LINKSYS™

User Guide

LAPAC1750PRO

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Section 1: Getting Started

The LAPAC1750PRO® Access Point provides continuous, high-speed access between wireless devices and Ethernet devices. It is an advanced, standards-based solution for wireless networking in businesses of any size. The access point (AP) enables wireless local area network (WLAN) deployment while providing state-of-the-art wireless networking features.

The access point can operate in one modes: Standalone Mode. In Standalone Mode, the access point acts as an individual access point in the network, and you manage it by using the Administrator Web User Interface (UI) or SNMP.

This document describes how to perform the setup, management, and maintenance of the access point in Standalone Mode.

Before you power on a new access point, review the following sections to check required hardware and software components, client configurations, and compatibility issues. Make sure you have everything you need for a successful launch and test of your new or extended wireless network.

This section contains the following topics:

- Administrator's Computer Requirements
- Wireless Client Requirements
- Online Help, Supported Browsers, and Limitations
- Dynamic and Static IP Addressing on the AP
- Installing the Access Point
- Configuring the Ethernet Settings
- Configuring IEEE 802.1X Authentication
- Configuring Security on the Wireless Access Point

To manage the access point by using the Web interface, the AP needs an IP address. If you use VLANs or IEEE 802.1X Authentication (port security) on your network, you might need to configure additional settings on the AP before it can connect to the network.

NOTE:
The access point is not designed to function as a gateway to the Internet. To connect your WLAN to other LANs or the Internet, you need a gateway device.

Administrator's Computer Requirements

The following table describes the minimum requirements for the administrator's computer for configuration and administration of the access point through a Web-based user interface (UI).

Table 1: Requirements for the Administrator's Computer

Required Software or Component	Description
Ethernet Connection to the Access Point	The computer used to configure the first access point must be connected to the access point by an Ethernet cable.
Wireless Connection to the Network	After initial configuration and launch of the first access point on your new wireless network, you can make subsequent configuration changes through the Administration Web pages using a wireless connection to the internal network. For wireless connection to the access point, your administration device will need Wi-Fi capability similar to that of any wireless client: Portable or built-in Wi-Fi client adapter that supports one or more of the IEEE 802.11 modes in which you plan to run the access point.

Web Browser and Operating System	Configuration and administration of the access point is provided through a Web-based user interface hosted on the access point. We recommend using one of the following supported Web browsers to access the access point Administration Web pages: • Microsoft® Internet Explorer® version 9.x or 11.x (with up-to-date patch level for either major version) • Mozilla Firefox version 26.x • Google Chrome version 32.x • Safari version 5.x The administration Web browser must have JavaScript™ enabled to support the interactive features of the administration interface.
Security Settings	Ensure that security is disabled on the wireless client used to initially configure the access point.

Wireless Client Requirements

The access point provides wireless access to any client with a properly configured Wi-Fi client adapter for the 802.11 mode in which the access point is running. The access point supports multiple client operating systems. Clients can be laptop or desktop computers, personal digital assistants (PDAs), or any other hand-held, portable or stationary device equipped with a Wi-Fi adapter and supporting drivers.

In order to connect to the access point, wireless clients need the software and hardware described in the following table.

Table 2: Requirements for Wireless Clients

Required Component	Description
Wi-Fi Client Adapter	Portable or built-in Wi-Fi client adapter that supports one or more of the IEEE 802.11 modes in which you plan to run the access point. (IEEE 802.11a, 802.11b, 802.11g, 802.11n, and 802.11ac modes are supported.)
Wireless Client Software	Client software, such as Microsoft Windows Supplicant, configured to associate with the access point.
Client Security Settings	Security should be disabled on the client used to do initial configuration of the access point. If the Security mode on the access point is set to anything other than plain text, wireless clients will need to set a profile to the authentication mode used by the access point and provide a valid username and password, certificate, or similar user identity proof. Security modes are Static WEP, IEEE 802.1X, WPA with RADIUS server, and WPA-PSK. For information about configuring security on the access point, see "Virtual Access Point (VAP)".

Online Help, Supported Browsers, and Limitations

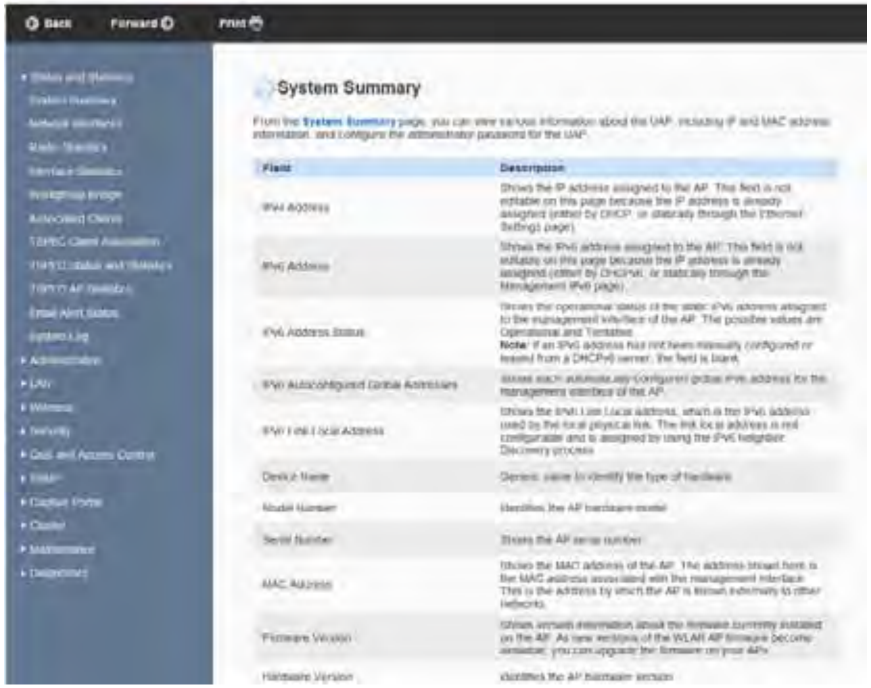
Online help for the access point Administration Web pages provides information about all fields and features available from the user interface (UI). The information in the online help is a subset of the information available in the LAPAC1750PRO Access Point Administrator's Guide.

Online help information corresponds to each page on the access point Administration UI.

For information about the settings on the current page, click the link on the right side of a page or the More... link at the bottom of the help panel on the UI.

The following figure shows an example of the online help available from the links on the user interface.

Figure 1: Administrator UI Online Help



System Summary

From the **System Summary** page, you can view various information about the UAP, including IP and MAC address information, and configure the administrator password for the UAP.

Field	Description
IPv4 Address	Shows the IP address assigned to the AP. This field is not editable on this page because the IP address is already assigned (either by DHCP or statically through the Ethernet Settings page).
IPv6 Address	Shows the IPv6 address assigned to the AP. This field is not editable on this page because the IP address is already assigned (either by DHCPv6 or statically through the Management IPv6 page).
IPv6 Address Status	Shows the operational status of the static IPv6 address assigned to the management interface of the AP. The possible values are Operational and Tentative. **Note:** If an IPv6 address has not been manually configured or leased from a DHCPv6 server, the field is blank.
IPv6 Autoconfigured Global Addresses	Shows each automatically configured global IPv6 address for the management interface of the AP.
IPv6 Link Local Address	Shows the IPv6 Link Local address, which is the IPv6 address used by the local physical link. The link local address is not configurable and is assigned by using the IPv6 Neighbor Discovery process.
Device Name	Generic name to identify the type of hardware.
Model Number	Identifies the AP hardware model.
Serial Number	Shows the AP serial number.
MAC Address	Shows the MAC address of the AP. The address shown here is the MAC address associated with the management interface. This is the address by which the AP is known externally to other networks.
Firmware Version	Shows version information about the firmware currently installed on the AP. As new versions of the WLAN AP firmware become available, you can upgrade the firmware on your APs.
Hardware Version	Identifies the AP hardware version.

Dynamic and Static IP Addressing on the AP

When you power on the access point, the built-in DHCP client searches for a DHCP server on the network in order to obtain an IP address and other network information. If the AP does not find a DHCP server on the network, the AP continues to use its default Static IP Address (192.168.1.252) until you re-assign it a new static IP address (and specify a static IP addressing policy) or until the AP successfully receives network information from a DHCP server.

To change the connection type and assign a static IP address by using the Web UI, see “VLAN and IPv4 Address” on page 46.

NOTE:
If you do not have a DHCP server on your internal network, and do not plan to use one, the first thing you must do after powering on the access point is change the connection type from DHCP to static IP. You can either assign a new static IP address to the AP or continue using the default address. We recommend assigning a new static IP address so that if you bring up another WLAN AP on the same network, the IP address for each AP will be unique.

Recovering an IP Address

If you experience trouble communicating with the access point, you can recover a static IP address by resetting the AP configuration to the factory defaults (see “Restoring Configuration” on page 164 and “To Restore the Factory Default Configuration” on page 165), or you can get a dynamically assigned address by connecting the AP to a network that has a DHCP server.

Discovering a Dynamically Assigned IP Address

If you have access to the DHCP server on your network and know the MAC address of your AP, you can view the new IP address associated with the MAC address of the AP.

NOTE:
The MAC address of access point is shown on product label and brown box label.

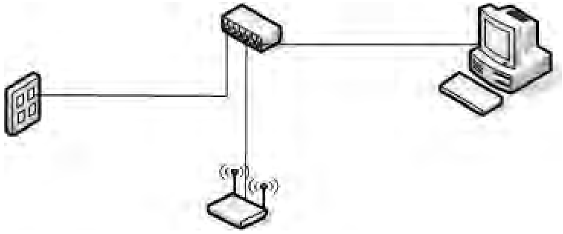
Installing the Access Point

To access the Administration Web UI, you enter the IP address of the AP into a Web browser. You can use the default IP address of the AP (192.168.1.252) to log on to the AP and assign a static IP address, or you can use a DHCP server on you network to assign network information to the AP. The DHCP client on the AP is enabled by default.

To install the access point, use the following steps:

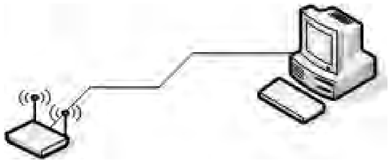
1. Connect the AP to an administrative PC by using a LAN connection or a direct-cable connection.

- To use a LAN connection, connect one end of an Ethernet cable to the network port on the access point and the other end to the same hub where your PC is connected, as shown in the following figure.



The hub or switch you use must permit broadcast signals from the access point to reach all other devices on the network.

- To use a direct-cable connection, connect one end of an Ethernet straight-through or crossover cable to the network port on the access point and the other end of the cable to the Ethernet port on the PC, as shown in the following figure. You can also use a serial cable to connect the serial port on the AP to a serial port on the administrative computer.



For initial configuration with a direct Ethernet connection and no DHCP server, be sure to set your PC to a static IP address in the same subnet as the default IP address on the access point. (The default IP address for the access point is 192.168.1.252.)

If you use this method, you will need to reconfigure the cabling for subsequent startup and deployment of the access point so that the access point is no longer connected directly to the PC but instead is connected to the LAN (either by using a hub or directly).

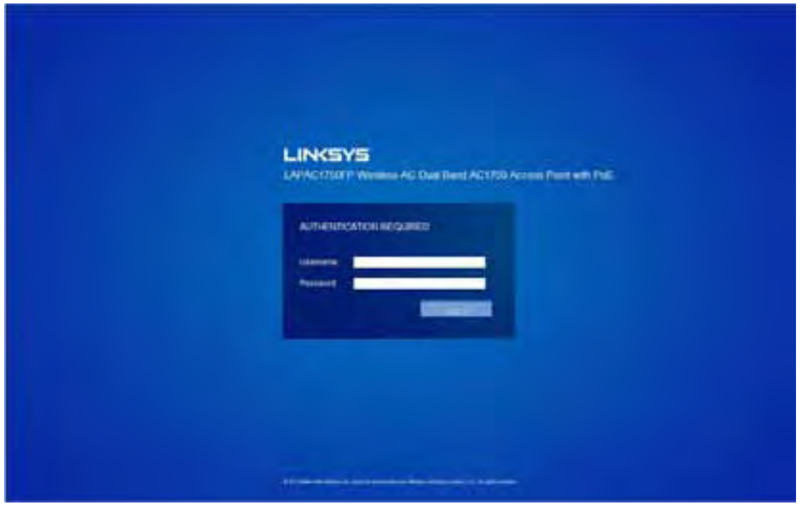
NOTE:
It is possible to detect access points on the network with a wireless connection. However, we strongly advise against using this method. In most environments you may have no way of knowing whether you are actually connecting to the intended AP. Also, many of the initial configuration changes required will cause you to lose connectivity with the AP over a wireless connection.

NOTE:
Ethernet Port 1 and Port 2 can be used together in Link Aggregation mode when supported by the connected devices.

2. Connect the power adapter to the power port on the back of the access point, and then plug the other end of the power cord into a power outlet.
3. Use your Web browser to log on to the access point Administration Web pages.

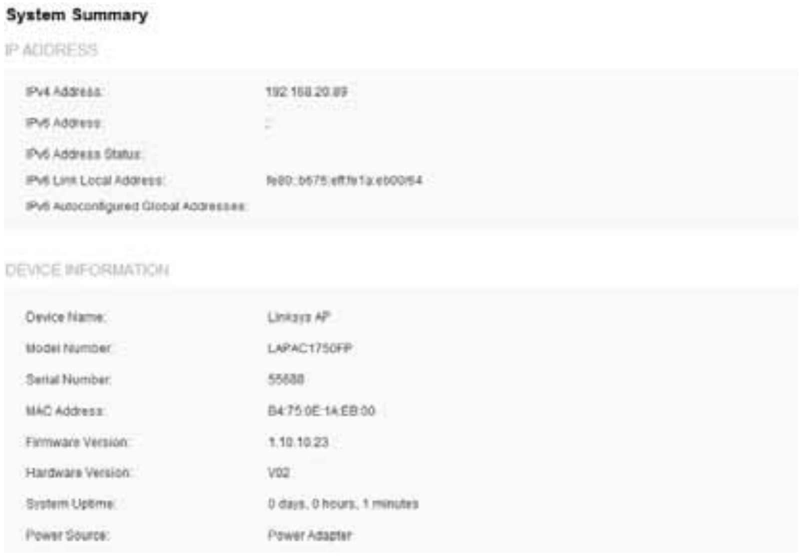
- If the AP did not acquire an IP address from a DHCP server on your network, enter 192.168.1.252 in the address field of your browser, which is the default IP address of the AP.
- If you used a DHCP server on your network to automatically configure network information for the AP, enter the new IP address of the AP into the Web browser.

4. When prompted, enter admin for the user name and admin for the password, then click **Log In**.


LINKSYS
LAPAC1750PF Wireless-AC Dual Band AC1750 Access Point with PoE
AUTHENTICATION REQUIRED
Username
Password

- When you first log in, the **System Summary** page for access point administration is displayed, as the following figure shows.

Figure 2: System Summary Page



System Summary

IP ADDRESS

IPv4 Address:	192.168.20.89
IPv6 Address:	::
IPv6 Address Status:	
IPv6 Link Local Address:	fe80::b675:eff:fe1a:eb00/64
IPv6 Autoconfigured Global Addresses:	

DEVICE INFORMATION

Device Name:	Linksys AP
Model Number:	LAPAC1750PP
Serial Number:	55688
MAC Address:	B4:75:0E:1A:EB:00
Firmware Version:	1.10.10.23
Hardware Version:	V02
System Uptime:	0 days, 0 hours, 1 minutes
Power Source:	Power Adapter

5. Verify the settings on the **System Summary** page.

- Review access point description.

For information about the fields on the System Summary page, see "System Summary" on page 11.

6. If you do not have a DHCP server on the management network and do not plan to use one, you must change the Connection Type from DHCP to Static IP.

   You can either assign a new Static IP address to the AP or continue using the default address. We recommend assigning a new Static IP address so that if you bring up another Access Point on the same network, the IP address for each AP will be unique. To change the connection type and assign a static IP address, see "VLAN and IPv4 Address" on page 46.

7. If your network uses VLANs, you might need to configure the management VLAN ID or untagged VLAN ID on the access point in order for it to work with your network.

   For information about how to configure VLAN information, see "VLAN and IPv4 Address" on page 46.

8. If your network uses IEEE 802.1X port security for network access control, you must configure the 802.1X supplicant information on the AP.

   For information about how to configure the 802.1X user name and password, see "802.1X Supplicant" on page 94.

Configuring the Ethernet Settings

The default Ethernet settings, which include DHCP and VLAN information, might not work for all networks.

By default, the DHCP client on the access point automatically broadcasts requests for network information. If you want to use a static IP address, you must disable the DHCP client and manually configure the IP address and other network information.

The management VLAN is VLAN 1 by default. This VLAN is also the default untagged VLAN. If you already have a management VLAN configured on your network with a different VLAN ID, you must change the VLAN ID of the management VLAN on the access point.

For information about using the Web interface to configure the Ethernet settings, see "VLAN and IPv4 Address" on page 46.

Configuring IEEE 802.1X Authentication

On networks that use IEEE 802.1X, port-based network access control, a supplicant (client) cannot gain access to the network until the 802.1X authenticator grants access. If your network uses 802.1X, you must configure 802.1X authentication information that the AP can supply to the authenticator.

If your network uses IEEE 802.1X see "802.1X Supplicant" on page 94 for information about how to configure 802.1X by using the Web interface.

Verifying the Installation

Make sure the access point is connected to the LAN and associate some wireless clients with the network. Once you have tested the basics of your wireless network, you can enable more security and fine-tune the AP by modifying advanced configuration features.

1. Connect the access point to the LAN.

- If you configured the access point and administrator PC by connecting both into a network hub, then your access point is already connected to the LAN. The next step is to test some wireless clients.
- If you configured the access point by using a direct cable connection from your computer to the access point, do the following procedures:

a. Disconnect the cable from the computer and the access point.

b. Connect an Ethernet cable from the access point to the LAN.

c. Connect your computer to the LAN by using an Ethernet cable or a wireless card.

2. Test LAN connectivity with wireless clients.

   Test the access point by trying to detect it and associate with it from some wireless client devices. For information about requirements for these clients, see "Wireless Client Requirements" on page 2.

3. Secure and configure the access point by using advanced features.

   Once the wireless network is up and you can connect to the AP with some wireless clients, you can add in layers of security, create multiple virtual access points (VAPs), and configure performance settings.

NOTE:
The WLAN AP is not designed for multiple, simultaneous configuration changes. If more than one administrator is logged onto the Administration Web pages and making changes to the configuration, there is no guarantee that all configuration changes specified by multiple users will be applied.

By default, no security is in place on the access point, so any wireless client can associate with it and access your LAN. An important next step is to configure security, as described in "Virtual Access Point (VAP)" on page 64.

Configuring Security on the Wireless Access Point

You configure secure wireless client access by configuring security for each virtual access point (VAP) that you enable. You can configure up to 8 VAPs per radio that simulate multiple APs in one physical access point. By default, only one VAP is enabled. For each VAP, you can configure a unique security mode to control wireless client access.

Each radio has 8 VAPs, with VAP IDs from 0-7. By default, only VAP 0 on each radio is enabled. VAP0 has the following default settings:

- VLAN ID: 1
- Broadcast SSID: Enabled
- SSID: LinksysSMB24G for Radio 1 (2.4GHz), and LinksysSMB5G for Radio 2 (5GHz)
- Security: None
- MAC Authentication Type: None
- Redirect Mode: None

All other VAPs are disabled by default. The default SSID for VAPs 1–7 is "Virtual Access Point x" where x is the VAP ID.

To prevent unauthorized access to the access point, we recommend that you select and configure a security option other than None for the default VAP and for each VAP that you enable.

For information about how to configure the security settings on each VAP, see "Virtual Access Point (VAP)" on page 64.

Section 2: Viewing Access Point System Status

This section describes the information you can view from the tabs under the Status and Statistics heading on the Administration Web UI.

Status and Statistics

This topic contains the following subsections:

- System Summary
- Network Interfaces
- Radio Statistics
- Workgroup Bridge
- Associated Client
- TSPEC Client Associations
- TSPEC Status and Statistics
- TSPEC AP Statistics
- Email Alert Status
- System Log

System Summary

From the System Summary page, you can view various information about the access point (AP), including IP and MAC address information. Table 3 describes the fields and configuration options on the System Summary page.

Table 3: System Summary Page

Field	Description
IPv4 Address	Shows the IP address assigned to the AP. This field is not editable on this page because the IP address is already assigned (either by DHCP, or statically through the Ethernet Settings page).
IPv6 Address	Shows the IPv6 address assigned to the AP. This field is not editable on this page because the IP address is already assigned (either by DHCPv6, or statically through the Management IPv6 page).
IPv6 Address Status	Shows the operational status of the static IPv6 address assigned to the management interface of the AP. The possible values are Operational and Tentative. **Note**: If an IPv6 address has not been manually configured or leased from a DHCPv6 server, the field is blank.
IPv6 Autoconfigured Global Addresses	Shows each automatically configured global IPv6 address for the management interface of the AP.
IPv6 Link Local Address	Shows the IPv6 Link Local address, which is the IPv6 address used by the local physical link. The Link Local address is not configurable and is assigned by using the IPv6 Neighbor Discovery process.
Device Name	Generic name to identify the type of hardware.
Model Number	Identifies the AP hardware model.
Serial Number	Shows the AP serial number.

MAC Address	Shows the MAC address of the AP. The address shown here is the MAC address associated with the management interface. This is the address by which the AP is known externally to other networks.
Firmware Version	Shows version information about the firmware currently installed on the AP. As new versions of the WLAN AP firmware become available, you can upgrade the firmware on your AP.
Hardware Version	Identifies the AP hardware version.
System Uptime	Provides information about the system start up time.
Power Source	The power source of monitor system is the power adapter or PoE.

Connecting to the AP Web Interface Using the IPv6 Address

To connect to the AP by using the IPv6 global address or IPv6 Link Local address, you must enter the AP address into your browser in a special format.

NOTE:
The following instructions and examples work with Microsoft Internet Explorer 7 (IE7) and might not work with other browsers.

To connect to an IPv6 global address, add square brackets around the IPv6 address. For example, if the AP global IPv6 address is 2520::230:abff:fe00:2420, type the following address into the IE7 address field: http://[2520::230:abff:fe00:2420].

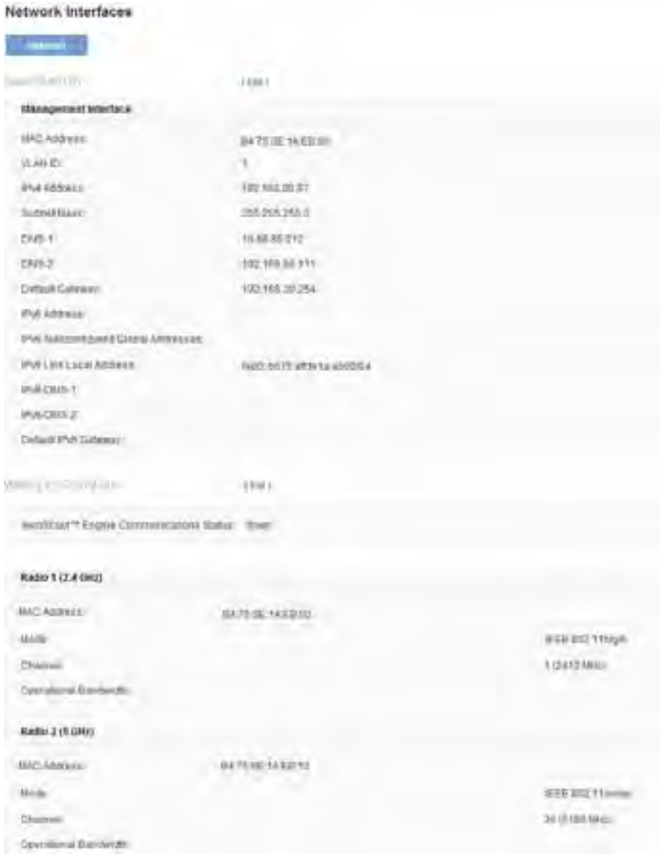
To connect to the iPv6 Link Local address, replace the colons (:) with hyphens (-), add the interface number, preceded by an "s," then add ".ipv6-literal.net." For example, if the AP Link Local address is fe80::230:abff:fe00:2420, and the Windows interface is defined as "%6," type the following address into the IE7 address field: http://fe80--230-abff-fe00-2420s6.ipv6-literal.net.

Network Interfaces

This page displays the current settings for the wired Ethernet interface and the wireless radio interfaces on the AP.

To monitor Ethernet LAN (wired) and wireless LAN (WLAN) settings, click the System Status > Status and Statistics > Network Interfaces tab.

Figure 3: Viewing Network Interfaces



Network Interfaces

Management Interface

MAC Address: [illegible]
VLAN ID: 1
IPv4 Address: [illegible]
Subnet Mask: [illegible]
DNS-1: [illegible]
DNS-2: [illegible]
Default Gateway: [illegible]
IPv6 Address:
IPv6 Autoconfigured Global Addresses:
IPv6 Link Local Address: [illegible]
IPv6 DNS-1:
IPv6 DNS-2:
Default IPv6 Gateway:

[illegible] Engine Communications Status: [illegible]

Radio 1 (2.4 GHz)

MAC Address: [illegible]
Mode: IEEE 802.11b/g/n
Channel: 1 (2412 MHz)
Operational Bandwidth:

Radio 2 (5 GHz)

MAC Address: [illegible]
Mode: [illegible]
Channel: 36 (5180 MHz)
Operational Bandwidth:

NOTE:
The information on this page is read-only. To change the wired or wireless interface settings, click the **Edit** link associated with the appropriate section.

LAN Status (Management Interface)

LAN Status shows information about the internal Ethernet interface, which is the primary interface used to manage the AP.

Table 4: LAN Interface Settings

Field	Description
MAC Address	The MAC address for the LAN interface for the Ethernet port on this AP. This is a read-only field that you cannot change.
VLAN ID	The management VLAN ID. This is the VLAN associated with the IP address you use to access the AP management interface. The default management VLAN ID is 1.
IPv4 Address	The IP address of the management interface.
Subnet Mask	The subnet mask associated with the management IP address.
DNS-1 **DNS-2**	The primary and secondary DNS servers to use for name-to-IP address resolution.
Default Gateway	The default gateway for the IPv4 network interface.
IPv6 Address	The IPv6 address of the management interface.
IPv6 Autoconfigured Global Addresses	If the AP has been assigned one or more IPv6 addresses automatically, the addresses are listed.
IPv6 Link Local Address	The IPv6 Link Local address, which is the IPv6 address used by the local physical link. The Link Local address is not configurable and is assigned by using the IPv6 Neighbor Discovery process.
IPv6-DNS-1 **IPv6-DNS-2**	The primary and secondary DNS servers to use for name-to-IPv6 address resolution.
Default IPv6 Gateway	The default gateway for the IPv6 network interface.

To change the wired settings, click the Edit link. After you click Edit, you are redirected to the VLAN and IPv4 Address page.

For information about configuring these settings, see “VLAN and IPv4 Address

Wireless Status

The wireless settings show summary information about the radio interface configuration.

Table 5 describes the fields and configuration options available on the Wireless Status page.

Table 5: Wireless Status

Field	Description
AeroScout™ Engine Communications Status	The status of the AeroScout protocol on the AP. When enabled, AeroScout devices are recognized and data is sent to an AeroScout Engine (AE) for analysis. The AE determines the geographical location of 802.11-capable devices, such as STAs, APs, and AeroScout’s line of 802.11-enabled RFID devices, or tags. The AE communicates with APs that support the AE protocol in order to collect information about the RF devices detected by the APs.
Radio One and Radio Two	
MAC Address	The MAC addresses for the interface. This page shows the MAC addresses for Radio Interface One and Radio Interface Two. A MAC address is a permanent, unique hardware address for any device that represents an interface to the network. The MAC address is assigned by the manufacturer. You cannot change the MAC address. It is provided here for informational purposes as a unique identifier for an interface.

Mode	The Physical Layer (PHY) standard the radio uses: • IEEE 802.11b/g — 802.11b and 802.11g clients can connect to the AP. • IEEE 802.11b/g/n — 802.11b, 802.11g, and 802.11n clients operating in the 2.4-GHz frequency can connect to the AP. • IEEE 802.11n — Only 802.11n clients operating in the 2.4-GHz frequency can connect to the AP. • IEEE 802.11a — Only 802.11a clients can connect to the AP. This mode is available only on Radio 2. • IEEE 802.11a/n/ac — 802.11a, 802.11n, and 802.11ac clients operating in the 5-GHz frequency can connect to the AP. This mode is available only on Radio 2. • IEEE 802.11n/ac — 802.11n clients and 802.11ac clients operating in the 5-GHz frequency can connect to the AP. This mode is available only on Radio 2.
Channel	The current operating channel. The channel defines the portion of the radio spectrum the radio uses for transmitting and receiving. Each mode offers a number of channels, depending on how the spectrum is licensed by national and transnational authorities such as the Federal Communications Commission (FCC) or the International Telecommunication Union (ITU-R).
Operational Bandwidth	The size of the bandwidth, in MHz, the current channel is using.

To change the radio mode or channel settings, click the Edit link. After you click Edit, you are redirected to the Radio page.

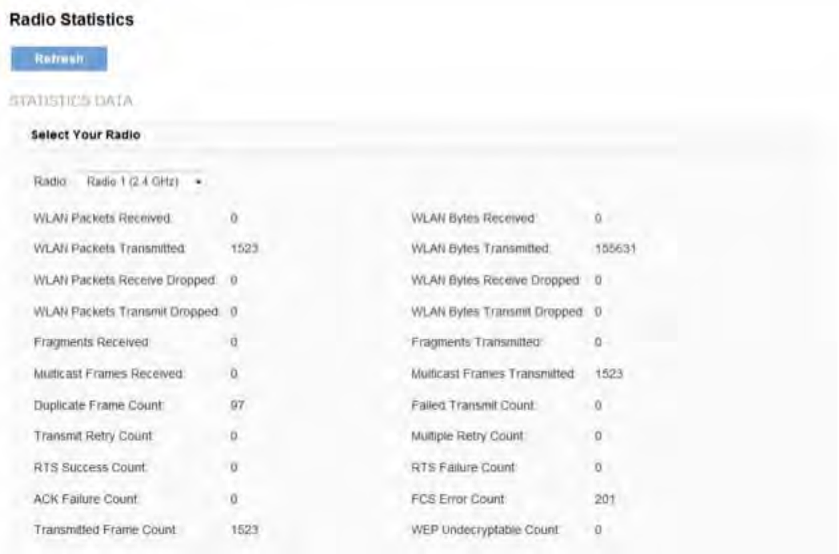
For information about configuring these settings, see "Radio".

Radio Statistics

The Radio Statistics page provides detailed information about the packets and bytes transmitted and received on the radio (wireless) interface of this access point.

To view Radio Statistics, click the System Status > Radio Statistics tab.

Figure 4: Radio Statistics



Radio: Radio 1 (2.4 GHz)

WLAN Packets Received	0	WLAN Bytes Received	0
WLAN Packets Transmitted	1523	WLAN Bytes Transmitted	155631
WLAN Packets Receive Dropped	0	WLAN Bytes Receive Dropped	0
WLAN Packets Transmit Dropped	0	WLAN Bytes Transmit Dropped	0
Fragments Received	0	Fragments Transmitted	0
Multicast Frames Received	0	Multicast Frames Transmitted	1523
Duplicate Frame Count	97	Failed Transmit Count	0
Transmit Retry Count	0	Multiple Retry Count	0
RTS Success Count	0	RTS Failure Count	0
ACK Failure Count	0	FCS Error Count	201
Transmitted Frame Count	1523	WEP Undecryptable Count	0

The following table describes details about the Radio Statistics information.

Table 6: Radio Statistics Information

Field	Description
Radio	Choose either radio 1 or radio 2.
WLAN Packets Received	Total packets received by the AP on this radio interface.
WLAN Bytes Received	Total bytes received by the AP on this radio interface.
WLAN Packets Transmitted	Total packets transmitted by the AP on this radio interface.

WLAN Bytes Transmitted	Total bytes transmitted by the AP on this radio interface.
WLAN Packets Received Dropped	Number of packets received by the AP on this radio interface that were dropped.
WLAN Bytes Received Dropped	Number of bytes received by the AP on this radio interface that were dropped.
WLAN Packets Transmit Dropped	Number of packets transmitted by the AP on this radio interface that were dropped.
WLAN Bytes Transmit Dropped	Number of bytes transmitted by the AP on this radio interface that were dropped.
Fragments Received	Count of successfully received MPDU frames of type data or management.
Fragments Transmitted	Number of transmitted MPDU with an individual address or an MPDU with a multicast address of type data or management.
Multicast Frames Received	Count of MSDU frames received with the multicast bit set in the destination MAC address.
Multicast Frames Transmitted	Count of successfully transmitted MSDU frames where the multicast bit is set in the destination MAC address.
Duplicate Frame Count	Number of times a frame is received and the Sequence Control field indicates it is a duplicate.
Failed Transmit Count	Number of times an MSDU is not transmitted successfully due to transmit attempts exceeding either the short retry limit or the long retry limit.
Transmit Retry Count	Number of times an MSDU is successfully transmitted after one or more retries.

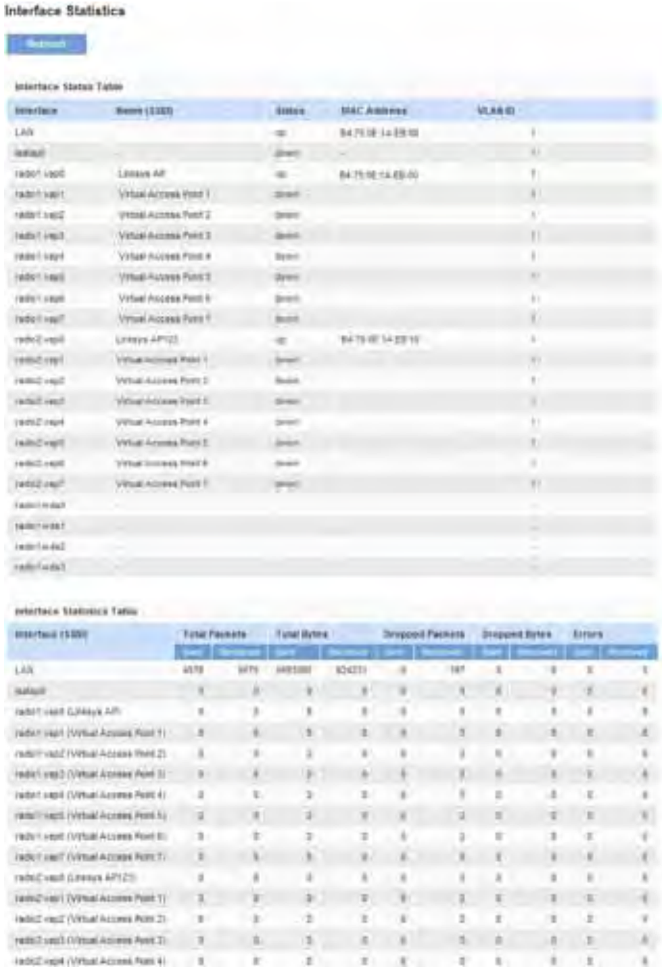
Multiple Retry Count	Number of times an MSDU is successfully transmitted after more than one retry.
RTS Success Count	Count of CTS frames received in response to an RTS frame.
RTS Failure Count	Count of CTS frames not received in response to an RTS frame.
ACK Failure Count	Count of ACK frames not received when expected.
FCS Error Count	Count of FCS errors detected in a received MPDU frame.
Transmitted Frame Count	Count of each successfully transmitted MSDU.
WEP Undecryptable Count	Count of encrypted frames received where: 1. The key configuration of the transmitter indicates that the frame should not have been encrypted. 2. The frame was discarded due to the receiving station not implementing the privacy option.

Interface Statistics

The Interface Statistics page provides some basic information about the AP and a real-time display of transmit and receive statistics for the Ethernet interface on the AP, and for the VAPs on both radio interfaces. All transmit and receive statistics shown are totals since the AP was last started. If you reboot the AP, these figures indicate transmit and receive totals since the reboot.

To view transmit and receive statistics, click the System Status > Interface Statistics tab.

Figure 5: Interface Statistics



Interface Statistics

Interface Status Table

Interface	Name (SSID)	Status	MAC Address	VLAN ID
LAN		up	84:75:18:14:E8:10	1
default	-	down	-	1
radio1 vap0	Linksys AP	up	84:75:18:14:E8:00	1
radio1 vap1	Virtual Access Point 1	down		1
radio1 vap2	Virtual Access Point 2	down		1
radio1 vap3	Virtual Access Point 3	down		1
radio1 vap4	Virtual Access Point 4	down		1
radio1 vap5	Virtual Access Point 5	down		1
radio1 vap6	Virtual Access Point 6	down		1
radio1 vap7	Virtual Access Point 7	down		1
radio2 vap0	Linksys AP123	up	84:75:18:14:E8:10	1
radio2 vap1	Virtual Access Point 1	down		1
radio2 vap2	Virtual Access Point 2	down		1
radio2 vap3	Virtual Access Point 3	down		1
radio2 vap4	Virtual Access Point 4	down		1
radio2 vap5	Virtual Access Point 5	down		1
radio2 vap6	Virtual Access Point 6	down		1
radio2 vap7	Virtual Access Point 7	down		1
radio1 wds0	-			-
radio1 wds1	-			-
radio1 wds2	-			-
radio1 wds3	-			-

Interface Statistics Table

Interface (SSID)	Total Packets		Total Bytes		Dropped Packets		Dropped Bytes		Errors	
	Sent	Received	Sent	Received	Sent	Received	Sent	Received	Sent	Received
LAN	4578	5879	[illegible]	[illegible]	0	197	0	0	0	0
default	0	0	0	0	0	0	0	0	0	0
radio1 vap0 (Linksys AP)	0	0	0	0	0	0	0	0	0	0
radio1 vap1 (Virtual Access Point 1)	0	0	0	0	0	0	0	0	0	0
radio1 vap2 (Virtual Access Point 2)	0	0	0	0	0	0	0	0	0	0
radio1 vap3 (Virtual Access Point 3)	0	0	0	0	0	0	0	0	0	0
radio1 vap4 (Virtual Access Point 4)	0	0	0	0	0	0	0	0	0	0
radio1 vap5 (Virtual Access Point 5)	0	0	0	0	0	0	0	0	0	0
radio1 vap6 (Virtual Access Point 6)	0	0	0	0	0	0	0	0	0	0
radio1 vap7 (Virtual Access Point 7)	0	0	0	0	0	0	0	0	0	0
radio2 vap0 (Linksys AP123)	0	0	0	0	0	0	0	0	0	0
radio2 vap1 (Virtual Access Point 1)	0	0	0	0	0	0	0	0	0	0
radio2 vap2 (Virtual Access Point 2)	0	0	0	0	0	0	0	0	0	0
radio2 vap3 (Virtual Access Point 3)	0	0	0	0	0	0	0	0	0	0
radio2 vap4 (Virtual Access Point 4)	0	0	0	0	0	0	0	0	0	0

Table 7: Interface Statistics

Field	Description
Interface Status Table	
Interface	The name of the Ethernet or VAP interface.
Name (SSID)	Wireless network name. Also known as the SSID, this alphanumeric key uniquely identifies a wireless local area network. The SSID is set on the VAP tab. (See "Virtual Access Point (VAP)" on page 64)
Status	Shows whether the interface is enabled (up) or disabled (down).
MAC Address	MAC address for the specified interface. The AP has a unique MAC address for each interface. Each radio has a different MAC address for each interface on each of its two radios.
VLAN ID	Virtual LAN (VLAN) ID. You can use VLANs to establish multiple internal and guest networks on the same AP. The VLAN ID is set on the VAP tab. (See "Virtual Access Point (VAP)" on page 64)
Interface Statistics Table	
Total Packets	Indicates total packets sent or received by this AP.
Total Bytes	Indicates total bytes sent or received by this AP.
Dropped Packets	Indicates total number of packets sent or received by this AP that were dropped.
Dropped Bytes	Indicates total number of bytes sent or received by this AP that were dropped.
Errors	Indicates total errors related to sending and receiving data on this AP.

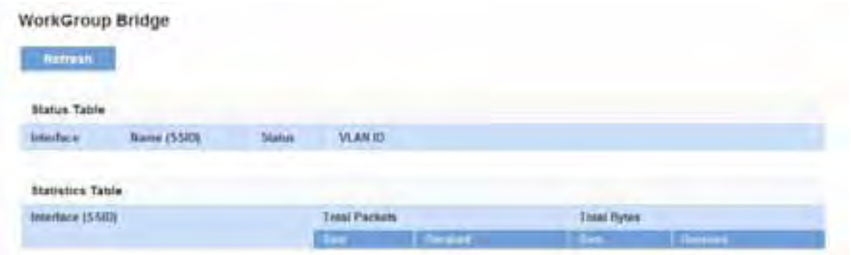
Click **Refresh** to refresh the information on the page.

Workgroup Bridge

The Workgroup Bridge page displays packet and byte counts for traffic between stations on a workgroup bridge.

The information in the following table is available for each network interface that is configured as a workgroup bridge interface.

Figure 6: Workgroup Bridge



Status Table

Interface	Name (SSID)	Status	VLAN ID

Statistics Table

Interface (SSID)	Total Packets		Total Bytes	
	Sent	Received	Sent	Received

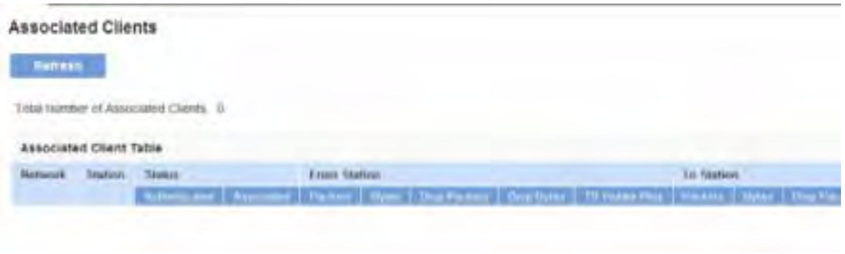
Table 8: Workgroup Bridge

Field	Description
Status Table	
Interface	Name of the Ethernet or VAP interface.
Name (SSID)	Wireless network name. Also known as the SSID, this alphanumeric key uniquely identifies a wireless local area network. The SSID is set on the VAP tab. See Configuring VAPs.
Status	Whether the interface is disconnected or is administratively configured as enabled (up) or disabled (down).
VLAN ID	Virtual LAN (VLAN) ID. You can use VLANs to establish multiple internal and guest networks on the same AP. The VLAN ID is set on the VAP tab. See Configuring VAPs.
Statistics Table	
Total Packets	The total number of Sent/Received packets bridged between the wired clients in the workgroup bridge and the wireless network.
Total Bytes	The total number of Sent/Received bytes bridged between the wired clients in the workgroup bridge and the wireless network.

Associated Client

The associated clients are displayed along with information about packet traffic transmitted and received for each station. Click the *System Status > Associations Client tab.*

Figure 7: Association Client



Total number of Associated Clients 0

Associated Client Table

Network	Station	Status		From Station					To Station		
		Authenticated	Associated	Packets	Bytes	Drop Packets	Drop Bytes	TS Violate Pkts	Packets	Bytes	Drop Pa

Table 9: Associated Clients

Field	Description
Network	Shows which VAP the client is associated with. For example, an entry of wlan0vap2 means the client is associated with Radio 1, VAP 2. An entry of wlan0 means the client is associated with VAP 0 on Radio 1. An entry of wlan1 means the client is associated with VAP 0 on Radio 2.
Station	Shows the MAC address of the associated wireless client.

Status	The Authenticated and Associated Status shows the underlying IEEE 802.11 authentication and association status, which is present no matter which type of security the client uses to connect to the AP. This status does not show other (IEEE 802.1X) authentication or association status. Some points to keep in mind with regard to this field are: • If the AP security mode is None or Static WEP, the authentication and association status of clients showing on the Client Associations tab will be in line with what is expected; that is, if a client shows as authenticated to the AP, it will be able to transmit and receive data. (This is because Static WEP uses only IEEE 802.11 authentication.) • If the AP uses IEEE 802.1X or WPA security, however, it is possible for a client association to show on this tab as authenticated (via the IEEE 802.11 security) but actually not be authenticated to the AP via the second layer of security.
From Station These fields report information about traffic sent from a wireless client to the AP.	
Packets	The number of packets received from the wireless client.
Bytes	The number of bytes received from the wireless client.
Drop Packets	The number of packets that were dropped after being received.
Drop Bytes	The number of bytes that were dropped after being received.
TS Violate Packets	The number of packets sent from a wireless client to the AP in excess of its active TS uplink bandwidth, or for an access category requiring admission control to which the wireless client has not been admitted.

To Station These fields report information about traffic sent from the AP to a wireless client.	
Packets	The number of packets sent from the AP to the wireless client.
Bytes	The number of bytes sent from the AP to the wireless client.
Drop Packets	The number of packets that the AP attempted to send to the wireless client but were dropped.
Drop Bytes	The number of bytes that the AP attempted to send to the wireless client but were dropped.
TS Violate Packets	The number of packets sent from the AP to a wireless client in excess of its active TS downlink bandwidth, or for an access category requiring admission control to which the wireless client has not been admitted.

Link Integrity Monitoring

The access point provides link integrity monitoring to continually verify its connection to each associated client. To do this, the AP sends data packets to clients every few seconds when no other traffic is passing. This allows the AP to detect when a client goes out of range, even during periods when no normal traffic is exchanged. The client connection drops off the list within 300 seconds if these data packets are not acknowledged, even if no disassociation message is received.

TSPEC Client Associations

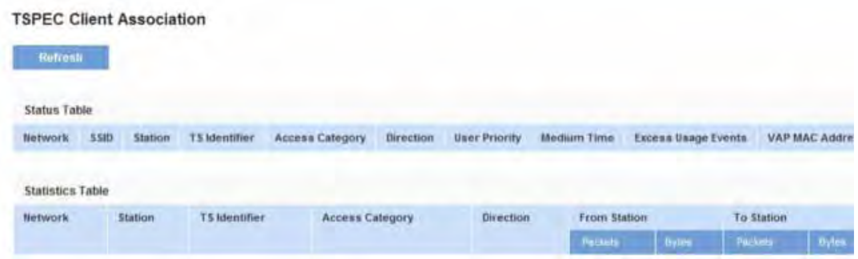
The TSPEC Client Association Status and Statistics page provides information about the TSPEC client data transmitted and received by this access point. Table 10 shows voice and video packets transmitted and received by the association, along with status information.

The page shows a real-time display of transmit and receive statistics for the TSPEC clients. All transmit and receive statistics shown are totals since the client association started.

A TSPEC is a traffic specification that is sent from a QoS-capable wireless client to an AP requesting a certain amount of network access for the traffic stream (TS) it represents. A traffic stream is a collection of data packets identified by the wireless client as belonging to a particular user priority. An example of a voice traffic stream is a Wi-Fi-certified™ telephone handset that marks its codec-generated data packets as voice priority traffic. An example of a video traffic stream is a video player application on a wireless laptop that prioritizes a video conference feed from a corporate server.

To view TSPEC Client Association statistics, click the *System Status* > *TSPEC Client Associations* tab.

Figure 8: TSPEC Client Associations



TSPEC Client Association

Status Table

Network	SSID	Station	TS Identifier	Access Category	Direction	User Priority	Medium Time	Excess Usage Events	VAP MAC Addre

Statistics Table

Network	Station	TS Identifier	Access Category	Direction	From Station		To Station	
					Packets	Bytes	Packets	Bytes

Table 10: TSPEC Client Associations

Field	**Description**
Status	
Network	Radio interface used by the client.
SSID	The service set identifier associated with this TS client.
Station	Client station MAC address.
TS Identifier	TSPEC Traffic Session Identifier (range 0-7).
Access Category	TS Access Category (voice or video).
Direction	The traffic direction for this TS. • Uplink • Downlink • Bidirectional
User Priority	The User Priority (UP) for this TS. The UP is sent with each packet in the UP portion of the IP header. Typical values are: • 6 or 7 for voice • 4 or 5 for video The value may differ depending on other priority traffic sessions.
Medium Time	The time that the TS traffic occupies the transmission medium.
Excess Usage Events	The number of times the client has exceeded the medium time established for its TSPEC. Minor, infrequent violations are ignored.
VAP MAC Address	The VAP MAC address.
Statistics	
Network	Radio interface used by the client.
Station	Client station MAC address.
TS Identifier	TSPEC Traffic Session Identifier (range 0-7).
Access Category	TS Access Category (voice or video).
Direction	The traffic direction for this TS. Direction can be: • Uplink • Downlink • Bidirectional

From Station	The number of packets and bytes received from the wireless client, and the number of packets and bytes that were dropped after being received. Also, the number of packets: • in excess of an admitted TSPEC. • for which no TSPEC has been established when admission is required by the AP.
To Station	The number of packets and bytes transmitted from the AP to the client, and the number of packets and bytes that were dropped upon transmission. Also, the number of packets: • in excess of an admitted TSPEC. • for which no TSPEC has been established when admission is required by the AP.

TSPEC Status and Statistics

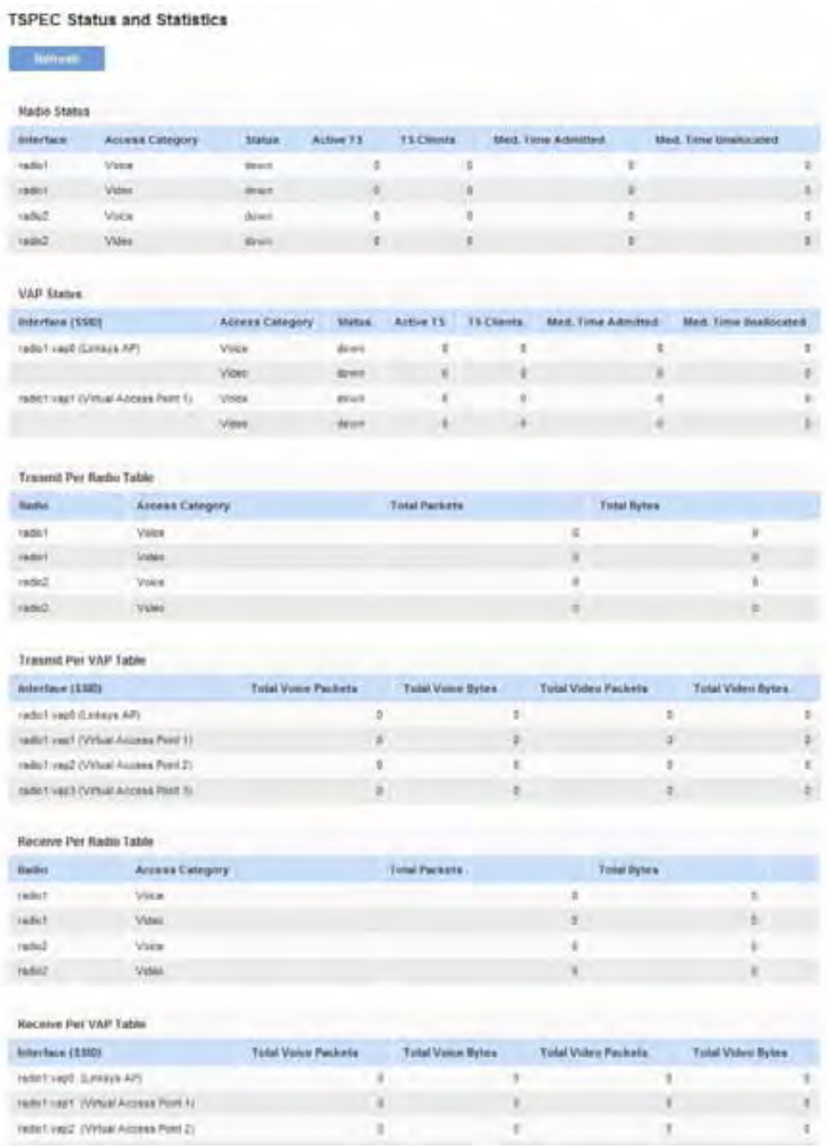
The TSPEC Status and Statistics page provides:

- Summary information about TSPEC sessions by radio
- Summary information about TSPEC sessions by VAP
- Real-time transmit and receive statistics for the TSPEC VAPs on all radio interfaces.

All transmit and receive statistics shown are totals since the AP was last started. If you reboot the AP, these figures indicate transmit and receive totals since the reboot.

To view TSPEC status and statistics, click the *System Status* > *TSPEC Status and Statistics* tab. The following image has been edited to show some of the transmit and receive statistics.

Figure 9: TSPEC Status and Statistics



TSPEC Status and Statistics

Radio Status

Interface	Access Category	Status	Active TS	TS Clients	Med. Time Admitted	Med. Time Unallocated
radio1	Voice	down	0	0	0	0
radio1	Video	down	0	0	0	0
radio2	Voice	down	0	0	0	0
radio2	Video	down	0	0	0	0

VAP Status

Interface (SSID)	Access Category	Status	Active TS	TS Clients	Med. Time Admitted	Med. Time Unallocated
radio1:vap0 (Linksys AP)	Voice	down	0	0	0	0
	Video	down	0	0	0	0
radio1:vap1 (Virtual Access Point 1)	Voice	down	0	0	0	0
	Video	down	0	0	0	0

Trasmit Per Radio Table

Radio	Access Category	Total Packets	Total Bytes
radio1	Voice	0	0
radio1	Video	0	0
radio2	Voice	0	0
radio2	Video	0	0

Trasmit Per VAP Table

Interface (SSID)	Total Voice Packets	Total Voice Bytes	Total Video Packets	Total Video Bytes
radio1:vap0 (Linksys AP)	0	0	0	0
radio1:vap1 (Virtual Access Point 1)	0	0	0	0
radio1:vap2 (Virtual Access Point 2)	0	0	0	0
radio1:vap3 (Virtual Access Point 3)	0	0	0	0

Receive Per Radio Table

Radio	Access Category	Total Packets	Total Bytes
radio1	Voice	0	0
radio1	Video	0	0
radio2	Voice	0	0
radio2	Video	0	0

Receive Per VAP Table

Interface (SSID)	Total Voice Packets	Total Voice Bytes	Total Video Packets	Total Video Bytes
radio1:vap0 (Linksys AP)	0	0	0	0
radio1:vap1 (Virtual Access Point 1)	0	0	0	0
radio1:vap2 (Virtual Access Point 2)	0	0	0	0

Table 11: TSPEC Status and Statistics

Field	Description
Interface	Indicates the name of the Radio or VAP interface.
Access Category	Indicates Current Access Category associated with this Traffic Stream (voice or video).
Status	Indicates whether the TSPEC session is enabled (up) or disabled (down) for the corresponding Access Category. **Note**: This is a configuration status (does not necessarily represent the current session activity).
Active TS	Indicates the number of currently active TSPEC Traffic Streams for this radio and Access Category.
TS Clients	Indicates the number of Traffic Stream clients associated with this radio and Access Category.
Med. Time Admitted	Time allocated for this Access Category over the transmission medium to carry data. This value should be less than or equal to the maximum bandwidth allowed over the medium for this TS.
Med. Time Unallocated	Time of unused bandwidth for this Access Category.
Total Bytes	Indicates the total number of TS bytes sent (in Transmit table) or received (in Received table) by this Radio for the specified Access Category.
Total Packets	Indicates the total number of TS packets sent (in Transmit table) or received (in Received table) by this Radio for the specified Access Category.
Total Voice Packets	Indicates the total number of TS voice packets sent (in Transmit table) or received (in Received table) by this AP for this VAP.
Total Voice Bytes	Indicates the total TS voice bytes sent (in Transmit table) or received (in Received table) by this AP for this VAP.
Total Video Packets	Indicates the total number of TS video packets sent (in Transmit table) or received (in Received table) by this AP for this VAP.
Total Video Bytes	Indicates the total TS video bytes sent (in Transmit table) or received (in Received table) by this AP for this VAP.

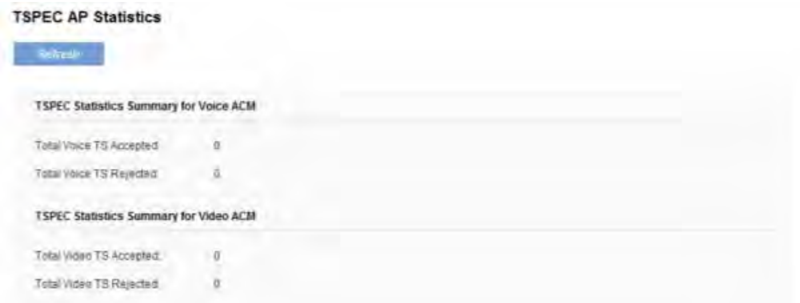
Click **Refresh** to refresh the page.

TSPEC AP Statistics

The TSPEC AP Statistics page provides information on the voice and video Traffic Streams accepted and rejected by the AP.

To view TSPEC AP statistics, click the *System Status* > *TSPEC AP Statistics* tab.

Figure 10: TSPEC AP Statistics



TSPEC AP Statistics

TSPEC Statistics Summary for Voice ACM

Total Voice TS Accepted 0

Total Voice TS Rejected 0

TSPEC Statistics Summary for Video ACM

Total Video TS Accepted 0

Total Video TS Rejected 0

Table 12: TSPEC AP Statistics

Field	Description
TSPEC Statistics Summary for Voice ACM	Indicates the total number of accepted and the total number of rejected voice Traffic Streams.
TSPEC Statistics Summary for Video ACM	Indicates the total number of accepted and the total number of rejected video Traffic Streams.

Click **Refresh** to refresh the page.

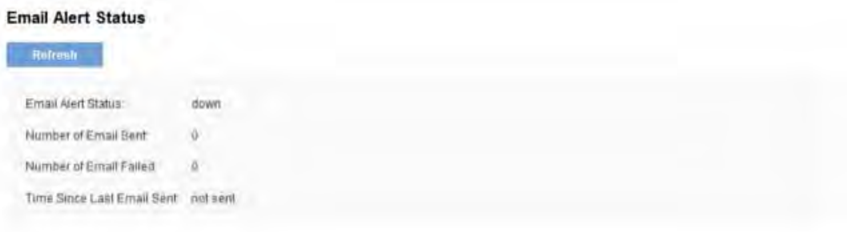
Email Alert Status

The Email Alert Status page provides information about the email alerts sent based on the syslog messages generated in the AP.

To view the Email Alert Operational Status, click the *System Status* > *Email Alert Status* tab.

To configure the email alerts, see "Email Alert" on page 38.

Figure 11: Email Alert Status



Email Alert Status

Email Alert Status:	down
Number of Email Sent	0
Number of Email Failed	0
Time Since Last Email Sent	not sent

Table 13: Email Alert Status

Field	Description
Email Alert Status	The Email Alert operational status The status is either **Up** or **Down**. The default is **Down**.
Number of Email Sent	The total number of emails sent so far. The range is an unsigned integer of 32 bits. The default is 0.
Number of Email Failed	The total number of email failures so far. The range is an unsigned integer of 32 bits. The default is 0.
Time Since Last Email Sent	The time and date when the last email alert was sent. The AP uses the system time to report the information. If an email has not been sent since the device was reset, the status is not sent.

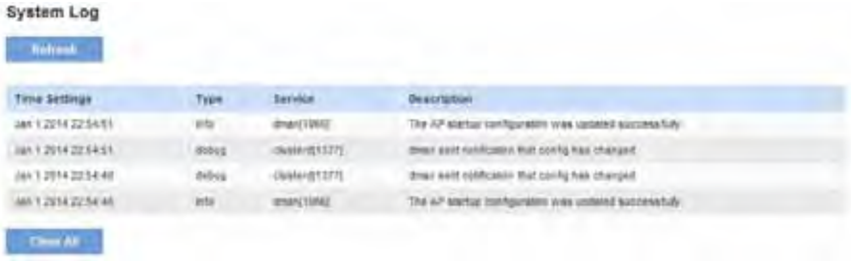
System Log

From the System Log page, you can view the most recent system log generated by this AP.

To view the Email Alert Operational Status, click the System Status > System Log tab.

To configure the Log settings, see "Log Settings".

Figure 13: System Log



System Log

Time Settings	Type	Service	Description
Jan 1 2014 22:54:51	info	dman[1066]	The AP startup configuration was updated successfully
Jan 1 2014 22:54:51	debug	clusterd[1377]	dman sent notification that config has changed
Jan 1 2014 22:54:48	debug	clusterd[1377]	dman sent notification that config has changed
Jan 1 2014 22:54:48	info	dman[1066]	The AP startup configuration was updated successfully

Table 14: System Log

Field	Description
Time Settings	The system time when the event occurred.
Type	Specify the type of the log messages to write to non-volatile memory. • emerg — emergency • alert — alert • crit — critical • err — error • warn — warning • notice — notice • info — info • debug — debug
Service	The software component associated with the log.
Description	Log content.

Section 3: Configuring the Access Point

- Administration
- LAN
- Wireless
- Security
- QoS and Access Control
- SNMP
- Captive Portal
- Cluster

Administration

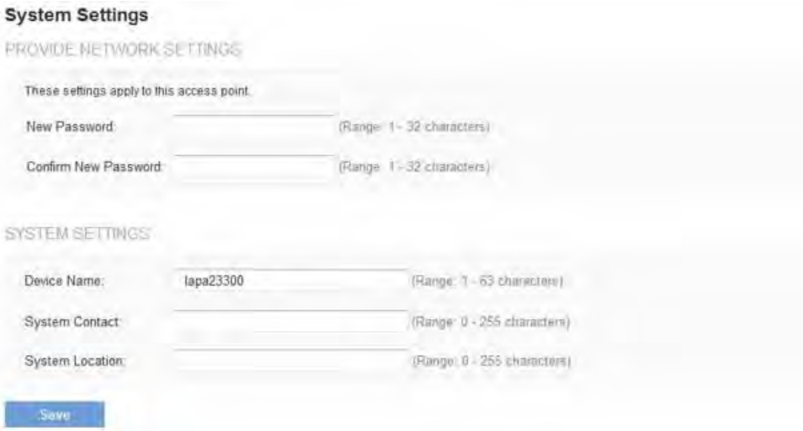
This section describes how to set up your access point and perform diagnostics. Use the tabs under the *Configuration* heading on the Administration Web UI.

- System Settings
- Time Settings
- Log Settings
- Email Alert
- Management Access
- HTTP/HTTPS Service
- Discovery - LLDP
- Discovery - Bonjour

System Settings

From the System Settings page, you can change the administrator password and system settings e.g. device name, system contact. We strongly recommended you choose a new password based on the standard guidelines for strong password security instead of using default password, which is "admin". Figure 12 shows the System Settings page.

Figure 12: System Settings



System Settings

PROVIDE NETWORK SETTINGS

These settings apply to this access point.

New Password: (Range: 1 - 32 characters)

Confirm New Password: (Range: 1 - 32 characters)

SYSTEM SETTINGS

Device Name: lapa23300 (Range: 1 - 63 characters)

System Contact: (Range: 0 - 255 characters)

System Location: (Range: 0 - 255 characters)

Table 15: System Settings page

Field	Description
New Password	Enter a new administrator password. The characters you enter are displayed as bullets to prevent others from seeing your password as you type. The password can be up to 32 characters. Do not use special characters or spaces. **Note**: As an immediate first step in securing your wireless network, we recommend that you change the administrator password from the default.
Confirm New Password	Re-enter the new administrator password to confirm that you typed it as intended.

Device Name	Name your AP. This name appears only on the Basic Settings page and is used to identify the AP to the administrator. A valid name is 1 to 64 alphanumeric characters, and can include letters, digits, hyphens and spaces.
System Contact	Enter the name, e-mail address, or phone number of the person to contact regarding issues related to the AP.
System Location	Enter the physical location of the AP, for example Conference Room A.

Time Settings

The Network Time Protocol (NTP) is an Internet standard protocol that synchronizes computer clock times on your network. NTP servers transmit Coordinated Universal Time (UTC, also known as Greenwich Mean Time) to their client systems. NTP sends periodic time requests to servers, using the returned time stamp to adjust its clock. The timestamp is used to indicate the date and time of each event in log messages.

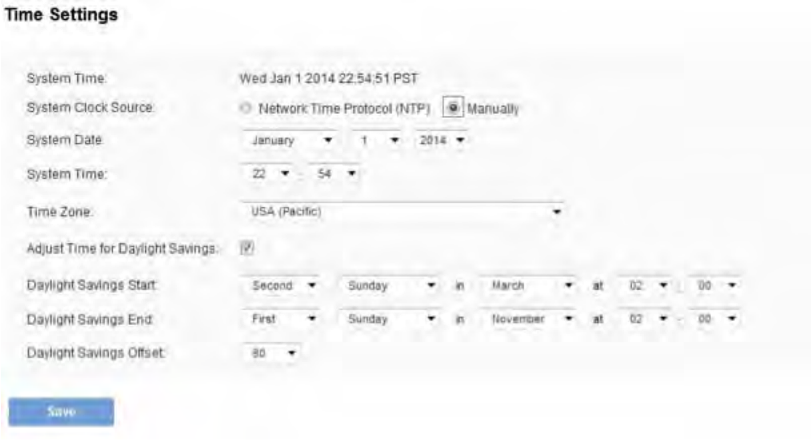
See **http://www.ntp.org** for more information about NTP.

To configure the address of the NTP server that the AP uses or to set the system time manually, click the Configuration > Administration > Time Settings tab and update the fields as described in Table 16.

NOTE:
The fields available to configure depend on whether you choose to set the system time manually or by using an NTP server.

Figure 13 shows the Time Settings page when the manual option is selected.

Figure 13: Setting the Time Manually

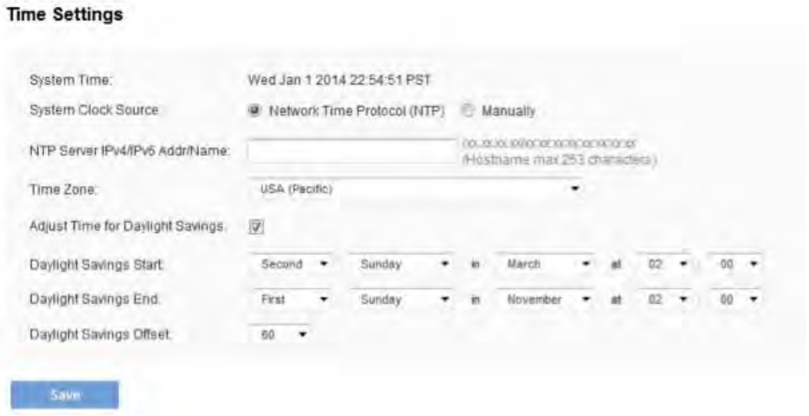


Time Settings

System Time: Wed Jan 1 2014 22:54:51 PST
System Clock Source: ○ Network Time Protocol (NTP) ● Manually
System Date: January ▾ 1 ▾ 2014 ▾
System Time: 22 ▾ : 54 ▾
Time Zone: USA (Pacific) ▾
Adjust Time for Daylight Savings: ☑
Daylight Savings Start: Second ▾ Sunday ▾ in March ▾ at 02 ▾ : 00 ▾
Daylight Savings End: First ▾ Sunday ▾ in November ▾ at 02 ▾ : 00 ▾
Daylight Savings Offset: 80 ▾

Figure 14 shows the Time Settings page when the Use Network Time Protocol (NTP) option is selected.

Figure 14: Setting the Time Using an NTP Server



Time Settings

System Time: Wed Jan 1 2014 22:54:51 PST
System Clock Source: ● Network Time Protocol (NTP) ○ Manually
NTP Server IPv4/IPv6 Addr/Name: [illegible] (Hostname max 253 characters)
Time Zone: USA (Pacific) ▾
Adjust Time for Daylight Savings: ☑
Daylight Savings Start: Second ▾ Sunday ▾ in March ▾ at 02 ▾ : 00 ▾
Daylight Savings End: First ▾ Sunday ▾ in November ▾ at 02 ▾ : 00 ▾
Daylight Savings Offset: 60 ▾

Table 16: Time Settings

Field	Description
System Clock Source	Set the system time. • To permit the AP to poll an NTP server, select Network Time Protocol (NTP). • To manually configure the time and date, select Manually. When this option is selected, the AP does not attempt to poll an NTP server.
NTP Server IPv4/ IPv6 Addr/Name	If NTP is enabled, specify the NTP server to use. You can specify the NTP server by hostname, IPv4 address, or IPv6 address, although using the IPv4/IPv6 address is not recommended as these can change more readily. If you specify a hostname, note the following requirements: • The length must be between 1–253 characters. • Upper and lower case characters, numbers, and hyphens are accepted. • The first character must be a letter (a–z or A–Z) or number (0–9), and the last character cannot be a hyphen.
Time Zone	Select your local time zone from the menu. The default is *USA (Pacific)*.
Adjust Time for Daylight Savings	System will adjust the reported time for Daylight Savings Time (DST), which is also known as Summer Time. When selected, fields to configure Daylight Savings Time settings will appear.
Daylight Savings Start	Configure the date and time to begin Daylight Savings Time for the System Time.
Daylight Saving End	Configure the date and time to end Daylight Savings Time for the System Time.
Daylight Savings Offset	Select the number of minutes to offset DST. The default is 60 (minutes).

NOTE:
After you configure the Time settings, you must click Save to apply the changes and save the changes to startup configuration file. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

NOTE:
Hostnames are composed of a series of labels joined with dots, as are all domain names. Each label must be between 1 and 63 characters long, and the entire hostname (including dots) has a maximum of 253 characters.

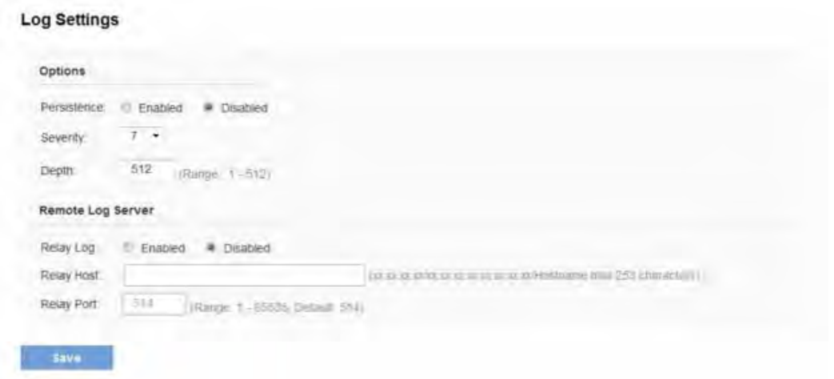
Log Settings

The Log Settings page shows real-time system logs on the AP such as wireless clients associating with the AP and being authenticated.

From the Log Settings page, you can enable and configure persistent logging to write system logs to non-volatile memory so that the events are not erased when the system reboots. This page also gives you the option of enabling a remote log relay host to capture all system logs and errors in a kernel log.

To view system events, click the *Configuration > Administration > Log Settings* tab.

Figure 15: Log Settings



Log Settings

Options

Persistence: ○ Enabled ● Disabled

Severity: 7

Depth: 512 (Range: 1 - 512)

Remote Log Server

Relay Log: ○ Enabled ● Disabled

Relay Host: (xx.xx.xx.xx/xxxx:xx:xx:xx:xx:xx:xx:xx/Hostname max 253 characters)

Relay Port: 514 (Range: 1 - 65535, Default: 514)

Configuring Persistent Logging Options

If the system unexpectedly reboots, log messages can be useful to diagnose the cause. However, log messages are erased when the system reboots unless you enable persistent logging.

Caution!
Enabling persistent logging can wear out the flash (non-volatile) memory and degrade network performance. You should only enable persistent logging to debug a problem. Make sure you disable persistent logging after you finish debugging the problem.

Table 17: Logging Options

Field	Description
Persistence	Choose Enabled to save system logs to non-volatile memory so that the logs are not erased when the AP reboots. When persistence is enabled, we can store up to 128 messages in non-volatile memory. Choose Disabled to save system logs to volatile memory. Logs in volatile memory are deleted when the system reboots.
Severity	Specify the severity level of the log messages to write to non-volatile memory. For example, if you specify 2, critical, alert, and emergency logs are written to non-volatile memory. Error messages with a severity level of 3–7 are written to volatile memory. • 0—emergency • 1—alert • 2—critical • 3—error • 4—warning • 5—notice • 6—info • 7—debug
Depth	You can store up to 512 messages in non-volatile memory. Once the number you configure in this field is reached, the oldest log event is overwritten by the new log event.

NOTE:
To apply your changes, click Save. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

Configuring the Log Relay Host for Kernel Messages

The Kernel Log is a comprehensive list of system events (shown in the System Log) and kernel messages such as error conditions, like dropping frames.

You cannot view kernel log messages directly from the Administration Web UI for an AP. You must first set up a remote server running a syslog process and acting as a syslog log relay host on your network. Then, you can configure the access point to send syslog messages to the remote server.

Remote log server collection for AP syslog messages provides the following features:

- Allows aggregation of syslog messages from multiple APs
- Stores a longer history of messages than kept on a single AP
- Triggers scripted management operations and alerts

To use Kernel Log relaying, you must configure a remote server to receive the syslog messages. The procedure to configure a remote log host depends on the type of system you use as the remote host.

NOTE:
The syslog process will default to use port 514. We recommend keeping this default port. However, If you choose to reconfigure the log port, make sure that the port number you assign to syslog is not being used by another process.

Enabling or Disabling the Log Relay Host on the Log Settings Page

To enable and configure Log Relaying on the **Log Settings** page, set the Log Relay options as described in the following table, and then click **Save**.

Table 18: Log Relay Host

Field	Description
Relay Log	Select Enabled to allow the access point to send log messages to a remote host. Select Disabled to keep all log messages on the local system.
Relay Host	Specify the IPv4 address, IPv6 address, or DNS name of the remote log server.
Relay Port	Specify the Port number for the syslog process on the Relay Host. The default port is 514.

NOTE:
To apply your changes, click Save. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

NOTE:
Hostnames are composed of series of labels joined with dots, as are all domain names. Each label must be between 1 and 63 characters long, and the entire hostname (including dots) has a maximum of 253 characters.

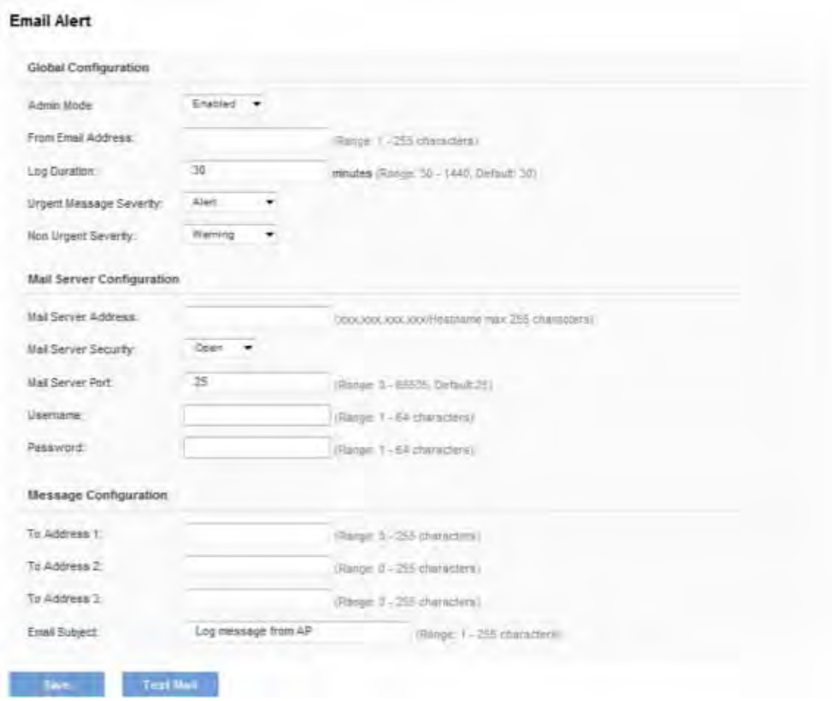
If you enabled the Log Relay Host, clicking **Save** will activate remote logging. The AP will send its kernel messages in real-time for display to the remote log server monitor, a specified kernel log file, or other storage, depending on how you configured the Log Relay Host.

If you disabled the Log Relay Host, clicking **Save** will disable remote logging.

Email Alert

The Email Alert feature allows the AP to automatically send email messages when an event at or above the configured severity level occurs. Use the Email Alert page to configure mail server settings, to set the severity level that triggers alerts, and to add up to three email addresses where urgent and non urgent email alerts are sent.

Figure 16: Configuring Email Alert



Email Alert

Global Configuration

Admin Mode: Enabled

From Email Address: (Range: 1 - 255 characters)

Log Duration: 30 minutes (Range: 30 - 1440, Default: 30)

Urgent Message Severity: Alert

Non Urgent Severity: Warning

Mail Server Configuration

Mail Server Address: (xxx.xxx.xxx.xxx/Hostname max 255 characters)

Mail Server Security: Open

Mail Server Port: 25 (Range: 1 - 65535, Default:25)

Username: (Range: 1 - 64 characters)

Password: (Range: 1 - 64 characters)

Message Configuration

To Address 1: (Range: 3 - 255 characters)

To Address 2: (Range: 0 - 255 characters)

To Address 3: (Range: 0 - 255 characters)

Email Subject: Log message from AP (Range: 1 - 255 characters)

Table 19: Email Alert Configuration

Field	Description
Global Configuration	
Admin Mode	Globally enable or disable the Email Alert feature on the AP. By default, email alerts are disabled.

From Email Address	Specify the email address that appears in the From field of alert messages sent from the AP, for example AP23@foo.com. The address can be a maximum of 255 characters and can contain only printable characters. By default, no address is configured.
Log Duration	This duration, in minutes, determines how frequently the non critical messages are sent to the SMTP Server. The range is 30-1440 minutes. The default is 30 minutes.
Urgent Message Severity	Configures the severity level for log messages that are considered to be urgent. Messages in this category are sent immediately. The security level you select and all higher levels are urgent: • Emergency indicates system is unusable. It is the highest level of severity. • Alert indicates action must be taken immediately. • Critical indicates critical conditions. • Error indicates error conditions. • Warning indicates warning conditions. • Notice indicates normal but significant conditions. • Informational indicates informational messages. • Debug indicates debug-level messages.
Non Urgent Severity	Configures the severity level for log messages that are considered to be non urgent. Messages in this category are collected and sent in a digest form at the time interval specified by the Log Duration field. The security level you select, and all levels up to but not including the lowest urgent level, are considered non-urgent. Messages below the security level you specify are not sent via email. See the Urgent Message field description for information about the security levels.

Mail Server Configuration	
Mail Server Address	Specify the IP address or hostname of the SMTP server on the network.
Mail Server Security	Specify whether to use SMTP over SSL (TLSv1) or no security (Open) for authentication with the mail server. The default is TLSv1.
Mail Server Port	Configures the TCP port number for SMTP. The range is a valid port number from 0 to 65535. The default is “465”, which is the standard port for SMTP.
Username	Specify the username to use when authentication with the mail server is required. The username is a 64-byte character string with all printable characters. The default is “admin”.
Password	Specify the password associated with the username configured in the previous field.
Message Configuration	
To Address 1	Configure the first email address to which alert messages are sent. The address must be a valid email address. By default, no address is configured.
To Address 2	Optionally, configure the second email address to which alert messages are sent. The address must be a valid email address. By default, no address is configured.
To Address 3	Optionally, configure the third email address to which alert messages are sent. The address must be a valid email address. By default, no address is configured.
Email Subject	Specify the text to be displayed in the subject of the email alert message. The subject can contain up to 255 alphanumeric characters. The default is “Log message from AP”.

NOTE:
After you configure the Email Alert settings, you must click Save to apply the changes and save the changes to startup configuration file.

NOTE:
Hostnames are composed of a series of labels joined with dots, as are all domain names. Each label must be between 1 and 63 characters long, and the entire hostname (including dots) has a maximum of 253 characters.

To validate the configured email server credentials, click Test Mail. You can send a test email once the email server details are configured.

The following text shows an example of an email alert sent from the AP to the network administrator:

From: AP-192.168.2.10@mailserver.com

Sent: Wednesday, February 08, 2012 11:16 AM

To: administrator@mailserver.com

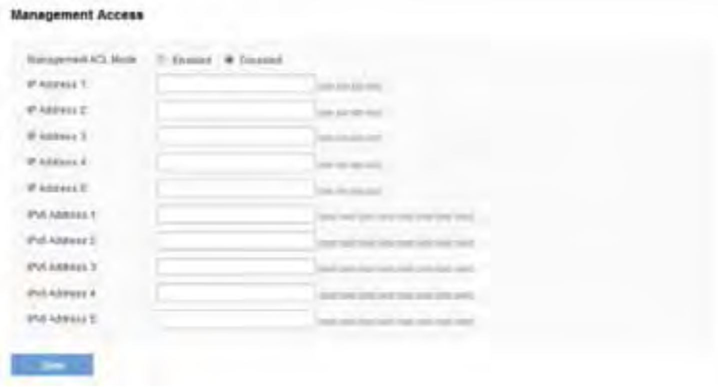
Subject: log message from AP

```
TIME            Priority   Process Id          Message
Feb 8 03:48:25    info      login[1457]         root login on 'ttyp0'
Feb 8 03:48:26    info       mini_http-ssl[1175]   Max concurrent connections of
20 reached
                                  on current connections of 20 reached
```

Management Access

You can create an access control list (ACL) that lists up to five IPv4 hosts and five IPv6 hosts that are authorized to access the AP management interface. If this feature is disabled, anyone can access the management interface from any network client by supplying the correct AP user name and password.

Figure 17: Management Access



Management Access

Management ACL Mode ○ Enabled ● Disabled

IP Address 1:

IP Address 2:

IP Address 3:

IP Address 4:

IP Address 5:

IPv6 Address 1:

IPv6 Address 2:

IPv6 Address 3:

IPv6 Address 4:

IPv6 Address 5:

Save

Table 20: Management Access

Field	Description
Management ACL Mode	Enable or disable the management ACL feature. At least one IPv4 or IPv6 address should be configured before enabling Management ACL Mode. If enabled, only the IP addresses you specify will have Web, Telnet, SSH, and SNMP access to the management interface.
IP Address (1–5)	Enter up to five IPv4 addresses that are allowed management access to the AP. Use dotted-decimal format (for example, 192.168.10.10).
IPv6 Address (1–5)	Enter up to five IPv6 addresses that are allowed management access to the AP. Use the standard IPv6 address format (for example 2001:0db8:1234::abcd).

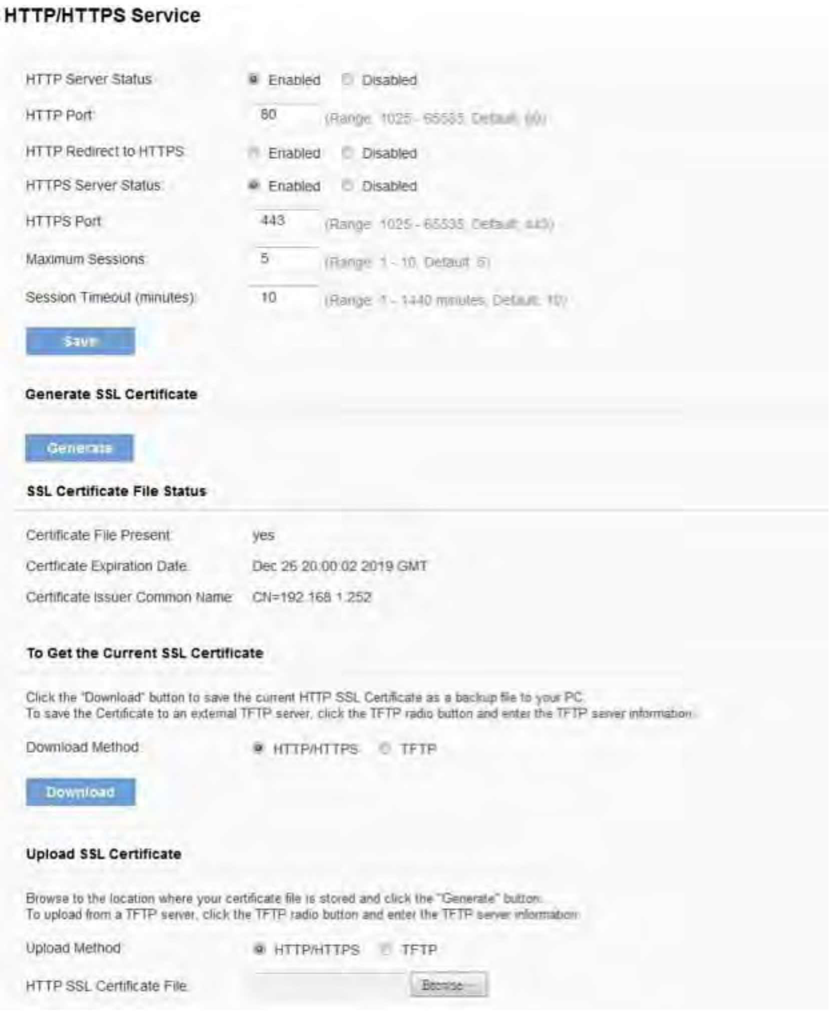
NOTE:
After you configure the settings, click Save to apply the changes and to save the settings.

HTTP/HTTPS Service

The AP can be managed through HTTP or secure HTTP (HTTPS) sessions. By default both HTTP and HTTPS access are enabled. Either access type can be disabled separately.

To configure Web server settings, click the Services > Web Server tab.

Figure 18: HTTP/HTTPS Service



HTTP/HTTPS Service

HTTP Server Status: ● Enabled ○ Disabled

HTTP Port: 80 (Range: 1025 - 65535, Default: 80)

HTTP Redirect to HTTPS: ○ Enabled ○ Disabled

HTTPS Server Status: ● Enabled ○ Disabled

HTTPS Port: 443 (Range: 1025 - 65535, Default: 443)

Maximum Sessions: 5 (Range: 1 - 10, Default: 5)

Session Timeout (minutes): 10 (Range: 1 - 1440 minutes, Default: 10)

Generate SSL Certificate

SSL Certificate File Status

Certificate File Present: yes

Certficate Expiration Date: Dec 25 20:00:02 2019 GMT

Certificate Issuer Common Name: CN=192.168.1.252

To Get the Current SSL Certificate

Click the "Download" button to save the current HTTP SSL Certificate as a backup file to your PC.
To save the Certificate to an external TFTP server, click the TFTP radio button and enter the TFTP server information.

Download Method: ● HTTP/HTTPS ○ TFTP

Upload SSL Certificate

Browse to the location where your certificate file is stored and click the "Generate" button.
To upload from a TFTP server, click the TFTP radio button and enter the TFTP server information.

Upload Method: ● HTTP/HTTPS ○ TFTP

HTTP SSL Certificate File:

Table 21: HTTP/HTTPS Service

Field	Description
HTTP Server Status	Enable or disable access through HTTP. This setting is independent of the HTTPS server status setting.
HTTP Port	Specify the port number for HTTP traffic (default is "80").
HTTP Redirect to HTTPS	Redirecting all traffic from HTTP to HTTPS and make sure users always access the site securely. This field is available only when HTTP access disabled.
HTTPS Server Status	Enable or disable access through a Secure HTTP Server (HTTPS).
HTTPS Port	Specify the port number for HTTPS traffic (default is "443").
Maximum Sessions	When a user logs in to the AP web interface, a session is created. This session is maintained until the user logs off or the session inactivity timer expires. Enter the number web sessions, including both HTTP and HTTPS, that can exist at the same time. The range is 1–10 sessions. The default is "5". If the maximum number of sessions is reached, the next user who attempts to log on to the AP web interface receives an error message about the session limit.
Session Timeout	Enter the maximum amount of time in minutes an inactive user remains logged on to the AP web interface. When the configured timeout is reached, the user is automatically logged off the AP. The range is 1–1440 minutes (1440 minutes = 1 day). The default is "60" (minutes).
Generate SSL Certificate	

Generate SSL Certificate	Click **Generate** to generate a new HTTP SSL certificate for the secure Web server. This should be done once the access point has an IP address to ensure that the common name for the certificate matches the IP address of the access point. Generating a new SSL certificate will restart the secure Web server. The secure connection will not work until the new certificate is accepted on the browser.
SSL Certificate File Status	
Certificate File Present	Indicates if the HTTP SSL Certificate file is present. Range is either Yes or No.
Certificate Expiration Date	Indicates when the HTTP SSL Certificate file will expire. The range is a valid date.
Certificate Issuer Common Name	The Common Name attribute of the server certificate. The range is a valid string. For example, /CN=self-signed/OU=Broadcom Corp./L=Morrisville/ST=North Carolina/C=US
To Get the Current HTTP SSL Certificate	
Download Method	Select either HTTP/HTTPS or TFTP option. Click Download to save the current HTTP SSL Certificate as a backup file to your PC.
HTTP SSL Certificate File	This field is available when the selected download method is TFTP. Enter the filename of the certificate. The filename is a 256-byte alphanumeric string. The default is "Mini_httpd.pem". **Note:** File name should not contain spaces, < , > , | , \ , / , : , (,), & , ; , # , ?, *, $, %, ‘, “, and successive ‘.’.
Server IP	The IPv4 or IPv6 address of the TFTP server where the file will be downloaded. The default is "0.0.0.0".
Upload SSL Certificate	
Upload Method	Select the upload method: • HTTP/HTTPS: Upload the file by using a Web browser • TFTP: Upload the file from a TFTP server
HTTP SSL Certificate File	If the selected upload method is HTTP, click the Browse button to browse to the file to upload to the AP. If the selected upload method is TFTP, this field displays a text box. Enter the filename of the certificate to upload to the AP. **Note:** File name should not contain spaces, < , > , | , \ , / , : , (,), & , ; , # , ?, *, $, %, ‘, “, and successive ‘.’.
Server IP	The IPv4 or IPv6 address of the TFTP server where the file is located. The default is "0.0.0.0."

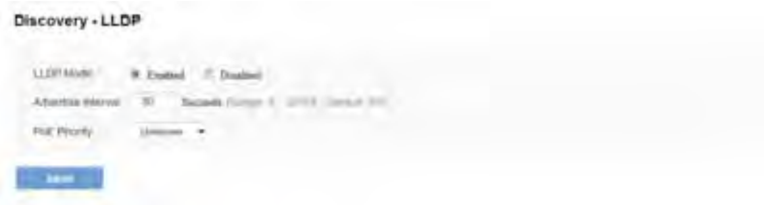
NOTE:
Click Save to apply the changes and save the changes to startup configuration file. If you disable the protocol you are currently using to access the AP management interface, the current connection will end and you will not be able to access the AP by using that protocol until it is enabled.

Discovery - LLDP

Link Layer Discovery Protocol (LLDP) is defined by the IEEE 802.1AB standard and allows the access point to advertise information about itself such as the system name, port name, system capabilities, and power requirements. This information can help you identify system topology and detect bad configurations on the LAN. The AP also supports the Link Layer Discovery Protocol for Media Endpoint Devices (LLDP-MED), which standardizes additional information elements that devices can pass to each other to improve network management.

To configure LLDP settings, click the Services > LLDP tab and update the fields as described in Table 22.

Figure 19: Discovery-LLDP



Discovery - LLDP

LLDP Mode ● Enabled ○ Disabled

Advertise Interval 30 Seconds (Range: 5 - 32768, Default: 30)

PoE Priority Unknown

Table 22: LLDP Settings

Field	Description
LLDP Mode	Enables or disables LLDP. The default is Enabled.
Advertise Interval	Specifies the number of seconds between LLDP message transmissions. The default transmission interval is "30" seconds and can be set from "5" to 32768 (seconds).
PoE Priority	The priority level transmitted by the AP in the Extended Power information element. The PoE priority level helps the Power Sourcing Equipment (PSE), such as a switch, determine which powered devices should be given priority in power allocation when the PSE doesn't have enough capacity to supply power to all connected devices. The PoE priority can be one of the following: • Low • High • Critical • Unknown

Click Save to apply the changes and save the changes to startup configuration file.

Discovery - Bonjour

Bonjour is a software feature that allows the wireless access point and its services to be discovered on a local network using multicast Domain Name System (mDNS) service records. You can either enable or disable the Bonjour component systemwide. The feature is not configurable on any specific network interface.

To set Bonjour status, click the *Configuration* > *Administrator* > *Discovery - Bonjour* tab.

Figure 20: Discovery - Bonjour

Discovery - Bonjour

Bonjour Status ● Enabled ○ Disabled

Table 23: Discovery - Bonjour

Field	Description
Bonjour Status	Enables or disables Bonjour. The default is Enabled.

The access point uses a default AP IP address assignment if a DHCP server is absent in the network. There is no implementation of IPv4 Link-Local Addressing or IPv6 Stateless Address Auto-configuration for the access point.

DNS-SD and mDNS are used for advertisement of services and hostname lookup. The service types listed in the following table are defined by the DNS-SD records and advertised via mDNS by the Bonjour component. The Bonjour component works in both IPv4 and IPv6 networks.

Table 24: Bonjour Status Service Types

Service Type	Description
brcm-sb	Broadcom-specific service type. Allows clients to discover Broadcom devices.
http	AP management Web UI.
https	AP switch management Web UI.
telnet	AP management CLI.
ssh	Secure AP management CLI.

LAN

This section describes how to manage the access point and contains the following subsections:

- VLAN and IPv4 Address
- IPv6 Address
- IPv6 Tunnel

The configuration pages for the features in this section are located under the Manage heading on the Administration Web UI.

VLAN and IPv4 Address

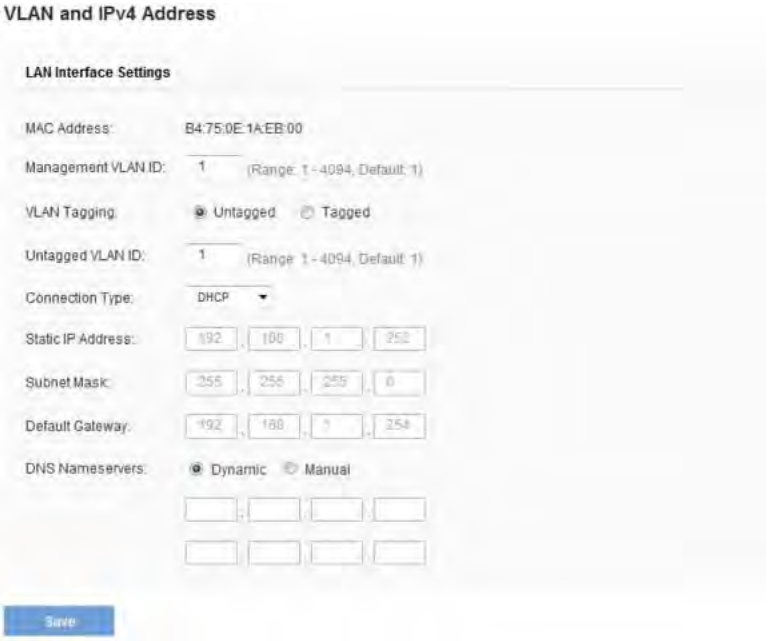
The default wired interface settings, which include DHCP and VLAN information, might not work for all networks.

By default, the DHCP client on the access point automatically broadcasts requests for network information. If you want to use a static IP address, you must disable the DHCP client and manually configure the IP address and other network information.

The management VLAN is VLAN 1 by default. This VLAN is also the default untagged VLAN. If you already have a management VLAN configured on your network with a different VLAN ID, you must change the VLAN ID of the management VLAN on the AP.

To configure the LAN settings, click the *Configuration* > *LAN* > *VLAN and IPv4 Address* tab.

Figure 21: VLAN and IPv4 Address



VLAN and IPv4 Address

LAN Interface Settings

MAC Address: B4:75:0E:1A:EB:00

Management VLAN ID: 1 (Range: 1 - 4094, Default: 1)

VLAN Tagging: ● Untagged ○ Tagged

Untagged VLAN ID: 1 (Range: 1 - 4094, Default: 1)

Connection Type: DHCP

Static IP Address: 192 . 168 . 1 . 252

Subnet Mask: 255 . 255 . 255 . 0

Default Gateway: 192 . 168 . 1 . 254

DNS Nameservers: ● Dynamic ○ Manual

The following table describes the fields to view or configure on the VLAN and IPv4 Address page.

Table 25: VLAN and IPv4 Address

Field	Description
MAC Address	Shows the MAC address for the LAN interface for the Ethernet port on this AP. This is a read-only field that you cannot change.
Management VLAN ID	The management VLAN is the VLAN associated with the IP address you use to access the AP. The default management VLAN ID is "1." Provide a number between 1 and 4094 for the management VLAN ID.

VLAN Tagging	If you disable the untagged VLAN, all traffic is tagged with a VLAN ID. By default all traffic on the access point uses VLAN 1, which is the default untagged VLAN. This means that all traffic is untagged until you disable the untagged VLAN, change the untagged traffic VLAN ID, or change the VLAN ID for a VAP or client using RADIUS.
Untagged VLAN ID	Provide a number between 1 and 4094 for the untagged VLAN ID. Traffic on the VLAN that you specify in this field will not be tagged with a VLAN ID.
Connection Type	If you select DHCP, the access point acquires its IP address, subnet mask, DNS, and gateway information from a DHCP server. If you select Static IP, you must enter information in the Static IP Address, Subnet Mask, and Default Gateway fields.
Static IP Address	Enter the static IP address in the text boxes. This field is disabled if you use DHCP as the connection type.
Subnet Mask	Enter the Subnet Mask in the text boxes.
Default Gateway	Enter the Default Gateway in the text boxes.
DNS Name Servers	Select the mode for the DNS. In Dynamic mode, the IP addresses for the DNS servers are assigned automatically via DHCP. This option is only available if you specified DHCP for the Connection Type. In Manual mode, you must assign static IP addresses to resolve domain names.

NOTE:
After you configure the wired settings, you must click Save to apply the changes and save the changes to startup configuration file. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

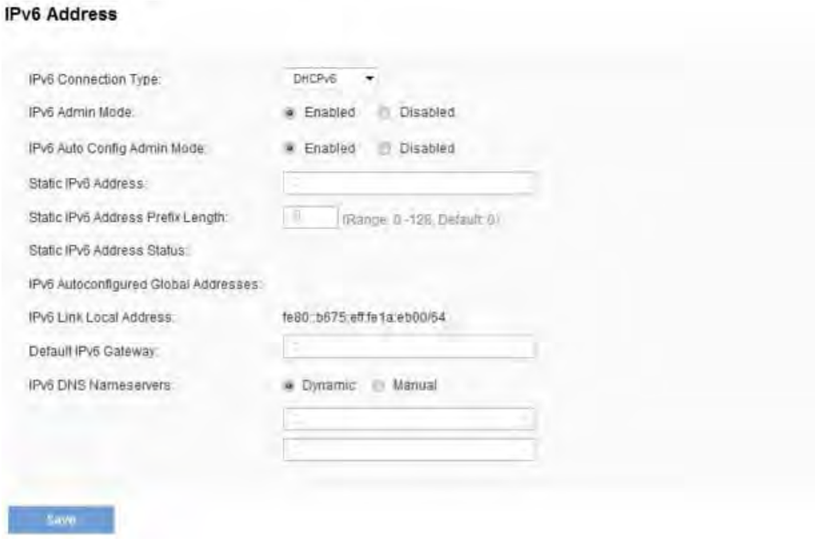
IPv6 Address

The IPv6 Address page contains settings that allow the LAPAC1750PRO Access Point to be managed over an IPv6 network. Use this page to configure the IPv6 management interface settings.

By default, the DHCPv6 client on the access point automatically broadcasts requests for network information. If you want to use a static IPv6 address, you must disable the DHCPv6 client and manually configure the Static IPv6 address and other network information.

To configure the settings that allow system management over an IPv6 network, click the *Configuration > LAN > IPv6 Address* tab.

Figure 22: IPv6 Address



IPv6 Address

IPv6 Connection Type: DHCPv6

IPv6 Admin Mode: ● Enabled ○ Disabled

IPv6 Auto Config Admin Mode: ● Enabled ○ Disabled

Static IPv6 Address:

Static IPv6 Address Prefix Length: 0 (Range: 0 -128, Default: 0)

Static IPv6 Address Status:

IPv6 Autoconfigured Global Addresses:

IPv6 Link Local Address: fe80::b675:eff:fe1a:eb00/64

Default IPv6 Gateway:

IPv6 DNS Nameservers: ● Dynamic ○ Manual

Table 26: IPv6 Address Settings

Field	Description
IPv6 Connection Type	Select the option to determine how the IPv6 address for the management interface is configured: • DHCPv6—The Access Point acquires its IPv6 address, DNS, and gateway information from a DHCPv6 server. • Static IPv6—You must enter information in the Static IPv6 Address, Prefix length, and Default Gateway fields. **Note:** If the selected connection type is DHCPv6, only the IPv6 Connection Type, IPv6 Admin Mode, and IPv6 Auto Config Admin Mode can be configured. All other fields are for static IPv6 configuration only.
IPv6 Admin Mode	Enable or disable IPv6 management access to the AP
IPv6 Auto Config Admin Mode	Enable or disable IPv6 auto address configuration on the AP. When IPv6 Auto Config Mode is enabled, automatic IPv6 address configuration and gateway configuration is allowed by processing the Router Advertisements received on the LAN port. The AP can have multiple auto configured IPv6 addresses.
Static IPv6 Address	Enter a static IPv6 address. The AP can have a static IPv6 address even if addresses have already been configured automatically.
Static IPv6 Address Prefix Length	Enter the static IPv6 prefix length, which is an integer in the range of 0–128.
Static IPv6 Address Status	Shows the operational status of the static IPv6 address assigned to the management interface of the AP. The possible values are Operational and Tentative. **Note:** If an IPv6 address has not been manually configured, the field is blank.
IPv6 Autoconfigured Global Addresses	If the AP has been assigned one or more IPv6 addresses automatically, the addresses are listed.
IPv6 Link Local Address	Shows the IPv6 Link Local address, which is the IPv6 address used by the local physical link. The link local address is not configurable and is assigned by using the IPv6 Neighbor Discovery process.
Default IPv6 Gateway	Enter the IPv6 address of the default IPv6 gateway.
IPv6 DNS Name Servers	Select the method to use to configure the IPv6 address of the DNS server(s) to use for name-to-IPv6 address resolution: • Dynamic —The IPv6 addresses for the DNS servers are assigned automatically via DHCPv6. This option is only available if you specified DHCPv6 for the Connection Type. • Manual—You must assign static IPv6 addresses to resolve domain names

NOTE:

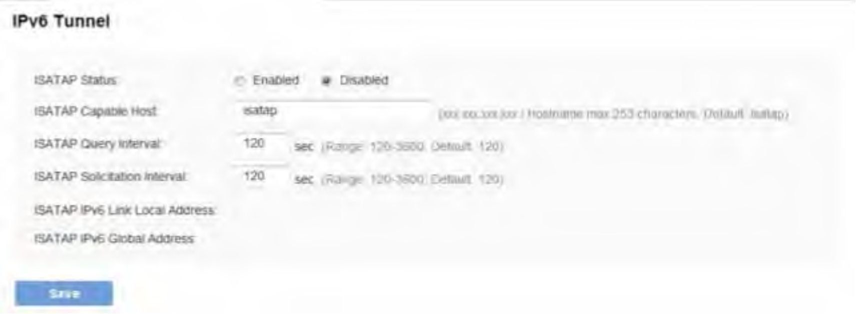
After you configure the wired settings, you must click Save to apply the changes and save the changes to startup configuration file. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

IPv6 Tunnel

The access point supports the Intra-Site Automatic Tunnel Addressing Protocol (ISATAP), which enables the AP to transmit IPv6 packets over the LAN encapsulated within IPv4 packets. The protocol enables the access point to communicate with remote IPv6-capable hosts even when the LAN that connects them does not support IPv6. The access point acts as an initiator of the tunnel and allows communication with remote IPv6 hosts. An ISATAP router acts as the end of the tunnel within the network to help Access Point to auto-configure ISATAP tunnel interface.

From the IPv6 Tunnel page, you can enable, configure and display ISATAP global operational and configuration parameters. To configure the ISATAP settings on the access point, click the *Configuration > LAN > IPv6 Tunnel* tab.

Figure 23: IPv6 Tunnel Settings



IPv6 Tunnel

ISATAP Status: ○ Enabled ● Disabled

ISATAP Capable Host: isatap (xxx.xxx.xxx.xxx / Hostname max 253 characters. Default: isatap)

ISATAP Query Interval: 120 sec (Range: 120-3600, Default: 120)

ISATAP Solicitation Interval: 120 sec (Range: 120-3600, Default: 120)

ISATAP IPv6 Link Local Address:

ISATAP IPv6 Global Address:

The following table describes the fields to view or configure on the IPv6 Tunnel page.

Table 27: IPv6 Tunnel Settings

Field	Description
ISATAP Status	Select Enable or Disable for the administrative mode of ISATAP.
ISATAP Capable Host	Specify the IP address or DNS name of the ISATAP router. The default value is "isatap".
ISATAP Query Interval	Specify how often the AP should send queries to the DNS server to attempt to resolve the ISATAP host name into an IP address. The AP sends router solicitation messages only when the IP address of an ISATAP router is unknown. The valid range is 120–3600 seconds. (The default value is "120" seconds.)
ISATAP Solicitation Interval	Specify how often the AP should send router solicitation messages to the ISATAP router(s) it learns about through the DNS query messages. The AP sends router solicitation messages only when there is no active ISATAP router. The valid range is 120–3600 seconds. (The default value is "120" seconds.)
ISATAP IPv6 Link Local Address	Displays Link Local IPv6 address of the ISATAP interface.
ISATAP IPv6 Global Address	Displays global IPv6 address of ISATAP the interface.

NOTE:
After you configure the wired settings, you must click Save to apply the changes and save the changes to startup configuration file. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity.

NOTE:
DNS name is composed of a series of labels joined with dots, as are all domain names. Each label must be between 1 and 63 characters long, and the entire hostname (including dots) has a maximum of 253 characters.

Wireless

The wireless features are located under the Configuration heading on the administration Web UI.

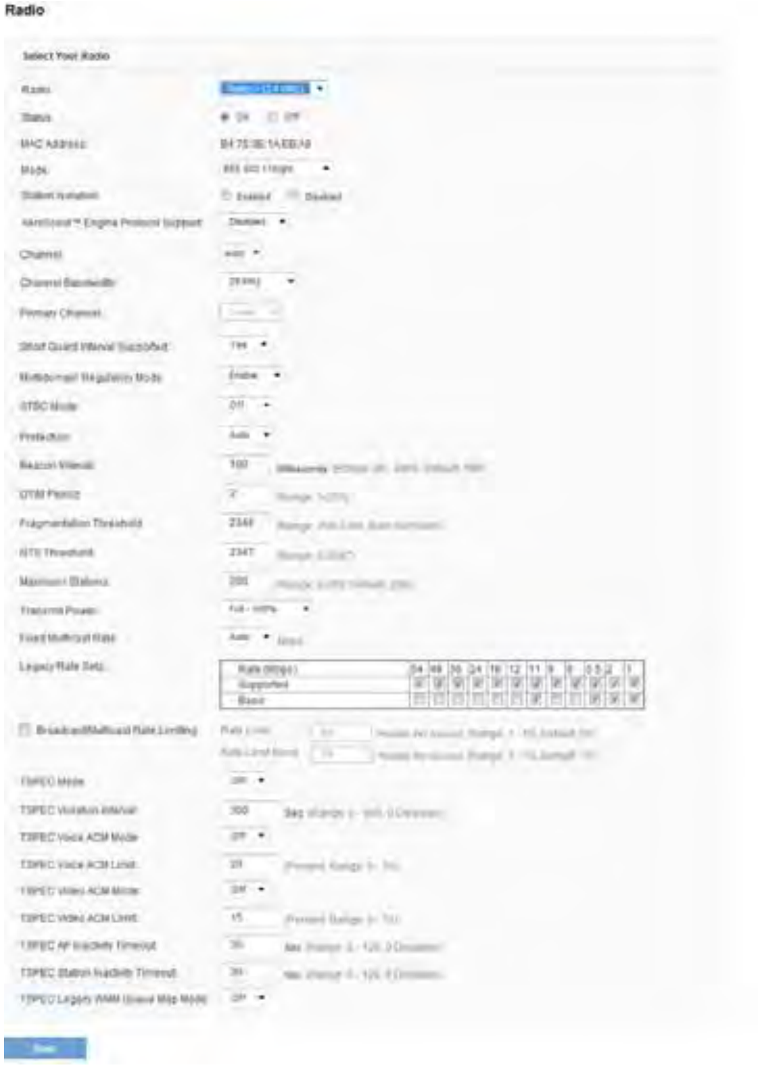
- Radio
- Rogue AP Detection
- Virtual Access Point (VAP)
- Scheduler
- Scheduler Association
- Bandwidth Utilization
- MAC Filter
- WDS Bridge
- Workgroup Bridges
- Qos

Radio

Radio settings directly control the behavior of the radio devices in the AP, and determine how and what type of electromagnetic waves the AP emits.

Different settings display depending on the mode you select. All settings are described in Table 28.

Figure 24: Radio Settings



Radio

Select Your Radio

Radio: Radio 1 (2.4 GHz)

Status: ● On ○ Off

MAC Address: [illegible]

Mode: 802.11b/g/n

Station Isolation: ○ Enabled ○ Disabled

AeroScout™ Engine Protocol Support: Disabled

Channel: auto

Channel Bandwidth: 20 MHz

Primary Channel: Lower

Short Guard Interval Supported: Yes

Multidomain Regulatory Mode: Enable

STBC Mode: Off

Protection: Auto

Beacon Interval: 100 Milliseconds (Range: 20 - 2000, Default: 100)

DTIM Period: 2 (Range: 1-255)

Fragmentation Threshold: 2346 (Range: 256-2346, Even Numbers)

RTS Threshold: 2347 (Range: 0-2347)

Maximum Stations: 200 (Range: 0-200, Default: 200)

Transmit Power: Full - 100%

Fixed Multicast Rate: Auto Mbps

Legacy Rate Sets:

Rate (Mbps)	54	48	36	24	18	12	11	9	6	5.5	2	1
Supported	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑
Basic	□	□	□	□	□	□	☑	□	□	☑	☑	☑

□ Broadcast/Multicast Rate Limiting: Rate Limit 50 Packets Per Second (Range: 1 - 50, Default: 50); Rate Limit Burst 75 Packets Per Second (Range: 1 - 75, Default: 75)

TSPEC Mode: Off

TSPEC Violation Interval: 300 Sec (Range: 0 - 900, 0 Disables)

TSPEC Voice ACM Mode: Off

TSPEC Voice ACM Limit: 20 (Percent Range: 0 - 70)

TSPEC Video ACM Mode: Off

TSPEC Video ACM Limit: 15 (Percent Range: 0 - 70)

TSPEC AP Inactivity Timeout: 30 Sec (Range: 0 - 120, 0 Disables)

TSPEC Station Inactivity Timeout: 30 Sec (Range: 0 - 120, 0 Disables)

TSPEC Legacy WMM Queue Map Mode: Off

Table 28: Radio Settings

Field	Description
Radio	Select Radio 1 or Radio 2 to specify which radio to configure. Radio 1 stands for 2.4GHz radio, and Radio 2 stands for 5GHz radio. The rest of the settings on this tab apply to the radio you select in this field. Be sure to configure settings for both radios.
Status (On/Off)	Specify whether you want the radio on or off by selecting On or Off. If you turn off a radio, the AP sends disassociation frames to all the wireless clients it is currently supporting so that the radio can be gracefully shutdown and the clients can start the association process with other available APs.
MAC Address	Indicates the Media Access Control (MAC) addresses for the interface. This page shows the MAC addresses for Radio interface. A MAC address is a permanent, unique hardware address for any device that represents an interface to the network. The MAC address is assigned by the manufacturer. You cannot change the MAC address. It is provided here for informational purposes as a unique identifier for an interface.

Mode	The Mode defines the Physical Layer (PHY) standard the radio uses. **Note**: The modes available depend on the country code setting and radio. Select one of the following modes for each radio interface: • IEEE 802.11b/g — 802.11b and 802.11g clients can connect to the AP. • IEEE 802.11b/g/n — 802.11b, 802.11g, and 802.11n clients operating in the 2.4-GHz frequency can connect to the AP. • IEEE 802.11n — Only 802.11n clients operating in the 2.4-GHz frequency can connect to the AP. • IEEE 802.11a — Only 802.11a clients can connect to the AP. This mode is available only on Radio 2. • IEEE 802.11a/n/ac — 802.11a, 802.11n, and 802.11ac clients operating in the 5-GHz frequency can connect to the AP. This mode is available only on Radio 2. • IEEE 802.11n/ac — 802.11n clients and 802.11ac clients operating in the 5-GHz frequency can connect to the AP. This mode is available only on Radio 2.
Station Isolation	To enable Station Isolation, select the check box directly beside it. When Station Isolation is disabled, wireless clients can communicate with one another normally by sending traffic through the AP. When Station Isolation is enabled, the AP blocks communication between wireless clients on the same VAP. The AP still allows data traffic between its wireless clients and wired devices on the network, across a Wireless Distribution System (WDS) link, and with other wireless clients associated with a different VAP, but not among wireless clients.

AeroScout™ Engine Protocol Support	Options are Enabled or Disabled. The default is Disabled. When enabled, Aeroscout devices are recognized and data is sent to an Aeroscout Engine (AE) for analysis. The AE determines the geographical location of 802.11-capable devices, such as STAs, APs, and AeroScout's line of 802.11-enabled RFID devices, or tags. The AE communicates with APs that support the AE protocol in order to collect information about the RF devices detected by the APs. Using the AE protocol, LAPAC1750PRO supports direct communication between AE and the APs. When operating in managed mode, the AE is configured with the IP address of the managed access points from which it collects information. The Wireless Switch cannot communicate with the AE. **Note**: Only AeroScout tag hardware of types T2 and T3 are explicitly supported. Other tag models are also supported only if their implementation of the AeroScout protocol conforms to the AeroScout Engine - Access Point Interface Specification, version 2.1. **Note**: AeroScout tags operate only in 802.11 b/g mode. Therefore, network administrators who use the AeroScout tags must configure at least one radio on APs that are expected to detect tags in either 802.11b/g or 802.11b/g/n mode. The radios configured in 2.4 GHz IEEE 802.11 mode or any of the 5GHZ modes cannot detect AeroScout tags. **Note**: The AE protocol allows access points to mark detected APs as rogue devices. The LAPAC1750PRO APs do not support this feature and never report detected APs as rogues.

Channel	Select the Channel. The range of available channels is determined by the mode of the radio interface and the country code setting. If you select Auto for the channel setting, the AP scans available channels and selects a channel where no traffic is detected. The channel defines the portion of the radio spectrum the radio uses for transmitting and receiving. Each mode offers a number of channels, depending on how the spectrum is licensed by national and transnational authorities such as the Federal Communications Commission (FCC) or the International Telecommunication Union (ITU-R). When automatic channel assignment is enabled on the Channel Management page for Clustering, the channel policy for the radio is automatically set to static mode, and the Auto option is not available for the Channel field. This allows the automatic channel feature to set the channels for the radios in the cluster.
Channel Bandwidth (802.11n and 802.11ac modes only)	The 802.11n specification allows a 40 MHz-wide channel in addition to the legacy 20 MHz channel available with other modes. The 40 MHz channel enables higher data rates but leaves fewer channels available for use by other 2.4 GHz and 5 GHz devices. The 802.11ac specification allows an 80 MHz-wide channel in addition to the 20 MHz and 40 MHz channels. Set the field to 20 MHz to restrict the use of the channel bandwidth to a 20 MHz channel. For the 802.11ac mode, set the field to 40 MHz to prevent the radio from using the 80 MHz channel bandwidth.

Primary Channel (802.11n modes only)	This setting can be changed only when the channel bandwidth is set to 40 MHz. A 40-MHz channel can be considered to consist of two 20-MHz channels that are contiguous in the frequency domain. These two 20-MHz channels are often referred to as the Primary and Secondary channels. The Primary Channel is used for 802.11n clients that support only a 20-MHz channel bandwidth and for legacy clients. Select one of the following options: • Upper — Set the Primary Channel as the upper 20-MHz channel in the 40-MHz band. • Lower — Set the Primary Channel as the lower 20-MHz channel in the 40-MHz band.
Short Guard Interval Supported	This field is available only if the selected radio mode includes 802.11n. The guard interval is the dead time, in nanoseconds, between OFDM symbols. The guard interval prevents Inter-Symbol and Inter-Carrier Interference (ISI, ICI). The 802.11n mode allows for a reduction in this guard interval from the a and g definition of 800 nanoseconds to 400 nanoseconds. Reducing the guard interval can yield a 10% improvement in data throughput. Select one of the following options: • Yes — The AP transmits data using a 400 nanosecond guard Interval when communicating with clients that also support the short guard interval. • No — The AP transmits data using an 800 nanosecond guard interval.

Multidomain Regulatory Mode	This feature is configurable on a per radio basis. By default it is enabled. Multidomain Regulatory Mode (World Mode) causes the AP to broadcast which country it is operating in as a part of its beacons and probe responses. This allows client stations to operate in any country without reconfiguration. Disabling this feature prevents the country code setting from being broadcast in the beacons. However, this only applies to radios configured to operate in the g band (2.4 GHz band). For radios operating in the a band (5 GHz band), the AP software configures support for 802.11h. When 802.11h is supported, the country code information is broadcast in the beacons.
STBC Mode	This field is available only if the selected radio mode includes 802.11n. Space Time Block Coding (STBC) is an 802.11n technique intended to improve the reliability of data transmissions. The data stream is transmitted on multiple antennas so the receiving system has a better chance of detecting at least one of the data streams. Select one of the following options: • On—The AP transmits the same data stream on multiple antennas at the same time. • Off—The AP does not transmit the same data on multiple antennas.

Protection	The protection feature contains rules to guarantee that 802.11 transmissions do not cause interference with legacy stations or applications. By default, these protection mechanisms are enabled (Auto). With protection enabled, protection mechanisms will be invoked if legacy devices are within range of the AP. You can disable (Off) these protection mechanisms. When protection is off, legacy clients or APs within range can be affected by 802.11n transmissions. Protection is also available when the mode is 802.11b/g. When protection is enabled in this mode, it protects 802.11b clients and APs from 802.11g transmissions. **Note**: This setting does not affect the ability of the client to associate with the AP.
Beacon Interval	Beacon frames are transmitted by an AP at regular intervals to announce the existence of the wireless network. The default behavior is to send a beacon frame once every 100 milliseconds (or 10 per second). Enter a value from 20 to 2000 milliseconds.
DTIM Period	Specify a DTIM period from 1 to 255 beacons. The Delivery Traffic Information Map (DTIM) message is an element included in some beacon frames. It indicates which client stations, currently sleeping in low-power mode, have data buffered on the AP awaiting pick-up. The DTIM period you specify indicates how often the clients served by this AP should check for buffered data still on the AP awaiting pickup. The measurement is in beacons. For example, if you set this field to 1, clients will check for buffered data on the AP at every beacon. If you set this field to 10, clients will check on every 10th beacon.

Fragmentation Threshold	Specify a number between 256 and 2,346 to set the frame size threshold in bytes. The fragmentation threshold is a way of limiting the size of packets (frames) transmitted over the network. If a packet exceeds the fragmentation threshold you set, the fragmentation function is activated and the packet is sent as multiple 802.11 frames. If the packet being transmitted is equal to or less than the threshold, fragmentation is not used. Setting the threshold to the largest value (2,346 bytes) effectively disables fragmentation. Fragmentation plays no role when Aggregation is enabled. Fragmentation involves more overhead both because of the extra work of dividing up and reassembling of frames it requires, and because it increases message traffic on the network. However, fragmentation can help improve network performance and reliability if properly configured. Sending smaller frames (by using lower fragmentation threshold) might help with some interference problems; for example, with microwave ovens. By default, fragmentation is off. We recommend not using fragmentation unless you suspect radio interference. The additional headers applied to each fragment increase the overhead on the network and can greatly reduce throughput.

RTS Threshold	Specify a Request to Send (RTS) Threshold value between 0 and 2347. The RTS threshold indicates the number of octets in an MPDU, below which an RTS/CTS handshake is not performed. Changing the RTS threshold can help control traffic flow through the AP, especially one with a lot of clients. If you specify a low threshold value, RTS packets will be sent more frequently. This will consume more bandwidth and reduce the throughput of the packet. On the other hand, sending more RTS packets can help the network recover from interference or collisions which might occur on a busy network, or on a network experiencing electromagnetic interference.
Maximum Stations	Specify the maximum number of stations allowed to access this AP at any one time. You can enter a value between 0 and 200.
Transmit Power	Enter a percentage value for the transmit power level for this AP. The default value, which is 100%, can be more cost-efficient than a lower percentage since it gives the AP a maximum broadcast range and reduces the number of APs needed. To increase capacity of the network, place APs closer together and reduce the value of the transmit power. This helps reduce overlap and interference among APs. A lower transmit power setting can also keep your network more secure because weaker wireless signals are less likely to propagate outside of the physical location of your network.
Fixed Multicast Rate	Select the multicast traffic transmission rate you want the AP to support.

Legacy Rate Sets	Check the transmission rate sets you want the AP to support and the basic rate sets you want the AP to advertise: • Rates are expressed in megabits per second. • Supported Rate Sets indicate rates that the AP supports. You can check multiple rates (click a check box to select or deselect a rate). The AP will automatically choose the most efficient rate based on factors like error rates and distance of client stations from the AP. • Basic Rate Sets indicate rates that the AP will advertise to the network for the purposes of setting up communication with other APs and client stations on the network. It is generally more efficient to have an AP broadcast a subset of its supported rate sets.
Broadcast/ Multicast Rate Limiting	Enabling multicast and broadcast rate limiting can improve overall network performance by limiting the number of packets transmitted across the network. By default the Multicast/Broadcast Rate Limiting option is disabled. Until you enable Multicast/Broadcast Rate Limiting, the following fields will be disabled.
– Rate Limit	Enter the rate limit you want to set for multicast and broadcast traffic. The limit should be greater than 1, but less than 50 packets per second. Any traffic that falls below this rate limit will always conform and be transmitted to the appropriate destination. The default and maximum rate limit setting is 50 packets per second.
– Rate Limit Burst	Setting a rate limit burst determines how far above the rate limit bursts can go before all traffic exceeds the rate limit. This burst limit allows intermittent bursts of traffic on a network above the set rate limit. The default and maximum rate limit burst setting is 75 packets per second.

TSPEC Mode	Regulates the overall TSPEC mode on the AP. • On—The AP handles TSPEC requests according to the TSPEC settings you configure on the Radio page. Use this setting if the AP handles traffic from QoS-capable devices, such as a Wi-Fi-certified phone. • Off—The AP ignores TSPEC requests from client stations. Use this setting if you do not want to use TSPEC to give QoS-capable devices priority for time-sensitive traffic.
TSPEC Violation Interval	• Specify the time interval (in seconds) for the AP to report (through the system log and SNMP traps) associated clients that do not adhere to mandatory admission control procedures.
TSPEC Voice ACM Mode	Regulates mandatory admission control (ACM) for the voice access category. The options are: • On—A station is required to send a TSPEC request for bandwidth to the AP before sending or receiving a voice traffic stream. The AP responds with the result of the request, which includes the allotted medium time if the TSPEC was admitted. • Off—A station can send and receive voice priority traffic without requiring an admitted TSPEC; the AP ignores voice TSPEC requests from client stations.
TSPEC Voice ACM Limit	Specify an upper limit on the amount of traffic the AP attempts to transmit on the wireless medium using a voice admission control to gain access.
TSPEC Video ACM Mode	Regulates mandatory admission control for the video access category. The options are: • On—A station is required to send a TSPEC request for bandwidth to the AP before sending or receiving a video traffic stream. The AP responds with the result of the request, which includes the allotted medium time if the TSPEC was admitted. • Off—A station can send and receive video priority traffic without requiring an admitted TSPEC; the AP ignores video TSPEC requests from client stations.

TSPEC Video ACM Limit	Specify an upper limit on the amount of traffic the AP attempts to transmit on the wireless medium using a video admission control to gain access.
TSPEC AP Inactivity Timeout	Specify the amount of time for an AP to detect a downlink TS as idle before deleting it.
TSPEC Station Inactivity Timeout	Specify the amount of time for an AP to detect an uplink TS as idle before deleting it.
TSPEC Legacy WMM Queue Map Mode	Select On to allow intermixing of legacy traffic on queues operating as ACM.

Use the Radio page to configure both Radio 1 and Radio 2. The settings on the page apply only to the radio that you choose from the Radio drop-down list. After you configure settings for one of the radios, click Save and then select and configure the other radio. Be sure to click Save to apply the second set of configuration settings for the other radio.

NOTE:
Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

Rogue AP Detection

A Rogue AP is an access point that has been installed on a secure network without explicit authorization from a system administrator. Rogue access points pose a security threat because anyone with access can mistakenly or maliciously install a wireless AP that can potentially allow unauthorized parties to access the network.

The status page for Rogue AP Detection provides real-time statistics for all APs detected by the LAPAC1750PRO Access Point in the vicinity of the network. If the AP listed as a rogue is actually a legitimate AP, you can add it to the Known AP List. Click Refresh to refresh the page.

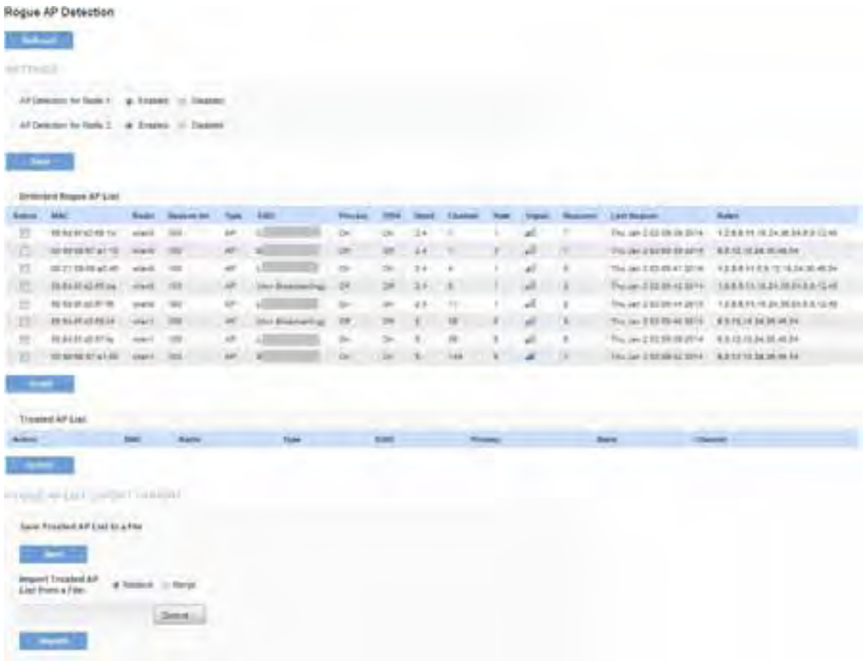
NOTE:
The detected Rogue AP List and Known AP List provide information. The LAPAC1750PRO Access Point does not have any control over the APs on the lists and cannot apply any security policies to APs detected through the RF scan.

When AP detection is enabled, the radio will periodically switch from its operating channel to scan other channels within the same band. Neighbor AP detection can be configured independently on each radio. Click Save to refresh the screen and display the most current information.

NOTE:
Note: Rogue AP detection does not have any refresh mechanism and the SSID are retained in the database once detected.

To view information about other access points on the wireless network, click the Status > Rogue AP Detection tab.

Figure 25: Viewing Rogue AP Detection



Rogue AP Detection

AP Detection for Radio 1 ● Enabled ○ Disabled

AP Detection for Radio 2 ● Enabled ○ Disabled

Detected Rogue AP List

Trusted AP List

You must enable AP detection on a radio in order to collect information about other APs within range.

Table 29: Rogue AP Detection

Field	Description
AP Detection for Radio 1	To enable Radio 1 to perform neighbor AP detection and collect information about neighbor APs, select Enabled. To disable neighbor AP detection on Radio 1, select *Disabled*. If you change the AP detection setting, click **Save**.
AP Detection for Radio 2	To enable Radio 2 to perform neighbor AP detection and collect information about neighbor APs, select Enabled. To disable neighbor AP detection on Radio 2, select *Disabled*. If you change the AP detection setting, click **Save**.
Action	The available action depends on which list an AP is in. • If the AP is in the Detected Rogue AP List, the Grant button is available. Click Grant to move the AP from the Detected Rogue AP List to the Trusted AP List. • If the AP is in the Trusted AP List, the Delete button is available. Click Delete to move the AP from the Trusted AP list to the Detected Rogue AP List. **Note**: The Detected Rogue AP List and Known AP List provide information. The LAPAC1750PRO Access Point does not have any control over the APs on the list and cannot apply any security policies to APs detected through the RF scan.
MAC	Shows the MAC address of the neighboring AP.
Radio	The Radio field indicates which radio detected the neighboring AP: • wlan0 (Radio 1) • wlan1 (Radio 2)
Beacon Interval	Shows the beacon interval being used by this AP. Beacon frames are transmitted by an AP at regular intervals to announce the existence of the wireless network. The default behavior is to send a beacon frame once every 100 milliseconds (or 10 per second).
Type	Indicates the type of device: • AP indicates the neighboring device is an AP that supports the IEEE 802.11 Wireless Networking Framework in Infrastructure Mode. • Ad Hoc indicates a neighboring station running in Ad Hoc Mode. Stations set to Ad Hoc Mode communicate with each other directly, without the use of a traditional AP. Ad Hoc Mode is an IEEE 802.11 Wireless Networking Framework also referred to as peer-to-peer mode or an Independent Basic Service Set (IBSS).

SSID	The Service Set Identifier (SSID) for the AP. The SSID is an alphanumeric string of up to 32 characters that uniquely identifies a wireless local area network. It is also referred to as the Network Name.
Privacy	Indicates whether there is any security on the neighboring device. • Off indicates that the Security mode on the neighboring device is set to None (no security). • On indicates that the neighboring device has some security in place. Security is configured on the AP from the VAP page.
WPA	Indicates whether WPA security is on or off for this AP.
Band	This indicates the IEEE 802.11 mode being used on this AP. (For example, IEEE 802.11a, IEEE 802.11b, IEEE 802.11g.) The number shown indicates the mode according to the following map: • 2.4 indicates IEEE 802.11b, 802.11g, or 802.11n mode (or a combination of the modes) • 5 indicates IEEE 802.11a or 802.11n mode (or both modes)
Channel	Shows the channel on which the AP is currently broadcasting. The channel defines the portion of the radio spectrum that the radio uses for transmitting and receiving.
Rate	Shows the rate (in megabits per second) at which this AP is currently transmitting. The current rate will always be one of the rates shown in Supported Rates.
Signal	Indicates the strength of the radio signal emitting from this AP. If you hover the mouse pointer over the bars, a number appears and shows the strength in decibels (dB).
Beacons	Shows the total number of beacons received from this AP since it was first discovered.

Last Beacon	Shows the date and time of the last beacon received from this AP.
Rates	Shows supported and basic (advertised) rate sets for the neighboring AP. Rates are shown in megabits per second (Mbps). All Supported Rates are listed, with Basic Rates shown in bold. Rate sets are configured on the Radio page.

To save the Known AP List to a file, click Save. The list contains the MAC addresses of all APs that have been added to the Known AP List. By default, the filename is Rogue2.cfg. You can use a text editor or Web browser to open the file and view its contents.

Use the Import feature to import a list of known APs from a saved list. The list might be from another AP or created from a text file. If the MAC address of an AP appears in the Known AP List, it will not be detected as a rogue.

To import an AP list from a file, use the following steps:

1. Choose whether to replace the existing Known AP List or add the entries in the imported file to the Known AP List.

- Select Replace to import the list and replace the contents of the Known AP List.
- Select Merge to import the list and add the APs in the imported file to the APs currently displayed in the Known AP List.

2. Click Browse and choose the file to import.

The file you import must be a plain-text file with a .txt or .cfg extension. Entries in the file are MAC addresses in hexadecimal format with each octet separated by colons, for example 00:11:22:33:44:55. Separate entries with a single space. For the AP to accept the file, it must contain only MAC addresses.

3. Click Import.

Once the import is complete, the screen refreshes and the MAC addresses of the APs in the imported file appear in the Known AP List.

Virtual Access Point (VAP)

Virtual Access Points (VAPs) segment the wireless LAN into multiple broadcast domains that are the wireless equivalent of Ethernet VLANs. VAPs simulate multiple APs in one physical AP. Each radio supports up to 8 VAPs.

For each VAP you can customize the security mode to control wireless client access. Each VAP can also have a unique SSID. Multiple SSIDs make a single AP look like two or more APs to other systems on the network. By configuring VAPs, you can maintain better control over broadcast and multicast traffic, which affects network performance.

You can configure each VAP to use a different VLAN, or you can configure multiple VAPs to use the same VLAN, whether the VLAN is on the same radio or on a different radio. VAP0, which is always enabled on both radios, is assigned to the default VLAN 1.

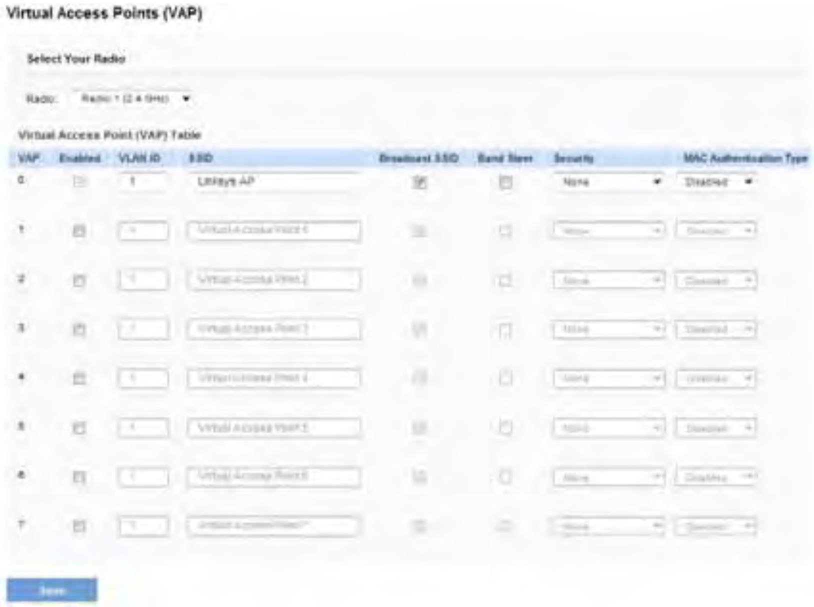
The AP adds VLAN ID tags to wireless client traffic based on the VLAN ID you configure on the VAP page or by using the RADIUS server assignment. If you use an external RADIUS server, you can configure multiple VLANs on each VAP. The external RADIUS server assigns wireless clients to the VLAN when the clients associate and authenticate.

If wireless clients use a security mode that does not communicate with the RADIUS server, or if the RADIUS server does not provide the VLAN information, you can assign a VLAN ID to each VAP. The AP assigns the VLAN to all wireless clients that connect to the AP through that VAP. About the RADIUS server setting please see "RADIUS Server"

NOTE:
Before you configure VLANs on the AP be sure to verify that the switch and DHCP server the AP uses can support IEEE 802.1Q VLAN encapsulation.

To set up multiple VAPs, click Configuration > Wireless > Virtual Access Points (VAP).

Figure 26: Virtual Access Points (VAP)



Virtual Access Points (VAP)

Select Your Radio

Radio: Radio 1 (2.4 GHz)

Virtual Access Point (VAP) Table

VAP	Enabled	VLAN ID	SSID	Broadcast SSID	Band Steer	Security	MAC Authentication Type
0	☑	1	Linksys AP	☑	☐	None	Disabled
1	☐	1	Virtual Access Point 1	☐	☐	None	Disabled
2	☐	1	Virtual Access Point 2	☐	☐	None	Disabled
3	☐	1	Virtual Access Point 3	☐	☐	None	Disabled
4	☐	1	Virtual Access Point 4	☐	☐	None	Disabled
5	☐	1	Virtual Access Point 5	☐	☐	None	Disabled
6	☐	1	Virtual Access Point 6	☐	☐	None	Disabled
7	☐	1	Virtual Access Point 7	☐	☐	None	Disabled

Table 30: Virtual Access Point Settings

Field	Description
Radio	Select the radio to configure. VAPs are configured independently on each radio.
VAP	You can configure up to eight VAPs for each radio. VAP0 is the physical radio interface; so to disable VAP0 you must disable the radio.
Enabled	You can enable or disable a configured network. If you disable the specified network, you will lose the VLAN ID you entered.

VLAN ID	When a wireless client connects to the AP using this VAP, the AP tags all traffic from the wireless client with the VLAN ID you enter in this field unless you enter the untagged VLAN ID or use a RADIUS server to assign a wireless client to a VLAN. The range for the VLAN ID is 1–4094. If you use RADIUS-based authentication for clients, you can optionally add the following attributes to the appropriate file in the RADIUS or AAA server to configure a VLAN for the client: • Tunnel-Type • Tunnel-Medium-Type • Tunnel-Private-Group-ID The RADIUS-assigned VLAN ID overrides the VLAN ID you configure on the VAP page. You configure the untagged and management VLAN IDs on the VLAN and IPv4 Address page.
SSID	Enter a name for the wireless network. The SSID is an alphanumeric string of up to 32 characters. You can use the same SSID for multiple VAPs, or you can choose a unique SSID for each **VAP**. **Note**: If you are connected as a wireless client to the same AP that you are administering, resetting the SSID will cause you to lose connectivity to the AP. You will need to reconnect to the new SSID after you save this new setting.
Broadcast SSID	Specify whether to allow the AP to broadcast the Service Set Identifier (SSID) in its beacon frames. The Broadcast SSID parameter is enabled by default. When the VAP does not broadcast its SSID, the network name is not displayed in the list of available networks on a client station. Instead, the client must have the exact network name configured in the supplicant before it is able to connect. • To enable the SSID broadcast, select the Broadcast SSID check box. • To prohibit the SSID broadcast, clear the Broadcast SSID check box. **Note**: Disabling the broadcast SSID is sufficient to prevent clients from accidentally connecting to your network, but it will not prevent even the simplest of attempts by a hacker to connect or monitor unencrypted traffic. Suppressing the SSID broadcast offers a very minimal level of protection on an otherwise exposed network (such as a guest network) where the priority is making it easy for clients to get a connection and where no sensitive information is available.
Band Steer	Enable this feature to encourage dual-band wireless clients to connect to the radio operating in the 5 GHz band instead of the radio operating in the 2.4 GHz band. The 5 GHz band has more channels available and is generally utilized less than the 2.4 GHz band. The Access Point can improve overall network throughput by effectively utilizing the 5 GHz band.

Security	Select one of the following Security modes for this VAP: • *None* • *Static WEP* • *IEEE802.1X* • *WPA Personal* • *WPA Enterprise* If you select a security mode other than None, additional fields appear. These fields are explained below. **Note**: The security mode you set here is specifically for this VAP.
MAC Authentication Type	You can configure a global list of MAC addresses that are allowed or denied access to the network. The drop-down menu for this feature allows you to select the type of MAC Authentication to use: • Disabled: Do not use MAC Authentication. • Local: Use the MAC Authentication list that you configure on the MAC Authentication page. • RADIUS: Use the MAC Authentication list on the external RADIUS server. For more information about MAC Authentication, see MAC Filter.

NOTE:
After you configure the VAP settings, you must click Save to apply the changes and save the changes to startup configuration file. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

None (Plain-text)

If you select None as your security mode, no further options are configurable on the AP. This mode means that any data transferred to and from the access point is not encrypted. This security mode can be useful during initial network configuration or for problem solving, but it is not recommended for regular use on the internal network because it is not secure.

Static WEP

Wired Equivalent Privacy (WEP) is a security algorithm for 802.11 wireless networks. WEP uses static 64-bit (40-bit secret key + 24-bit initialization vector (IV)) or 128-bit (104-bit secret key + 24-bit IV) shared key for data encryption between wireless stations and access points. WEP uses the stream cipher RC4 for encryption.

Static WEP is an easily broken security algorithm, but it offers more protection than setting the security mode to None (Plain-text), as it does prevent an outsider from easily sniffing out unencrypted wireless traffic.

Table 31: Static WEP

Field	Description
Transfer Key Index	The Transfer Key Index indicates which WEP key the AP uses to encrypt the data it transmits with WPA devices. Key indexes 1 through 4 are available. The default is 1.
Key Length	Select the length of the key: • 64 bits • 128 bits
Key Type	Select the length of the key: • ASCII • Hex
WEP Keys	There are four WEP keys can be set. The keys you enter depend on the key type selected: • ASCII: Includes uppercase and lowercase alphabetic letters, the numeric digits, and special symbols such as @ and #. • Hex: Hexadecimal (base 16) characters (0-9 and A-F). Use the same number of characters for each key as specified in the Characters Required field. These are the RC4 WEP keys shared with the stations using the access point. Each client station must be configured to use one of these same WEP keys in the same slot as specified on the access point. The number of characters you enter into the WEP Key fields is determined by the key length and key type you select. For example, if you use 128-bit ASCII keys, you must enter 26 characters in the WEP key. The number of characters required updates automatically based on how you set the key length and key type.
Authentication	The authentication algorithm defines the method used to determine whether a client station is allowed to associate with the access point when static WEP is the security mode. • Open System: authentication allows any client station to associate with the WAP device whether that client station has the correct WEP key or not. This algorithm is also used in plaintext, IEEE 802.1X, and WPA modes. When the authentication algorithm is set to Open System, any client can associate with the access point. • Shared Key: authentication requires the client station to have the correct WEP key in order to associate with the access point. When the authentication algorithm is set to Shared Key, a station with an incorrect WEP key cannot associate with theaccess point. • Open System and Shared Key: When you select both authentication algorithms, client stations configured to use WEP in shared key mode must have a valid WEP key in order to associate with the access point. Also, client stations configured to use WEP as an open system (shared key mode not enabled) can associate with the access point even if they do not have the correct WEP key.

NOTE:
After you configure the security settings, you must click Save to apply the changes and save the changes to startup configuration file.

WPA Personal

WPA Personal is a Wi-Fi Alliance IEEE 802.11i standard, which includes AES-CCMP and TKIP mechanisms. It employs a pre-shared key (instead of using IEEE 802.1X and EAP as is used in the Enterprise WPA security mode). The PSK is used for an initial check of credentials only.

This security mode is backwards-compatible for wireless clients that support the original WPA.

Table 32: WPA Personal

Field	Description
WPA Versions	Select the types of client stations you want to support: WPA: If all client stations on the network support the original WPA but none support the newer WPA2, then select WPA. WPA2: If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard. WPA and WPA2: If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select both of the check boxes. This lets both WPA and WPA2 client stations associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.
Cipher Suites	Select the cipher suite you want to use: • *TKIP* • *CCMP (AES)* • *TKIP and CCMP (AES)* TKIP and AES clients can associate with the AP. WPA clients must have one of the following to be able to associate with the AP: • *A valid TKIP key* • *A valid AES-CCMP key* Clients not configured to use WPA Personal will not be able to associate with the AP.
Key	The pre-shared key is the shared secret key for WPA Personal. Enter a string of between 8 and 63 characters. Acceptable characters include upper and lower case alphabetic letters, the numeric digits, and special symbols such as @ and #.
Broadcast Key Refresh Rate	Enter a value to set the interval at which the broadcast (group) key is refreshed for clients associated to this VAP (the default is “300”). The valid range is 0–86400 seconds. A value of 0 indicates that the broadcast key is not refreshed.

WPA Enterprise

WPA Enterprise with RADIUS is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes CCMP (AES), and TKIP mechanisms. The Enterprise mode requires the use of a RADIUS server to authenticate users.

This security mode is backwards-compatible with wireless clients that support the original WPA.

Table 33: WPA Enterprise

Field	Description
WPA Versions	Select the types of client stations you want to support: • WPA: If all client stations on the network support the original WPA but none support the newer WPA2, then select WPA. • WPA2: If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard. • WPA and WPA2: If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select both WPA and WPA2. This lets both WPA and WPA2 client stations associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.

Enable pre-authentication	If for WPA versions you select only WPA2 or both WPA and WPA2, you can enable pre-authentication for WPA2 clients. Click **Enable pre-authentication** if you want WPA2 wireless clients to send a pre-authentication packet. The pre-authentication information will be relayed from the AP the client is currently using to the target AP. Enabling this feature can help speed up authentication for roaming clients who connect to multiple APs. This option does not apply if you selected WPA for WPA versions because the original WPA does not support this feature.
Cipher Suites	Select the cipher suite you want to use: • *TKIP* • *CCMP (AES)* • *TKIP and CCMP (AES)* By default both TKIP and CCMP are selected. When both TKIP and CCMP are selected, client stations configured to use WPA with RADIUS must have one of the following: • *A valid TKIP RADIUS IP address and RADIUS Key* • *A valid CCMP (AES) IP address and RADIUS key*
Use Global RADIUS Server Settings	By default each VAP uses the global RADIUS settings that you define for the AP at the top of the VAP page. However, you can configure each VAP to use a different set of RADIUS servers. To use the global RADIUS server settings, make sure the check box is selected. To use a separate RADIUS server for the VAP, clear the check box and enter the RADIUS server IP address and key in the following fields.

RADIUS IP Address Type	Specify the IP version that the RADIUS server uses. You can toggle between the address types to configure IPv4 and IPv6 global RADIUS address settings, but the AP contacts only the RADIUS server or servers for the address type you select in this field.
RADIUS IP Address **RADIUS IPv6 Address**	Enter the IPv4 or IPv6 address for the primary RADIUS server for this VAP. If the IPv4 RADIUS IP Address Type option is selected in the previous field, enter the IP address of the RADIUS server that all VAPs use by default, for example 192.168.10.23. If the IPv6 RADIUS IP Address Type option is selected, enter the IPv6 address of the primary global RADIUS server, for example 2001:0db8:1234::abcd.
RADIUS IP or IPv6 Address 1–3	Enter up to three IPv4 and/or IPv6 addresses to use as the backup RADIUS servers for this VAP. The field label is RADIUS IP Address when the IPv4 RADIUS IP Address Type option is selected and RADIUS IPv6 Address when the IPv6 RADIUS IP Address Type option is selected. If authentication fails with the primary server, each configured backup server is tried in sequence.
RADIUS Key	Enter the RADIUS key in the text box. The RADIUS Key is the shared secret key for the global RADIUS server. You can use up to 63 standard alphanumeric and special characters. The key is case sensitive, and you must configure the same key on the AP and on your RADIUS server. The text you enter will be displayed as "*" characters to prevent others from seeing the RADIUS key as you type.
RADIUS Key 1–3	Enter the RADIUS key associated with the configured backup RADIUS servers. The server at RADIUS IP Address-1 uses RADIUS Key-1, RADIUS IP Address-2 uses RADIUS Key-2, and so on.

Enable RADIUS Accounting	Select this option to track and measure the resources a particular user has consumed such as system time, amount of data transmitted and received, and so on. If you enable RADIUS accounting, it is enabled for the primary RADIUS server and all backup servers.
Active Server	The RADIUS IP address and key for up to four RADIUS servers can be configured on the AP. Select which of the four RADIUS servers the VAP should contact to authenticate wireless clients.
Broadcast Key Refresh Rate	Enter a value to set the interval at which the AP will refresh session (unicast) keys for each client associated to the VAP. The valid range is 0–86400 seconds. A value of 0 indicates that the broadcast key is not refreshed.
Session Key Refresh Rate	Enter a value to set the interval at which the AP will refresh session (unicast) keys for each client associated to the VAP.

Scheduler

The Radio and VAP Scheduler is a standalone LAPAC1750PRO Access Point feature. To configure the Radio and VAP scheduler, select the Scheduler tab in the Manage section. The Radio and VAP Scheduler allows you to configure a rule with a specific time interval for VAPs or radios to be operational, thereby automating the enabling or disabling of the VAPs and radios.

One of the ways you can use this feature is to schedule radios to operate only during the office working hours in order to achieve security and reduce power consumption. You can also use the scheduler to allow access to VAPs for wireless clients only during specific times of day.

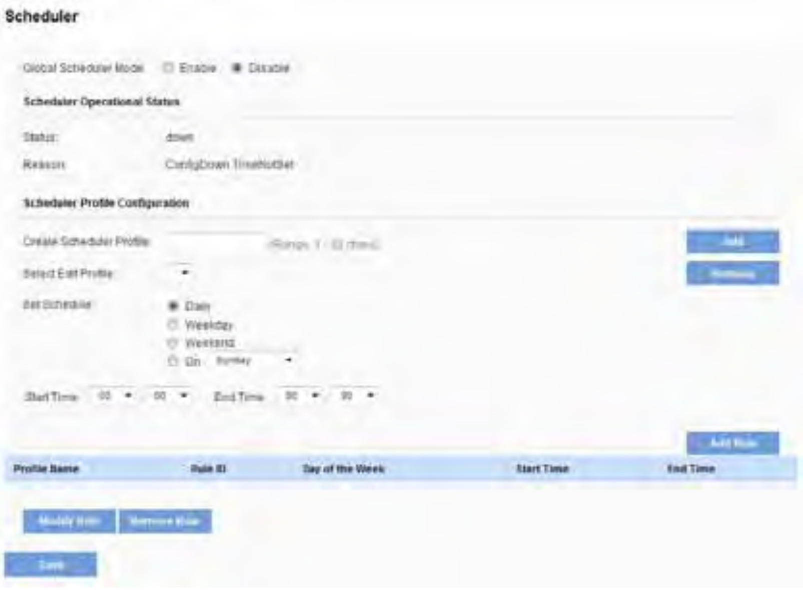
Each rule specifies the start time, end time and day (or days) of the week the radio or VAP can be operational. The rules are periodic in nature and are repeated every week.

A valid rule must contain all of the following parameters:

- Days of the Week
- Start Time (hour and minutes)
- End Time (hour and minutes)

Only valid rules are added to the profile. Up to 16 rules are grouped together to form a scheduling profile. Any two entries belonging to the same profile must not overlap. The time granularity for the schedules is one minute. The LAPAC1750PRO Access Point supports up to 16 profiles.

Figure 27: Scheduler Configuration



Scheduler

Global Scheduler Mode ○ Enable ● Disable

Scheduler Operational Status

Status: down

Reason: ConfigDown TimeNotSet

Scheduler Profile Configuration

Create Scheduler Profile (Range: 1 - 32 chars)

Select Edit Profile

Set Schedule ● Daily ○ Weekday ○ Weekend ○ On Sunday

Start Time 00 00 End Time 00 00

Profile Name	Rule ID	Day of the Week	Start Time	End Time

Table 34: Scheduler Configuration

Field	Description
Global Scheduler Mode	A global switch to enable or disable the scheduler feature. The default is Disable.
Scheduler Operational Status	
Status	The operational status of the scheduler. The range is up or down. The default is down.
Reason	Provides additional information about the status. The reason can be one or more of the following: • IsActive – Operational status is up. • ConfigDown – Operational status is down because global configuration is disabled. • TimeNotSet – Operational status is down because the AP time has not been set, either manually or by specifying an NTP server to use. • ManagedMode– Operational status is down because the AP is in managed mode.
Scheduler Profile	The scheduler profile defines the list of profile names that can be associated to the VAP or Radio configuration. Rules are associated with a named scheduler profile. You can define up to 16 scheduler profile names. By default, no profiles are created. The profile name can be up to 32 alphanumeric characters. Click Add to add the profile name.
Rule Configuration	Each scheduler profile may have up to 16 periodic rules. This table includes the settings you use to configure periodic rules.
Select Profile	Select the profile name from the menu.
Set Schedule	The day of the week. Range is: Daily, Weekday (Monday to Friday), Weekend (Saturday and Sunday), *Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday*. The default is *Daily.*

Start Time	The time when the radio or VAP will be operationally enabled. The time is in HH:MM 24-hour format. The range is <00-23>:<00-59>. The default is 00:00.
End Time	The time when the radio or VAP will be operationally disabled. The time is in HH:MM 24-hour format. The range is <00-23>:<00-59>. The default is 00:00.

After you select a profile from the Select Profile field, the rules that have been added to the selected profile appear in the table below the Rule Configuration area. When you add a new rule to a profile, it appears in the table. Use the Modify Rule and Remove Rule buttons to manage the rules associated with a profile.

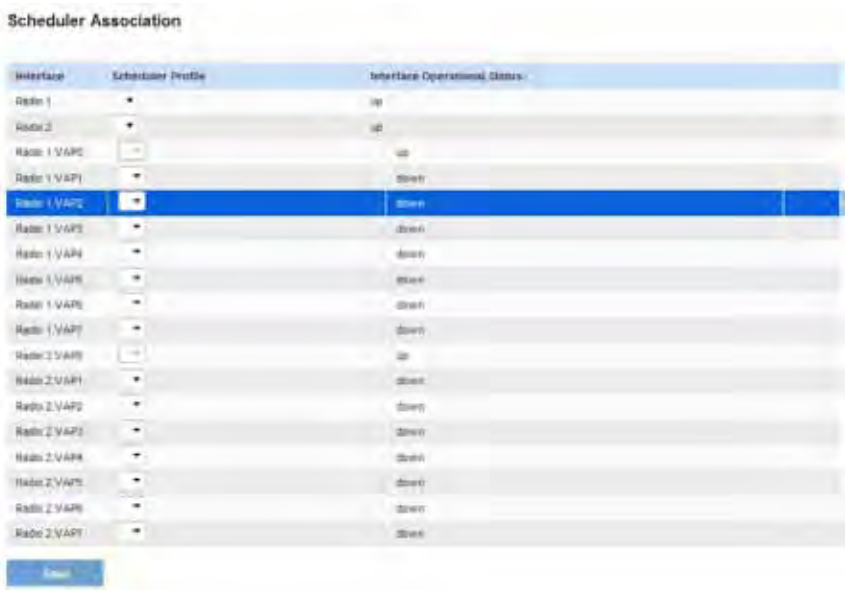
Use the buttons to perform the following tasks:

- Add: To add a scheduler profile, specify the name of the profile in the appropriate field and click Add.
- Remove: To remove a scheduler profile, select it from the Select Profile field in the Rule Configuration table and click Remove.
- Add Rule: After you configure the rule settings, click Add Rule to add the rule to the selected profile.
- Modify Rule: To change an existing rule, select the rule, update the values in the Rule Configuration area, and click Modify Rule.
- Remove Rule: To delete a rule from a profile, select the rule and click Remove Rule.
- Save: After making any modifications, click Save to apply the changes and to save the settings.

Scheduler Association

For a scheduler profile to take effect, you must associate it with at least one radio or VAP interface. To associate the Scheduler profiles, select the Scheduler Association tab in the Manage section. By default, there are no scheduler profiles created, so no profile is associated to any radio or VAP. The scheduler profile needs to be explicitly associated to a radio or VAP configuration. Only one scheduler profile can be associated to any radio or VAP configuration; however, a single profile can be associated to multiple radios or VAPs. If the scheduler profile associated with a VAP or radio is deleted, then the associated profile to the VAP or radio is removed implicitly. If the radio is operationally disabled, then all the VAPs associated to that radio are also operationally disabled irrespective of the VAP configuration.

Figure 28: Scheduler Association



Scheduler Association

Interface	Scheduler Profile	Interface Operational Status
Radio 1		up
Radio 2		up
Radio 1 VAP0		up
Radio 1 VAP1		down
Radio 1 VAP2		down
Radio 1 VAP3		down
Radio 1 VAP4		down
Radio 1 VAP5		down
Radio 1 VAP6		down
Radio 1 VAP7		down
Radio 2 VAP0		up
Radio 2 VAP1		down
Radio 2 VAP2		down
Radio 2 VAP3		down
Radio 2 VAP4		down
Radio 2 VAP5		down
Radio 2 VAP6		down
Radio 2 VAP7		down

The scheduler profiles need to be associated to a radio interface or the VAP interface for applying the periodic rules to a specific radio or VAP.

Table 35: Scheduler Association Settings

Field	Description
Per-Radio Scheduler Association	
Radio	Identifies the radio associated with the rest of the information in the row.
Scheduler Profile	Select the scheduler profile to associate with Radio 1 or Radio 2.
Operational Status	The operational status of the scheduler, which is either up or down.
Per-VAP Scheduler Association	
VAP	Identifies the VAP associated with the rest of the information in the row.
Scheduler Profile	Select the scheduler profile to associate with the desired VAP.
Operational Status	The operational status of the scheduler, which is either up or down.

NOTE:
After you associate a scheduler profile with a radio interface or a VAP interface, you must click Save to apply the changes and to save the settings.

Bandwidth Utilization

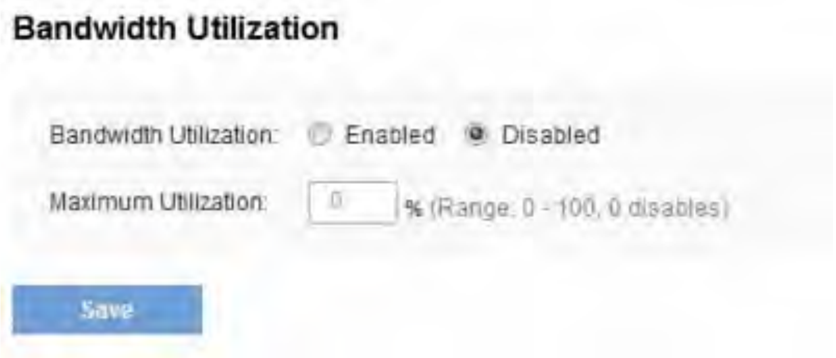
Use this page to load balance the distribution of wireless client connections across multiple access points.

You can set network utilization thresholds on the access point to maintain the speed and performance of the wireless network as clients associate and disassociate with the AP. The load balancing settings apply to both radios, but the load of each radio is calculated independently.

With load balancing, you can ensure that all access points on the network handle a proportionate share of wireless traffic, and that no single access point gets overloaded.

To configure load balancing and set limits and behavior to be triggered by a specified utilization rate of the access point, click the *Configuration* > *Wireless* > *Bandwidth Utilization* tab and save the fields shown in the following figure.

Figure 29: Bandwidth Utilization



Bandwidth Utilization

Bandwidth Utilization: ○ Enabled ● Disabled

Maximum Utilization: 0 % (Range: 0 - 100, 0 disables)

Table 36: Bandwidth Utilization

Field	Description
Bandwidth Utilization	To enable load balancing on this AP, click Enabled. To disable load balancing on this AP, click Disabled.
Maximum Utilization	Provide the percentage of network bandwidth utilization allowed on the radio before the AP stops accepting new client associations. The default is 0, which means that all new associations will be allowed regardless of the utilization rate.

NOTE:
After you configure the load balancing settings, you must click Save to apply the changes and save the changes to startup configuration file . Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

MAC Filtering

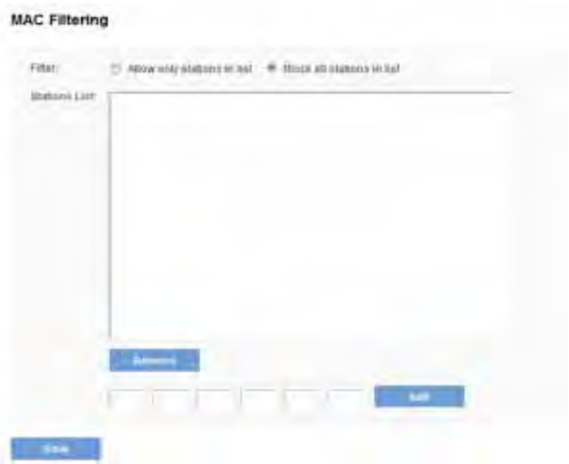
A Media Access Control (MAC) address is a hardware address that uniquely identifies each node of a network. All IEEE 802 network devices share a common 48-bit MAC address format, usually displayed as a string of 12 hexadecimal digits separated by colons, for example 00:DC:BA:09:87:65. Each wireless network interface card (NIC) used by a wireless client has a unique MAC address.

You can use the Administrator UI on the AP or use an external RADIUS server to control access to the network through the AP based on the MAC address of the wireless client. This feature is called MAC Filtering. To control access, you configure a global list of MAC addresses locally on the AP or on an external RADIUS server. Then, you set a filter to specify whether the clients with those MAC addresses are allowed or denied access to the network. When a wireless client attempts to associate with an AP, the AP looks up the MAC address of the client in the local stations list or on the RADIUS server. If it is found, the global allow or deny setting is applied. If it is not found, the opposite is applied.

On the Virtual Access Point (VAP) page, MAC Filtering Type controls whether the AP uses the station list configured locally on the MAC Filtering page or the external RADIUS server. The Allow/Block filter setting on the MAC Filtering page determines whether the clients in the station list (local or RADIUS) can access the network through the AP.

To enable filtering by MAC address, click the *Configuration* > *Wireless* > *MAC Filtering* tab.

Figure 30: MAC Filtering



MAC Filtering

Filter: ○ Allow only stations in list ● Block all stations in list

Stations List

NOTE:
Global MAC Authentication settings apply to all VAPs on both radios.

Table 37: MAC Filtering

Field	Description
Filter	To set the MAC Address Filter, select one of the following options: • Allow only stations in the list. Any station that is not in the stations list is denied access to the network through the AP. • Block all stations in list. Only the stations that appear in the list are denied access to the network through the AP. All other stations are permitted access. **Note**: The filter you select is applied to the clients in the stations list, regardless of whether that station list is local or on the RADIUS server.
Stations List	This is the local list of clients that are either permitted or denied access to the network through the AP. To add a MAC address to the local stations list, enter its 48-bit MAC address into the lower text boxes, then click **Add**. To remove a MAC address from the stations list, select its 48-bit MAC address, then click **Remove**. The stations in the list will either be allowed or denied access based on how you set the filter in the previous field. The Access Point allows up to 512 MAC addresses to be added to the station list. **Note**: If MAC authentication for the VAP is set to Local, the AP uses the stations list to permit or deny the clients access to the network. If the MAC authentication type is set to RADIUS, the AP ignores the MAC addresses configured in this list and uses the list that is stored on the RADIUS server. The MAC authentication type is set on the VAP page.

NOTE:
After you configure local MAC Authentication settings, you must click Update to apply the changes and to save the settings. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

Configuring MAC Authentication on the RADIUS Server

If you use RADIUS MAC authentication for MAC-based access control, you must configure a station list on the RADIUS server. The station list contains client MAC address entries, and the format for the list is described in the following table.

Table 38: Configuring MAC Authentication on the RADIUS Server

RADIUS Server Attribute	Description	Value
User-Name (1)	MAC address of the client station.	Valid Ethernet MAC address.
User-Password (2)	A fixed global password used to lookup a client MAC entry.	NOPASSWORD

WDS Bridge

The Wireless Distribution System (WDS) allows you to connect multiple Access Points. With WDS, APs communicate with one another without wires in a standardized way. This capability is critical in providing a seamless experience for roaming clients and for managing multiple wireless networks. It can also simplify the network infrastructure by reducing the amount of cabling required. You can configure the AP in point-to-point or point-to-multipoint bridge mode based on the number of links to connect.

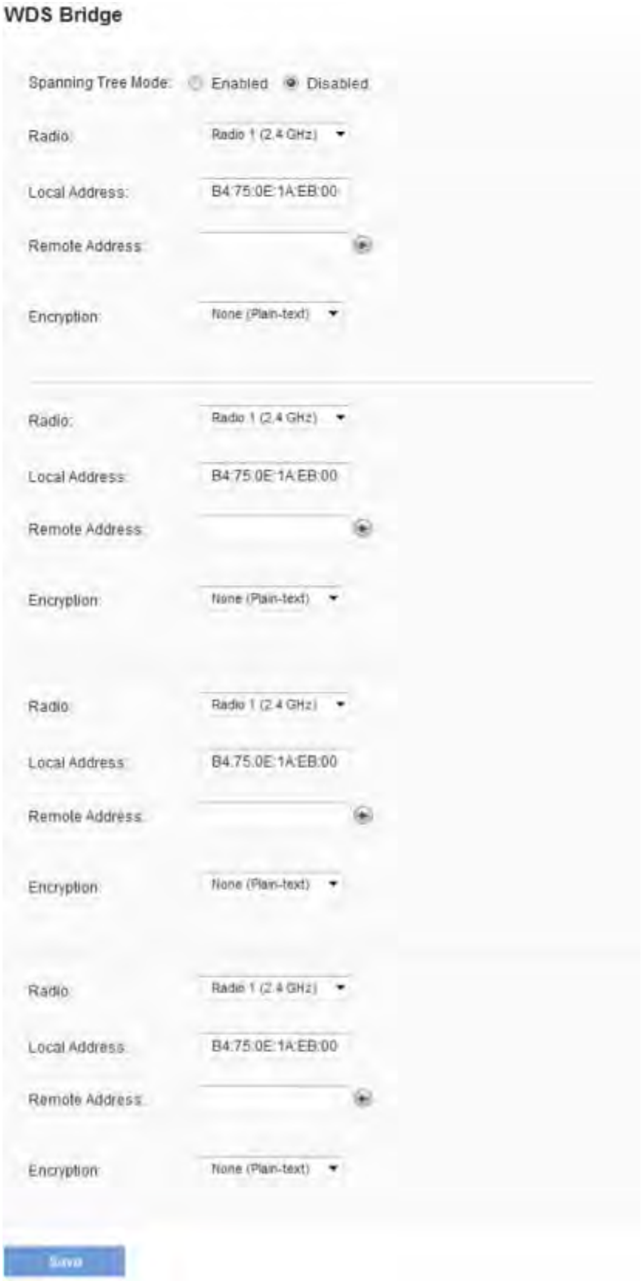
In the point-to-point mode, the AP accepts client associations and communicates with wireless clients and other repeaters. The AP forwards all traffic meant for the other network over the tunnel that is established between the APs. The bridge does not add to the hop count. It functions as a simple OSI layer 2 network device.

In the point-to-multipoint bridge mode, one AP acts as the common link between multiple APs. In this mode, the central AP accepts client associations and communicates with the clients and other repeaters. All other APs associate only with the central AP that forwards the packets to the appropriate wireless bridge for routing purposes.

The access point can also act as a repeater. In this mode, the AP serves as a connection between two APs that might be too far apart to be within cell range. When acting as a repeater, the AP does not have a wired connection to the LAN and repeats signals by using the wireless connection. No special configuration is required for the AP to function as a repeater, and there are no repeater mode settings. Wireless clients can still connect to an AP that is operating as a repeater.

To specify the details of traffic exchange from this access point to others, click the *Configuration* > *Wireless* > *WDS Bridge* tab.

Figure 31: WDS Bridge



WDS Bridge

Spanning Tree Mode: ○ Enabled ● Disabled

Radio: Radio 1 (2.4 GHz)
Local Address: B4:75:0E:1A:EB:00
Remote Address:
Encryption: None (Plain-text)

Radio: Radio 1 (2.4 GHz)
Local Address: B4:75:0E:1A:EB:00
Remote Address:
Encryption: None (Plain-text)

Radio: Radio 1 (2.4 GHz)
Local Address: B4:75:0E:1A:EB:00
Remote Address:
Encryption: None (Plain-text)

Radio: Radio 1 (2.4 GHz)
Local Address: B4:75:0E:1A:EB:00
Remote Address:
Encryption: None (Plain-text)

Before you configure WDS on the AP, note the following guidelines:

- When using WDS, be sure to configure WDS settings on both APs participating in the WDS link.
- You can have only one WDS link between any pair of APs. That is, a remote MAC address may appear only once on the WDS Bridge page for a particular AP.
- Both APs participating in a WDS link must be on the same radio channel and using the same IEEE 802.11 mode. (See Radio for information on configuring the Radio mode and channel.)
- When 802.11h is operational, setting up two WDS links can be difficult.
- If you use WPA encryption on the WDS link over Radio 1, VAP0 of Radio 1 must use WPA Personal or WPA Enterprise as the security mode. If you use WPA on a WDS link over Radio 2, VAP0 of Radio 2 must use WPA Personal or WPA Enterprise as the security mode.
- Channel auto setting is not recommended for all WDS link device both APs participating in the WDS link.

To configure WDS on this AP, describe each AP intended to receive hand-offs and send information to this AP. For each destination AP, configure the fields listed in Table 39.

Table 39: WDS Bridge

Field	Description
Spanning Tree Mode	Spanning Tree Protocol (STP) prevents switching loops. STP is recommended if you configure WDS links. Select Enabled to use STP Select Disabled to turn off STP links (not recommended)
Radio	For each WDS link on a two-radio AP, select Radio 1 or Radio 2. The rest of the settings for the link apply to the radio selected in this field. The read-only local address will change depending on which radio you select in this field.
Local Address	Indicates the MAC addresses for this AP. For each WDS link on a two-radio AP, the local address reflects the MAC address for the internal interface on the selected radio (Radio 1 on wlan0 or Radio 2 on wlan1).
Remote Address	Specify the MAC address of the destination AP; that is, the AP on the other end of the WDS link to which data will be sent or handed-off and from which data will be received. **Note**: Click the drop-down arrow to the right of the Remote Address field to see a list of all the available MAC addresses and their associated SSIDs on the network. Select the appropriate MAC address from the list. The SSID displayed in the drop-down list is simply to help you identify the correct MAC address for the destination AP. This SSID is a separate SSID to that which you set for the WDS link. The two do not (and should not) be the same value or name.
Encryption	You can use no encryption or WPA (PSK) on the WDS link. If you are unconcerned about security issues on the WDS link you may decide not to set any type of encryption. Alternatively, if you have security concerns you can choose WPA (PSK). In WPA (PSK) mode, the AP uses WPA2-PSK with CCMP (AES) encryption over the WDS link. **Note**: In order to configure WPA-PSK on any WDS link, VAP0 of the selected radio must be configured for WPA-PSK or WPA-Enterprise.

If you select None as your preferred WDS encryption option, you will not be asked to fill in any more fields on the WDS Bridge page. All data transferred between the two APs on the WDS link will be unencrypted.

NOTE:
To disable a WDS link, you must remove the value configured in the Remote Address field.

WPA/PSK on WDS Links

The following table describes the additional fields that appear when you select WPA/PSK as the encryption type.

NOTE:
In order to configure WPA-PSK on any WDS link, VAP0 of the selected radio must be configured for WPA-PSK or WPA-Enterprise.

Table 40: WPA/PSK on WDS Links

Field	**Description**
Encryption	WPA (PSK)
SSID	Enter an appropriate name for the new WDS link you have created. This SSID should be different from the other SSIDs used by this AP. However, it is important that the same SSID is also entered at the other end of the WDS link. If this SSID is not the same for both APs on the WDS link, they will not be able to communicate and exchange data. The SSID can be any alphanumeric combination.
Key	Enter a unique shared key for the WDS bridge. This unique shared key must also be entered for the AP at the other end of the WDS link. If this key is not the same for both APs, they will not be able to communicate and exchange data. The WPA-PSK key is a string of at least 8 characters to a maximum of 63 characters. Acceptable characters include upper and lower case alphabetic letters, the numeric digits, and special symbols such as @ and #.

NOTE:
After you configure the WDS settings, you must click Save to apply the changes and to save the settings. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

NOTE:
Partner WDS AP in the remote network retains its management IP address acquired from a DHCP server connected to the WDS AP in the main network even if the WDS link is broken. The IP address is released when the WDS interface is brought administratively down.

Workgroup Bridges

The Workgroup Bridge feature enables the AP to extend the accessibility of a remote network. In Workgroup Bridge mode, the access point acts as a wireless station (STA) on the wireless LAN. It can bridge traffic between a remote wired network or associated wireless clients and the wireless LAN that is connected using the Workgroup Bridge mode.

The Workgroup Bridge feature enables support for STA-mode and AP-mode operation simultaneously. The access point can operate in one BSS as an STA device while operating on another BSS as an access point. When Workgroup Bridge mode is enabled, then the access point supports only one BSS for wireless clients that associate with it, and another BSS to which the access point associates as a wireless client.

It is recommended that Workgroup Bridge mode be used only when the WDS bridge feature cannot be operational with a peer Access Point. WDS is a better solution and is preferred over the Workgroup Bridge solution. The Workgroup Bridge feature should be used only when connecting to AP devices from a different manufacturer. When the Workgroup Bridge feature is enabled, the VAP configurations are not applied; only the Workgroup Bridge configuration is applied.

NOTE:
The WDS feature does not work when the Workgroup Bridge mode is enabled on the access point.

In Workgroup Bridge mode, the BSS managed by the access point while operating in access point mode is referred to as the access point interface, and associated STAs as downstream STAs. The BSS managed by the other access point (that is, the one to which the access point associates as an STA) is referred to as the infrastructure client interface, and the other access point is referred as the upstream AP.

The devices connected to the wired interface of the access point, as well as the downstream stations associated to the access point's access point interface can access the network connected by the infrastructure client interface. To allow the bridging of packets, the VLAN configuration for the access point interface and wired interface should match that of the infrastructure client interface.

Workgroup Bridge mode can be used as range extender to enable the BSS to provide access to remote or hard-to-reach networks. A single-radio can be configured to forward packets from associated STAs to another access point in the same ESS, without using WDS.

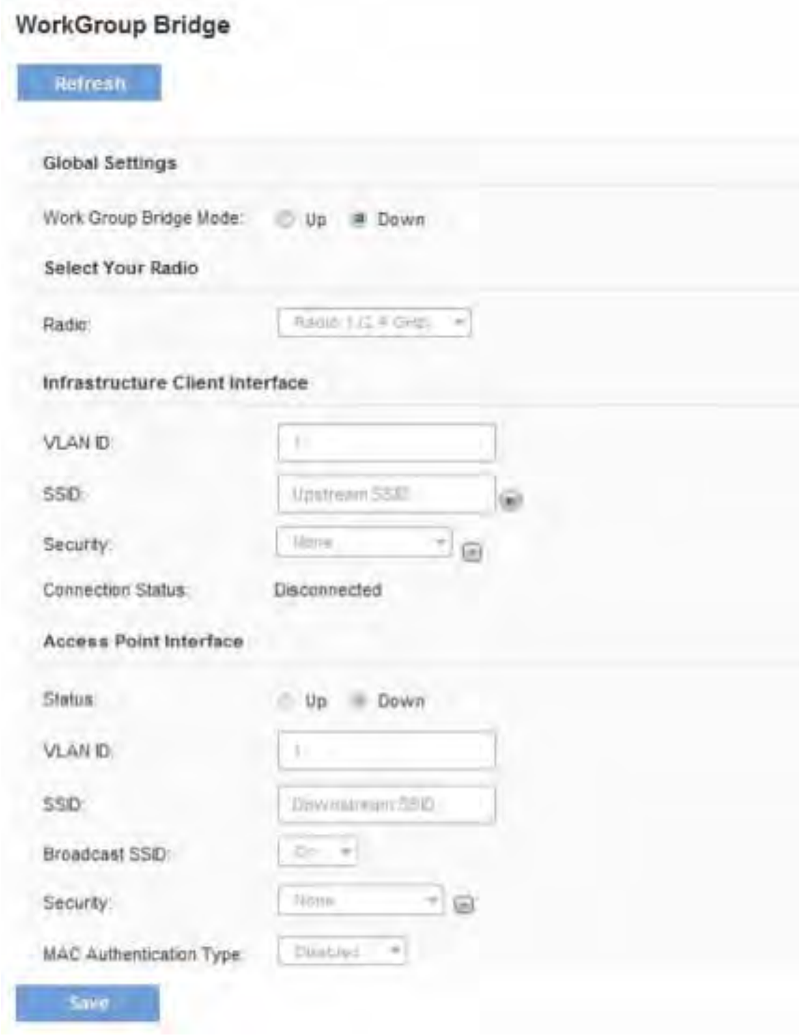
NOTE:
Workgroup Bridge mode currently supports only IPv4 traffic.

NOTE:
Workgroup Bridge mode is not supported across a cluster.

Use the WorkGroup Bridge page to configure the Work Group Bridge mode on the AP and to configure the settings that allow the AP to serve as a bridge between remote clients and the wireless LAN.

To configure the Workgroup Bridge settings, click the *Configuration* > *Wireless* > *WorkGroup Bridge* tab.

Figure 32: Workgroup Bridge



WorkGroup Bridge

Global Settings

Work Group Bridge Mode: ○ Up ● Down

Select Your Radio

Radio: Radio 1 (2.4 GHz)

Infrastructure Client Interface

VLAN ID: 1

SSID: Upstream SSID

Security: None

Connection Status: Disconnected

Access Point Interface

Status: ○ Up ● Down

VLAN ID: 1

SSID: Downstream SSID

Broadcast SSID: On

Security: None

MAC Authentication Type: Disabled

Table 41: Workgroup Bridge

Field	Description
Workgroup Bridge Mode	Set the administrative mode of the Workgroup Bridge feature.
Radio	Select the radio on which to configure Workgroup Bridge mode.
Infrastructure Client Interface	
VLAN ID	The VLAN associated with the BSS.
SSID	The SSID of the Basic Service Set (BSS). The BSS includes upstream access point and all of its connected clients (STAs).
Security	The type of security to use for authenticating as a client station on the upstream access point. Choices are: • None • Static WEP • WPA Personal • WPA Enterprise
Connection Status	The Infrastructure Client Interface will be associated to the upstream access point with the configured credentials. The access point may obtain its IP address from a DHCP server on the upstream link. Alternatively, you can assign a static IP address. The Connection Status field indicates whether the WAP is connected to the upstream access point. Click Refresh to view the latest connection status.
Access Point Interface	
Status	Status is indicated as Up (Enable) or Down (disable). If the downstream interface is down, wireless clients cannot connect to the access point.
VLAN ID	The VLAN ID on the local AP interface. This VLAN ID should be the same VLAN ID as advertised on the Infrastructure Client Interface.
SSID	Specify the SSID to broadcast to downstream clients.
Broadcast SSID	Select this option if you want the downstream SSID to be broadcast to wireless clients.
Security	Select the type of security downstream clients will use to authenticate with the access point. Choices are: • None • WPA Personal • WPA Enterprise
MAC Authentication Type	Select one of the following options for MAC authentication: • Disabled—The set of clients in the APs BSS that can access the upstream network is not restricted to the clients specified in a MAC address list. • Local—The set of clients in the AP's BSS that can access the upstream network is restricted to the clients specified in a locally defined MAC address list. • RADIUS—The set of clients in the AP's BSS that can access the upstream network is restricted to the clients specified in a MAC address list on a RADIUS server. If you select Local or RADIUS, see "MAC Filter" for instructions on creating the MAC filter list.

QoS

Quality of Service (QoS) provides you with the ability to specify parameters on multiple queues for increased throughput and better performance of differentiated wireless traffic like Voice-over-IP (VoIP), other types of audio, video, and streaming media, as well as traditional IP data over the access point.

Configuring QoS on the access point consists of setting parameters on existing queues for different types of wireless traffic, and effectively specifying minimum and maximum wait times (through Contention Windows) for transmission. The settings described here apply to data transmission behavior on the AP only, not to that of the client stations.

AP Enhanced Distributed Channel Access (EDCA) Parameters affect traffic flowing from the AP to the client station.

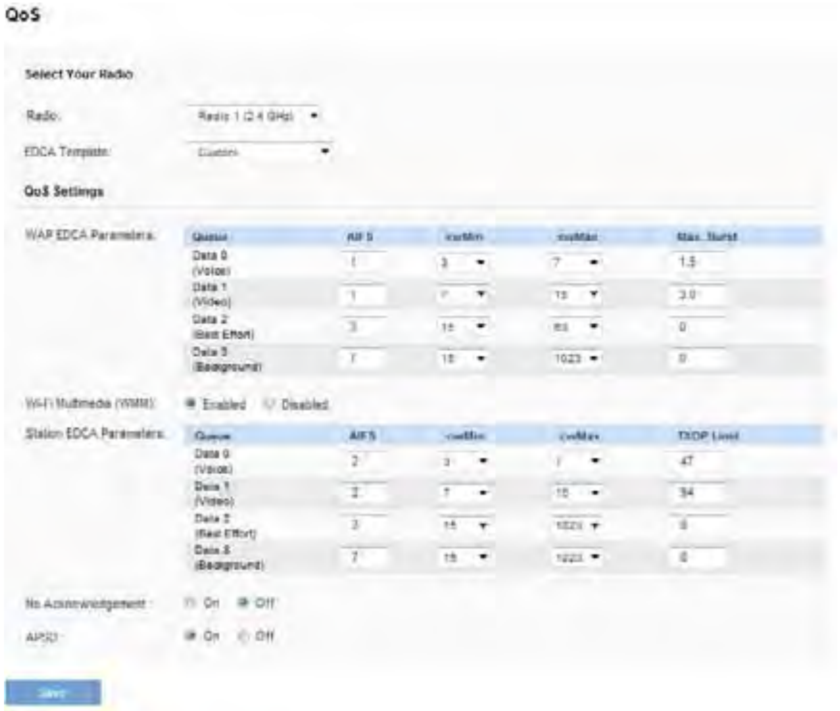
Station Enhanced Distributed Channel Access (EDCA) Parameters affect traffic flowing from the client station to the AP.

The default values for the AP and station EDCA parameters are those suggested by the Wi-Fi Alliance in the Wi-Fi MultiMedia (WMM) specification. In normal use these values should not need to be changed. Changing these values will affect the QoS provided.

NOTE:
The QoS settings apply to both radios, but the traffic for each radio is queued independently.

To set up queues for QoS, click the QoS tab under the Wireless heading and configure settings as described in Table 42.

Figure 33: QoS



QoS

Select Your Radio

Radio: Radio 1 (2.4 GHz)

EDCA Template: Custom

QoS Settings

WAP EDCA Parameters:

Queue	AIFS	cwMin	cwMax	Max. Burst
Data 0 (Voice)	1	3	7	1.5
Data 1 (Video)	1	7	15	3.0
Data 2 (Best Effort)	3	15	63	0
Data 3 (Background)	7	15	1023	0

Wi-Fi Multimedia (WMM): ● Enabled ○ Disabled

Station EDCA Parameters:

Queue	AIFS	cwMin	cwMax	TXOP Limit
Data 0 (Voice)	2	3	7	47
Data 1 (Video)	2	7	15	94
Data 2 (Best Effort)	3	15	1023	0
Data 3 (Background)	7	15	1023	0

No Acknowledgement: ○ On ● Off

APSD: ● On ○ Off

Table 42: QoS Settings

Field	Description
Radio	Select the radio with the QoS settings to view or configure.
EDCA Template	The AP has multiple templates with predefined EDCA parameters. The menu includes the following templates: • Custom • Default • Optimized for Voice You can change the individual EDCA parameters only when the selected EDCA template is Custom.
WAP EDCA Parameters	

Queue	Queues are defined for different types of data transmitted from AP-to-station: • *Data 0 (Voice)*—High priority queue, minimum delay. Time-sensitive data such as VoIP and streaming media are automatically sent to this queue. • *Data 1(Video)*—High priority queue, minimum delay. Time-sensitive video data is automatically sent to this queue. • *Data 2 (best effort)*—Medium priority queue, medium throughput and delay. Most traditional IP data is sent to this queue. • *Data 3 (Background)*—Lowest priority queue, high throughput. Bulk data that requires maximum throughput and is not time-sensitive is sent to this queue (FTP data, for example).
AIFS (Inter-Frame Space)	Arbitration Inter-Frame Spacing (AIFS) specifies a wait time for data frames. The wait time is measured in slots. Valid values for AIFS are 1 through 255.
cwMin(Minimum Contention Window)	This parameter is input to the algorithm that determines the initial random backoff wait time (window) for retry of a transmission. The value specified for Minimum Contention Window is the upper limit (in milliseconds) of a range from which the initial random backoff wait time is determined. The first random number generated will be a number between 0 and the number specified here. If the first random backoff wait time expires before the data frame is sent, a retry counter is incremented and the random backoff value (window) is doubled. Doubling will continue until the size of the random backoff value reaches the number defined in the Maximum Contention Window. Valid values for cwMin are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1023. The value for cwMin must be lower than the value for cwMax.
cwMax (Maximum Contention Window)	The value specified for the Maximum Contention Window is the upper limit (in milliseconds) for the doubling of the random backoff value. This doubling continues until either the data frame is sent or the Maximum Contention Window size is reached. Once the Maximum Contention Window size is reached, retries will continue until a maximum number of retries allowed is reached. Valid values for cwMax are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1023. The value for cwMax must be higher than the value for cwMin.
Max. Burst Length	The Max. Burst Length is an AP EDCA parameter and only applies to traffic flowing from the AP to the client station. This value specifies (in milliseconds) the maximum burst length allowed for packet bursts on the wireless network. A packet burst is a collection of multiple frames transmitted without header information. The decreased overhead results in higher throughput and better performance. Valid values for maximum burst length are 0.0 through 999.
Wi-Fi Multimedia Settings	

Wi-Fi Multimedia	Wi-Fi Multimedia (WMM) is enabled by default. With WMM enabled, QoS prioritization and coordination of wireless medium access is on. With WMM enabled, QoS settings on the access point control downstream traffic flowing from the AP to client station (AP EDCA parameters) and the upstream traffic flowing from the station to the AP (station EDCA parameters). Disabling WMM deactivates QoS control of station EDCA parameters on upstream traffic flowing from the station to the AP. With WMM disabled, you can still set some parameters on the downstream traffic flowing from the AP to the client station (AP EDCA parameters). To disable WMM extensions, click Disabled. To enable WMM extensions, click Enabled.
Station EDCA Parameters	
Queue	Queues are defined for different types of data transmitted from station-to-AP: • *Data 0 (Voice)*—Highest priority queue, minimum delay. Time-sensitive data such as VoIP and streaming media are automatically sent to this queue. • *Data 1(Video)*—Highest priority queue, minimum delay. Time-sensitive video data is automatically sent to this queue. • *Data 2 (best effort)*—Medium priority queue, medium throughput and delay. Most traditional IP data is sent to this queue. • *Data 3 (Background)*—Lowest priority queue, high throughput. Bulk data that requires maximum throughput and is not time-sensitive is sent to this queue (FTP data, for example).
AIFS (Inter-Frame Space)	*Arbitration Inter-Frame Spacing (AIFS)* specifies a wait time for data frames. The wait time is measured in slots. Valid values for AIFS are 1 through 255.

cwMin (Minimum Contention Window)	This parameter is used by the algorithm that determines the initial random backoff wait time (window) for retry of a data transmission during a period of contention for Unified Access Point resources. The value specified here in the Minimum Contention Window is the upper limit (in milliseconds) of a range from which the initial random backoff wait time will be determined. The first random number generated will be a number between 0 and the number specified here. If the first random backoff wait time expires before the data frame is sent, a retry counter is incremented and the random backoff value (window) is doubled. Doubling will continue until the size of the random backoff value reaches the number defined in the Maximum Contention Window.
cwMax (Maximum Contention Window)	The value specified here in the Maximum Contention Window is the upper limit (in milliseconds) for the doubling of the random backoff value. This doubling continues until either the data frame is sent or the Maximum Contention Window size is reached. Once the Maximum Contention Window size is reached, retries will continue until a maximum number of retries allowed is reached.
TXOP Limit	The TXOP Limit is a station EDCA parameter and only applies to traffic flowing from the client station to the AP. The Transmission Opportunity (TXOP) is an interval of time, in milliseconds, when a WME client station has the right to initiate transmissions onto the wireless medium (WM) towards the Unified Access Point. The TXOP Limit maximum value is 65535.
Other QoS Settings	
No Acknowledgement	Select *On* to specify that the AP should not acknowledge frames with QosNoAck as the service class value.

APSD	Select *On* to enable Automatic Power Save Delivery (APSD), which is a power management method. APSD is recommended if VoIP phones access the network through the AP.

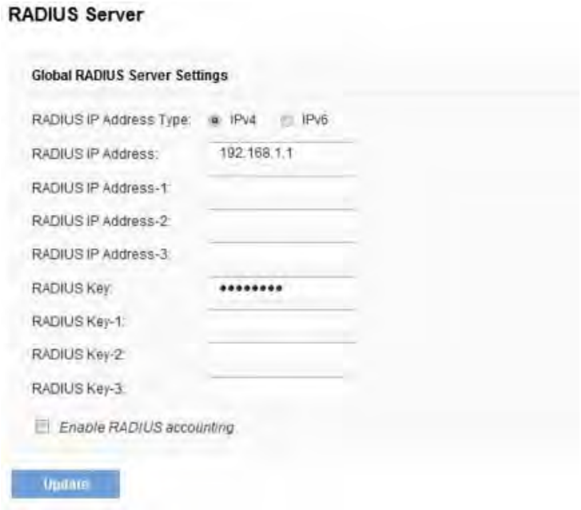
NOTE:
After you configure the QoS settings, you must click Save to apply the changes and save the changes to startup configuration file. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

Security

You can configure up to four global IPv4 or IPv6 RADIUS servers. One of the servers always acts as a primary while the others act as backup servers. The network type (IPv4 or IPv6) and accounting mode are common across all configured RADIUS servers. You can configure each VAP to use the global RADIUS server settings, which is the default, or you can configure a per-VAP RADIUS server set. You can also configure separate RADIUS server settings for each VAP. For example, you can configure one VAP to use an IPv6 RADIUS server while other VAPs use the global IPv4 RADIUS server settings you configure.

To set up multiple VAPs, click **Configuration** > **Security** > **RADIUS Server**.

Figure 34: Setting RADIUS Server



RADIUS Server

Global RADIUS Server Settings

RADIUS IP Address Type: ● IPv4 ○ IPv6

RADIUS IP Address: 192.168.1.1

RADIUS IP Address-1:

RADIUS IP Address-2:

RADIUS IP Address-3:

RADIUS Key: ••••••••

RADIUS Key-1:

RADIUS Key-2:

RADIUS Key-3:

□ Enable RADIUS accounting

Virtual Access Point Settings describes the fields and configuration options on the VAP page.

Table 43: RADIUS Server Settings

Field	Description
RADIUS IP Address Type	Specify the IP version that the RADIUS server uses. You can toggle between the address types to configure IPv4 and IPv6 global RADIUS address settings, but the AP contacts only the RADIUS server or servers for the address type you select in this field.
RADIUS IP Address RADIUS IPv6 Address	Enter the IPv4 or IPv6 address for the primary global RADIUS server. By default, each VAP uses the global RADIUS settings that you define for the AP at the top of the VAP page, see "Virtual Access Point (VAP)". When the first wireless client tries to authenticate with the AP, the AP sends an authentication request to the primary server. If the primary server responds to the authentication request, the AP continues to use this RADIUS server as the primary server, and authentication requests are sent to the address you specify. If the IPv4 RADIUS IP Address Type option is selected in the previous field, enter the IP address of the RADIUS server that all VAPs use by default, for example 192.168.10.23. If the IPv6 RADIUS IP Address Type option is selected, enter the IPv6 address of the primary global RADIUS server, for example 2001:0db8:1234::abcd.
RADIUS IP or IPv6 Address 1–3	Enter up to three IPv4 or IPv6 addresses to use as the backup RADIUS servers. The field label is RADIUS IP Address when the IPv4 RADIUS IP Address Type option is selected and RADIUS IPv6 Address when the IPv6 RADIUS IP Address Type option is selected. If authentication fails with the primary server, each configured backup server is tried in sequence. The IPv4 or IPv6 address must be valid in order for the AP to attempt to contact the server.
RADIUS Key	Enter the RADIUS key in the text box. The RADIUS key is the shared secret key for the global RADIUS server. You can use up to 63 standard alphanumeric and special characters. The key is case sensitive, and you must configure the same key on the AP and on your RADIUS server. The text you enter will be displayed as "*" characters to prevent others from seeing the RADIUS key as you type.
RADIUS Key 1–3	Enter the RADIUS key associated with the configured backup RADIUS servers. The server at RADIUS IP Address-1 uses RADIUS Key-1, RADIUS IP Address-2 uses RADIUS Key-2, and so on.
Enable RADIUS Accounting	Select this option to track and measure the resources a particular user has consumed such as system time, amount of data transmitted and received, and so on. If you enable RADIUS accounting, it is enabled for the primary RADIUS server and all backup servers.

NOTE:
After you configure the VAP settings, you must click Save to apply the changes.

802.1X Supplicant

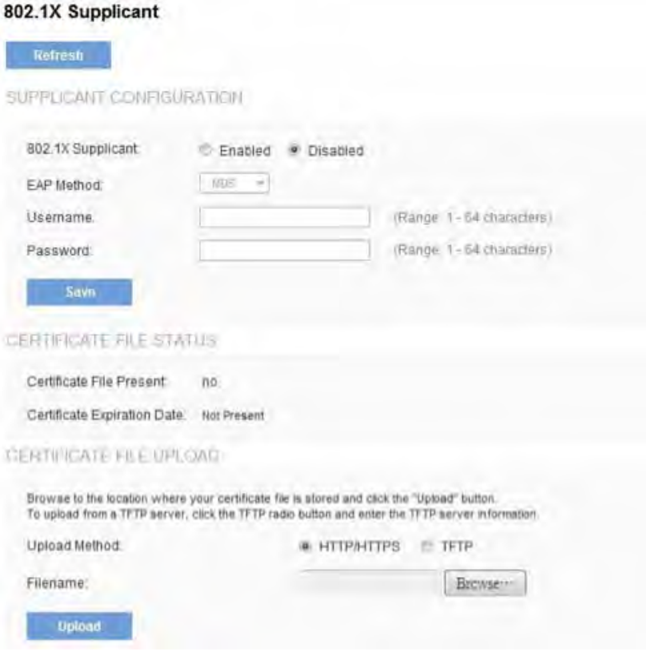
802.1X Supplicant settings allow the access point to gain access to a secured wired network.

Use these settings to enable the access point as an 802.1X supplicant (client) on the wired network. An MD5 user name and password can be configured to allow the access point to authenticate via 802.1X.

On networks that use IEEE 802.1X, port-based network access control, a supplicant cannot gain access to the network until the 802.1X authenticator grants access. If your network uses 802.1X, you must configure 802.1X authentication information that the AP can supply to the authenticator.

To configure the access point 802.1X supplicant user name and password by using the Web interface, click the Configuration > Security > 802.1X Supplicant tab and configure the fields shown in Table 44.

Figure 35: 802.1X Supplicant



802.1X Supplicant: ○ Enabled ● Disabled

EAP Method: MD5

Username: (Range 1 - 64 characters)

Password: (Range 1 - 64 characters)

Certificate File Present: no

Certificate Expiration Date: Not Present

Browse to the location where your certificate file is stored and click the "Upload" button.
To upload from a TFTP server, click the TFTP radio button and enter the TFTP server information.

Upload Method: ● HTTP/HTTPS ○ TFTP

Filename:

Table 44: 802.1X Supplicant Authentication

Field	Description
Supplicant Configuration	
802.1X Supplicant	Click Enabled to enable the Administrative status of the 802.1X Supplicant. Click Disabled to disable the Administrative status of the 802.1X Supplicant.
EAP Method	Select the algorithm to be used for encrypting authentication user names and passwords. The options are as follows: • MD5—A hash function defined in RFC 3748 that provides basic security. • PEAP—Protected Extensible Authentication Protocol, which provides a higher level of security than MD5 by encapsulating it within a TLS tunnel. • TLS—Transport Layer Security, as defined in RFC 5216, an open standard that provides a high level of security.
Username	Enter the MD5 user name for the AP to use when responding to requests from an 802.1X authenticator. The user name can be up to 64 characters. ASCII printable characters are allowed, which includes upper and lower case alphabetic letters, the numeric digits, and special symbols such as @ and #.
Password	Enter the MD5 password for the AP to use when responding to requests from an 802.1X authenticator. The password can be up1 to 64 characters. ASCII printable characters are allowed, which includes upper and lower case letters, numbers, and special symbols such as @ and #.
Certificate File Status	
Certificate File Present	Indicates if the HTTP SSL Certificate file is present. Range is yes or no. The default is no.
Certificate Expiration Date	Indicates when the HTTP SSL Certificate file will expire. The range is a valid date. If no certificate file exists on the AP, the field displays Not Present.
Certificate File Upload	

Upload Method	Select the method to use for uploading a certificate file to the AP, which is either HTTP/HTTPS (upload by Web browser) or TFTP (upload by TFTP server).
Filename	Specify the path and filename of the certificate file: • For HTTP uploads, click Browse to find the location where the certificate file is stored. Select the file to upload to the access point. Click Upload to initiate the file transfer. • For TFTP uploads, enter the filename, including the path, of the certificate to upload to the access point.
Server IP (TFTP Upload Only)	The IPv4 or IPv6 address of the TFTP server where the file is located. The default is 0.0.0.0. After you specify the filename and server IP, click Upload to initiate the file transfer.

NOTE:
After you configure the settings on the 802.1X Supplicant page, you must click Save to apply the changes. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

QoS and Access Control

This section describes how to configure QoS settings that affect traffic from the wireless clients to the AP. By using the access point Client QoS features, you can limit bandwidth and apply ACLs and DiffServ policies to the wireless interface.

This section describes the following features:

- Global Settings.
- ACL
- Class Map
- Policy Map
- Client QoS Status

Global Settings

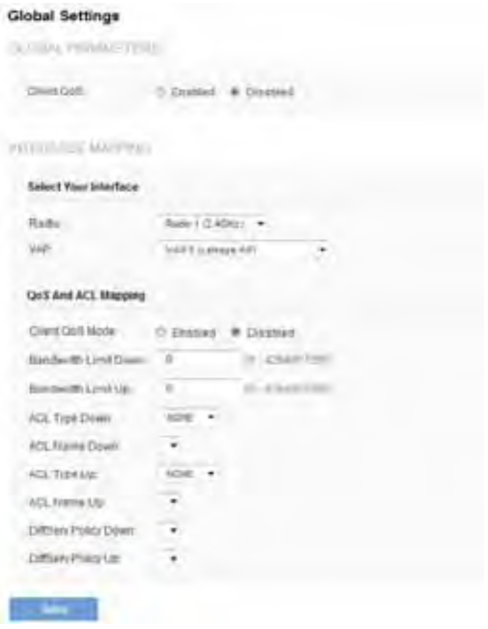
The client QoS features on the access point provide additional control over certain QoS aspects of wireless clients that connect to the network, such as the amount of bandwidth an individual client is allowed to send and receive. To control general categories of traffic, such as HTTP traffic or traffic from a specific subnet, you can configure ACLs and assign them to one or more VAPs.

In addition to controlling general traffic categories, Client QoS allows you to configure per-client conditioning of various micro-flows through Differentiated Services (DiffServ). DiffServ policies are a useful tool for establishing general micro-flow definition and treatment characteristics that can be applied to each wireless client, both inbound and outbound, when it is authenticated on the network.

From the **Global Settings page**, you can enable the Client QoS feature, specify client bandwidth limits, and select the ACLs and DiffServ policies to use as default values for clients associated with the VAP when the client does not have their own attributes defined by a RADIUS server.

To enabled or disabled the Client QoS and to configure the QoS settings for a VAP, click the *Configuration > QoS and Access Control > Global Settings* tab.

Figure 36: QoS Global Settings



Global Settings

GLOBAL PARAMETERS

Client QoS ○ Enabled ● Disabled

INTERFACE MAPPING

Select Your Interface

Radio: Radio 1 (2.4GHz)

VAP: [illegible]

QoS And ACL Mapping

Client QoS Mode ○ Enabled ● Disabled

Bandwidth Limit Down: 0 [illegible]

Bandwidth Limit Up: 0 [illegible]

ACL Type Down: NONE

ACL Name Down:

ACL Type Up: NONE

ACL Name Up:

DiffServ Policy Down:

DiffServ Policy Up:

Table 45: QoS Global Settings

Field	Description
Client QoS	Enable or disable Client QoS operation on the AP. Changing this setting will not affect the WMM settings you configure on the QoS page.
Radio	Select Radio 1 or Radio 2 to specify which radio to configure.
VAP	Specify the VAP that will have the Client QoS settings that you configure. The QoS settings you configure for the selected VAP will not affect clients that access the network through other VAPs.
Client QoS Mode	Enable or disable QoS operation on the VAP selected in the VAP menu. QoS must be enabled globally (from the Client QoS field) and on the VAP for the Client QoS settings to be applied to wireless clients.
Bandwidth Limit Down	Enter the maximum allowed transmission rate from the AP to the wireless client in bits per second. The valid range is 0–429496000 bits/sec. The value you enter must be a multiple of 8000 bits/sec, in other words, the value must be n × 8000 bits/sec, where n = 0, 1, 2, 3... If you attempt to set the limit to a value that is not a multiple of 8000 bits/sec, the configuration will be rejected. A value of 0 means that the bandwidth maximum limit is not enforced in this direction.
Bandwidth Limit Up	Enter the maximum allowed client transmission rate to the AP in bits per second. The valid range is 0–4294967295 bps. The value you enter must be n × 8000 bits/sec, where n = 0, 1, 2, 3... If you attempt to set the limit to a value that is not a multiple of 8000 bits/sec, the configuration will be rejected. A value of 0 means that the bandwidth maximum limit is not enforced in this direction.

ACL Type Down	Select the type of ACL to apply to traffic in the outbound (down) direction, which can be one of the following: • IPv4: The ACL examines IPv4 packets for matches to ACL rules • IPv6: The ACL examines IPv6 packets for matches to ACL rules • MAC: The ACL examines layer 2 frames for matches to ACL rules
ACL Name Down	Select the name of the ACL applied to traffic in the outbound (down) direction. After switching the packet or frame to the outbound interface, the ACL's rules are checked for a match. The packet or frame is transmitted if it is permitted, and discarded if it is denied.
ACL Type Up	Select the type of ACL to apply to traffic in the inbound (up) direction, which can be one of the following: • IPv4: The ACL examines IPv4 packets for matches to ACL rules • IPv6: The ACL examines IPv6 packets for matches to ACL rules • MAC: The ACL examines Layer 2 frames for matches to ACL rules
ACL Name Up	Select the name of the ACL applied to traffic entering the AP in the inbound (up) direction. When a packet or frame is received by the AP, the ACL's rules are checked for a match. The packet or frame is processed if it is permitted, and discarded if it is denied.
DiffServ Policy Down	Select the name of the DiffServ policy applied to traffic from the AP in the outbound (down) direction.
DiffServ Policy Up	Select the name of the DiffServ policy applied to traffic sent to the AP in the inbound (up) direction.

ACL

ACLs are a collection of permit and deny conditions called rules, that provide security by blocking unauthorized users and allowing authorized users to access specific resources. ACLs can block any unwarranted attempts to reach network resources.

The access point supports up to 50 IPv4, IPv6, and MAC ACLs.

IPv4 and IPv6 ACLs

IP ACLs classify traffic for Layers 3 and 4.

Each ACL is a set of up to 10 rules applied to traffic sent from a wireless client or to be received by a wireless client. Each rule specifies whether the contents of a given field should be used to permit or deny access to the network. Rules can be based on various criteria and may apply to one or more fields within a packet, such as the source or destination IP address, the source or destination L4 port, or the protocol carried in the packet.

ACL Configuration Process

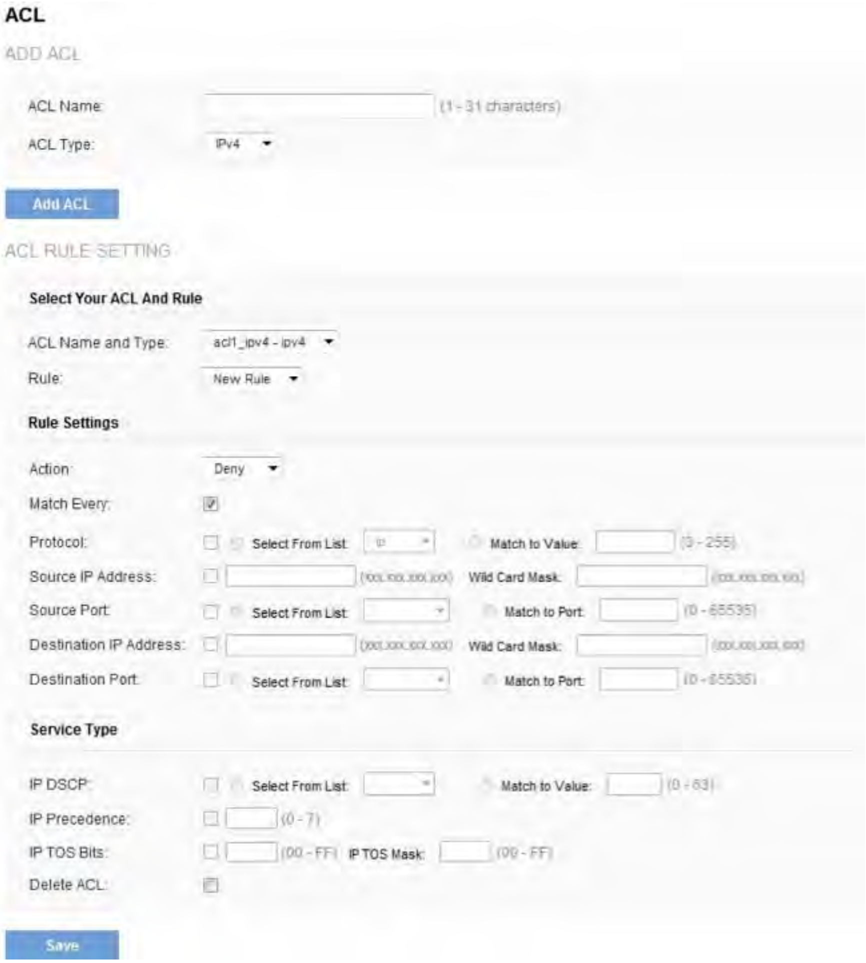
Configure ACLs and rules on the ACL page (steps 1–5), and then apply the rules to a specified VAP on the Global Settings page (step 6).

Use the following general steps to configure ACLs:

1. Specify a name for the ACL.
2. Select the type of ACL to add.
3. Add the ACL
4. Add new rules to the ACL.
5. Configure the match criteria for the rules.
6. Apply the ACL to one or more VAPs.

To configure an ACL click the Configuration >Qos and Access Control > ACL tab. The following figure shows the page after an IPv4 ACL has been created.

Figure 37: ACL



ACL

ADD ACL

ACL Name: (1 - 31 characters)

ACL Type: IPv4

Add ACL

ACL RULE SETTING

Select Your ACL And Rule

ACL Name and Type: acl1_ipv4 - ipv4

Rule: New Rule

Rule Settings

Action: Deny

Match Every: ☑

Protocol: □ ○ Select From List: IP ○ Match to Value: (0 - 255)

Source IP Address: □ (xxx.xxx.xxx.xxx) Wild Card Mask: (xxx.xxx.xxx.xxx)

Source Port: □ ○ Select From List: ○ Match to Port: (0 - 65535)

Destination IP Address: □ (xxx.xxx.xxx.xxx) Wild Card Mask: (xxx.xxx.xxx.xxx)

Destination Port: □ ○ Select From List: ○ Match to Port: (0 - 65535)

Service Type

IP DSCP: □ ○ Select From List: ○ Match to Value: (0 - 63)

IP Precedence: □ (0 - 7)

IP TOS Bits: □ (00 - FF) IP TOS Mask: (00 - FF)

Delete ACL: □

Save

Table 46: ACL Configuration

Field	Description
ACL	
ACL Name	Enter a name to identify the ACL. The name can contain from 1–31 alphanumeric characters and the following special characters: hyphen, underscore, backslash and colon. Spaces are not allowed.
ACL Type	Select the type of ACL to configure: • IPv4 • IPv6 • MAC IPv4 and IPv6 ACLs control access to network resources based on Layer 3 and Layer 4 criteria. MAC ACLs control access based on Layer 2 criteria.
ACL RULE SETTING	
ACL Name and Type	Select the ACL to configure with the new rule. The list contains all ACLs added in the ACL Configuration section.
Rule	To configure a new rule to add to the selected ACL, select New Rule. To add an existing rule to an ACL or to modify a rule, select the rule number. When an ACL has multiple rules, the rules are applied to the packet or frame in the order in which you add them to the ACL. There is an implicit deny all rule as the final rule.

Action	Specifies whether the ACL rule permits or denies an action. • When you select Permit, the rule allows all traffic that meets the rule criteria to enter or exit the AP (depending on the ACL direction you select). Traffic that does not meet the criteria is dropped. • When you select Deny, the rule blocks all traffic that meets the rule criteria from entering or exiting the AP (depending on the ACL direction you select). Traffic that does not meet the criteria is forwarded unless this rule is the final rule. Because there is an implicit deny all rule at the end of every ACL, traffic that is not explicitly permitted is dropped.
Match Every	Indicates that the rule, which either has a permit or deny action, will match the frame or packet regardless of its contents. If you select this field, you cannot configure any additional match criteria. The Match Every option is selected by default for a new rule. You must clear the option to configure other match fields.
IPv4 ACL	
Protocol	Select the Protocol field to use a Layer 3 or Layer 4 protocol match condition based on the value of the IP Protocol field in IPv4 packets or the Next Header field of IPv6 packets. Once you select the field, choose the protocol to match by keyword or enter a protocol ID. **Select From List** Select one of the following protocols from the list: • IP • ICMP • IGMP • TCP • UDP **Match to Value** To match a protocol that is not listed by name, enter the protocol ID. The protocol ID is a standard value assigned by the IANA. The range is a number from 0–255.
Source IP Address	Select this field to require a packet's source IP address to match the address listed here. Enter an IP address in the appropriate field to apply this criterion.
Wild Card Mask	Specifies the source/destination IP address wildcard mask. The wild card mask determines which bits are used and which bits are ignored. A wild card mask of 255.255.255.255 indicates that no bit is important. A wildcard of 0.0.0.0 indicates that all of the bits are important. This field is required when Source IP Address is checked. A wild card mask is in essence the inverse of a subnet mask. For example, to match the criteria to a single host address, use a wildcard mask of 0.0.0.0. To match the criteria to a 24-bit subnet (for example, 192.168.10.0/24), use a wild card mask of 0.0.0.255.

Source Port	Select this field to include a source port in the match condition for the rule. The source port is identified in the datagram header. Once you select the field, choose the port name or enter the port number. *Select From List* Select the keyword associated with the source port to match: • ftp • ftpdata • http • smtp • snmp • telnet • tftp • www Each of these keywords translates into its equivalent port number. *Match to Port* Enter the IANA port number to match to the source port identified in the datagram header. The port range is 0–65535 and includes three different types of ports: • 0–1023: Well Known Ports • 1024–49151: Registered Ports • 49152–65535: Dynamic and/or Private Ports
Destination IP Address	Select this field to require a packet's destination IP address to match the address listed here. Enter an IP address in the appropriate field to apply this criterion.
Destination Port	Select this field to include a destination port in the match condition for the rule. The destination port is identified in the datagram header. Once you select the field, choose the port name or enter the port number. *Select From List* Select the keyword associated with the destination port to match: • ftp • ftpdata • http • smtp • snmp • telnet • tftp • www Each of these keywords translates into its equivalent port number. *Match to Port* Enter the IANA port number to match to the destination port identified in the datagram header. The port range is 0–65535 and includes three different types of ports: • 0–1023: Well Known Ports • 1024–49151: Registered Ports • 49152–65535: Dynamic and/or Private Ports
IP TOS Bits	Select this field and enter a value to use the packet's Type of Service bits in the IP header as match criteria. The IP TOS field in a packet is defined as all eight bits of the Service Type octet in the IP header. The TOS Bits value is a two-digit hexadecimal number from 00 to ff. The high-order three bits represent the IP precedence value. The high-order six bits represent the IP Differentiated Services Code Point (DSCP) value.

IP TOS Mask	Enter an IP TOS mask value to identify the bit positions in the TOS Bits value that are used for comparison against the IP TOS field in a packet. The TOS Mask value is a two-digit hexadecimal number from 00 to ff, representing an inverted (i.e. wildcard) mask. The zero-valued bits in the TOS Mask denote the bit positions in the TOS Bits value that are used for comparison against the IP TOS field of a packet. For example, to check for an IP TOS value having bits 7 and 5 set and bit 1 clear, where bit 7 is most significant, use a TOS Bits value of a0 and a TOS Mask of 00. This is an optional configuration.
IPv6 ACL	
Protocol	Select the Protocol field to use a Layer 3 or Layer 4 protocol match condition based on the value of the IP Protocol field in IPv4 packets or the Next Header field of IPv6 packets. Once you select the field, choose the protocol to match by keyword or protocol ID.
Source IPv6 Address	Select this field to require a packet's source IPv6 address to match the address listed here. Enter an IPv6 address in the appropriate field to apply this criterion.
Source IPv6 Prefix Len	Enter the prefix length of the source IPv6 address.
Source Port	Select this option to include a source port in the match condition for the rule. The source port is identified in the datagram header. Once you select the option, choose the port name or enter the port number.
Destination IPv6 Address	Select this field to require a packet's destination IPv6 address to match the address listed here. Enter an IPv6 address in the appropriate field to apply this criterion.
Destination IPv6 Prefix Len	Enter the prefix length of the destination IPv6 address.
Source Port Range	Enter the port range to match to the source port identified in the datagram header. The port range is 0–65535 and includes three different types of ports: • 0–1023: Well Known Ports • 1024–49151: Registered Ports • 49152–65535: Dynamic and/or Private Ports To specify a single port, use the same value for the start and end range.
Destination Port	Select this option to include a destination port in the match condition for the rule. The destination port is identified in the datagram header. Once you select the option, choose the port name or enter the port number.
IPv6 Flow Label	Flow label is 20-bit number that is unique to an IPv6 packet. It is used by end stations to signify quality-of-service handling in routers (range 0 to 1048575).
MAC ACL	

EtherType	Select the EtherType field to compare the match criteria against the value in the header of an Ethernet frame. Select an EtherType keyword or enter an EtherType value to specify the match criteria. *Select from List Select* Select one of the following protocol types: • appletalk • arp • ipv4 • ipv6 • ipx • netbios • pppoe *Match to Value* Enter a custom protocol identifier to which packets are matched. The value is a four-digit hexadecimal number in the range of 0600–FFFF.
Class of Service	Select this field and enter an 802.1p user priority to compare against an Ethernet frame. The valid range is 0–7. This field is located in the first/only 802.1Q VLAN tag.
Source MAC Address	Select this field and enter the source MAC address to compare against an Ethernet frame.
Source MAC Mask	Select this field and enter the source MAC address mask specifying which bits in the source MAC to compare against an Ethernet frame. A 0 indicates that the address bit is significant, and an f indicates that the address bit is to be ignored. A MAC mask of 00:00:00:00:00:00 matches a single MAC address.
Destination MAC Address	Select this field and enter the destination MAC address to compare against an Ethernet frame.
Destination MAC Mask	Enter the destination MAC address mask specifying which bits in the destination MAC to compare against an Ethernet frame. A 0 indicates that the address bit is significant, and an f indicates that the address bit is to be ignored. A MAC mask of 00:00:00:00:00:00 matches a single MAC address.
VLAN ID	Select this field and enter the VLAN IDs to compare against an Ethernet frame. This field is located in the first/only 802.1Q VLAN tag.

After you set the desired rule criteria, click **Save**. To delete an ACL, select the Delete ACL option and click **Save**.

Class Map

The Client QoS feature contains Differentiated Services (DiffServ) support that allows traffic to be classified into streams and given certain QoS treatment in accordance with defined per-hop behaviors.

Standard IP-based networks are designed to provide best effort data delivery service. Best effort service implies that the network delivers the data in a timely fashion, although there is no guarantee that it will. During times of congestion, packets may be delayed, sent sporadically, or dropped. For typical Internet applications, such as e-mail and file transfer, a slight degradation in service is acceptable and in many cases unnoticeable. However, on applications with strict timing requirements, such as voice or multimedia, any degradation of service has undesirable effects.

By classifying the traffic and creating policies that define how to handle these traffic classes, you can make sure that time-sensitive traffic is given precedence over other traffic.

The access point supports up to 50 class maps.

Defining DiffServ

To use DiffServ for Client QoS, use the Configuration > Qos and Access Control > Class Map and Configuration > Qos and Access Control > Policy Map pages to define the following categories and their criteria:

- Class: create classes and define class criteria
- Policy: create policies, associate classes with policies, and define policy statements

Once you define the class and associate it with a policy, apply the policy to a specified VAP on the Global Settings page.

Packets are classified and processed based on defined criteria. The classification criteria are defined by class. The processing is defined by a policy's attributes. Policy attributes may be defined on a per-class instance basis, and it is these attributes that are applied when a match occurs. A policy can contain multiple classes. When the policy is active, the actions taken depend on which class matches the packet.

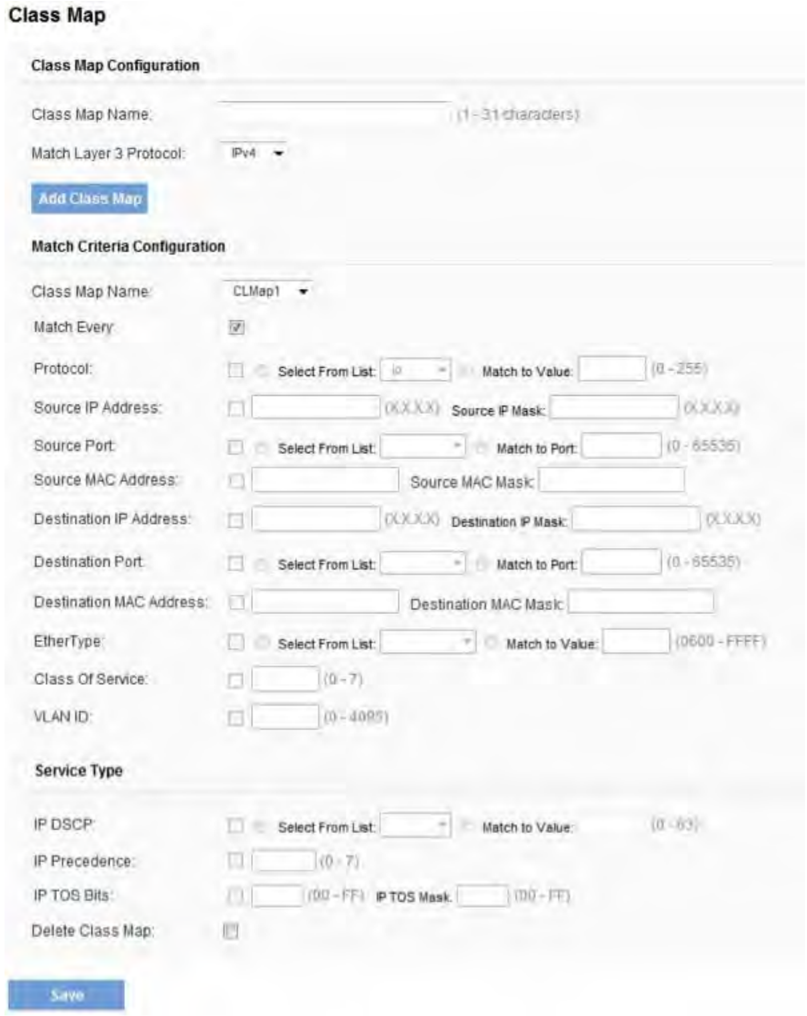
Packet processing begins by testing the class match criteria for a packet. A policy is applied to a packet when a class match within that policy is found. DiffServ is supported for IPv4 and IPv6 packets.

Use the Class Map page to add a new Diffserv class name, or to rename or delete an existing class, and define the criteria to associate with the DiffServ class.

To configure a DiffServ Class Map, click the *Configuration* > *Qos and Access Control* > *Class Map* tab.

NOTE:
The Class Map page displays the Match Criteria Configuration fields only if a class map has been created. To create a class map, enter a name in the Class Map Name field and click Add Class Map.

Figure 38: QoS DiffServ Class Map



Class Map

Class Map Configuration

Class Map Name: (1 - 31 characters)

Match Layer 3 Protocol: IPv4

Match Criteria Configuration

Class Map Name: CLMap1

Match Every: ☑

Protocol: □ ○ Select From List: ip ○ Match to Value: (0 - 255)

Source IP Address: □ (X.X.X.X) Source IP Mask: (X.X.X.X)

Source Port: □ ○ Select From List: ○ Match to Port: (0 - 65535)

Source MAC Address: □ Source MAC Mask:

Destination IP Address: □ (X.X.X.X) Destination IP Mask: (X.X.X.X)

Destination Port: □ ○ Select From List: ○ Match to Port: (0 - 65535)

Destination MAC Address: □ Destination MAC Mask:

EtherType: □ ○ Select From List: ○ Match to Value: (0600 - FFFF)

Class Of Service: □ (0 - 7)

VLAN ID: □ (0 - 4095)

Service Type

IP DSCP: □ ○ Select From List: ○ Match to Value: (0 - 63)

IP Precedence: □ (0 - 7)

IP TOS Bits: □ (00 - FF) IP TOS Mask: (00 - FF)

Delete Class Map: □

Table 47: DiffServ Class Map

Field	Description
Class Map Configuration	
Class Map Name	The name can range from 1 to 31 alphanumeric characters.
Match Layer 3 Protocol	Specify whether to classify IPv4 or IPv6 packets.
Match Criteria Configuration	
Class Map Name	Select name of the class to configure. Use the fields in the Match Criteria Configuration area to match packets to a class. Select the check box for each field to be used as a criterion for a class and enter data in the related field. You can have multiple match criteria in a class. **Note**: The match criteria fields that are available depend on whether the class map is an IPv4 or IPv6 class map.
Match Every	Select Match Every to specify that the match condition is true to all the parameters in a Layer 3 packet. All Layer 3 packets will match a Match Every match condition.
Protocol	Select the Protocol field to use a Layer 3 or Layer 4 protocol match condition based on the value of the IP Protocol field in IPv4 packets or the Next Header field of IPv6 packets. Once you select the field, choose the protocol to match by keyword or enter a protocol ID. **Select From List** Select one of the following protocols from the list: • IP • ICMP • IPv6 • ICMPv6 • IGMP • TCP • UDP **Match to Value** To match a protocol that is not listed by name, enter the protocol ID. The protocol ID is a standard value assigned by the IANA. The range is a number from 0–255.
IPv4 Class Maps	
Source IP Address	Select this field to require a packet's source IP address to match the address listed here. Enter an IP address in the appropriate field to apply this criterion.
Source IP Mask	Enter the source IP address mask. The mask for DiffServ is a network-style bit mask in IP dotted decimal format indicating which part(s) of the destination IP Address to use for matching against packet content. A DiffServ mask of 255.255.255.255 indicates that all bits are important, and a mask of 0.0.0.0 indicates that no bits are important. The opposite is true with an ACL wild card mask. For example, to match the criteria to a single host address, use a mask of 255.255.255.255. To match the criteria to a 24-bit subnet (for example, 192.168.10.0/24), use a mask of 255.255.255.0.

Destination IP Address	Select this field to require a packet's destination IP address to match the address listed here. Enter an IP address in the appropriate field to apply this criterion.
Destination IP Mask	Enter the destination IP address mask. The mask for DiffServ is a network-style bit mask in IP dotted decimal format indicating which part(s) of the destination IP Address to use for matching against packet content. A DiffServ mask of 255.255.255.255 indicates that all bits are important, and a mask of 0.0.0.0 indicates that no bits are important. The opposite is true with an ACL wild card mask. For example, to match the criteria to a single host address, use a mask of 255.255.255.255. To match the criteria to a 24-bit subnet (for example 192.168.10.0/24), use a mask of 255.255.255.0.
IPv6 Class Maps	
Source IPv6 Address	Select this field to require a packet's source IPv6 address to match the address listed here. Enter an IPv6 address in the appropriate field to apply this criterion.
Source IPv6 Prefix Length	Enter the prefix length of the source IPv6 address.
Destination IPv6 Address	Select this field to require a packet's destination IPv6 address to match the address listed here. Enter an IPv6 address in the appropriate field to apply this criterion.
Destination IPv6 Prefix Length	Enter the prefix length of the destination IPv6 address.
IPv6 Flow Label	Flow label is 20-bit number that is unique to an IPv6 packet. It is used by end stations to signify QoS handling in routers (range 0 to 1048575).
IPv4 and IPv6 Class Maps	

Source Port	Select this field to include a source port in the match condition for the rule. The source port is identified in the datagram header. Once you select the field, choose the port name or enter the port number. **Select From List** Select the keyword associated with the source port to match: • ftp • ftpdata • http • smtp • snmp • telnet • tftp • www Each of these keywords translates into its equivalent port number. **Match to Port** Enter the IANA port number to match to the source port identified in the datagram header. The port range is 0–65535 and includes three different types of ports: • 0–1023: Well Known Ports • 1024–49151: Registered Ports • 49152–65535: Dynamic and/or Private Ports

Destination Port	Select this field to include a destination port in the match condition for the rule. The destination port is identified in the datagram header. Once you select the field, choose the port name or enter the port number. **Select From List** Select the keyword associated with the destination port to match: • ftp • ftpdata • http • smtp • snmp • telnet • tftp • www Each of these keywords translates into its equivalent port number. **Match to Port** Enter the IANA port number to match to the destination port identified in the datagram header. The port range is 0–65535 and includes three different types of ports: • 0–1023: Well Known Ports • 1024–49151: Registered Ports • 49152–65535: Dynamic and/or Private Ports

EtherType	Select the EtherType field to compare the match criteria against the value in the header of an Ethernet frame. Select an EtherType keyword or enter an EtherType value to specify the match criteria. **Select from List Select** Select one of the following protocol types: • appletalk • arp • ipv4 • ipv6 • ipx • netbios • pppoe **Match to Value** Enter a custom protocol identifier to which packets are matched. The value is a four-digit hexadecimal number in the range of 0600–FFFF.
Class of Service	Select the field and enter a class of service 802.1p user priority value to be matched for the packets. The valid range is 0–7.
Source MAC Address	Select this field and enter the source MAC address to compare against an Ethernet frame.
Source MAC Mask	Enter the source MAC address mask specifying which bits in the destination MAC to compare against an Ethernet frame. An f indicates that the address bit is significant, and a 0 indicates that the address bit is to be ignored. A MAC mask of ff:ff:ff:ff:ff:ff matches a single MAC address.
Destination MAC Address	Select this field and enter the destination MAC address to compare against an Ethernet frame.

Destination MAC Mask	Enter the destination MAC address mask specifying which bits in the destination MAC to compare against an Ethernet frame. An f indicates that the address bit is significant, and a 0 indicates that the address bit is to be ignored. A MAC mask of ff:ff:ff:ff:ff:ff matches a single MAC address.
VLAN ID	Select the field and enter a VLAN ID to be matched for packets. The VLAN ID range is 0–4095.
IPv4 Class Maps	
Service Type	You can specify one type of service to use in matching packets to class criteria.
IP DSCP	To use IP DSCP as a match criterion, select the check box and select a DSCP value keyword or enter a DSCP. Select from List Select from a list of DSCP types. Match to Value Enter a DSCP Value to match (0–63).
IP Precedence	Select this field to match the packet's IP Precedence value to the class criteria IP Precedence value. The IP Precedence range is 0–7.
IP TOS Bits	Select this field and enter a value to use the packet's Type of Service bits in the IP header as match criteria. The TOS bit value ranges between (00–FF). The high-order three bits represent the IP precedence value. The high-order six bits represent the IP Differentiated Services Code Point (DSCP) value.
IP TOS Mask	Enter an IP TOS mask value to perform a boolean AND with the TOS field in the header of the packet and compared against the TOS entered for this rule. The TOS Mask can be used to compare specific bits (Precedence/Type of Service) from the TOS field in the IP header of a packet against the TOS value entered for this rule. (00–FF).
Delete Class Map	Check to delete the class map selected in the Class Map Name menu. The class map cannot be deleted if it is already attached to a policy.

To delete a Class Map, select the Delete Class Map option and click **Save**.

Policy Map

Use the Policy Map page to create DiffServ policies and to associate a collection of classes with one or more policy statements.

The access point supports up to 50 policy maps.

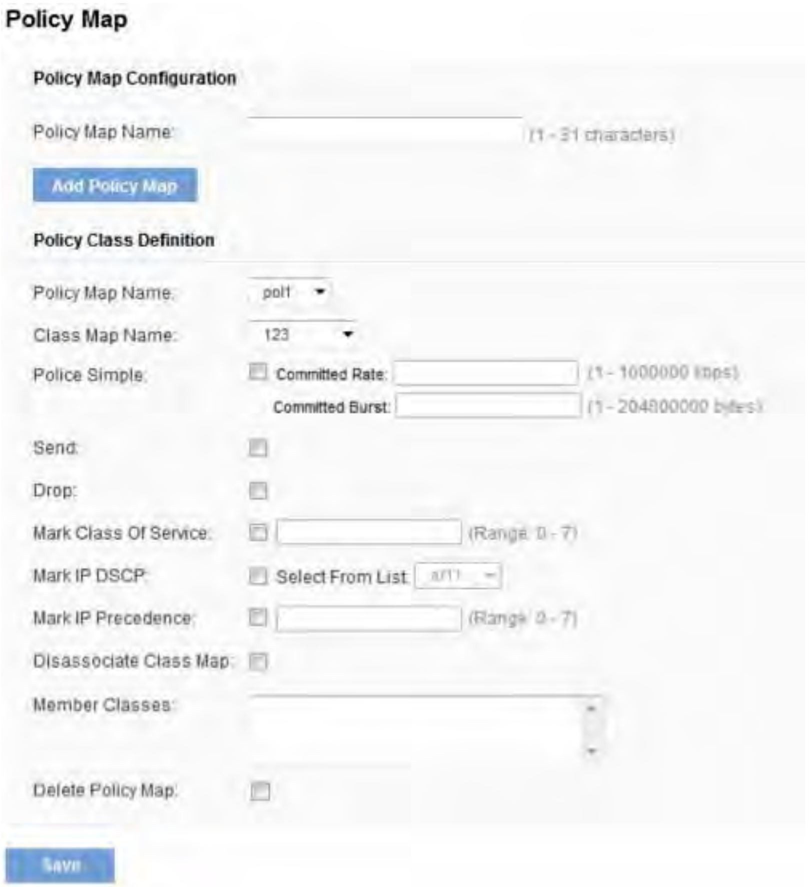
Packets are classified and processed based on defined criteria. The classification criteria are defined by class on the Class Map page. The processing is defined by a policy's attributes on the Policy Map page. Policy attributes may be defined on a per-class instance basis, and it is these attributes that are applied when a match occurs. A policy map can contain up to 10 class maps. When the policy is active, the actions taken depend on which class matches the packet.

Packet processing begins by testing the class match criteria for a packet. A policy is applied to a packet when a class match within that policy is found.

NOTE:
The Policy Map page displays the policy configuration fields only if a policy map has been created. To create a policy map, enter a name in the Policy Map Name field and click Add Policy Map.

To create a DiffServ policy, click the *Configuration* > *Qos and Access Control* > *Policy Map* tab. The following image shows the page after a policy map has been created.

Figure 39: QoS DiffServ Policy Map



Policy Map

Policy Map Configuration

Policy Map Name: (1 - 31 characters)

Add Policy Map

Policy Class Definition

Policy Map Name: pol1

Class Map Name: 123

Police Simple: □ Committed Rate: (1 - 1000000 kbps)
Committed Burst: (1 - 204800000 bytes)

Send: □

Drop: □

Mark Class Of Service: □ (Range: 0 - 7)

Mark IP DSCP: □ Select From List af11

Mark IP Precedence: □ (Range: 0 - 7)

Disassociate Class Map: □

Member Classes:

Delete Policy Map: □

Save

Table 48: DiffServ Policy Map

Field	Description
Policy Map Name	Enter then name of the policy map to add. The name can contain up to 31 alphanumeric characters.
Policy Map Name (Policy Class Definition)	Select the policy to associate with a member class.
Class Map Name	Select the member class to associate with this policy name.
Police Simple	Select this option to establish the traffic policing style for the class. The simple form of the policing style uses a single data rate and burst size, resulting in two outcomes: conform and nonconform. *Committed Rate* Enter the committed rate, in Kbps, to which traffic must conform. *Committed Burst* Enter the committed burst size, in bytes, to which traffic must conform. Ideally, burst size should be 1.5 times the committed rate (in bytes) for Rate Limiting to work properly. For example, if the committed rate is 1 Gbps, then the committed burst size should be 187500000 bytes.
Send	Select Send to specify that all packets for the associated traffic stream are to be forwarded if the class map criterion is met.
Drop	Select Drop to specify that all packets for the associated traffic stream are to be dropped if the class map criterion is met.

Mark Class of Service	Select this field to mark all packets for the associated traffic stream with the specified class of service value in the priority field of the 802.1p header. If the packet does not already contain this header, one is inserted. The CoS value is an integer from 0–7.
Mark IP DSCP	Select this field to mark all packets for the associated traffic stream with the IP DSCP value you select from the list or specify. *Select from List* *Select from a list of DSCP types.*
Mark IP Precedence	Select this field to mark all packets for the associated traffic stream with the specified IP precedence value. The IP precedence value is an integer from 0–7.
Disassociate Class Map	Select this option and click **Save** to remove the class selected in the Class Map Name menu from the policy selected in the Policy Map Name menu.
Member Classes	Lists all DiffServ classes currently defined as members of the selected policy. If no class is associated with the policy, the field is empty.
Delete Policy Map	Select this field to delete the policy map showing in the Policy Map Name menu.

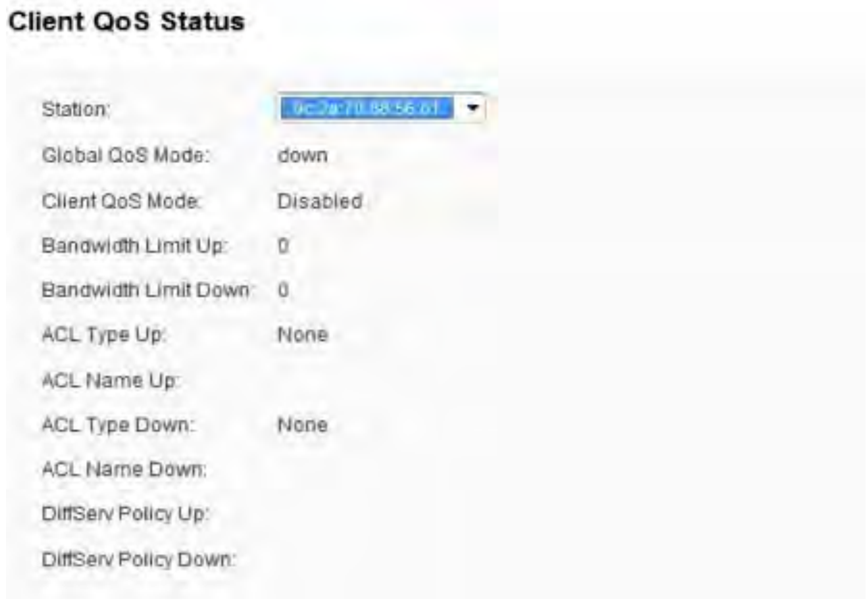
To delete a Policy Map, select the Delete Policy Map option and click **Save**.

Client QoS Status

The *Client QoS Status* page shows the client QoS settings that are applied to each client currently associated with the AP.

To view QoS settings for an associated client, click the Configuration > QoS and Access Control > Client QoS Status tab.

Figure 40: Client QoS Status



Client QoS Status

Station: 0c:2a:70:88:56:61

Global QoS Mode: down

Client QoS Mode: Disabled

Bandwidth Limit Up: 0

Bandwidth Limit Down: 0

ACL Type Up: None

ACL Name Up:

ACL Type Down: None

ACL Name Down:

DiffServ Policy Up:

DiffServ Policy Down:

Table 49: Client QoS Status

Field	Description
Station	The Station menu contains the MAC address of each client currently associated with the AP. To view the QoS settings applied to a client, select its MAC address from the list.
QoS Mode	Shows whether the QOS mode for the selected client is up (enabled) or down (disabled). **Note**: For the QoS Mode to be enabled on a client, it must be globally enabled on the AP and enabled on the VAP the client is associated with. Use the Global Settings page to enable the QoS Global Admin mode and the per-VAP QoS Mode.

Bandwidth Limit Up	Shows the maximum allowed transmission rate from the client to the AP in bits per second (bps). The valid range is 0–4294967295 bps.
Bandwidth Limit Down	Shows the maximum allowed transmission rate from the AP to the client in bits per second (bps). The valid range is 0–4294967295 bps.
ACL Type Up	Shows the type of ACL that is applied to traffic in the inbound (client-to-AP) direction, which can be one of the following: • IPv4: The ACL examines IPv4 packets for matches to ACL rules. • IPv6: The ACL examines IPv6 packets for matches to ACL rules. • MAC: The ACL examines layer 2 frames for matches to ACL rules.
ACL Name Up	Shows the name of the ACL applied to traffic entering the AP in the inbound direction. When a packet or frame is received by the AP, the ACL's rules are checked for a match. The packet or frame is processed if it is permitted and discarded if it is denied.
ACL Type Down	Shows the type of ACL to apply to traffic in the outbound (AP-to-client) direction, which can be one of the following: • IPv4: The ACL examines IPv4 packets for matches to ACL rules. • IPv6: The ACL examines IPv6 packets for matches to ACL rules • MAC: The ACL examines layer 2 frames for matches to ACL rules
ACL Name Down	Shows the name of the ACL applied to traffic in the outbound direction. After switching the packet or frame to the outbound interface, the ACL's rules are checked for a match. The packet or frame is transmitted if it is permitted and discarded if it is denied.
DiffServ Policy Up	Shows the name of the DiffServ policy applied to traffic sent to the AP in the inbound (client-to-AP) direction.
DiffServ Policy Down	Shows the name of the DiffServ policy applied to traffic from the AP in the outbound (AP-to-client) direction.

SNMP

This section describes how to configure the SNMP settings on the access point and contains the following subsections:

- General
- Views
- Groups
- Targets
- Users

General

Simple Network Management Protocol (SNMP) defines a standard for recording, storing, and sharing information about network devices. SNMP facilitates network management, troubleshooting, and maintenance. The AP supports SNMP versions 1, 2, and 3. Unless specifically noted, all configuration parameters on this page apply to SNMPv1 and SNMPv2c only.

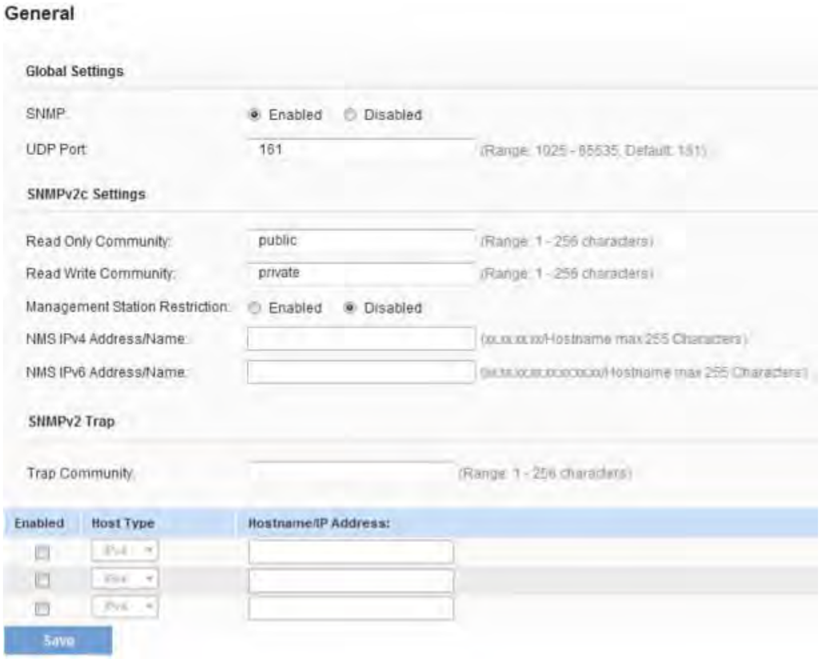
Key components of any SNMP-managed network are managed devices, SNMP agents, and a management system. The agents store data about their devices in Management Information Bases (MIBs) and return this data to the SNMP manager when requested. Managed devices can be network nodes such as APs, routers, switches, bridges, hubs, servers, or printers.

The access point can function as an SNMP managed device for seamless integration into network management systems such as HP OpenView.

From the SNMP page under the Services heading, you can start or stop control of SNMP agents, configure community passwords, access MIBs, and configure SNMP Trap destinations.

To configure SNMP, click the Configuration > SNMP > General tab and save the fields described in Table 50 on page 118.

Figure 41: SNMP-General



General

Global Settings

SNMP: ● Enabled ○ Disabled

UDP Port: 161 (Range: 1025 - 65535, Default: 161)

SNMPv2c Settings

Read Only Community: public (Range: 1 - 256 characters)

Read Write Community: private (Range: 1 - 256 characters)

Management Station Restriction: ○ Enabled ● Disabled

NMS IPv4 Address/Name: (xx.xx.xx.xx/Hostname max 255 Characters)

NMS IPv6 Address/Name: (xx:xx:xx:xx:xx:xx:xx:xx/Hostname max 255 Characters)

SNMPv2 Trap

Trap Community: (Range: 1 - 256 characters)

Enabled	Host Type	Hostname/IP Address:
□	IPv4	
□	IPv6	
□	IPv6	

Table 50: SNMP-General Settings

Field	Description
SNMP Enabled/Disabled	You can specify the SNMP administrative mode on your network. By default SNMP is enabled. To enable SNMP, click Enabled. To disable SNMP, click Disabled. After changing the mode, you must click Save to save your configuration changes. **Note**: If SNMP is disabled, all remaining fields on the SNMP page are disabled. This is a global SNMP parameter which applies to SNMPv1, SNMPv2c, and SNMPv3.
UDP Port	By default an SNMP agent only listens to requests from port 161. However, you can configure this so the agent listens to requests on another port. Enter the port number on which you want the SNMP agents to listen to requests. The valid range is 1-65535. **Note**: This is a global SNMP parameter that applies to SNMPv1, SNMPv2c, and SNMPv3.
Read Only Community	Enter a read-only community name. The valid range is 1-256 characters. The community name, as defined in SNMPv2c, acts as a simple authentication mechanism to restrict the machines on the network that can request data to the SNMP agent. The name functions as a password, and the request is assumed to be authentic if the sender knows the password. The community name can be in any alphanumeric format.
Read Write Community	If you have enabled SNMP set requests you can set a read-write community name. The valid range is 1-256 characters. Setting a community name is similar to setting a password. Only requests from the machines that identify themselves with this community name will be accepted. The community name can be in any alphanumeric format.
Management Station Restriction	You can restrict the source of permitted SNMP requests. To restrict the source of permitted SNMP requests, click Enabled. To permit any source submitting an SNMP request, click Disabled.

NMS IPv4 Address/Name	Specify the IPv4 DNS hostname or subnet of the machines that can execute get and set requests to the managed devices. The valid range is 1-256 characters. As with community names, this provides a level of security on SNMP settings. The SNMP agent will only accept requests from the hostname or subnet specified here. To specify a subnet, enter one or more subnetwork address ranges in the form address/mask_length where address is an IP address and mask_length is the number of mask bits. Both address/mask and address/mask_length formats are supported. Individual hosts can be provided for this, i.e. IP address or Hostname. For example, if you enter a range of 192.168.1.0/24 this specifies a subnetwork with address 192.168.1.0 and a subnet mask of 255.255.255.0. The address range is used to specify the subnet of the designated NMS. Only machines with IP addresses in this range are permitted to execute get and set requests on the managed device. Given the example above, the machines with addresses from 192.168.1.1 through 192.168.1.254 can execute SNMP commands on the device. (The address identified by suffix .0 in a subnetwork range is always reserved for the subnet address, and the address identified by .255 in the range is always reserved for the broadcast address). As another example, if you enter a range of 10.10.1.128/25 machines with IP addresses from 10.10.1.129 through 10.10.1.254 can execute SNMP requests on managed devices. In this example, 10.10.1.128 is the network address and 10.10.1.255 is the broadcast address. 126 addresses would be designated.
NMS IPv6 Address/Name	Specify the IPv6 DNS hostname or subnet of the machines that can execute get and set requests to the managed devices.

Trap Community	Enter the global community string associated with SNMP traps. The valid range is 1-256 characters. Traps sent from the device will provide this string as a community name. The community name can be in any alphanumeric format. Special characters are not permitted.
Host Type	Specify whether the enabled host is an IPv4 host or an IPv6 host.
Hostname or IP address	Enter the DNS hostname of the computer to which you want to send SNMP traps. The valid range is 1-256 characters. An example of a DNS hostname is: snmptraps.foo.com. Since SNMP traps are sent randomly from the SNMP agent, it makes sense to specify where exactly the traps should be sent. You can add up to a maximum of three DNS hostnames. Ensure you select the Enabled check box beside the appropriate hostname.

NOTE:
After you configure the SNMP settings, you must click Save to apply the changes. Changing some settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change AP settings when WLAN traffic is low.

NOTE:
Hostnames are composed of series of labels concatenated with dots, as are all domain names. Each label must be between 1 and 63 characters long, and the entire hostname (including the delimiting dots) has a maximum of 253 characters.

Views

A MIB view is a family of view subtrees, which is a pairing of an OID subtree value together with a bit string mask value. Each MIB view is defined by two sets of view subtrees, included in or excluded from the MIB view. You can create MIB views to control the OID range that SNMP users can access.

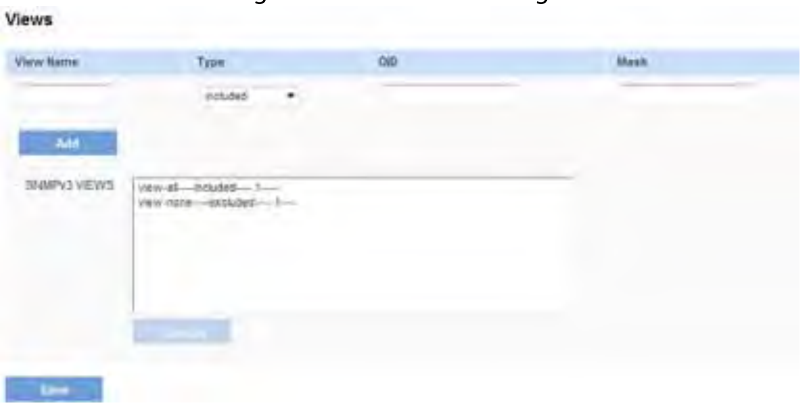
Note that the access point supports a maximum of 16 views.

The following notes summarize some critical guidelines regarding SNMP View configuration. Please read all the notes before proceeding with SNMP View configuration.

NOTE:
A MIB view called all is created by default in the system. This view contains all management objects supported by the system.

NOTE:
By default, view-all and view-none SNMP views are created on the AP. These views cannot be deleted but OID, Masks and Type fields can be modified.

Figure 1: SNMP Views Configuration



view-all—included— 1—
view-none—excluded— 1—

To display the SNMP Views *Configuration page, click the Configuration* > *SNMP* > *Views* tab. Table 51 describes the fields you can configure on the Views page.

Table 51: SNMP Views

Field	Description
View Name	Enter a name to identify the MIB view. View names can contain up to 32 alphanumeric characters.
Type	Specifies whether to include or exclude the view subtree or family of subtrees from the MIB view.
OID	Enter an OID string for the subtree to include or exclude from the view. For example, the system subtree is specified by the OID string .1.3.6.1.2.1.1.
Mask	The OID mask is 47 characters in length. The format of the OID mask is xx.xx.xx (.)... or xx:xx:xx.... (:) and is 16 octets in length. Each octet is 2 hexadecimal characters separated by either a period or a colon. Only hex characters are accepted in this field. For example, OID mask FA.80 is 11111010.10000000. A family mask is used to define a family of view subtrees. The family mask indicates which sub-identifiers of the associated family OID string are significant to the family's definition. A family of view subtrees allows control access to one row in a table, in a more efficient manner.
SNMP Views	This field shows the MIB views on the access point.

Use the buttons on the page to perform the following tasks:

- **Add:** Add the new view to the SNMP Views table.
- **Remove:** Remove the selected view from the SNMP Views table.
- **Save:** Apply and save the changed SNMP view settings.

Groups

SNMP groups allow you to combine users into groups of different authorization and access privileges. Each group is associated with one of three security levels:

- .noAuthNoPriv.
- .authNoPriv.
- .authPriv.

Read and/or write access to management objects (MIBs) for each group is controlled by associating a MIB view to a group for read and write access, separately.

By default, the access point has two groups:

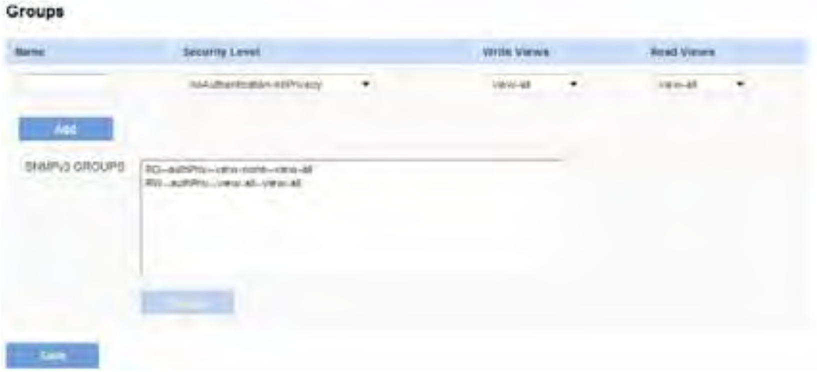
- RO — A read-only group with no authentication and no data encryption. No security is provided by this group. By default, users of this group will have read access to the default all MIB view, which can be modified by the user.
- RW — A read/write group using authentication and data encryption. Users in this group use an MD5 key/password for authentication and a DES key/password for encryption. Both the MD5 and DES key/passwords must be defined. By default, users of this group will have read and write access to default all MIB view, which can be modified by the user.
-

NOTE:
The default groups RO and RW cannot be deleted.

NOTE:
The Access Point supports a maximum of 8 groups.

To define additional groups, navigate to the Configuration > SNMP > Groups page and configure the settings that Table 52 describes.

Figure 42: SNMP Groups



RO--authPriv--view-none--view-all
RW--authPriv--view-all--view-all

Table 52: SNMP Groups

Field	Description
Name	Specify a name to use to identify the group. The default group names are RW and RO. Group names can contain up to 32 alphanumeric characters.
Security Level	Select one of the following security levels for the group: • noAuthentication-noPrivacy — No authentication and no data encryption (no security). • Authentication-noPrivacy — Authentication, but no data encryption. With this security level, users send SNMP messages that use an MD5 key/password for authentication, but not a DES key/password for encryption. • Authentication-Privacy — Authentication and data encryption. With this security level, users send an MD5 key/password for authentication and a DES key/password for encryption. For groups that require authentication, encryption, or both, you must define the MD5 and DES key/passwords on the SNMP Users page.

Write Views	Select the write access to management objects (MIBs) for the group: • write-all—The group can create, alter, and delete MIBs. • write-none—The group is not allowed to create, alter, or delete MIBS.
Read Views	Select the read access to management objects (MIBs) for the group: • view-all—The group is allowed to view and read all MIBs. • view-none—The group cannot view or read MIBs.
SNMP Groups	This field shows the default groups and the groups that have been defined on the AP.

Use the buttons on the page to perform the following tasks:

- **Add:** Add the new group to the SNMP Groups table.
- **Remove:** Remove the selected group from the SNMP Group table.
- **Save:** Apply and save the changed SNMP group settings.
-

Targets

An SNMP target receives trap messages and forwards them to the SNMP manager. Inform messages are not supported. Each target is associated with target IP address, UDP port, and SNMP user name.

NOTE:
Required SNMP user configuration "Users" on page 125 should be completed before configuring SNMP targets.

NOTE:
The access point supports a maximum of eight targets.

To display the SNMP Targets Configuration page, click the *Configuration* > *SNMP* > *Targets* tab.

Figure 43: SNMP Targets

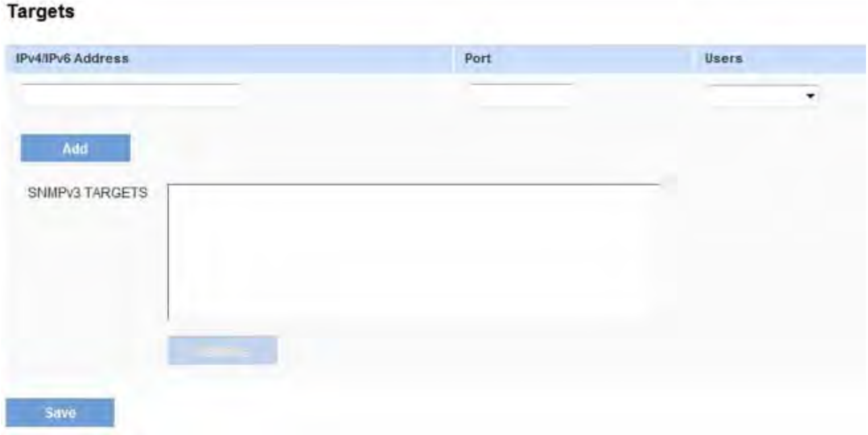


Table 53: SNMP Targets

Field	**Description**
IPv4/IPv6 Address	Enter the IP address of the remote SNMP target (receiver).
Port	Enter the UDP port to use for sending SNMP targets.
Users	Enter the name of the SNMP user to associate with the target. To configure SNMP users, see “Users” on page 125
SNMP Targets	This field shows the SNMP targets configured on the access point.

Use the buttons on the page to perform the following tasks:

- **Add:** Add the new target to the SNMP Targets table.
- **Remove:** Remove the selected target from the SNMP Targets table.
- **Save:** Apply and save the changed SNMP target settings.

Users

From the Users page, you can define multiple users, associate the desired security level to each user, and configure per user security keys.

Each user is mapped to an SNMP group, either from predefined or user-defined groups, configured for authentication and encryption types with authentication encryption pass-phrases (optional if authentication or encryption type is set to none.) For authentication, only MD5 type is supported, and for encryption only DES type is supported. There are no default SNMP users on the access point.

Figure 44: SNMP Users

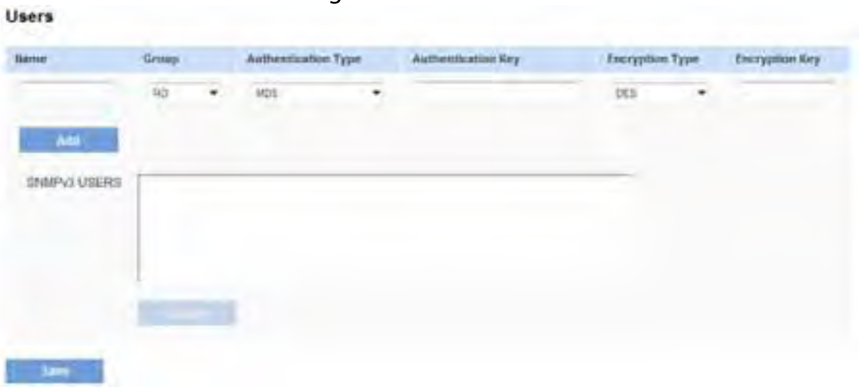


Table 54 describes the fields to configure SNMP users.

Table 54: SNMP Users

Field	Description
Name	Enter the user name to identify the SNMP user. User names can contain up to 32 alphanumeric characters.
Group	Map the user to a group. The default groups are RW and RO. You can define additional groups on the SNMP Groups page.
Authentication Type	Select the type of authentication to use on SNMP requests from the user: • *MD5* — Require MD5 authentication on SNMP requests from the user. • *None* — SNMP requests from this user require no authentication.

Authentication Key	If you specify MD5 as the authentication type, enter a password to enable the SNMP agent to authenticate requests sent by the user. Note: The passphrase must be between 8 and 32 characters in length. If you wish to use a space in the phrase, you must use quotation marks – ex: "Admin 123" – or the phrase will be truncated as Admin.
Encryption Type	Select the type of privacy to use on SNMP requests from the user: • *DES* — Use DES encryption on SNMP requests from the user. • *None* — SNMP requests from this user require no privacy.
Encryption Key	If you specify DES as the privacy type, enter a key to use to encrypt the SNMP requests. **Note**: The passphrase must be between 8 and 32 characters in length. If you wish to use a space in the phrase, you must use quotation marks – ex: "Admin 123" – or the phrase will be truncated as Admin.
SNMP Users	This field shows the users that have been defined on the AP.

Use the buttons on the page to perform the following tasks:

- **Add:** Add the new user to the SNMP Users table.
- **Remove:** Remove the selected user from the SNMP Users table.
- **Save:** Apply and save the changed SNMP user settings.

Captive Portal

This section describes the Captive Portal (CP) feature, which allows you to block wireless clients from accessing the network until user verification has been established. You can configure CP verification to allow access for both guest and authenticated users. The access point CP feature supports both IPv4 and IPv6 clients.

Authenticated users must be validated against a database of authorized Captive Portal groups or users before access is granted. The database can be stored locally on the access point or on a RADIUS server.

Captive Portal consists of two CP instances. Each instance can be configured independently, with different verification methods for each VAP or SSID. The AP operates concurrently with some VAPs configured for CP authentication and other VAPs configured for normal wireless authentication methods, such as WPA or WPA Enterprise.

This section describes the following features:

- Global ConfigurationAuthenticated Clients
- Failed Authentication Clients

Global Configuration

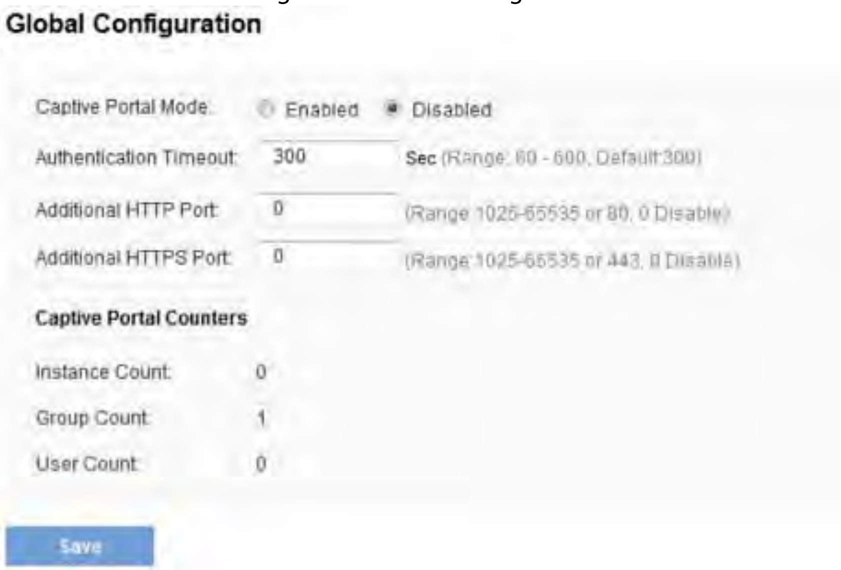
- Instance Configuration
- Instance Association
- Web Portal Customization
- Web Customization Preview
- Upload Custom Images
- Local Groups
- Local Users
- Authenticated Clients
- Failed Authentication Clients

Global Configuration

The Captive Portal (CP) feature allows you to block wireless clients from accessing the network until user verification has been established. Use the CP Global Configuration page to control the administrative state of the CP feature and configure global settings that affect all captive portal instances configured on the AP.

Click the Configuration > Captive Portal > Global Configuration tab to access the page, which the following figure shows.

Figure 45: Global Configuration



Global Configuration

Captive Portal Mode: ○ Enabled ● Disabled

Authentication Timeout: 300 Sec (Range: 60 - 600, Default:300)

Additional HTTP Port: 0 (Range 1025-65535 or 80, 0 Disable)

Additional HTTPS Port: 0 (Range:1025-65535 or 443, 0 Disable)

Captive Portal Counters

Instance Count: 0

Group Count: 1

User Count: 0

The following table describes the fields on the CP **Global Configuration** page.

Table 55: Global Configuration

Field	**Description**
Captive Portal Mode	Enables or disables the administrative mode of CP on the AP.
Authentication Timeout	This field specifies the number of seconds the AP keeps the unauthenticated client information. If the user does not enter authentication credentials within the authentication timeout period, the client details are removed so that stale entries do not persist upon leaving. The default authentication timeout is 300 seconds.
Additional HTTP Port	HTTP traffic uses port 80, but you can configure an additional port for HTTP traffic. Enter a port number between 1025-65535. Port number 80 or 443 cannot be used, and the HTTP and HTTPs ports cannot be the same.
Additional HTTPS Port	HTTP traffic over SSL (HTTPS) uses port 443, but you can configure an additional port for HTTPS traffic. Enter a port number between 1025-65535. Port number 80 or 443 cannot be used, and the HTTP and HTTPs ports cannot be the same.
Instance Count	The number of CP instances currently configured on the AP. Up to two instances can be configured.
Group Count	The number of CP groups currently configured on the AP. Up to two groups can be configured. Default Group exists by default and cannot be deleted.
User Count	The number of CP users currently configured on the AP. Up to 128 users can be configured.

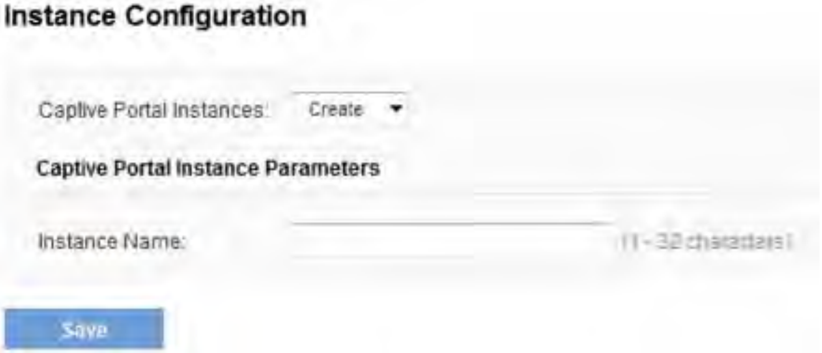
Instance Configuration

You can create up to two Captive Portal instances; each CP instance is a defined set of instance parameters. Instances can be associated with one or more VAPs. Different instances can be configured to respond differently to users as they attempt to access the associated VAP.

Click the *Configuration* > *Captive Portal* > *Instance Configuration* tab to access the page.

Figure 46 shows the CP Instance Configuration page when the Create option is selected from the Captive Portal Instances menu.

Figure 46: CP Instance Configuration - Create

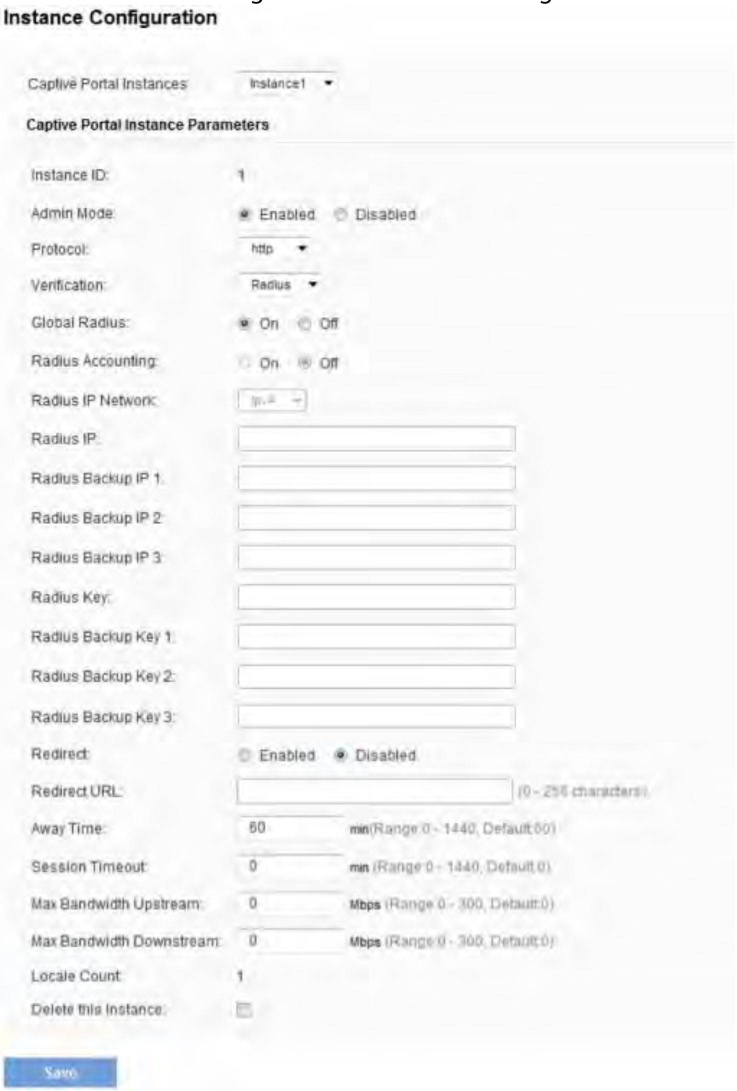


Instance Configuration

Captive Portal Instances:	Create ▾	
Captive Portal Instance Parameters		
Instance Name:		(1 - 32 characters)

Figure 47 on page 129 shows the CP Instance Configuration page when a CP instance has been created and is selected from the Captive Portal Instances menu. The fields available also change depending on the option selected from the Verification menu. In Figure 47 on page 129, the verification method is RADIUS.

Figure 47: CP Instance Configuration



Instance Configuration

Captive Portal Instances	Instance1 ▾	
Captive Portal Instance Parameters		
Instance ID:	1	
Admin Mode:	● Enabled ○ Disabled	
Protocol:	http ▾	
Verification:	Radius ▾	
Global Radius:	● On ○ Off	
Radius Accounting:	○ On ● Off	
Radius IP Network:	ipv4 ▾	
Radius IP:		
Radius Backup IP 1:		
Radius Backup IP 2:		
Radius Backup IP 3:		
Radius Key:		
Radius Backup Key 1:		
Radius Backup Key 2:		
Radius Backup Key 3:		
Redirect:	○ Enabled ● Disabled	
Redirect URL:		(0 - 256 characters)
Away Time:	60	min(Range 0 - 1440, Default 60)
Session Timeout:	0	min (Range 0 - 1440, Default 0)
Max Bandwidth Upstream:	0	Mbps (Range 0 - 300, Default 0)
Max Bandwidth Downstream:	0	Mbps (Range 0 - 300, Default 0)
Locale Count:	1	
Delete this Instance:	□	

The following table describes the fields on the CP Instance Configuration page. The fields that appear on the page depend on the option selected from the Captive Portal Instances menu.

Table 56: Captive Portal Instance Configuration

Field	Description
Captive Portal Instances	Select an existing instance to view or configure its settings, or select Create to configure a new CP instance. The access point supports two instances. If both instances have been configured, you must delete an instance before you can create a new one.
Instance Name	This field is available only if Create is selected from the Captive Portal Instances field. Specify a name for the new CP instance.
Instance ID	The CP instance identifier. For an existing instance, this field cannot be configured. When creating a new CP instance, the ID cannot be used by another CP instance. If you attempt to assign an Instance ID that is in use, an error message is displayed.
Admin Mode	Select the option to enable the administrative mode of the selected CP instance, or clear the option to disable it.
Protocol	Specifies HTTP or HTTPs as the protocol for the CP instance to use during the verification process.
Verification	The authentication method for CP to use to verify clients: • Guest—The user does not need to be authenticated by a database. • Local—The Access Point uses a local database to authenticated users. • RADIUS—The Access Point uses a database on a remote RADIUS server to authenticate users.
Redirect	Specifies that CP should redirect the newly authenticated client to the configured URL. If this option is clear, the user sees the locale-specific welcome page after a successful verification.
Redirect URL	Enter the URL (including http://), either IPv4 or an IPv6 address, to which the newly authenticated client is redirected if the URL Redirect Mode is enabled. The IPv4 address should be in a form similar to http://xxx.xxx.xxx.xxx (http://192.0.2.10). The IPv6 address should be in a form similar to http://[xxxx:xxxx:xxxx:xxxx::xxxx:xxxx:xxxx:xxxx] (http://[2001:DB8::CAD5:7D91]). The range is from 0 to 256 characters.
Away Time	The amount of time a user remains in the CP authenticated client list after it disassociates from the AP. If the time specified in this field expires before the client attempts to reauthenticate, its entry is removed from the authenticated client list. The range is from 0 to 1440 minutes. The default value is 60 minutes. **Note**: An away timeout value is also configured for each user. See the Local Users page. The user's away timeout value has precedence over the value configured here.
Session Timeout	The amount of time to wait before terminating a session. A user is logged out after the session timeout is reached. If the value is set to 0, the timeout is not enforced. The range is from 0 to 1440 minutes. The default value is 0.
Max Bandwidth Upstream	The maximum upload speed, in megabits per second, that a client can transmit traffic when using the captive portal. This setting limits the bandwidth at which the client can send data into the network. The range is from 0 to 300 Mbps. The default value is 0.
Max Bandwidth Downstream	The maximum download speed, in megabits per second, that a client can receive traffic when using the captive portal. This setting limits the bandwidth at which the client can receive data from the network. The range is from 0 to 300 Mbps. The default value is 0.
User Group Name	The user group associated with this instance. Each CP user is associated with a group, and a group is associated with a CP instance.

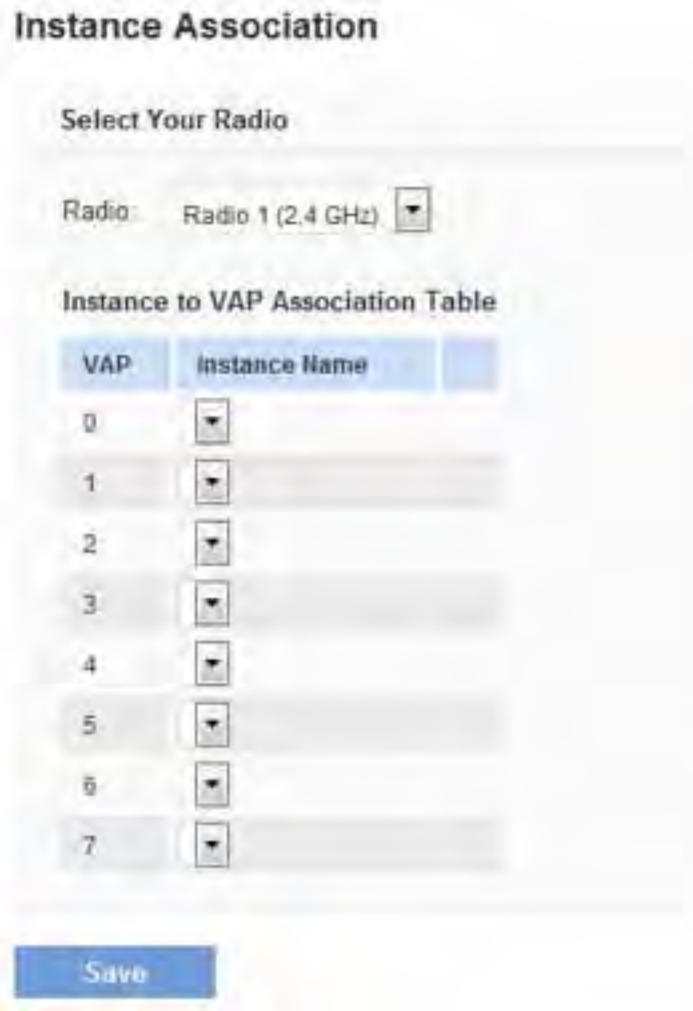
Global RADIUS	If the Verification Mode is RADIUS, select to specify that the default Global RADIUS server list is used to authenticating clients. If you want the CP feature to use a different set of RADIUS servers, clear this setting and configure the servers in the fields on this page.
RADIUS Accounting	Enables tracking and measuring the resources a particular user has consumed, such as system time and amount of data transmitted and received.
RADIUS IP Network	Specify whether the RADIUS IP addresses are IPv4 or IPv6 RADIUS server addresses.
RADIUS IP	The IPv4 or IPv6 address for the primary RADIUS server for this VAP. The IPv4 address should be in a form similar to xxx.xxx.xxx.xxx (192.0.2.10). The IPv6 address should be in a form similar to xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx (2001:DB8::CAD5:7D91). When the first wireless client tries to authenticate with a VAP, the access point sends an authentication request to the primary server. If the primary server responds to the authentication request, the access point continues to use this RADIUS server as the primary server, and authentication requests are sent to the address you specify.
RADIUS Backup IP 1–3	Up to three IPv4 or IPv6 backup RADIUS server addresses. If authentication fails with the primary server, each configured backup server is tried in sequence.
RADIUS Current	Specify which RADIUS server to use to authenticate clients: • *primary* — Use the RADIUS server with the IP address configured in the RADIUS IP field. • *backupone* — Use the RADIUS server with the IP address configured in the RADIUS Backup IP 1 field. • *backuptwo* — Use the RADIUS server with the IP address configured in the RADIUS Backup IP 2 field. • *backupthree* — Use the RADIUS server with the IP address configured in the RADIUS Backup IP 3 field.
RADIUS Key	The shared secret key that the access point uses to authenticate to the primary RADIUS server. You can use up to 63 standard alphanumeric and special characters. The key is case sensitive and must match the key configured on the RADIUS server. The text you enter will be displayed as "*" characters.
RADIUS Backup Key 1–3	The RADIUS key associated with the configured backup RADIUS servers. The server at RADIUS IP Address-1 uses RADIUS Key-1, RADIUS IP Address-2 uses RADIUS Key-2, and so on.
Locale Count	The number of locales associated with the instance. You can create and assign up to three different locales to each CP instance from the Web Customization page.
Delete Instance	To delete the current instance, select this option and click **Save.**

Instance Association

Use the Instance Association page to associate a CP instance to a VAP. The associated CP instance settings will apply to users who attempt to authenticate on the VAP.

Click the Configuration > Captive Portal > Instance Association tab to access the page, which the following figure shows.

Figure 48: Instance Association



Instance Association

Select Your Radio

Radio: Radio 1 (2.4 GHz)

Instance to VAP Association Table

VAP	Instance Name
0	
1	
2	
3	
4	
5	
6	
7	

The following table describes the fields on the CP **Instance Association** page.

Table 57: Captive Portal Instance Association

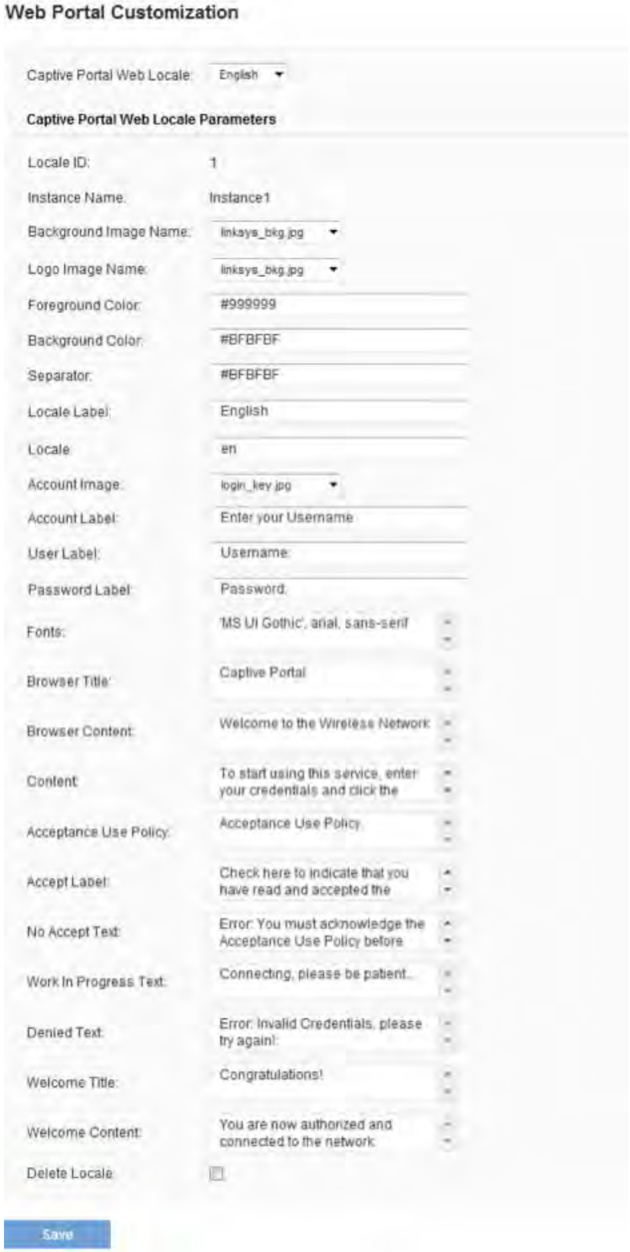
Field	Description
RADIO	Select the radio associated with the VAP to configure.
VAP	The list of VAP IDs. A CP instance can be associated with multiple VAPs.
Instance Name	Select the instance to associate with each VAP. If the menu is blank, no instance is associated with the VAP.

Web Portal Customization

When users initiate access to a VAP that is associated with a captive portal instance, an authentication page displays. You can use the page to create unique pages for different locales on your network, and to customize the textual and graphic elements of the pages. Use this page to create and customize the authentication page.

Click the *Configuration* > *Captive Portal* > *Web Portal Customization* tab to access the page, which the following figure shows.

Figure 49: Web Portal Customization



Web Portal Customization

Captive Portal Web Locale: English

Captive Portal Web Locale Parameters

Locale ID: 1

Instance Name: Instance1

Background Image Name: linksys_bkg.jpg

Logo Image Name: linksys_bkg.jpg

Foreground Color: #999999

Background Color: #BFBFBF

Separator: #BFBFBF

Locale Label: English

Locale: en

Account Image: login_key.jpg

Account Label: Enter your Username

User Label: Username:

Password Label: Password:

Fonts: 'MS UI Gothic', arial, sans-serif

Browser Title: Captive Portal

Browser Content: Welcome to the Wireless Network

Content: To start using this service, enter your credentials and click the

Acceptance Use Policy: Acceptance Use Policy.

Accept Label: Check here to indicate that you have read and accepted the

No Accept Text: Error: You must acknowledge the Acceptance Use Policy before

Work In Progress Text: Connecting, please be patient...

Denied Text: Error: Invalid Credentials, please try again!

Welcome Title: Congratulations!

Welcome Content: You are now authorized and connected to the network.

Delete Locale: □

Table 58: Web Portal Customization

Field	Description
Captive Portal Locale	To create a new Web locale, select Create from the available menu. To view or update an existing Web locale, select its name from the menu.
Captive Portal Web Local Parameters	
Web Locale Name	This field is displayed only if Create is selected from the Captive Portal Web Locale menu. Enter a Web Locale Name to assign to the page. The name can be from 1 to 32 alphanumeric characters.
Captive Portal Instances	This field is displayed only if Create is selected from the Captive Portal Web Locale menu. From the Captive Portal Instances list, select the CP instance that this locale is associated with. You can associate multiple locales with an instance. When a user attempts to access a particular VAP that is associated with a CP instance, the locales that are associated with that instance display as links on the authentication page. The user can select a link to switch to that locale.
Locale ID	The ID that is automatically assigned to the locale when it is created. The ID cannot be configured.
Instance ID	The ID of the CP instance associated with the locale.
Instance Name	The user-configured name of the CP instance.
Background Image Name	The image to display as the page background. You can click Upload/Delete Custom Image to upload images to the AP for use with Captive Portal instances.
Logo Image Name	The image file to display on the top left corner of the page. This image is used for branding purposes, such as the company logo. If you uploaded a custom logo image to the access point, you can select it from the list.

Foreground color	The HTML code for the foreground color in 6-digit hexadecimal format. The range is from 1 to 32 characters. The default is #999999.
Background color	The HTML code for the background color in 6-digit hexadecimal format. The range is from 1 to 32 characters. The default is #BFBFBF.
Separator	The HTML code for the color of the thick horizontal line that separates the page header from the page body, in 6-digit hexadecimal format. The range is from 1 to 32 characters. The default is #BFBFBF. The default is #BFBFBF.
Locale Label	A descriptive label for the locale, from 1 to 32 characters. The default is English.
Locale	An abbreviation for the locale, from 1 to 32 characters. The default is en.
Account Image	The image file to display above the login field to depict an authenticated login.
Account Label	The text that instructs the user to enter a user name. The range is from 0 to 32 characters.
User Label	The label for the user name text box. The range is from 0 to 32 characters.
Password Label	The label for the user password text box. The range is from 0 to 64 characters.
Button Label	The label on the button users click to submit their user name/password for authentication. The range is from 2 to 32 characters. The default is Connect.
Fonts	The name of the font to use for all text on the CP page. You can enter multiple font names, each separated by a comma. If the first font is not available on the client system, the next font will be used, and so on. For font names that have spaces, surround the entire name in quotes. The range is from 1 to 512 characters. The default is arial, sans-serif, 'MS UI Gothic'.

Browser Title	The text to display in the browser title bar. The range is from 1 to 128 characters. The default is Captive Portal.
Browser Content	The text that displays in the page header, to the right of the logo. The range is from 1 to 128 characters. The default is Welcome to the Wireless Network.
Content	The instructive text that displays in the page body below the user name and password text boxes. The range is from 0 to 256 characters. The default is: To start using this service, enter your credentials and click the connect button.
Acceptance Use Policy	The text that appears in the Acceptance Use Policy box. The range is from 0 to 8192 characters. The default is: Acceptance Use Policy.
Accept Label	The text that instructs users to select the check box to acknowledge reading and accepting the Acceptance Use Policy. The range is from 0 to 128 characters. The default is: Check here to indicate that you have read and accepted the Acceptance Use Policy.
No Accept Text	The text that displays in a pop-up window when a user submits login credentials without selecting the Acceptance Use Policy check box. The range is from 1 to 128 characters. The default is: Error: You must acknowledge the Acceptance Use Policy before connecting!
Work In Progress Text	The text that displays during authentication. The range is from 1 to 128 characters. The default is: Connecting, please be patient....
Denied Text	The text that displays when a user fails authentication. The range is from 1 to 128 characters. The default is: Error: Invalid Credentials, please try again!
Welcome Title	The text that displays when the client has authenticated to the VAP. The range is from 1 to 128 characters. The default is: Congratulations!

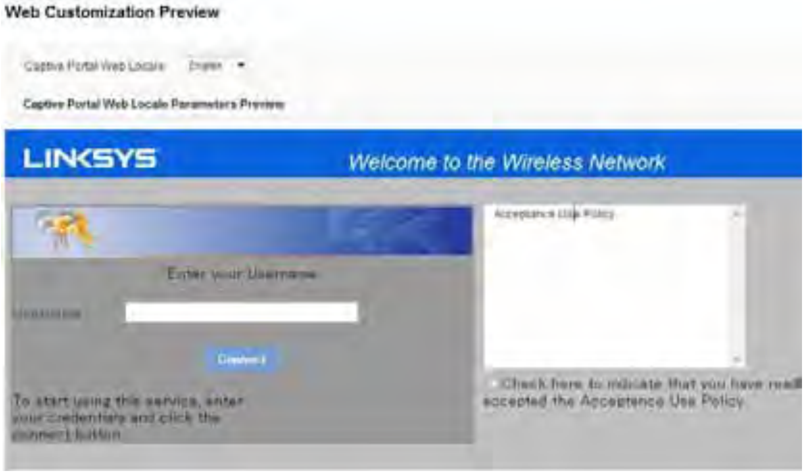
Welcome Content	The text that displays when the client has connected to the network. The range is from 0 to 256 characters. The default is: You are now authorized and connected to the network.
Delete Locale	To delete the current locale, select this option and click Save.

Web Customization Preview

Use the Web Customization Preview page to view an example of the authentication page a CP user sees upon connecting to the access point.

Click the Configuration > Captive Portal > Web Customization Preview tab to access the page, which the following figure shows.

Figure 50: CP Web Customization Preview


Web Customization Preview
Captive Portal Web Locale: English
Captive Portal Web Locale Parameters Preview
LINKSYS
Welcome to the Wireless Network
Enter your Username
Username
Connect
Acceptance Use Policy

To start using this service, enter your credentials and click the connect button.

Check here to indicate that you have read accepted the Acceptance Use Policy

To preview a CP authentication page, select the Web locale from the menu.

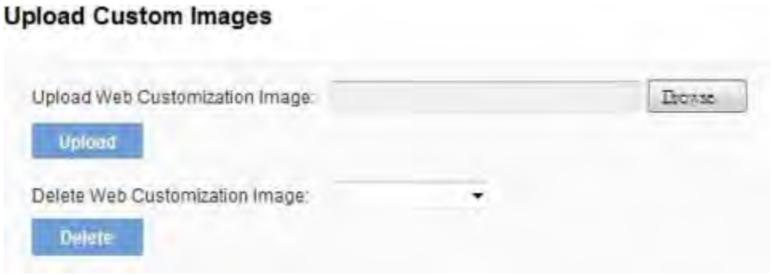
Upload Custom Images

When users initiate access to a VAP that is associated to a captive portal instance, an authentication page displays. You can customize this page with your own logo and other graphics.

Up to 18 images can be uploaded (assuming six locales, with each locale having three images).

Click the Configuration > Captive Portal > Upload Custom Images tab to access the page, which the following figure shows.

Figure 51: Upload Custom Images


Upload Custom Images
Upload Web Customization Image:
Browse
Upload
Delete Web Customization Image:
Delete

Images will be resized to fit the specified dimensions. For best results, the logo and account images should be similar in proportion to the default images, as follows:

Table 59: Captive Portal Default Images

Image Type	Use	Default Width x Height
Background	Displays in the page background.	10 × 800 pixels
Logo	Displays at top left of page to provide branding information.	168 × 78 pixels
Account	Displays above the login field to depict an authenticated login.	295 × 55 pixels

The following table describes the fields on the Captive Portal Upload Custom Images page.

Table 60: Captive Portal Upload Custom Images

Field	Description
Upload Web Customization Image	To select an image to upload to the AP for use in the CP authentication page, click Browse and browse to the image to upload. After you select the appropriate image, click Upload.
Delete Web Customization Image	To remove an image that has been uploaded, select the name of the image from the available menu and click Delete.

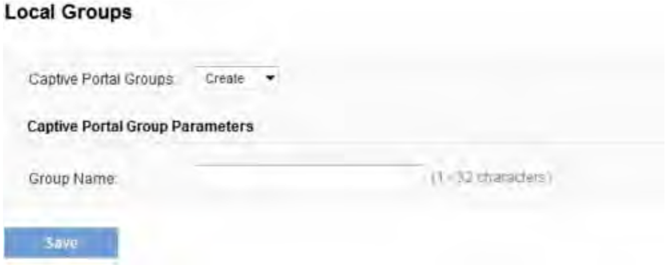
Local Groups

Each local user is assigned to a user group. Each group is assigned to a CP instance. The group facilitates managing the assignment of users to CP instances.

The user group named Default is built-in and cannot be deleted. You can create up to two additional user groups. The fields available on the page depend on the option selected from the Captive Portal Groups menu.

Click the *Configuration* > *Captive Portal* > *Local Groups* tab to access the page, which the following figure shows.

Figure 52: CP Local Groups



Local Groups

Captive Portal Groups: Create

Captive Portal Group Parameters

Group Name: (1 - 32 characters)

The following table describes the fields on the CP Local Groups page that you use to create a CP local group.

Table 61: Captive Portal Local Group Configuration

Field	Description
Captive Portal Groups	The menu includes all CP groups that exist on the switch. To create a new group, select Create. To delete a CP group, select the group name.
Group Name	This field is available only if the option selected from the Captive Portal Group menu is Create. Specify a name for the local user.
Delete Group	This field is available only if the option selected from the Captive Portal Group menu is a user-created CP group. To delete the selected group, select the check box and click Save.

Local Users

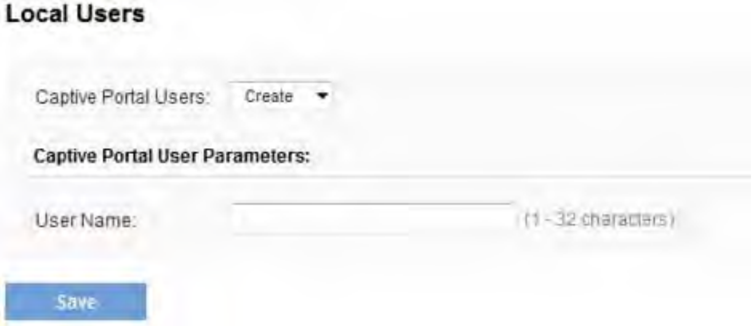
You can configure a captive portal instance to accommodate both guest users and authorized users. Guest users do not have assigned user names and passwords.

Authorized users provide a valid user name and password that must first be validated against a local database or RADIUS server. Authorized users are typically assigned to a CP instance that is associated with a different VAP than guest users.

Use the Local Users page to configure up to 128 authorized users in the local database.

Click the *Configuration* > *Captive Portal* > *Local Users* tab to access the page, which the following figure shows.

Figure 53: CP Local Users



Local Users

Captive Portal Users: Create

Captive Portal User Parameters:

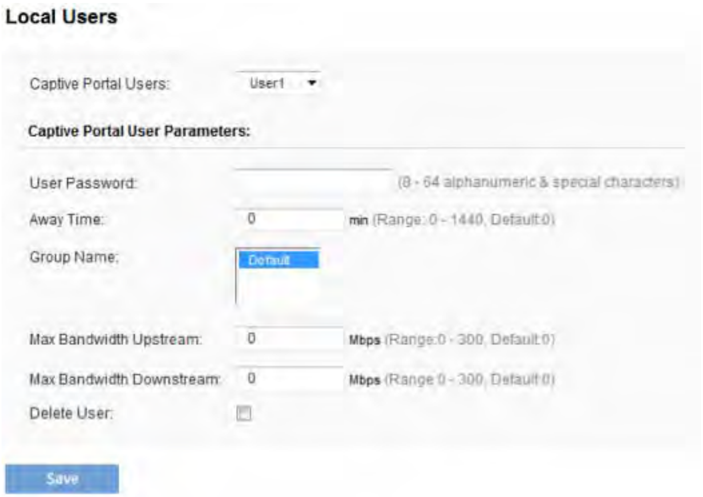
User Name: (1 - 32 characters)

The following table describes the fields on the CP **Local Users** page that you use to create a CP local user.

Table 62: Creating Captive Portal Local Users

Field	Description
Captive Portal Users	To create a new user, select Create.
User Name	Specify a name for the local user.

After you create a user or select an existing user from the Captive Portal Users menu, additional fields appear on the screen.



Local Users

Captive Portal Users: User1

Captive Portal User Parameters:

User Password: (8 - 64 alphanumeric & special characters)

Away Time: 0 min (Range: 0 - 1440, Default:0)

Group Name: Default

Max Bandwidth Upstream: 0 Mbps (Range:0 - 300, Default:0)

Max Bandwidth Downstream: 0 Mbps (Range:0 - 300, Default:0)

Delete User: □

The following table describes the fields on the CP Local Users page that you use to configure settings for an existing CP local user.

Table 63: Creating Captive Portal Local Users

Field	Description
Captive Portal Users	Select the name of the user with the settings to configure.
User Password	Enter the user's password, from 8 to 64 alphanumeric and special characters. A user enter must enter the password to log into the network through the captive portal.
Away Time	The amount of time a user remains in the CP authenticated client list after it disassociates from the AP. If the time specified in this field expires before the client attempts to reauthenticate, its entry is removed from the authenticated client list. The range is from 0 to 1440 minutes. The default value is 0. **Note**: An away timeout value is also configured for a captive portal instance. See the Instance Configuration page. The timeout value configured for a local user has precedence over the value configured for the captive portal instance.

Group Name	Select the group to which the user belongs. Each CP instance is configured to support a particular group of users.
Maximum Bandwidth Upstream	The maximum upload speed, in megabits per second, that a client can transmit traffic when using the captive portal. This setting limits the client's bandwidth used to send data into the network. The range is from 0 to 300 Mbps. The default is 0.
Maximum Bandwidth Downstream	The maximum download speed, in megabits per second, at which a client can receive traffic when using the captive portal. This setting limits the client's bandwidth used to receive data from the network. The range is from 0 to 300 Mbps. The default is 0.
Delete User	To delete the current user, select this option and click Save.

Authenticated Clients

The Authenticated Clients page provides information about clients that have authenticated on any captive portal instance.

Click the Configuration > Captive Portal > Authenticated Clients tab to access the page, which the following figure shows.

Figure 54: CP Authenticated Clients

The following table describes the fields on the CP **Authenticated** Clients page.

Table 64: Captive Portal Authenticated Client List

Field	**Description**
Total Number of Authenticated Clients	The number of clients that have successfully authenticated on any CP instance. This number includes only clients that are currently authenticated.
MAC Address	The MAC address of the client.
IP Address	The IPv4 or IPv6 address of the client. If the client has a valid IPv4 address assigned, it will be displayed here otherwise a global IPv6 address, either from DHCPv6 or Autoconfiguration or statically configured, will be used.
User Name	The client's Captive Portal user name.
Protocol Mode	The protocol the user used to establish the connection (HTTP or HTTPS).
Verify Mode	The method used to authenticate the user on the Captive Portal, which can be one of these values: • Guest—The user does not need to be authenticated by a database. • Local—The access point uses a local database to authenticated users. • RADIUS—The access point uses a database on a remote RADIUS server to authenticate users.

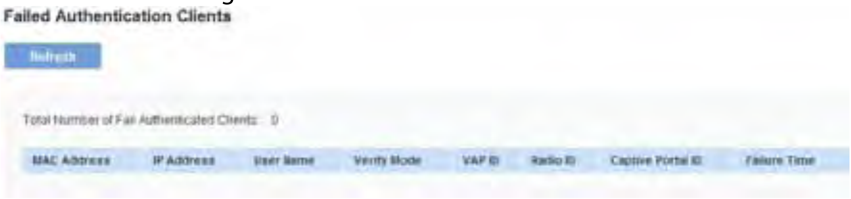
VAP ID	The VAP that the user is associated with.
Radio ID	The ID of the radio. Because the WAP321 has a single radio, this field always displays Radio1.
Captive Portal ID	The ID of the Captive Portal instance to which the user is associated.
Session Timeout	The time remaining, in seconds, for the CP session to be valid. After the time reaches zero, the client is deauthenticated.
Away Timeout	The time remaining, in seconds, for the client to be valid. The timer starts when the client dissociates from the CP. After the time reaches zero, the client is deauthenticated.
Rx Packets	The number of IP packets received by the access point from the user station.
Tx Packets	The number of IP packets transmitted from the access point to the user station.
Rx Bytes	The number of bytes received by the access point from the user station.
Tx Bytes	The number of bytes transmitted from the access point to the user station.

Failed Authentication Clients

The *Failed Authenticated* Clients page lists information about clients that attempted to authenticate on a Captive Portal and failed.

Click the *Configuration* > *Captive Portal* > *Failed Authenticated Clients* tab to access the page, which the following figure shows.

Figure 55: CP Failed Authenticated Clients



Failed Authentication Clients

Refresh

Total Number of Fail Authenticated Clients: 0

MAC Address	IP Address	User Name	Verify Mode	VAP ID	Radio ID	Captive Portal ID	Failure Time

The following table describes the fields on the CP **Failed Authenticated Clients** page.

Table 65: Captive Portal Failed Authenticated Client List

Field	Description
MAC Address	The MAC address of the client.
IP Address	The IP address of the client.
User Name	The client's Captive Portal user name.
Verify Mode	The method the client attempted to use to authenticate on the Captive Portal, which can be one of these values: • Guest—The user does not need to be authenticated by a database. • Local—The Access Point uses a local database to authenticated users. • RADIUS—The Access Point uses a database on a remote RADIUS server to authenticate users.
VAP ID	The VAP that the user attempted to associated with.
Radio ID	The ID of the radio that the user attempted to connect to.
Captive Portal ID	The ID of the Captive Portal instance to which the user attempted to associate.
Failure Time	The time that the authentication failure occurred. A timestamp is included that shows the time of the failure.

Cluster

The access point supports AP clusters. A cluster provides a single point of administration and lets you view, deploy, configure, and secure the wireless network as a single entity rather than a series of separate wireless devices.

- Access Points
- Sessions
- Channel Management
- Wireless Neighborhood

Access Points

The AP cluster is a dynamic, configuration-aware group of APs in the same subnet of a network. Each cluster can have up to 16 members. Only one cluster per wireless network is supported; however, a network subnet can have multiple clusters. Clusters can share various configuration information such as VAP settings and QoS queue parameters.

A cluster can be formed between two APs if the following conditions are met:

- The APs use the same radio mode (for example, radio 1 uses 802.11g)
- The APs are connected on the same bridged segment.
- The APs joining the cluster have the same Cluster Name.
- Clustering mode is enabled on both APs.

NOTE:
For two APs to be in the same cluster, they do not need to have the same number of radios; however, the supported capabilities of the radios should be same.

Clustering Single and Dual Radio APs

Clusters can contain a mixture of APs with two radios and APs with a single radio. When the configuration of a single-radio AP in the cluster changes, the AP propagates the change to the first radio of all cluster members. The configuration of the second radio on any dual-radio APs in the cluster is not affected.

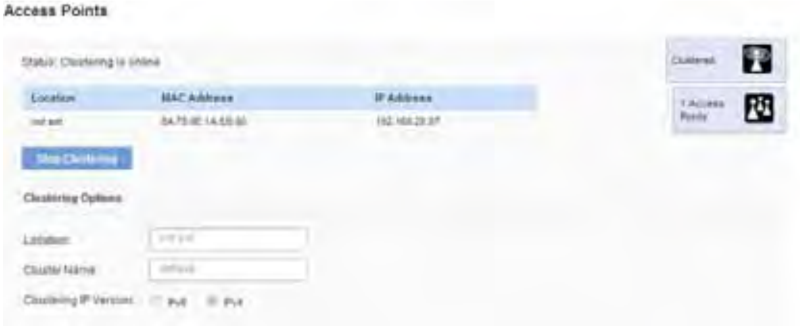
If a cluster contains only single-radio APs and a dual radio AP joins the cluster, then only radio 1 on the dual-radio AP is configured with the cluster configuration. Radio 2 on the AP remains as it was prior to joining the cluster. However, if the cluster already has at least one dual-radio AP, then the second radio of the AP joining the cluster is configured with the cluster settings.

Viewing and Configuring Cluster Members

The Access Points tab allows you to start or stop clustering on an AP, view the cluster members, and configure the location and cluster name for a cluster member. From the Configuration > Cluster > Access Points page, you can also click the IP address of each cluster member to navigate to configuration settings and data on an access point in the cluster.

To view information about cluster members and to configure the location and cluster of an individual member, click the Configuration > Cluster > Access Points tab.

Figure 56: Cluster Information and Member Configuration



Access Points

Status: Clustering is online

Location	MAC Address	IP Address
not set	[illegible]	[illegible]

Clustering Options

Location: [illegible]

Cluster Name: default

Clustering IP Version: ○ IPv6 ● IPv4

If clustering is currently disabled on the AP, the Start Clustering button is visible. If clustering is enabled, the Stop Clustering button is visible. You can edit the clustering option information when clustering is disabled.

The following table describes the configuration and status information available on the cluster Access Points page.

Table 66: Access Points in the Cluster

Field	Description
Status	If the status field is visible, then the AP is enabled for clustering. If clustering is not enabled, then the AP is operating in stand-alone mode and none of the information in this table is visible. To disable clustering on the AP, click Stop Clustering.
Location	Description of where the access point is physically located.
MAC Address	Media Access Control (MAC) address of the access point. The address shown here is the MAC address for the bridge (br0). This is the address by which the AP is known externally to other networks.
IP Address	Specifies the IP address for the access point. Each IP address is a link to the Administration Web pages for that access point. You can use the links to navigate to the Administration Web pages for a specific access point. This is useful for viewing data on a specific access point to make sure a cluster member is picking up cluster configuration changes, to configure advanced settings on a particular access point, or to switch a standalone access point to cluster mode.

The following table describes the cluster information to configure for an individual member. The clustering options are read-only when clustering is enabled. To configure the clustering options, you must stop clustering.

Table 67: Clustering Options

Field	Description
Location	Enter a description of where the access point is physically located.
Cluster Name	Enter the name of the cluster for the AP to join. The cluster name is not sent to other APs in the cluster. You must configure the same cluster name on each AP that is a member of the cluster. The cluster name must be unique for each cluster you configure on the network.
Clustering IP Version	Specify the IP version that the APs in the cluster use to communicate with each other.

Removing an Access Point from the Cluster

To remove an access point from the cluster, do the following.

1. Go to the Administration Web pages for the clustered access point.
   The Administration Web pages for the standalone access point are displayed.
2. Click the Configuration > Cluster > Access Points tab in the Administration pages.
3. Click **Stop Clustering**.
   The change will be reflected under Status for that access point; the access point will now show as standalone (instead of cluster).

Adding an Access Point to a Cluster

To add an access point that is currently in standalone mode back into a cluster, do the following.

1. Go to the Administration Web pages for the standalone access point.

The Administration Web pages for the standalone access point are displayed.

2. Click the Configuration > Cluster > Access Points tab in the Administration pages for the standalone access point.

The Access Points tab for a standalone access point indicates that the current mode is standalone and provides a button for adding the access point to a cluster (group).

3. Click Start Clustering.

The access point is now a cluster member. Status (Mode) on the Configuration > Cluster > Access Points tab now indicates cluster instead of Not Clustered.

Navigating to Configuration Information for a Specific AP

In general, the access point is designed for central management of clustered access points. All access points in a cluster reflect the same configuration. In this case, it does not matter which access point you actually connect to for administration.

There may be situations, however, when you want to view or manage information on a particular access point. For example, you might want to check status information such as client associations or events for an access point. In this case, you can navigate to the Administration Web interface for individual access points by clicking the IP address links on the Access Points tab.

All clustered access points are shown on the Cluster > Access Points page. To navigate to clustered access points, you can simply click on the IP address for a specific cluster member shown in the list.

Navigating to an AP by Using its IP Address in a URL

You can also link to the Administration Web pages of a specific access point, by entering the IP address for that access point as a URL directly into a Web browser address bar in the following form:

http://IPAddressOfAccessPoint

where IPAddressOfAccessPoint is the address of the particular access point you want to monitor or configure.

Sessions

The Sessions page shows information on client stations associated with access points in the cluster. Each client is identified by its MAC address, along with the AP (location) to which it is currently connected. This page shows a maximum of 20 clients per radio of the clustered APs. See all clients associated with a particular AP, view the Status and Statistics > Associations Clients web page directly on that AP.

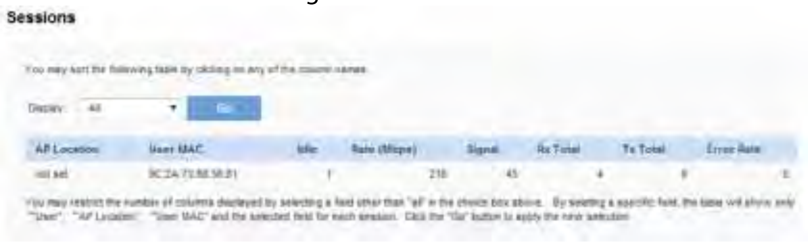
To view a particular statistic for client sessions, select an item from the Display drop-down list and click Go. You can view information about idle time, data rate, signal strength and so on; all of which are described in detail in the table below.

A session in this context is the period of time in which a user on a client device (station) with a unique MAC address maintains a connection with the wireless network. The session begins when the client logs on to the network, and the session ends when the client either logs off intentionally or loses the connection for some other reason.

NOTE:
A session is not the same as an association, which describes a client connection to a particular access point. A client network connection can shift from one clustered AP to another within the context of the same session. A client station can roam between APs and maintain the session.

To manage sessions associated with the cluster, click the Cluster > Sessions tab.

Figure 57: Cluster Sessions



Sessions

You may sort the following table by clicking on any of the column names.

Display: All ▾ Go

AP Location	User MAC	Idle	Rate (Mbps)	Signal	Rx Total	Tx Total	Error Rate
not set	9C:2A:70:88:58:B1	1	216	45	4	9	0

You may restrict the number of columns displayed by selecting a field other than "all" in the choice box above. By selecting a specific field, the table will show only "User", "AP Location", "User MAC" and the selected field for each session. Click the "Go" button to apply the new selection.

Details about the session information are described in the following table.

Table 68: Cluster Sessions

Field	**Description**
AP Location	Indicates the location of the access point. This is derived from the location description specified on the System Settings tab.
User MAC	Indicates the MAC address of the wireless client device. A MAC address is a hardware address that uniquely identifies each node of a network.
Idle	Indicates the amount of time this station has remained inactive. A station is considered to be idle when it is not receiving or transmitting data.

Rate	The speed at which this access point is transferring data to the specified client. The data transmission rate is measured in megabits per second (Mbps). This value should fall within the range of the advertised rate set for the mode in use on the access point. For example, 6 to 54 Mbps for 802.11a.
Signal	Indicates the strength of the radio frequency (RF) signal the client receives from the access point. The measure used for this is a value known as Received Signal Strength Indication (RSSI), and will be a value between 0 and 100. RSSI is determined by a mechanism implemented on the network interface card (NIC) of the client station.
Rx Total	Indicates number of total packets received from the client during the current session.
Tx Total	Indicates number of total packets transmitted to the client during this session.
Error Rate	Indicates the percentage of time frames are dropped during transmission on this access point.

Sorting Session Information

To sort the information shown in the tables by a particular indicator, click the column label by which you want to order things. For example, if you want to see the table rows ordered by signal strength, click the Signal column label. The entries will be sorted by signal strength.

Channel Management

When Channel Management is enabled, the access point automatically assigns radio channels used by clustered access points. The automatic channel assignment reduces mutual interference (or interference with other access points outside of its cluster) and maximizes Wi-Fi bandwidth to help maintain the efficiency of communication over the wireless network.

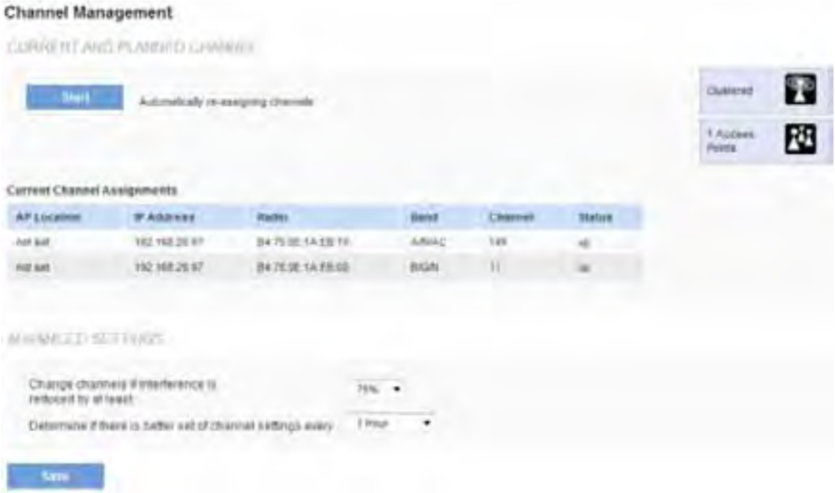
You must start channel management to get automatic channel assignments; it is disabled by default on a new AP.

At a specified interval, the Channel Manager maps APs to channel use and measures interference levels in the cluster. If significant channel interference is detected, the Channel Manager automatically re-assigns some or all of the APs to new channels per an efficiency algorithm (or automated channel plan). If the Channel Manager determines that a change is necessary, that information is sent to all members of the cluster and a syslog message is generated indicating the sender AP, new and old channel assignments.

The Channel Management page shows previous, current, and planned channel assignments for clustered access points. By default, automatic channel assignment is disabled. You can start channel management to optimize channel usage across the cluster on a scheduled interval.

To configure and view the channel assignments for the cluster members, click the Configuration > Cluster > Channel Management tab.

Figure 58: Cluster Channel Management



Channel Management

CURRENT AND PLANNED CHANNELS

Start Automatically re-assigning channels

Current Channel Assignments

AP Location	IP Address	Radio	Band	Channel	Status
Not set	192.168.20.97	B4:75:0E:1A:EB:19	A/N/AC	149	up
Not set	192.168.20.97	B4:75:0E:1A:E8:00	B/G/N	11	up

ADVANCED SETTINGS

Change channels if interference is reduced by at least: 75%

Determine if there is better set of channel settings every: 1 Hour

Save

From this page, you can view channel assignments for all APs in the cluster and stop or start automatic channel management. By using the advanced settings on the page, you can modify the interference reduction potential that triggers channel re-assignment, change the schedule for automatic updates, and re-configure the channel set used for assignments.

Stopping/Starting Automatic Channel Assignment

By default, automatic channel assignment is disabled (off).

NOTE:
Channel Management overrides the default cluster behavior, which is to synchronize radio channels of all APs across a cluster. When Channel Management is enabled, the radio channel is not synced across the cluster to other APs.

- Click **Start** to resume automatic channel assignment.
- When automatic channel assignment is enabled, the Channel Manager periodically maps radio channels used by clustered access points and, if necessary, re-assigns channels on clustered APs to reduce interference (with cluster members or other APs outside the cluster).
- Click **Stop** to stop automatic channel assignment. (No channel usage maps or channel re-assignments will be made. Only manual updates will affect the channel assignment.)
-

NOTE:
When automatic channel assignment is enabled, the channel policy for the radio is automatically set to static mode, and the Auto option is not available for the Channel field on the Wireless Settings or Radio pages. This allows the automatic channel feature to set the channels for the radios in the cluster.

Viewing Current Channel Assignments and Setting Locks

The Current Channel Assignments section shows a list of all access points in the cluster by IP address. The display shows the band on which each AP is broadcasting (a/b/g/n), the current channel used by each AP, and an option to lock an AP on its current radio channel so that it cannot be re-assigned to another.

Table 69: Channel Assignments

Field	Description
IP Address	Specifies the IP address for the access point.
Radio	Identifies the MAC address of the radio.
Band	Indicates the band on which the access point is broadcasting.
Current	Indicates the radio channel on which this access point is currently broadcasting.
Locked	Click Locked to force the access point to remain on the current channel. When Locked is selected (enabled) for an access point, automated channel management plans will not re-assign the AP to a different channel as a part of the optimization strategy. Instead, APs with locked channels will be factored in as requirements for the plan. If you click Save, you will see that locked APs show the same channel for the Current Channel and Proposed Channel fields. Locked APs will keep their current channels.

Viewing the Last Proposed Set of Changes

The Proposed Channel Assignments shows the last channel plan. The plan lists all access points in the cluster by IP address, and shows the current and proposed channels for each AP. Locked channels will not be re-assigned and the optimization of channel distribution among APs will take into account the fact that locked APs must remain on their current channels. APs that are not locked may be assigned to different channels than they were previously using, depending on the results of the plan.

Table 70: Last Proposed Changes

Field	Description
IP Address	Specifies the IP address for the access point.
Radio	Indicates the radio channel on which this access point is currently broadcasting.
Proposed Channel	Indicates the radio channel to which this access point would be re-assigned if the channel plan is executed.

Configuring Advanced Settings

Advanced settings allow you to customize and schedule the channel plan for the cluster. If you use Channel Management as provided (without updating Advanced Settings), channels are automatically fine-tuned once every hour if interference can be reduced by 25 percent or more. Channels will be re-assigned even if the network is busy. The appropriate channel sets will be used (b/g for APs using IEEE 802.11b/g and a for APs using IEEE 802.11a).

The default settings are designed to satisfy most scenarios where you would need to implement channel management.

Use Advanced Settings to modify the interference reduction potential that triggers channel re-assignment, change the schedule for automatic updates, and re-configure the channel set used for assignments. If there are no fields showing in the Advanced section, click the toggle button to display the settings that modify timing and details of the channel planning algorithm.

Table 71: Channel Management Advanced Settings

Field	Description
Change channels if interference is reduced by at least	Specify the minimum percentage of interference reduction a proposed plan must achieve in order to be applied. The default is 75 percent. Use the drop-down menu to choose percentages ranging from 5 percent to 75 percent. This setting lets you set a gating factor for channel re-assignment so that the network is not continually disrupted for minimal gains in efficiency. For example, if channel interference must be reduced by 75 percent and the proposed channel assignments will only reduce interference by 30 percent, then channels will not be re-assigned. However, if you re-set the minimal channel interference benefit to 25 percent and click Save, the proposed channel plan will be implemented and channels re-assigned as needed.
Determine if there is better set of channels every	Use the drop-down menu to specify the schedule for automated updates. A range of intervals is provided, from 30 minutes to 6 months. The default is 1 Hour (channel usage re-assessed and the resulting channel plan applied every hour).

Click **Save** under Advanced settings to apply these settings.

Advanced settings will take affect when they are applied and influence how automatic channel management is performed.

Wireless Neighborhood

The Wireless Neighborhood shows up to 20 access points per radio within range of every member of the cluster, shows which access points are within range of which cluster members, and distinguishes between cluster members and nonmembers.

Note: The Wireless Neighborhood page shows up to 20 access points per radio. To see all the access points detected on a given cluster access point, navigate to that cluster member's web interface.

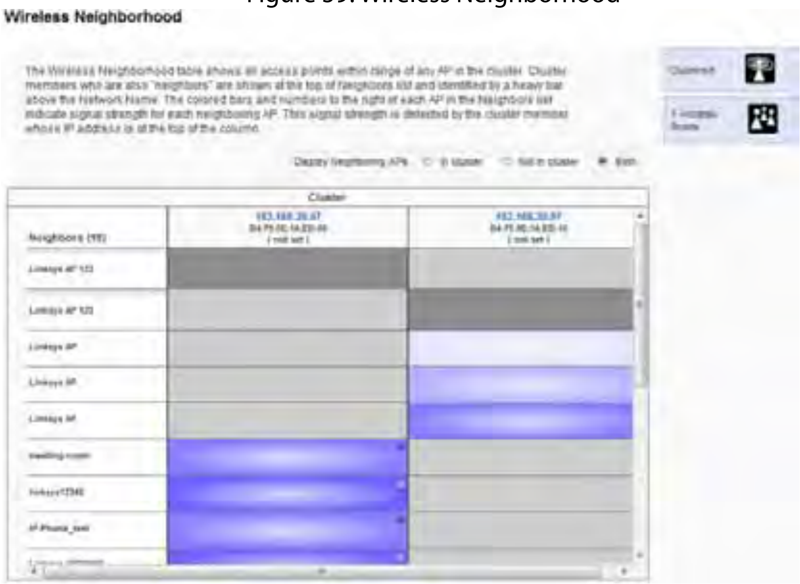
For each neighbor access point, the Configuration > Cluster > Wireless Neighborhood view shows identifying information (SSID or Network Name, IP address, MAC address) along with radio statistics (signal strength, channel, beacon interval). You can click on an AP to get additional statistics about the APs in radio range of the currently selected AP.

The Wireless Neighborhood view can help you:

- Detect and locate unexpected (or rogue) access points in a wireless domain so that you can take action to limit associated risks
- Verify coverage expectations. By assessing which APs are visible at what signal strength from other APs, you can verify that the deployment meets your planning goals.
- Detect faults. Unexpected changes in the coverage pattern are evident at a glance in the color coded table.

To view neighboring access points, click the Configuration > Cluster > Wireless Neighborhood tab.

Figure 59: Wireless Neighborhood



Wireless Neighborhood

The Wireless Neighborhood table shows all access points within range of any AP in the cluster. Cluster members who are also "neighbors" are shown at the top of Neighbors list and identified by a heavy bar above the Network Name. The colored bars and numbers to the right of each AP in the Neighbors list indicate signal strength for each neighboring AP. This signal strength is detected by the cluster member whose IP address is at the top of the column.

Display Neighboring APs ○ In cluster ○ Not in cluster ● Both

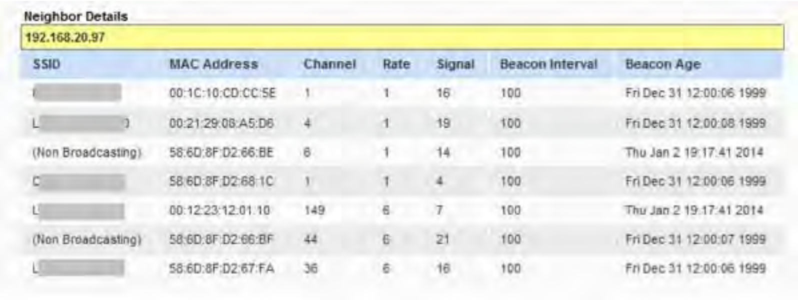
Table 72: Wireless Neighborhood Information

Field	Description
Display neighboring APs	Click one of the following radio buttons to change the view: • In cluster — Shows only neighbor APs that are members of the cluster • Not in cluster — Shows only neighbor APs that are not cluster members • Both — Shows all neighbor APs (cluster members and non-members)
Cluster	The Cluster list at the top of the table shows IP addresses for all access points in the cluster. (This is the same list of cluster members shown on the Cluster > Access Points tab.) If there is only one AP in the cluster, only a single IP address column will be displayed here, indicating that the AP is clustered with itself. You can click on an IP address to view more details on a particular AP.
Neighbors	Access points which are neighbors of one or more of the clustered APs are listed in the left column by SSID (Network Name). An access point which is detected as a neighbor of a cluster member can also be a cluster member itself. Neighbors who are also cluster members are always shown at the top of the list with a heavy bar above and include a location indicator. The colored bars to the right of each AP in the Neighbors list shows the signal strength for each of the neighbor APs as detected by the cluster member whose IP address is shown at the top of the column. The color of the bar indicates the signal strength: • Dark Blue Bar — A dark blue bar and a high signal strength number (for example 50) indicates good signal strength detected from the neighbor seen by the AP whose IP address is listed above that column. • Lighter Blue Bar — A lighter blue bar and a lower signal strength number (for example 20 or lower) indicates medium or weak signal strength from the neighbor seen by the AP whose IP address is listed above that column • White Bar — A white bar and the number 0 indicates that a neighboring AP that was detected by one of the cluster members cannot be detected by the AP whose IP address if listed above that column. • Light Gray Bar — A light gray bar and no signal strength number indicates a neighbor that is detected by other cluster members but not by the AP whose IP address is listed above that column. • Dark Gray Bar — A dark gray bar and no signal strength number indicates this is the AP whose IP address is listed above that column (since it is not applicable to show how well the AP can detect itself).

Viewing Details for a Cluster Member

To view details on a cluster member AP, click on the IP address of a cluster member at the top of the page. The following figure shows the Neighbor Details for Radio 1 of the AP with an IP address of 192.168.20.97.

Figure 60: Details for a Cluster Member AP



Neighbor Details

192.168.20.97

SSID	MAC Address	Channel	Rate	Signal	Beacon Interval	Beacon Age
[redacted]	00:1C:10:CD:CC:5E	1	1	16	100	Fri Dec 31 12:00:06 1999
[redacted]	00:21:29:08:A5:D6	4	1	19	100	Fri Dec 31 12:00:08 1999
(Non Broadcasting)	58:6D:8F:D2:66:BE	6	1	14	100	Thu Jan 2 19:17:41 2014
[redacted]	58:6D:8F:D2:68:1C	1	1	4	100	Fri Dec 31 12:00:06 1999
[redacted]	00:12:23:12:01:10	149	6	7	100	Thu Jan 2 19:17:41 2014
(Non Broadcasting)	58:6D:8F:D2:66:BF	44	6	21	100	Fri Dec 31 12:00:07 1999
[redacted]	58:6D:8F:D2:67:FA	36	6	16	100	Fri Dec 31 12:00:06 1999

Table 73: Cluster Member Details

Field	Description
SSID	The Service Set Identifier (SSID) for the access point. The SSID is an alphanumeric string of up to 32 characters that uniquely identifies a wireless local area network. It is also referred to as the Network Name. A guest network and an internal network running on the same access point must always have two different network names.
MAC Address	Shows the MAC address of the neighboring access point. A MAC address is a hardware address that uniquely identifies each node of a network.
Channel	Shows the channel on which the access point is currently broadcasting. The channel defines the portion of the radio spectrum that the radio uses for transmitting and receiving.
Rate	Shows the rate (in megabits per second) at which this access point is currently transmitting. The current rate will always be one of the rates shown in Supported Rates.
Signal	Indicates the strength of the radio signal emitting from this access point as measured in decibels (Db).
Beacon Interval	Shows the beacon interval being used by this access point. Beacon frames are transmitted by an access point at regular intervals to announce the existence of the wireless network. The default behavior is to send a beacon frame once every 100 milliseconds (or 10 per second).
Beacon Age	Shows the date and time of the last beacon received from this access point.

Section 4: Maintenance of the Access Point

This section describes how to maintain the access point and see system detailed information.

- Maintenance
- Diagnostics

Maintenance

From the access point Administrator UI, you can perform the following maintenance tasks:

Firmware

- Switching Firmware Image
- Firmware Upgrade

Configuration Backup/Restore

- Backup Configuration
- Restoring Configuration

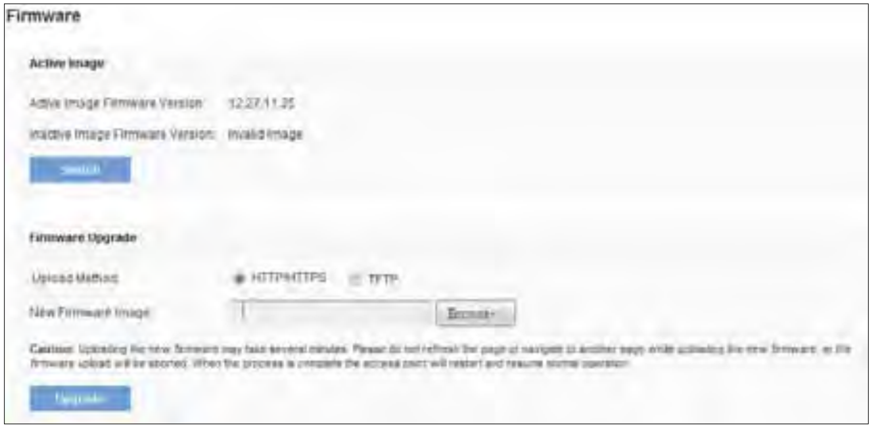
Reset/Reboot

- To Restore the Factory Default Configuration
- To Reboot the Access Point

Firmware

Use this page to select the firmware image that the AP loads when it boots and to upload a new firmware image to the device.

Figure 61: Firmware Maintenance



Firmware

Active Image

Active Image Firmware Version: 12.27.11.25

Inactive Image Firmware Version: Invalid Image

Firmware Upgrade

Upload Method ● HTTP/HTTPS ○ TFTP

New Firmware Image

Caution: Uploading the new firmware may take several minutes. Please do not refresh the page or navigate to another page while uploading the new firmware, or the firmware upload will be aborted. When the process is complete the access point will restart and resume normal operation.

Table 74: Firmware Information and Management

Field	Description
Active Image	Identifies the firmware images on the system: • Active Image Firmware Version—The version number of the image that is loaded during system boot. • Inactive Image Firmware Version—The version number of the inactive (backup) image on the system.
Upload Method	The method to use to upload a new firmware image to the AP: • HTTP—Use a Web browser. • TFTP—Use a TFTP server.
New Firmware Image (HTTP Upload)	Click Browse to find and select the new firmware image located on an administrative system.
Image Filename (TFTP Upload)	The path and filename of the firmware image to upload to the AP.
Server IP (TFTP Upload)	The IP address of the TFTP server where the new firmware image is located.

Use the buttons to perform the following tasks:

- **Switch:** Use the secondary image as the primary image. The change takes effect the next time the AP boots. For more information, see Switching Firmware Image.
- **Upgrade:** Upload the specified firmware image to the AP. For more information about the firmware upgrade procedures, see Firmware Upgrade.

Click Maintenance > Firmware to display the Manage Firmware page. From the Manage Firmware page, you can:

- View the current firmware version for the primary and secondary image
- Switch the firmware image running on the AP.
- Upload a new firmware version.

Switching Firmware Image

The AP always tries to boot with the primary image. If the primary image fails to load, then the secondary image is used to boot the AP. Whenever such a failover occurs, the system creates a log message to help you troubleshoot the firmware failure.

Use the following steps to switch the firmware image running on the AP:

1. **Click** Switch.

A dialog box displays confirming the firmware image switch and subsequent reboot.

2. Click **OK** to proceed.

The process may take several minutes during which time the access point will be unavailable. Do not power down the access point while the image switch is in process. When the image switch is complete, the access point restarts. The AP resumes normal operation with the same configuration settings it had before the upgrade.

Firmware Upgrade

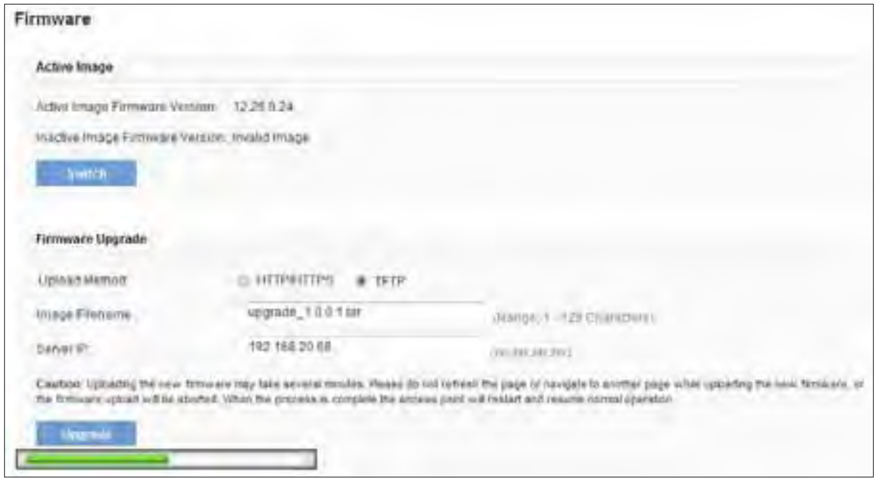
As new versions of the access point firmware become available, you can upgrade the firmware on your devices to take advantage of new features and enhancements. The AP uses a TFTP client for firmware upgrades. You can also use HTTP to perform firmware upgrades.

After you upload new firmware and the system reboots, the newly added firmware becomes the primary image. If the upgrade fails, the original firmware remains as the primary image.

NOTE:
When you upgrade the firmware, the access point retains the existing configuration information.

Use the following steps to upgrade the firmware on an access point by using TFTP:

1. Select TFTP for Upload Method.
2. Enter a name (1 to 256 characters) for the image file in the Image Filename field, including the path to the directory that contains the image to upload. For example, to upload the ap_upgrade.tar image located in the /share/builds/ap directory, enter /share/builds/ap/ap_upgrade.tar in the New Firmware Image field.The firmware upgrade file supplied must be a .tar file. Do not attempt to use .bin files or files of other formats for the upgrade; these types of files will not work.
3. Enter the IP address of the TFTP server.



Active Image Firmware Version: 12.25.0.24

Inactive Image Firmware Version: Invalid Image

Upload Method ○ HTTP/HTTPS ● TFTP

Image Filename upgrade_1.0.0.1.tar (Range: 1 - 128 Characters)

Server IP: 192.168.20.68 (xxx.xxx.xxx.xxx)

Caution: Uploading the new firmware may take several minutes. Please do not refresh the page or navigate to another page while uploading the new firmware, or the firmware upload will be aborted. When the process is complete the access point will restart and resume normal operation.

4. Click Upgrade.

Upon clicking Upgrade for the firmware upgrade, a popup confirmation window is displayed that describes the upgrade process.

5. Click OK to confirm the upgrade and start the process.

NOTE:
The firmware upgrade process begins once you click Upgrade and then OK in the popup confirmation window.

The upgrade process may take several minutes during which time the access point will be unavailable. Do not power down the access point while the upgrade is in process. When the upgrade is complete, the access point restarts. The AP resumes normal operation with the same configuration settings it had before the upgrade.

6. To verify that the firmware upgrade completed successfully, check the firmware version shown on the Firmware page (or the System Summary tab). If the upgrade was successful, the updated version name or number is indicated.

Use the following steps to upgrade the firmware on an access point by using HTTP:

1. Select HTTP for Upload Method.
2. If you know the path to the new firmware image file, enter it in the New Firmware Image field. Otherwise, click the Browse button and locate the firmware image file.

   The firmware upgrade file supplied must be a .tar file. Do not attempt to use .bin files or files of other formats for the upgrade; these types of files will not work.
3. Click Upgrade to apply the new firmware image.

   Upon clicking Upgrade for the firmware upgrade, a popup confirmation window is displayed that describes the upgrade process.
4. Click OK to confirm the upgrade and start the process.

NOTE:
The firmware upgrade process begins once you click Upgrade and then OK in the popup confirmation window.

The upgrade process may take several minutes during which time the access point will be unavailable. Do not power down the access point while the upgrade is in process. When the upgrade is complete, the access point restarts. The AP resumes normal operation with the same configuration settings it had before the upgrade.

1. To verify that the firmware upgrade completed successfully, check the firmware version shown on the Firmware page (or the Status Status > Status and Statistics > System Summary tab). If the upgrade was successful, the updated version name or number is indicated.

Configuration Backup/Restore

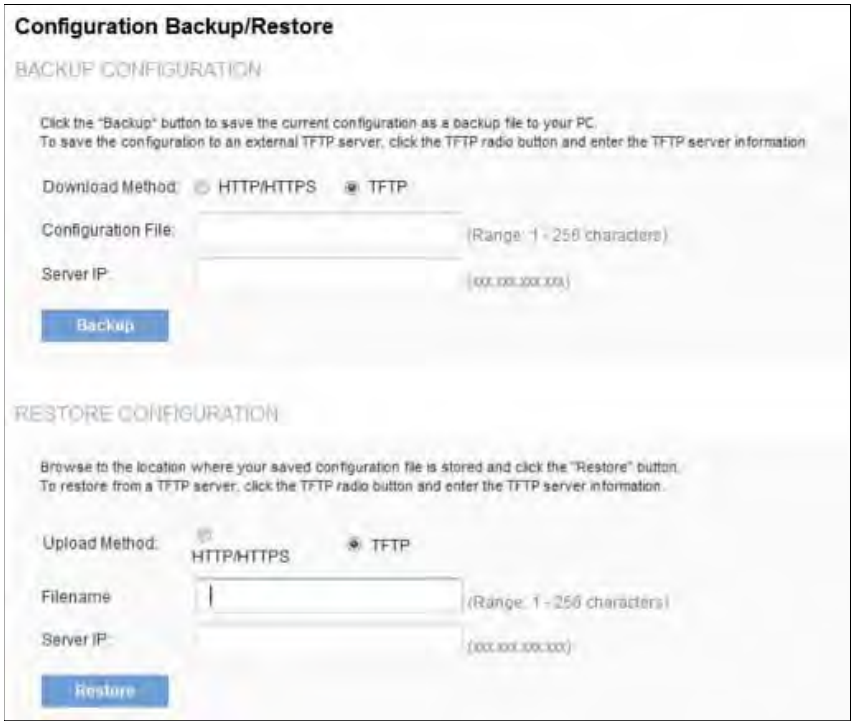
The access point configuration file is in XML format and contains all of the information about the AP settings. You can download the configuration file to a management station to manually edit the content or to save as a back-up copy. (for example, config.xml). The backup file can be used at a later date to restore the access point to the previously save configuration. When you upload a configuration file to the AP, the configuration information in the XML file is applied to the AP.

NOTE:
When you click Restore, the access point will reboot. Please wait for the reboot process to complete (a minute or two). The AP Administration Web pages will not be accessible until the AP has rebooted.

Upon reboot, you should see the configuration settings restored to those contained in the specified backup file.

When you upload a configuration file to the AP, the configuration information in the XML file is applied to the AP. Click the Maintenance > Configuration Backup/Restore tab to access the configuration management page, which the following figure shows.

Figure 62: Configuration Backup/Restore



Configuration Backup/Restore

BACKUP CONFIGURATION

Click the "Backup" button to save the current configuration as a backup file to your PC.
To save the configuration to an external TFTP server, click the TFTP radio button and enter the TFTP server information

Download Method: ○ HTTP/HTTPS ● TFTP

Configuration File: (Range: 1 - 256 characters)

Server IP: (xxx.xxx.xxx.xxx)

RESTORE CONFIGURATION

Browse to the location where your saved configuration file is stored and click the "Restore" button.
To restore from a TFTP server, click the TFTP radio button and enter the TFTP server information.

Upload Method: ○ HTTP/HTTPS ● TFTP

Filename (Range: 1 - 256 characters)

Server IP (xxx.xxx.xxx.xxx)

Backup Configuration

You can use HTTP or TFTP to transfer files to and from the access point. After you download a configuration file to the management station, you can manually edit the file, which is in XML format. Then, you can upload the edited configuration file to apply those configuration settings to the AP.

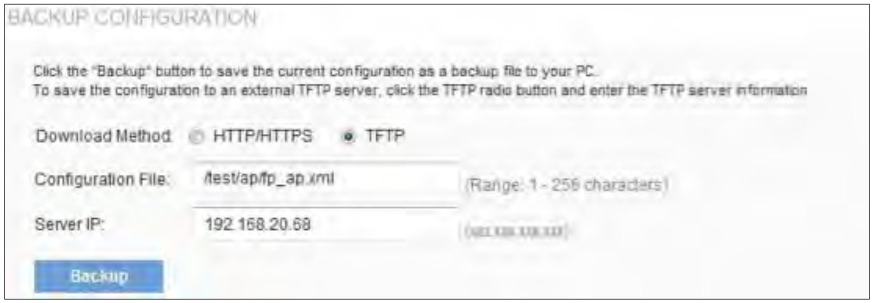
Use the following steps to save a copy of the current settings on an AP to a backup configuration file by using TFTP:

1. Select TFTP for Download Method.

2. Enter a name (1 to 256 characters) for the backup file in the Filename field, including the .xml file name extension and the path to the directory where you want to save the file.

NOTE:
File name should not contain spaces, < , > , | , \ , / , : , (,), & , ; , # , ?, *, $, %, ‘, “, and successive ‘.’ .

3. Enter the IP address of the TFTP server.



BACKUP CONFIGURATION

Click the "Backup" button to save the current configuration as a backup file to your PC.
To save the configuration to an external TFTP server, click the TFTP radio button and enter the TFTP server information

Download Method ○ HTTP/HTTPS ● TFTP

Configuration File: /test/ap/fp_ap.xml (Range: 1 - 256 characters)

Server IP: 192.168.20.68 (xxx.xxx.xxx.xxx)

4. Click Backup to save the file.

Use the following steps to save a copy of the current settings on an AP to a backup configuration file by using HTTP:

1. Select HTTP for Download Method.

2. Click the Backup button.

   A dialog box will pop up to verify the download.

3. To proceed with the download, select OK.

   A dialog box will open asking you to view or save the file.

4. Select the Save File option and select OK.

5. Use the file browser to navigate to the directory where you want to save the file, and click OK to save the file.

   You can keep the default file name (config.xml) or rename the backup file, but be sure to save the file with an .xml extension.

Restoring Configuration

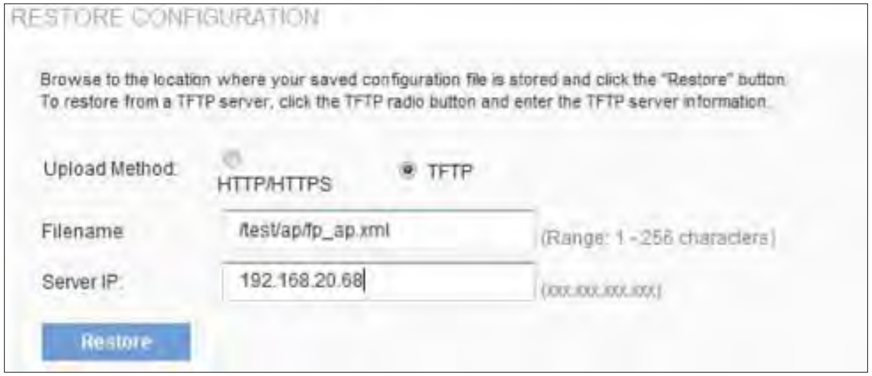
You can use HTTP or TFTP to transfer files to and from the access point. After you download a configuration file to the management station, you can manually edit the file, which is in XML format. Then, you can upload the edited configuration file to apply those configuration settings to the AP.

Use the following procedures to restore the configuration on an AP to previously saved settings by using TFTP:

1. Select TFTP for Upload Method.
2. Enter a name (1 to 256 characters) for the backup file in the Filename field, including the .xml file name extension and the path to the directory that contains the configuration file to upload.

NOTE:
File name should not contain spaces, < , > , | , \ , / , : , (,), & , ; , # , ?, *, $, %, ‘, “, and successive “. .

3. Enter the IP address of the TFTP server in the Server IP field.



RESTORE CONFIGURATION

Browse to the location where your saved configuration file is stored and click the "Restore" button
To restore from a TFTP server, click the TFTP radio button and enter the TFTP server information.

Upload Method: ○ HTTP/HTTPS ● TFTP

Filename: /test/ap/fp_ap.xml (Range: 1 - 256 characters)

Server IP: 192.168.20.68 (xxx.xxx.xxx.xxx)

4. Click the Restore button.

   The AP will reboot. A reboot confirmation dialog and follow-on rebooting status message will pop up. Please wait for the reboot process to complete, which might take several minutes. The Administration Web UI is not accessible until the AP has rebooted.

Use the following steps to save a copy of the current settings on an AP to a backup configuration file by using HTTP:

1. Select HTTP for Upload Method.
2. User the Browse button to select the file to restore.
3. Click the Restore button.

   A File Upload or Choose File dialog box will pop up.
4. Navigate to the directory that contains the file, select the file to upload and click Open.

   (Only those files created with the Backup function and saved as .xml backup configuration files are valid to use with Restore; for example, ap_config.xml.)
5. Click the Restore button.

   A dialog box will open asking you to verify the restore.
6. Click OK to proceed.

   The AP will reboot. A reboot confirmation dialog and follow-on rebooting status message will pop up. Please wait for the reboot process to complete, which might take several minutes.

   The Administration Web UI is not accessible until the AP has rebooted.

Reset/Reboot

- **To Restore the Factory Default Configuration**

If you are experiencing problems with the access point and have tried all other troubleshooting measures, click Reset. This restores factory defaults and clears all settings, including settings such as a new password or wireless settings.

- **To Reboot the Access Point**

For maintenance purposes or as a troubleshooting measure, you can reboot the access point. To reboot the access point, click the Reboot button on the Reset/Reboot page.

Diagnostics

This section include following subsections:

- Packet Capture
- Diagnostic Log

Packet Capture

1. Wireless packet capture operates in two modes:

- Capture file mode
- Remote capture mode

For capture file mode, captured packets are stored in a file on the access point. The AP can transfer the file to a TFTP server. The file is formatted in pcap format and can be examined using tools such as Wireshark and OmniPeek.

For remote capture mode, the captured packets are redirected in real time to an external PC running the Wireshark® tool.

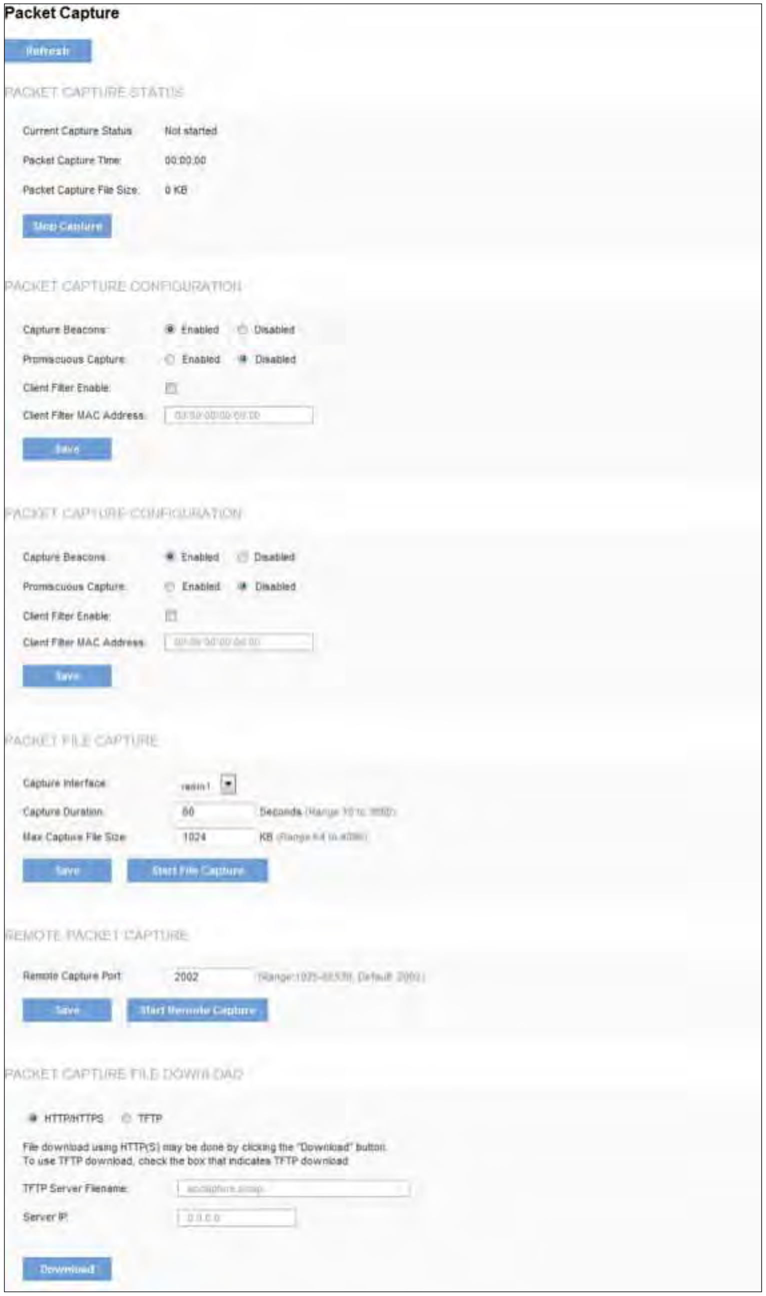
The AP can capture the following types of packets:

- 802.11 packets received and transmitted on radio interfaces. Packets captured on radio interfaces include the 802.11 header.
- 802.3 packets received and transmitted on the Ethernet interface.
- 802.3 packets received and transmitted on the internal logical interfaces such as VAPs and WDS interfaces.

Click Maintenance > Diagnostics > Packet Capture to display the Packet Capture Configuration and Settings page. From this page you can:

- View the current packet capture status.
- Configure packet capture parameters.
- Configure packet file capture.
- Configure a remote capture port.
- Download a packet capture file.

Figure 63: Packet Capture Configuration



Packet Capture

PACKET CAPTURE STATUS

Current Capture Status: Not started

Packet Capture Time: 00:00:00

Packet Capture File Size: 0 KB

PACKET CAPTURE CONFIGURATION

Capture Beacons: ● Enabled ○ Disabled

Promiscuous Capture: ○ Enabled ● Disabled

Client Filter Enable: □

Client Filter MAC Address: 00:00:00:00:00:00

PACKET CAPTURE CONFIGURATION

Capture Beacons: ● Enabled ○ Disabled

Promiscuous Capture: ○ Enabled ● Disabled

Client Filter Enable: □

Client Filter MAC Address: 00:00:00:00:00:00

PACKET FILE CAPTURE

Capture Interface: radio1

Capture Duration: 60 Seconds (Range 10 to 3600)

Max Capture File Size: 1024 KB (Range 64 to 4096)

REMOTE PACKET CAPTURE

Remote Capture Port: 2002 (Range:1025-65530, Default: 2002)

PACKET CAPTURE FILE DOWNLOAD

● HTTP/HTTPS ○ TFTP

File download using HTTP(S) may be done by clicking the "Download" button.
To use TFTP download, check the box that indicates TFTP download

TFTP Server Filename: apcapture.pcap

Server IP: 0.0.0.0

Packet Capture Status

Packet Capture Status allows you to view the status of packet capture on the AP.

Table 75 describes the fields to configure the packet capture status.

Table 75: Packet Capture Status

Field	Description
Current Capture Status	Shows whether packet capture is running or stopped.
Packet Capture Time	Shows elapsed capture time.
Packet Capture File Size	Shows the current capture file size.

Packet Capture Configuration

Packet Capture Configuration allows you to configure parameters that affect how packet capture functions on the radio interfaces.

Table 76 describes the fields to configure the packet capture status.

Table 76: Packet Capture Configuration

Field	Description
Capture Beacons	Enable to capture the 802.11 beacons detected or transmitted by the radio.
Promiscuous Capture	Enable to place the radio in promiscuous mode when the capture is active. In promiscuous mode the radio receives all traffic on the channel, including traffic that is not destined to this AP. While the radio is operating in promiscuous mode, it continues serving associated clients. Packets not destined to the AP are not forwarded. As soon as the capture is completed, the radio reverts to non-promiscuous mode operation.
Client Filter Enable	Enable to use the WLAN client filter to capture only frames that are transmitted to, or received from a WLAN client with a specified MAC address.
Client Filter MAC Address	Specify a MAC address for WLAN client filtering. Note: The MAC filter is active only when capture is performed on an 802.11 interface.

NOTE:

Changes to packet capture configuration parameters take affect after packet capture is restarted. Modifying the parameters while the packet capture is running doesn't affect the current packet capture session. In order to begin using new parameter values, an existing packet capture session must be stopped and re-started.

Packet File Capture

In Packet File Capture mode the AP stores captured packets in the RAM file system.

Upon activation, the packet capture proceeds until one of the following occurs:

- The capture time reaches configured duration.
- The capture file reaches its maximum size.
- The administrator stops the capture.

During the capture, you can monitor the capture status, elapsed capture time, and the current capture file size. This information can be updated, while the capture is in progress, by clicking Refresh.

Table 77 describes the fields to configure the packet capture status.

Table 77: Packet File Capture

Field	Description
Capture Interface	Select an AP Capture Interface name from the drop-down menu. AP capture interface names are eligible for packet capture are the following: • brtrunk - Linux bridge interface in the AP • eth0 - 802.3 traffic on the Ethernet port. • wlan0 - VAP0 traffic on radio 1. • wlan0wds0 ~ wlan0wds3 — Traffic on the specified WDS interface. • wlan0vap1 ~ wlan0vap7 — Traffic on the specified VAP on Radio 1. • wlan1 - VAP0 traffic on radio 2. • wlan1vap1 ~ wlan1vap7 — Traffic on the specified VAP on Radio 2. • radio1 - 802.11 traffic on radio 1. • radio2 - 802.11 traffic on radio 2.
Capture Duration	Specify the time duration in seconds for the capture (range 10 to 3600).
Max Capture File Size	Specify the maximum allowed size for the capture file in KB (range 64 to 4096).

Remote Packet Capture

Remote Packet Capture allows you to specify a remote port as the destination for packet captures. This feature works in conjunction with the Wireshark network analyzer tool for Windows. A packet capture server runs on the AP and sends the captured packets via a TCP connection to the Wireshark tool.

A Windows PC running the Wireshark tool allows you to display, log, and analyze captured traffic.

When the remote capture mode is in use, the AP doesn’t store any captured data locally in its file system.

You can trace up to five interfaces on the AP at the same time. However, you must start a separate Wireshark session for each interface. You can configure the IP port number used for connecting Wireshark to the AP. The default port number is 2002. The system uses 5 consecutive port numbers starting with the configured port for the packet capture sessions.

If a firewall is installed between the Wireshark PC and the AP, these ports must be allowed to pass through the firewall. The firewall must also be configured to allow the Wireshark PC to initiate TCP connection to the AP.

In order to configure Wireshark to use the AP as the source for captured packets, you must specify the remote interface in the Capture Options menu. For example, to capture packets on an AP with IP address 192.168.1.252 on radio 1 using the default IP port, specify the following interface:

rpcap://192.168.1.252/radio1

To capture packets on the Ethernet interface of the AP and VAP0 on radio 1 using IP port 58000, start two Wireshark sessions and specify the following interfaces:

rpcap://192.168.1.252:58000/eth0

rpcap://192.168.1.252:58000/wlan0

When you are capturing traffic on the radio interface, you can disable beacon capture, but other 802.11 control frames are still sent to Wireshark. You can set up a display filter to show only the following:

- Data frames in the trace
- Traffic on specific BSSIDs
- Traffic between two clients

Some examples of useful display filters are:

- Exclude beacons and ACK/RTS/CTS frames:

  !(wlan.fc.type_subtype == 8 || wlan.fc.type == 1)
- Data frames only:

  wlan.fc.type == 2
- Traffic on a specific BSSID:

  wlan.bssid == 00:02:bc:00:17:d0
- All traffic to and from a specific client:
- wlan.addr == 00:00:e8:4e:5f:8e

In remote capture mode, traffic is sent to the PC running Wireshark via one of the network interfaces. Depending on where the Wireshark tool is located the traffic can be sent on an Ethernet interface or one of the radios. In order to avoid a traffic flood caused by tracing the trace packets, the AP automatically installs a capture filter to filter out all packets destined to the Wireshark application. For example if the Wireshark IP port is configured to be 58000 then the following capture filter is automatically installed on the AP:

not portrange 58000-58004.

Enabling the packet capture feature impacts performance of the AP and can create a security issue (unauthorized clients may be able to connect to the AP and trace user data). The AP performance is negatively impacted even if there is no active Wireshark session with the AP. The performance is negatively impacted to a greater extent when packet capture is in progress.

Due to performance and security issues, the packet capture mode is not saved in NVRAM on the AP; if the AP resets, the capture mode is disabled and then you must re-enable it in order to resume capturing traffic. Packet capture parameters (other than mode) are saved in NVRAM.

In order to minimize performance impact on the AP while traffic capture is in progress, you should install capture filters to limit which traffic is sent to the Wireshark tool. When capturing 802.11 traffic, a large portion of the captured frames tends to be beacons (typically sent every 100ms by all Access Points). Although Wireshark supports a display filter for beacon frames, it does not support a capture filter to prevent the AP from forwarding captured beacon packets to the Wireshark tool. In order to reduce performance impact of capturing the 802.11 beacons, you can disable the capture beacons mode.

The remote packet capture facility is a standard feature of the Wireshark tool for Windows.

NOTE:

Remote packet capture is not standard on the Linux version of Wireshark; the Linux version doesn't work with the AP.

Wireshark is an open source tool and is available for free; it can be downloaded from http://www.wireshark.org.

Table 78 describes the fields to configure the packet capture status.

Table 78: Remote Packet Capture

Field	Description
Remote Capture Port	Specify the remote port to use as the destination for packet captures. Default port is 2002. (Range 1025 to 65530).

Packet Capture File Download

Packet Capture File Download allows you to download the capture file by TFTP to a configured TFTP server or by HTTP(S) to a PC. TFTP file name should not contain spaces, <, >, |, \, /, : , (,), &, ; , #, ? , *, $, % and successive “.”. The captured packets are stored in file /tmp/apcapture.pcap on the AP. A capture is automatically stopped when the capture file download command is triggered.

Because the capture file is located in the RAM file system, it disappears if the AP is reset.

Diagnostic Log

The Diagnostic Log page provides a way to gather the diagnostic/troubleshooting information about the AP beyond what is available through the Web UI.

Table 79 describes the field of diagnostic log.

Table 79: Diagnostic Log

Field	Description
Download	To download the diagnostic information for support, click Download button.

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