit the properties of an existing policy:

1 Select **Configuration** > **Wireless LANs** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create a new WLAN or **Edit** to modify the properties of an existing WLAN.

3 Select **Firewall** from the Wireless LAN Policy options.



IP Firewall Rules

Inbound IP Firewall Rules <none>

Outbound IP Firewall Rules <none>

Inbound IPv6 Firewall Rules

Outbound IPv6 Firewall Rules

MAC Firewall Rules

Inbound MAC Firewall Rules <none>

Outbound MAC Firewall Rules <none>

Association ACL

Association ACL <none>

Application Policy

Application Policy <none>

Enable Voice/Video Metadata □

Enable HTTP Metadata □

Enable SSL Metadata □

Enable TCP RTT □

Trust Parameters

ARP Trust □

Validate ARP Header Mismatch ☑

DHCP Trust □

IPv6 Settings

ND Trust □

Validate ND Header Mismatch ☑

DHCPv6 Trust □

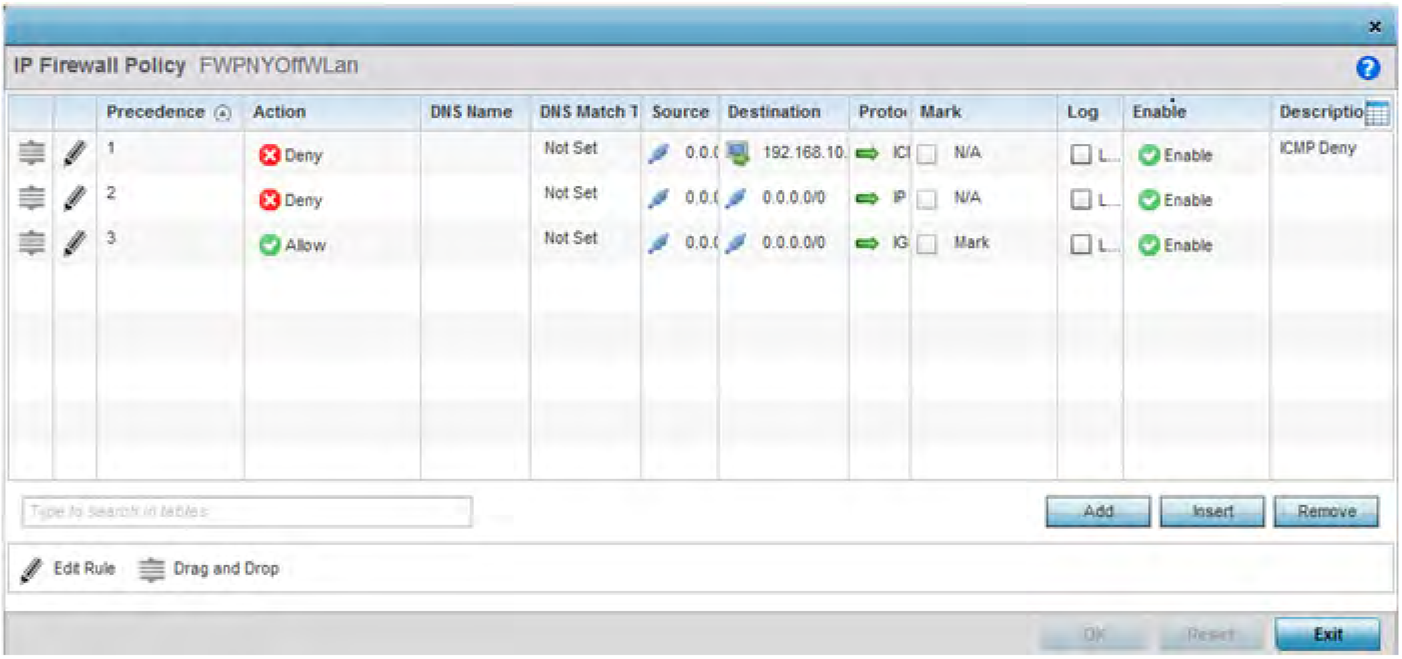
Figure 6-18 *WLAN Policy Firewall screen*

The screen displays editable fields for *IP Firewall Rules*, *MAC Firewall Rules*, *Trust Parameters, IPv6 Settings* and *Wireless Client Deny* limits.

Select an existing **Inbound IP Firewall Rule** and **Outbound IP Firewall Rule** using the drop-down menu. If no rules exist, select the **Create** icon to display a screen where Firewall rules can be created. Select the **Edit** icon to modify the configuration of a selected Firewall policy configuration.

4 If creating a new IP firewall rule, provide a name up to 32 characters.

5 Select the **Add** button.



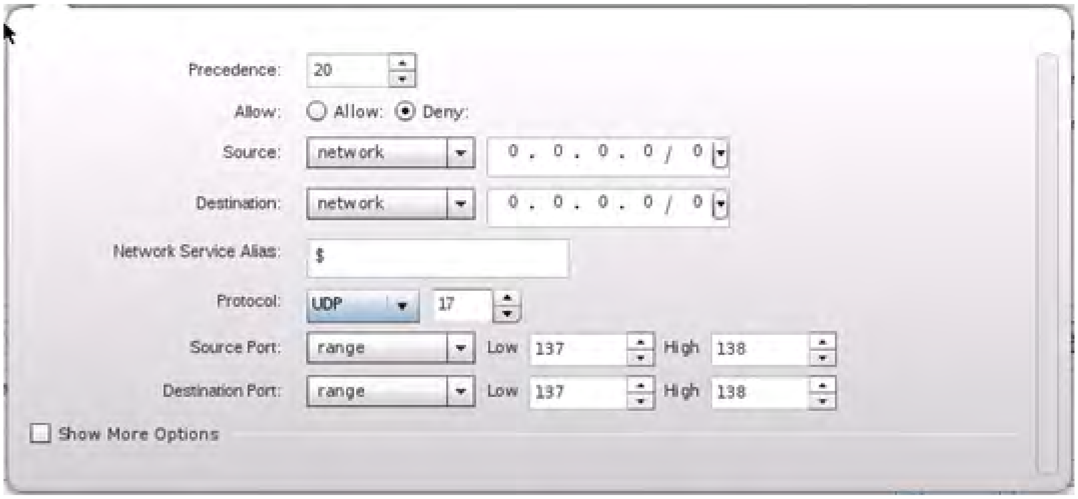
IP Firewall Policy FWPNYOffWLan

		Precedence	Action	DNS Name	DNS Match T	Source	Destination	Proto	Mark	Log	Enable	Descriptio
		1	☒ Deny		Not Set	0.0.(	192.168.10.	ICI	□ N/A	□ L...	✓ Enable	ICMP Deny
		2	☒ Deny		Not Set	0.0.(	0.0.0.0/0	IP	□ N/A	□ L...	✓ Enable	
		3	✓ Allow		Not Set	0.0.(	0.0.0.0/0	IG	□ Mark	□ L...	✓ Enable	

Figure 6-19 *IP Firewall Rules screen*

6 IP firewall rule configurations can either be modified as a collective group of variables or selected and updated individually as their filtering attributes require a more refined update.

a. Select the **Edit Rule** icon to the left of a particular IP firewall rule configuration to update its parameters collectively.



Precedence: 20

Allow: ○ Allow: ● Deny:

Source: network 0 . 0 . 0 . 0 / 0

Destination: network 0 . 0 . 0 . 0 / 0

Network Service Alias: $

Protocol: UDP 17

Source Port: range Low 137 High 138

Destination Port: range Low 137 High 138

□ Show More Options

Figure 6-20 *IP Firewall Rules Add Criteria screen*

b. Click the icon within the **Description** column (top right-hand side of the screen) and select IP filter values as needed to add criteria into the configuration of the IP ACL.

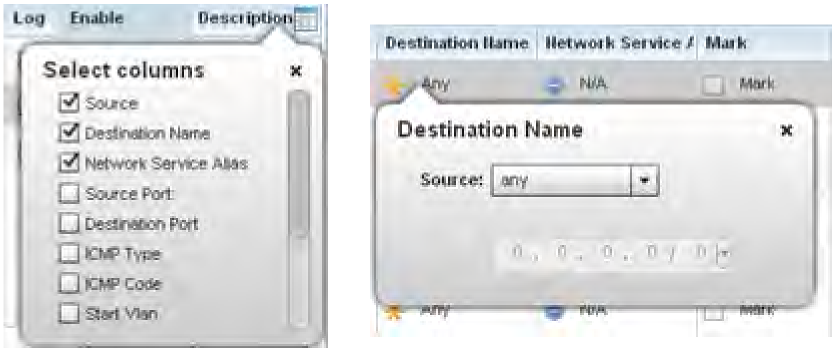


Figure 6-21 *IP Firewall Rules Add Criteria screen*

NOTE: Only those selected IP ACL filter attributes display. Each value can have its current setting adjusted by selecting that IP ACL's column to display a pop-up to adjust that one value.

7 Define the following IP firewall rule settings as required:

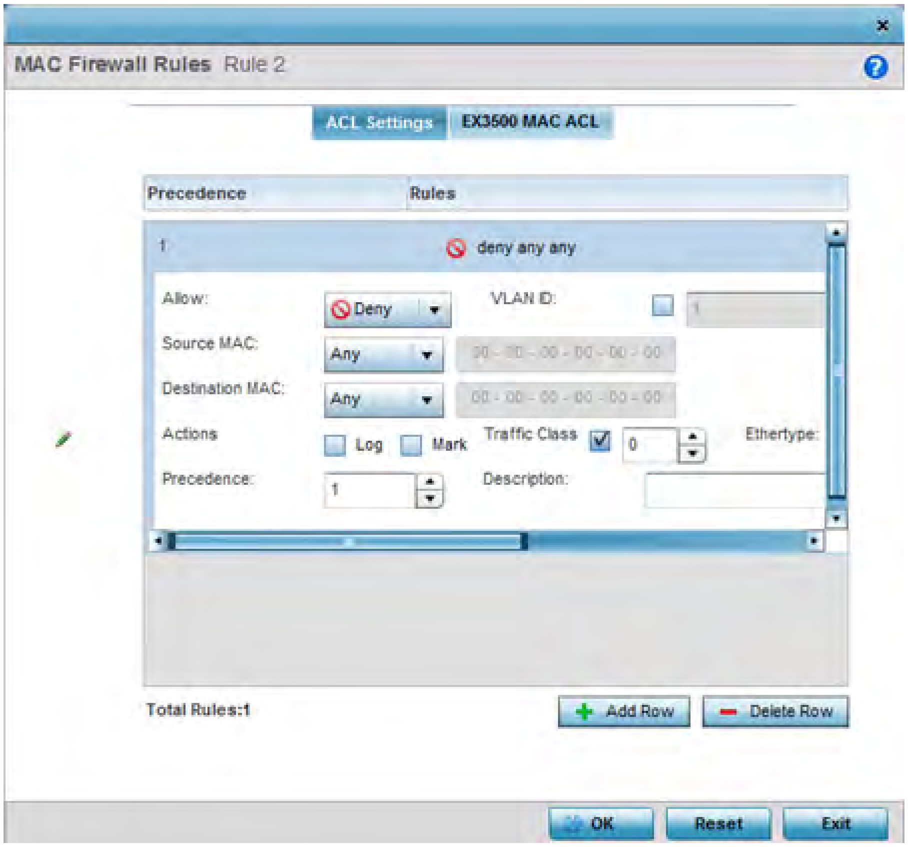
Precedence	Specify or modify a precedence for this IP policy between 1-5000. Rules with lower precedence are always applied to packets first. If modifying a precedence to apply a higher integer, it will move down the table to reflect its lower priority.
Action	Every IP Firewall rule is made up of matching criteria rules. The action defines the packet's disposition if it matches the specified criteria. The following actions are supported: *Deny* - Instructs the Firewall to restrict a packet from proceeding to its destination. *Allow* - Instructs the Firewall to allow a packet to proceed to its destination.
DNS Name	Specify the DNS Name which may be a full domain name, a portion of a domain name or a suffix. This name is used for the DNS Match Type criteria.
DNS Match Type	Specify the DNS matching criteria that the DNS Name can be matched against. This can be configured as an exact match for a DNS domain name, a suffix for the DNS name or a domain that contains a portion of the DNS name. If traffic matches the configured criteria in the DNS Match Type, that rule will be applied to the ACL.
Source	Select the source IP address or network group configuration used as basic matching criteria for this IP ACL rule.
Destination	Determine whether filtered packet destinations for this IP firewall rule do not require any classification (*any*), are designated as a set of configurations consisting of protocol and port mappings (an *alias*), set as a numeric IP address (*host*) or defined as *network* IP and mask. Selecting alias requires a destination network group alias be available or created.
Network Service Alias	The *service alias* is a set of configurations consisting of protocol and port mappings. Both source and destination ports are configurable. Set an alphanumeric service alias (beginning with a $) and include the protocol as relevant. Selecting either *tcp* or *udp* displays an additional set of specific TCP/UDP source and destinations port options.

Source Port	If using either *tcp* or *udp* as the protocol, define whether the source port for incoming IP ACL rule application is *any*, *equals* or an administrator defined *range*. If not using tcp or udp, this setting displays as N/A. This is the data local origination port designated by the administrator. Selecting *equals* invokes a spinner control for setting a single numeric port. Selecting *range* displays spinner controls for *Low* and *High* numeric range settings. A source port cannot be a destination port.
Destination Port	If using either *tcp* or *udp* as the protocol, define whether the destination port for outgoing IP ACL rule application is *any, equals* or an administrator defined *range.* If not using tcp or udp, this setting displays as N/A. This is the data destination virtual port designated by the administrator. Selecting *equals* invokes a spinner control for setting a single numeric port. Selecting *range* displays spinner controls for *Low* and *High* numeric range settings.
ICMP Type	Selecting *ICMP* as the protocol for the IP rule displays an additional set of ICMP specific options for ICMP type and code. The *Internet Control Message Protocol* (ICMP) uses messages identified by numeric *type*. ICMP messages are used for packet flow control or generated in IP error responses. ICMP errors are directed to the source IP address of the originating packet. Assign an ICMP type from 1-10.
ICMP Code	Selecting *ICMP* as the protocol for the IP rule displays an additional set of ICMP specific options for ICMP type and code. Many ICMP types have a corresponding *code*, helpful for troubleshooting network issues (0 - *Net Unreachable,* 1 *Host Unreachable*, 2 *Protocol Unreachable* etc.).
Start VLAN	Select a Start VLAN icon within a table row to set (apply) a start VLAN range for this IP ACL filter. The Start VLAN represents the virtual LAN beginning numeric identifier arriving packets must adhere to in order to have the IP ACL rules apply.
End VLAN	Select an End VLAN icon within a table row to set (apply) an end VLAN range for this IP ACL filter. The End VLAN represents the virtual LAN end numeric identifier arriving packets must adhere to in order to have the IP ACL rules apply.
Mark	Select an IP Firewall rule's *Mark* checkbox to enable or disable event marking and set the rule's 8021p or dscp level (from 0 - 7).
Log	Select an IP Firewall rule's *Log* checkbox to enable or disable event logging for this rule's usage.
Enable	Select an IP Firewall rule's *Enable* or *Disable* icon to determine this rule's inclusion with the IP firewall policy.
Description	Lists the administrator assigned description applied to the IP ACL rule. Select a description within the table to modify its character string as filtering changes warrant. Select the icon within the Description table header to launch a *Select Columns* screen used to add or remove IP ACL criteria from the table.

8 Select existing inbound and outbound **MAC Firewall Rules** using the drop-down menu. If no rules exist, select **Create** to display a screen where Firewall rules can be created. MAC firewall rules can also be applied to an EX3500 Ethernet PoE switch connected and utilized by a WiNG managed device.

9 Select the **+ Add Row** button.

10 Select the added row to expand it into configurable parameters.



Precedence	Rules
1	deny any any

Allow: Deny

VLAN ID: □ 1

Source MAC: Any 00 - 00 - 00 - 00 - 00 - 00

Destination MAC: Any 00 - 00 - 00 - 00 - 00 - 00

Actions: □ Log □ Mark

Traffic Class: ☑ 0

Ethertype:

Precedence: 1

Description:

Total Rules:1

Figure 6-22 *MAC Firewall Rules screen*

11 Define the following parameters for either the inbound or outbound MAC Firewall Rules for either a WiNG managed device or an EX3500 switch connected to a WiNG managed device:

Allow	Every IP Firewall rule is made up of matching criteria rules. The action defines what to do with the packet if it matches the specified criteria. The following actions are supported: *Deny* - Instructs the Firewall to deny a packet from proceeding to its destination. *Permit* - Instructs the Firewall to allow a packet to proceed to its destination.
VLAN ID	Enter a VLAN ID representative of the shared SSID each user employs to interoperate within the network (once authenticated by the local RADIUS server). The VLAN ID can be between 1 - 4094. EX3500 PoE switches utilize a VLAN Mask option (from 0 - 4095) to mask the exposure of the VLAN ID.
Match 802.1P	Configures IP DSCP to 802.1p priority mapping for untagged frames. Use the spinner control to define a setting between 0-7.
Source and Destination MAC	Enter both *Source* and *Destination* MAC addresses. The wireless controller uses the source IP address, destination MAC address as basic matching criteria. Provide a subnet mask if using a mask.

Action	The following actions are supported: *Log* - Creates a log entry that a Firewall rule has allowed a packet to either be denied or permitted. *Mark* - Modifies certain fields inside the packet and then permits them. Therefore, mark is an action with an implicit permit. *Mark, Log* - Conducts both mark and log functions.
Traffic Class	Sets an ACL traffic classification value for the packets identified by this inbound MAC filter. Traffic classifications are used for QoS purposes. Use the spinner to define a traffic class from 1- 10.
Ethertype	Use the drop-down menu to specify an Ethertype of either *ipv6*, *arp*, *wisp* or *monitor 8021q*. An EtherType is a two-octet field within an Ethernet frame. It is used to indicate which protocol is encapsulated in the payload of an Ethernet frame. EX3500 PoE switches utilize an Ether Mask option (from 0 - 65535) to mask the exposure of the Ethertype.
Precedence	Use the spinner control to specify a precedence for this MAC Firewall rule between 1-1500. Access policies with lower precedence are always applied first to packets.
Description	Provide an ACL setting description (up to 64 characters) for the rule to help differentiate the it from others with similar configurations.

12 If creating a new **Association ACL**, provide a name specific to its function. Avoid naming it after a WLAN it may support. The name cannot exceed 32 characters.

13 Assign an **Application Policy** to the firewall and set the following metadata extraction rules:

Application Policy	Use the drop-down menu to assign an application policy to the WLAN’s firewall configuration. When an application is recognized and classified by the WiNG application recognition engine, administrator defined actions can be applied to that specific application. An application policy defines the rules or actions executed on recognized HTTP, SSL and voice/video applications. For more information, refer to *Application on page 7-58*.
Voice/Video Metadata	Select this option to enable the extraction of voice and video metadata flows. When enabled, administrators can track voice and video calls by extracting parameters (packets transferred and lost, jitter, audio codec and application name). Most Enterprise VoIP applications like facetime, skype for business and VoIP terminals can be monitored for call quality and visualized on the NSight dashboard in manner similar to HTTP and SSL. Call quality and metrics can only be determined from calls established unencrypted. This setting is disabled by default.
HTTP Metadata	Select this option to enable the extraction of HTTP flows. When enabled, administrators can track HTTP Websites accessed by both internal and guest clients and visualize HTTP data usage, hits, active time and total clients on the NSight application’s dashboard. This setting is disabled by default.
SSL Metadata	Select this option to enable the extraction of SSL flows. When enabled, administrators can track SSL Websites accessed by both internal and guest clients and visualize SSL data usage, hits, active time and total clients on the NSight application’s dashboard.This setting is disabled by default.

Enable TCP RTT	Select this option to enable the extraction of *Round Trip Time* (RTT) from *Transmission Control Protocol (TCP)* flows. When enabled, the RTT information from TCP flows detected on the VLAN interface associated with the WLAN is extracted and forwarded to the NSight server by Access Points. However, this TCP-RTT metadata is viewable only on the NSight dashboard. Therefore, ensure the NSight server is up, an NSight policy (pointing to the NSight server) is applied on the Access Point's RF Domain, and NSight analytics data collection is enabled. This setting is disabled by default.

14 Set the following **Trust Parameters**:

ARP Trust	Select the check box to enable ARP Trust on this WLAN. ARP packets received on this WLAN are considered trusted and information from these packets is used to identify rogue devices within the network. This setting is disabled by default.
Validate ARP Header Mismatch	Select this option to verify the mismatch for source MAC in the ARP and Ethernet headers. By default, mismatch verification is enabled.
DHCP Trust	Select the check box to enable DHCP trust on this WLAN. This setting is disabled by default.

15 Set the following **IPv6 Settings**:

ND Trust	Select this option to enable the trust of neighbor discovery requests on an IPv6 supported firewall on this WLAN. This setting is disabled by default.
Validate ND Header Mismatch	Select this option to enable a mismatch check for the source MAC within the ND header and Link Layer Option. This setting is enabled by default.
DHCPv6 Trust	Select this option to enable the trust all DHCPv6 responses on this WLAN's firewall. DHCPv6 is a networking protocol for configuring IPv6 hosts with IP addresses, IP prefixes or other configuration attributes required on an IPv6 network. This setting is disabled by default.
RA Guard	Select this option to enable router advertisements or ICMPv6 redirects on this WLAN's firewall. This setting is disabled by default.

16 Set the following **Wireless Client Deny** configuration:

Wireless Client Denied Traffic Threshold	If enabled, any associated client which exceeds the thresholds configured for storm traffic is either deauthenticated or blacklisted depending on the selected action. The threshold range is 1-1000000 packets per second. This feature is disabled by default.
Action	If enabling a wireless client threshold, use the drop-down menu to determine whether clients are deauthenticated when the threshold is exceeded or blacklisted from connectivity for a user defined interval. Selecting *None* applies no consequence to an exceeded threshold.
Blacklist Duration	Select the check box and define a setting between 0 - 86,400 seconds. Once the blacklist duration has been exceeded, offending clients can reauthenticate once again.

17 Set a **Firewall Session Hold Time** in either *Seconds* (1 - 300) or *Minutes* (1 - 5). This is the hold time for caching user credentials and firewall state information when a client roams. The default setting is 30 seconds.

18 Select **OK** when completed to update this WLAN's Firewall settings. Select **Reset** to revert the screen back to its last saved configuration.

WLAN Firewall Deployment Considerations

Before defining an access control configuration on a WLAN, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- IP and non-IP traffic on the same Layer 2 interface can be filtered by applying both an IP ACL and a MAC ACL to the interface.

6.1.4 Configuring Client Settings

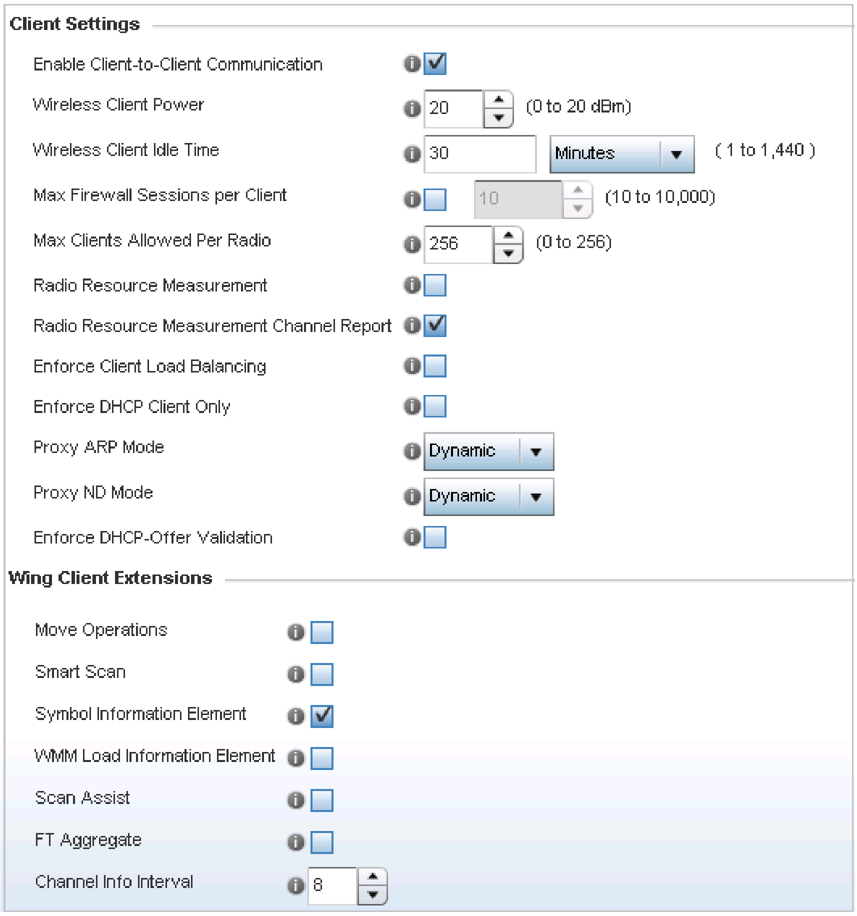
Wireless LAN Policy

Each WLAN can maintain its own unique client support configuration. These include wireless client inactivity timeouts and broadcast settings.

1 Select **Configuration** > **Wireless** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN, or select and existing WLAN and **Edit** to modify its properties.

3 Select the **Client Settings** tab.



Client Settings

Enable Client-to-Client Communication ☑

Wireless Client Power 20 (0 to 20 dBm)

Wireless Client Idle Time 30 Minutes (1 to 1,440)

Max Firewall Sessions per Client □ 10 (10 to 10,000)

Max Clients Allowed Per Radio 256 (0 to 256)

Radio Resource Measurement □

Radio Resource Measurement Channel Report ☑

Enforce Client Load Balancing □

Enforce DHCP Client Only □

Proxy ARP Mode Dynamic

Proxy ND Mode Dynamic

Enforce DHCP-Offer Validation □

Wing Client Extensions

Move Operations □

Smart Scan □

Symbol Information Element ☑

WMM Load Information Element □

Scan Assist □

FT Aggregate □

Channel Info Interval 8

Figure 6-23 *WLAN Policy Client Settings screen*

4 Define the following **Client Settings** for the WLAN:

Enable Client-to-Client Communication	Select this option to enable client to client communication within this WLAN. The default is enabled, meaning clients are allowed to exchange packets with other clients. It does not necessarily prevent clients on other WLANs from sending packets to this WLAN, but as long as this setting also disabled on that WLAN, clients are not permitted to interoperate.
Wireless Client Power	Use this parameter to set the maximum transmit power (between 0 - 20 dBm) communicated to wireless clients for transmission within the network. The default value is 20 dBm.
Wireless Client Idle Time	Set the maximum amount of time wireless clients are allowed to be idle within this WLAN. Set the idle time in either *Seconds* (60 - 86,400), *Minutes* (1 - 1,440), *Hours* (1 - 24) or *Days* (1). When this setting is exceeded, the client is no longer able to access resources and must re-authenticate. The default value is 1,800 seconds.
Max Firewall Sessions per Client	Select this option to set the maximum amount of sessions (between 10 - 10,000) clients within the network over the Firewall. When enabled, this parameter limits the number of simultaneous sessions allowed by the Firewall per wireless client. This feature is disabled by default.
Max Clients Allowed Per Radio	Use the spinner control to set the maximum number of clients (from 0 - 256) allowed to associate to each radio within this WLAN. The default setting is 256.
Radio Resource Measurement	Select this option to enable radio resource measurement capabilities (IEEE 802.11k) on this WLAN. 802.11k improves how traffic is distributed. In a WLAN, each device normally connects to an Access Point with the strongest signal. Depending on the number and locations of the clients, this arrangement can lead to excessive demand on one Access Point and underutilization others, resulting in degradation of overall network performance. With 802.11k, if the Access Point with the strongest signal is loaded to its capacity, a client connects to a underutilized Access Point. Even if the signal is weaker, the overall throughput is greater since it's an efficient use of the network's resources. This setting is disabled by default.
Radio Resource Measurement Channel Report	Select this option to enable radio resource measurement channel reporting (IEEE 802.11k) on this WLAN. This setting is disabled by default.
Enforce Client Load Balancing	Select the check box to distribute clients evenly amongst associated Access Point radios. This feature is disabled by default. Loads are balanced by ignoring association and probe requests. Probe and association requests are not responded to, forcing a client to associate with another Access Point radio.
Enforce DHCP Client Only	Select the check box to enforce that the firewall only allows packets from clients if they used DHCP to obtain an IP address, disallowing static IP addresses. This feature is disabled by default.
Proxy ARP Mode	Use the drop-down menu to define the proxy ARP mode as either *Strict* or *Dynamic*. Proxy ARP is the technique used to answer ARP requests intended for another system. By faking its identity, the Access Point accepts responsibility for routing packets to the actual destination. Dynamic is the default value.

Proxy ND Mode	Use the drop-down menu to define the proxy *neighbor discovery* (ND) mode for WLAN member clients as either *Strict* or *Dynamic*. ND Proxy is used in IPv6 to provide reachability by allowing the a client to act as proxy. Proxy certificate signing can be done either dynamically (requiring exchanges of identity and authorization information) or statically when the network topology is defined. Dynamic is the default value.
Enforce DHCP-Offer Validation	Select the check box to enforce DHCP offer validation. The default setting is disabled.

5 Define the following **Wing Client Extensions** to potentially increase client roaming reliability and handshake speed:

Move Operations	Select the check box to enable the use of *Hyper-Fast Secure Roaming* (HFSR) for clients utilizing this WLAN. This feature applies only to certain client devices. This feature is disabled by default.
Smart Scan	Enable smart scan to adjust clients channel scans to a few channels as opposed to all available channels. This feature is disabled by default.
Symbol Information Element	Select the check box to support the Symbol Information Element with legacy Symbol Technology clients, thus making them optimally interoperable with the latest Extreme Networks Access Points. The default setting is enabled.
WMM Load Information Element	Select the check box to support a WMM Load Information Element in radio transmissions with legacy clients. The default setting is disabled.
Scan Assist	Enable scan assist to achieve faster roams on DFS channels by eliminating passive scans. Clients would get channel information directly from possible roam candidates. This setting is disabled by default.
FT Aggregate	Enable *fast transition* (FT) aggregate to increase roaming speed by eliminating separate key exchange handshake frames with potential roam candidates. Enable fast transition to complete an initial FT over DS handshake with multiple roam candidates (up to 6) at once, eliminating the need to send separate FT over DS handshakes to each roam candidate. This setting is disabled by default.
Channel Info Interval	Configure the channel information interval to periodically retrieve channel information directly from potential roam candidates without making a scan assist request.

6 Define the following **Coverage Hole Detection** settings to determine how detected coverage holes are managed:

Enable	Enable this setting to inform an Access Point when it experiences a coverage hole (area of poor wireless coverage). This setting is disabled by default.
Use 11k Clients	Optionally enable this setting to also use 802.11k-only-capable clients to detect coverage holes. This is a reduced set of coverage hole detection capabilities (only standard 11k messages and behaviors). This setting is disabled by default.
Threshold	Use the spinner control to set the Access Point signal strength (as seen by the client) below which a coverage hole incident is reported. The threshold can be set from -80 to -60.

Offset	Use the spinner control to set the offset added to the threshold to obtain the Access Point signal strength (as seen by the client) considered adequate. The offset can be set from 5 to 20.

7 Set the following **AP Attributes Information**:

Enable	Select this option to include the AP-Attributes information element in the beacon. The information element helps clients recognize which wing-extensions are supported by the AP. This setting is enabled by default.
Include Hostname	Select this option to include the AP's hostname in the AP-Attributes information element. This setting is disabled by default.

8 Define the following **Timeout Settings** for the WLAN:

Credential Cache Timeout	Set a timeout period for the credential cache in *Days*, *Hours*, *Minutes* or *Seconds.*
VLAN Cache Timeout	Set a timeout period for the VLAN cache in *Days*, *Hours*, *Minutes* or *Seconds.*

9 Select **Controller Assisted Mobility,** within the **Mobility** field, to use a controller or service platform's mobility database to assist in roaming between RF Domains. This feature is disabled by default.

10 Use the **Device ID** settings, within the **OpenDNS** field, to specify a 16 character maximum OpenDNS device ID forwarded in a DNS query. OpenDNS extends DNS by adding additional features such as misspelling correction, phishing protection, and optional content filtering.

11 Select **Client Isolation**, within the **T5 PowerBroadband Client Settings** field, to disallow clients connecting to the WLAN to communicate with one another. This setting applies exclusively to CPE devices managed by a T5 controller and is disabled by default.

Use the **Inactivity Time Out** field to define the inactivity timeout specific to T5 clients. Set the maximum amount of time T5 clients are allowed to be idle within this WLAN. Set the idle time in either Seconds (60 - 86,400), Minutes (1 - 1,440), Hours (0 - 24) or Days (0 - 1). When this setting is exceeded, the client is no longer able to access resources and must reauthenticate. The default value is 1,800 seconds.

A T5 controller, once enabled as a supported external device, can provide data to WiNG to assist in a T5's management within a WiNG supported subnet populated by both types of devices. The *Customer Premises Equipment* (CPEs) are the T5 controller managed radio devices. These CPEs use a *Digital Subscriber Line* (DSL) as their high speed Internet access mechanism using the CPE's physical wallplate connection and phone jack.

12 Select **OK** when completed to update the WLAN's client setting configuration. Select **Reset** to revert the screen back to the last saved configuration.

6.1.4.1 WLAN Client Setting Deployment Considerations

▸ *Configuring Client Settings*

Before defining a WLAN's client settings, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- Clients on the same WLAN associated with an AAP can communicate locally at the AP Level without going through the controller or service platform. If this is undesirable, an Access Point's Client-to-Client Communication option should be disabled.
- When the wireless client idle time setting is exceeded, the client is no longer able to access WLAN resources and must re-authenticate. The default value is 1,800 seconds.

6.1.5 Configuring WLAN Accounting Settings

Accounting is the method of collecting and sending security server information for billing, auditing, and reporting user data; such as start and stop times, executed commands (such as PPP), number of packets and number of bytes. Accounting enables wireless network administrators to track the services users are accessing and the network resources they are consuming. When accounting is enabled, the network access server reports and logs user activity to a RADIUS security server in the form of accounting records. Each accounting record is comprised of AV pairs and is stored on a local access control server. The data can be analyzed for network management, client billing, and/or auditing. Accounting methods must be defined through AAA.

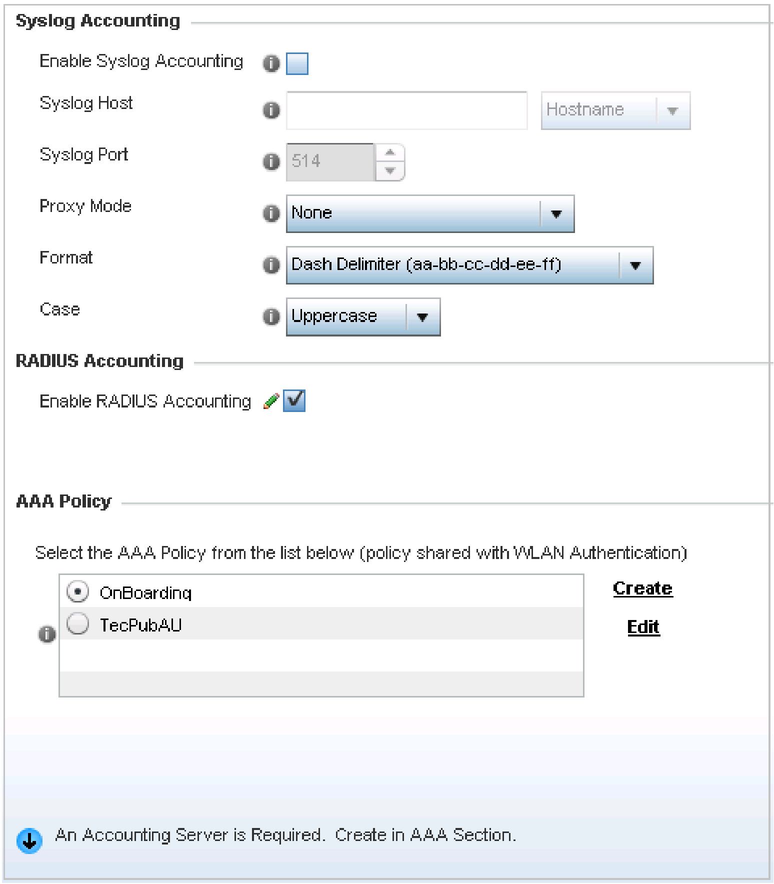
Accounting can be enabled and applied to WLANs, to uniquely log accounting events specific to the WLAN. Accounting logs contain information about the use of remote access services by users. This information is of great assistance in partitioning local versus remote users and how to best accommodate each. Remote user information can be archived to an external location for periodic network and user permission administration.

To configure WLAN accounting settings:

1 Select **Configuration** > **Wireless LANs** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select **Edit** to modify the properties of an existing WLAN.

3 Select **Accounting**.



Syslog Accounting

Enable Syslog Accounting □

Syslog Host [ ] Hostname

Syslog Port 514

Proxy Mode None

Format Dash Delimiter (aa-bb-cc-dd-ee-ff)

Case Uppercase

RADIUS Accounting

Enable RADIUS Accounting ☑

AAA Policy

Select the AAA Policy from the list below (policy shared with WLAN Authentication)

● OnBoarding

○ TecPubAU

An Accounting Server is Required. Create in AAA Section.

Figure 6-24 *WLAN Policy Accounting screen*

4 Set the following **System Log Accounting** information:

Enable Syslog Accounting	Use this option to generate accounting records in standard syslog format (RFC 3164). The feature is disabled by default.
Syslog Host	Specify the IP address or hostname of the external syslog host where accounting records are routed. Hostnames cannot include an underscore character.
Syslog Port	Use the spinner control to set the destination UDP port number of the external syslog host where the accounting records are routed.
Proxy Mode	If a proxy is needed to connect to the syslog server choose a proxy mode of *Through RF Domain Manager* or *Through Wireless Controller.* If no proxy is needed, select *None*.
Format	Specify the delimiter format for the MAC address to be packed in the syslog request. Available formats are No Delimiter (aabbccddeeff), Colon Delimiter (aa:bb:cc:dd:ee:ff), Dash Delimiter (aa-bb-cc-dd-ee-ff), Dot Delimiter (aabb.ccdd.eeff) and Middle Dash Delimiter (aabbcc-ddeeff).
Case	Specify to send the MAC addresses in either Uppercase or Lowercase for syslog requests.

5 Select the **Enable RADIUS Accounting** check box to use an external RADIUS resource for AAA accounting. When the check box is selected, a **AAA Policy** field displays. Either use the default AAA policy with the WLAN, or select **Create** to define a new AAA configuration that can be applied to the WLAN. This setting is disabled by default.

6 Select **OK** when completed to update this WLAN's accounting settings. Select **Reset** to revert the screen to its last saved configuration.

6.1.5.1 *Accounting Deployment Considerations*

Before defining a WLAN AAA configuration, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- When using RADIUS authentication, the WAN port round trip delay should not exceed 150ms. Excessive delay over a WAN can cause authentication and roaming issues. When excessive delays exists, a distributed RADIUS service should be used.
- Authorization policies should be implemented when users need to be restricted to specific WLANs, or time and date restrictions need to be applied.
- Authorization policies can also apply bandwidth restrictions and assign Firewall policies to users and devices.

6.1.6 Configuring WLAN Service Monitoring Settings

▸ *Wireless LAN Policy*

Service Monitoring is a mechanism for administrating external AAA server, captive portal server, Access Point adoption, and DHCP server activity for WLANs. Service monitoring enables an administrator to better notify users of a service's availability and make resource substitutions. Service monitoring can be enabled and applied to log activity as needed for specific WLANs.

External services can be rendered unavailable due to any of the following instances:

- When the RADIUS authentication server becomes unavailable. The RADIUS server could be local or external to the controller, service platform or Access Point.

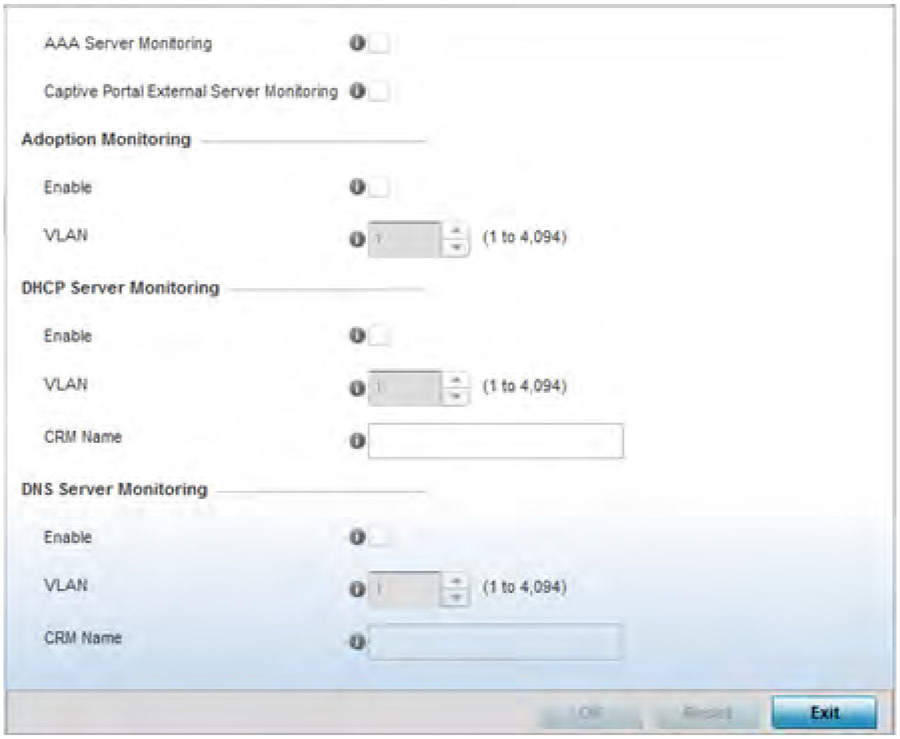
- When an externally hosted captive portal is unavailable (for any reason)
- If an Access Point's connected controller or service platform becomes unavailable
- When a monitored DHCP server resource becomes unavailable

To configure WLAN service monitoring:

1 Select **Configuration** > **Wireless LANs** > **Wireless LAN Policy** to display a high-level display of the existing WLANs.

2 Select the **Add** button to create an additional WLAN or select **Edit** to modify the properties of an existing WLAN.

3 Select **Service Monitoring**.



AAA Server Monitoring □

Captive Portal External Server Monitoring □

Adoption Monitoring

Enable □

VLAN 1 (1 to 4,094)

DHCP Server Monitoring

Enable □

VLAN 1 (1 to 4,094)

CRM Name

DNS Server Monitoring

Enable □

VLAN 1 (1 to 4,094)

CRM Name

Figure 6-25 *WLAN Policy Service Monitoring screen*

4 Select the **AAA Server monitoring** option to monitor a dedicated external RADIUS server and ensure its adoption resource availability. This setting is disabled by default.

5 Select the **Captive Portal External Server monitoring** option to monitor externally hosted captive portal activity, and temporary and restrictive user access to the controller or service platform managed network. This setting is disabled by default.

6 Refer to the **Adoption Monitoring** field to set the WLAN's adoption service monitoring configuration.

Enable	Enable adoption monitoring to check Access Point adoptions to the controller or service platform. When the connection is lost, captive portal users are migrated to a defined VLAN. This feature is disabled by default, so it must be enabled to monitor WLAN specific adoption data.
VLAN	Select the VLAN users are migrated to when an Access Point's connection to its adopting controller or service platform is lost. The available range is from 1 - 4,094.

7 Refer to the **DHCP Server Monitoring** field to set the WLAN's adoption service monitoring configuration.

Enable	Select enable to monitor activity over the defined DHCP Server. When the connection to the DHCP server is lost, captive portal users are automatically migrated a defined VLAN. The feature is disabled by default.
VLAN	Select the VLAN users are migrated to when the defined DHCP server resource becomes unavailable. The available range is from 1 - 4,094.
CRM Name	Enter the DHCP server to monitor for availability. When this DHCP server resource becomes unavailable, the device falls back to defined VLAN. This VLAN has a DHCP server configured that provides a pool of IP addresses and with a lease time less than the main DHCP server.

8 Refer to the **DNS Server Monitoring** field to set the WLAN's DNS service monitoring configuration.

Enable	Select enable to monitor activity over the defined DNS Server. When the connection to the DNS server is lost, captive portal users are automatically migrated a defined VLAN. The feature is disabled by default.
VLAN	Select the VLAN users are migrated to when the defined DNS server resource becomes unavailable. The available range is from 1 - 4,094.
CRM Name	Enter the DNS server to monitor for availability. When this DNS server resource becomes unavailable, the device falls back to defined VLAN. This VLAN has a DNS server configured that provides DNS address resolution till the main DNS server becomes available.

9 Select **OK** when completed to update this WLAN's service monitor settings. Select **Reset** to revert the screen back to its last saved configuration.

6.1.7 Configuring Client Load Balancing Settings

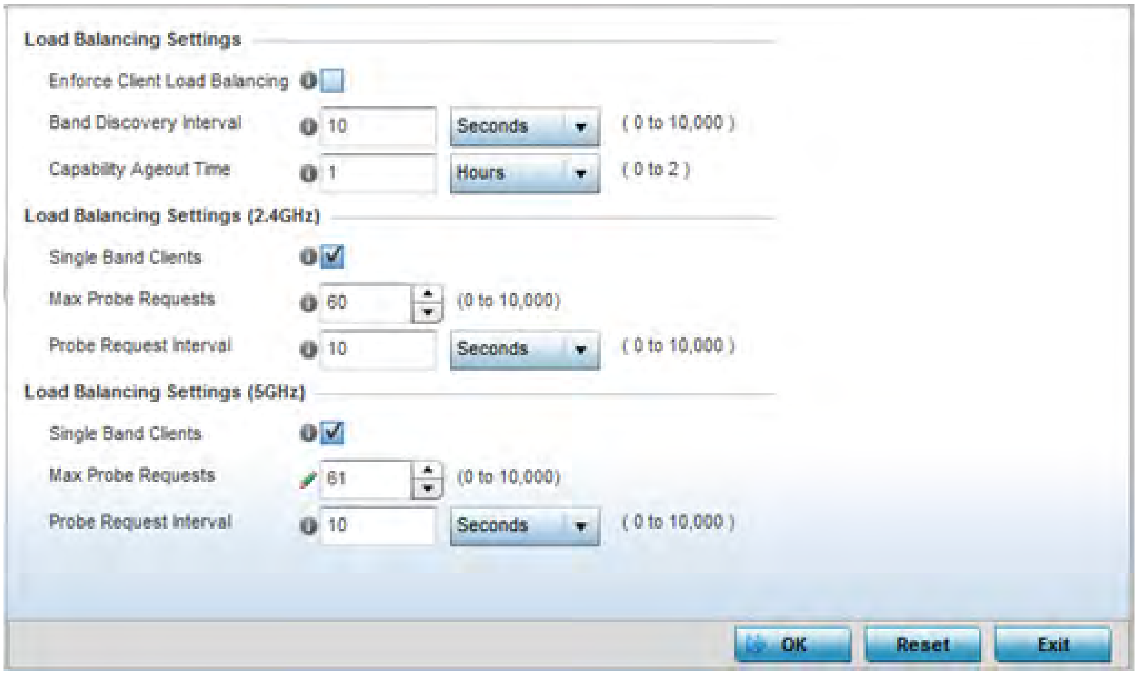
▸ *Wireless LAN Policy*

To configure WLAN client load balance settings:

1 Select **Configuration** > **Wireless LANs** > **Wireless LAN Policy** to display a high-level display of the existing WLANs.

2 Select the **Add** button to create an additional WLAN or select **Edit** to modify the properties of an existing wireless controller WLAN.

3 Select **Client Load Balancing**.



Load Balancing Settings

Enforce Client Load Balancing □

Band Discovery Interval 10 Seconds (0 to 10,000)

Capability Ageout Time 1 Hours (0 to 2)

Load Balancing Settings (2.4GHz)

Single Band Clients ☑

Max Probe Requests 60 (0 to 10,000)

Probe Request Interval 10 Seconds (0 to 10,000)

Load Balancing Settings (5GHz)

Single Band Clients ☑

Max Probe Requests 61 (0 to 10,000)

Probe Request Interval 10 Seconds (0 to 10,000)

Figure 6-26 *WLAN Policy Client Load Balancing screen*

4 Refer to the **Load Balancing Settings** section to configure load balancing for the WLAN.

Enforce Client Load Balancing	Select this option to enforce a client load balance distribution on this WLAN's Access Point radios. AP6522, AP6532, AP6562, AP7161, AP7602, AP7622, AP81XX and AP8232 models can support 256 clients per Access Point. AP6521 model can support up to 128 clients per Access Point. AP7612, AP7632, AP7662 models can support 512 clients per Access Point. Loads are balanced by ignoring association and probe requests. Probe and association requests are not responded to, forcing a client to associate with another Access Point radio.This setting is disabled by default.
Band Discovery Interval	Enter a value (from 0 - 10,000 seconds) to set the interval dedicated to discover a client's radio band capability before its Access Point radio association. The default setting is 24 seconds.
Capability Ageout Time	Define a value in either *Seconds* (0 - 10,000), *Minutes* (0 -166) or *Hours* (0 -2) to ageout a client's capabilities from the internal table. The default is 24 seconds.

5 Refer to the **Load Balancing Settings (2.4GHz)** section to configure load balancing for the 2.4 GHz WLAN.

Single Band Clients	Select this option to enable association for single band clients on the 2.4GHz frequency, even if load balancing is available. This setting is enabled by default.
Max Probe Requests	Enter a value from 0 - 10,000 for the maximum number of probe requests for clients using the 2.4GHz frequency. The default value is 60.
Probe Request Interval	Enter a value in seconds between 0 - 10,000 to configure the interval for client probe requests beyond which it is allowed to associate for clients on the 2.4GHz network. The default is 10 seconds.

6 Refer to the **Load Balancing Settings (5GHz)** section to configure load balancing for the 5 GHz WLAN.

Single Band Clients	Select this option to enable the association of single band clients on 5GHz, even if load balancing is available. This setting is enabled by default.
Max Probe Requests	Enter a value from 0 - 10,000 for the maximum number of probe requests for clients using 5GHz. The default value is 60.
Probe Request Interval	Enter a value in seconds from 0 - 10,000 to configure the interval for client probe requests. When exceeded, clients can associate using 5GHz. The default setting is 10 seconds.

7 Select **OK** when completed to update this WLAN's advanced settings. Select **Reset** to revert the screen back to its last saved configuration.

6.1.8 Configuring Advanced WLAN Settings

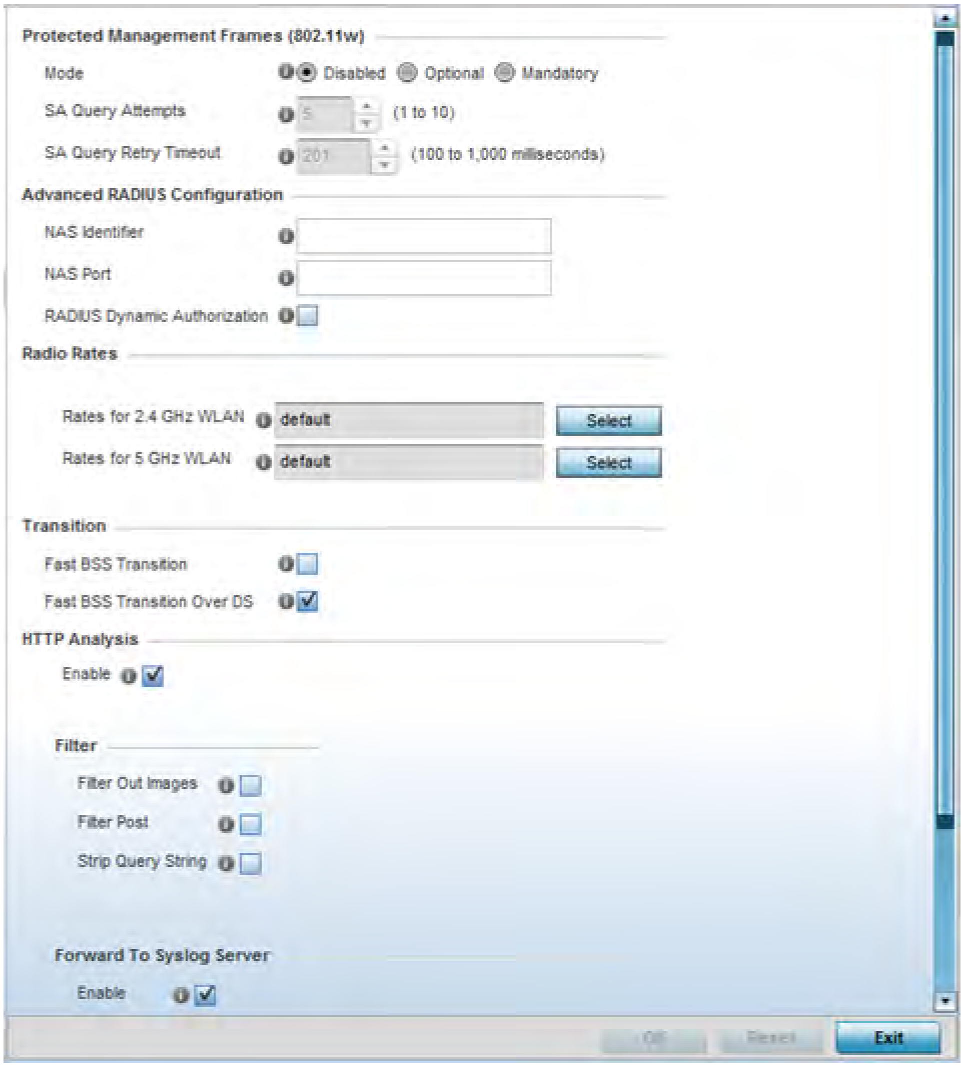
▸ *Wireless LAN Policy*

To configure advanced settings on a WLAN:

1 Select **Configuration** > **Wireless LANs** > **Wireless LAN Policy** to display available WLANs.

2 Select the **Add** button to create an additional WLAN or select **Edit** to modify the properties of an existing WLAN.

3 Select **Advanced**.



Protected Management Frames (802.11w)

Mode ● Disabled ○ Optional ○ Mandatory

SA Query Attempts 5 (1 to 10)

SA Query Retry Timeout 201 (100 to 1,000 milliseconds)

Advanced RADIUS Configuration

NAS Identifier

NAS Port

RADIUS Dynamic Authorization □

Radio Rates

Rates for 2.4 GHz WLAN default Select

Rates for 5 GHz WLAN default Select

Transition

Fast BSS Transition □

Fast BSS Transition Over DS ☑

HTTP Analysis

Enable ☑

Filter

Filter Out Images □

Filter Post □

Strip Query String □

Forward To Syslog Server

Enable ☑

Figure 6-27 *WLAN Policy Advanced screen*

4 Refer to the **Protected Management Frames (802.11w)** field to set a frame protection mode and security association for the WLAN's advanced configuration.

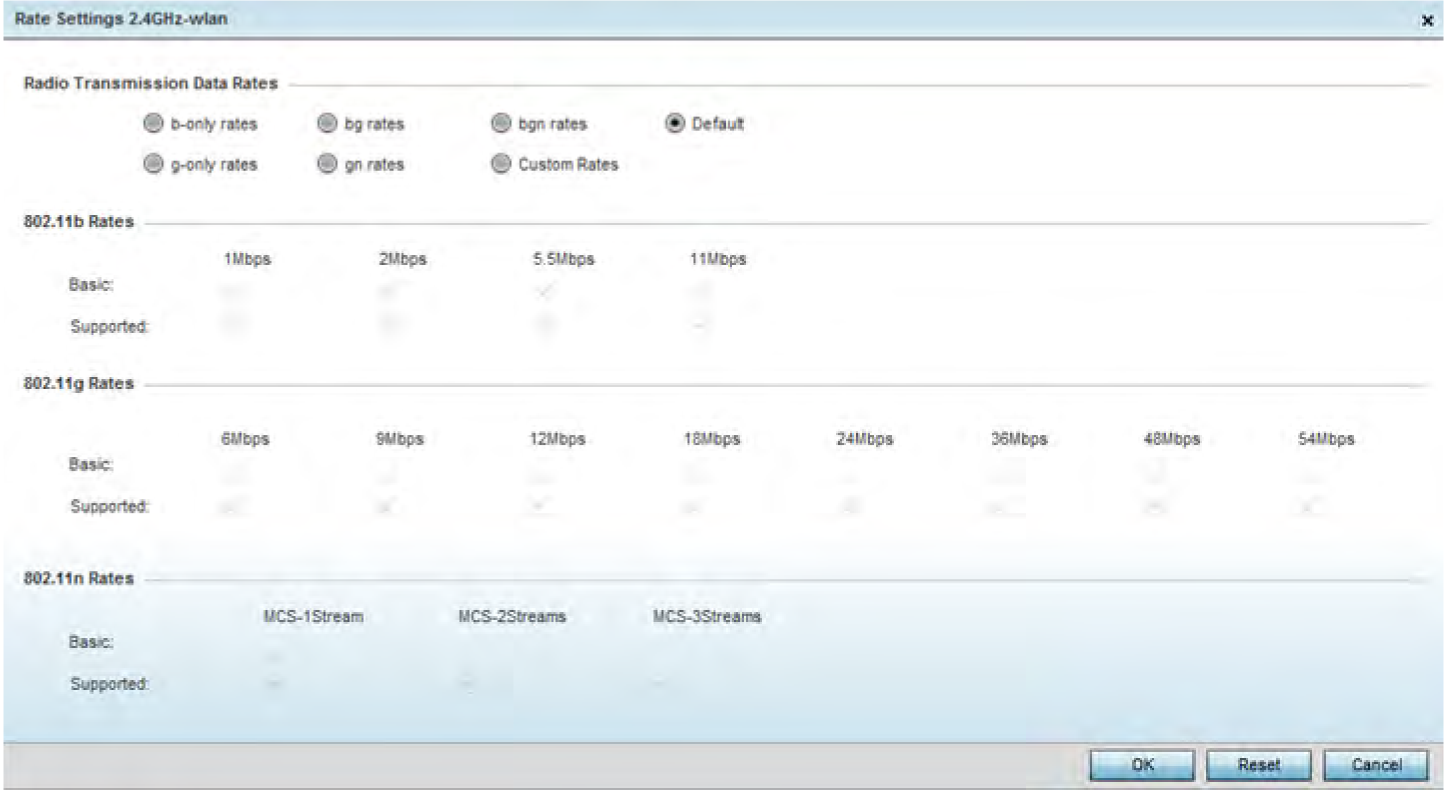
Mode	Select a radio button for the mode (either *Disabled*, *Optional* or *Mandatory*). Disabled is the default setting.
SA Query Attempts	Use the spinner control to set the number of security association query attempts between 1-10. The default value is 5.
SA Query Retry Timeout	Set the timeout (from 100-1,000 milliseconds) for waiting for a response to a SA query before resending it. The default is 201 milliseconds.

5 Refer to the **Advanced RADIUS Configuration** field to set the WLAN's NAS configuration and RADIUS Dynamic Authorization.

NAS Identifier	Specify what's included in the RADIUS NAS-Identifier field for authentication and accounting packets relating to this WLAN. Configuring a value is optional, and defaults are used if not configured.

NAS Port	The profile database on the RADIUS server consists of user profiles for each connected *network access server* (NAS) port. Each profile is matched to a username representing a physical port. When authorizing users, it queries the user profile database using a username representative of the physical NAS port making the connection. Set the numeric port value from 0-4,294,967,295.
RADIUS Dynamic Authorization	Select the check box to enable a mechanism that extends the RADIUS protocol to support unsolicited messages sent from the RADIUS server. These messages allow administrators to issue *change of authorization* (CoA) messages, which affect session authorization, or *Disconnect Messages (DM)*, which terminated a session immediately. This feature is disabled by default.

6 Refer to the **Radio Rates** field to define selected data rates for both the 2.4 and 5.0 GHz bands.



Rate Settings 2.4GHz-wlan

Radio Transmission Data Rates

○ b-only rates ○ bg rates ○ bgn rates ● Default

○ g-only rates ○ gn rates ○ Custom Rates

802.11b Rates

	1Mbps	2Mbps	5.5Mbps	11Mbps
Basic:				
Supported:				

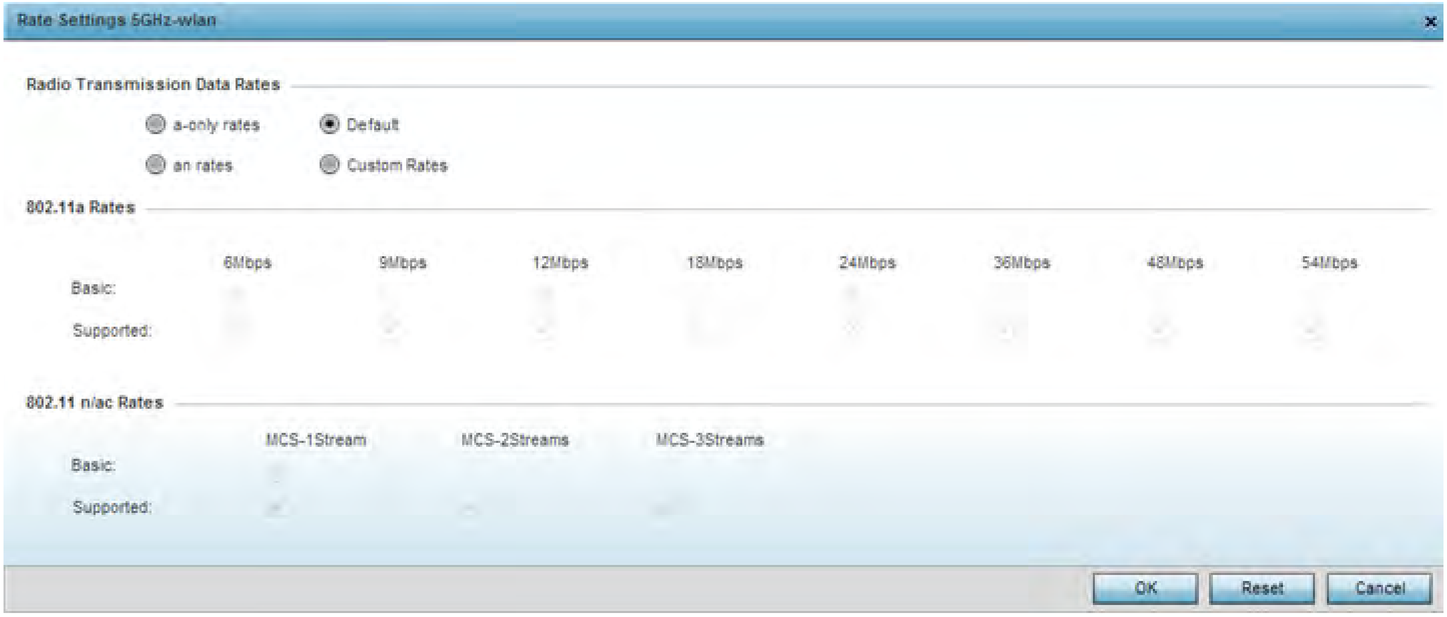
802.11g Rates

	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
Basic:								
Supported:								

802.11n Rates

	MCS-1Stream	MCS-2Streams	MCS-3Streams
Basic:			
Supported:			

Figure 6-28 *Advanced WLAN Rate Settings 2.4 GHz screen*



Rate Settings 5GHz-wlan

Radio Transmission Data Rates

○ a-only rates ● Default

○ an rates ○ Custom Rates

802.11a Rates

802.11 n/ac Rates

Figure 6-29 *Advanced WLAN Rate Settings 5 GHz screen*

Define both minimum *Basic* and optimal *Supported* rates as required for the 802.11b rates, 802.11g rates and 802.11n supported by the 2.4 GHz band and the 802.11a and 802.11n rates supported by the 5.0 GHz band. These are the supported client rates within this WLAN.

802.11n MCS rates are defined as follows both with and without *short guard intervals* (SGI):

Table 6.1 *MCS-1Stream*

MCS Index	Number of Streams	20 MHz No SGI	20 MHz With SGI	40 MHz No SGI	40MHz With SGI
0	1	6.5	7.2	13.5	15
1	1	13	14.4	27	30
2	1	19.5	21.7	40.5	45
3	1	26	28.9	54	60
4	1	39	43.4	81	90
5	1	52	57.8	108	120
6	1	58.5	65	121.5	135
7	1	65	72.2	135	150

Table 6.2 *MCS-2Stream*

MCS Index	Number of Streams	20 MHz No SGI	20 MHz With SGI	40 MHz No SGI	40MHz With SGI
0	2	13	14.4	27	30
1	2	26	28.9	54	60
2	2	39	43.4	81	90
3	2	52	57.8	108	120
4	2	78	86.7	162	180
5	2	104	115.6	216	240

Table 6.2 *MCS-2Stream*

MCS Index	Number of Streams	20 MHz No SGI	20 MHz With SGI	40 MHz No SGI	40MHz With SGI
6	2	117	130	243	270
7	2	130	144.4	270	300

Table 6.3 *MCS-3Stream*

MCS Index	Number of Streams	20 MHz No SGI	20 MHz With SGI	40 MHz No SGI	40MHz With SGI
0	3	19.5	21.7	40.5	45
1	3	39	43.3	81	90
2	3	58.5	65	121.5	135
3	3	78	86.7	162	180
4	3	117	130.7	243	270
5	3	156	173.3	324	360
6	3	175.5	195	364.5	405
7	3	195	216.7	405	450

802.11ac MCS rates are defined as follows both with and without *short guard intervals* (SGI):

Table 6.4 *MCS-802.11ac (theoretical throughput for single spatial streams)*

MCS Index	20 MHz No SGI	20 MHz With SGI	40 MHz No SGI	40MHz With SGI	80 MHz No SGI	80MHz With SGI
0	6.5	7.2.	13.5	15	29.3	32.5
1	13	14.4	27	30	58.5	65
2	19.5	21.7	40.5	45	87.8	97.5
3	26	28.9	54	60	117	130
4	39	43.3	81	90	175.5	195
5	52	57.8	108	120	234	260
6	58.5	65	121.5	135	263.3	292.5
7	65	72.2	135	150	292.5	325
8	78	86.7	162	180	351	390
9	n/a	n/a	180	200	390	433.3

7 Set the following **Transition** options:

Fast BSS Transition	If needed, select the *Fast BSS Transition* check box to enable 802.11r fast roaming on this WLAN. This setting is disabled by default. 802.11r is an attempt to undo the burden that security and QoS added to the handoff process, and restore it back to an original four message exchange process. The central application for the 802.11r standard is VOIP using mobile phones within wireless Internet networks.
Fast BSS Transition Over DS	Optionally select the *Fast BSS Transition Over DS* check box to enable 802.11r over DS fast roaming on this WLAN. This setting is enabled by default.

8 Enable **HTTP Analysis** for log file analysis on this WLAN. This setting is disabled by default.

9 Set the following HTTP analysis **Filter** settings for the WLAN:

Filter Out Images	Select this option to filter images out of this WLAN's log files. This setting is disabled by default.
Filter Post	Select this option to filter posts out of this WLAN's log files. This setting is disabled by default.
Strip Query String	Select this option to filter query strings out of this WLAN's log files. This setting is disabled by default.

10 Set the following **Forward to Syslog Server** settings for HTTP analysis on this WLAN:

Enable	Select the check box to forward any firewall HTTP Analytics to a specified syslog server for this WLAN. This setting is disabled by default.
Host	Enter a *Hostname* or *IP Address* for the syslog server to forward HTTP Analytics. Hostnames cannot include an underscore character.
Port	Specify the port number utilized by the syslog server. The default port is 514.
Proxy Mode	If a proxy is needed to connect to the syslog server, select a proxy mode of either *Through RF Domain Manager* or *Through Wireless Controller*. If no proxy is needed, select *None*.

11 Select **OK** when completed to update this WLAN's advanced settings. Select **Reset** to revert the screen back to its last saved configuration.

6.1.9 Configuring Auto Shutdown Settings

Wireless LAN Policy

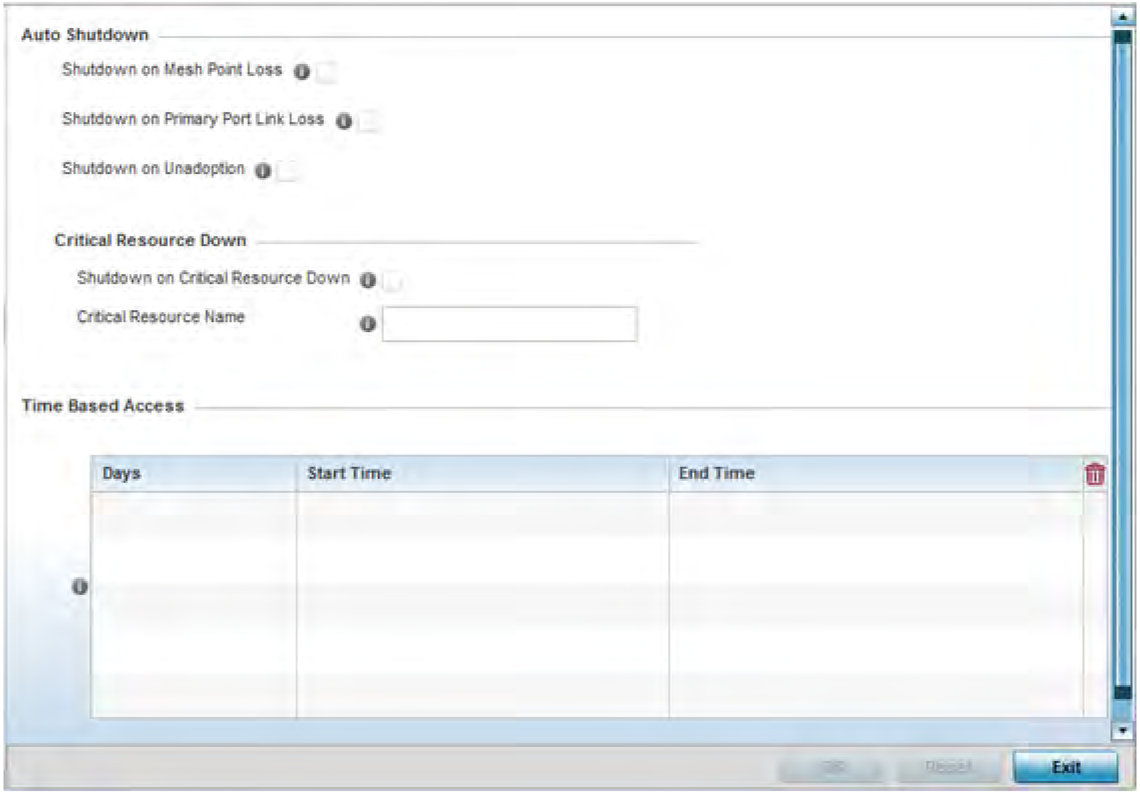
The *Auto Shutdown* feature set the WLAN to shutdown when certain criteria are met. It also allows administrators to set the operating days and hours of certain WLANs for security or bandwidth purposes.

To configure advanced settings on a WLAN:

1 Select **Configuration** > **Wireless LANs** > **Wireless LAN Policy** available WLANs.

2 Select the **Add** button to create an additional WLAN or select **Edit** to modify the properties of an existing WLAN.

3 Select **Auto Shutdown**.



Auto Shutdown

Shutdown on Mesh Point Loss □

Shutdown on Primary Port Link Loss □

Shutdown on Unadoption □

Critical Resource Down

Shutdown on Critical Resource Down □

Critical Resource Name

Time Based Access

Days	Start Time	End Time

Figure 6-30 *WLAN Policy Auto Shutdown screen*

4 Refer to the **Auto Shutdown** field to set the WLANs shutdown criteria.

Shutdown on Mesh Point Loss	Select this option to automatically disable the WLAN when its associated mesh point is unreachable. This setting is disabled by default.
Shutdown on Primary Port Link Loss	Select this option to automatically disable the WLAN when its primary port link is unreachable. This setting is disabled by default.
Shutdown on Unadoption	Select this option to automatically disable the WLAN when associated Access Points are unadopted. This setting is disabled by default.

5 Set the following **Critical Resource Down** settings to determine whether a WLAN auto shutdown is enabled when a defined critical resource goes offline:

Shutdown on Critical Resource Down	Enable this feature to bring the selected WLAN offline when a defined critical resource goes offline. This setting is disabled by default.
Critical Resource Name	When enabled, enter a 127 character maximum critical resource name.This is the resource that must remain online to render the selected WLAN online.

6 To configure **Time Based Access** for this WLAN, click **+ Add Row** and configure each of the following options.

Days	Use the drop-down menu to select a day of the week to apply this access policy. Selecting *All* will apply the policy every day. Selecting *weekends* will apply the policy on Saturdays and Sundays only. Selecting *weekdays* will apply the policy on Monday, Tuesday, Wednesday, Thursday and Friday only. Selecting individual days of the week will apply the policy only on the selected day.

Start Time	This value sets the starting time the WLAN is activated. Use the spinner controls to select the hour and minute, in a 12h time format. Then use the radio button to choose *AM* or *PM*.
End Time	This value sets the ending time of day(s) that the WLAN will be disabled. Use the spinner controls to select the hour and minute, in a 12h time format. Then use the radio button to choose *AM* or *PM*.

7 Select **OK** when completed to update the auto shutdown settings. Select **Reset** to revert the screen back to its last saved configuration.

6.2 Configuring WLAN QoS Policies

▸ *Wireless LAN Policy*

QoS provides a data traffic prioritization scheme. QoS reduces congestion from excessive traffic. If there is enough bandwidth for all users and applications (unlikely because excessive bandwidth comes at a very high cost), then applying QoS has very little value. QoS provides policy enforcement for mission-critical applications and/or users that have critical bandwidth requirements when bandwidth is shared by different users and applications.

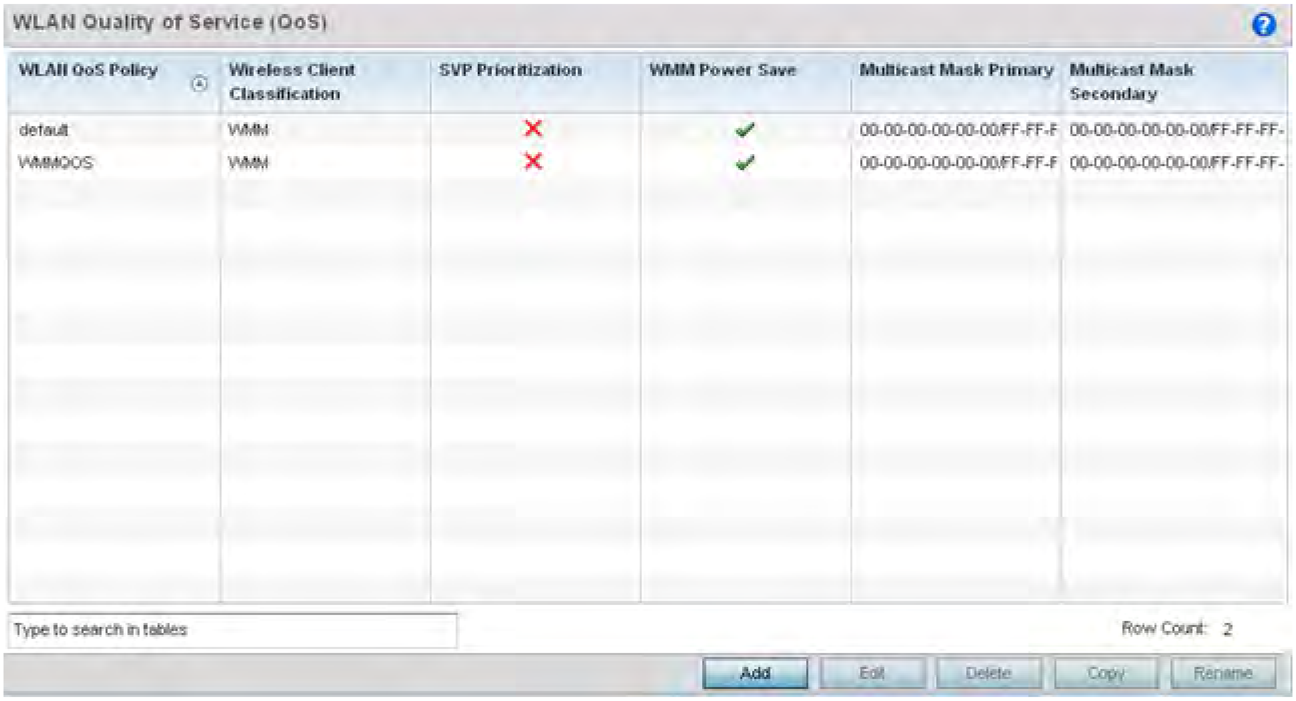
QoS helps ensure each WLAN receives a fair share of the overall bandwidth, either equally or as per the proportion configured. Packets directed towards clients are classified into categories such as Video, Voice and Data. Packets within each category are processed based on the weights defined for each WLAN.

The Quality of Service screen displays a list of QoS policies available to WLANs. If none of the exiting QoS policies supports an ideal QoS configuration for the intended data traffic of this WLAN, select the **Add** button to create new policy. Select the radio button of an existing WLAN and select **Ok** to map the QoS policy to the WLAN displayed in the banner of the screen.

Use the WLAN *Quality of Service* (QoS) Policy screen to add a new QoS policy or edit the attributes of an existing policy.

☑ **NOTE:** WLAN QoS configurations differ significantly from QoS policies configured for radios. WLAN QoS configurations are designed to support the data requirements of wireless clients, including the data types they support and their network permissions. Radio QoS policies are specific to the transmit and receive characteristics of the connected radio’s themselves, independent from the wireless clients the Access Point radios supported.

1 Select **Configuration** > **Wireless** > **WLAN QoS Policy** to display existing QoS policies available to WLANs.



WLAN Quality of Service (QoS)

WLAN QoS Policy	Wireless Client Classification	SVP Prioritization	WMM Power Save	Multicast Mask Primary	Multicast Mask Secondary
default	WMM	✗	✓	00-00-00-00-00-00/FF-FF-F	00-00-00-00-00-00/FF-FF-FF-
WMMQOS	WMM	✗	✓	00-00-00-00-00-00/FF-FF-F	00-00-00-00-00-00/FF-FF-FF-

Figure 6-31 *WLAN QoS Policy screen*

2 Refer to the following read-only information on each listed QoS policy to determine whether an existing policy can be used as is, an existing policy requires edit or a new policy requires creation:

WLAN QoS Policy	Displays the name assigned to this WLAN QoS policy when it was initially created. The assigned policy name cannot be modified as part of the edit process.
Wireless Client Classification	Lists each policy's *Wireless Client* Classification as defined for this WLAN's intended traffic. The Classification Categories are the different WLAN-WMM options available to a radio. Classification types include: *WMM* – Implies WiFi Multimedia QoS extensions are enabled on this radio. This allows different traffic streams between the wireless client and the Access Point to be prioritized according to the type of traffic (voice, video etc). WMM classification is required to support the high throughput data rates required of 802.11n device support. *Voice* – Optimized for voice traffic. Implies all traffic on this WLAN is prioritized as voice traffic on the radio. *Video* – Optimized for video traffic. Implies all traffic on this WLAN is prioritized as video traffic on the radio. *Normal* – Optimized for best effort traffic. Implies all traffic on this WLAN is prioritized as best effort traffic on the radio. *Low* – Optimized for background traffic. Implies all traffic on this WLAN is low priority on the radio. *Non-Unicast* – Optimized for non-Unicast traffic. Implies all traffic on this WLAN is designed for broadcast or multicast.

SVP Prioritization	A green check mark defines the policy as having *Spectralink Voice Prioritization* (SVP) enabled to allow the wireless controller to identify and prioritize traffic from Spectralink/Polycomm phones using the SVP protocol. Phones using regular WMM and SIP are not impacted by SVP prioritization. A red “X” defines the QoS policy as not supporting SVP prioritization.
WMM Power Save	Enables support for the WMM based power-save mechanism, also known as *Unscheduled Automatic Power Save Delivery* (U-APSD). This is primarily used by voice devices that are WMM capable. The default setting is enabled.
Multicast Mask Primary	Displays the primary multicast mask defined for each listed QoS policy. Normally all multicast and broadcast packets are buffered until the periodic DTIM interval (indicated in the 802.11 beacon frame), when clients in power save mode wake to check for frames. However, for certain applications and traffic types, the administrator may want the frames transmitted immediately, without waiting for the DTIM interval. By configuring a primary and secondary multicast mask, an administrator can indicate which frames are transmitted immediately. Setting masks is optional and only needed if there are traffic types requiring special handling.
Multicast Mask Secondary	Displays the secondary multicast mask defined for each listed QoS policy.

☑ **NOTE:** When using a wireless client classification other than WMM, only legacy rates are supported on that WLAN.

3 Either select the **Add** button to define a new WLAN QoS policy, or select an existing WLAN QoS policy and select **Edit** to modify its existing configuration. Existing QoS policies can be selected and deleted as needed. Optionally **Copy** a policy or **Rename** a WLAN QoS Policy as needed.

A *Quality of Service* (QoS) policy screen displays for the new or selected WLAN. The screen displays the WMM tab by default, but additional tabs also display for WLAN and wireless client rate limit configurations. For more information, refer to the following:

- *Configuring a WLAN’s QoS WMM Settings*
- *Configuring Rate Limit Settings*

6.2.1 Configuring a WLAN’s QoS WMM Settings

Using WMM, end-user satisfaction is maintained in a wider variety of environments and traffic conditions. WMM makes it possible for both home networks and Enterprises to decide which data streams are most important and assign them a higher traffic priority.

WMM’s prioritization capabilities are based on the four access categories. The higher the access category, the higher the probability to transmit this kind of traffic over the WLAN. Access categories were designed to correspond to 802.1d priorities to facilitate interoperability with QoS policy management mechanisms. WMM enabled wireless controllers/Access Points coexist with legacy devices (not WMM-enabled).

Packets not assigned to a specific access category are categorized by default as having best effort priority. Applications assign each data packet to a given access category packets are then added to one of four independent transmit queues (one per access category - voice, video, best effort or background) in the client. The client has an internal collision resolution mechanism to address collision among different queues, which selects the frames with the highest priority to transmit.

The same mechanism deals with external collision, to determine which client(s) should be granted the *opportunity to transmit* (TXOP). The collision resolution algorithm responsible for traffic prioritization is probabilistic and depends on two timing parameters that vary for each access category.

- The minimum interframe space, or *Arbitrary Inter-Frame Space Number* (AIFSN)
- The contention window, sometimes referred to as the random backoff wait

Both values are smaller for high-priority traffic. The value of the contention window varies through time. Initially the contention window is set to a value that depends on the AC. As frames with the highest AC tend to have the lowest backoff values, they are more likely to get a TXOP.

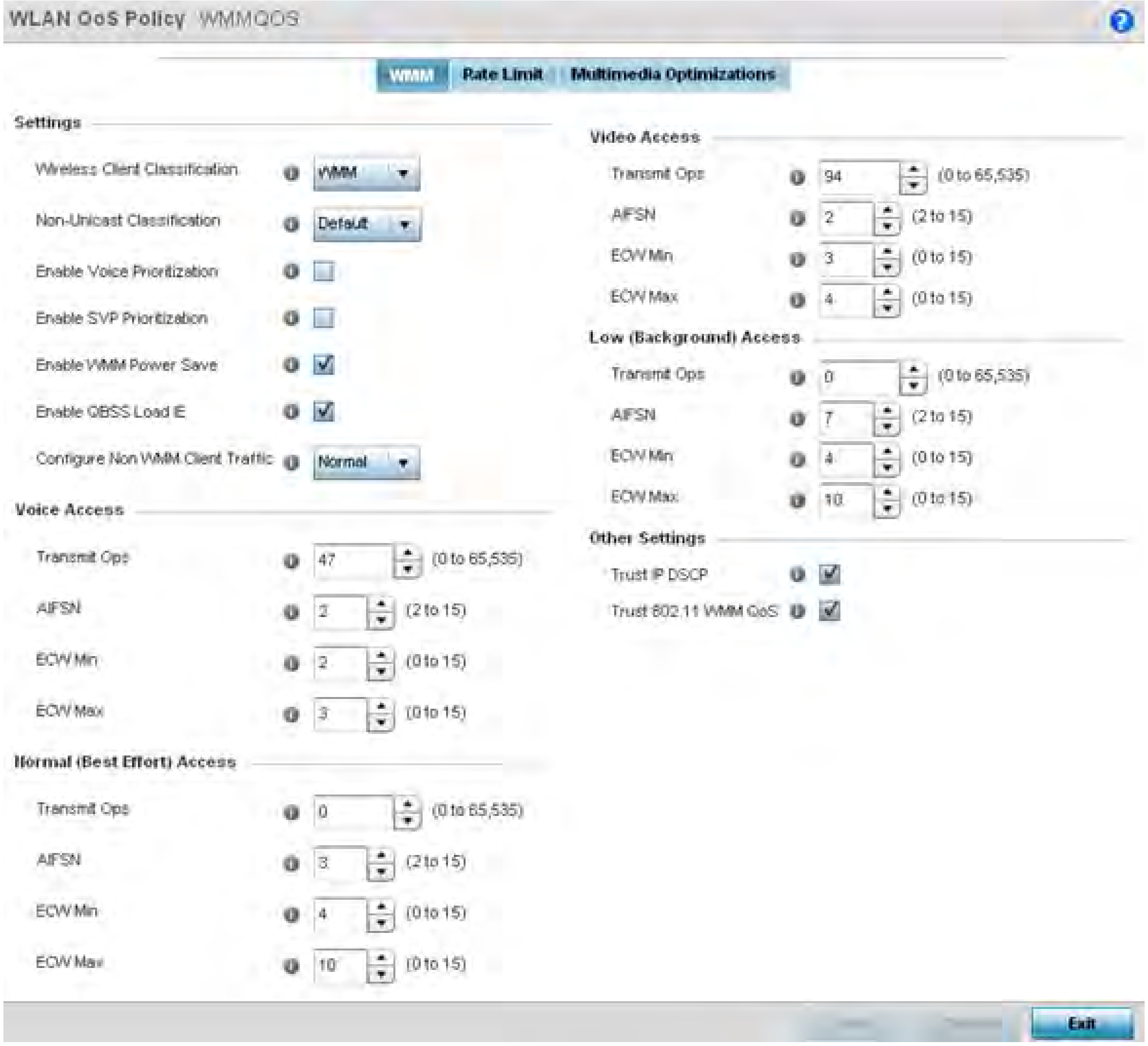
After each collision the contention window is doubled until a maximum value (also dependent on the AC) is reached. After successful transmission, the contention window is reset to its initial, AC dependant value. The AC with the lowest backoff value gets the TXOP.

To configure a WMM configuration for a WLAN:

1 Select **Configuration** > **Wireless** > **WLAN QoS Policy** to display existing QoS Policies.

2 Select the **Add** button to create a new QoS policy or **Edit** to modify the properties of an existing WLAN QoS policy.

The **WMM** tab displays by default.



WLAN QoS Policy WMMQOS

Settings

Wireless Client Classification: WMM

Non-Unicast Classification: Default

Enable Voice Prioritization: □

Enable SVP Prioritization: □

Enable WMM Power Save: ☑

Enable QBSS Load IE: ☑

Configure Non WMM Client Traffic: Normal

Voice Access

Transmit Ops: 47 (0 to 65,535)

AIFSN: 2 (2 to 15)

ECW Min: 2 (0 to 15)

ECW Max: 3 (0 to 15)

Normal (Best Effort) Access

Transmit Ops: 0 (0 to 65,535)

AIFSN: 3 (2 to 15)

ECW Min: 4 (0 to 15)

ECW Max: 10 (0 to 15)

Video Access

Transmit Ops: 94 (0 to 65,535)

AIFSN: 2 (2 to 15)

ECW Min: 3 (0 to 15)

ECW Max: 4 (0 to 15)

Low (Background) Access

Transmit Ops: 0 (0 to 65,535)

AIFSN: 7 (2 to 15)

ECW Min: 4 (0 to 15)

ECW Max: 10 (0 to 15)

Other Settings

Trust IP DSCP: ☑

Trust 802.11 WMM QoS: ☑

Figure 6-32 *WLAN QoS Policy - WMM screen*

3 Configure the following in respect to the WLAN's intended WMM radio traffic and user requirements:

Wireless Client Classification	Use the drop-down menu to select the *Wireless Client* Classification for this WLAN's intended traffic type. The classification categories are the different WLAN-WMM options available to the radio. Classification types include: *WMM* – Implies WiFi Multimedia QoS extensions are enabled on this radio. This allows different traffic streams between the wireless client and the Access Point to be prioritized according to the type of traffic (voice, video etc). The WMM classification is required to support the high throughput data rates required of 802.11n device support. WMM is the default setting. *Voice* – Optimized for voice traffic. Implies all traffic on this WLAN is prioritized as voice traffic on the radio. *Video* – Optimized for video traffic. Implies all traffic on this WLAN is prioritized as video traffic on the radio. *Normal* – Optimized for best effort traffic. Implies all traffic on this WLAN is prioritized as best effort traffic on the radio. *Low* – Optimized for background traffic. Implies all traffic on this WLAN is low priority on the radio.
Non-Unicast Classification	Use the drop-down menu to select the Non-Unicast Classification for this WLAN's intended traffic. Non-unicast classification types include: *Voice* – Optimized for voice traffic. Implies all traffic on this WLAN is prioritized as voice traffic on the radio. *Video* – Optimized for video traffic. Implies all traffic on this WLAN is prioritized as video traffic on the radio. *Normal* – Optimized for best effort traffic. Implies all traffic on this WLAN is prioritized as best effort traffic on the radio. *Low* – Optimized for background traffic. Implies all traffic on this WLAN is low priority on the radio.
Enable Voice Prioritization	Select this option if Voice traffic is prioritized on the WLAN. This gives priority to voice and voice management packets supported only on certain legacy VOIP phones. This feature is disabled by default.
Enable SVP Prioritization	Enabling *Spectralink Voice Prioritization* (SVP) allows the identification and prioritization of traffic from Spectralink/Polycomm phones. This gives priority to voice on certain legacy VOIP phones. If the wireless client classification is WMM, non WMM devices recognized as voice devices have their traffic transmitted at voice priority. Devices are classified as voice when they emit SIP, SCCP, or H323 traffic. Thus, selecting this option has no effect on devices supporting WMM. This feature is disabled by default.
Enable WMM Power Save	Enables support for the WMM based power-save mechanism, also known as *Unscheduled Automatic Power Save Delivery* (U-APSD). This is primarily used by voice devices that are WMM capable. The default setting is enabled.
Enable QBSS Load IE	Check this option to enable a QoS Basis Service Set (QBSS) information element (IE) in beacons and probe response packets advertised by Access Points. The default value is enabled.

Configure Non WMM Client Traffic	Use the drop-down menu to select the Non-WMM client traffic Classification. Non-WMM classification types include: *Voice* – Optimized for voice traffic. Implies all traffic on this WLAN is prioritized as voice traffic on the radio. *Video* – Optimized for video traffic. Implies all traffic on this WLAN is prioritized as video traffic on the radio. *Normal* – Optimized for best effort traffic. Implies all traffic on this WLAN is prioritized as best effort traffic on the radio. *Low* – Optimized for background traffic. Implies all traffic on this WLAN is low priority on the radio.

4 Set the following **Voice Access** settings for the WLAN's QoS policy:

Transmit Ops	Use the slider to set the maximum device transmit duration after obtaining a transmit opportunity. The default value is 47.
AIFSN	Set the current *Arbitrary Inter-frame Space Number* (AIFSN) between 2-15. Higher-priority traffic voice categories should have lower AIFSNs than lower-priority traffic categories. This will cause lower-priority traffic to wait longer before attempting access. The default value is 2.
ECW Min	The ECW Min is combined with the ECW Max to create the contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic. The available range is from 0-15. The default value is 2.
ECW Max	The ECW Max is combined with the ECW Min to create the contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic. The available range is from 0-15. The default value is 3.

5 Set the following **Normal (Best Effort) Access** settings for the WLAN's QoS policy:

Transmit Ops	Use the slider to set the maximum duration a device can transmit after obtaining a transmit opportunity. The default value is 0.
AIFSN	Set the current AIFSN between 2-15. Lower priority traffic categories should have higher AIFSNs than higher priority traffic categories. This will cause lower priority traffic to wait longer before attempting access. The default value is 3.
ECW Min	The ECW Min is combined with the ECW Max to create the contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Higher values are used for lower priority traffic (like Normal). The available range is from 0-15. The default value is 4.
ECW Max	The ECW Max is combined with the ECW Min to create the contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Higher values are used for lower priority traffic (like Normal). The available range is from 0-15. The default value is 10.

6 Set the following **Video Access** settings for the WLAN’s QoS policy:

Transmit Ops	Use the slider to set the maximum duration a device can transmit after obtaining a transmit opportunity. The default values is 94.
AIFSN	Set the current *Arbitrary Inter-frame Space Number* (AIFSN) between 2-15. Higher-priority traffic video categories should have lower AIFSNs than lower-priority traffic categories. This will cause lower-priority traffic to wait longer before attempting access. The default value is 2.
ECW Min	The ECW Min is combined with the ECW Max to create the contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic (like video). The available range is from 0-15. The default value is 3.
ECW Max	The ECW Max is combined with the ECW Min to create the contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic (like video). The available range is from 0-15. The default value is 4.

7 Set the following **Low (Background) Access** settings for the WLAN’s QoS policy:

Transmit Ops	Use the slider to set the maximum duration a device can transmit after obtaining a transmit opportunity. For higher-priority traffic categories, this value should be set to a low number. The default value is 0.
AIFSN	Set the current AIFSN between 2-15. Lower priority traffic categories should have higher AIFSNs than higher priority traffic categories. This will cause lower priority traffic to wait longer before attempting access. The default value is 7.
ECW Min	The ECW Min is combined with the ECW Max to create the contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Higher values are used for lower priority traffic (like Low). The available range is from 0-15. The default value is 4.
ECW Max	The ECW Max is combined with the ECW Min to create the contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Higher values are used for lower priority traffic (like Low). The available range is from 0-15. The default value is 10.

8 Set the following **Other Settings** for the WLAN’s QoS policy:

Trust IP DSCP	Select this option to trust IP DSCP values for WLANs. The default value is enabled.
Trust 802.11 WMM QoS	Select this option to trust 802.11 WMM QoS values for WLANs. The default value enabled.

9 Select **OK** when completed to update this WLAN’s QoS settings. Select **Reset** to revert the screen back to its last saved configuration.

6.2.2 Configuring Rate Limit Settings

Excessive traffic can cause performance issues or bring down the network entirely. Excessive traffic can be caused by numerous sources including network loops, faulty devices or malicious software such as a worm or virus that has infected on one or more devices. Rate limiting reduces the maximum rate sent or received from the wireless network (and WLAN) per wireless client. It prevents any single user from overwhelming the wireless network. It can also provide differential service for service providers. The uplink and downlink rate limits are usually configured on a RADIUS server using vendor specific attributes. Rate limits are extracted from the RADIUS server's response. When such attributes are not present, the settings defined on the controller, service platform or Access Point are applied. An administrator can set separate QoS rate limit configurations for data transmitted from the network (upstream) and data transmitted from a WLAN's wireless clients back to associated radios (downstream).

Before defining rate limit thresholds for WLAN upstream and downstream traffic, define the normal number of ARP, broadcast, multicast and unknown unicast packets that typically transmit and receive from each supported WMM access category. If thresholds are defined too low, normal network traffic (required by end-user devices) will be dropped resulting in intermittent outages and performance problems.

Connected wireless clients can also have QoS rate limit settings defined in both the *upstream* and *downstream* direction.

To configure a QoS rate limit configuration for a WLAN:

1 Select **Configuration** > **Wireless** > **WLAN QoS Policy** to display existing QoS policies available to WLANs.

2 Either select the **Add** button to define a new WLAN QoS policy, or select an existing WLAN QoS policy and select **Edit** to modify its existing configuration.

3 Select the **Rate Limit** tab.

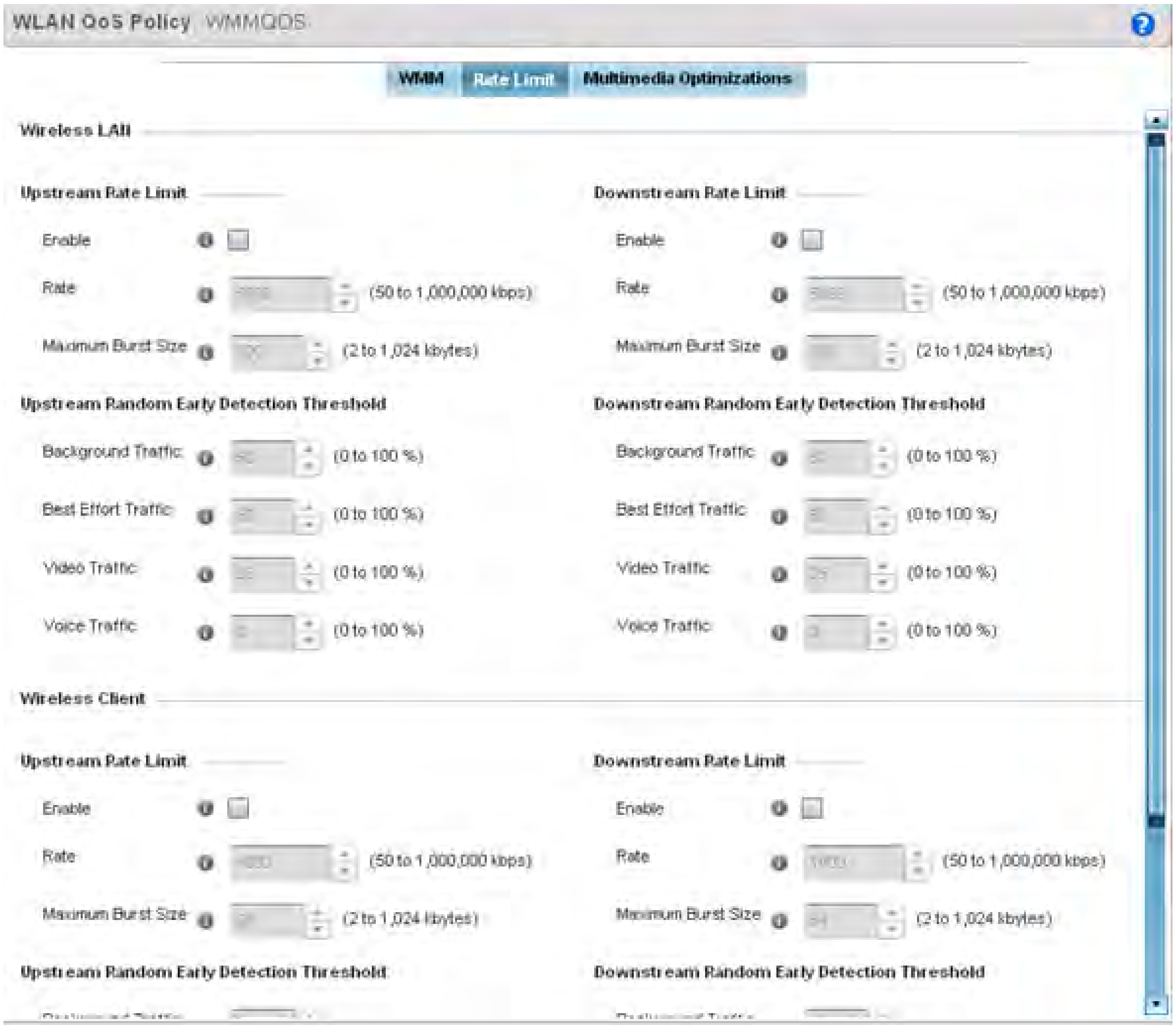


Figure 6-33 *QoS Policy WLAN Rate Limit screen*

4 Configure the following parameters in respect to the intended WLAN **Upstream Rate Limit,** or traffic from the controller or service platform to associated Access Point radios and connected wireless clients:

Enable	Select the *Enable* check box to enable rate limiting for data transmitted from the controller or service platform to associated Access Point radios and connected wireless clients. Enabling this option does not invoke rate limiting for data traffic in the downstream direction. This feature is disabled by default.
Rate	Define an upstream rate limit between 50 - 1,000,000 kbps. This limit constitutes a threshold for the maximum the number of packets transmitted or received over the WLAN (from all access categories). Traffic that exceeds the defined rate is dropped and a log message is generated. The default setting is 5000 kbps.

Maximum Burst Size	Set a maximum burst size between 2 - 1024 kbytes. The smaller the burst, the less likely the upstream packet transmission will result in congestion for the WLAN's client destinations. By trending the typical number of ARP, broadcast, multicast and unknown unicast packets over a period of time, the average rate for each access category can be obtained. Once a baseline is obtained, administrators should add a 10% margin (minimally) to allow for traffic bursts. The default burst size is 320 kbytes.

5 Set the following WLAN **Upstream Random Early Detection Threshold** settings for each access category. An early random drop is done when a traffic stream falls below the set threshold.

Background Traffic	Set a percentage value for background traffic in the upstream direction. This is a percentage of the maximum burst size for low priority traffic. Background traffic exceeding the defined threshold is dropped and a log message is generated. Background traffic consumes the least bandwidth of any access category, so this value can be set to a lower value once a general upstream rate is known by the network administrator (using a time trend analysis). The default threshold is 50%.
Best Effort Traffic	Set a percentage value for best effort traffic in the upstream direction. This is a percentage of the maximum burst size for normal priority traffic. Best effort traffic exceeding the defined threshold is dropped and a log message is generated. Best effort traffic consumes little bandwidth, so this value can be set to a lower value once a general upstream rate is known by the network administrator (using a time trend analysis). The default threshold is 50%.
Video Traffic	Set a percentage value for video traffic in the upstream direction. This is a percentage of the maximum burst size for video traffic. Video traffic exceeding the defined threshold is dropped and a log message is generated. Video traffic consumes significant bandwidth, so this value can be set to a higher value once a general upstream rate is known by the network administrator (using a time trend analysis). The default threshold is 25%.
Voice Traffic	Set a percentage value for voice traffic in the upstream direction. This is a percentage of the maximum burst size for voice traffic. Voice traffic exceeding the defined threshold is dropped and a log message is generated. Voice applications consume significant bandwidth, so this value can be set to a higher value once a general upstream rate is known by the network administrator (using a time trend analysis). The default threshold is 0%.

6 Configure the following parameters in respect to the intended WLAN **Downstream Rate Limit,** or traffic from wireless clients to associated Access Point radios and the controller or service platform:

Enable	Select the *Enable* radio button to enable rate limiting for data transmitted from the controller or service platform to its associated Access Point radios and connected wireless clients. Enabling this option does not invoke rate limiting for data traffic in the upstream direction. This feature is disabled by default.

Rate	Define an upstream rate limit between 50 - 1,000,000 kbps. This limit constitutes a threshold for the maximum the number of packets transmitted or received over the WLAN (from all access categories). Traffic that exceeds the defined rate is dropped and a log message is generated. The default setting is 5000 kbps.
Maximum Burst Size	Set a maximum burst size between 2 - 1024 kbytes. The smaller the burst, the less likely the downstream packet transmission will result in congestion for the WLAN's client destinations. By trending the typical number of ARP, broadcast, multicast and unknown unicast packets over a period of time, the average rate for each access category can be obtained. Once a baseline is obtained, administrators should add a 10% margin (minimally) to allow for traffic bursts. The default burst size is 320 kbytes.

7 Set the following WLAN **Downstream Random Early Detection Threshold** settings for each access category. An early random drop is done when the amount of tokens for a traffic stream falls below the set threshold.

Background Traffic	Set a percentage value for background traffic in the downstream direction. This is a percentage of the maximum burst size for low priority traffic. Background traffic exceeding the defined threshold is dropped and a log message is generated. Background traffic consumes the least bandwidth of any access category, so this value can be set to a lower value once a general downstream rate is known by the network administrator (using a time trend analysis). The default threshold is 50%.
Best Effort Traffic	Set a percentage value for best effort traffic in the downstream direction. This is a percentage of the maximum burst size for normal traffic. Best effort traffic exceeding the defined threshold is dropped and a log message is generated. Best effort traffic consumes little bandwidth, so this value can be set to a lower value once a general downstream rate is known by the network administrator (using a time trend analysis). The default threshold is 50%.
Video Traffic	Set a percentage value for video traffic in the downstream direction. This is a percentage of the maximum burst size for video traffic. Video traffic exceeding the defined threshold is dropped and a log message is generated. Video traffic consumes significant bandwidth, so this value can be set to a higher value once a general downstream rate is known by the network administrator (using a time trend analysis). The default threshold is 25%.
Voice Traffic	Set a percentage value for voice traffic in the downstream direction. This is a percentage of the maximum burst size for voice traffic. Voice traffic exceeding the defined threshold is dropped and a log message is generated. Voice applications consume significant bandwidth, so this value can be set to a higher value once a general upstream rate is known by the network administrator (using a time trend analysis). The default threshold is 0%. 0% means no early random drops will occur.

8 Configure the following parameters in respect to the intended Wireless Client **Upstream Rate Limit**:

Enable	Select the *Enable* radio button to enable rate limiting for data transmitted from the client to its associated Access Point radio and connected wireless controller. Enabling this option does not invoke client rate limiting for data traffic in the downstream direction. This feature is disabled by default.

Rate	Define an upstream rate limit between 50 - 1,000,000 kbps. This limit constitutes a threshold for the maximum the number of packets transmitted or received (from all access categories). Traffic that exceeds the defined rate is dropped by the client and a log message is generated. The default rate is 1,000 kbps.
Maximum Burst Size	Set a maximum burst size between 2 - 1024 kbytes. The smaller the burst, the less likely the upstream packet transmission will result in congestion for the wireless client. The default burst size is 64 kbytes.

9 Set the following Wireless Client **Upstream Random Early Detection Threshold** settings for each access category:

Background Traffic	Set a percentage value for background traffic in the upstream direction. This is a percentage of the maximum burst size for low priority traffic. Background traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default threshold is 50%.
Best Effort Traffic	Set a percentage for best effort traffic in the upstream direction. This is a percentage of the maximum burst size for normal traffic. Best effort traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default threshold is 50%.
Video Traffic	Set a percentage value for video traffic in the upstream direction. This is a percentage of the maximum burst size for video traffic. Video traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default threshold is 25%.
Voice Traffic	Set a percentage value for voice traffic in the downstream direction. This is a percentage of the maximum burst size for voice traffic. Voice traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default threshold is 0%.0% implies no early random drops occur.

10 Configure the following parameters in respect to the intended Wireless Client **Downstream Rate Limit** (traffic from a controller or service platform to associated Access Point radios and the wireless client):

Enable	Select the Enable radio button to enable rate limiting for data transmitted from connected wireless clients to the controller or service platform. Enabling this option does not invoke rate limiting for data traffic in the upstream direction. This feature is disabled by default.
Rate	Define a downstream rate limit between 50 - 1,000,000 kbps.This limit constitutes a threshold for the maximum the number of packets transmitted or received by the client. Traffic that exceeds the defined rate is dropped and a log message is generated. The default rate is 1,000 kbytes.
Maximum Burst Size	Set a maximum burst size between 2 - 64 kbytes. The smaller the burst, the less likely the downstream packet transmission will result in congestion for the wireless client. The default burst size is 64 kbytes.

11 Set the following Wireless Clients **Downstream Random Early Detection Threshold** settings:

Background Traffic	Set a percentage value for background traffic in the downstream direction. This is a percentage of the maximum burst size for low priority traffic. Background traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default is 50%.

Best Effort Traffic	Set a percentage value for best effort traffic in the downstream direction. This is a percentage of the maximum burst size for normal traffic. Best effort traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default is 50%.
Video Traffic	Set a percentage value for video traffic in the downstream direction. This is a percentage of the maximum burst size for video traffic. Video traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default is 25%.
Voice Traffic	Set a percentage value for voice traffic in the downstream direction. This is a percentage of the maximum burst size for voice traffic. Voice traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default threshold is 0%.0% means no early random drops occur.

12 Select **OK** to update this WLAN’s QoS rate limit settings. Select **Reset** to revert to the last saved configuration.

6.2.3 Configuring Multimedia Optimization Settings

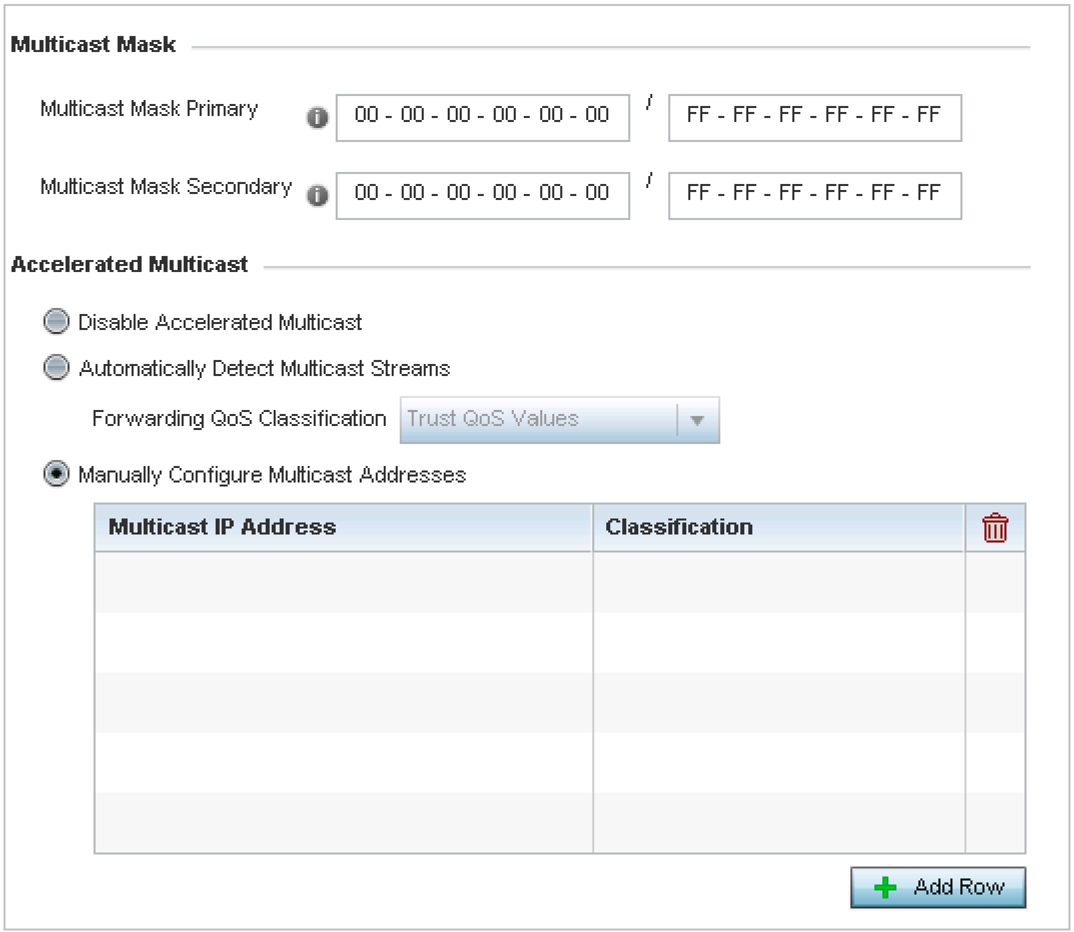
Multimedia optimizations customize the size and speed of multimedia content (voice, video etc.) to deliver WLAN traffic strategically to the WLAN's managed clients and their defined QoS requirements.

To configure multimedia optimizations for a controller, service platform or Access Point managed WLAN:

1 Select **Configuration** > **Wireless** > **WLAN QoS Policy** to display existing QoS policies available to WLANs.

2 Either select the **Add** button to define a new WLAN QoS policy, or select an existing WLAN QoS policy and select **Edit** to modify its existing configuration.

3 Select the **Multimedia Optimizations** tab.



Multicast Mask

Multicast Mask Primary: 00 - 00 - 00 - 00 - 00 - 00 / FF - FF - FF - FF - FF - FF

Multicast Mask Secondary: 00 - 00 - 00 - 00 - 00 - 00 / FF - FF - FF - FF - FF - FF

Accelerated Multicast

○ Disable Accelerated Multicast

○ Automatically Detect Multicast Streams

Forwarding QoS Classification: Trust QoS Values

● Manually Configure Multicast Addresses

Multicast IP Address	Classification

Figure 6-34 *QoS Policy WLAN Multimedia Optimizations screen*

4 Configure the following parameters in respect to the intended **Multicast Mask**:

Multicast Mask Primary	Configure the primary multicast mask defined for each listed QoS policy. Normally all multicast and broadcast packets are buffered until the periodic DTIM interval (indicated in the 802.11 beacon frame), when clients in power save mode wake to check for frames. However, for certain applications and traffic types, an administrator may want the frames transmitted immediately, without waiting for the DTIM interval. By configuring a primary and secondary multicast mask, an administrator can indicate which frames are transmitted immediately. Setting masks is optional and only needed if there are traffic types requiring special handling.
Multicast Mask Secondary	Set a secondary multicast mask for the WLAN QoS policy in case the primary becomes unavailable.

5 Set the following **Accelerated Multicast** settings:

Disable Multicast Streaming	Select this option to disable all Multicast Streaming on the WLAN.

Automatically Detect Multicast Streams	Select this option to have multicast packets converted to unicast to provide better overall airtime utilization and performance. The administrator can either have the system automatically detect multicast streams and convert all detected multicast streams to unicast, or specify which multicast streams are converted to unicast. When the stream is converted and queued for transmission, there are a number of classification mechanisms that can be applied to the stream and the administrator can select what type of classification they wan.
Manually Configure Multicast Adddresses	Select this option and specify a list of multicast addresses and classifications. Packets are accelerated when the destination addresses matches.

6 Select **OK** when completed to update this WLAN's Multimedia Optimizations settings. Select Reset to revert the screen back to its last saved configuration.

6.2.4 WLAN QoS Deployment Considerations

Before defining a QoS configuration on a WLAN, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- WLAN QoS configurations differ significantly from QoS policies configured for wireless controller associated Access Point radios. WLAN QoS configurations are designed to support the data requirements of wireless clients, including the data types they support and their network permissions. Radio QoS policies are specific to the transmit and receive characteristics of the connected radio’s themselves, independent from the wireless clients these Access Point radios support.
- Enabling WMM support on a WLAN only advertises WMM capability to wireless clients. The wireless clients must be also able to support WMM and use the parameters correctly while accessing the wireless network to truly benefit.
- Rate limiting is disabled by default on all WLANs. To enable rate limiting, a threshold must be defined for WLAN.
- Before enabling rate limiting on a WLAN, a baseline for each traffic type should be performed. Once a baseline has been determined, a minimum 10% margin should be added to allow for traffic bursts.
- The bandwidth required for real-time applications such as voice and video are very fairly easy to calculate as the bandwidth requirements are consistent and can be realistically trended over time. Applications such as Web, database and Email are harder to estimate, since bandwidth usage varies depending on how the applications are utilized.

6.3 Radio QoS Policy

Without a dedicated QoS policy, a wireless network operates on a best-effort delivery basis, meaning all traffic has equal priority and an equal chance of being delivered in a timely manner. When congestion occurs, all traffic has an equal chance of being dropped!

When configuring a QoS policy for a radio, select specific network traffic, prioritize it, and use congestion-management and congestion-avoidance techniques to provide deployment customizations best suited to each QoS policy’s intended wireless client base.

Wireless devices, associated Access Point radios and connected clients support several *Quality of Service* (QoS) techniques enabling real-time applications (such as voice and video) to co-exist simultaneously with lower priority background applications (such as Web, E-mail and file transfers). A well designed QoS policy should:

- Classify and mark data traffic to accurately prioritize and segregate it (by access category) throughout the network.
- Minimize the network delay and jitter for latency sensitive traffic.
- Ensure higher priority traffic has a better likelihood of delivery in the event of network congestion.
- Prevent the ineffective utilization of Access Points degrading session quality by configuring admission control mechanisms within each radio QoS policy

Wireless clients supporting low and high priority traffic contend with one another for access and data resources. The IEEE 802.11e amendment has defined *Enhanced Distributed Channel Access* (EDCA) mechanisms stating high priority traffic can access the network sooner then lower priority traffic. The EDCA defines four traffic classes (or access categories); *voice* (highest), *video* (next highest), *best effort* and *background* (lowest).The EDCA has defined a time interval for each traffic class, known as the *Transmit Opportunity* (TXOP). The TXOP prevents traffic of a higher priority from completely dominating the wireless medium, thus ensuring lower priority traffic is still supported by controller or service platform associated Access Points and their connected radios.

IEEE 802.11e includes an advanced power saving technique called *Unscheduled Automatic Power Save Delivery* (U-APSD) that provides a mechanism for wireless clients to retrieve packets buffered by an Access Point. U-APSD reduces the amount of signaling frames sent from a client to retrieve buffered data from an Access Point. U-APSD also allows Access Points to deliver buffered data frames as *bursts*, without backing-off between data frames. These improvements are useful for voice clients, as they provide improved battery life and call quality.

The Wi-Fi alliance has created *Wireless Multimedia* (WMM) and *WMM Power Save* (WMM-PS) certification programs to ensure interoperability between 802.11e WLAN infrastructure implementations and wireless clients. A WiNG wireless network supports both WMM and WMM-Power Save techniques. WMM and WMM-PS (U-APSD) are enabled by default in each WLAN profile.

Enabling WMM support on a WLAN just advertises the WLAN's WMM capability and radio configuration to wireless clients. The wireless clients must be also able to support WMM and use the values correctly while accessing the WLAN.

WMM includes advanced parameters (CWMin, CWMax, AIFSN and TXOP) specifying back-off duration and inter-frame spacing when accessing the network. These parameters are relevant to both connected Access Point radios and their wireless clients. Parameters impacting Access Point transmissions to their clients are controlled using per radio WMM settings, while parameters used by wireless clients are controlled by a WLAN's WMM settings.

WiNG wireless devices include a *Session Initiation Protocol* (SIP), *Skinny Call Control Protocol* (SCCP) and *Application Layer Gateway* (ALGs) enabling devices to identify voice streams and dynamically set voice call bandwidth. Controllers and service platforms use the data to provide prioritization and admission control to these devices without requiring TSPEC or WMM client support.

WiNG wireless devices support static QoS mechanisms per WLAN to provide prioritization of WLAN traffic when legacy (non WMM) clients are deployed. When enabled on a WLAN, traffic forwarded to a client is prioritized and forwarded based on the WLAN's WMM access control setting.

✓ **NOTE:** Statically setting a WLAN WMM access category value only prioritizes traffic from the to the client, not from the client.

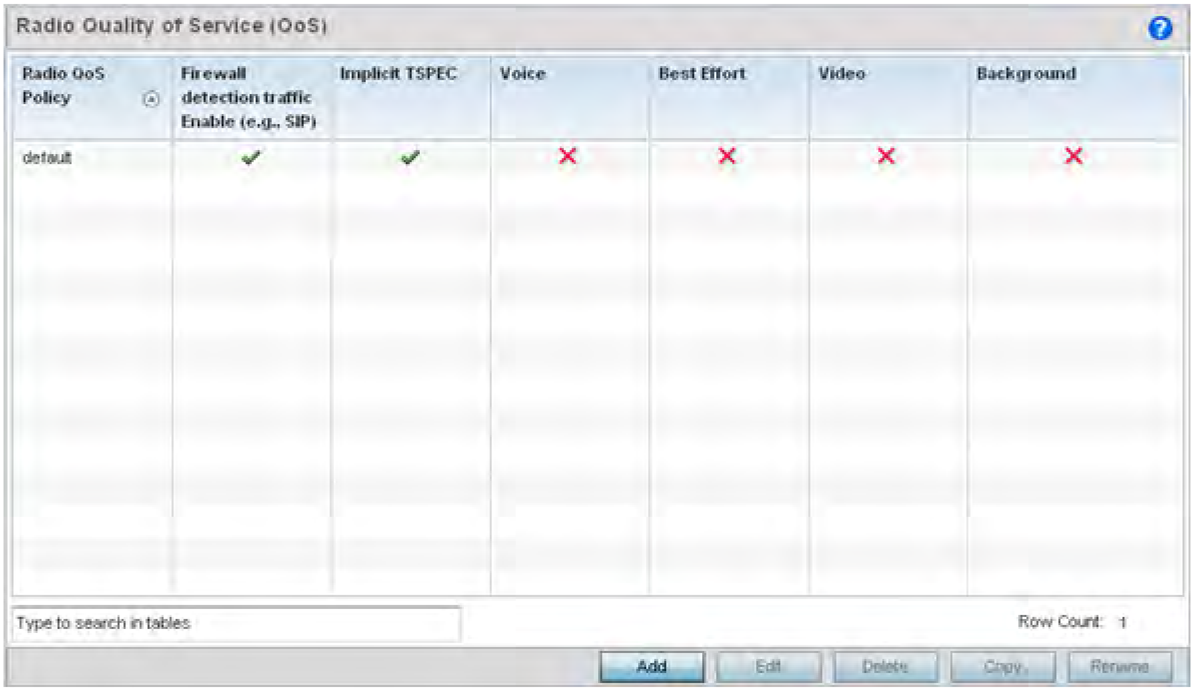
Rate limits can be applied to WLANs using groups defined locally or externally from a RADIUS server using *Vendor Specific Attributes* (VSAs). Rate limits can be applied to authenticating users using 802.1X, captive portal authentication and MAC authentication.

6.3.1 Configuring Radio QoS Policies

▸ *Radio QoS Policy*

To configure a radio’s QoS policy:

1 Select **Configuration** > **Wireless** > **Radio QoS Policy** to display existing Radio QoS policies.



Radio Quality of Service (QoS)

Radio QoS Policy	Firewall detection traffic Enable (e.g., SIP)	Implicit TSPEC	Voice	Best Effort	Video	Background
default	✓	✓	✗	✗	✗	✗

Type to search in tables

Row Count: 1

Figure 6-35 *Radio QoS Policy screen*

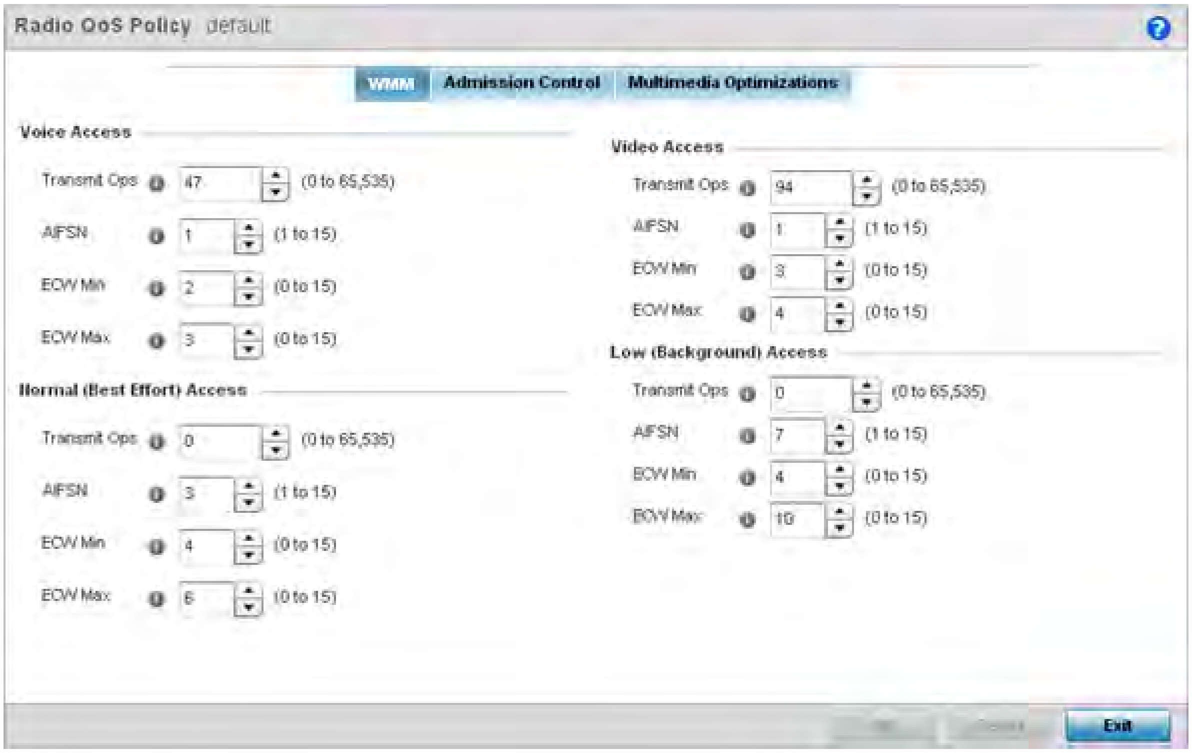
The Radio QoS Policy screen lists those radio QoS policies created thus far. Any of these policies can be selected and applied.

2 Refer to the following information listed for each existing Radio QoS policy:

Radio QoS Policy	Displays the name of each Radio QoS policy. This is the name set for each listed policy when it was created and cannot be modified as part of the policy edit process.
Firewall detection traffic Enable (e.g., SIP)	A green check mark defines the policy as applying radio QoS settings to traffic detected by the Firewall. A red “X” defines the policy as having Firewall detection disabled. When enabled, the Firewall simulates the reception of frames for voice traffic when the voice traffic was originated via SIP or SCCP control traffic. If a client exceeds configured values, the call is stopped and/or received voice frames are forwarded at the next non admission controlled traffic class priority. This applies to clients that do not send TSPEC frames only.

Implicit TSPEC	A green check mark defines the policy as requiring wireless clients to send their traffic specifications to a controller or service platform managed Access Point before they can transmit or receive data. If enabled, this setting applies to just this radio's QoS policy. When enabled, the Access Point simulates the reception of frames for any traffic class by looking at the amount of traffic the client is receiving and sending. If the client sends more traffic than has been configured for an admission controlled traffic class, the traffic is forwarded at the priority of the next non admission controlled traffic class. This applies to clients that do not send TSPEC frames only.
Voice	A green check mark indicates that Voice prioritization QoS is enabled on the radio. A red X indicates *Voice* prioritization QoS is disabled on the radio.
Best Effort	A green check mark indicates that Best Effort QoS is enabled on the radio. A red X indicates *Best Effort* QoS is disabled on the radio.
Video	A green check mark indicates that Video prioritization QoS is enabled on the radio. A red X indicates *Video* prioritization QoS is disabled on the radio.
Background	A green check mark indicates that Background prioritization QoS is enabled on the radio. A red X indicates *Background* prioritization QoS is disabled on the radio.

3 Either select **Add** to create a new radio QoS policy, or select one of the existing policies listed and select the **Edit** button to modify its configuration. Optionally **Copy** or **Rename** QoS policies as needed.



Radio QoS Policy default

WMM | Admission Control | Multimedia Optimizations

Voice Access

Transmit Ops: 47 (0 to 65,535)
AIFSN: 1 (1 to 15)
ECW Min: 2 (0 to 15)
ECW Max: 3 (0 to 15)

Normal (Best Effort) Access

Transmit Ops: 0 (0 to 65,535)
AIFSN: 3 (1 to 15)
ECW Min: 4 (0 to 15)
ECW Max: 6 (0 to 15)

Video Access

Transmit Ops: 94 (0 to 65,535)
AIFSN: 1 (1 to 15)
ECW Min: 3 (0 to 15)
ECW Max: 4 (0 to 15)

Low (Background) Access

Transmit Ops: 0 (0 to 65,535)
AIFSN: 7 (1 to 15)
ECW Min: 4 (0 to 15)
ECW Max: 10 (0 to 15)

Figure 6-36 *Radio QoS Policy WMM screen*

The Radio QoS Policy screen displays the **WMM** tab by default. Use the WMM tab to define the access category configuration (*CWMin*, *CWMax*, *AIFSN* and *TXOP* values) in respect to the type of wireless data planned for this new or updated WLAN radio QoS policy.

4 Set the following **Voice Access** settings for the Radio QoS policy:

Transmit Ops	Use the slider to set the maximum duration a device can transmit after obtaining a transmit opportunity. When resources are shared between a *Voice over IP* (VoIP) call and a low priority file transfer, bandwidth is normally exploited by the file transfer, thus reducing call quality or even causing the call to disconnect. With voice QoS, a VoIP call (a real-time session), receives priority, maintaining a high level of voice quality. For higher-priority traffic categories (like voice), the Transmit Ops value should be set to a low number. The default value is 47.
AIFSN	Set the current AIFSN between 1-15. Higher-priority traffic voice categories should have lower AIFSNs than lower-priority traffic categories. This will cause lower-priority traffic to wait longer before attempting access. The default value is 1.
ECW Min	The ECW Min is combined with the ECW Max to create a contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic. The available range is from 0-15. The default value is 2.
ECW Max	The ECW Max is combined with the ECW Min to create a contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic. The available range is from 0-15. The default value is 3.

5 Set the following **Normal (Best Effort) Access** settings for the radio QoS policy:

Transmit Ops	Use the slider to set the maximum duration a device can transmit after obtaining a transmit opportunity. For higher-priority traffic categories, this value should be set to a low number. The default value is 0.
AIFSN	Set the current AIFSN between1-15. Lower priority traffic categories should have higher AIFSNs than higher priority traffic categories. This will cause lower priority traffic to wait longer before attempting access. The default value is 3.
ECW Min	The ECW Min is combined with the ECW Max to create a contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Higher values are used for lower priority traffic (like Normal). The available range is from 0-15. The default value is 4.
ECW Max	The ECW Max is combined with the ECW Min to create a contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Higher values are used for lower priority traffic (like Normal). The available range is from 0-15. The default value is 6.

6 Set the following **Video Access** settings for the Radio QoS policy:

Transmit Ops	Use the spinner control to set the maximum duration a radio can transmit after obtaining a transmit opportunity. For higher-priority traffic categories (like video), this value should be set to a low number. The default value is 94.

AIFSN	Set the current AIFSN between 1-15. Higher-priority traffic categories should have lower AIFSNs than lower-priority traffic categories. This will cause lower-priority traffic to wait longer before attempting access. The default value is 1.
ECW Min	The ECW Min is combined with the ECW Max to create a contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic (like video). The available range is from 0-15. The default value is 3.
ECW Max	The ECW Max is combined with the ECW Min to create a contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic (like video). The available range is from 0-15. The default value is 4.

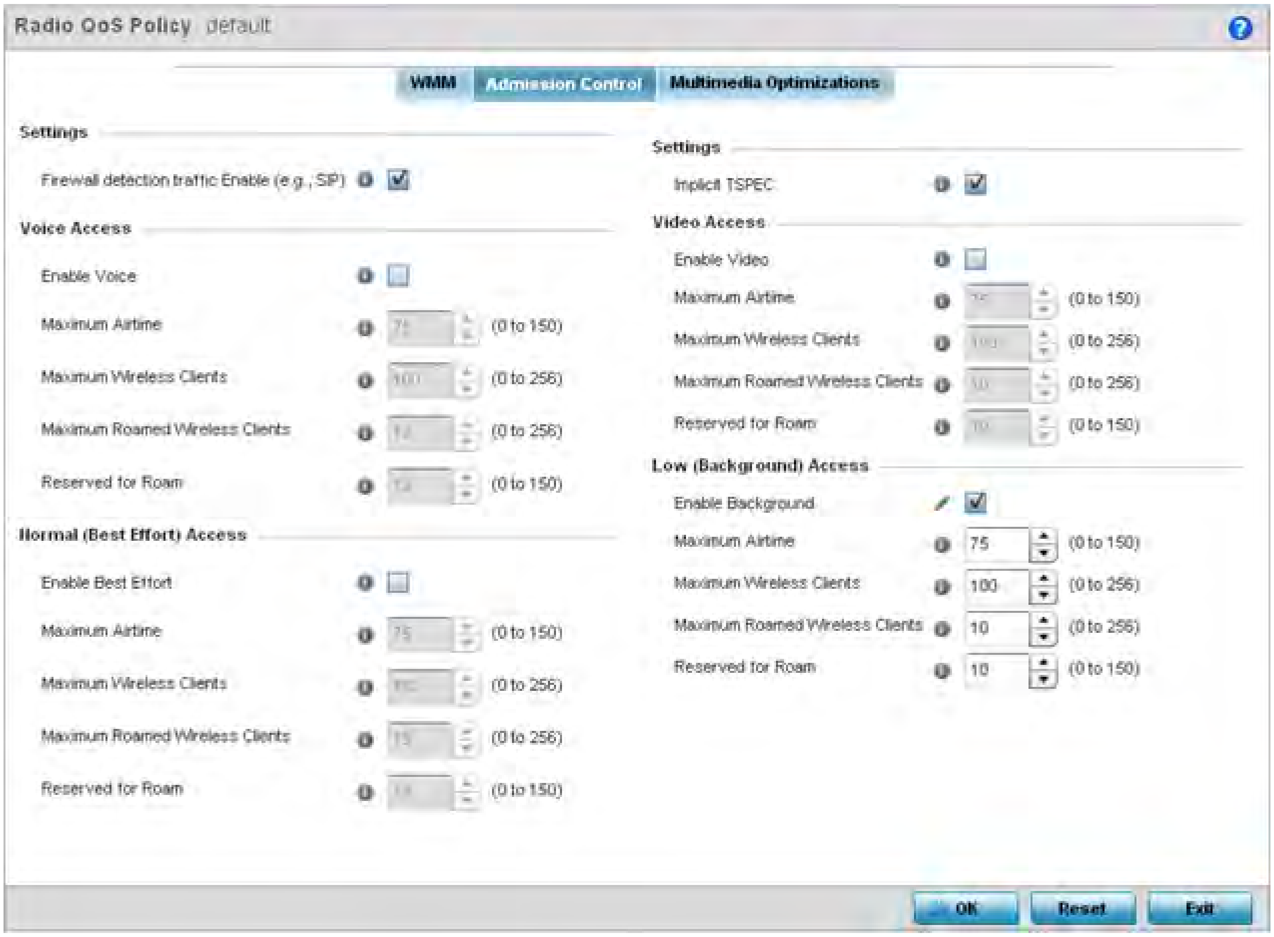
7 Set the following **Low (Background) Access** settings for the radio QoS policy:

Transmit Ops	Use the slider to set the maximum duration a device can transmit after obtaining a transmit opportunity. For higher-priority traffic categories, this value should be set to a low number. The default value is 0.
AIFSN	Set the current AIFSN between 1-15. Lower priority traffic categories should have higher AIFSNs than higher priority traffic categories. This will cause lower priority traffic to wait longer before attempting access. The default value is 7.
ECW Min	The ECW Min is combined with the ECW Max to create a contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Higher values are used for lower priority traffic (like Low). The available range is from 0-15. The default value is 4.
ECW Max	The ECW Max is combined with the ECW Min to create a contention value in the form of a numerical range. From this range, a random number is selected for the back off mechanism. Lower values are used for higher priority traffic (like video). The available range is from 0-15. The default value is 10.

8 Select **OK** when completed to update the radio QoS settings for this policy. Select **Reset** to revert the WMM screen back to its last saved configuration.

9 Select the **Admission Control** tab to configure an admission control configuration for selected radio QoS policy. Admission control requires clients send their *traffic specifications* (TSPEC) to a controller or service platform managed Access Point before they can transmit or receive data.

The name of the Radio QoS policy for which the admission control settings apply displays in the banner of the QoS Policy screen.



Radio QoS Policy default

Settings

Firewall detection traffic Enable (e.g., SIP) ☑

Voice Access

Enable Voice □

Maximum Airtime 75 (0 to 150)

Maximum Wireless Clients 100 (0 to 256)

Maximum Roamed Wireless Clients [illegible] (0 to 256)

Reserved for Roam [illegible] (0 to 150)

llormal (Best Effort) Access

Enable Best Effort □

Maximum Airtime 75 (0 to 150)

Maximum Wireless Clients [illegible] (0 to 256)

Maximum Roamed Wireless Clients 15 (0 to 256)

Reserved for Roam [illegible] (0 to 150)

Settings

Implicit TSPEC ☑

Video Access

Enable Video □

Maximum Airtime [illegible] (0 to 150)

Maximum Wireless Clients 100 (0 to 256)

Maximum Roamed Wireless Clients 10 (0 to 256)

Reserved for Roam 10 (0 to 150)

Low (Background) Access

Enable Background ☑

Maximum Airtime 75 (0 to 150)

Maximum Wireless Clients 100 (0 to 256)

Maximum Roamed Wireless Clients 10 (0 to 256)

Reserved for Roam 10 (0 to 150)

Figure 6-37 *Radio QoS Policy Admission Control screen*

10 Select the **Firewall detection traffic Enable (e.g, SIP)** check box to force admission control to traffic whose access category is detected by the firewall. This feature is enabled by default.

11 Select the **Implicit TSPEC** check box to require wireless clients to send their traffic specifications to a controller or service platform managed Access Point before they can transmit or receive data. If enabled, this setting applies to just this radio's QoS policy. This feature is enabled by default.

12 Set the following **Voice Access** admission control settings for this radio QoS policy:

Enable Voice	Select the check box to enable admission control for this policy's voice traffic. Only voice traffic admission control is enabled, not any of the other access categories (each access category must be separately enabled and configured).
Maximum Airtime	Set the maximum airtime (in the form of a percentage of the radio's bandwidth) allotted to admission control for voice supported client traffic. The available percentage range is from 0-150%, with 150% being available to account for over-subscription. This value ensures the radio's bandwidth is available for high bandwidth voice traffic (if anticipated on the wireless medium) or other access category traffic if voice support is not prioritized. Voice traffic requires longer radio airtime to process, so set a longer airtime value if this radio QoS policy is intended to support voice. The default value is 75%.

Maximum Wireless Clients	Set the number of voice supported wireless clients allowed to exist (and consume bandwidth) within the radio’s QoS policy. Select from an available range of 0-256 clients. Consider setting this value proportionally to the number of other QoS policies supporting the voice access category, as wireless clients supporting voice use a greater proportion of resources than lower bandwidth traffic (like low and best effort categories). The default value is 100 clients.
Maximum Roamed Wireless Clients	Set the number of voice supported wireless clients allowed to roam to a different radio. Select from a range of 0-256 clients. The default value is 10 roamed clients.
Reserved for Roam	Set the roam utilization (in the form of a percentage of the radio’s bandwidth) allotted to admission control for voice supported clients who have roamed to a different radio. The available percentage range is from 0-150%, with 150% available to account for over-subscription. The default value is 10%.

13 Set the following **Normal (Best Effort) Access** admission control settings for this radio QoS policy

Enable Best Effort	Select the check box to enable admission control for this policy’s video traffic. Only normal background traffic admission control is enabled, not any of the other access categories (each access category must be separately enabled and configured). This feature is disabled by default.
Maximum Airtime	Set the maximum airtime (in the form of a percentage of the radio’s bandwidth) allotted to admission control for normal background client traffic. The available percentage range is from 0-150%, with 150% being available to account for over-subscription. This value helps ensure the radio’s bandwidth is available for lower bandwidth normal traffic (if anticipated to proliferate the wireless medium). Normal background traffic only needs a short radio airtime to process, so set an intermediate airtime value if this radio QoS policy is reserved for background data support. The default value is 75%.
Maximum Wireless Clients	Set the number of wireless clients supporting background traffic allowed to exist (and consume bandwidth) within the radio’s QoS policy. Select from an available range of 0-256 clients. The default value is 100 clients.
Maximum Roamed Wireless Clients	Set the number of voice supported wireless clients allowed to roam to a different radio. Select from a range of 0-256 clients. The default value is 10 roamed clients.
Reserved for Roam	Set the roam utilization (in the form of a percentage of the radio’s bandwidth) allotted to admission control for normal background supported clients who have roamed to a different radio. The available percentage range is from 0-150%, with 150% available to account for over-subscription. The default value is 10%.

14 Set the following **Video Access** admission control settings for this radio QoS policy:

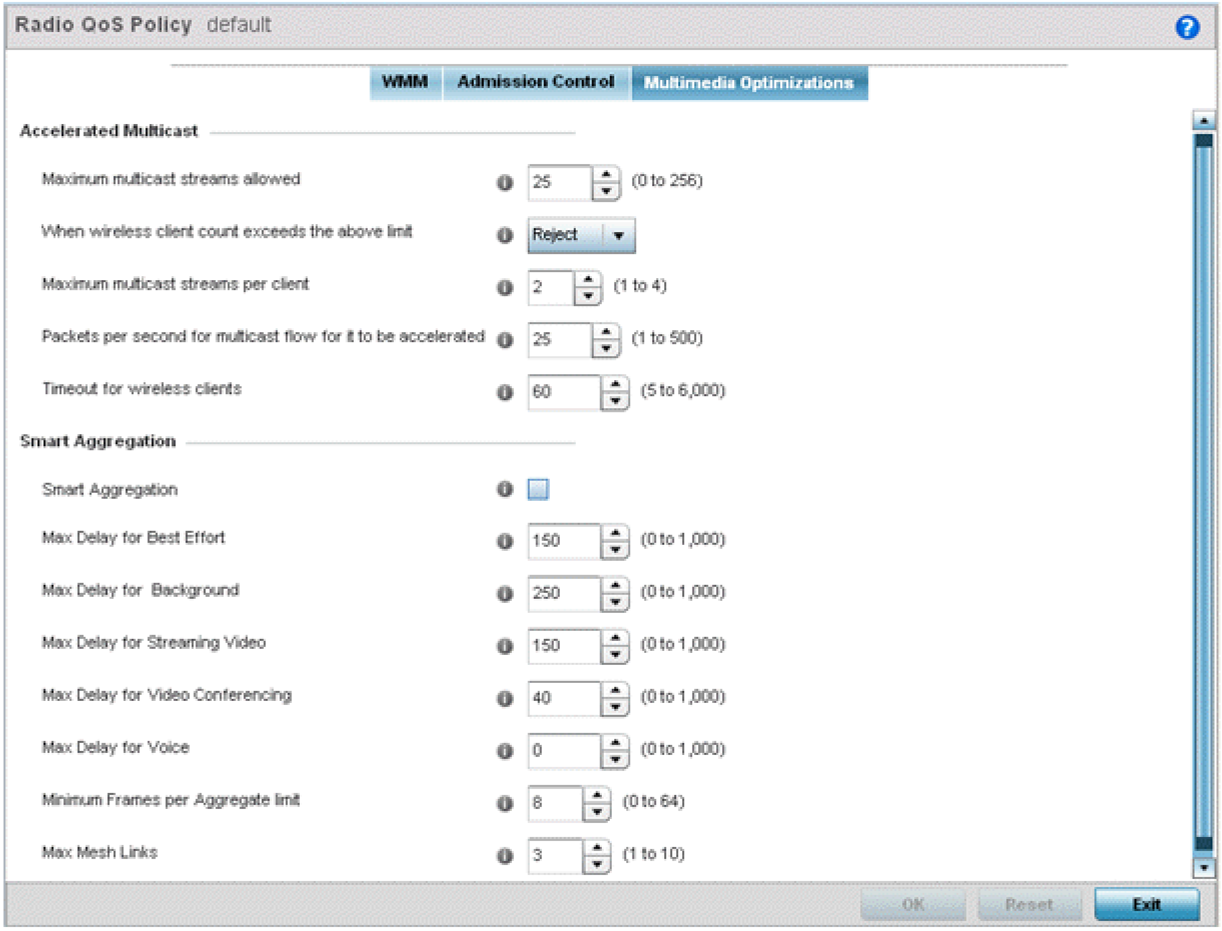
Enable Video	Select the check box to enable admission control for this policy’s video traffic. Only video traffic admission control is enabled, not any of the other access categories (each access category must be separately enabled and configured). This feature is disabled by default.

Maximum Airtime	Set the maximum airtime (in the form of a percentage of the radio's bandwidth) allotted to admission control for video supported client traffic. The available percentage range is from 0-150%, with 150% being available to account for over-subscription. This value helps ensure the radio's bandwidth is available for high bandwidth video traffic (if anticipated on the wireless medium) or other access category traffic if video support is not prioritized. Video traffic requires longer radio airtime to process, so set a longer airtime value if this radio QoS policy is intended to support video. The default value is 75%.
Maximum Wireless Clients	Set the number of wireless clients supporting background traffic allowed to exist (and consume bandwidth) within the radio's QoS policy. Select from an available range of 0-256 clients. The default value is 100 clients.
Maximum Roamed Wireless Clients	Set the number of video supported wireless clients allowed to roam to a different radio. Select from a range of 0-256 clients. The default value is 10 roamed clients.
Reserved for Roam	Set the roam utilization (in the form of a percentage of the radio's bandwidth) allotted to admission control for video supported clients who have roamed to a different radio. The available percentage range is from 0-150%, with 150% accounting for over-subscription. The default value is 10%.

15 Set the following **Low (Background) Access** admission control settings for this radio QoS policy:

Enable Background	Select the check box to enable admission control for this policy's lower priority best effort traffic. Only low best effort traffic admission control is enabled, not any of the other access categories (each access category must be separately enabled and configured).
Maximum Airtime	Set the maximum airtime (in the form of a percentage of the radio's bandwidth) allotted to admission control for low, best effort, client traffic. The available percentage range is from 0-150%, with 150% being available to account for over-subscription. Best effort traffic only needs a short radio airtime to process, so set an intermediate airtime value if this radio QoS policy is reserved to support background data. The default value is 75%.
Maximum Wireless Clients	Set the number of low and best effort supported wireless clients allowed to exist (and consume bandwidth) within the radio's QoS policy. Select from an available range of 0-256 clients. The default value is 100 clients.
Maximum Roamed Wireless Clients	Set the number of low and best effort supported wireless clients allowed to roam to a different radio. Select from a range of 0-256 clients. The default value is 10 roamed clients.
Reserved for Roam	Set the roam utilization (in the form of a percentage of the radio's bandwidth) allotted to admission control for normal background supported clients who have roamed to a different radio. The available percentage range is from 0-150%, with 150% available to account for over-subscription. The default value is 10%.

16 Select the **Multimedia Optimizations** tab to set the advanced multimedia QoS and Smart Aggregation configuration for selected radio QoS policy.



Radio QoS Policy default

Accelerated Multicast

Maximum multicast streams allowed 25 (0 to 256)

When wireless client count exceeds the above limit Reject

Maximum multicast streams per client 2 (1 to 4)

Packets per second for multicast flow for it to be accelerated 25 (1 to 500)

Timeout for wireless clients 60 (5 to 6,000)

Smart Aggregation

Smart Aggregation □

Max Delay for Best Effort 150 (0 to 1,000)

Max Delay for Background 250 (0 to 1,000)

Max Delay for Streaming Video 150 (0 to 1,000)

Max Delay for Video Conferencing 40 (0 to 1,000)

Max Delay for Voice 0 (0 to 1,000)

Minimum Frames per Aggregate limit 8 (0 to 64)

Max Mesh Links 3 (1 to 10)

Figure 6-38 *Radio QoS Policy Multimedia Optimizations screen*

17 Set the following **Accelerated Multicast** settings for this radio QoS policy:

Maximum multicast streams allowed	Specify the maximum number of multicast streams (between 0 and 256) permitted to use accelerated multicast. The default value is 25.
When wireless client count exceeds the above limit	When the wireless client count using accelerated multicast exceeds the maximum number, set the radio to either *Reject* new wireless clients or *Revert* existing clients to a non-accelerated state.
Maximum multicast streams per client	Specify the maximum number of multicast streams (between 1 and 4) wireless clients can use. The default value is 2.
Packets per second for multicast flow for it to be accelerated	Specify the threshold of multicast packets per second (between 1 and 500) that triggers acceleration for wireless clients. The default value is 25.
Timeout for wireless clients	Specify a timeout value in seconds (between 5 and 6,000) for wireless clients to revert back to a non-accelerated state. The default value is 60.

18 Define the following **Smart Aggregation** settings:

Smart Aggregation enhances frame aggregation by dynamically selecting the time when the aggregated frame is transmitted. In a frame's typical aggregation, an aggregated frame is sent when it meets one of these conditions:

- When a preconfigured number of aggregated frames is reached

- When an administrator defined interval has elapsed since the first frame (of a set of frames to be aggregated) was received
- When an administrator defined interval has elapsed since the last frame (not necessarily the final frame) of a set of frames to be aggregated was received

With this enhancement, an aggregation delay is set uniquely for each traffic class. For example, voice traffic might not be aggregated, but sent immediately. Whereas, background data traffic is set a delay for aggregating frames, and these aggregated frames are sent.

Smart Aggregation	Select to enable smart aggregation and dynamically define when an aggregated frame is transmitted. Smart aggregation is disabled by default.
Max Delay for Best Effort	Set the maximum time (in milliseconds) to delay best effort traffic. The default setting is 150 milliseconds.
Max Delay for Background	Set the maximum time (in milliseconds) to delay background traffic. The default setting is 250 milliseconds.
Max Delay for Streaming Video	Set the maximum time (in milliseconds) to delay streaming video traffic. The default setting is 150 milliseconds.
Max Delay for Video Conferencing	Set the maximum time (in milliseconds) to delay video conferencing traffic. The default setting is 40 milliseconds.
Max Delay for Voice	Set the maximum time (in milliseconds) to delay voice traffic. The default setting is 0 milliseconds.
Minimum frames per Aggregate limit	Set the minimum number of frames to aggregate in a frame before it is transmitted. The default setting is 8 frames.
Max Mesh Links	Set the maximum number of mesh hops for smart aggregation. The default setting is 3.

Select **OK** to update the radio QoS settings for this policy. Select **Reset** to revert to the last saved configuration.

6.3.2 Radio QoS Configuration and Deployment Considerations

▸ *Radio QoS Policy*

- Before defining a radio QoS policy, refer to the following deployment guidelines to ensure the configuration is optimally effective:
- To support QoS, each multimedia application, wireless client and WLAN is required to support WMM.
- WMM enabled clients can co-exist with non-WMM clients on the same WLAN. Non-WMM clients are always assigned a Best Effort access category.
- Default WMM values should be used for all deployments. Changing these values can lead to unexpected traffic blockages, and the blockages might be difficult to diagnose.
- Overloading an Access Point radio with too much high priority traffic (especially voice) degrades overall service quality for all users.
- TSPEC admission control is only available with newer voice over WLAN phones. Many legacy voice devices do not support TSPEC or even support WMM traffic prioritization.

6.4 Association ACL

An association ACL is a policy-based ACL that either prevents or allows wireless clients from connecting to a WLAN.

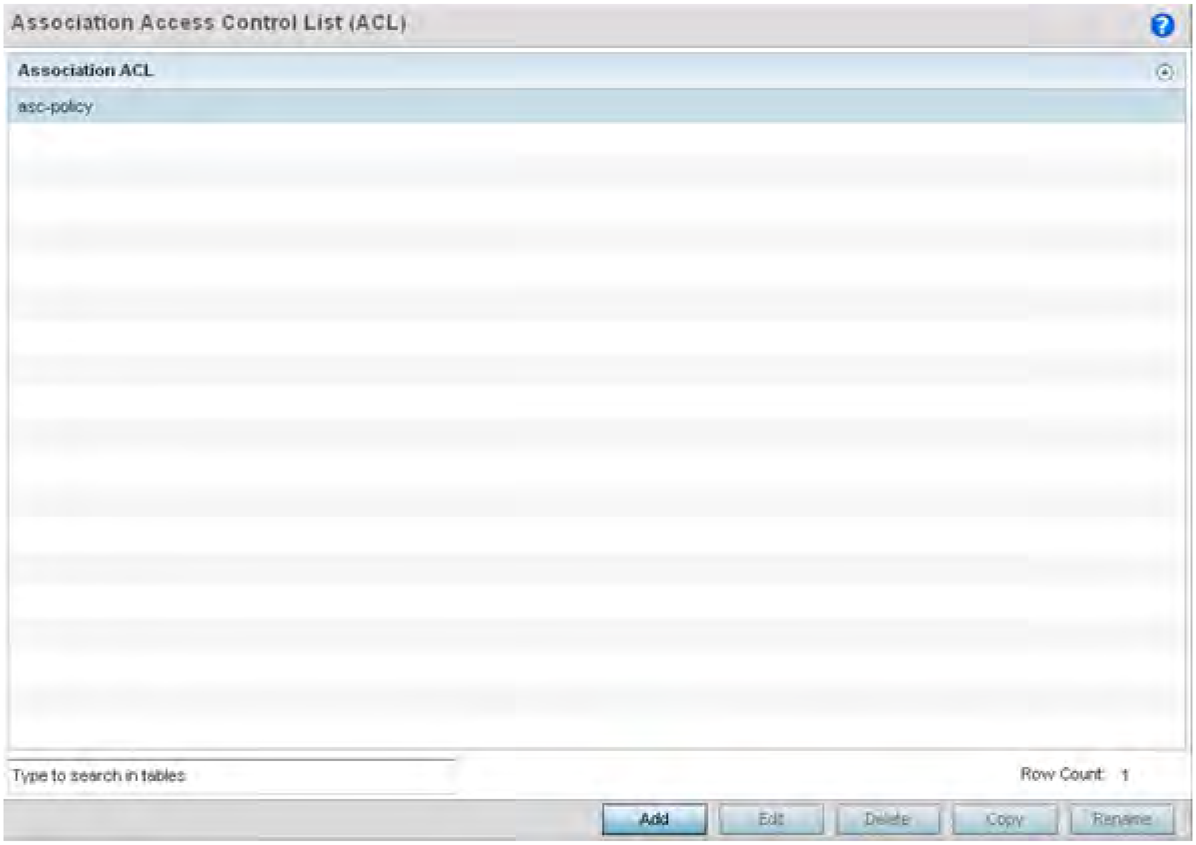
An association ACL affords a system administrator the ability to grant or restrict client access by specifying a wireless client MAC address or range of MAC addresses to either include or exclude from connectivity.

Association ACLs are applied to WLANs as an additional access control mechanism. They can be applied to WLANs from within a WLAN Policy's Advanced configuration screen. For more information on applying an existing Association ACL to a WLAN, see *Configuring Advanced WLAN Settings*.

To define an association ACL deployable with a WLAN:

1 Select **Configuration** > **Wireless** > **Association ACL** to display existing Association ACLs.

The **Association Access Control List (ACL)** screen lists those Association ACL policies created thus far. Any of these policies can be selected and applied.



Association Access Control List (ACL)

Association ACL
asc-policy

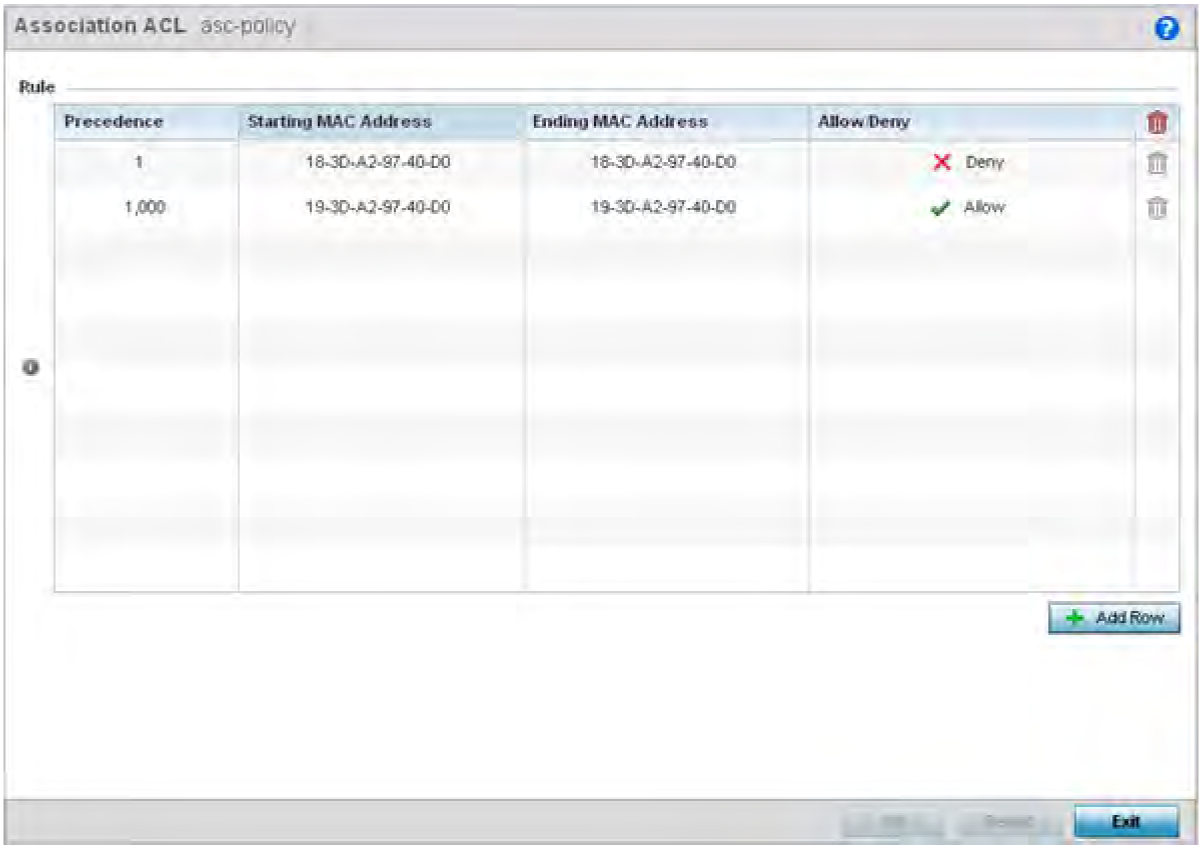
Type to search in tables

Row Count: 1

Figure 6-39 *Association Access Control List (ACL) screen*

2 Select **Add** to define a new ACL configuration, **Edit** to modify an existing ACL configuration or **Delete** to remove one. Optionally **Copy** or **Rename** a list as needed.

A unique Association ACL screen displays for defining the new ACL or modifying a selected ACL.



Association ACL asc-policy

Rule

Precedence	Starting MAC Address	Ending MAC Address	Allow/Deny
1	18-3D-A2-97-40-D0	18-3D-A2-97-40-D0	✗ Deny
1,000	19-3D-A2-97-40-D0	19-3D-A2-97-40-D0	✓ Allow

Figure 6-40 *Association Access Control List (ACL) screen*

3 Select the **+ Add Row** button to add an association ACL template.

4 Set the following parameters for the creation or modification of the Association ACL:

Association ACL	If creating an new association ACL, provide a name specific to its function. Avoid naming it after the WLAN it may support. The name cannot exceed 32 characters.
Precedence	The rules within a WLAN's ACL are applied to packets based on their precedence values. Every rule has a unique sequential precedence value you define. You cannot add two rules's with the same precedence. The default precedence is 1, so be careful to prioritize ACLs accordingly as they are added.
Starting MAC Address	Provide a starting MAC range address for clients requesting association.
Ending MAC Address	Provide an ending MAC range address for clients requesting association.
Allow/Deny	Use the drop-down menu to either *Allow* or *Deny* access if a MAC address matches this rule.

5 Select the **+ Add Row** button to add MAC address ranges and allow/deny designations.

6 Select **OK** to update the Association ACL settings. Select **Reset** to revert to the last saved configuration.

6.4.1 Association ACL Deployment Considerations

▸ Association ACL

Before defining an Association ACL configuration and applying it to a WLAN, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- Use the Association ACL screen strategically to name and configure ACL policies meeting the requirements of the particular WLANs they may map to. However, be careful not to name ACLs after specific WLANs, as individual ACL policies can be used by more than one WLAN.
- You cannot apply more than one MAC based ACL to a Layer 2 interface. If a MAC ACL is already configured on a Layer 2 interface, and a new MAC ACL is applied to the interface, the new ACL replaces the previously configured one.

6.5 Smart RF Policy

Self Monitoring At Run Time RF Management (Smart RF) is a WiNG innovation designed to simplify RF configurations for new deployments, while (over time) providing on-going deployment optimization radio performance improvements.

A Smart RF policy can reduce deployment costs by scanning the RF environment to determine the best channel and transmit power configuration for each radio. Smart RF policies can be applied to specific RF Domains, to apply site specific deployment configurations and self-healing values to groups of devices within pre-defined physical RF coverage areas.

Smart RF centralizes the decision process and makes intelligent RF configuration decisions using information obtained from the RF environment. Smart RF helps reduce ongoing management and maintenance costs by constantly monitoring the network for external interference, neighbor interference, non-WiFi interference and client connectivity. Smart RF then intelligently applies various algorithms to arrive at the optimal channel and power selection for all Access Points in the network and constantly reacts to changes in the RF environment.

Smart RF also provides self-healing functions by monitoring the network in real-time and provides automatic mitigation from potentially problematic events such as radio interference, non-WiFi interference (noise), external WiFi interference, coverage holes and radio failures. Smart RF employs self-healing to enable a WLAN to better maintain wireless client performance and site coverage during dynamic RF environment changes, which typically require manual reconfiguration to resolve.

Smart RF is supported on any RF Domain manager. In standalone environments, individual controllers, service platforms or Access Points manage the calibration and monitoring phases. In clustered environments, a single controller or service platform is elected a Smart RF master and the remaining cluster members operate as Smart RF clients. In cluster operation, the Smart RF master co-ordinates the calibration and configuration and during the monitoring phase receives information from the Smart RF clients.

If a Smart RF managed radio is operating in WLAN mode on a channel requiring DFS, it will switch channels if radar is detected.

- If Smart RF is enabled, the radio picks a channel defined in the Smart RF policy.
- If Smart RF is disabled, but a Smart RF policy is mapped, the radio picks a channels specified in the Smart RF policy
- If no SMART RF policy is mapped, the radio selects a random channel

If the radio is a dedicated sensor, it stops termination on that channel if a neighboring Access Points detects radar. The Access Point attempts to come back to its original channel (statically configured or selected by Smart RF) after the channel evacuation period has expired.

Change this behavior using a no dfs-rehome command from the controller or service platform CLI. This keeps the radio on the newly selected channel and prevents the radio from coming back to the original channel, even after the channel evacuation period.

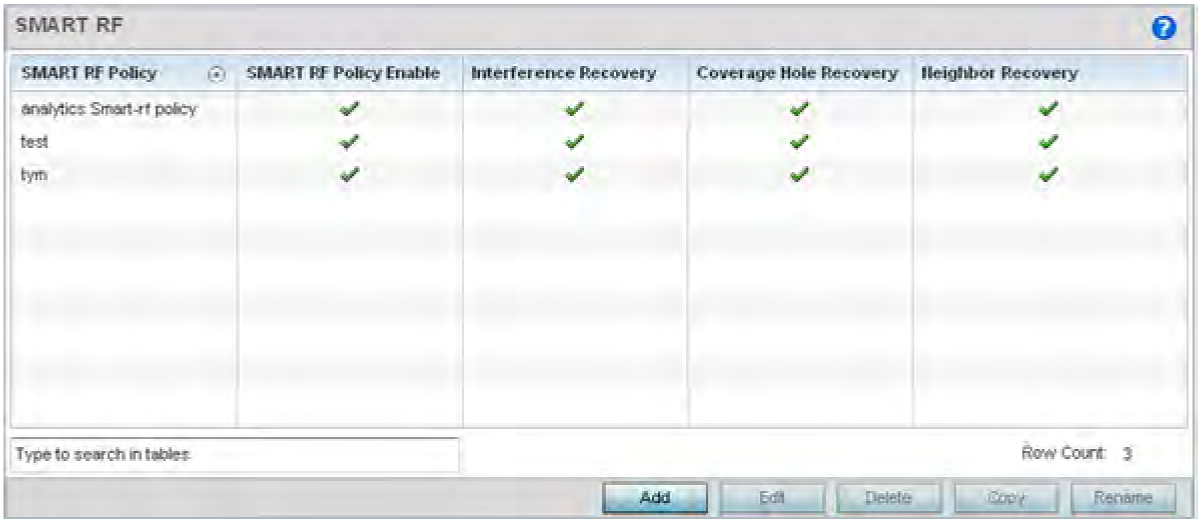
☑ **NOTE:** RF planning must be performed to ensure overlapping coverage exists at a deployment site for Smart RF to be a viable network performance tool. Smart RF can only provide recovery when Access Points are deployed appropriately. Smart RF is not a solution, it's a temporary measure. Administrators need to determine the root cause of RF deterioration and fix it. Smart RF history/events can assist.

To define a Smart RF policy:

1 Select **Configuration** > **Wireless** > **Smart RF Policy** to display existing Smart RF policies.

The Smart RF screen lists those Smart RF policies created thus far. Any of these policies can be selected and applied.

The user has the option of displaying the configurations of each Smart RF Policy defined thus far, or referring to the **Smart RF Browser** and either selecting individual Smart RF polices or selecting existing RF Domains to review which Smart RF policies have been applied. For more information on how RF Domains function, and how to apply a Smart RF policy, see *About RF Domains* and *Managing RF Domains*.



SMART RF

SMART RF Policy	SMART RF Policy Enable	Interference Recovery	Coverage Hole Recovery	Neighbor Recovery
analytics Smart-rf policy	✓	✓	✓	✓
test	✓	✓	✓	✓
tym	✓	✓	✓	✓

Type to search in tables

Row Count: 3

Figure 6-41 *Smart RF Policy screen*

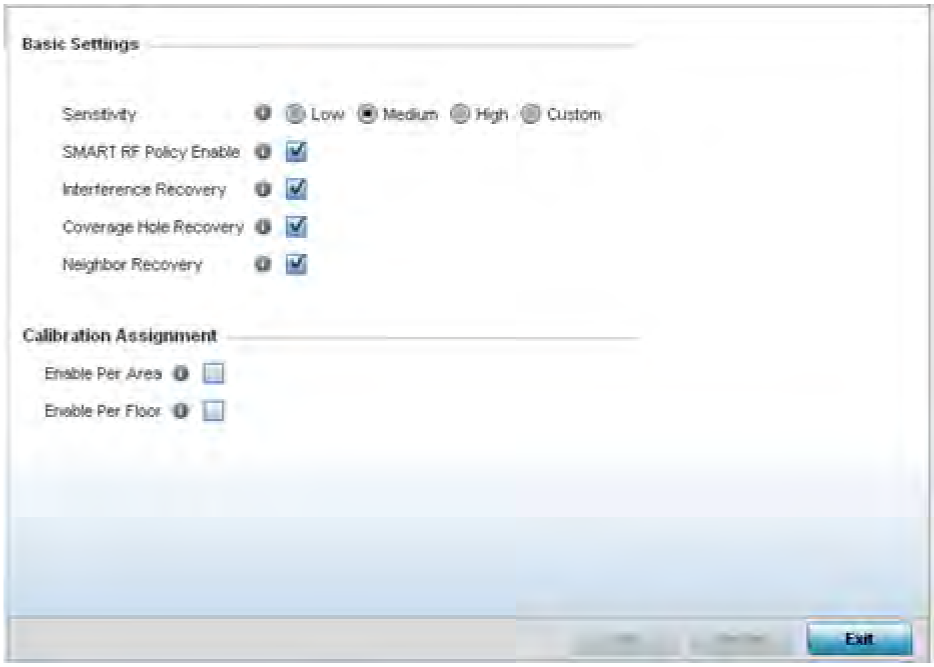
2 Refer to the following configuration data for existing Smart RF policies:

Smart RF Policy	Displays the name assigned to the Smart RF policy when it was initially created. The name cannot be modified as part of the edit process.
Smart RF Policy Enable	Displays a green check mark if Smart RF has been enabled for the listed policy. A red "X" designates the policy as being disabled.
Interference Recovery	Displays a green check mark if interference recovery has been enabled for the listed policy. A red "X" designates interference recovery being disabled.

Coverage Hole Recovery	Displays a green check mark if coverage hole recovery has been enabled for the listed policy. A red “X” designates coverage hole recovery being disabled.
Neighbor Recovery	Displays a green check mark if neighbor recovery has been enabled for the listed policy. A red “X” designates neighbor recovery being disabled.

3 Select **Add** to create a new Smart RF policy, **Edit** to modify the attributes of a existing policy or **Delete** to remove obsolete policies from the list of those available. Optionally **Copy** or **Rename** a list as needed.

The **Basic Configuration** screen displays by default for the new or modified Smart RF policy.



Basic Settings

Sensitivity ○ Low ● Medium ○ High ○ Custom

SMART RF Policy Enable ☑

Interference Recovery ☑

Coverage Hole Recovery ☑

Neighbor Recovery ☑

Calibration Assignment

Enable Per Area □

Enable Per Floor □

Figure 6-42 *Smart RF Basic Configuration screen*

4 Refer to the **Basic Settings** field to enable a Smart RF policy and define its sensitivity and detector status.

Sensitivity	Select a radio button corresponding to the desired Smart RF sensitivity. Options include *Low*, *Medium*, *High* and *Custom*. Medium, is the default setting. The Custom option allows an administrator to adjust the parameters and thresholds for Interference Recovery, Coverage Hole Recovery and Neighbor Recovery. Using the Low, Medium (recommended) and High settings still allow these features to be utilized.
SMART RF Policy Enable	Select the *Smart RF Policy Enable* check box to enable this Smart RF policy for immediate support or inclusion with a RF Domain. Smart RF is enabled by default.

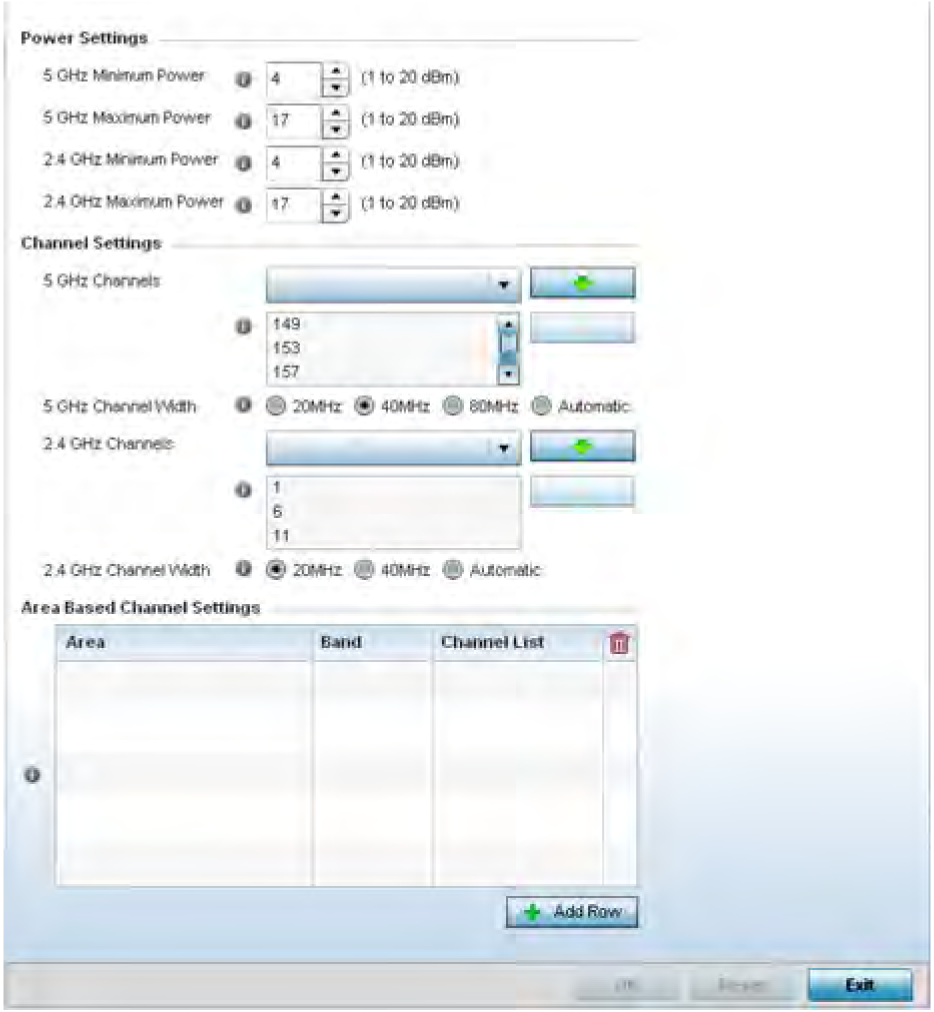
Interference Recovery	Select the check box to enable Interference Recovery from neighboring radios and other sources of WiFi and non-WiFi interference when excess noise and interference is detected within the Smart RF supported radio coverage area. Smart RF provides mitigation from interference sources by monitoring the noise levels and other RF parameters on an Access Point radio's current channel. When a noise threshold is exceeded, Smart RF can select an alternative channel with less interference. To avoid channel flapping, a hold timer is defined which disables interference avoidance for a specific period of time upon detection. Interference Recovery is enabled by default.
Coverage Hole Recovery	Select the check box to enable Coverage Hole Recovery when a radio coverage hole is detected within the Smart RF supported radio coverage area. When coverage hole is detected, Smart RF first determines the power increase needed based on the signal to noise ratio for a client as seen by the Access Point radio. If a client's signal to noise value is above the threshold, the transmit power is increased until the signal to noise rate falls below the threshold.
Neighbor Recovery	Select the check box to enable Neighbor Recovery when a failed radio is detected within the Smart RF supported radio coverage area. Smart RF can provide automatic recovery by instructing neighboring APs to increase their transmit power to compensate for the coverage loss. Neighbor recovery is enabled by default when the sensitivity setting is medium.

5 Refer to the **Calibration Assignment** field to define whether Smart RF Calibration and radio grouping is conducted by area or floor. Both options are disabled by default.

6 Select **OK** to update the Smart RF Basic Configuration settings for this policy. Select **Reset** to revert to the last saved configuration.

7 Select **Channel and Power**.

Use the Channel and Power screen to refine Smart RF power settings over both 5 and 2.4 GHz radios and select channel settings in respect to the device channel usage.



Power Settings

5 GHz Minimum Power	4	(1 to 20 dBm)
5 GHz Maximum Power	17	(1 to 20 dBm)
2.4 GHz Minimum Power	4	(1 to 20 dBm)
2.4 GHz Maximum Power	17	(1 to 20 dBm)

Channel Settings

5 GHz Channels: 149, 153, 157

5 GHz Channel Width: ○ 20MHz ● 40MHz ○ 80MHz ○ Automatic

2.4 GHz Channels: 1, 6, 11

2.4 GHz Channel Width: ● 20MHz ○ 40MHz ○ Automatic

Area Based Channel Settings

Area	Band	Channel List

Figure 6-43 *Smart RF Channel and Power screen*

✓ **NOTE:** The Power Settings and Channel Settings parameters are only enabled when Custom or Medium is selected as the Sensitivity setting from the Basic Configuration screen.

8 Refer to the **Power Settings** field to define Smart RF recovery settings for either the selected 5.0 GHz (802.11a) or 2.4 GHz (802.11bg) radio.

5 GHz Minimum Power	Use the spinner control to select a 1 - 20 dBm minimum power level for Smart RF to assign to a radio in the 5 GHz band. 4 dBm is the default setting.
5 GHz Maximum Power	Use the spinner control to select a 1 - 20 dBm maximum power level Smart RF can assign a radio in the 5 GHz band. 17 dBm is the default setting.
2.4 GHz Minimum Power	Use the spinner control to select a 1 - 20 dBm minimum power level Smart RF can assign a radio in the 2.4 GHz band. 4 dBm is the default setting.
2.4 GHz Maximum Power	Use the spinner control to select a 1 - 20 dBm maximum power level Smart RF can assign a radio in the 2.4 GHz band. 17 dBm is the default setting.

9 Set the following **Channel Settings** for the 5.0 GHz and 2.4 GHz radios:

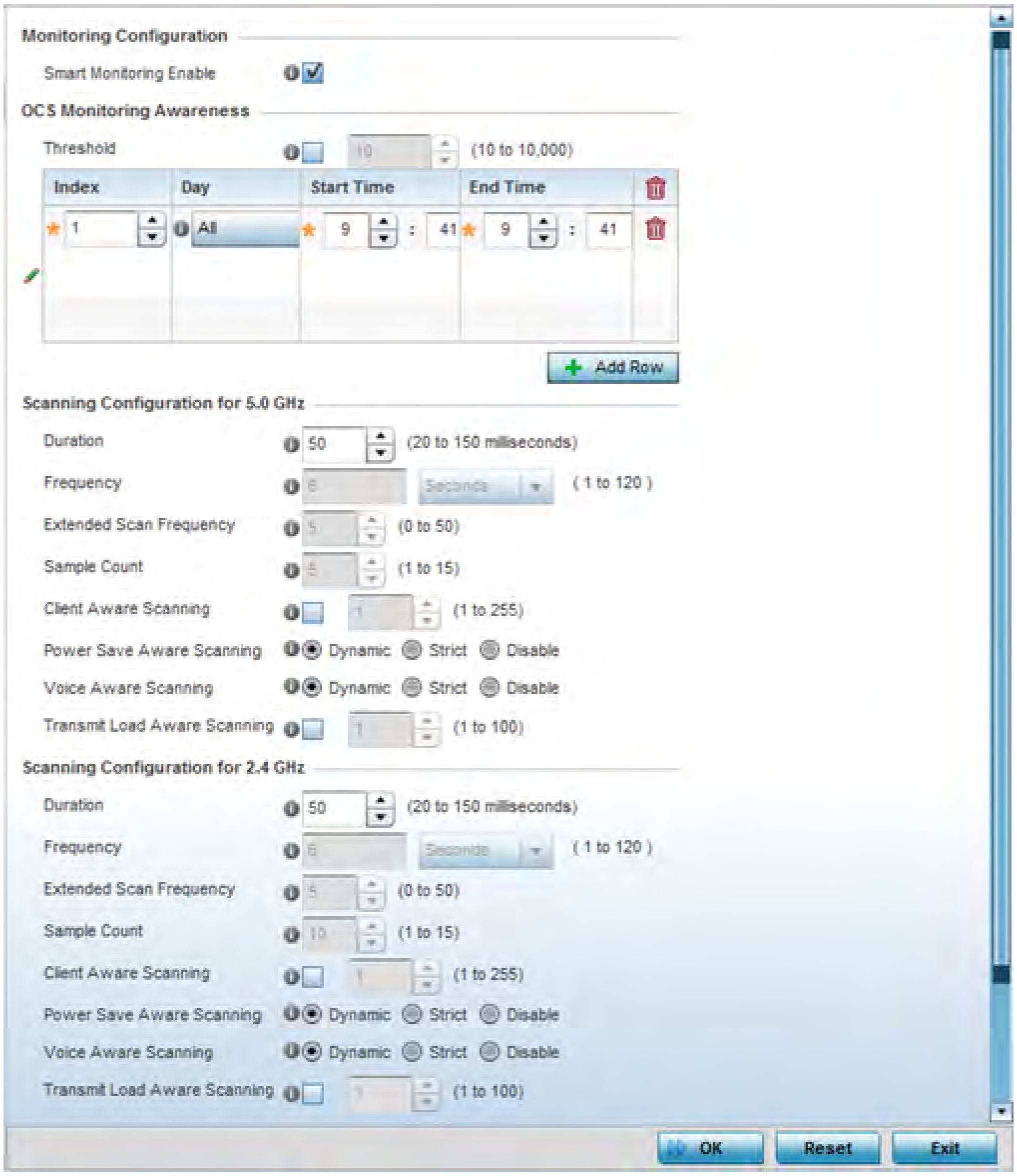
5 GHz Channels	Use the *Select* drop-down menu to define the 5 GHz channels used for Smart RF assignments.
5 GHz Channel Width	20 and 40 MHz channel widths are supported by the 802.11a radio. 20/40 MHz operation (the default setting for the 5 GHz radio) allows the Access Point to receive packets from clients using 20 MHz of bandwidth while transmitting a packet using 40 MHz bandwidth. This mode is supported for 11n users on both the 2.4 and 5 GHz radios. If an 11n user selects two channels (a Primary and Secondary channel), the system is configured for dynamic 20/40 operation. When 20/40 is selected, clients can take advantage of wider channels. 802.11n clients experience improved throughput using 40 MHz while legacy clients (either 802.11a or 802.11b/g depending on the radio selected) can still be serviced without interruption using 20 MHz. Select *Automatic* to enable automatic assignment of channels to working radios to avoid channel overlap and avoid interference from external RF sources. 40MHz is the default setting. If deploying an 802.11ac supported Access Point, 80MHz channel width options are available as well.
2.4 GHz Channels	Set the 2.4 GHz channels used in Smart RF scans.
2.4 GHz Channel Width	20 and 40 MHz channel widths are supported by the 802.11a radio. 20 MHz is the default setting for 2.4 GHz radios. 20/40 MHz operation (the default setting for the 5 GHz radio) allows the Access Point to receive packets from clients using 20 MHz of bandwidth while transmitting a packet using 40 MHz bandwidth. This mode is supported for 11n users on both the 2.4 and 5 GHz radios. If an 11n user selects two channels (a Primary and Secondary channel), the system is configured for dynamic 20/40 operation. When 20/40 is selected, clients can take advantage of *wider channels*. 802.11n clients experience improved throughput using 40 MHz while legacy clients (either 802.11a or 802.11b/g depending on the radio selected) can still be serviced without interruption using 20 MHz. Select *Automatic* to enable automatic assignment of channels to working radios to avoid channel overlap and avoid interference from external RF sources. 20MHz is the default setting.

10 Select **+ Add Row** and set the following **Area Based Channel Settings** for the Smart RF policy:

Area	Specify the deployment area assigned to the listed policy when deployed a means of identifying the devices physical locations.
Band	Specify the radio band, either 2.4 GHz or 5 GHz, for the Smart RF policy assigned to the specified area.
Channel List	Specify the channels associated with the Smart RF policy for the specified area and band.

11 Select **OK** to update the Smart RF Channel and Power settings for this policy. Select **Reset** to revert to the last saved configuration.

12 Select the **Scanning Configuration** tab.



Monitoring Configuration

Smart Monitoring Enable ☑

OCS Monitoring Awareness

Threshold □ 10 (10 to 10,000)

Index	Day	Start Time	End Time
1	All	9 : 41	9 : 41

Scanning Configuration for 5.0 GHz

Duration 50 (20 to 150 milliseconds)

Frequency 6 Seconds (1 to 120)

Extended Scan Frequency 5 (0 to 50)

Sample Count 5 (1 to 15)

Client Aware Scanning □ 1 (1 to 255)

Power Save Aware Scanning ● Dynamic ○ Strict ○ Disable

Voice Aware Scanning ● Dynamic ○ Strict ○ Disable

Transmit Load Aware Scanning □ 1 (1 to 100)

Scanning Configuration for 2.4 GHz

Duration 50 (20 to 150 milliseconds)

Frequency 6 Seconds (1 to 120)

Extended Scan Frequency 5 (0 to 50)

Sample Count 10 (1 to 15)

Client Aware Scanning □ 1 (1 to 255)

Power Save Aware Scanning ● Dynamic ○ Strict ○ Disable

Voice Aware Scanning ● Dynamic ○ Strict ○ Disable

Transmit Load Aware Scanning □ 1 (1 to 100)

Figure 6-44 *Smart RF Scanning Configuration screen*

✓ **NOTE:** The monitoring and scanning parameters within the Scanning Configuration screen are only enabled when *Custom* is selected as the Sensitivity setting from the Basic Configuration screen.

13 *Enable* or *disable* **Smart Monitoring Enable**. The feature is enabled by default.

When enabled, detector radios monitor their coverage areas for potential failed peers or coverage area holes requiring transmission adjustments for coverage compensation.

14 Select **+ Add Row** and set **OCS Monitoring Awareness Settings** for the Smart RF policy:

Threshold	Select this option and specify a threshold from 10 - 10,000. When the threshold is reached awareness settings are overridden with the values specified in the table.

Index	Select an Index value from 1 - 3 for awareness overrides. The overrides are executed based on index, with the lowest index being executed first.
Day	Use the drop-down menu to select a day of the week to apply the override. Selecting All will apply the policy every day. Selecting weekends will apply the policy on Saturdays and Sundays only. Selecting weekdays will apply the policy on Monday, Tuesday, Wednesday, Thursday and Friday. Selecting individual days of the week will apply the policy only on the selected day.
Start Time	This value sets the starting time of day(s) that the overrides will be activated. Use the spinner controls to select the hour and minute, in 12h time format. Then use the radio button to choose AM or PM.
End Time	This value sets the ending time of day(s) that the overrides will be disabled. Use the spinner controls to select the hour and minute, in 12h time format. Then use the radio button to choose AM or PM.

15 Set the following **Scanning Configurations** for both the **2.4** and **5.0** GHz radio bands:

Duration	Set a channel scan duration (from 20 - 150 milliseconds) Access Point radios use to monitor devices within the network and, if necessary, perform self healing and neighbor recovery to compensate for coverage area losses within a RF Domain. The default setting is 50 milliseconds for both the 2.4 and 5 GHz bands.
Frequency	Set the scan frequency using the drop-down menu. Set a scan frequency in either *Seconds* (1 - 120) or *Minutes* (0 - 2). The default setting is 6 seconds for both the 5 and 2.4 GHz bands.
Extended Scan Frequency	Use the spinner control to set an extended scan frequency between 0 - 50. This is the frequency radios scan channels on other than their peer radios. The default setting is 5 for both the 5 and 2.4 GHz bands.
Sample Count	Use the spinner control to set a sample scan count value between 1 - 15. This is the number of RF readings radios gather before they send the data to the Smart RF master. The default setting is 5 for both the 5 and 2.4 GHz bands
Client Aware Scanning	Set a client awareness count (number of clients from 1 - 255) for off channel scans of either the 5 GHz or 2.4 GHz band.
Power Save Aware Scanning	Select either the *Dynamic*, *Strict* or *Disable* radio button to define how power save scanning is set for Smart RF. Strict disables smart monitoring as long as a power save capable client is associated to a radio. Dynamic disables smart monitoring as long as there is data buffered for a power save client at the radio. The default setting is Dynamic for both the 5 and 2.4 GHz bands.
Voice Aware Scanning	Select either the *Dynamic*, *Strict* or *Disable* radio button to define how voice aware recognition is set for Smart RF. Strict disables smart monitoring as long as a voice client is associated to a radio. Dynamic disables smart monitoring as long as there is data buffered for a voice client at the radio. The default setting is Dynamic for both the 5 and 2.4 GHz bands.
Transmit Load Aware Scanning	Select this option to set a transmit load percentage from 1 - 100 serving as a threshold before scanning is avoided for an Access Point's 2.4 GHz radio.

16 Select **OK** to update the Smart RF Scanning Configuration settings for this policy. Select **Reset** to revert to the last saved configuration.

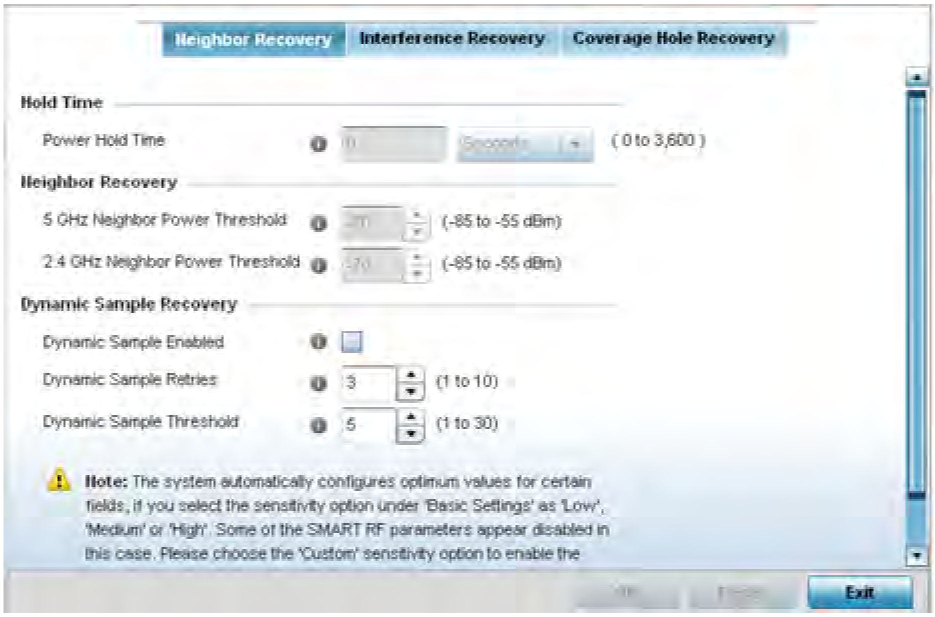
17 Select **Recovery**.

> ☑ **NOTE:** The recovery parameters within the Neighbor Recovery, Interference and Coverage Hole Recovery tabs are only enabled when *Custom* is selected as the Sensitivity setting from the Basic Configuration screen.

The **Neighbor Recovery** tab displays by default. Use the *Neighbor*, *Interference* and *Coverage Hole* recovery tabs to define how 5 and 2.4 GHz radios compensate for failed neighbor radios, interference impacting the Smart RF supported network and detected coverage holes requiring neighbor radio intervention.

18 Set the **Hold Time** for the Smart RF configuration.

Power Hold Time	Defines the minimum time between two radio power changes during neighbor recovery. Set the time in either *Seconds* (0 - 3,600), *Minutes* (0 - 60) or *Hours* (0 - 1). The default setting is 0 seconds.



Hold Time

Power Hold Time: 0 Seconds (0 to 3,600)

Neighbor Recovery

5 GHz Neighbor Power Threshold: -70 (-85 to -55 dBm)

2.4 GHz Neighbor Power Threshold: -70 (-85 to -55 dBm)

Dynamic Sample Recovery

Dynamic Sample Enabled: □

Dynamic Sample Retries: 3 (1 to 10)

Dynamic Sample Threshold: 5 (1 to 30)

Note: The system automatically configures optimum values for certain fields, if you select the sensitivity option under 'Basic Settings' as 'Low', 'Medium' or 'High'. Some of the SMART RF parameters appear disabled in this case. Please choose the 'Custom' sensitivity option to enable the

Figure 6-45 *Smart RF Advanced Configuration screen - Neighbor Recovery tab*

19 Set the following **Neighbor Recovery** parameters:

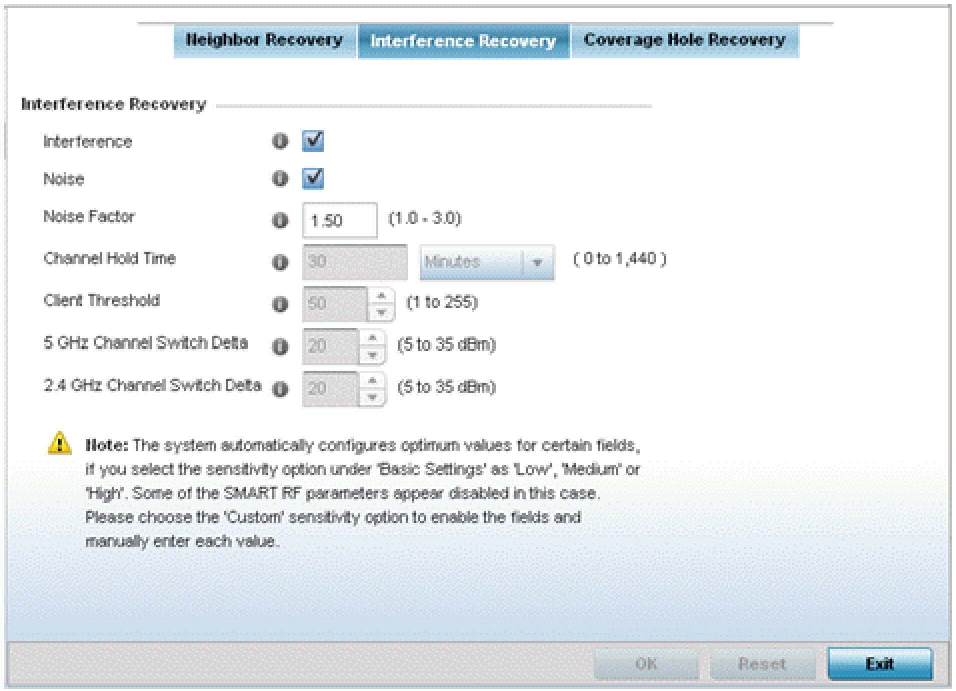
5 GHz Neighbor Power Threshold	Use the spinner control to set a value between -85 to -55 dBm the 5.0 GHz radio uses as a maximum power increase threshold if the radio is required to increase its output power to compensate for a failed radio within its wireless radio coverage area. The default value is -70 dBm.
2.4 GHz Neighbor Power Threshold	Use the spinner control to set a value between -85 to -55 dBm the 2.4 GHz radio uses as a maximum power increase threshold if the radio is required to increase its output power to compensate for a failed radio within its wireless radio coverage area. The default value is -70 dBm.

20 Set the following **Dynamic Sample Recovery** parameters:

Dynamic Sample Enabled	Select this option to enable dynamic sampling. Dynamic sampling enables an administrator to define how Smart RF adjustments are triggered by locking retry and threshold values. This setting is disabled by default.
Dynamic Sample Retries	Set the number of retries (from 1 - 10) attempted before a power level adjustment is implemented to compensate for a potential coverage hole. The default setting is 3.
Dynamic Sample Threshold	Set the minimum number of sample reports (from 1- 30) before a Smart RF power compensation requires dynamic sampling. The default setting is 5.

21 Select **OK** to update the Smart RF Neighbor Recovery settings for this policy. Select **Reset** to revert to the last saved configuration.

22 Select the **Interference Recovery** tab.



Interference Recovery

Interference ☑

Noise ☑

Noise Factor 1.50 (1.0 - 3.0)

Channel Hold Time 30 Minutes (0 to 1,440)

Client Threshold 50 (1 to 255)

5 GHz Channel Switch Delta 20 (5 to 35 dBm)

2.4 GHz Channel Switch Delta 20 (5 to 35 dBm)

Note: The system automatically configures optimum values for certain fields, if you select the sensitivity option under 'Basic Settings' as 'Low', 'Medium' or 'High'. Some of the SMART RF parameters appear disabled in this case. Please choose the 'Custom' sensitivity option to enable the fields and manually enter each value.

Figure 6-46 *Smart RF Advanced Configuration screen - Interference Recovery tab*

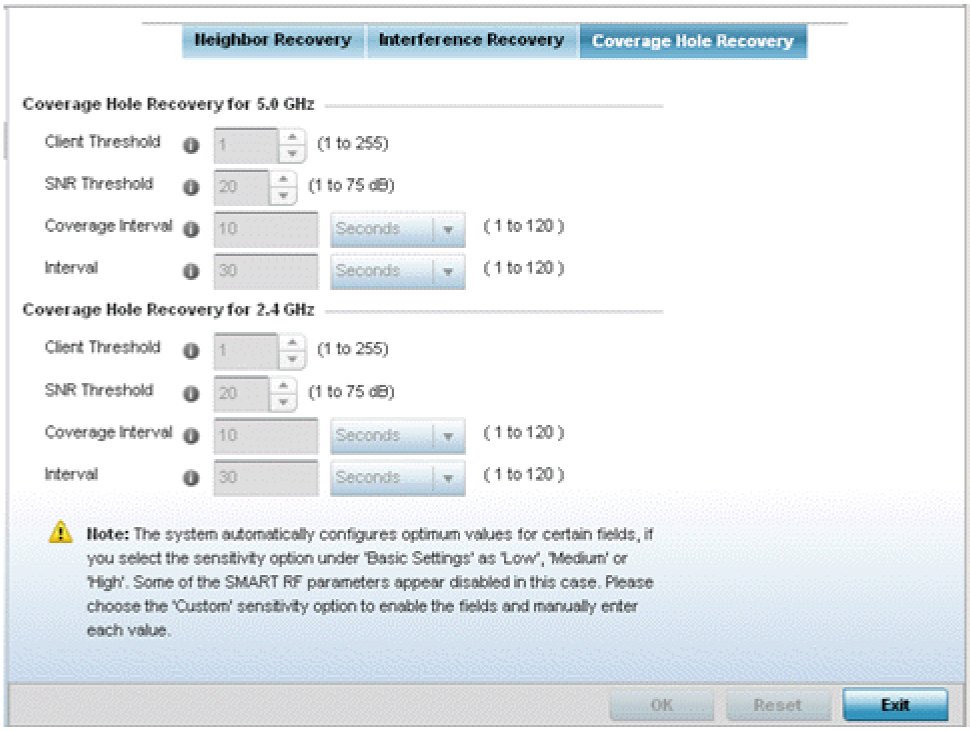
23 Set the following **Interference Recovery** parameters:

Interference	Select the check box to allow the Smart RF policy to scan for excess interference from supported radio devices. WLANs are susceptible to sources of interference, such as neighboring radios, cordless phones, microwave ovens and Bluetooth devices. When interference for WiFi sources is detected, Smart RF supported devices can change the channel and move to a cleaner channel. This feature is enabled by default.
Noise	Select the check box to allow the Smart RF policy to scan for excess noise from WiFi devices. When detected, Smart RF supported devices can change their channel and move to a cleaner channel. This feature is enabled by default.

Noise Factor	Define the *noise factor* (level of network interference detected) taken into account by Smart RF during interference recovery calculations. The default setting is 1.50.
Channel Hold Time	Defines the minimum time between channel changes during neighbor recovery. Set the time in either *Seconds* (0 - 86,400), *Minutes* (0 - 1,440) or *Hours* (0 - 24) or *Days* (0 - 1). The default setting is 30 minutes.
Client Threshold	Use the spinner to set a client threshold for the Smart RF policy between 1 - 255. If the set threshold number of clients are connected to a radio, it does not change its channel even though it requires one, based on the interference recovery determination made by the smart master. The default is 50.
5 GHz Channel Switch Delta	Use the spinner to set a channel interference delta (between 5 - 35 dBm) for the 5.0 GHz radio. This parameter is the difference between interference levels on the current channel and a prospective channel. If the difference is below the configured threshold, the channel will not change. The default setting is 20 dBm.
2.4 GHz Channel Switch Delta	Use the spinner to set a channel interference delta (between 5 - 35 dBm) for the 2.4 GHz radio. This parameter is the difference between interference levels on the current channel and a prospective channel. If the difference is below the configured threshold, the channel will not change. The default setting is 20 dBm.

24 Select **OK** to update the Smart RF Interference Recovery settings for this policy. Select **Reset** to revert to the last saved configuration.

25 Select the **Coverage Hole Recovery** tab.



Coverage Hole Recovery for 5.0 GHz

Client Threshold 1 (1 to 255)

SNR Threshold 20 (1 to 75 dB)

Coverage Interval 10 Seconds (1 to 120)

Interval 30 Seconds (1 to 120)

Coverage Hole Recovery for 2.4 GHz

Client Threshold 1 (1 to 255)

SNR Threshold 20 (1 to 75 dB)

Coverage Interval 10 Seconds (1 to 120)

Interval 30 Seconds (1 to 120)

Note: The system automatically configures optimum values for certain fields, if you select the sensitivity option under 'Basic Settings' as 'Low', 'Medium' or 'High'. Some of the SMART RF parameters appear disabled in this case. Please choose the 'Custom' sensitivity option to enable the fields and manually enter each value.

Figure 6-47 *Smart RF Advanced Configuration screen - Coverage Hole Recovery tab*

26 Set the following **Coverage Hole Recovery for 2.4 GHz** and **5.0 GHz** parameters:

Client Threshold	Use the spinner to set a client threshold for the Smart RF policy between 1 - 255. This is the minimum number of clients a radio should have associated in order for coverage hole recovery to trigger. The default setting is 1.
SNR Threshold	Use the spinner control to set a signal to noise threshold (between 1 - 75 dB). This is the signal to noise threshold for an associated client as seen by its associated Access Point radio. When exceeded, the radio increases its transmit power in order to increase coverage for the associated client. The default value is 20 dB.
Coverage Interval	Define the interval coverage hole recovery should be initiated after a coverage hole is detected. The default is 10 seconds for both the 2.4 and 5.0 GHz radios.
Interval	Define the interval coverage hole recovery should be conducted before a coverage hole is detected. The default is 30 seconds for both the 2.4 and 5.0 GHz radios.

27 Select **OK** to update the Smart RF coverage hole recovery settings for this policy. Select **Reset** to revert to the last saved configuration.

6.5.1 Smart RF Configuration and Deployment Considerations

▸ *Smart RF Policy*

Before defining a Smart RF policy, refer to the following deployment guidelines to ensure the configuration is optimally effective:

- The Smart RF calibration process impacts associated users and should not be run during business or production hours. The calibration process should be performed during scheduled maintenance intervals or non-business hours.
- For Smart RF to provide effective recovery, RF planning must be performed to ensure overlapping coverage exists at the deployment site. Smart RF can only provide recovery when Access Points are deployed appropriately. Smart RF is not a solution, it's a temporary measure. Administrators need to determine the root cause of RF deterioration and fix it. Smart RF history/events can assist.

If a Smart RF managed radio is operating in WLAN mode on a channel requiring DFS, it will switch channels if radar is detected.

- If Smart RF is enabled, the radio picks a channel defined in the Smart RF policy
- If Smart RF is disabled, but a Smart RF policy is mapped, the radio picks a channels specified in the Smart RF policy
- If no SMART RF policy is mapped, the radio selects a random channel

If the radio is a dedicated sensor, it stops termination on that channel if a neighboring Access Points detects radar. The Access Point attempts to come back to its original channel (statically configured or selected by Smart RF) after the channel evacuation period has expired.

Change this behavior using a no dfs-rehome command from the controller or service platform CLI. This keeps the radio on the newly selected channel and prevents the radio from coming back to the original channel, even after the channel evacuation period.

6.6 MeshConnex Policy

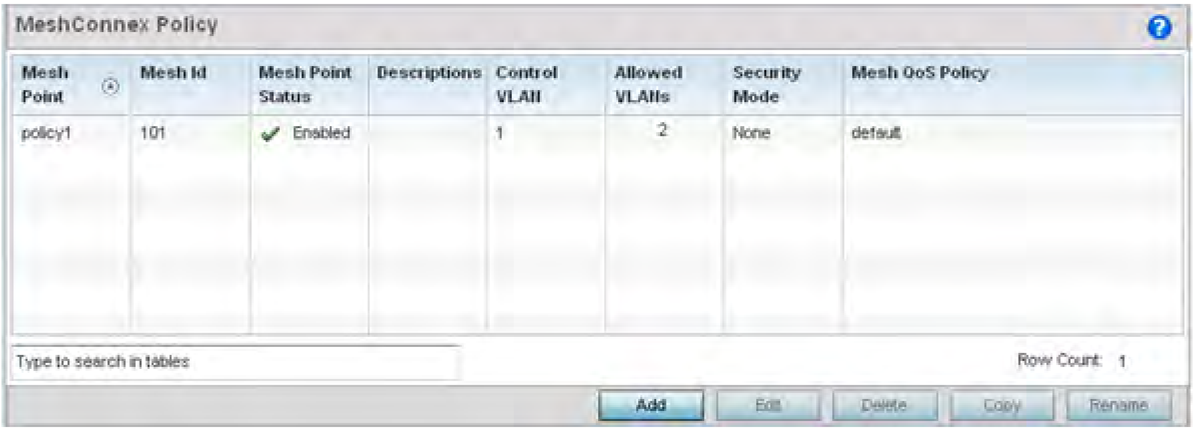
MeshConnex is a mesh networking technology that is comparable to the 802.11s mesh networking specification. MeshConnex meshing uses a hybrid proactive/on-demand path selection protocol, similar to *Ad hoc On Demand Distance Vector* (AODV) routing protocols. This allows it to form efficient paths using multiple attachment points to a distribution WAN, or form purely ad-hoc peer-to-peer mesh networks in the absence of a WAN. Each device in the MeshConnex mesh proactively manages its own path to the distribution WAN, but can also form peer-to-peer paths on demand to improve forwarding efficiency. MeshConnex is not compatible with MiNT Based meshing, though the two technologies can be enabled simultaneously in certain circumstances.

MeshConnex is designed for large-scale, high-mobility outdoor mesh deployments. MeshConnex continually gathers data from beacons and transmission attempts to estimate the efficiency and throughput of each MP-to-MP link. MeshConnex uses this data to dynamically form and continually maintain paths for forwarding network frames.

In MeshConnex systems, a *mesh point* (MP) is a virtual mesh networking instance on a device, similar to a WLAN AP. On each device, up to 4 MPs can be created and 2 can be created per radio. MPs can be configured to use one or both radios in the device. If the MP is configured to use both radios, the path selection protocols will continually select the best radio to reach each destination. Each MP participates in a single Mesh Network, defined by the MeshID. The MeshID is typically a descriptive network name, similar to the SSID of a WLAN. All MPs configured to use the same MeshID attempt to form a mesh and interoperate. The MeshID allows overlapping mesh networks to discriminate and disregard MPs belonging to different networks.

To define a MeshConnex policy:

1 Select **Configuration** > **Wireless** > **MeshConnex Policy** to display existing MeshConnex policies.



MeshConnex Policy

Mesh Point	Mesh Id	Mesh Point Status	Descriptions	Control VLAN	Allowed VLANs	Security Mode	Mesh QoS Policy
policy1	101	✓ Enabled		1	2	None	default

Type to search in tables

Row Count: 1

Figure 6-48 *MeshConnex Policy screen*

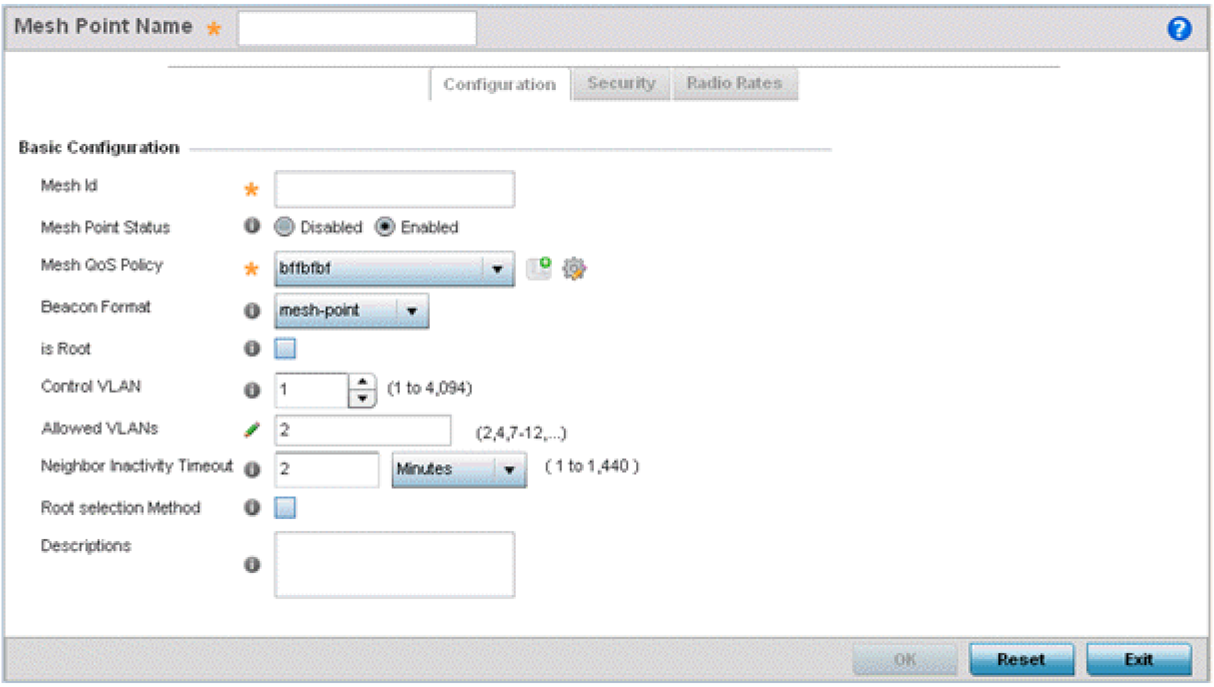
2 Refer to the following configuration data for existing MeshConnex policies:

Mesh Point Name	Displays the administrator assigned name of each listed mesh point.
Mesh ID	Displays the IDs (mesh identifiers) assigned to mesh points.
Mesh Point Status	Specified the status of each configured mesh point (either *Enabled* or *Disabled*).
Descriptions	Displays any descriptive text provided by the administrator for each configured mesh point.

Control VLAN	Displays the VLAN (virtual interface ID) for the control VLAN on each of the configured mesh points.
Allowed VLANs	Displays the list of VLANs allowed on each configured mesh point.
Security Mode	Displays the security assigned to each configured mesh point. The field displays *None* for no security or *PSK* for pre-shared key authentication.
Mesh QoS Policy	Displays the mesh Quality of Service policy associated to each configured mesh point.

3 Select **Add** to create a new MeshConnex policy, **Edit** to modify the attributes of a existing policy or **Delete** to remove obsolete policies from the list of those available. Optionally **Copy** or **Rename** a policy as needed.

The **Configuration** screen displays by default for the new or modified MeshConnex policy.



Mesh Point Name *

Basic Configuration

Mesh Id *

Mesh Point Status ○ Disabled ● Enabled

Mesh QoS Policy * bffbfbf

Beacon Format mesh-point

is Root □

Control VLAN 1 (1 to 4,094)

Allowed VLANs 2 (2,4,7-12,...)

Neighbor Inactivity Timeout 2 Minutes (1 to 1,440)

Root selection Method □

Descriptions

Figure 6-49 *MeshConnex Configuration screen*

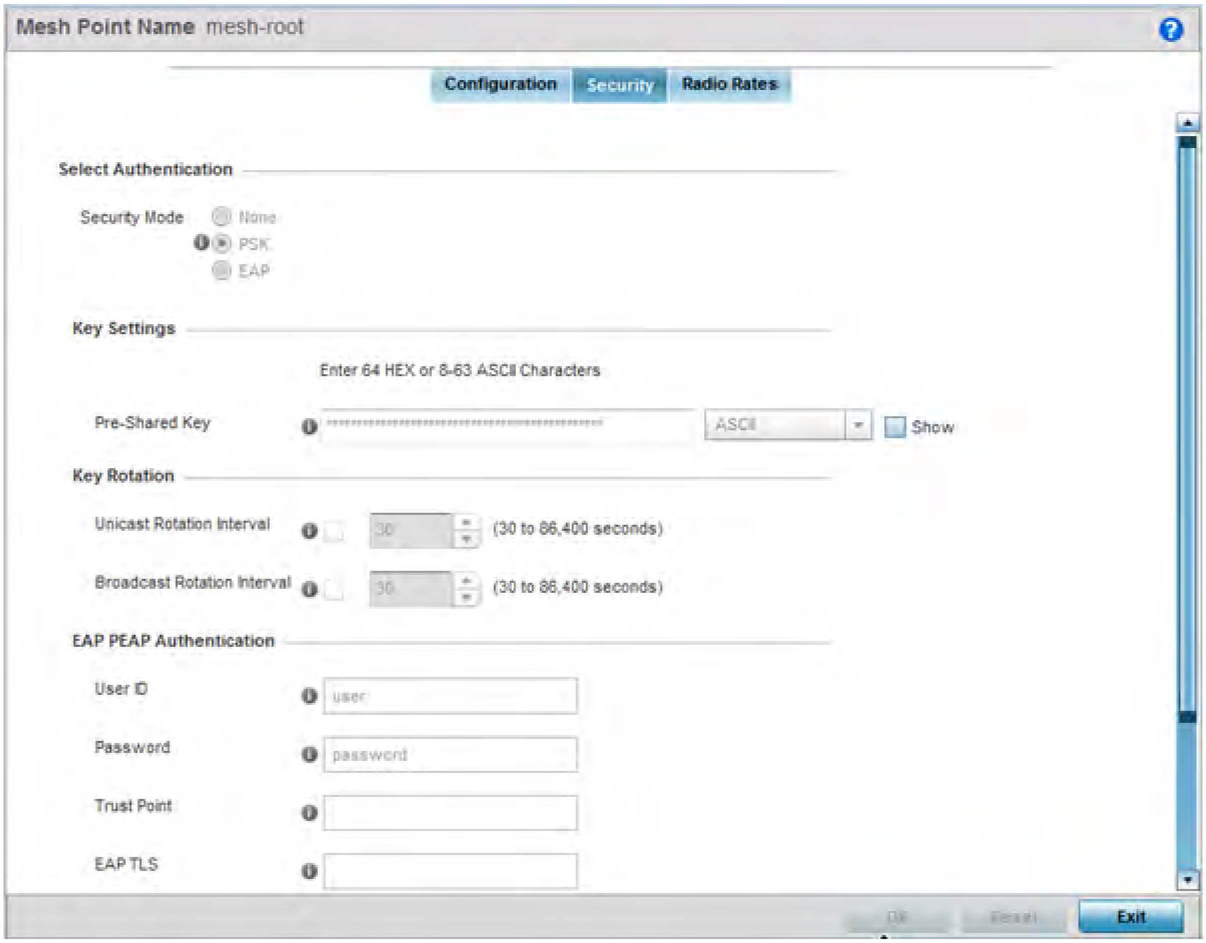
4 Refer to the **Basic Configuration** field to define a MeshConnex configuration.

Mesh Point Name	Specify a name for the new mesh point. The name should be descriptive to easily differentiate it from other mesh points. This field is mandatory.
Mesh Id	Specify a 32 character maximum mesh identifier for this mesh point. This field is optional.
Mesh Point Status	To enable this mesh point, click the *Enabled* radio button. To disable the mesh point click the Disabled button.The default value is enabled.
Mesh QoS Policy	Use the drop-down menu to specify the mesh Quality of Service policy to use on this mesh point. This value is mandatory. If no suitable Mesh QoS policies exist, click the create icon to create a new Mesh QoS policy.
Beacon Format	Use the drop-down menu to specify the format for beacon transmissions. To use Access Point style beacons, select *access-point* from the drop-down menu. To use mesh point style beacons, select *mesh-point*. The default value is mesh-point.

Is Root	Select this option to specify the mesh point as a root in the mesh topology.
Control VLAN	Use the spinner control to specify a VLAN to carry meshpoint control traffic. The valid range for control VLAN is between 1 and 4094. The default value is VLAN 1.
Allowed VLANs	Specify the VLANs allowed to pass traffic on the mesh point. Separate all VLANs with a comma. To specify a range of allowed VLANs separate the starting VLAN and the ending VLAN with a hyphen.
Neighbor Inactivity Timeout	Specify a timeout in *seconds*, *minutes*, *hours* or *days,* up to a maximum of 1 day. This represents the allowed interval between frames received from a neighbor before their client privileges are revoked. The default value is 2 minutes.
Description	Enter a 64 character maximum description about the mesh point configuration.

5 Select **OK** to update the MeshConnex Configuration settings for this policy. Select **Reset** to revert to the last saved configuration.

6 Select the **Security** tab.



Mesh Point Name mesh-root

Select Authentication

Security Mode ○ None ● PSK ○ EAP

Key Settings

Enter 64 HEX or 8-63 ASCII Characters

Pre-Shared Key ******************************** ASCII ☐ Show

Key Rotation

Unicast Rotation Interval ☐ 30 (30 to 86,400 seconds)

Broadcast Rotation Interval ☐ 30 (30 to 86,400 seconds)

EAP PEAP Authentication

User ID user

Password password

Trust Point

EAP TLS

Figure 6-50 *MeshConnex Security screen*

7 Refer to the **Select Authentication** field to define an authentication method for the mesh policy.

Security Mode	Select a security authentication mode for the mesh point. Select *None* to have no authentication for the mesh point. Select *EAP* to use a secured credential exchange, dynamic keying and strong encryption. If selecting EAP, refer to the *EAP PEAP Authentication* field at the bottom of the screen and define the credentials of an EAP user and trustpoint. Select *PSK* to set a pre-shared key as the authentication for the mesh-point. If PSK is selected, enter a pre-shared key in the *Key Settings* field.

8 Set the following **Key Settings** for the mesh point:

Pre-Shared Key	When the security mode is set as PSK, enter a 64 character HEX or an 8-63 ASCII character passphrase used for authentication on the mesh point.

9 Set the following **Key Rotation** for the mesh point:

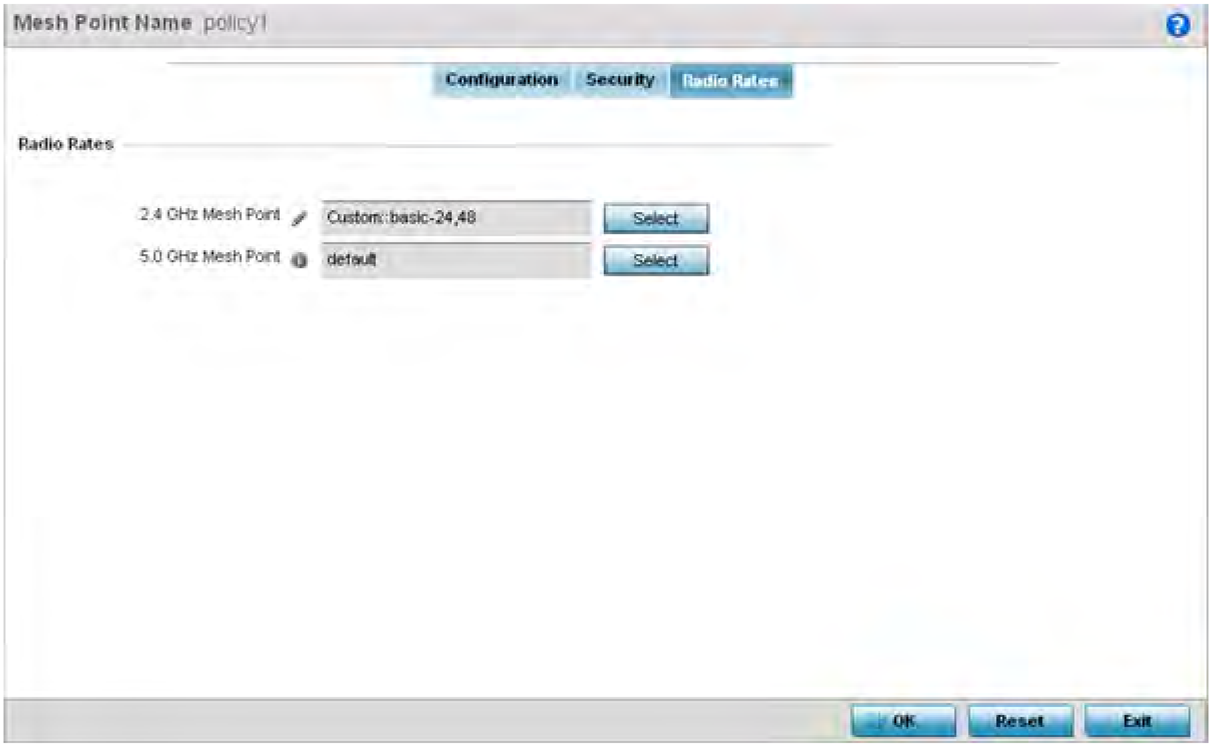
Unicast Rotation Interval	Define an interval for unicast key transmission (30 -86,400 seconds).
Broadcast Rotation Interval	When enabled, the key indices used for encrypting/decrypting broadcast traffic is alternatively rotated based on the defined interval. Define an interval for broadcast key transmission in seconds (30-86,400). Key rotation enhances the broadcast traffic security on the WLAN.

10 Set the following **EAP PEAP Authentication** settings if using EAP to secure the mesh point:

User ID	Create a 32 character maximum user name for a peap-mschapv2 authentication credential exchange.
Password	Define a 32 character maximum password for the EAP PEAP username created above.
Trust Point	Provide the 64 character maximum name of the trustpoint used for installing the CA certificate and validating the server certificate.
EAP TLS	Provide the 64 character maximum name of the trustpoint used for installing the client certificate, client private key and CA certificate.
Type	Use the drop-down menu to select the EAP authentication method used by the supplicant. The default EAP type is PEAP-MS-CHAPv2.
EAP Identity	Enter the 32 character maximum identity string used during phase 1 authentication. This string does not need to represent the identity of the user, rather an anonymous identity string.
AAA Policy	Select an existing AAA Policy from the drop-down menu to apply to this user's mesh point EAP configuration. *Authentication, authorization,* and *accounting* (AAA) is a framework for intelligently controlling access to the network, enforcing user authorization policies and auditing and tracking usage. These combined processes are central for securing wireless client resources and wireless network data flows.

11 Select **OK** to save the changes made to the configuration. Select **Reset** to revert to the last saved configuration.

12 Select the **Radio Rates** tab.



Mesh Point Name policy1

Radio Rates

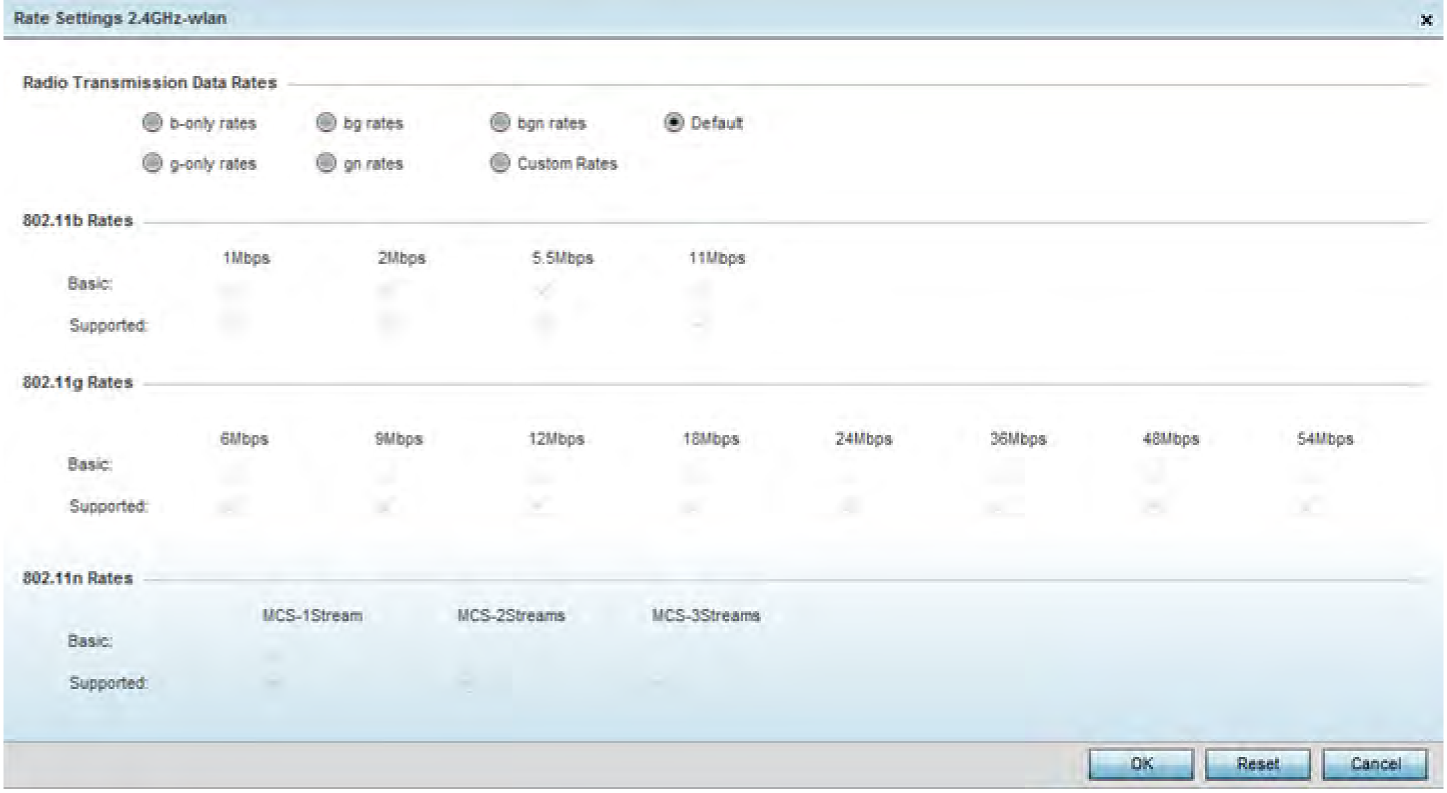
2.4 GHz Mesh Point: Custom::basic-24,48

5.0 GHz Mesh Point: default

Figure 6-51 *Radio Rate Settings*

13 Set the following **Radio Rates** for both the 2.4 and 5 GHz radio bands:

2.4 GHz Mesh Point	Click the *Select* button to configure radio rates for the 2.4 GHz band. Define both minimum Basic and optimal Supported rates as required for the 802.11b rates, 802.11g rates and 802.11n rates supported by the 2.4 GHz band. These are the rates wireless client traffic is supported within this mesh point. If supporting 802.11n, select a Supported MCS index. Set a MCS (modulation and coding scheme) in respect to the radio's channel width and guard interval. A MCS defines (based on RF channel conditions) an optimal combination of 8 data rates, bonded channels, multiple spatial streams, different guard intervals and modulation types. Mesh points can communicate as long as they support the same basic MCS (as well as non-11n basic rates). The selected rates apply to associated client traffic within this mesh point only.
5.0 GHz Mesh Point	Click the *Select* button to configure radio rates for the 5.0 GHz band. Define both minimum Basic and optimal Supported rates as required for 802.11a and 802.11n rates supported by the 5.0 GHz radio band. These are the rates wireless client traffic is supported within this mesh point. If supporting 802.11n, select a Supported MCS index. Set a MCS (modulation and coding scheme) in respect to the radio's channel width and guard interval. A MCS defines (based on RF channel conditions) an optimal combination of 8 data rates, bonded channels, multiple spatial streams, different guard intervals and modulation types. Mesh points can communicate as long as they support the same basic MCS (as well as non-11n basic rates). The selected rates apply to associated client traffic within this mesh point only.


Rate Settings 2.4GHz-wlan

Radio Transmission Data Rates

○ b-only rates ○ bg rates ○ bgn rates ● Default
○ g-only rates ○ gn rates ○ Custom Rates

802.11b Rates

	1Mbps	2Mbps	5.5Mbps	11Mbps
Basic:				
Supported:				

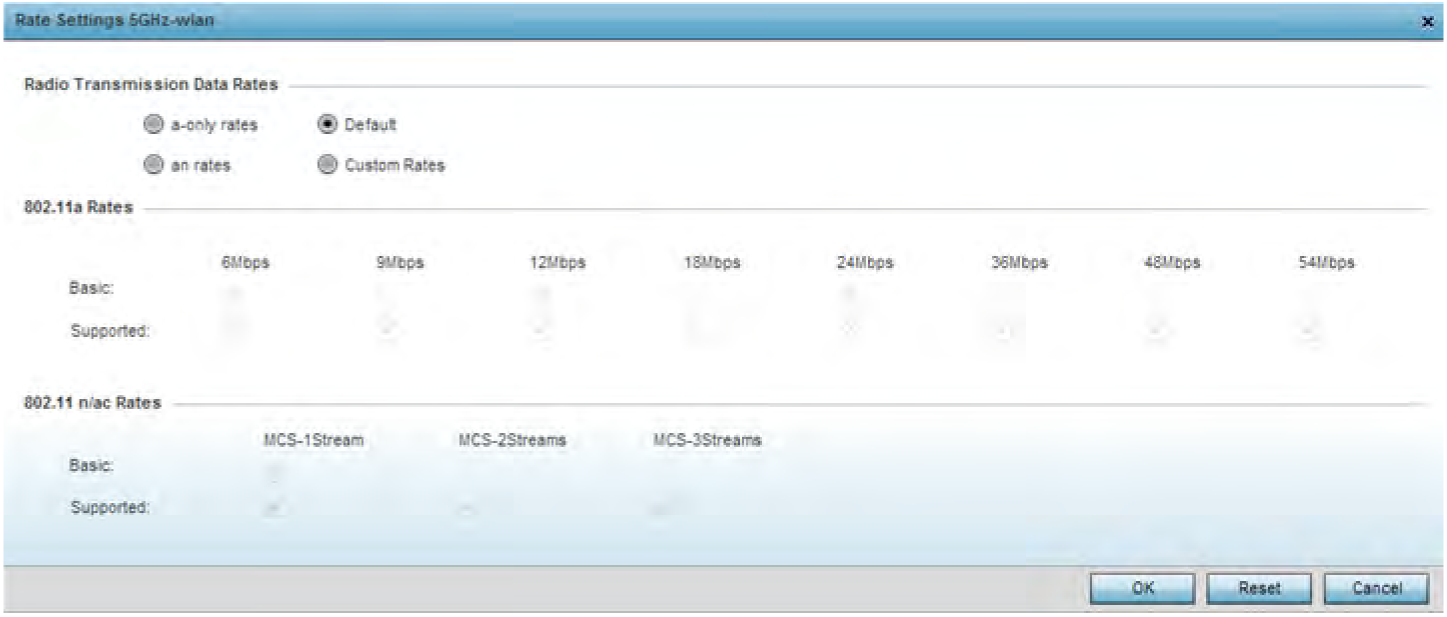
802.11g Rates

	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
Basic:								
Supported:								

802.11n Rates

	MCS-1Stream	MCS-2Streams	MCS-3Streams
Basic:			
Supported:			

Figure 6-52 *Advanced Rate Settings 2.4 GHz screen*


Rate Settings 5GHz-wlan

Radio Transmission Data Rates

○ a-only rates ● Default
○ an rates ○ Custom Rates

802.11a Rates

	6Mbps	9Mbps	12Mbps	18Mbps	24Mbps	36Mbps	48Mbps	54Mbps
Basic:								
Supported:								

802.11 n/ac Rates

	MCS-1Stream	MCS-2Streams	MCS-3Streams
Basic:			
Supported:			

Figure 6-53 *Advanced Rate Settings 5 GHz screen*

Define both minimum *Basic* and optimal *Supported* rates as required for the 802.11b rates, 802.11g rates and 802.11n rates supported by the 2.4 GHz band and 802.11a and 802.11n rates supported by the 5.0 GHz radio band. These are the rates wireless client traffic is supported within this mesh point.

If supporting 802.11n, select a Supported MCS index. Set a MCS (modulation and coding scheme) in respect to the radio’s channel width and guard interval. A MCS defines (based on RF channel conditions) an optimal combination of 8 data rates, bonded channels, multiple spatial streams, different guard intervals and modulation types. Clients can associate as long as they support basic MCS (as well as non-11n basic rates).

14 Select **OK** to save the changes made to the configuration. Select **Reset** to revert to the last saved configuration.

6.7 Mesh QoS Policy

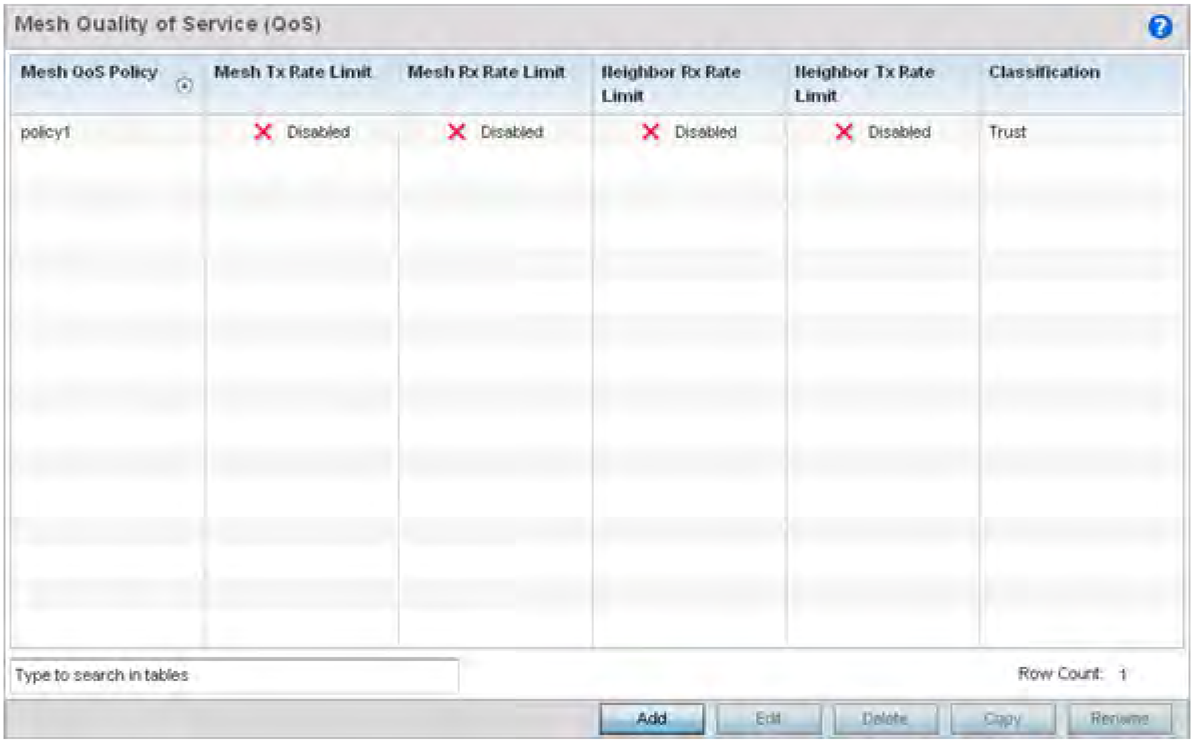
Mesh *Quality of Service* (QoS) provides a data traffic prioritization scheme. QoS reduces congestion from excessive traffic. If there is enough bandwidth for all users and applications (unlikely because excessive bandwidth comes at a very high cost), then applying QoS has very little value. QoS provides policy enforcement for mission-critical applications and/or users that have critical bandwidth requirements when bandwidth is shared by different users and applications.

Mesh QoS helps ensure each mesh point on the mesh network receives a fair share of the overall bandwidth, either equally or as per the proportion configured. Packets directed towards clients are classified into categories such as video, voice and data. packets within each category are processed based on the weights defined for each mesh point.

The Quality of Service screen displays a list of Mesh QoS policies available to mesh points. Each mesh QoS policy can be selected to edit its properties. If none of the exiting Mesh QoS policies supports an ideal QoS configuration for the intended data traffic of this mesh point, select the Add button to create new policy. Select an existing mesh QoS policy and select **Edit** to change the properties of the Mesh QoS policy.

To define a Mesh QoS policy:

1 Select **Configuration** > **Wireless** > **Mesh QoS Policy** to display existing Mesh QoS policies.



Mesh Quality of Service (QoS)

Mesh QoS Policy	Mesh Tx Rate Limit	Mesh Rx Rate Limit	Neighbor Rx Rate Limit	Neighbor Tx Rate Limit	Classification
policy1	✗ Disabled	✗ Disabled	✗ Disabled	✗ Disabled	Trust

Type to search in tables

Row Count: 1

Figure 6-54 *Mesh QoS Policy screen*

2 Refer to the following configuration data for existing Smart RF policies:

Mesh QoS Policy	Displays the administrator assigned name of each mesh QoS policy.
Mesh Tx Rate Limit	Displays whether or not a *Mesh Tx Rate Limit* is enabled for each Mesh QoS policy. When the rate limit is enabled a green check mark is displayed, when it is disabled a red X is displayed.
Mesh Rx Rate Limit	Displays whether or not a *Mesh Rx Rate Limit* is enabled for each Mesh QoS policy. When the rate limit is enabled a green check mark is displayed, when it is disabled a red X is displayed.
Neighbor Rx Rate Limit	Displays whether or not a *Neighbor Rx Rate Limit* is enabled for each Mesh QoS policy. When the rate limit is enabled a green check mark is displayed, when it is disabled a red X is displayed.
Neighbor Tx Rate Limit	Displays whether or not a *Neighbor Tx Rate Limit* is enabled for each Mesh QoS policy. When the rate limit is enabled a green check mark is displayed, when it is disabled a red X is displayed.
Classification	Displays the forwarding QoS classification for each Mesh QoS policy. Classification types are *Trust*, *Voice, Video, Best Effort* and *Background*.

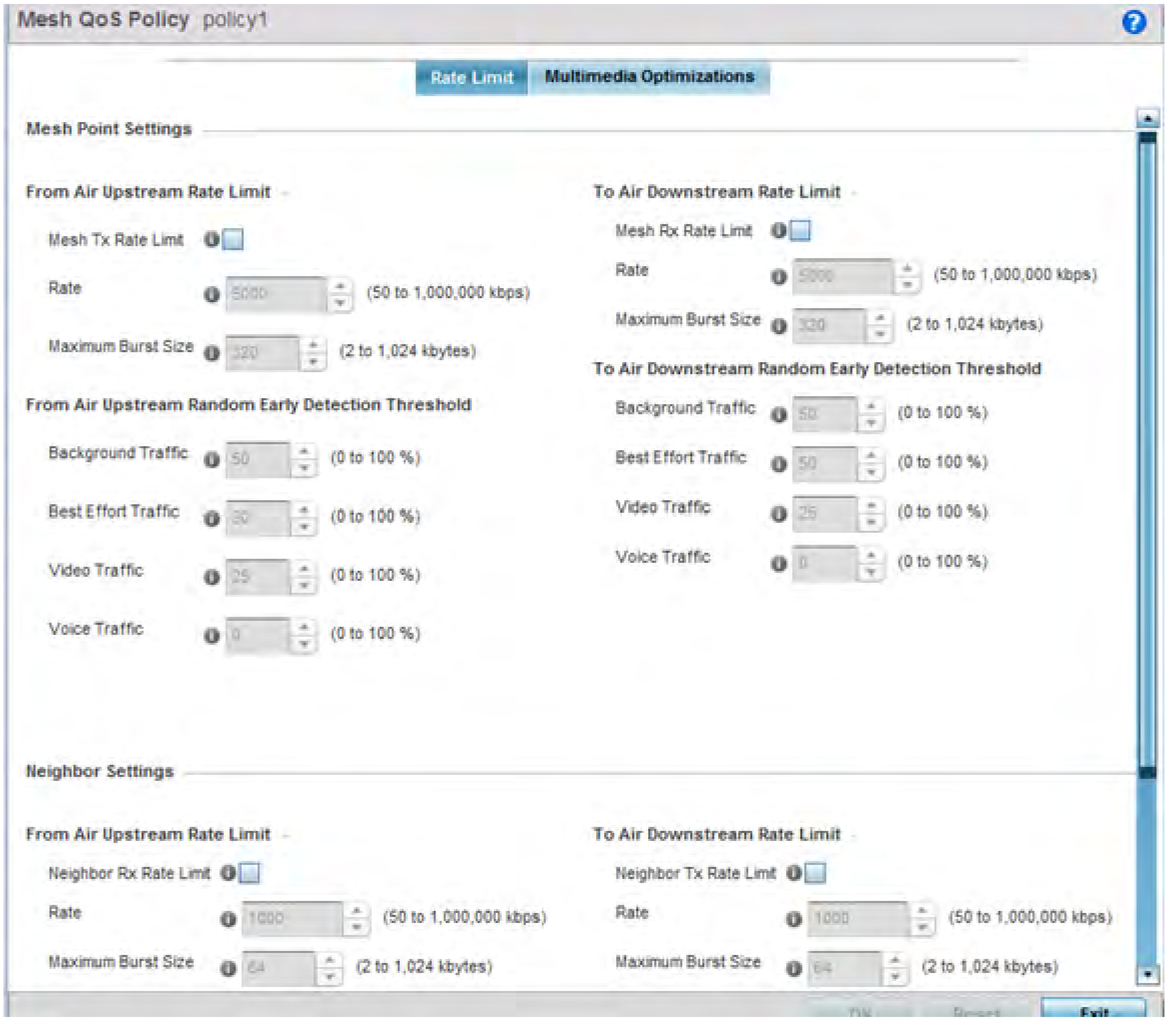
3 Select the **Add** button to define a new Mesh QoS policy, or select an existing Mesh QoS policy and select **Edit** to modify its existing configuration. Existing QoS policies can be selected and deleted as needed. Optionally **Copy** or **Rename** a policy as needed.

The **Rate Limit** screen displays by default for the new or modified QoS policy.

Excessive traffic can cause performance issues or bring down the network entirely. Excessive traffic can be caused by numerous sources including network loops, faulty devices or malicious software such as a worm or virus that has infected on one or more devices at the branch. Rate limiting limits the maximum rate sent to or received from the wireless network (and mesh point) per neighbor. It prevents any single user from overwhelming the wireless network. It can also provide differential service for service providers. An administrator can set separate QoS rate limit configurations for data transmitted from the network and data transmitted from a mesh point's neighbor back to their associated Access Point radios and managing controller or service platform.

Before defining rate limit thresholds for mesh point transmit and receive traffic, define the normal number of ARP, broadcast, multicast and unknown unicast packets that typically transmit and receive from each supported WMM access category. If thresholds are defined too low, normal network traffic (required by end-user devices) is dropped, resulting in intermittent outages and performance problems.

A connected neighbor can also have QoS rate limit settings defined in both the *transmit* and *receive* direction.



Mesh QoS Policy policy1

Mesh Point Settings

From Air Upstream Rate Limit

Mesh Tx Rate Limit ☐

Rate 5000 (50 to 1,000,000 kbps)

Maximum Burst Size 320 (2 to 1,024 kbytes)

From Air Upstream Random Early Detection Threshold

Background Traffic 50 (0 to 100 %)

Best Effort Traffic 30 (0 to 100 %)

Video Traffic 25 (0 to 100 %)

Voice Traffic 0 (0 to 100 %)

To Air Downstream Rate Limit

Mesh Rx Rate Limit ☐

Rate 5000 (50 to 1,000,000 kbps)

Maximum Burst Size 320 (2 to 1,024 kbytes)

To Air Downstream Random Early Detection Threshold

Background Traffic 50 (0 to 100 %)

Best Effort Traffic 50 (0 to 100 %)

Video Traffic 25 (0 to 100 %)

Voice Traffic 0 (0 to 100 %)

Neighbor Settings

From Air Upstream Rate Limit

Neighbor Rx Rate Limit ☐

Rate 1000 (50 to 1,000,000 kbps)

Maximum Burst Size 64 (2 to 1,024 kbytes)

To Air Downstream Rate Limit

Neighbor Tx Rate Limit ☐

Rate 1000 (50 to 1,000,000 kbps)

Maximum Burst Size 64 (2 to 1,024 kbytes)

Figure 6-55 *Mesh QoS Policy Rate Limit screen*

4 Configure the following parameters in respect to the intended **From Air Upstream Rate Limit,** or traffic from the controller to associated Access Point radios and their associated neighbor:

Mesh Tx Rate Limit	Select the check box to enable rate limiting for all data received from any mesh point in the mesh network. This feature is disabled by default.
Rate	Define a receive rate limit between 50 - 1,000,000 kbps. This limit constitutes a threshold for the maximum the number of packets transmitted or received over the mesh point (from all access categories). Traffic that exceeds the defined rate is dropped and a log message is generated. The default setting is 5000 kbps.
Maximum Burst Size	Set a maximum burst size between 2 - 1024 kbytes. The smaller the burst, the less likely the transmit packet transmission will result in congestion for the mesh point's client destinations. By trending the typical number of ARP, broadcast, multicast and unknown unicast packets over a period of time, the average rate for each access category can be obtained. Once a baseline is obtained, administrators should then add a 10% margin (minimally) to allow for traffic bursts at the site. The default burst size is 320 kbytes.

5 Set the following **From Air Upstream Random Early Detection Threshold** settings for each access category. An early random drop is done when a traffic stream falls below the set threshold.

Background Traffic	Set a percentage value for background traffic in the transmit direction. This is a percentage of the maximum burst size for low priority traffic. Background traffic exceeding the defined threshold is dropped and a log message is generated. Background traffic consumes the least bandwidth of any access category, so this value can be set to a lower value once a general transmit rate is known by the network administrator (using a time trend analysis). The default threshold is 50%.
Best Effort Traffic	Set a percentage value for best effort traffic in the transmit direction. This is a percentage of the maximum burst size for normal priority traffic. Best effort traffic exceeding the defined threshold is dropped and a log message is generated. Best effort traffic consumes little bandwidth, so this value can be set to a lower value once a general transmit rate is known by the network administrator (using a time trend analysis). The default threshold is 50%.
Video Traffic	Set a percentage value for video traffic in the transmit direction. This is a percentage of the maximum burst size for video traffic. Video traffic exceeding the defined threshold is dropped and a log message is generated. Video traffic consumes significant bandwidth, so this value can be set to a higher value once a general transmit rate is known by the network administrator (using a time trend analysis). The default threshold is 25%.
Voice Traffic	Set a percentage value for voice traffic in the transmit direction. This is a percentage of the maximum burst size for voice traffic. Voice traffic exceeding the defined threshold is dropped and a log message is generated. Voice applications consume significant bandwidth, so this value can be set to a higher value once a general upstream rate is known by the network administrator (using a time trend analysis). The default threshold is 0%.

6 Configure the following parameters in respect to the intended **To Air Downstream Rate Limit,** or traffic from neighbors to associated Access Point radios and the controller or service platform:

Mesh Rx Rate Limit	Select the check box to enable rate limiting for all data transmitted by the device to any mesh point in the mesh. This feature is disabled by default.
Rate	Define an transmit rate limit between 50 - 1,000,000 kbps. This limit constitutes a threshold for the maximum the number of packets transmitted or received over the mesh point (from all access categories). Traffic that exceeds the defined rate is dropped and a log message is generated. The default setting is 5000 kbps.
Maximum Burst Size	Set a maximum burst size between 2 - 1024 kbytes. The smaller the burst, the less likely the receive packet transmission will result in congestion for the mesh points wireless client destinations. By trending the typical number of ARP, broadcast, multicast and unknown unicast packets over a period of time, the average rate for each access category can be obtained. Once a baseline is obtained, administrators should then add a minimum of a 10% margin to allow for traffic bursts at the site. The default burst size is 320 kbytes.

7 Set the following **To Air Downstream Random Early Detection Threshold** settings for each access category. An early random drop occurs when the amount of tokens for a traffic stream falls below the set threshold.

Background Traffic	Set a percentage value for background traffic in the receive direction. This is a percentage of the maximum burst size for low priority traffic. Background traffic exceeding the defined threshold is dropped and a log message is generated. Background traffic consumes the least bandwidth of any access category, so this value can be set to a lower value once a general receive rate is known by the network administrator (using a time trend analysis). The default threshold is 50%.
Best Effort Traffic	Set a percentage value for best effort traffic in the receive direction. This is a percentage of the maximum burst size for normal traffic. Best effort traffic exceeding the defined threshold is dropped and a log message is generated. Best effort traffic consumes little bandwidth, so this value can be set to a lower value once a general receive rate is known by the network administrator (using a time trend analysis). The default threshold is 50%.
Video Traffic	Set a percentage value for video traffic in the receive direction. This is a percentage of the maximum burst size for video traffic. Video traffic exceeding the defined threshold is dropped and a log message is generated. Video traffic consumes significant bandwidth, so this value can be set to a higher value once a general receive rate is known by the network administrator (using a time trend analysis). The default threshold is 25%.
Voice Traffic	Set a percentage value for voice traffic in the receive direction. This is a percentage of the maximum burst size for voice traffic. Voice traffic exceeding the defined threshold is dropped and a log message is generated. Voice applications consume significant bandwidth, so this value can be set to a higher value once a general transmit rate is known by the network administrator (using a time trend analysis). The default threshold is 0%. 0% means no early random drops will occur.

8 Configure the following parameters in respect to the intended Neighbor Settings **From Air Upstream Rate Limit**:

Neighbor Rx Rate Limit	Select the radio button to enable rate limiting for data transmitted from the client to its associated Access Point radio and connected controller or service platform. Enabling this option does not invoke client rate limiting for data traffic in the receive direction. This feature is disabled by default.
Rate	Define an transmit rate limit between 50 - 1,000,000 kbps. This limit constitutes a threshold for the maximum the number of packets transmitted or received (from all access categories). Traffic that exceeds the defined rate is dropped by the client and a log message is generated. The default rate is 1,000 kbps.
Maximum Burst Size	Set a maximum burst size between 2 - 1024 kbytes. The smaller the burst, the less likely the transmit packet transmission will result in congestion for the wireless client. The default burst size is 64 kbytes.

9 Set the following Neighbor Settings **From Air Upstream Random Early Detection Threshold** for each access category:

Background Traffic	Set a percentage value for background traffic in the transmit direction. This is a percentage of the maximum burst size for low priority traffic. Background traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default threshold is 50%.
Best Effort Traffic	Set a percentage value for best effort traffic in the transmit direction. This is a percentage of the maximum burst size for normal traffic. Best effort traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default threshold is 50%.
Video Traffic	Set a percentage value for video traffic in the transmit direction. This is a percentage of the maximum burst size for video traffic. Video traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default threshold is 25%.
Voice Traffic	Set a percentage value for voice traffic in the receive direction. This is a percentage of the maximum burst size for voice traffic. Voice traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default threshold is 0%.0% implies no early random drops will occur.

10 Configure the following parameters in respect to the intended Neighbor **To Air Downstream Rate Limit,** or traffic from a controller or service platform to associated Access Point radios and the wireless client:

Neighbor Tx Rate Limit	Select the radio button to enable rate limiting for data transmitted from connected wireless clients. Enabling this option does not invoke rate limiting for data traffic in the transmit direction. This feature is disabled by default.
Rate	Define a receive rate limit between 50 - 1,000,000 kbps.This limit constitutes a threshold for the maximum the number of packets transmitted or received by the client. Traffic that exceeds the defined rate is dropped and a log message is generated. The default rate is 1,000 kbytes.
Maximum Burst Size	Set a maximum burst size between 2 - 64 kbytes. The smaller the burst, the less likely the receive packet transmission will result in congestion for the wireless client. The default burst size is 64 kbytes.

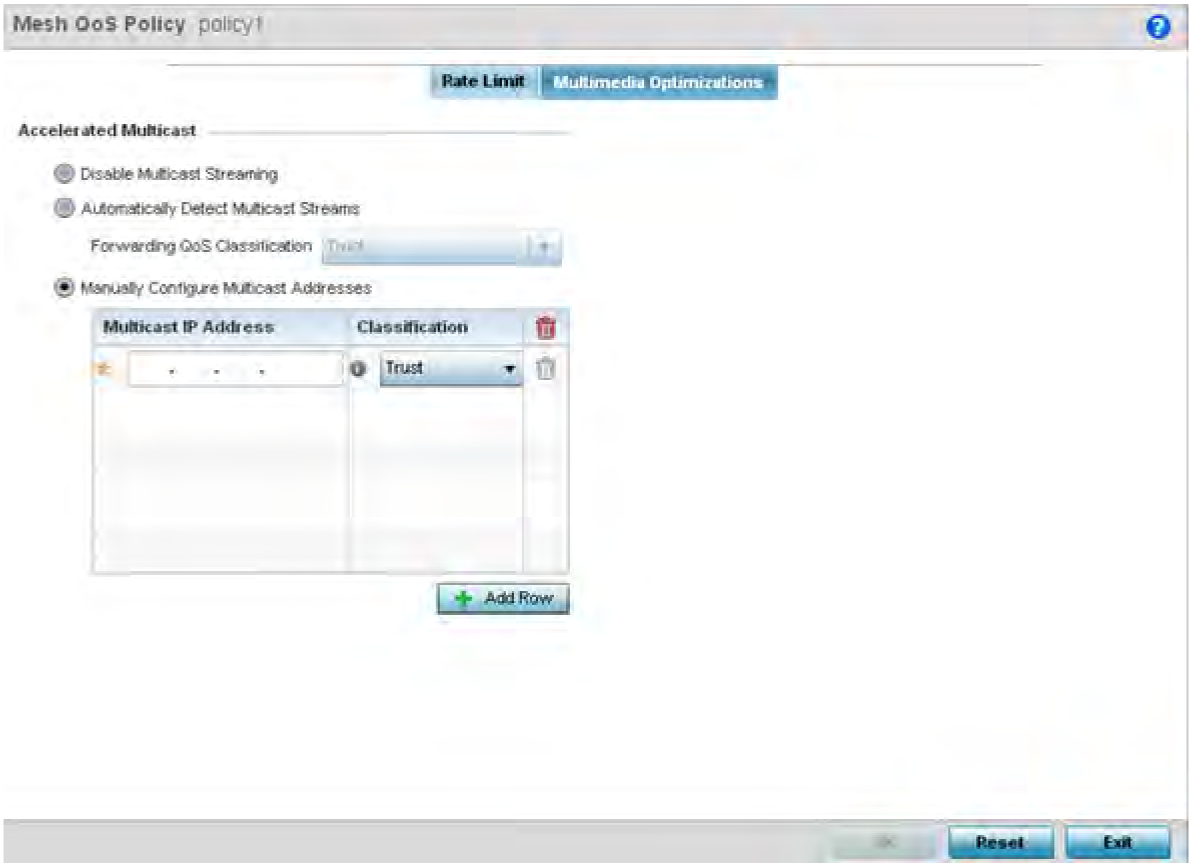
11 Set the following **To Air Downstream Random Early Detection** settings for each access category:

Background Traffic	Set a percentage value for background traffic in the receive direction. This is a percentage of the maximum burst size for low priority traffic. Background traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default is 50%.
Best Effort Traffic	Set a percentage value for best effort traffic in the receive direction. This is a percentage of the maximum burst size for normal traffic. Best effort traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default is 50%.
Video Traffic	Set a percentage value for video traffic in the receive direction. This is a percentage of the maximum burst size for video traffic. Video traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default is 25%.

Voice Traffic	Set a percentage value for voice traffic in the receive direction. This is a percentage of the maximum burst size for voice traffic. Voice traffic exceeding the defined threshold is dropped by the client and a log message is generated. The default threshold is 0%.0% means no early random drops occur.

12 Select **OK** when completed to update this Mesh QoS rate limit settings. Select **Reset** to revert the screen back to its last saved configuration.

13 Select the **Multimedia Optimizations** tab.



Mesh QoS Policy policy1

Accelerated Multicast

○ Disable Multicast Streaming

○ Automatically Detect Multicast Streams

Forwarding QoS Classification: Trust

● Manually Configure Multicast Addresses

Multicast IP Address	Classification
. . .	Trust

Figure 6-56 *Mesh QoS Policy Multimedia Optimizations screen*

14 Set the following **Accelerated Multicast** settings:

Disable Multicast Streaming	Select this option to disable all Multicast Streaming on the mesh point.
Automatically Detect Multicast Streams	Select this option to allow the administrator to have multicast packets that are being bridged converted to unicast to provide better overall airtime utilization and performance. The administrator can either have the system automatically detect multicast streams and convert all detected multicast streams to unicast, or specify which multicast streams are to be converted to unicast. When the stream is converted and being queued up for transmission, there are a number of classification mechanisms that can be applied to the stream and the administrator can select what type of classification they would want. Classification types are *Trust, Voice*, *Video*, *Best Effort*, and *Background*.

Manually Configure Multicast Addresses	Select *+ Add Row* and specify a list of multicast addresses and classifications. Packets are accelerated when the destination addresses matches.

15 Select **OK** when completed to update the Mesh Multimedia Optimizations settings. Select **Reset** to revert the screen back to its last saved configuration.

6.8 Passpoint Policy

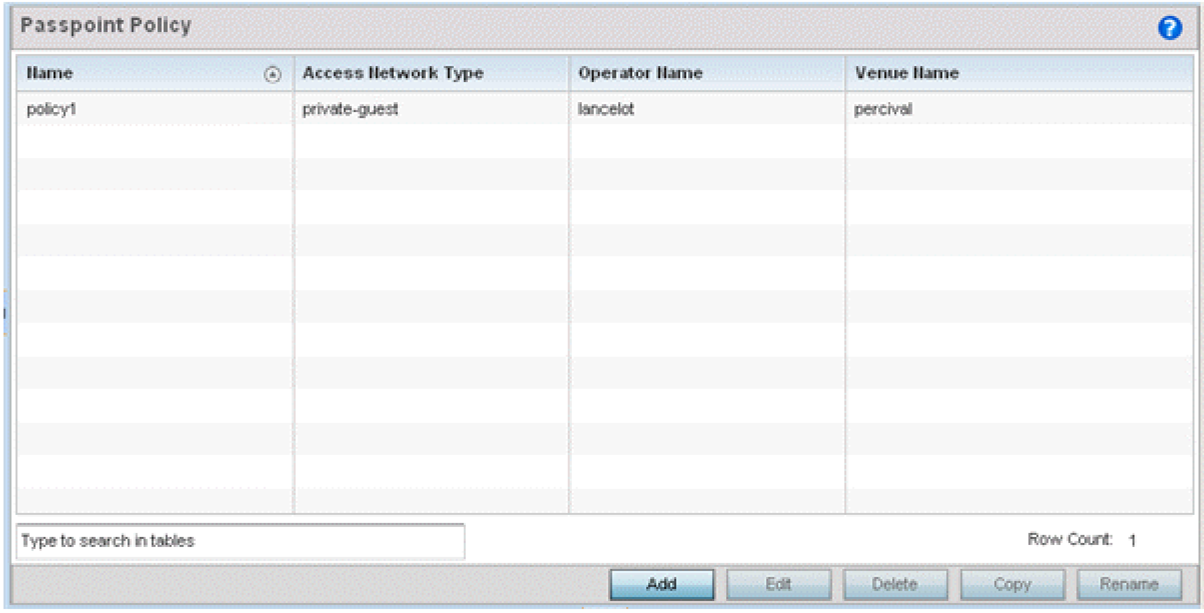
A *passpoint* policy provides an interoperable platform for streamlining Wi-Fi access to Access Points deployed as public hotspots. Passpoint is supported across a wide range of wireless network deployment scenarios and client devices.

Passpoint makes connecting to Wi-Fi networks easier by authenticating the user with an account based on an existing relationship, such as the user's mobile carrier or broadband ISP.

The Passpoint Policy screen displays a list of passpoint polices for network hotspots. Each passpoint policy can be selected to edit its properties. If no exiting passpoint policies supports the required deployment, select Add to create a new policy.

To administrate and manage existing passpoint policies:

1 Select **Configuration** > **Wireless** > **Passpoint Policy** to display existing policies.



Passpoint Policy

Name	Access Network Type	Operator Name	Venue Name
policy1	private-guest	lancelot	percival

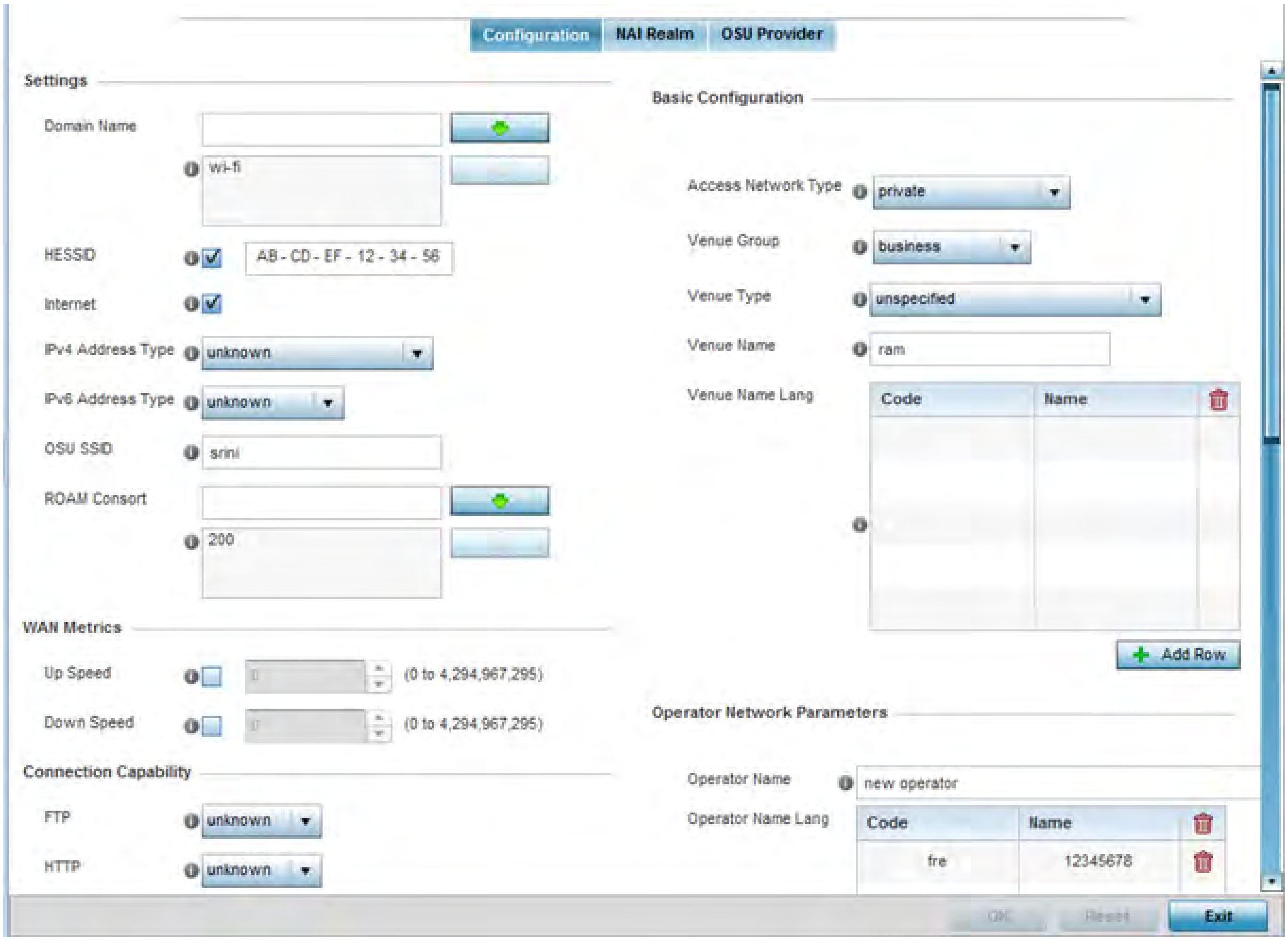
Figure 6-57 *Passpoint Policy screen*

2 Refer to the following configuration data for existing passpoint policies:

Name	Displays the administrator assigned name of each passpoint policy.
Access Network Type	Displays the network access permissions the administrator has set for the passpoint policy.
Operator Name	Displays the unique name assigned to the administrator or operator responsible for the configuration and operation of the Access Point managed hotspot.

Venue Name	Displays the administrator assigned name of the venue (or physical location) of the deployed Access Point hotspot.

3 Select **Add** to define a new passpoint policy, or select an existing policy and select **Edit** to modify its configuration. Existing policies can be selected and deleted, copied, or renamed as needed. Optionally **Copy** or **Rename** a policy as needed.



Settings

Domain Name: wi-fi

HESSID ☑ AB - CD - EF - 12 - 34 - 56

Internet ☑

IPv4 Address Type: unknown

IPv6 Address Type: unknown

OSU SSID: srini

ROAM Consort: 200

WAN Metrics

Up Speed □ 0 (0 to 4,294,967,295)

Down Speed □ 0 (0 to 4,294,967,295)

Connection Capability

FTP: unknown

HTTP: unknown

Basic Configuration

Access Network Type: private

Venue Group: business

Venue Type: unspecified

Venue Name: ram

Venue Name Lang

Code	Name

Operator Network Parameters

Operator Name: new operator

Operator Name Lang

Code	Name
fre	12345678

Figure 6-58 *Passpoint Policy - Configuration screen*

4 Refer to the following **Settings** to define an Internet connection medium for the passpoint policy:

Domain Name	Optionally add a 255 character maximum domain name to the pool available to the passpoint policy.
HESSID	Select this option to apply a homogenous ESS ID. Leaving this option blank applies the BSSID instead. This option is disabled by default.
Internet	Select this option to enable Internet access to users of the passpoint hotspot. Internet access is enabled by default.

IPv4 Address Type	Use the drop-down menu to select the IPv4 formatted address type for this passpoint policy. IPv4 is a connectionless protocol operating on a best effort delivery model. IPv4 does not guarantee delivery or assures proper sequencing or avoidance of duplicate delivery (unlike TCP). Options include, *not available, public, port-restricted, port-restricted-double-nat, single-nat, double-nat, port-restricted-single-nat* and *unknown*.
IPv6 Address Type	Use the drop-down menu to select the IPv4 formatted address type for this passpoint policy. IPv6 is the latest revision of the *Internet Protocol* (IP) designed to replace IPv4. IPV6 provides enhanced identification and location information for computers on networks routing traffic across the Internet. Options include, *available, unavailable* and *unknown*.
OSU SSID	Optionally define a 32 character maximum sign-on ID that must be correctly provided to access the passpoint policy's hotspot resources.
ROAM Consort	Provide a 0 - 255 character roaming consortium number. A roaming consort ID is sent as roaming consortium information in a hotspot query response.

5 Set the following **WAN Metrics** for upstream and downstream bandwidth:

Up Speed	Enable this option to estimate the maximum upstream bandwidth from 0 - 4,294,967,295 Kbps.
Down Speed	Enable this option to estimate the maximum downstream bandwidth from 0 - 4,294,967,295 Kbps.

6 Set the following **Connection Capability** for passpoint policy's **FTP, HTTP, ICMP, IPSec VPN, PPTP VPN, SIP, SSH** and **TLS VPN** interfaces:

7 Use the drop-down menu to define these interfaces as **open, closed** or **unknown** for this passpoint policy configuration. Disabling unused interfaces is recommended to close unnecessary security holes.

8 Select **+ Add Row** to set a **Connection Capability Variable** to make specific virtual ports **open** or **closed** for Wi-Fi connection attempts, set rules for how the user is to connect with routing preference using this passpoint policy.

9 Select **+ Add Row** and set a **Network Authentication Type** to select how Wi-Fi connection attempts are authenticated and validated using a dedicated redirection URL resource.

10 Refer to the **Basic Configuration** field to set the following:

Access Network Type	Use the drop-down menu to select the network access method for this passpoint policy. Access network types include: *private* – General access to a private network hotspot (default setting) *private-guest* – Access to a private network hotspot with guest services *chargeable-public* – Access to a public hotspot with billable services *personal-device* – Access to a hotspot for personal devices such as wireless routers *emergency services* – Dedicated network hotspot access for emergency services only

Venue Group	Passpoint is supported across a wide range of wireless network deployment scenarios and client devices. Select the group type best suited to the majority of hotspot requestors utilizing the passpoint policy's unique configuration.
Venue Type	Select the venue type best suited to the actual location passpoint requestors are located. If an adequate option cannot be applied, a numeric venue type can be utilized.
Venue Name	Enter the *Venue Name* and address. The operator can configure an Access Point to describe the location of the hotspot. This information typically includes the name and address of the deployment location where the hotspot is located. Enter the name and address configured for the Access Point hotspot. The name cannot exceed 252 characters.
Venue Name Lang	Hotspot operators can list venue names in multiple languages. Select the *+ Add Row* button to add venue name languages. Enter the two or three character ISO-14962-1997 encoded string that defines the language used in the *Code* field. Enter the name of the venue in the *Name* field. The name cannot exceed 252 characters.

11 Refer to the **Operator Network Parameters** field to define the following:

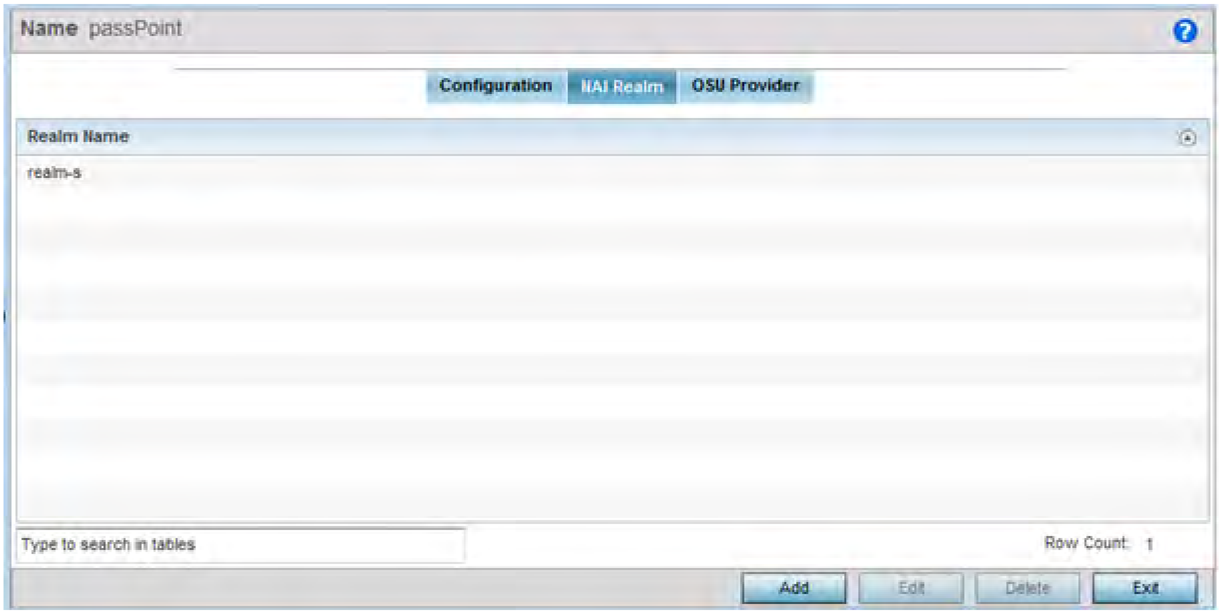
Operator Name	Provide the unique name (in English) of the administrator or operator responsible for the configuration and management or the hotspot. The name cannot exceed 64 characters.
Operator Name Lang	Operator names can be listed in multiple languages. Select *+ Add Row* to add operator name languages. Enter the two or three character ISO-14962-1997 encoded string defining the language used in the *Code* field. Enter the name of the operator in the *Name* field. The name cannot exceed 252 characters.
PLMNID	Operators providing mobile and Wi-Fi hotspot services have a unique *Public Land Mobile Network* (PLMN) ID. Select the *+ Add Row* button to add PLMN information for operators responsible for the configuration and operation of the hotspot. Provide a Description for the PLMN not exceeding 64 characters. Enter a three digit *Mobile Country Code* (MCC) and two digit *Mobile Network Code* (MNC) for the PLMN ID. The MCC identifies the region and country where the hotspot is deployed. The MNC identifies the operator responsible for the configuration and management of the hotspot by PLMN ID and country. Both the MCC and MNC fields are mandatory.

12 Select **OK** when completed to update the passpoint policy settings. Select **Reset** to revert the screen back to the last saved configuration.

13 Select the **NAI Realm** tab.

The *Network Access Identifier* (NAI) is the user identity submitted by the hotspot requesting client during authentication. The standard syntax is *user@realm*. NAI is frequently used when roaming, to identify the user and assist in routing an authentication request to the user's authentication server. The realm name is often the domain name of the service provider.

The NAI realm screen displays those realms created thus far for utilization with a passpoint policy.



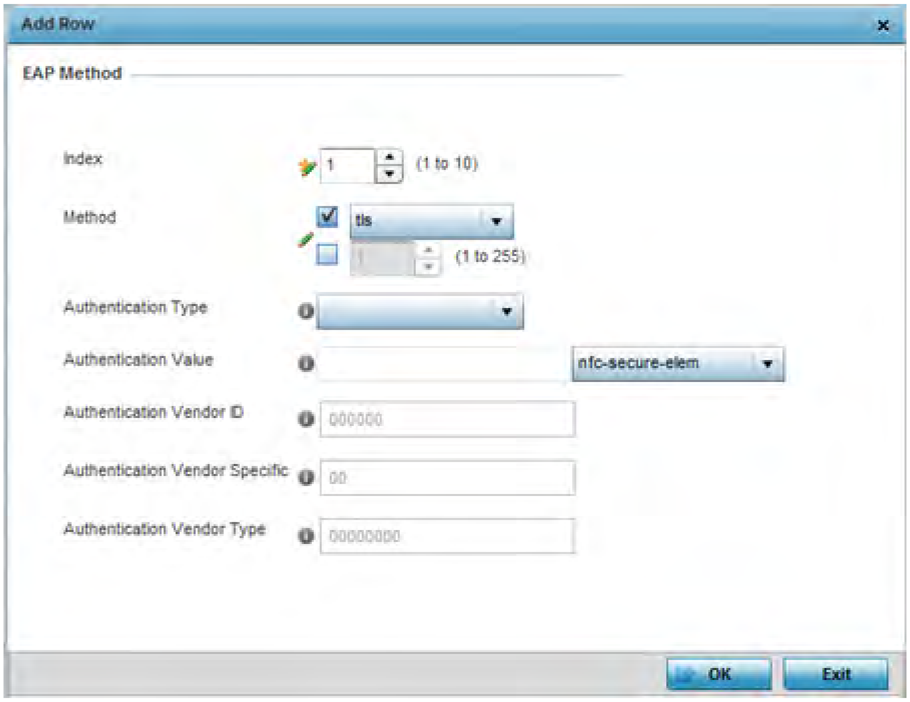
Realm Name
realm-s

Type to search in tables

Row Count: 1

Figure 6-59 *Passpoint Policy - NAI Realm screen*

Either select **Add** to create a new NAI realm configuration for passpoint hotspot utilization, **Edit** to modify the attributes on an existing selected configuration or **Delete** to remove a selected configuration from those available. Provide a **Realm Name** or names (32 characters maximum) delimited by a semi colon. Select **+ Add Row** to create a **EAP Method** configuration for the NAI realm.



Index: 1 (1 to 10)

Method: ☑ tls
□ 1 (1 to 255)

Authentication Type:

Authentication Value: nfc-secure-elem

Authentication Vendor ID: 000000

Authentication Vendor Specific: 00

Authentication Vendor Type: 00000000

Figure 6-60 *Passpoint Policy - NAI Realm Add/Edit screen*

14 Set the following **EAP Method** attributes to secure the NAI realm used by the passpoint policy:

Index	Select an EAP instance index from 1 - 10 to apply to this hotspot's EAP credential exchange and verification session. NAIs are often user identifiers in the EAP authentication protocol.
Method	Set an EAP method for the NAI realm. Options include *identity, otp, gtc, rsa-public-key, tls, sim, ttls, peap, ms-auth, ms-authv2, fast, psk* and *ikev2*.
Authentication Type	Use the drop-menu to specify the EAP method authentication type. Options include *expanded-eap, non-eap-inner, inner-eap, expanded-inner-eap*, *credential*, *tunn-eap-credential* and *vendor*.
Authentication Value	If setting the authentication type to either *non-eap-inner, inner-eap, credential* or *tunnel-eap-credential* define an authentication value that must be shared with the EAP credential validation server resource.
Authentication Vendor ID	If the authentication type is set to either, *expanded-eap* or *expanded-inner-eap*, set a 6 character authentication vendor ID that must match the one utilized by the EAP server resource.
Authentication Vendor Specific	If required, add 2 - 510 character vendor specific authentication data required for the selected authentication type. Enter the value is an *a-FA -F0-9* format.
Authentication Vendor Type	Set a 8 character authentication vendor type used exclusively for the *expanded-eap* or *expanded-inner-eap* authentication types.

15 Select **OK** to save the updates to the NAI realm.

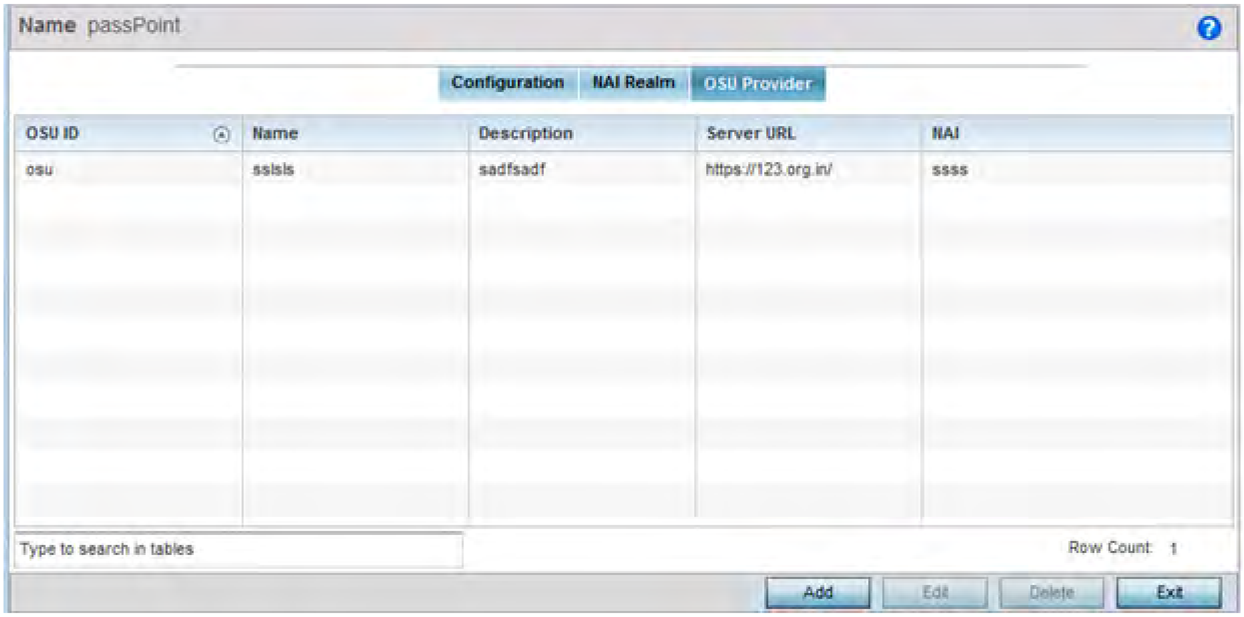
16 Select the **OSU Provider** tab.

WiNG managed clients can use Online Sign-Up (OSU) for registration and credential provisioning to obtain hotspot network access. Service providers have an OSU AAA server and certificate authority (CA). For a client and hotspot to trust one another, the OSU server holds a certificate signed by a CA whose root certificate is issued by a CA authorized by the Wi-Fi Alliance, and CA certificates are installed on the client device. A CA performs four functions:

- Issues certificates (creates and signs)
- Maintains certificate status information and issues *certificate revocation lists* (CRLs)
- Publishes current (non-expired) certificates and CRLs
- Maintains status archives for the expired or revoked certificates it has issued

Passpoint certificates are governed by the Hotspot 2.0 OSU Certificate Policy Specification. An OSU server certificate should be obtained from any of the CAs authorized by the Wi-Fi Alliance. Once an OSU provider is selected, the client connects to the OSU WLAN. It then triggers an HTTPS connection to the OSU server, which was received with the OSU providers list. The client validates the server certificate to ensure it's a trusted OSU server. The client is prompted to complete an online registration through their browser. When the client has a valid credential for the hotspot 2.0 WLAN, it disassociates from the OSU WLAN and connects to the hotspot 2.0 WLAN.

The OSU Provider screen displays those provider configurations created thus far for utilization with a passpoint policy.



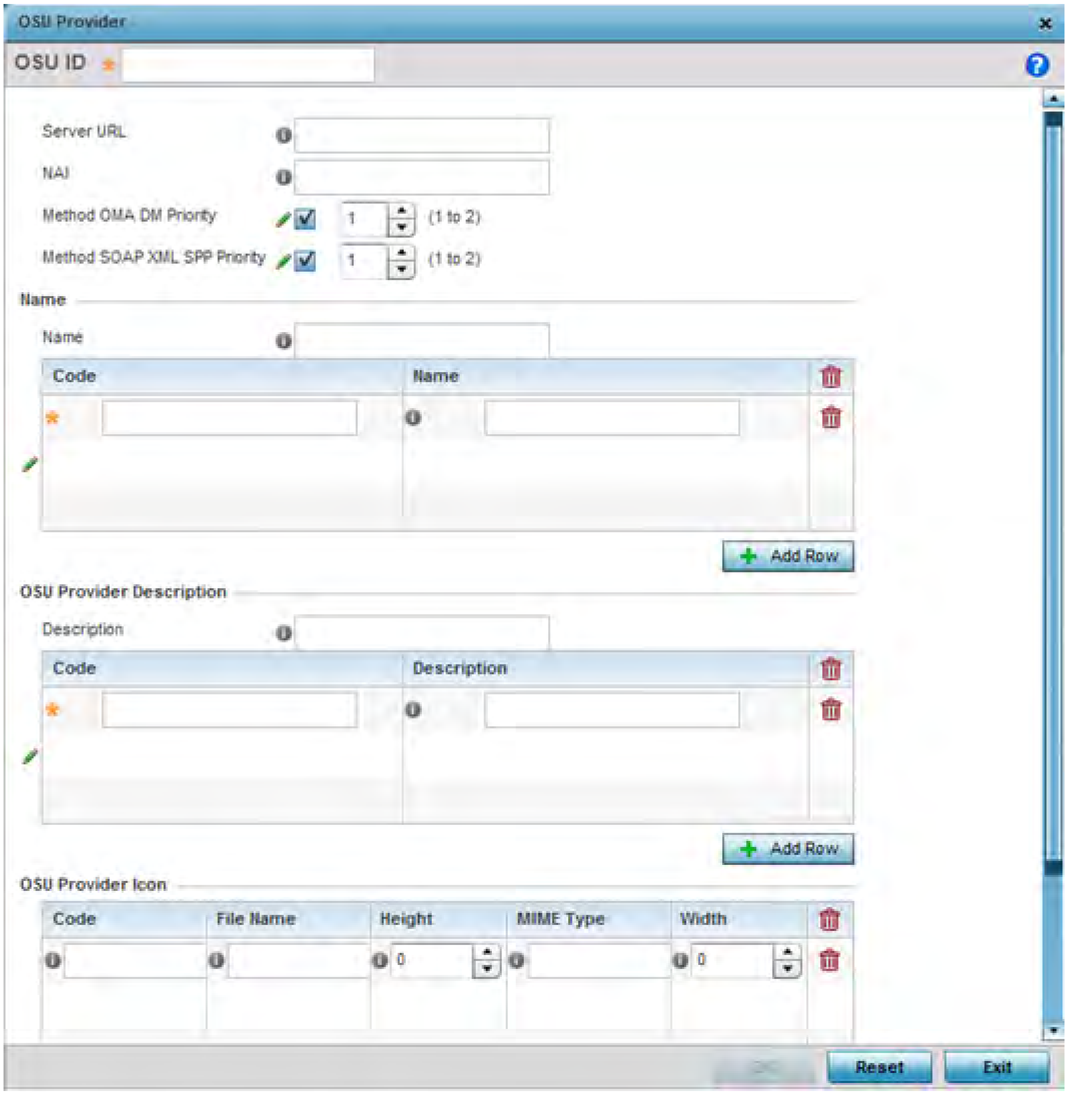
Name passPoint

OSU ID	Name	Description	Server URL	NAI
osu	sslsls	sadfsadf	https://123.org.in/	ssss

Row Count: 1

Figure 6-61 *Passpoint Policy - OSU Provider screen*

17 Either select **Add** to create a new OSU provider configuration for passpoint hotspot utilization, **Edit** to modify the attributes on an existing selected configuration or **Delete** to remove a selected configuration from those available.



OSU Provider

OSU ID *

Server URL

NAI

Method OMA DM Priority ☑ 1 (1 to 2)

Method SOAP XML SPP Priority ☑ 1 (1 to 2)

Name

Name

Code	Name
*	

Add Row

OSU Provider Description

Description

Code	Description
*	

Add Row

OSU Provider Icon

Code	File Name	Height	MIME Type	Width
		0		0

OK Reset Exit

Figure 6-62 *Passpoint Policy - OSU Provider Add/Edit screen*

18 If creating a new OSU provider configuration, provide it a 32 character maximum **OSU ID** serving as an online sign up identifier.

19 Set the following attributes to secure the NAI realm used by the passpoint policy:

Server URL	Provide a 255 character maximum sign up server URL for the OSU provider.
NAI	Enter a 255 character maximum *Network Access Identifier* (NAI) to identify the user and assist in routing an authentication request to the authentication server. The realm name is often the domain name of the service provider
Method OMA DM Priority	Select this option to provide *open mobile alliance* (OMA) device management priority. The OMA is a standards body developing open standards for mobile clients. OMA is relevant to service providers working across countries (with different languages), operators and mobile terminals. Adherence to OMA is strictly voluntary. Use the drop-menu to specify the priority as 1 or 2.

Method SOAP XML SPP Priority	Select this option to apply a SOAP-XML subscription provisioning protocol priority of either 1 or 2. The *simple object access protocol* (SOAP) is a protocol for exchanging structured information in Web services. SOAP uses XML as its message format, and relies on other application layer protocols, like HTTP or SMTP for message negotiation and transmission.

20 Refer to the **Name** field to optionally set a 252 character English language sign up name, then provide a 3 character maximum ISO-639 language **Code** to apply the sign up name in a language other then English. Apply a 252 character maximum hexadecimal online sign up **Name** to encode in the ISO-639 language code applied to the sign up name.

21 Refer to the **OSU Provider Description** field to set an online sign up description in a language other then English.

Select **+ Add Row** and provide a 3 character maximum ISO-639 language **Code** to apply the sign up name in a language other then English. Apply a 252 character maximum hexadecimal online sign up **Description** to encode in the ISO-639 language code applied to the sign up name.

22 Optionally provide an **OSU Provider Icon** by selecting **+ Add Row**. Apply the following configuration attributes to the icon.

Code	Enter a 3 character maximum ISO-639 language *Code* to define the language used in the OSU provider icon.
File Name	Provide a 255 character maximum icon name and directory path location to the icon file.
Height	Provide the icon height size in pixels from 0 - 65,535. The default setting is 0.
MIME Type	Set the icon MIME file type from 0 - 64. The MIME associates filename extensions with a MIME type. A MIME enables a fallback on an extension and are frequently used by Web servers.
Width	Provide the icon width size in pixels from 0 - 65,535. The default setting is 0.

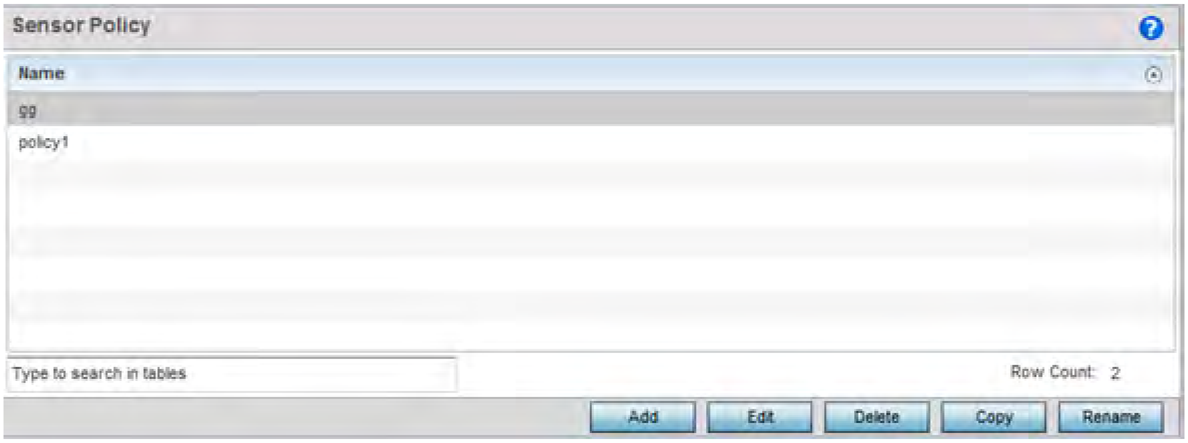
23 Select **OK** to save the updates to the OSU provider configuration. Select **Reset** to revert to the last saved configuration.

6.9 Sensor Policy

In addition to WIPS support, sensor functionality has now been added for Extreme Networks' MPact locationing system. The MPact system for Wi-Fi locationing includes WiNG controllers and Access Points functioning as sensors. Within the MPact architecture, sensors scan for RSSI data on an administrator defined interval and send to a dedicated MPact Server resource, as opposed to an ADSP server. The MPact Server collects the RSSI data from WiNG sensor devices, and calculates the location of Wi-Fi devices for MPact administrators.

To administrate and manage existing sensor policies:

1 Select **Configuration** > **Wireless** > **Sensor Policy** to display existing policies.



Sensor Policy

Name
gg
policy1

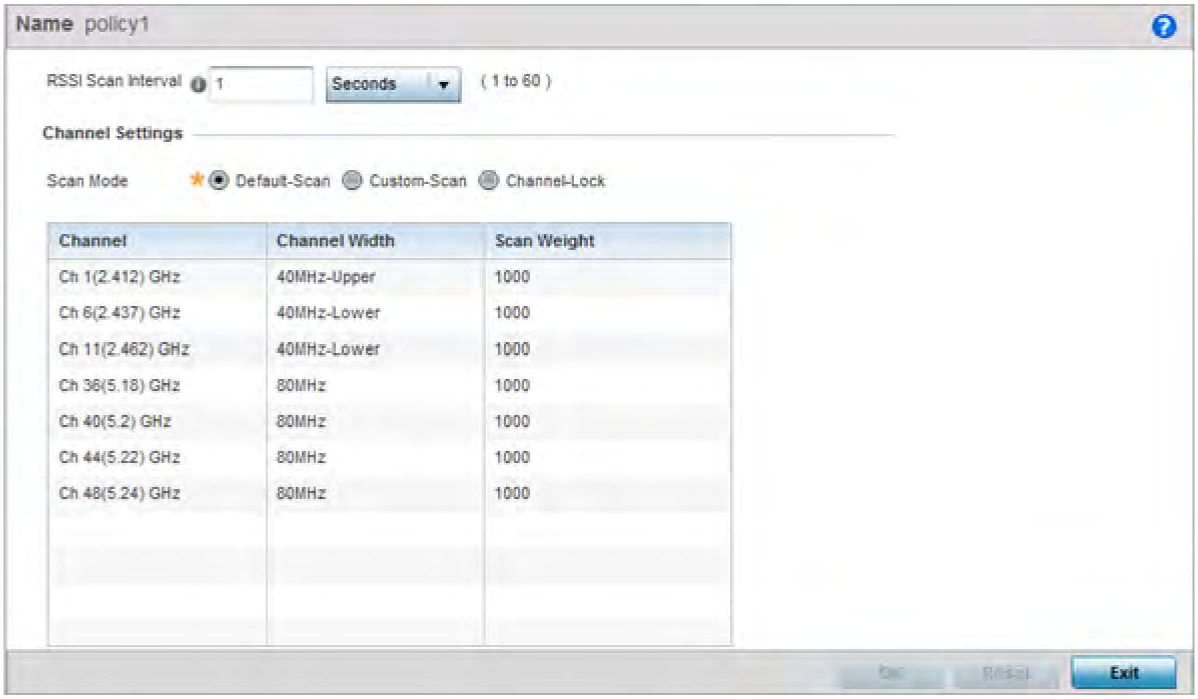
Type to search in tables

Row Count: 2

Figure 6-63 *Sensor Policy screen*

2 Select **Add** to define a new sensor policy, or select an existing policy and select **Edit** to modify its configuration. Existing sensor policies can be selected and deleted, copied, or renamed as needed.

NOTE: If a dedicated sensor is utilized with WIPS for rogue detection, any sensor policy selected from the Sensor Policy drop-down menu is discarded and not utilized by the sensor. To avoid this situation, use ADSP channel settings exclusively to configure the sensor and not the WiNG interface.



Name policy1

RSSI Scan Interval 1 Seconds (1 to 60)

Channel Settings

Scan Mode ● Default-Scan ○ Custom-Scan ○ Channel-Lock

Channel	Channel Width	Scan Weight
Ch 1(2.412) GHz	40MHz-Upper	1000
Ch 6(2.437) GHz	40MHz-Lower	1000
Ch 11(2.462) GHz	40MHz-Lower	1000
Ch 36(5.18) GHz	80MHz	1000
Ch 40(5.2) GHz	80MHz	1000
Ch 44(5.22) GHz	80MHz	1000
Ch 48(5.24) GHz	80MHz	1000

Figure 6-64 *Sensor Policy - Configuration screen*

3 Select **Add** to define a new sensor policy, or select an existing policy and select **Edit** to modify its configuration. Existing sensor policies can be selected and deleted, copied, or renamed as needed.

4 If creating a new sensor policy, assign it a **Name** up to 32 characters. No character spaces are permitted within the name. Define a name unique to the policy's channel and scan mode configuration to help differentiate it from other policies. If adding a new sensor policy, the Name must be provided and **Continue** selected to enable the remaining configuration parameters.

Use the **RSSI Scan Interval** drop-down menu to set a scan interval from 1 - 60 seconds. This is the scan period dedicated sensors (Access Point radios) utilize for RSSI (signal strength) assessments. Once obtained, the sensor sends the RSSI data to a specified MPact server resource (not an ADSP server) for the calculation of Wi-Fi device locations. The default is 1 second.

5 Set the following **Scan Mode** values depending on whether *Default-Scan, Custom Scan* or *Channel Lock* has been selected as the mode of scan operation:

Channel	*Default-Scan* - The list of available scan channels is fixed and defaulted in a spread pattern of 1, 6, 11, 36, 40, 44 and 48. No alternations to this channel pattern are available to the administrator. *Custom-Scan* - A list of unique channels in the 2.4, 4.9, 5 and 6 GHz band can be collectively or individually enabled for customized channel scans and RSSI reporting. *Channel-Lock* - Once selected, the existing Channel, Channel Width and Scan Weight table items are replaced by a Lock Frequency drop-down menu. Use this menu to lock the RSSI scan to one specific channel.
Channel Width	*Default-Scan* - Each channel's width is fixed and defaulted to either 40MHz-Upper (Ch 1), 40MHz-Lower (Ch 6 and CH 11) or 80MHz (CH 36, CH 40, CH 44 and CH 48). *Custom-Scan* - When custom channels are selected for RSSI scans, each selected channel can have its own width defined. Numerous channels have their width fixed at 20MHz, 802.11a radios support 20 and 40 MHz channel widths. *Channel-Lock* - If a specific channel is selected and locked for an RSSI scan, there's no ability to refine the width between adjacent channels, as only one channel is locked.
Scan Weight	*Default-Scan* - Each default channel's scan is of equal duration (1000) within the defined RSSI scan interval. No one channel receives scan priority within the defined RSSI scan interval. *Custom-Scan* - Each selected channel can have its weight prioritized in respect to the amount of time a scan is permitted within the defined RSSI scan interval. *Channel-Lock* - If a specific channel is selected and locked for an RSSI scan, there's no ability to refine the scan weightage in respect to all the remaining unlocked channels.

6 Select **OK** when completed to update the sensor policy settings. Select **Reset** to revert the screen back to the last saved configuration.

7 Network Configuration

Controllers, service platforms and Access Points allow packet routing customizations and unique network resources for deployment specific routing configurations.

For more information on the options available, refer to the following:

7.1 Policy Based Routing

Define a *policy based routing* (PBR) configuration to direct packets to selective paths. PBR can optionally mark traffic for preferential services. PBR minimally provides the following:

- A means to use source address, protocol, application and traffic class as traffic routing criteria
- The ability to load balance multiple WAN uplinks
- A means to selectively mark traffic for QoS optimization

Since PBR is applied to incoming routed packets, a route-map is created containing a set of filters and associated actions. Based on the actions defined in the route-map, packets are forwarded to the next relevant hop. Route-maps are configurable under a global policy called routing-policy, and applied to profiles and devices.

Route-maps contain a set of filters which select traffic (match clauses) and associated actions (set clauses) for routing. A routemap consists of multiple entries, each carrying a precedence value. An incoming packet is matched against the route-map with the highest precedence (lowest numerical value). If it matches, the routing decision is based on this route-map. If the packet does not match the route-map, the route-map entry with next highest precedence is matched. If the incoming packet does not match any of the route-map entries, it's subjected to typical destination based routing. Each route-map entry can optionally enable/disable logging.

The following criteria can optionally be used as traffic selection segregation criteria:

- *IP Access List* - A typical IP ACL can be used for traffic permissions. The mark and log actions in ACL rules however are neglected. Route-map entries have separate logging. Only one ACL can be configured per route map entry.

- *IP DSCP* - Packet filtering can be performed by traffic class, as determined from the IP DSCP field. One DSCP value is configurable per route map entry. If IP ACLs on a WLAN, ports or SVI mark the packet, the new/marked DSCP value is used for matching.
- *Incoming WLAN* - Packets can be filtered by the incoming WLAN. There are two ways to match the WLAN:
  - If the device doing policy based routing has an onboard radio and a packet is received on a local WLAN, then this WLAN is used for selection.
  - If the device doing policy based routing does not have an onboard radio and a packet is received from an extended VLAN, then the device which received the packet passes the WLAN information in the MINT packet for the PBR router to use as match criteria.
- *Client role* - The client role can be used as match criteria, similar to a WLAN. Each device has to agree on a unique identifier for role definition and pass the same MINT tunneled packets.
- *Incoming SVI* - A source IP address qualifier in an ACL typically satisfies filter requirements. But if the host originating the packet is multiple hops away, the incoming SVI can be used as match criteria. In this context the SVI refers to the device interface performing policy based routing, and not the originating connected device.

Each route map entry has a set of match and set (action) clauses. ACL rules configured under route map entries merge to create a single ACL. Route map precedence values determine the prioritization of the rules in this merged ACL. An IP DSCP value is also added to the ACL rules.

Set (or action) clauses determine the routing function when a packet satisfies match criteria. If no set clauses are defined, the default is to fallback to destination based routing for packets satisfying the match criteria. If no set clause is configured and fallback to destination based routing is disabled, then the packet is dropped. The following can be defined within set clauses:

- *Next hop* - The IP address of the next hop or the outgoing interface through which the packet should be routed. Up to two next hops can be specified. The outgoing interface should be a PPP, a tunnel interface or a SVI which has DHCP client configured. The first reachable hop should be used, but if all the next hops aren’t reachable, typical destination based route lookup is performed.
- *Default next hop* - If a packet subjected to PBR does not have an explicit route to the destination, the configured default next hop is used. This can be either the IP address of the next hop or the outgoing interface. Only one default next hop can be defined. The difference between the next hop and the default next-hop is in case of former, PBR occurs first, then destination based routing. In case of the latter, the order is reversed. With both cases:
  - a If a defined next hop is reachable, it’s used. If fallback is configured refer to (b).
  - b Do normal destination based route lookup. If a next hop is found its used, if not refer to (c).
  - c If default next hop is configured and reachable, it’s used. If not, drop the packet.
- *Fallback* - Fallback to destination based routing if none of the configured next hops are reachable (or not configured). This is enabled by default.
- *Mark IP DSCP* - Set IP DSCP bits for QoS using an ACL. The mark action of the route maps takes precedence over the mark action of an ACL.

☑ **NOTE:** A packet should optimally satisfy all the match criteria, if no match clause is defined in a route-map, it would match everything. Packets not conforming to any of the match clauses are subjected to normal destination based routing.

To define a PBR configuration:

1 Select the **Configuration** tab from the Web UI.

2 Select **Network.**