USRobotics®

Professional Access Point Administrator Guide

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Professional Access Point
Administrator Guide

U.S. Robotics Corporation
935 National Parkway
Schaumburg, Illinois
60173-5157
USA

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Web User Interface

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About This Document

This guide describes setup, configuration, administration and maintenance of one or more Professional Access Points on a wireless network.

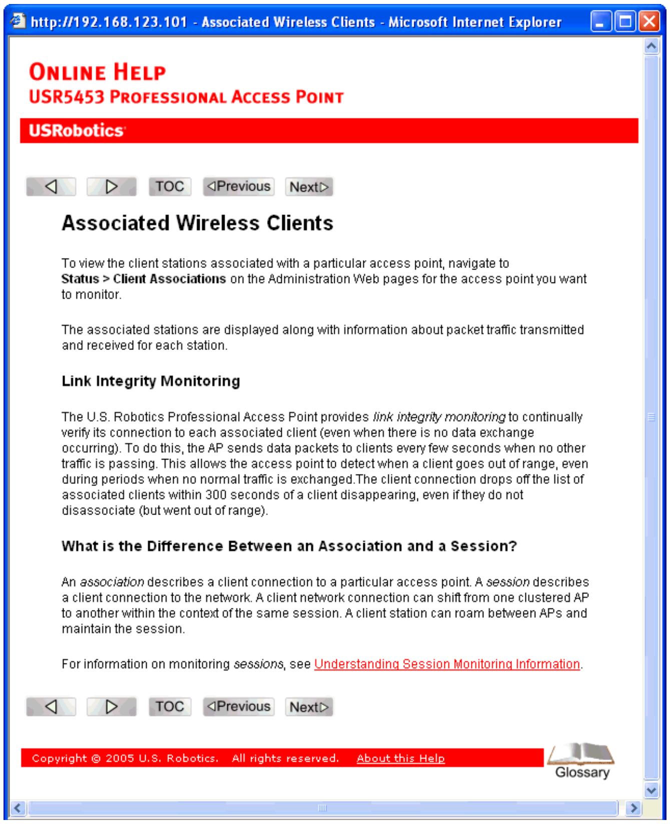
Administrator Audience

This information is intended for the person responsible for installing, configuring, monitoring, and maintaining the Professional Access Point as part of a small-to-medium business information technology infrastructure.

Online Help Features

Online Help for the Professional Access Point Web User Interface provides information about all fields and features available in the interface. The information in the Online Help is a subset of the information available in the *Administrator Guide*.

Online Help information corresponds to each tab on the Professional Access Point Web User Interface. To display help for the current tab, Click **Help** at the top of the Web User Interface page or click the **More...** link at the bottom of the tab's inline help panel.



http://192.168.123.101 - Associated Wireless Clients - Microsoft Internet Explorer
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Associated Wireless Clients

To view the client stations associated with a particular access point, navigate to **Status > Client Associations** on the Administration Web pages for the access point you want to monitor.

The associated stations are displayed along with information about packet traffic transmitted and received for each station.

Link Integrity Monitoring

The U.S. Robotics Professional Access Point provides *link integrity monitoring* to continually verify its connection to each associated client (even when there is no data exchange occurring). To do this, the AP sends data packets to clients every few seconds when no other traffic is passing. This allows the access point 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 of associated clients within 300 seconds of a client disappearing, even if they do not disassociate (but went out of range).

What is the Difference Between an Association and a Session?

An *association* describes a client connection to a particular access point. A *session* describes a client connection to the network. 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.

For information on monitoring *sessions*, see Understanding Session Monitoring Information.

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Copyright © 2005 U.S. Robotics. All rights reserved. About this Help
Glossary

Recommended Settings, Notes and Cautions

▶ An arrow next to field description information indicates a recommended or suggested configuration setting for an option on the Access Point.

A **Note** provides more information about a feature or technology and cross-references to related topics.

A **Caution** provides information about critical aspects of access point configuration, combinations of settings, events, or procedures that can adversely affect network connectivity, security, and so on.

Typographical Conventions

This guide uses the following typographical conventions:

italics	Glossary terms, new terms, and book titles
`typewriter font`	Screen text, URLs, IP addresses, and MAC addresses, UNIX file, command, and directory names, user-typed command-line entries
`typewriter font italics`	Variables
Bold Keywords	Menu titles, window names, and button names

PDF Links

In addition to URL links, which are shown in blue and underscored, this document contains links to related sections and to glossary terms. Whenever your cursor turns into the pointing hand, a single click will take you to the referenced topic.

Getting Started

This part of the Professional Access Point Administrator Guide provides the information that you need to establish a network by performing basic installation for one or more Professional Access Points:

- Overview
- Pre-Launch Checklist: Default Settings and Supported Administrator/Client Platforms
- Setting Up and Launching Your Wireless Network

Overview

The Professional Access Point provides continuous, high-speed access between your wireless and Ethernet devices. It is an advanced, standards-based solution for wireless networking in small and medium-sized businesses. The Professional Access Point enables zero-administration wireless local area network (WLAN) deployment while providing state-of-the-art wireless networking features.

The Professional Access Point provides best-of-breed security, ease-of-administration, and industry standards—providing a standalone and fully-secured wireless network without the need for additional management and security server software.

The access point can broadcast in the following modes.

- IEEE 802.11b
- IEEE 802.11g

The following sections list features and benefits of the Professional Access Point, and tell you what's next when you're ready to get started.

- Features and Benefits
    - IEEE Standards Support and Wi-Fi Compliance
    - Wireless Features
    - Security Features
    - Guest Interface
    - Clustering and Auto-Management
    - Networking

  - Maintainability

- What’s Next?

Features and Benefits

IEEE Standards Support and Wi-Fi Compliance

- Support for IEEE 802.11b and IEEE 802.11g wireless networking standards
- Provides bandwidth of up to 11 Mbps for IEEE 802.11b and 54 Mbps for IEEE 802.11g
- Wi-Fi compliance required for certification

Wireless Features

- Auto channel selection at startup
- Transmit power adjustment
- Wireless Distribution System (WDS) for connecting multiple access points wirelessly. Extends your network with less cabling and provides a seamless experience for roaming clients.
- Quality of Service (QoS) for enhanced throughput and better performance of time-sensitive wireless traffic like Video, Audio, Voice over IP (VoIP) and streaming media. The Professional Access Point QoS is Wi-Fi Multimedia (WMM) compliant.
- Load Balancing
- Built-in support for multiple SSIDs (network names) and multiple BSSIDs (basic service set IDs) on the same access point
- Channel management for automatic coordination of radio channel assignments to reduce access-point-to-access-point interference on the network and maximise Wi-Fi bandwidth
- Neighbouring access point detection finds nearby access points, including rogues.
- Support for multiple IEEE 802.11d Regulatory Domains (country codes for global operation)

Security Features

- Prohibit SSID Broadcast
- Station isolation
- Weak IV avoidance
- Wireless Equivalent Privacy (WEP)

- Wi-Fi Protected Access 2 (WPA2/802.11i)
- Advanced Encryption Standard (AES)
- User-based access control, local user database, and user life-cycle management with built-in RADIUS authentication server
- WPA/WPA2 Enterprise
- MAC address filtering

Guest Interface

- Unique network name (SSID) for the Guest interface
- Captive portal to guide guests to customized, guest-only Web page
- VLAN implementation

Clustering and Auto-Management

- Automatic setup with the Professional Access Point Detection Utility
- Provisioning and auto-configuration of access points through clustering and cluster rendezvous

  The administrator can specify how new access points should be configured before they are added to the network. When new access points are added to the same wired network, they can automatically rendezvous with the cluster and securely download the correct configuration. The process does not require manual intervention, but is under the control of the administrator.
- Single universal view of clustered access points and cluster configuration settings

  Configuration for all access points in a cluster can be managed from a single interface. Changes to common parameters are automatically reflected in all members of the cluster.
- Self-managed access points with automatic configuration synchronization

  The access points in a cluster periodically ensure that the cluster configuration is consistent, and check for the presence and availability of the other members of the cluster. The administrator can monitor this information through the Web User Interface.
- Enhanced local authentication using 802.1x without additional IT setup

  A cluster can maintain a user authentication server and database stored on the access points. This eliminates the need to install, configure, and maintain a RADIUS infrastructure and simplifies the administrative task of deploying a secure wireless network.

Networking

- Dynamic Host Configuration Protocol (DHCP) support for dynamically assigning network configuration information to systems on the LAN/WLAN.

- Virtual Local Area Network (VLAN) support

SNMP Support

The Professional Access Point includes the following standard Simple Network Protocol (SNMP) Management Information Bases (MIB):

- SNMP v1 and v2 MIBs
- IEEE802.11 MIB
- Four USRobotics proprietary MIBs support product, system, channel, and wireless system statistics.

Maintainability

- Status, monitoring, and tracking views of the network including session monitoring, client associations, transmit/receive statistics, and event log
- Link integrity monitoring to continually verify connection to the client, regardless of network traffic activity levels
- Reset configuration option
- Firmware upgrade
- Backup and restore of access point configuration
- Backup and restore of user database for built-in RADIUS server (when using IEEE 802.1x or WPA/ WPA2 Enterprise (RADIUS) security mode)

What’s Next?

Are you ready to get started with wireless networking? Read through the “Pre-Launch Checklist: Default Settings and Supported Administrator/Client Platforms” on page 5, and then follow the steps in “Setting Up and Launching Your Wireless Network” on page 13.

Pre-Launch Checklist: Default Settings and Supported Administrator/Client Platforms

Before you plug in and boot a new Access Point, review the following sections for hardware, software, and client configuration requirements and for compatibility issues. Make sure that you have everything you need for a successful launch and test of your new or extended wireless network.

- Professional Access Point
  - Default Settings for the Professional Access Point
  - What the Access Point Does Not Provide
- Administrator's Computer
- Wireless Client Computers
- Understanding Dynamic and Static IP Addressing on the Professional Access Point
  - How Does the Access Point Obtain an IP Address at Startup?
  - Dynamic IP Addressing
  - Static IP Addressing

Professional Access Point

The Professional Access Point provides continuous, high-speed access between your wireless and Ethernet devices in IEEE 802.11b and 802.11g modes.

The Professional Access Point offers a *Guest Interface* feature that allows you to configure access points for controlled guest access to the wireless network. This can be accomplished by using Virtual LANs. For more information on the Guest interface, see “Guest Login” on page 111 and “A Note About Setting Up Connections for a Guest Network” on page 15.

Default Settings for the Professional Access Point

Option	Default Settings	Related Information
System Name	`USR5453-AP`	"Setting the DNS Name" on page 81 in "Ethernet (Wired) Settings" on page 79
User Name	`admin` The user name is read-only. It cannot be modified.	
Password	`admin`	"Provide Administrator Password and Wireless Network Name" on page 28 in "Basic Settings" on page 25
Network Name (SSID)	`USR5453 Internal Network` for the Internal interface `USR5453 Guest Network` for the Guest interface	"Review / Describe the Access Point" on page 27 in "Basic Settings" on page 25 "Configuring Internal LAN Wireless Settings" on page 89 in "Wireless Settings" on page 87 "Configuring Guest Network Wireless Settings" on page 90 in "Wireless Settings" on page 87
Network Time Protocol (NTP)	None	"Time Protocol" on page 151
IP Address	`192.168.1.10` The default IP address is used if you do not use a *Dynamic Host Configuration Protocol* (DHCP) server. You can assign a new static IP address through the Web User Interface. If you have a DHCP server on the network, then an IP address will be dynamically assigned by the server at access point startup.	"Understanding Dynamic and Static IP Addressing on the Professional Access Point" on page 10
Connection Type	**Dynamic Host Configuration Protocol** (DHCP) If you do not have a DHCP server on the Internal network and do not plan to use one, the first thing you must do after bringing up the access point is to change the connection type from **DHCP** to **Static IP**. The Guest network must have a DHCP server.	"Understanding Dynamic and Static IP Addressing on the Professional Access Point" on page 10 For information on how to reconfigure the Connection Type, see "Configuring Internal Interface Ethernet Settings" on page 83.
Subnet Mask	255.255.255.0 This is determined by your network setup and DHCP server configuration.	"Ethernet (Wired) Settings" on page 79

Option	Default Settings	Related Information
Radio	**On**	"Radio" on page 119
IEEE 802.11 Mode	**802.11g**	"Radio" on page 119
802.11g Channel	**Auto**	"Radio" on page 119
Beacon Interval	**100**	"Radio" on page 119
DTIM Period	**2**	"Radio" on page 119
Fragmentation Threshold	**2346**	"Radio" on page 119
Regulatory Domain	**FCC**	"Radio" on page 119
RTS Threshold	**2347**	"Radio" on page 119
MAX Stations	**2007**	"Radio" on page 119
Transmit Power	**100 percent**	"Radio" on page 119
Rate Sets Supported (Mbps)	• **IEEE 802.11g: 54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1** • **IEEE 802.11b: 11, 5.5, 2, 1**	"Radio" on page 119
Rate Sets (Mbps) (Basic/Advertised)	• **IEEE 802.1g: 11, 5.5, 2, 1** • **IEEE 802.1b: 2, 1**	"Radio" on page 119
Broadcast SSID	**Allow**	"Broadcast SSID, Station Isolation, and Security Mode" on page 97 in "Security" on page 91
Security Mode	None	"Broadcast SSID, Station Isolation, and Security Mode" on page 97 in "Security" on page 91
Authentication Type	None	
MAC Filtering	**Allow any station unless in list**	"MAC Filtering" on page 125
Guest Login and Management	**Disabled**	"Guest Login" on page 111
Load Balancing	**Disabled**	"Load Balancing" on page 129
WDS Settings	None	"Wireless Distribution System" on page 143
SNMP	**Enabled**	"Enabling and Disabling Simple Network Management Protocol (SNMP)" on page 156
SNMP SET Requests	**Disabled**	"Enabling and Disabling Simple Network Management Protocol (SNMP)" on page 156

What the Access Point Does Not Provide

The Professional Access Point is not designed to function as a gateway to the Internet. To connect your

Wireless LAN (WLAN) to other LANs or the Internet, you need a gateway device.

Administrator's Computer

Configuration and administration of the Professional Access Point is accomplished with the Professional Access Point Detection Utility, which you run from the CD, and through a Web-based user interface. The following table describes the minimum requirements for the administrator's computer.

Required Software or Component	Description
Ethernet Connection to the First Access Point	The computer used to configure the first access point with the Detection Utility must be connected to the access point, either directly or through a hub, by an Ethernet cable. For more information on this step, see "Step 2. Connect the access point to network and power" on page 14 in Setting Up and Launching Your Wireless Network.
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 Web User Interface using a wireless connection to the internal network. For wireless connection to the access point, your administration device needs Wi-Fi capability: • 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 802.11b and 802.11g modes are supported. • Wireless client software such as Microsoft Windows XP or Funk Odyssey wireless client configured to associate with the Professional Access Point. For more details on Wi-Fi client setup, see "Wireless Client Computers" on page 9.
Web Browser / Operating System	Configuration and administration of the Professional Access Point is provided through a Web-based user interface hosted on the access point. USRobotics recommends using one of the following supported Web browsers to access the Web User Interface: • Microsoft Internet Explorer version 5.5 or 6.x (with up-to-date patch level for either major version) on Microsoft Windows XP or Microsoft Windows 2000 • Mozilla 1.7.x on Redhat 9 with 2.4 kernel The administration Web browser must have JavaScript enabled to support the interactive features of the Web User Interface. The browser must also support HTTP uploads to use the firmware upgrade feature.
Detection Utility Wizard on CD-ROM	You can run the Installation CD-ROM on any Windows laptop or computer that is connected to the access point via wired or wireless connection. It detects Professional Access Points on the network. The wizard steps you through initial configuration of new access points, and provides a link to the Web User Interface where you finish the basic setup process in a step-by-step mode and launch the network. For more information about using the Detection Utility, see "Step 3. Run the Detection Utility to find access points on the network" on page 16 under "Setting Up and Launching Your Wireless Network".

Required Software or Component	Description
CD-ROM Drive	The administrator's computer must have a CD-ROM drive to run the Installation CD-ROM.
Security Settings	Ensure that security is disabled on the wireless client used to initially configure the access point.

Wireless Client Computers

The Professional 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.

Multiple client operating systems are supported. Clients can be laptops or desktops, 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 following software and hardware.

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 802.11b and 802.11g modes are supported.) Wi-Fi client adapters vary considerably. The adapter can be a PC card built in to the client device, a portable PCMCIA or PCI card, or an external device such as a USB or Ethernet adapter that you connect to the client by means of a cable. The access point supports 802.11b/g modes, but you will probably make a decision during network design phase as to which mode to use. The fundamental requirement for clients is that they all have configured adapters that match the 802.11 mode for which your access point is configured.
Wireless Client Software	Client software such as Microsoft Windows Supplicant or Funk Odyssey wireless client configured to associate with the Professional 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 None, wireless clients will need to set a profile to the authentication mode used by the access point and provide a valid user name and password, certificate, or similar user identity proof. Security modes are Static WEP, IEEE 802.1x, WPA/WPA2 with RADIUS server, and WPA/WPA2-PSK. For information on configuring security on the access point, see "Security" on page 91.

Understanding Dynamic and Static IP Addressing on the Professional Access Point

Professional Access Points are designed to auto-configure, with very little setup required for the first access point and miminal configuration required for additional access points subsequently joining a pre-configured *cluster*.

How Does the Access Point Obtain an IP Address at Startup?

When you deploy the access point, it looks for a network DHCP server and, if it finds one, obtains an IP Address from the DHCP server. If no DHCP server is found on the network, the access point will continue to use its default Static IP Address (192.168.1.10) until you reassign it a new static IP address and specify a static IP addressing policy or until a DHCP server is brought online.

Note

- If you configure both an Internal and Guest network and plan to use a dynamic addressing policy for both, separate DHCP servers must be running on each network.
- A DHCP server is a requirement for the Guest network.

When you run the Detection Utility, it discovers the Professional Access Points on the network and lists their IP addresses and MAC addresses. The Detection Utility also provides a link to the Web User Interface of each access point using the IP address in the URL. For more information about the Detection Utility, see “Step 3. Run the Detection Utility to find access points on the network” on page 16.

Dynamic IP Addressing

The Professional Access Point generally expects that a DHCP server is running on the network where the access point is deployed. Most business networks already have DHCP service provided through either a gateway device or a centralized server. However, if no DHCP server is present on the Internal network, the access point will use the default Static IP Address for first-time startup.

Similarly, wireless clients and other network devices will receive their IP addresses from the DHCP server, if there is one. If no DHCP server is present on the network, you must manually assign static IP addresses to your wireless clients and other network devices.

The Guest network must have a DHCP server.

Static IP Addressing

The Professional Access Point ships with a default Static IP Address of 192.168.1.10. (See “Default Settings for the Professional Access Point” on page 6.) If no DHCP server is found on the network, the access point retains this static IP address at first-time startup.

After access point startup, you have the option of specifying a static IP addressing policy on Professional Access Points and assigning static IP addresses to APs on the Internal network via the access point Web User Interface. (See information about the **Connection Type** field and related fields in “Configuring Internal

Interface Ethernet Settings” on page 83.)

> **Caution** If you do not have a DHCP server on the Internal network and do not plan to use one, the first thing you must do after bringing up the access point is change the Connection Type from DHCP to Static IP. You can either assign a new Static IP address to the access point or continue using the default address. USRobotics recommends assigning a new Static IP address so that if later you bring up another Professional Access Point on the same network, the IP address for each access point 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 access point configuration to the factory defaults (see “Reset Configuration” on page 159), or you can get a dynamically assigned address by connecting the access point to a network that has DHCP.

Setting Up and Launching Your Wireless Network

Setting up and deploying one or more Professional Access Points is in effect creating and launching a wireless network. The Detection Utility wizard and corresponding Basic Settings Administration Web page simplify this process. Here is a step-by-step guide to setting up your Professional Access Points and the resulting wireless network. Have the Installation CD-ROM handy, and familiarise yourself with the "Pre-Launch Checklist: Default Settings and Supported Administrator/Client Platforms" on page 5 if you haven't already. The topics covered here are:

- Step 1. Unpack the access point
- Step 2. Connect the access point to network and power
- Step 3. Run the Detection Utility to find access points on the network
- Step 4. Log on to the Web User Interface
- Step 5. Configure Basic Settings and start the wireless network
- Wall Mounting the Access Point

Step 1. Unpack the access point

Unpack the access point and familiarize yourself with its hardware ports, associated cables, and accessories.

Access Point Hardware and Ports

The Access Point includes:

- Ethernet port for connection to the Local Area Network (LAN) via Ethernet network cable
- Power port and power adapter
- Reset button
- Two 5 dB antennas

What's inside the Access Point?

An access point is a single-purpose device designed to function as a wireless hub. Inside the access point is a Wi-Fi radio system, a microprocessor, and a mini-PC card. The access point boots from FlashROM that contains USRobotics firmware with the configurable, runtime features summarized in "Overview" on page 1.

As new features and enhancements become available, you can upgrade the firmware to add new functionality and performance improvements to the access points that make up your wireless network. (See “Upgrade” on page 160.)

Step 2. Connect the access point to network and power

The next step is to set up the network and power connections.

1. Do one of the following to create an Ethernet connection between the access point and your computer:

   - Connect one end of an Ethernet cable to the LAN port on the access point and the other end to the same networking device (such as a router) to which your computer is connected (see Figure 1).

   Or

   - Connect one end of an Ethernet cable to the LAN port on the access point and the other end of the cable to the Ethernet port on your computer (see Figure 2).

Initial Connection Notes

If you use a hub, the device that you use must permit broadcast signals from the access point to reach all other devices on the network. A standard hub should work fine. Some *switches*, however, do not allow directed or subnet broadcasts through. You may have to configure the switch to allow directed broadcasts.

For initial configuration with a direct Ethernet connection and no DHCP server, be sure to set your computer to a static IP address in the subnet 255.255.255.0. (The default IP address for the access point is 192.168.1.10.)

If for initial configuration you use a direct Ethernet (wired) connection between the access point and your computer, 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 your computer but instead is connected to the LAN (either via a networking device as shown in Figure 1 or directly).

It is possible to detect access points on the network (using the Detection Utility) with a wireless connection. However, USRobotics strongly advises against using this method. In your environment you may have no way of knowing whether you are connecting to the intended access point, and the initial configuration changes required may cause you to lose connectivity with the access point over a wireless connection.

Figure 1. Ethernet Connections When Using DHCP for Initial Configuration.

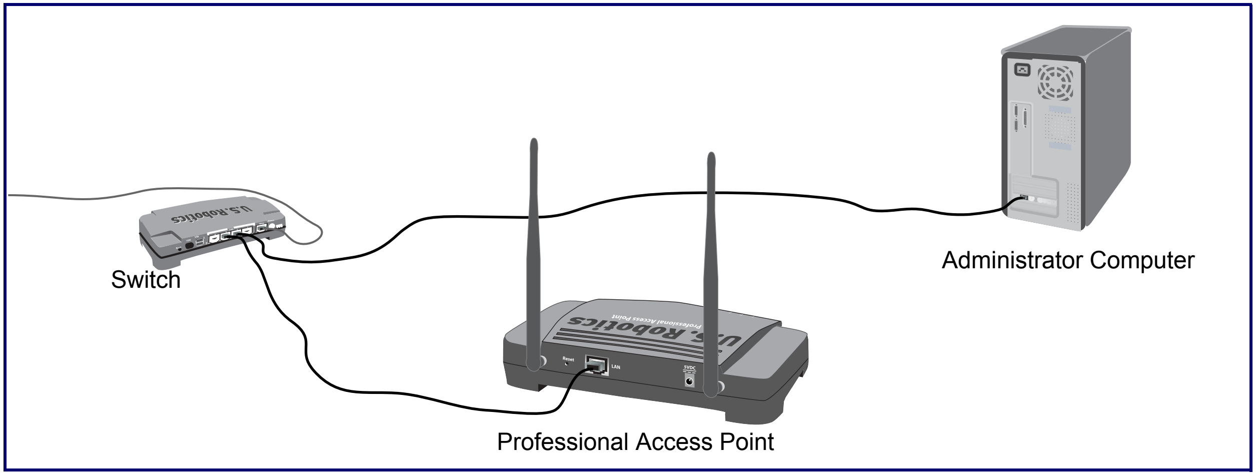
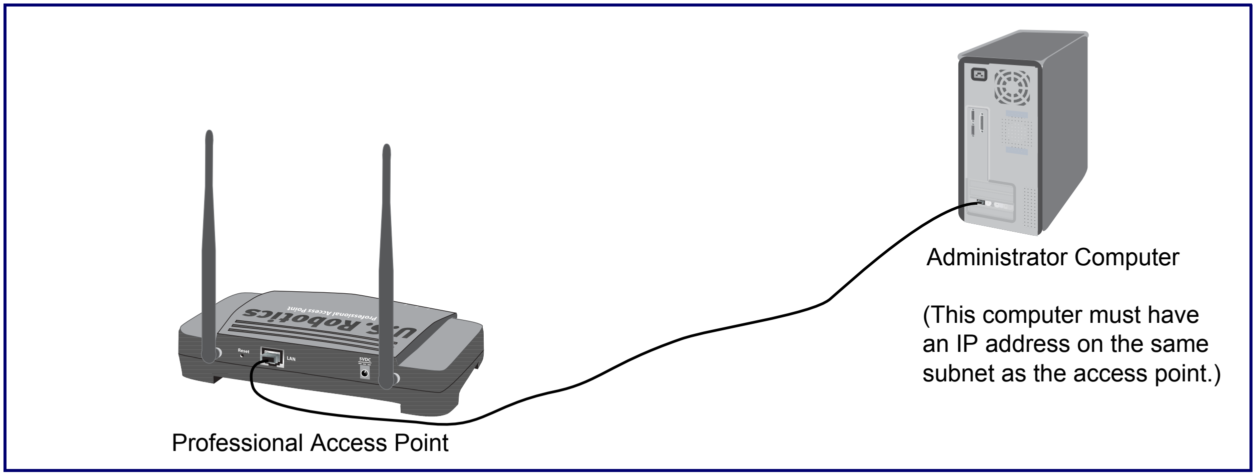


Figure 2. Ethernet Connections When Using Static IP Address for Initial Configuration.


Administrator Computer
(This computer must have an IP address on the same subnet as the access point.)
Professional Access Point

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 adapter into a power outlet (preferably, via a surge protector).

Note to UK Users Replace the plug on the power adapter with the UK standard plug that is supplied in your USRobotics package. Apply enough pressure to cause a click and firmly seat the new plug in the adapter.

A Note About Setting Up Connections for a Guest Network

The Professional Access Point offers a Guest Interface that allows you to configure an access point for controlled guest access to the network. The same access point can function as a bridge for two different wireless networks: a secure Internal LAN and a public Guest network. This is done virtually, by defining two different Virtual LANs in the Web User Interface.

Hardware Connections for a Guest VLAN

If you plan to configure a guest network using VLANs, do the following:

- Connect the LAN port on the access point to a VLAN-capable switch.
- Define VLANs on that switch.

Once you have the required physical connections set up, the rest of the configuration process is accomplished through the Web User Interface. For information on configuring Guest interface settings in the Web User Interface, see “Guest Login” on page 111.

Step 3. Run the Detection Utility to find access points on the network

The Detection Utility is an easy-to-use utility for discovering and identifying new Professional Access Points. The Detection Utility scans the network looking for access points, and displays ID details on those it finds.

Notes and Cautions

- Keep in mind that the Detection Utility recognizes and configures only USRobotics Professional Access Points. The Detection Utility will not find any other devices.
- Run the Detection Utility only in the subnet of the internal network (SSID). Do not run the Detection Utility on the guest subnetwork.
- The Detection Utility will find only those access points that have IP addresses. IP addresses are dynamically assigned to APs if you have a DHCP server running on the network. Keep in mind that if you deploy the access point on a network with no DHCP server, the default static IP address (192.168.1.10) will be used.

  Use caution with non-DHCP enabled networks: Do not deploy more than one new access point on a non-DHCP network because they will use the same default static IP addresses and conflict with each other. (For more information, see “Understanding Dynamic and Static IP Addressing on the Professional Access Point” on page 10 and “How Does the Access Point Obtain an IP Address at Startup?” on page 10.)

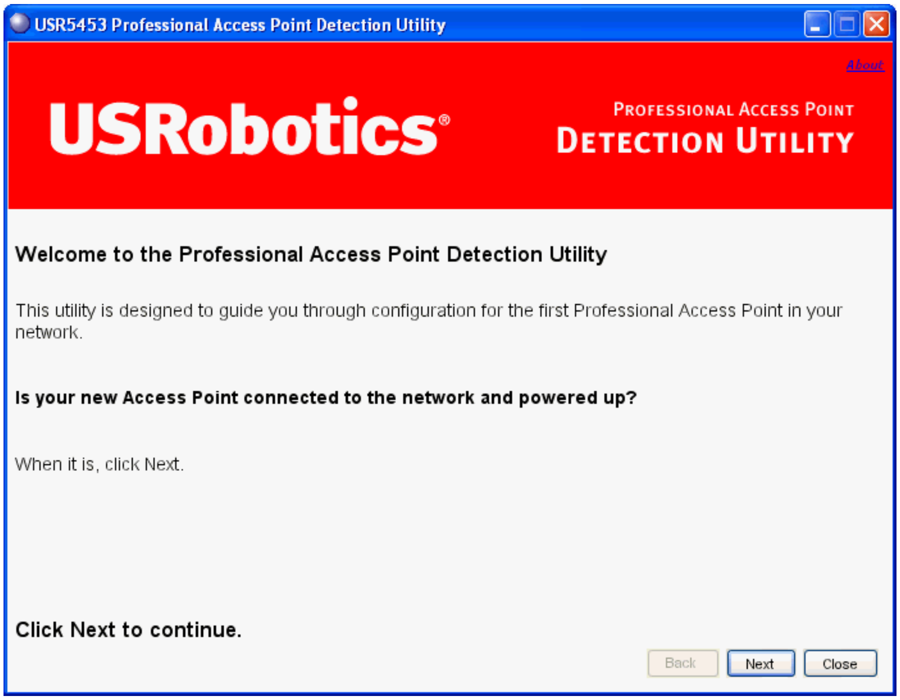
Run the Installation CD-ROM on a laptop or computer that is connected to the same network as your access points and use it to step through the discovery process as follows:

1. Insert the Installation CD-ROM into the CD-ROM drive on your computer and select **Setup** from the menu.

   If the CD-ROM does not start automatically, navigate to the CD-ROM drive and double-click **setup.exe**.

   If you receive a Windows Security Alert from your Windows Firewall, click **Unblock** to enable the java program to access your network. If network access is blocked, the Detection Utility cannot find your access point.

   The Detection Utility Welcome screen is displayed.


USR5453 Professional Access Point Detection Utility
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Back
Next
Close

Welcome to the Professional Access Point Detection Utility

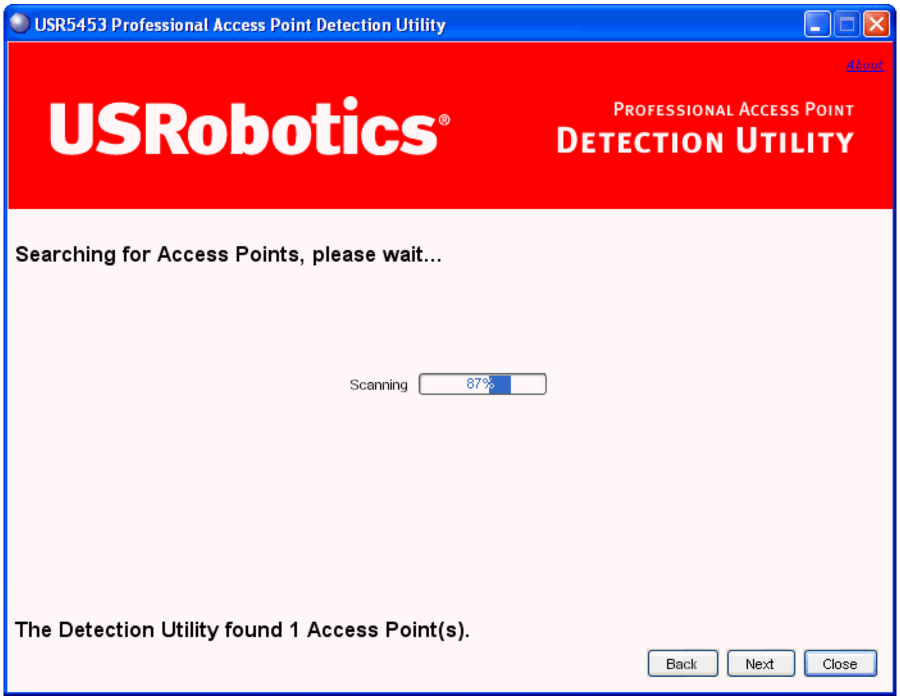
This utility is designed to guide you through configuration for the first Professional Access Point in your network.

Is your new Access Point connected to the network and powered up?

When it is, click Next.

Click Next to continue.

2. Click **Next** to search for access points. Wait for the search to complete, or until the Detection Utility has found your new access points.


USR5453 Professional Access Point Detection Utility
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Searching for Access Points, please wait...

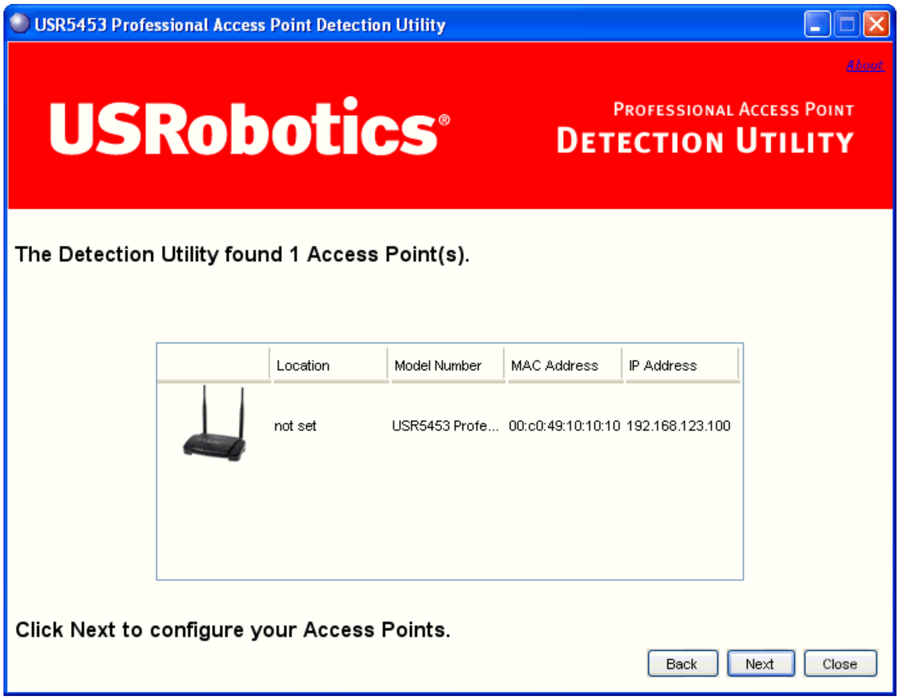
The Detection Utility found 1 Access Point(s).

Note If no access points are found, the Detection Utility indicates this and presents troubleshooting information about your LAN and power connections. Once you have checked hardware power and Ethernet connections, you can click the Detection Utility **Back** button to search again for access points.

3. Review the list of access points found.

   The Detection Utility will detect the IP addresses of Professional Access Points. Access points are listed with their locations,MAC addresses, and IP Addresses. If you are installing the first access point on a single-access-point network, only one entry will be displayed on this screen

   Verify the MAC addresses shown here against the Professional Access Point's LAN MAC address. (You can find the LAN MAC on the label on the bottom of the access point.) This will be especially helpful later in providing or modifying the descriptive **Location** name for each access point.


USR5453 Professional Access Point Detection Utility
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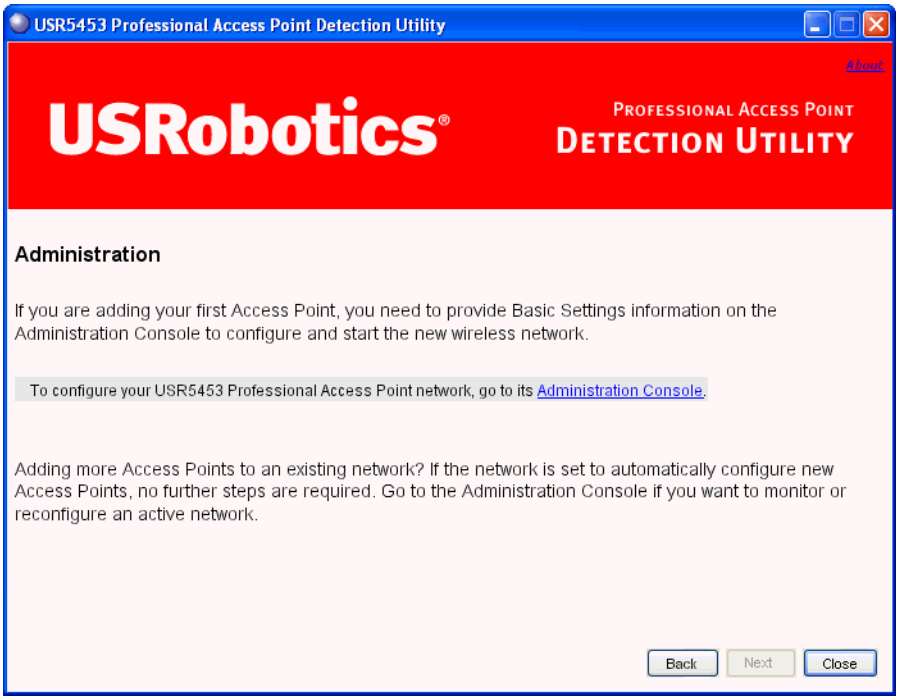
The Detection Utility found 1 Access Point(s).

	Location	Model Number	MAC Address	IP Address
	not set	USR5453 Profe...	00:c0:49:10:10:10	192.168.123.100

Click Next to configure your Access Points.

   Click **Next**.

4. Go to the Access Point Web User Interface by clicking the link provided on the Detection Utility page.


USR5453 Professional Access Point Detection Utility
About
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Professional Access Point
Detection Utility
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Next
Close

Administration

If you are adding your first Access Point, you need to provide Basic Settings information on the Administration Console to configure and start the new wireless network.

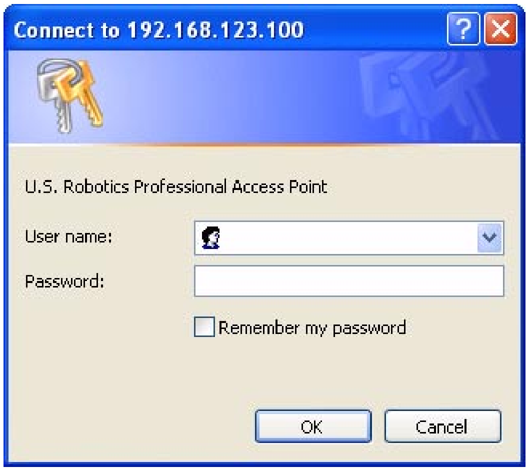
To configure your USR5453 Professional Access Point network, go to its Administration Console.

Adding more Access Points to an existing network? If the network is set to automatically configure new Access Points, no further steps are required. Go to the Administration Console if you want to monitor or reconfigure an active network.

Note The Detection Utility provides a link to the Web User Interface via the IP address of the *first* Professional Access Point.The Web User Interface is a management tool that you can access via the IP address for any access point in a cluster. (For more information about clustering see “Understanding Clustering” on page 34.)

Step 4. Log on to the Web User Interface

When you follow the link from the Detection Utility to the Professional Access Point Web User Interface, you are prompted for a user name and password.



Connect to 192.168.123.100

U.S. Robotics Professional Access Point

User name:

Password:

□ Remember my password

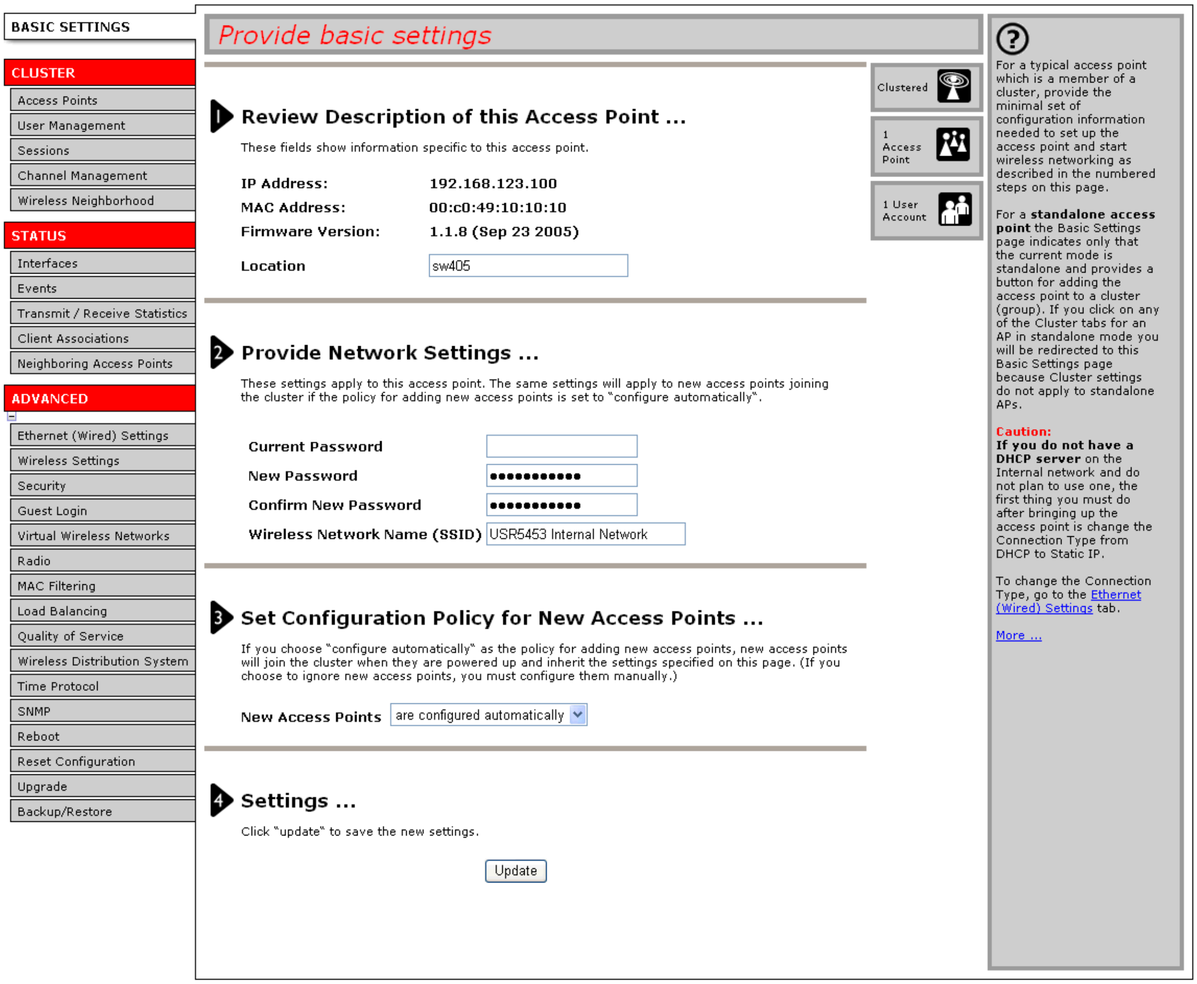
The defaults for user name and password are as follows.

Field	Default Setting
Username	admin
Password	admin

Enter the user name and password and click **OK**.

Viewing Basic Settings for Access Points

When you first log in, the Basic Settings page for Professional Access Point administration is displayed. These are global settings for all access points that are members of the cluster and, if automatic configuration is specified, for any new access points that are added later.



Provide basic settings

1 Review Description of this Access Point ...

These fields show information specific to this access point.

IP Address:	192.168.123.100
MAC Address:	00:c0:49:10:10:10
Firmware Version:	1.1.8 (Sep 23 2005)
Location	sw405

2 Provide Network Settings ...

These settings apply to this access point. The same settings will apply to new access points joining the cluster if the policy for adding new access points is set to "configure automatically".

Current Password	
New Password	••••••••••••
Confirm New Password	••••••••••••
Wireless Network Name (SSID)	USR5453 Internal Network

3 Set Configuration Policy for New Access Points ...

If you choose "configure automatically" as the policy for adding new access points, new access points will join the cluster when they are powered up and inherit the settings specified on this page. (If you choose to ignore new access points, you must configure them manually.)

New Access Points: are configured automatically

4 Settings ...

Click "update" to save the new settings.

For a typical access point which is a member of a cluster, provide the minimal set of configuration information needed to set up the access point and start wireless networking as described in the numbered steps on this page.

For a **standalone access point** the Basic Settings page indicates only that the current mode is standalone and provides a button for adding the access point to a cluster (group). If you click on any of the Cluster tabs for an AP in standalone mode you will be redirected to this Basic Settings page because Cluster settings do not apply to standalone APs.

Caution:
If you do not have a DHCP server on the Internal network and do not plan to use one, the first thing you must do after bringing up the access point is change the Connection Type from DHCP to Static IP.

To change the Connection Type, go to the Ethernet (Wired) Settings tab.

More ...

Step 5. Configure Basic Settings and start the wireless network

Provide a minimal set of configuration information by defining the basic settings for your wireless network. These settings are all available on the Basic Settings page of the Web User Interface, and are categorized into steps 1-4 on the Web page.

For a detailed description of these Basic Settings and how to properly configure them, please see “Basic Settings” on page 25. Summarized briefly, the steps are:

1. Review Description of this Access Point.

   Provide IP addressing information. For more information, see “Review / Describe the Access Point” on page 27.

2. Provide Network Settings.

Provide a new administrator password for clustered access points. For more information, see “Provide Administrator Password and Wireless Network Name” on page 28.

3. Set Configuration Policy for New Access Points.

   Choose to configure new access points automatically (as new members of the cluster) or ignore new access points.

   If you set a configuration policy to **configure new access points automatically,** new access points added to this network will join the cluster and be configured automatically based on the settings you defined here. Updates to the **Network** settings on any cluster member will be shared with all other access points in the group.

   If you chose to **ignore new access points**, any additional access points will run in standalone mode. In standalone mode, an access point does not share the cluster configuration with other access points; it must be configured manually.

   You can always update the settings on a standalone access point to have it join the cluster. You can also remove an access point from a cluster thereby switching it to run in standalone mode.

   For more information, see “Set Configuration Policy for New Access Points” on page 29.

4. Start Wireless Networking

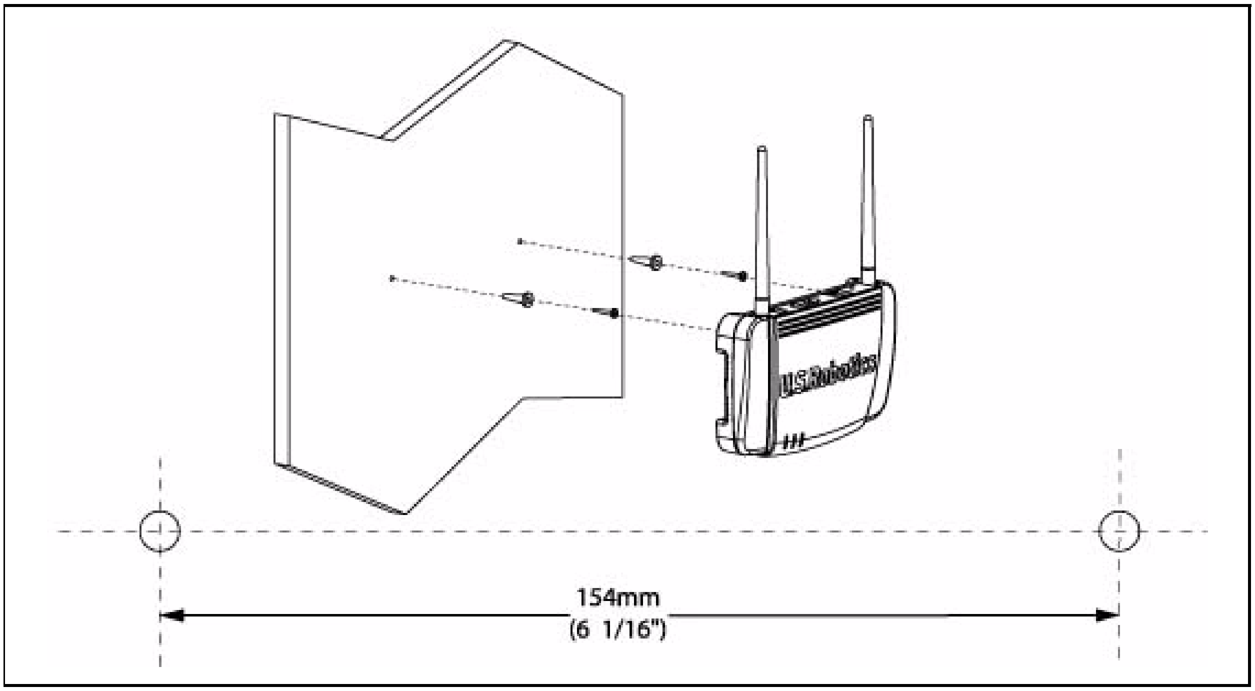
   Click the **Update** button to activate the wireless network with these new settings. For more information, see “Update Basic Settings” on page 30.

Default Configuration

If you follow the steps above and accept all the defaults, the access point will have the default configuration described in “Default Settings for the Professional Access Point” on page 6.

Wall Mounting the Access Point

The access point has keyhole openings for easy wall mounting. To expose the openings, remove the pads from the rear feet. You can then mount the access point to the wall with two anchored screws, as shown in the following illustration:



What's Next?

Next, make sure the access point is connected to the LAN, bring up your wireless clients, and connect the clients to the network. Once you have tested the basics of your wireless network, you can enable more security and fine-tune the access point by modifying its advanced configuration features.

Make Sure the Access Point is Connected 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.

If you configured the access point using a direct wired connection via Ethernet cable from your computer to the access point, do the following:

1. Disconnect the Ethernet cable from the computer.
2. Connect the free end of the cable to the LAN.
3. Connect your computer to the LAN either via Ethernet cable or wireless client card.

Test LAN Connectivity with Wireless Clients

Test the Professional Access Point by trying to detect it and associate with it from a wireless client device. (See “Wireless Client Computers” on page 9 in the Pre-Launch Checklist: Default Settings and Supported Administrator/Client Platforms for information on requirements for these clients.)

Secure and Fine-Tune the Access Point Using Advanced Features

Once the wireless network is operational and has been tested with a wireless client, you can add more security, add users, configure a Guest interface, and fine-tune the access point performance settings.

Web User Interface

This part of the Professional Access Point Administrator Guide covers usage of the Web User Interface with each section corresponding to a menu section:

- “Basic Settings” on page 25
- “Cluster” on page 33
- “Status” on page 67
- “Advanced” on page 79

Basic Settings

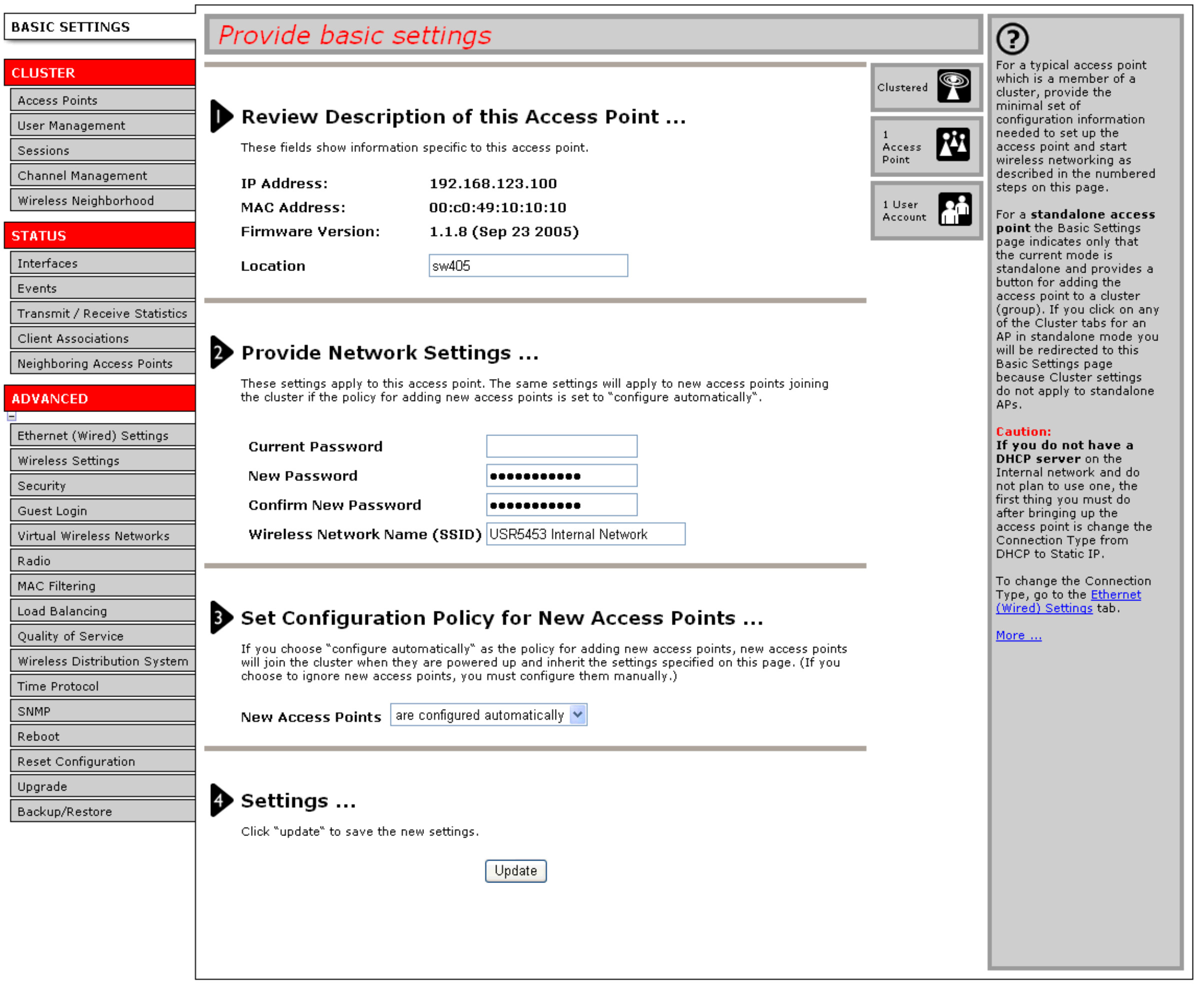
The basic configuration tasks are described in the following sections:

- Navigating to Basic Settings
- Review / Describe the Access Point
- Provide Administrator Password and Wireless Network Name
- Set Configuration Policy for New Access Points
- Update Basic Settings
- Summary of Settings
- Basic Settings for a Standalone Access Point
- Your Network at a Glance: Understanding Indicator Icons

Navigating to Basic Settings

To configure initial settings, click **Basic Settings**.

If you use the Detection Utility to link to the Web User Interface, the Basic Settings page is displayed by default.



Provide basic settings

1 Review Description of this Access Point ...

These fields show information specific to this access point.

IP Address:	192.168.123.100
MAC Address:	00:c0:49:10:10:10
Firmware Version:	1.1.8 (Sep 23 2005)
Location	sw405

2 Provide Network Settings ...

These settings apply to this access point. The same settings will apply to new access points joining the cluster if the policy for adding new access points is set to "configure automatically".

Current Password	
New Password	●●●●●●●●●●●
Confirm New Password	●●●●●●●●●●●
Wireless Network Name (SSID)	USR5453 Internal Network

3 Set Configuration Policy for New Access Points ...

If you choose "configure automatically" as the policy for adding new access points, new access points will join the cluster when they are powered up and inherit the settings specified on this page. (If you choose to ignore new access points, you must configure them manually.)

New Access Points: are configured automatically

4 Settings ...

Click "update" to save the new settings.

For a typical access point which is a member of a cluster, provide the minimal set of configuration information needed to set up the access point and start wireless networking as described in the numbered steps on this page.

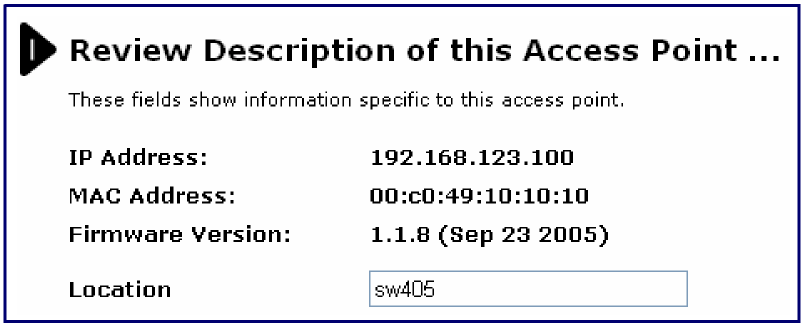
For a **standalone access point** the Basic Settings page indicates only that the current mode is standalone and provides a button for adding the access point to a cluster (group). If you click on any of the Cluster tabs for an AP in standalone mode you will be redirected to this Basic Settings page because Cluster settings do not apply to standalone APs.

Caution: **If you do not have a DHCP server** on the Internal network and do not plan to use one, the first thing you must do after bringing up the access point is change the Connection Type from DHCP to Static IP.

To change the Connection Type, go to the Ethernet (Wired) Settings tab.

Fill in the fields on the Basic Settings page as described below.

Review / Describe the Access Point



Review Description of this Access Point ...

These fields show information specific to this access point.

IP Address: 192.168.123.100

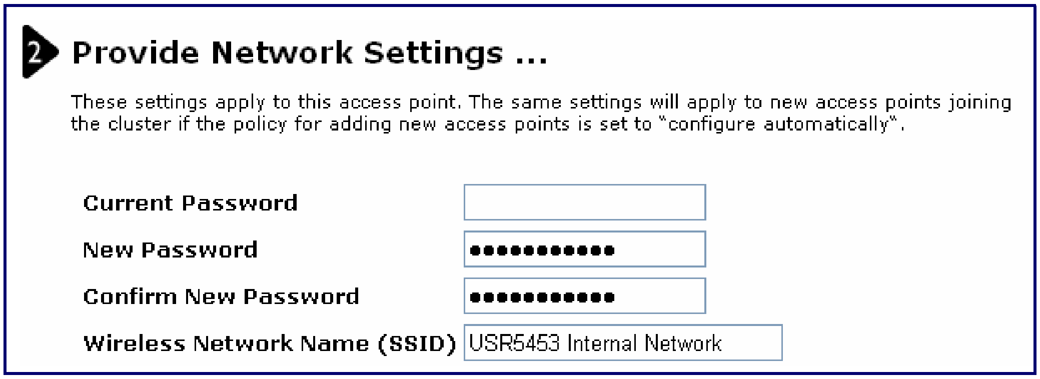
MAC Address: 00:c0:49:10:10:10

Firmware Version: 1.1.8 (Sep 23 2005)

Location: sw405

Field	Description
IP Address	The IP address assigned to this access point. This field is not editable because the IP address is already assigned (either via DHCP, or statically through the Ethernet (wired) settings as described in “Configuring Guest Interface Ethernet (Wired) Settings” on page 85).
MAC Address	The MAC address of the access point. 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 displayed for informational purposes as a unique identifier for an interface. The address shown here is the MAC address for the bridge (`br0`). This is the address by which the access point is known externally to other networks. To see MAC addresses for Guest and Internal interfaces on the access point, go to the Status menu and view the Interface tab.
Firmware Version	Version information about the firmware currently installed on the access point. As new versions of the Professional Access Point firmware become available, you can upgrade the firmware on your access points to take advantages of new features and enhancements. For instructions on how to upgrade the firmware, see “Upgrade” on page 160.
Location	Specify a location description for this access point.

Provide Administrator Password and Wireless Network Name



Provide Network Settings ...

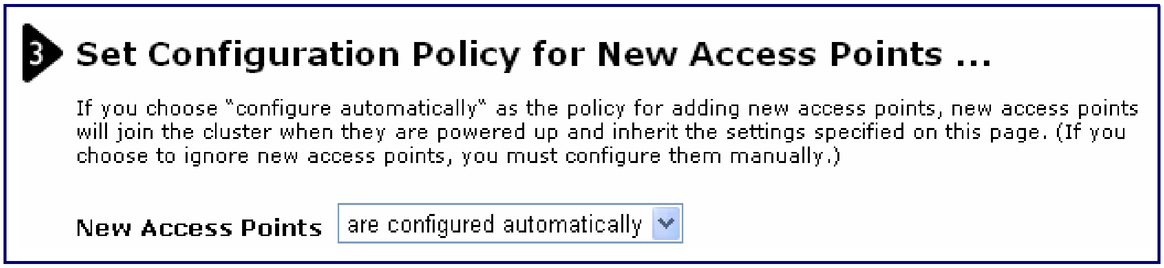
These settings apply to this access point. The same settings will apply to new access points joining the cluster if the policy for adding new access points is set to "configure automatically".

Current Password	
New Password	●●●●●●●●●●●●
Confirm New Password	●●●●●●●●●●●●
Wireless Network Name (SSID)	USR5453 Internal Network

Field	Description
Administrator Password	Enter a new administrator password. The characters you enter will be displayed as "•" characters to prevent others from seeing your password as you type. The Administrator password must be an alphanumeric string of up to 8 characters. Do not use special characters or spaces. ▶ As an immediate first step in securing your wireless network, USRobotics recommends that you change the administrator password from the default.
Administrator Password (again)	Re-enter the new password to confirm that you typed it as you intended.
Wireless Network Name (SSID)	Enter a name for the wireless network. This name will apply to all access points on this network. As you add more access points, they will share this SSID. The *Service Set Identifier* (SSID) must be an alphanumeric string of up to 32 characters **Note:** If you are connected as a wireless client to the access point that you are administering, resetting the SSID will cause you to lose connectivity to the access point. You will need to reconnect using the new SSID.

Note The Professional Access Point is not designed for multiple, simultaneous configuration changes. If more than one administrator is making changes to the configuration at the same time, all access points in the cluster will stay synchronized, but there is no guarantee that all changes specified by all of the administrators will be applied.

Set Configuration Policy for New Access Points



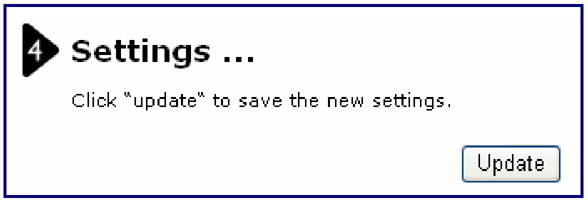
3 Set Configuration Policy for New Access Points ...

If you choose "configure automatically" as the policy for adding new access points, new access points will join the cluster when they are powered up and inherit the settings specified on this page. (If you choose to ignore new access points, you must configure them manually.)

New Access Points: are configured automatically

Field	Description
New Access Points	Choose the policy that you want to put in effect for adding New Access Points to the network. • If you choose **are configured automatically**, then when a new access point is added to the network it automatically joins the existing *cluster*. The cluster configuration is copied to the new access point, and no manual configuration is required to deploy it. • If you choose **are ignored**, new access points will not join the cluster; they will be considered *standalone*. You need to configure standalone access points manually via the Detection Utility and the Web User Interface residing on the standalone access points. (To get to the Web page for a standalone access point, use its IP address in a URL as follows: http://*IPAddressOfAccessPoint*.) **Note:** If you change the policy so that new access points are ignored, then any new access points you add to the network will not join the cluster. Existing clustered access points will not be aware of these standalone APs. Therefore, if you are viewing the Web User Interface via the IP address of a clustered access point, the new standalone APs will not show up in the list of access points on the Cluster menu's Access Points page. The only way to see a standalone access point is to browse to it directly by using its IP address as the URL. If you later change the policy back to the default so that new access points are configured automatically, all subsequent new APs will automatically join the cluster. Standalone APs, however, will stay in standalone mode until you explicitly add them to the cluster. For information on how to add standalone APs to the cluster, see "Adding an Access Point to a Cluster" on page 40.

Update Basic Settings



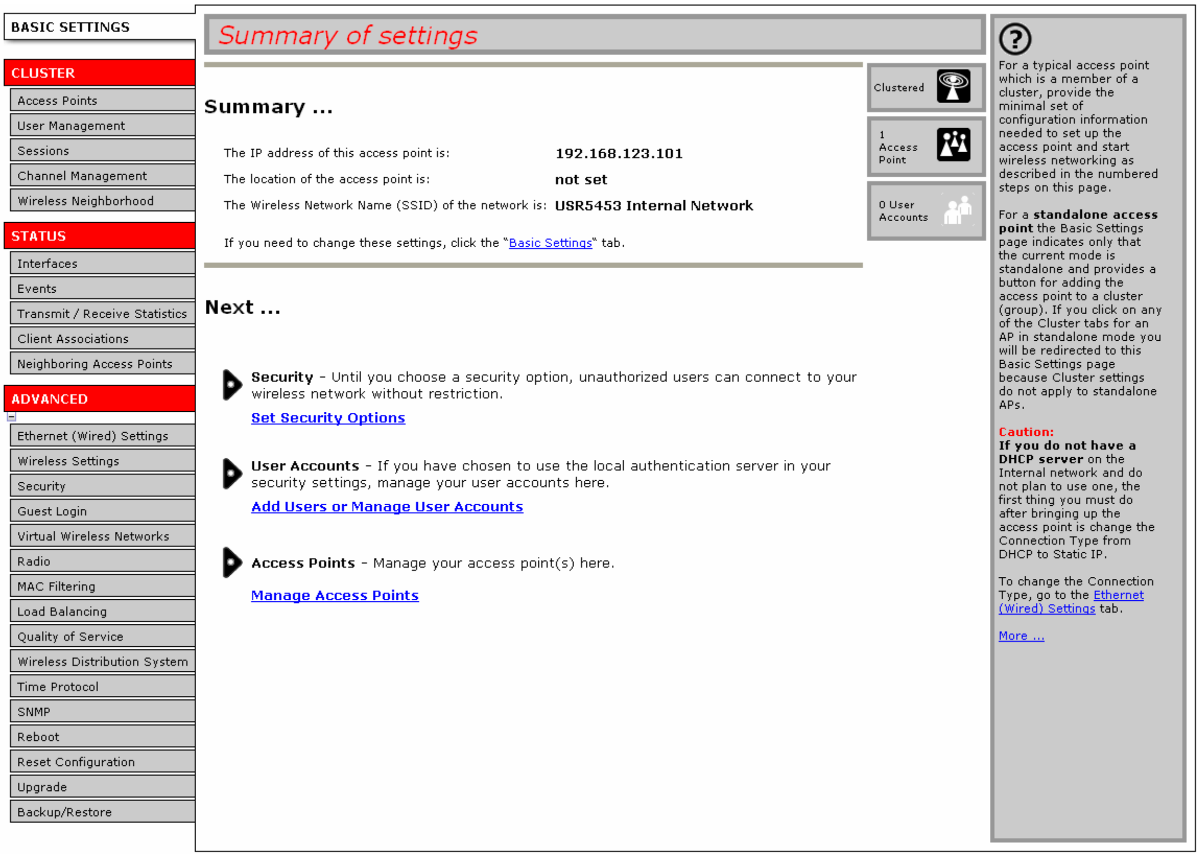
4 Settings ...

Click "update" to save the new settings.

When you have reviewed the new configuration, click **Update** to apply the settings and deploy the access points as a wireless network.

Summary of Settings

When you update the **Basic Settings**, a summary of the new settings is shown along with information about next steps.



Summary of settings

Summary ...

The IP address of this access point is: 192.168.123.101

The location of the access point is: not set

The Wireless Network Name (SSID) of the network is: USR5453 Internal Network

If you need to change these settings, click the "Basic Settings" tab.

Next ...

Security - Until you choose a security option, unauthorized users can connect to your wireless network without restriction.

Set Security Options

User Accounts - If you have chosen to use the local authentication server in your security settings, manage your user accounts here.

Add Users or Manage User Accounts

Access Points - Manage your access point(s) here.

Manage Access Points

For a typical access point which is a member of a cluster, provide the minimal set of configuration information needed to set up the access point and start wireless networking as described in the numbered steps on this page.

For a **standalone access point** the Basic Settings page indicates only that the current mode is standalone and provides a button for adding the access point to a cluster (group). If you click on any of the Cluster tabs for an AP in standalone mode you will be redirected to this Basic Settings page because Cluster settings do not apply to standalone APs.

Caution:
If you do not have a DHCP server on the Internal network and do not plan to use one, the first thing you must do after bringing up the access point is change the Connection Type from DHCP to Static IP.

To change the Connection Type, go to the Ethernet (Wired) Settings tab.

More ...

At initial startup, no security is in place on the access point. An important next step is to configure security, as described in "Security" on page 91.

At this point if you click Basic Settings again, the summary of settings page is replaced by the standard Basic Settings configuration options.

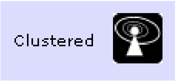
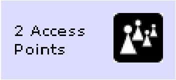
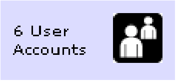
Basic Settings for a Standalone Access Point

The Basic Settings page for a standalone access point indicates only that the current mode is standalone and provides a button for adding the access point to a cluster (group). If you click on any of the Cluster tabs on the Web User Interface pages for an access point in standalone mode, you will be redirected to the Basic Settings page because Cluster settings do not apply to standalone APs.

For more information see “Standalone Mode” on page 37 and “Adding an Access Point to a Cluster” on page 40.

Your Network at a Glance: Understanding Indicator Icons

All the Cluster settings tabs on the Web User Interface include icons that show current network activity.

Icon	Description
 Clustered	When one or more APs on your network are available for service, the Wireless Network Available icon is shown. The clustering icon indicates whether the current access point is **Clustered** or **Not Clustered** (that is, standalone). For information about clustering, see “Understanding Clustering” on page 34.
 2 Access Points	The number of access points available for service on this network is indicated by the Access Points icon. For information about managing access points, see “Access Points” on page 33.
 6 User Accounts	The number of user accounts created and enabled on this network is indicated by the User Accounts icon. For information about setting up user accounts on the access point for use with the built-in authentication server, see “User Management” on page 43. See also “IEEE 802.1x” on page 104 and “WPA/WPA2 Enterprise (RADIUS)” on page 107, which are the two security modes that offer the option of using the built-in authentication server.

Cluster

This section covers the Web User Interface Cluster items:

- “Access Points” on page 33
- “User Management” on page 43
- “Sessions” on page 49
- “Channel Management” on page 53
- “Wireless Neighborhood” on page 61

Access Points

The Professional Access Point shows current basic configuration settings for clustered access points (location, IP address, MAC address, status, and availability) and provides a way of navigating to the full configuration for specific APs if they are cluster members.

Standalone access points or those which are not members of this cluster do not show up in this listing. To configure standalone access points, you must discover (via the Detection Utility) or know the IP address of the access point and by using its IP address in a URL (`http://`*`IPAddressOfAccessPoint`*).

Note The Professional Access Point is not designed for multiple, simultaneous configuration changes. If you have a network that includes multiple access points, and more than one administrator is logged on to the Web User Interface and making changes to the configuration, all access points in the cluster will stay synchronized but there is no guarantee that all configuration changes specified by multiple users will be applied.

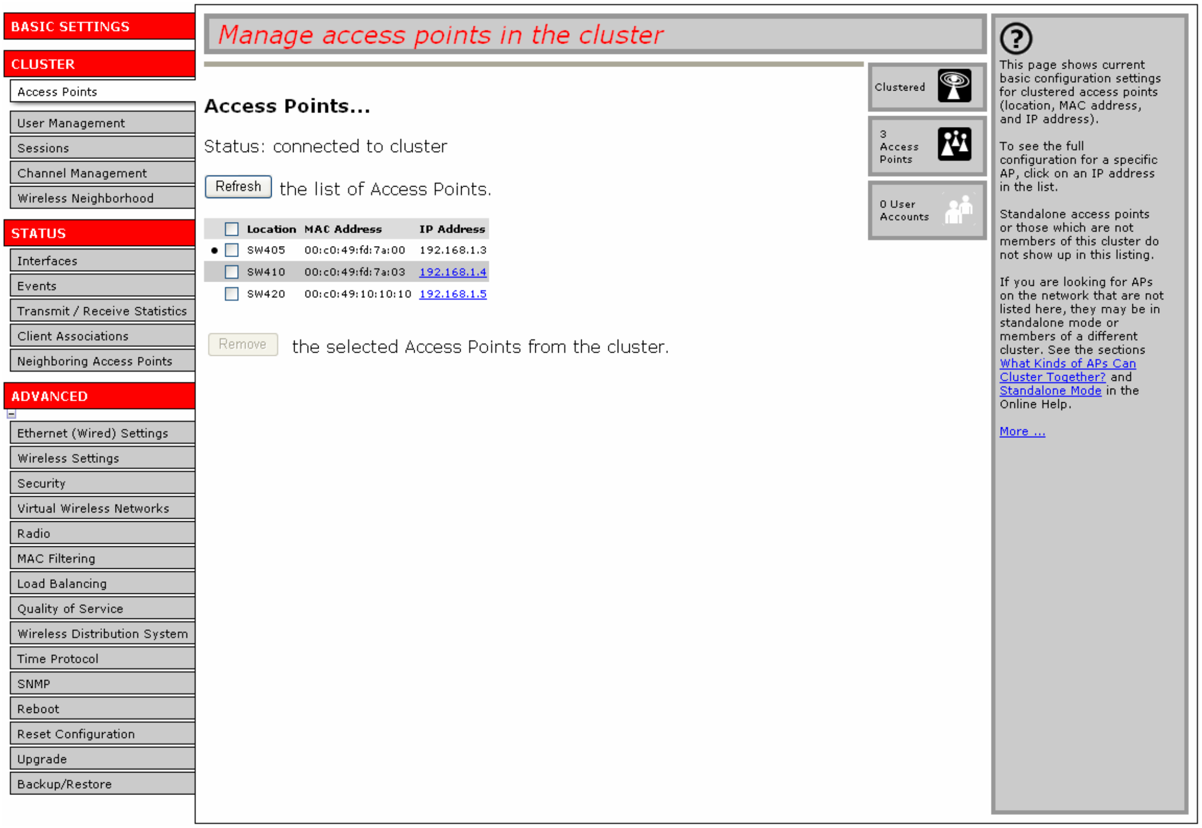
The following topics are covered:

- Navigating to Access Points Management
- Understanding Clustering
    - What is a Cluster?
    - How Many APs Can a Cluster Support?
    - What Kinds of APs Can Cluster?
    - Which Settings are Shared as Part of the Cluster Configuration and Which Are Not?
    - Cluster Mode
    - Standalone Mode
    - Cluster Formation

    - Cluster Size and Membership
    - Intra-Cluster Security
    - Auto-Synchronization of Cluster Configuration
- Understanding Access Point Settings
- Modifying the Location Description
- Removing an Access Point from the Cluster
- Adding an Access Point to a Cluster
- Navigating to the Web User Interface for a Specific Access Point

Navigating to Access Points Management

To view or edit information on access points in a cluster, click the Cluster menu's **Access Points** tab.



Manage access points in the cluster

Access Points...

Status: connected to cluster

Refresh the list of Access Points.

	□	Location	MAC Address	IP Address
●	□	SW405	00:c0:49:fd:7a:00	192.168.1.3
	□	SW410	00:c0:49:fd:7a:03	192.168.1.4
	□	SW420	00:c0:49:10:10:10	192.168.1.5

Remove the selected Access Points from the cluster.

This page shows current basic configuration settings for clustered access points (location, MAC address, and IP address).

To see the full configuration for a specific AP, click on an IP address in the list.

Standalone access points or those which are not members of this cluster do not show up in this listing.

If you are looking for APs on the network that are not listed here, they may be in standalone mode or members of a different cluster. See the sections What Kinds of APs Can Cluster Together? and Standalone Mode in the Online Help.

More ...

Understanding Clustering

A key feature of the Professional Access Point is the ability to form a dynamic, configuration-aware group (called a *cluster*) with other Professional Access Points in a network in the same subnet. Access points can participate in a self-organizing cluster which makes it easier for you to deploy, administer, and secure your wireless network. The cluster provides a single point of administration and lets you view the deployment of access points as a single wireless network rather than a series of separate wireless devices.

What is a Cluster?

A cluster is a group of access points which are coordinated as a single group via Professional Access Point administration. You cannot create multiple clusters on a single wireless network (SSID). Only one cluster per wireless network is supported.

How Many APs Can a Cluster Support?

Up to eight access points are supported in a cluster at any one time. If a new access point is added to a network with a cluster that is already at full capacity, the new access point is added in *standalone mode*. Note that when the cluster is full, extra APs are added in stand-alone mode regardless of the configuration policy in effect for new access points.

For related information, see “Cluster Mode” on page 37, “Standalone Mode” on page 37, and “Set Configuration Policy for New Access Points” on page 29.

What Kinds of APs Can Cluster?

A single Professional Access Point can form a cluster with itself (a cluster of one) and with other Professional Access Points of the same model. In order to be members of the same cluster, access points must be on the same LAN.

Having a mix of APs on the network does not adversely affect Professional Access Point clustering in any way. However, access points of other types will not join the cluster. Those APs must be administered with their own associated administration tools.

Which Settings are Shared as Part of the Cluster Configuration and Which Are Not?

Most configuration settings defined via the Professional Access Point Web User Interface will be propagated to cluster members as a part of the *cluster configuration*.

Settings Shared in the Cluster Configuration

The cluster configuration includes:

- Network name (SSID)
- Administrator Password
- Configuration policy
- User accounts and authentication
- Wireless interface settings
- Guest Welcome screen settings
- Network Time Protocol (NTP) settings

- Radio settings

  The following radio settings are synchronized across clusters:

  - Mode
  - Channel

    Note When **Channel Planning** is enabled, the radio Channel is not synchronized across the cluster. See “Stopping/Starting Automatic Channel Assignment” on page 56.

  - Fragmentation Threshold
  - RTS Threshold
  - Rate Sets

  The following radio settings are *not* synchronized across clusters:

  - Beacon Interval
  - DTIM Period
  - Maximum Stations
  - Transmit Power

- Security settings
- QoS queue parameters
- MAC address filtering

Settings Not Shared by the Cluster

The few exceptions (settings *not* shared among clustered access points) are the following; most of these, by their nature, must be unique:

- IP addresses
- MAC addresses
- Location descriptions
- Load Balancing settings
- WDS bridges
- Ethernet (Wired) Settings, including enabling or disabling Guest access
- Guest interface configuration

Settings that are not shared must be configured individually in the Web User Interface for each access point. To access the Web User Interface for an access point that is a member of the current cluster, click the Cluster menu's **Access Points** tab in the Web User Interface of the current access point, then click the member access point's **IP Address** link.

Cluster Mode

When an access point is a cluster member, it is considered to be in cluster mode. You define whether you want new access points to join the cluster or not via the configuration policy you set in the Basic Settings. (See "Set Configuration Policy for New Access Points" on page 29.) You can reset an access point in cluster mode to standalone mode. (See "Removing an Access Point from the Cluster" on page 39.)

Note When the cluster is full (eight APs is the limit), extra APs are added in *stand-alone mode* regardless of the configuration policy in effect for new access points.

Standalone Mode

The Professional Access Point can be configured in *standalone* mode. In standalone mode, an access point is not a member of the cluster and does not share the cluster configuration, but rather requires manual configuration that is not shared with other access points. (See "Set Configuration Policy for New Access Points" on page 29 and "Removing an Access Point from the Cluster" on page 39.)

Standalone access points are not listed on the Cluster menu's Access Points page in the Web User Interfaces of APs that are cluster members. You need to know the IP address for a standalone access point in order to configure and manage it directly. (See "Navigating to an Access Point by Using its IP Address in a URL" on page 40.)

The Basic Settings tab for a standalone access point indicates only that the current mode is standalone and provides a button for adding the access point to a cluster (group). If you click any of the Cluster tabs in the Web User Interface for a standalone access point, you will be redirected to the Basic Settings page because Cluster settings do not apply to standalone APs.

Note When the cluster is full, new APs are added in *stand-alone mode* regardless of the configuration policy in effect for new access points. A cluster supports a maximum of eight access points.

You can re-enable cluster mode on a standalone access point. (See "Adding an Access Point to a Cluster" on page 40.)

Cluster Formation

A cluster is formed when the first Professional Access Point is configured. (See "Setting Up and Launching Your Wireless Network" on page 13 and "Basic Settings" on page 25.)

If a cluster configuration policy in place, when a new access point is deployed, it attempts to rendezvous with an existing cluster.

If it is unable to locate a cluster, then it establishes a new cluster on its own.

If it locates a cluster but is rejected because the cluster is full or because the clustering policy is to ignore new access points, then the access point deploys in standalone mode.

Cluster Size and Membership

The upper limit of a cluster is eight access points. The Cluster Web User Interface pages provide a visual indicator of the number of access points in the current cluster and warn when the cluster has reached capacity.

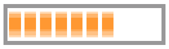
Intra-Cluster Security

To ensure that the security of the cluster as a whole is equivalent to the security of a single access point, communication of certain data between access points in a cluster is accomplished through Secure Sockets Layer (typically referred to as *SSL*) with private key encryption.

Both the cluster configuration file and the user database are transmitted among access points using SSL.

Auto-Synchronization of Cluster Configuration

If you are making changes to the access point configuration that require a relatively large amount of processing (such as adding several new users), you may encounter a synchronization progress bar after clicking **Update** on any of the Web User Interface pages. The progress bar indicates that the system is busy performing an auto-synchronization of the updated configuration across all APs in the cluster. The Web User Interface pages are not editable during the auto-synch.



Note that auto-synchronization always occurs during configuration updates that affect the cluster, but the processing time is usually negligible. The auto-synchronization progress bar is displayed only for longer-than-usual wait times.

Understanding Access Point Settings

The Access Points tab provides information about all access points in the cluster.

From this tab, you can view location descriptions, IP addresses, enable (activate) or disable (deactivate) *clustered* access points, and remove access points from the cluster. You can also modify the location description for an access point.

The IP address links provide a way to navigate to configuration settings and data on an access point.

Standalone access points (those which are not members of the cluster) are not shown on this page.

The following table describes the access point settings and information display in detail.

Field	Description
Location	Description of the access point's physical location.
MAC Address	Media Access Control (MAC) address of the access point. 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 the access point. The address shown here is the MAC address for the bridge (`br0`). This is the address by which the access point is known externally to other networks. To see MAC addresses for Guest and Internal interfaces on the access point, see the Status menu's Interfaces page.
IP Address	Specifies the IP address for the access point. Each IP address is a link to the Web User Interface for that access point. You can use the links to navigate to the Web User Interface 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.

Modifying the Location Description

To make modifications to the location description:

1. Navigate to the **Basic Settings** page.

2. Update the **Location** description in section 1 under **Review Description of this Access Point**.

3. Click **Update** button to apply the changes.

Removing an Access Point from the Cluster

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

1. Select the check box next to the access point.

2. Click **Remove** from Cluster.

   The change will be reflected under Status for that access point; the access point will now show as *standalone* (instead of *cluster*).

Note In some situations, it is possible for the cluster to lose synchronization. If, after removing an access point from the cluster, the access point list still reflects the deleted access point or shows an incomplete display, refer to the information on Cluster Recovery in "Troubleshooting".

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 Web User Interface for the standalone access point. (See "Navigating to an Access Point by Using its IP Address in a URL" on page 40.)

   The Web User Interface pages for the standalone access point are displayed.

2. Click the Basic Settings tab in the Administration pages for the standalone access point.

   The Basic Settings 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).

   Note If you click any of the Cluster tabs in the Web User Interface for an access point in standalone mode, you will be redirected to the Basic Settings page because Cluster settings do not apply to standalone APs.

3. Click the **Join Cluster** button.

   The access point is now a cluster member. Its Status (Mode) on the Cluster menu's Access Points page now indicates **cluster** instead of **standalone**.

Navigating to the Web User Interface for a Specific Access Point

In general, the Professional 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. You can navigate to the Web User Interface for an individual access point by clicking the access point's IP address link on the Access Points tab.

All clustered access points are shown on the Cluster menu's 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 Access Point by Using its IP Address in a URL

You can also link to the Web User Interface 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 that you want to monitor or configure.

For a standalone access point, this is the only way to navigate to the configuration information.

If you do not know the IP address for a standalone access point, use the Detection Utility to find all APs on the network and you should be able to derive which ones are standalone by comparing the Detection Utility findings with access points listed on the Cluster menu’s Access Points page. The APs that the Detection Utility finds that are not shown on the Access Points page are probably standalone APs. (For more information on using the Detection Utility, see “Step 3. Run the Detection Utility to find access points on the network” on page 16.)

User Management

The Professional Access Point includes user management capabilities for controlling access to your access points.

User management and authentication must always be used in conjunction with the following two security modes, which require use of a RADIUS server for user authentication and management.

- IEEE 802.1x mode (see “IEEE 802.1x” on page 104 in Security)
- WPA with RADIUS mode (see “WPA/WPA2 Enterprise (RADIUS)” on page 107 in Security)

You have the option of using either the internal RADIUS server embedded in the Professional Access Point or an external RADIUS server that you provide. If you use the embedded RADIUS server, use this Administration Web page on the access point to set up and manage user accounts. If you are using an external RADIUS server, you will need to set up and manage user accounts for that server in the Web User Interface.

On the User Management page, you can create, edit, remove, and view *user accounts*. Each user account consists of a user name and password. The set of users specified on the User Management page represent approved *clients* that can log in and use one or more access points to access local and possibly external networks via your wireless network.

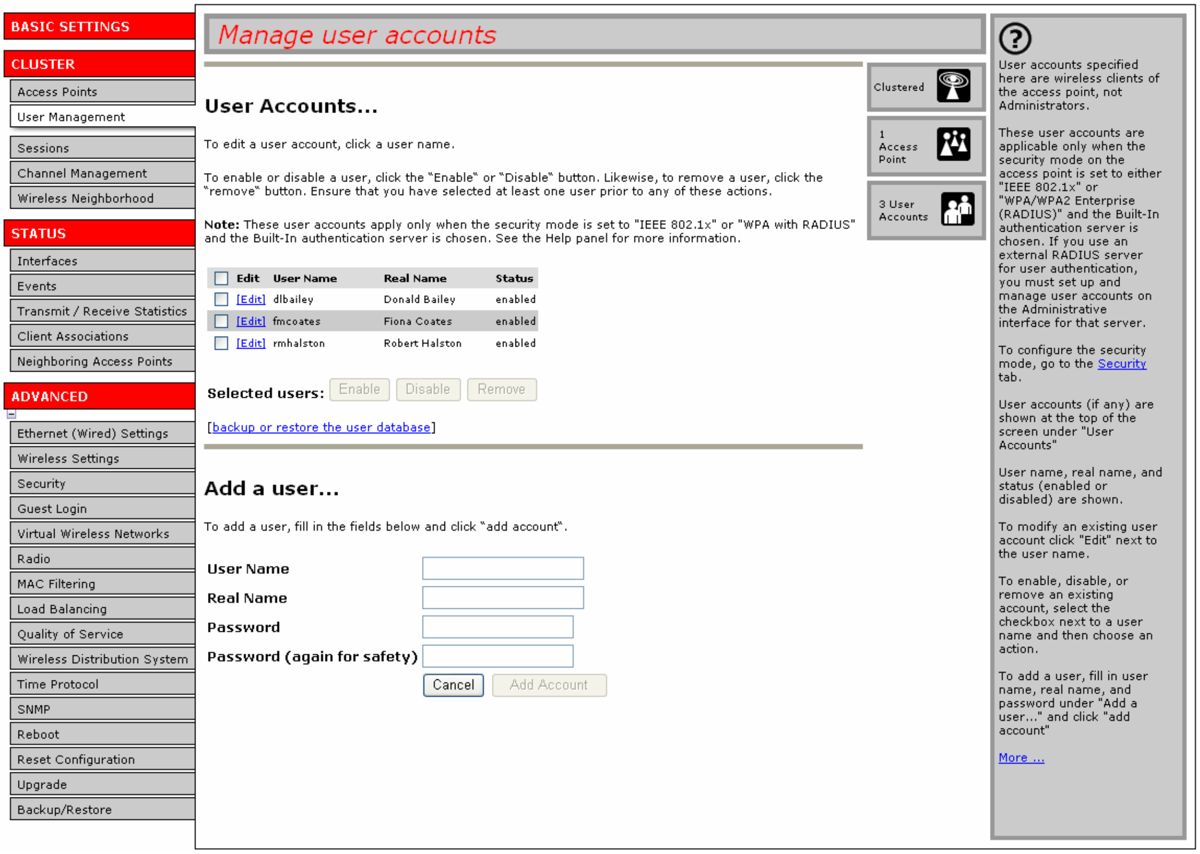
Note Users specified on the User Management page are those who use the APs as a connectivity hub, not administrators of the wireless network. Only those with the administrator user name and password and knowledge of the administration URL can log in as an administrator and view or modify configuration settings.

The following topics are covered:

- Navigating to User Management for Clustered Access Points
- Viewing User Accounts
- Adding a User
- Editing a User Account
- Enabling and Disabling User Accounts
- Removing a User Account
- Backing Up and Restoring a User Database

Navigating to User Management for Clustered Access Points

To set up or modify user accounts, click the Cluster Menu’s **User Management** tab.



Manage user accounts

User Accounts...

To edit a user account, click a user name.

To enable or disable a user, click the “Enable” or “Disable” button. Likewise, to remove a user, click the “remove” button. Ensure that you have selected at least one user prior to any of these actions.

Note: These user accounts apply only when the security mode is set to "IEEE 802.1x" or "WPA with RADIUS" and the Built-In authentication server is chosen. See the Help panel for more information.

☐	Edit	User Name	Real Name	Status
☐	[Edit]	dlbailey	Donald Bailey	enabled
☐	[Edit]	fmcoates	Fiona Coates	enabled
☐	[Edit]	rmhalston	Robert Halston	enabled

Selected users: Enable Disable Remove

[backup or restore the user database]

Add a user...

To add a user, fill in the fields below and click “add account”.

User Name
Real Name
Password
Password (again for safety)

User accounts specified here are wireless clients of the access point, not Administrators.

These user accounts are applicable only when the security mode on the access point is set to either "IEEE 802.1x" or "WPA/WPA2 Enterprise (RADIUS)" and the Built-In authentication server is chosen. If you use an external RADIUS server for user authentication, you must set up and manage user accounts on the Administrative interface for that server.

To configure the security mode, go to the Security tab.

User accounts (if any) are shown at the top of the screen under "User Accounts"

User name, real name, and status (enabled or disabled) are shown.

To modify an existing user account click "Edit" next to the user name.

To enable, disable, or remove an existing account, select the checkbox next to a user name and then choose an action.

To add a user, fill in user name, real name, and password under "Add a user..." and click "add account"

More ...

Viewing User Accounts

User accounts are shown at the top of the screen under **User Accounts**. User name, real name, and status (enabled or disabled) are shown.

Adding a User

To create a new user, do the following:

1. Under **Add a User**, provide information in the following fields.

Field	Description
Username	Provide a user name. The user name is an alphanumeric string of up to 237 characters. Do not use special characters or spaces.

Field	Description
Real Name	For information purposes, provide the user's full name. Real name is a maximum of 256 characters long.
Password	Specify a password for this user. The password is an alphanumeric string of up to 256 characters. Do not use special characters or spaces.

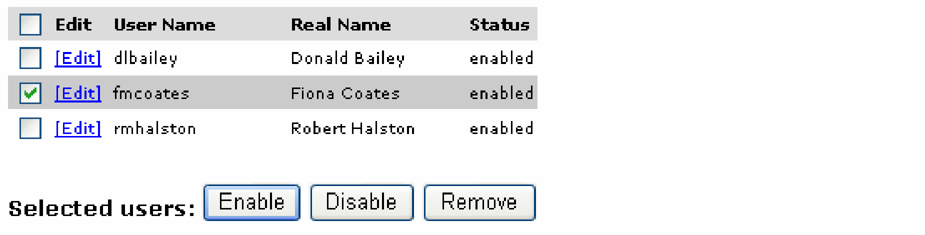
2. When you have filled in the fields, click **Add Account** to add the account.

   The new user is then displayed under **User Accounts.** The user account is **enabled** by default when you first create it.

Note A limit of 100 user accounts per access point is imposed by the Web User Interface. Network usage may impose a more practical limit, depending upon the demand from each user.

Editing a User Account

Once you have created a user account, it is displayed under **User Accounts** at the top of the User Management Administration Web page. To modify an existing user account, first select **[Edit]** next to the user name.



□	Edit	User Name	Real Name	Status
□	[Edit]	dlbailey	Donald Bailey	enabled
☑	[Edit]	fmcoates	Fiona Coates	enabled
□	[Edit]	rmhalston	Robert Halston	enabled

Then, make your changes in the Update Account section of the page and click **Update Account**.

Enabling and Disabling User Accounts

A user account must be enabled for the user to log on and use the access point.

You can enable or disable any user account. With this feature, you can maintain a set of user accounts and authorize or prevent users from accessing the network without having to remove or re-create accounts. This ability is useful in situations where users have an occasional need to access the network. For example, contractors who do work for your company on an intermittent but regular basis might need network access for 3 months at a time, then be off for 3 months, and back on for another assignment. You can enable and disable these user accounts as needed, and control access as appropriate.

Enabling a User Account

To enable a user account, select the check box next to the user name and click **Enable**.

A user with an account that is enabled can log on to the wireless access points in your network.

Disabling a User Account

To disable a user account, select the check box next to the user name and click **Disable**.

A user with an account that is disabled cannot log on to the wireless access points in your network. However, the user account remains in the database and can be enabled later as needed.

Removing a User Account

To remove a user account, select the check box next to the user name and click **Remove**.

If you think that you might need to add this user again at a later date, you might consider disabling the user account rather than removing it.

Backing Up and Restoring a User Database

You can save a copy of the current set of user accounts to a backup configuration file. The backup file can be used at a later date to restore the user accounts on the access point to the previous configuration.

Backing Up the User Database

To create a backup copy of the user accounts for the access point:

1. Click the **backup or restore the user database** link; then click **backup user database**.

   A File Download or Open dialogue box is displayed.

2. Choose the **Save** option.

   A file browser is displayed.

3. 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 use the default file name (`wirelessUsers.ubk`) or specify a new file name, but be sure to save the file with a `.ubk` extension.

Restoring a User Database from a Backup File

To restore a user database from a backup file:

1. Click the **backup or restore the user database** link; then click **restore user database**.

2. Select the backup configuration file that you want to use, either by typing the full path and file name in the **Restore** field or by clicking **Browse** and selecting the file.

   (Only those files that were created with the **User Database Backup** function and saved as `.ubk` backup configuration files are valid to use with **Restore**; for example, `wirelessUsers.ubk`.)

3. Click the **Restore** button.

   When the backup restore process is complete, a message indicates that the user database has been successfully restored. (This process is not time-consuming; the restore should complete almost immediately.)

   Click the Cluster menu’s **User Management** tab to see the restored user accounts.

Sessions

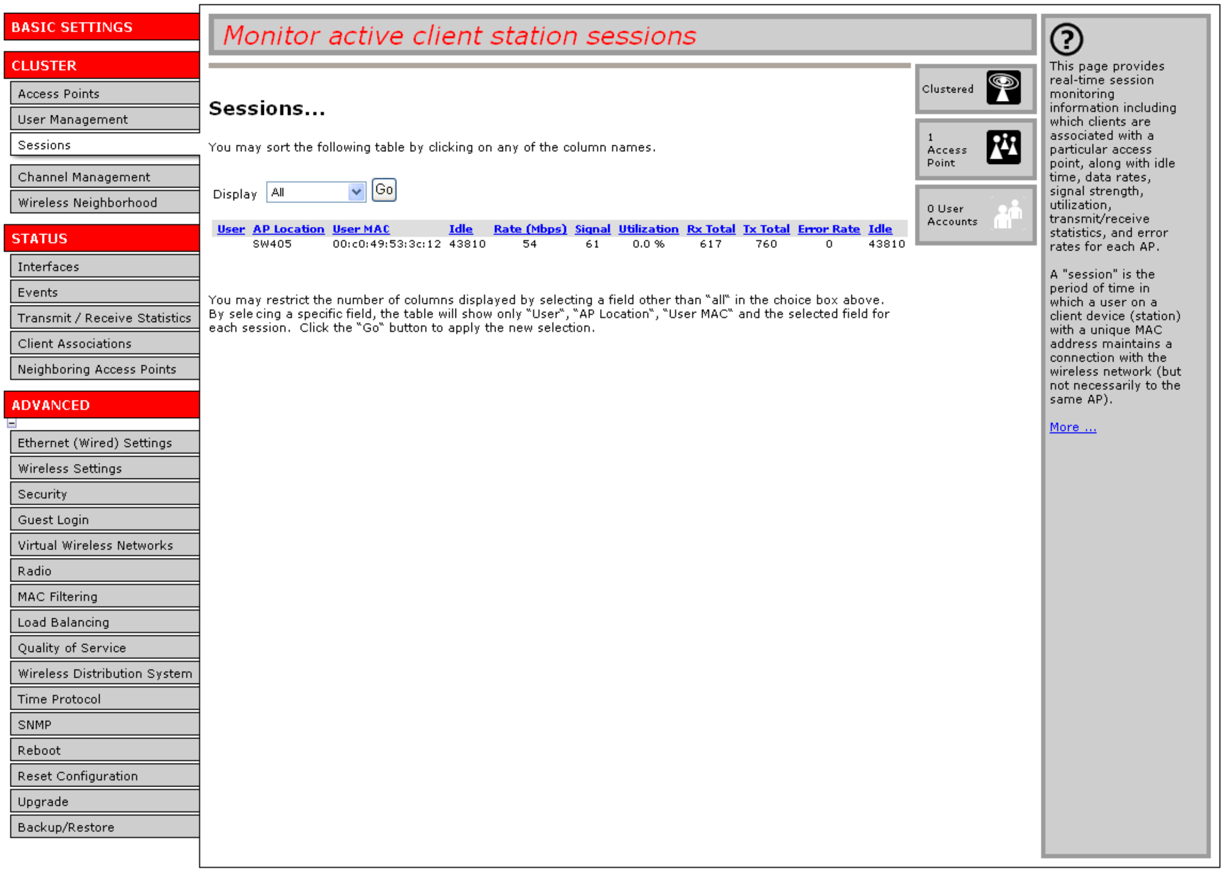
The Professional Access Point provides real-time session monitoring information including which users and clients are associated with a particular access point, data rates, transmit/receive statistics, signal strength, and idle time.

The following Session Monitoring topics are covered here:

- Navigating to Session Monitoring
- Understanding Session Monitoring Information
- Viewing Session Information for Access Points
- Sorting Session Information
- Refreshing Session Information

Navigating to Session Monitoring

To view session monitoring information, click the Cluster menu's **Sessions** tab.



Monitor active client station sessions

Sessions...

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

User	AP Location	User MAC	Idle	Rate (Mbps)	Signal	Utilization	Rx Total	Tx Total	Error Rate	Idle
	SW405	00:c0:49:53:3c:12	43810	54	61	0.0 %	617	760	0	43810

You may restrict the number of columns displayed by selecting a field other than "all" in the choice box above. By sele cing 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.

This page provides real-time session monitoring information including which clients are associated with a particular access point, along with idle time, data rates, signal strength, utilization, transmit/receive statistics, and error rates for each AP.

A "session" 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 (but not necessarily to the same AP).

Understanding Session Monitoring Information

The Sessions page shows information about users and client devices associated with access points in the cluster. Each session is identified by user name and client MAC address, along with the access point (location) to which the client is connected.

To view a particular statistic for a session, select the item from the **Display** list and click **Go**. You can view Idle Time, Data Rate, Signal, Utilization, and so on; all of which are described in detail in the table below.

A *session* is the period of time for which a user on a client device with a unique MAC address maintains a connection with the wireless network. The session begins when the user logs on to the *network*, and the session ends when the user either logs off intentionally or loses the connection unintentionally.

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 access point to another within the context of the same session. A client station can roam between APs and maintain the session.

For information about monitoring *associations* and *link integrity monitoring*, see “Client Associations” on page 73.

Details about session information are given below.

Field	Description
User	The user names of IEEE 802.1x clients. **Note:** This field is relevant only for clients that are connected to APs using IEEE 802.1x security mode *and* local authentication server. (For more information about this mode, see “IEEE 802.1x” on page 104.) For clients of APs using IEEE 802.1x with RADIUS server or other security modes, no user name will be shown here.
AP Location	The location of the access point. This is derived from the location description specified on the Basic Settings tab.
User MAC	The MAC address of the user’s client device. A MAC address is a hardware address that uniquely identifies each node of a network.
Idle	The amount of time that this station has remained inactive. A station is considered to be idle when it is not receiving or transmitting data. Idle time is measured in milliseconds.
Rate	The speed at which this access point is transferring data to the client. The data transmission rate is measured in megabits per second (Mbps). This value will fall within the range of the advertised rate set for the IEEE 802.1x mode in use on the access point. For example, 1 to 54Mbps for 802.11g.

Field	Description
Signal	Indicates the strength of the radio frequency (RF) signal the client receives from the access point. The measure used for this is an IEEE 802.1x value known as *Received Signal Strength Indication* (RSSI), and is a value between 0 and 100. RSSI is determined by a an IEEE 802.1x mechanism implemented on the network interface card (NIC) of the client.
Utilization	Utilization rate for this station. For example, if the station is active (transmitting and receiving data) 90% of the time and inactive 10% of the time, its utilization rate is 90%.
Rx Total	Receive Total: Indicates number of total packets received by the client during the current session.
Tx Total	Transmit Total: Indicates number of total packets transmitted to the client during this session.
Error Rate	Indicates the percentage frames that are dropped during transmission on this access point.

Viewing Session Information for Access Points

You can view session information for all access points on the network at the same time, or you can set the display to show session information for a specified access point chosen from the list at the top of the page.

To view information on all access points, select **Show all access points** at the top of the page.

To view session information on a particular access point, select **Show only this access point** and select the access point name from the list.

Sorting Session Information

To order (sort) the information in the tables, click on the column label by which you want to order the information rows. For example, if you want to see the table rows ordered by utilization rate, click on the **Utilization** column label. The entries will be sorted by utilization rate.

Refreshing Session Information

You can force an update of the information displayed on the Session Monitoring page by clicking the **Refresh** button.

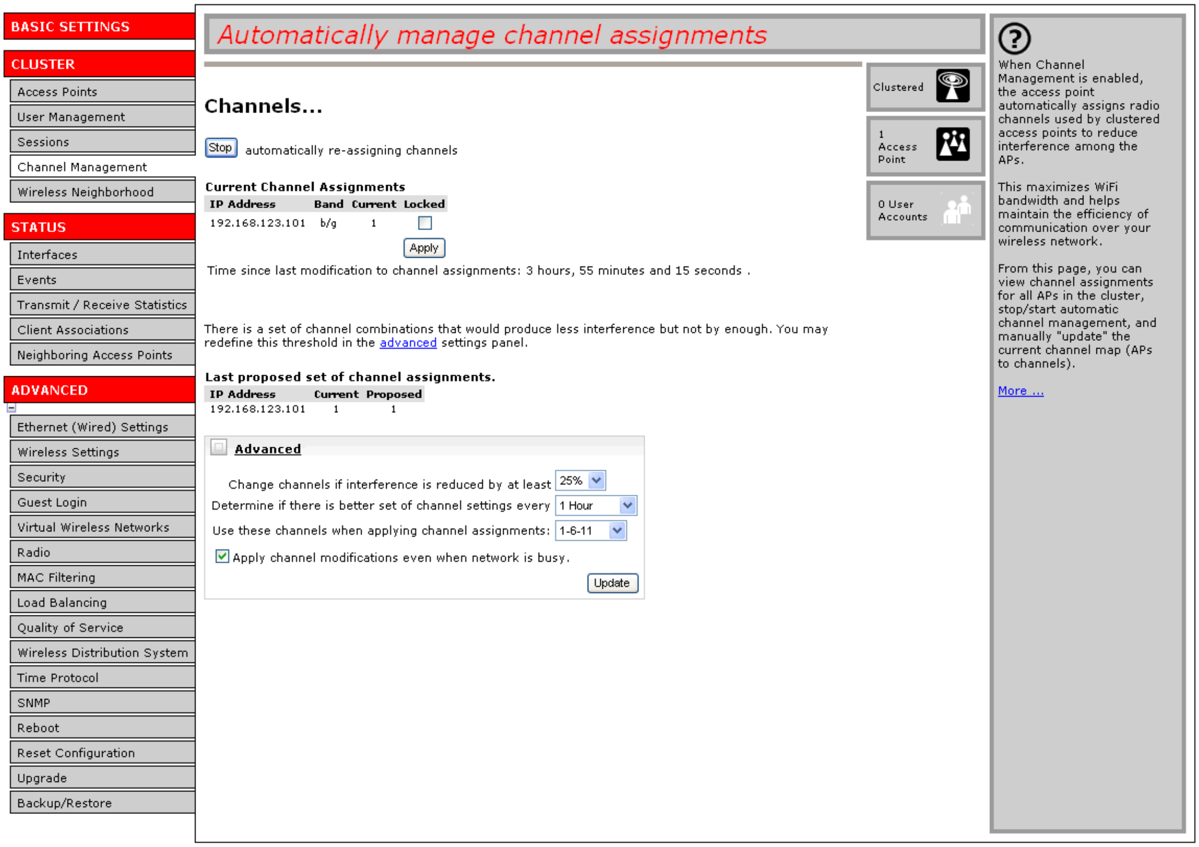
Channel Management

The following Channel Management topics are covered here:

- Navigating to Channel Management
- Understanding Channel Management
    - How it Works: Overview
    - Overlapping Channels: Background Information
    - Example: A Network before and after Channel Management
- Configuring and Viewing Channel Management Settings
    - Stopping/Starting Automatic Channel Assignment
    - Viewing Current Channel Assignments and Setting Locks
    - Viewing Last Proposed Set of Changes
    - Configuring Advanced Settings (Customizing and Scheduling Channel Plans)

Navigating to Channel Management

To view session monitoring information, click the Cluster menu's **Channel Management** tab.



Automatically manage channel assignments

Channels...

Stop automatically re-assigning channels

Current Channel Assignments

IP Address	Band	Current	Locked
192.168.123.101	b/g	1	□

Time since last modification to channel assignments: 3 hours, 55 minutes and 15 seconds .

There is a set of channel combinations that would produce less interference but not by enough. You may redefine this threshold in the advanced settings panel.

Last proposed set of channel assignments.

IP Address	Current	Proposed
192.168.123.101	1	1

□ **Advanced**

Change channels if interference is reduced by at least 25%

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

Use these channels when applying channel assignments: 1-6-11

☑ Apply channel modifications even when network is busy.

When Channel Management is enabled, the access point automatically assigns radio channels used by clustered access points to reduce interference among the APs.

This maximizes WiFi bandwidth and helps maintain the efficiency of communication over your wireless network.

From this page, you can view channel assignments for all APs in the cluster, stop/start automatic channel management, and manually "update" the current channel map (APs to channels).

Understanding Channel Management

When Channel Management is enabled, the Professional Access Point automatically assigns radio channels used by clustered access points to reduce interference with access points both within and outside of its cluster. This dynamic channel assignment maximizes Wi-Fi bandwidth and helps maintain the efficiency of communication over your wireless network.

How it Works: Overview

At a specified interval, or on demand, Channel Management maps APs to channel use and measures interference levels in the cluster. If significant channel interference is detected, Channel Management automatically reassigns some or all of the APs to new channels according to an efficiency algorithm (or *automated channel plan*).

Overlapping Channels: Background Information

The radio frequency (RF) broadcast Channel defines the portion of the radio spectrum that the radio on the access point uses for transmitting and receiving. The range of available channels for an access point is determined by the IEEE 802.11 mode, or band, of the access point. IEEE 802.11b and 802.11g modes (802.11 b/g) support the use of channels 1 through 11.

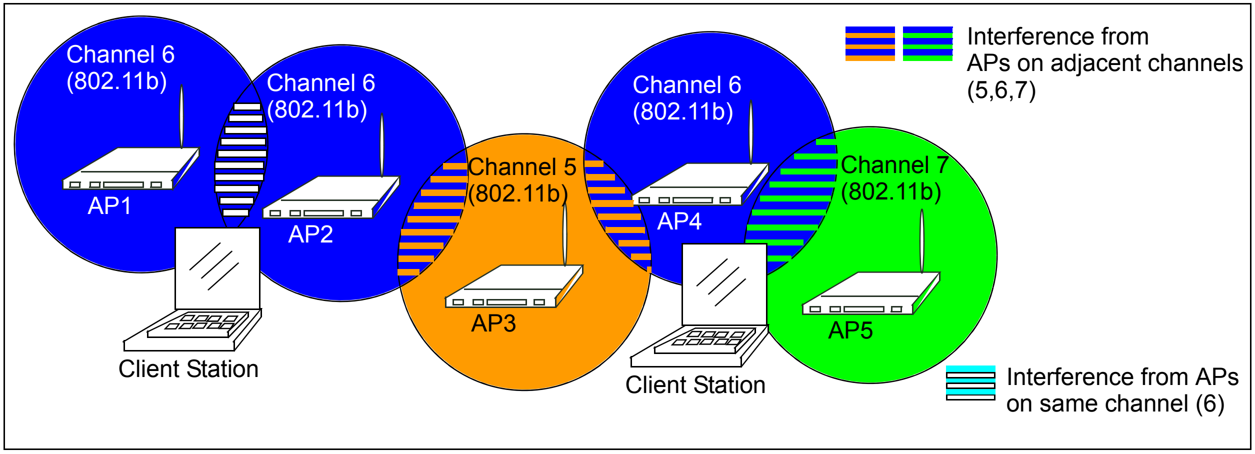
Interference can occur when multiple access points within range of each other are broadcasting on the same or overlapping channels. The impact of this interference on network performance can intensify during busy times when large amounts of data and media traffic compete for bandwidth.

Channel management uses a predetermined set of channels that minimizes interference. For the b/g radio band, the classic set of non-interfering channels is 1, 6, 11. Channels 1, 4, 8, 11 produce minimal overlap.

Example: A Network before and after Channel Management

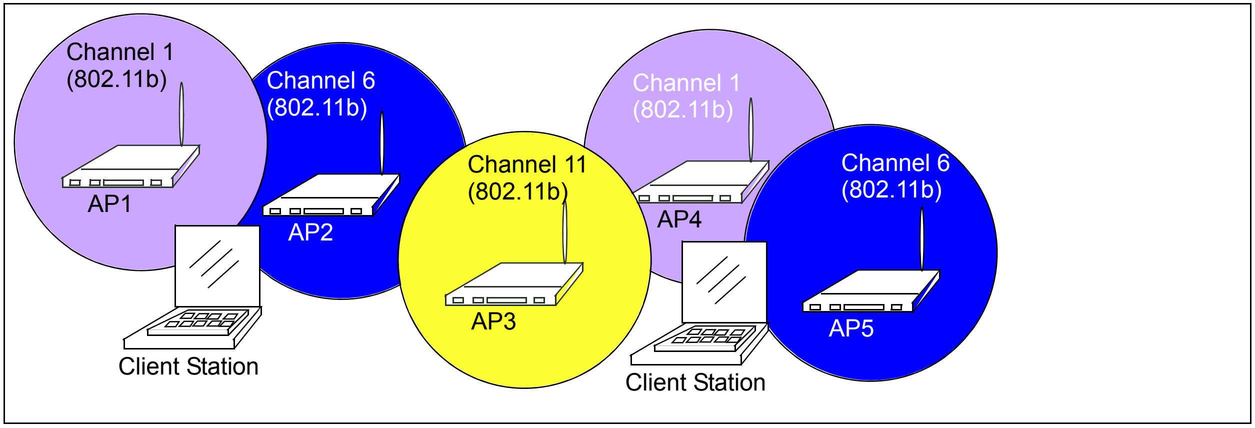
Without automated channel management, channel assignments to clustered APs might be made on consecutive channels, which would overlap and cause interference. For example, AP1 could be assigned to channel 6, AP2 to channel 6, and AP3 to channel 5 as shown in Figure 3.

Figure 3. Without Automatic Channel Management: APs Can Broadcast on Overlapping Channels.



With automated channel management, APs in the cluster are automatically reassigned to non-interfering channels as shown in Figure 4.

Figure 4. With Channel Management Enabled: APs are Reassigned to Non-Interfering Channels.



Configuring and Viewing Channel Management Settings

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 optimise channel usage across the cluster on a scheduled interval.

From this page, you can view channel assignments for all APs in the cluster, stop and start automatic channel management, and manually update the current channel map (APs to channels). During a manual update, channel management will assess channel usage and, if necessary, reassign APs to new channels to reduce interference based on the current Advanced channel management settings.

By using the Advanced channel management settings you can modify the interference reduction potential that triggers channel reassignment, change the schedule for automatic updates, and reconfigure the channel set used for assignments.

The following sections describe how to configure and use channel management on your network:

- Stopping/Starting Automatic Channel Assignment
- Viewing Current Channel Assignments and Setting Locks
    - Update Current Channel Assignments Manually
- Viewing Last Proposed Set of Changes
- Configuring Advanced Settings (Customizing and Scheduling Channel Plans)
    - Update Advanced Settings

Stopping/Starting Automatic Channel Assignment

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

To enable automatic channel assignment,

1. Click **Start**.
2. Wait 60 seconds.
3. Use your browser control to refresh the Channel Management page.

   When automatic channel assignment is enabled, channel management periodically maps radio channels used by clustered access points and, if necessary, reassigns channels on clustered APs to reduce interference with either cluster members or APs outside the cluster.

   Note Channel Management overrides the default cluster behaviour, which is to synchronize radio channels of all APs across a cluster. When Channel Management is enabled, the radio Channel is not synchronized across the cluster to other APs. See the note under Radio Settings in “Settings Shared in the Cluster Configuration” on page 35.

To stop automatic channel assignment, click **Stop**. No channel usage maps or channel reassignments will be made. Only manual updates will affect the channel assignment.

Viewing Current Channel Assignments and Setting Locks

The **Current Channel Assignments** show a list of all access points in the cluster by IP Address. The display shows the band on which each access point is broadcasting, the channel currently used by each access point, and an option to lock an access point on its current radio channel so that it cannot be reassigned to another. Details about **Current Channel Assignments** are provided below.

Field	Description
IP Address	Specifies the IP Address for the access point.
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	Select **Locked** if you want to this access point to remain on the current channel. When an access point's channel is locked, automated channel management plans will not reassign the access point 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 **Apply**, you will see that locked APs show the same channel for **Current Channel** and **Proposed Channel**. Locked APs keep their current channels.

Update Current Channel Assignments Manually

You can run a manual channel management update at any time by clicking **Update** under the **Current Channel Assignments** display.

Viewing Last Proposed Set of Changes

The **Last Proposed Set of 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 access point. Locked channels will not be reassigned, 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.

Field	Description
IP Address	Specifies the IP Address for the access point.
Current	Indicates the radio channel on which this access point is currently broadcasting.
Proposed	Indicates the radio channel to which this access point would be reassigned if the Channel Plan is executed.

Configuring Advanced Settings (Customizing and Scheduling Channel Plans)

If you use channel management 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 reassigned even if the network is busy. These defaults are designed to satisfy most situations in which you would need to implement channel management.

You can use **Advanced** settings to modify the interference reduction potential that triggers channel reassignment, change the schedule for automatic updates, and reconfigure the channel set used for assignments

Field	Description
Advanced	Click **Advanced** to show or hide display settings that modify timing and details of the channel planning algorithm. By default, advanced settings are hidden.
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 25 percent. Use the list to select percentages ranging from 5 percent to 75 percent. This setting lets you set a gating factor for channel reassignment 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 reassigned. However; if you reset the minimal channel interference benefit to 25 percent and click **Update**, the proposed channel plan will be implemented and channels reassigned as needed.
Determine if there is better set of channels every	Specify the schedule for automated updates. A range of intervals is provided, from 1 minute to 6 months The default is 1 hour (channel usage assessed and the resulting channel plan applied every hour).
Use these channels when applying channel assignments	Choose a set of non-interfering channels. The choices are: • b/g channels 1-6-11 • b/g channels 1-4-8-11 IEEE 802.11b and 802.11g modes support use of channels 1 through 11. For b and g radio bands, the classic set of non-interfering channels is 1, 6, and 11. Channels 1, 4, 8, and 11 produce minimal overlap.

Field	Description
Apply channel modifications even when the network is busy	Click to enable or disable this setting. If you enable this setting, channel modifications will be applied even when the network is busy. If you disable this setting, channel modifications will not be applied on a busy network. This setting, along with the interference reduction setting, is designed to help weigh the cost/benefit impact on network performance of reassigning channels against the inherent disruption it can cause to clients during a busy time.

Update Advanced Settings

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

Advanced settings take affect when they are applied, and they influence how automatic channel management is performed. The new interference reduction minimum, scheduled tuning interval, channel set, and network busy settings will be taken into account for automated and manual updates.

Wireless Neighborhood

The Wireless Neighborhood view shows those access points within range of any access point in the cluster. This page provides a detailed view of neighbouring access points including identifying information such as SSIDs and MAC addresses for each, cluster status, and statistical information such as the broadcast channel and signal strength of each AP.

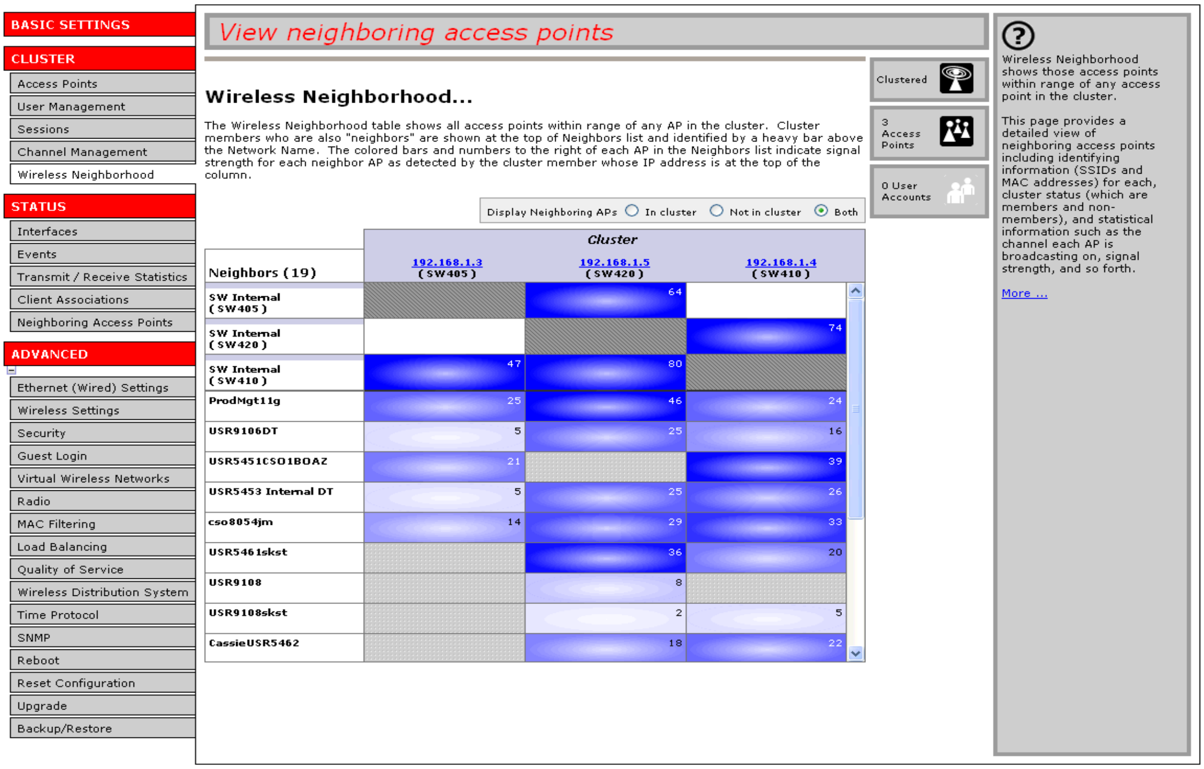
The following topics are covered here:

- Navigating to Wireless Neighborhood
- Understanding Wireless Neighbourhood Information
- Viewing Wireless Neighborhood
- Viewing Details for a Cluster Member

Navigating to Wireless Neighborhood

To view the Wireless Neighborhood, click the Cluster menu's **Wireless Neighborhood** tab.

Figure 5. Neighbour APs Both in Cluster and Not in Cluster.



View neighboring access points

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 neighbor AP as detected by the cluster member whose IP address is at the top of the column.

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

	Cluster		
Neighbors (19)	192.168.1.3 (SW405)	192.168.1.5 (SW420)	192.168.1.4 (SW410)
SW Internal (SW405)	▨	64	
SW Internal (SW420)		▨	74
SW Internal (SW410)	47	80	▨
ProdMgt11g	25	46	24
USR9106DT	5	25	16
USR5451CSO1BOAZ	21		39
USR5453 Internal DT	5	25	26
cso8054jm	14	29	33
USR5461skst		36	20
USR9108		8	
USR9108skst		2	5
CassieUSR5462		18	22

Wireless Neighborhood shows those access points within range of any access point in the cluster.

This page provides a detailed view of neighboring access points including identifying information (SSIDs and MAC addresses) for each, cluster status (which are members and non-members), and statistical information such as the channel each AP is broadcasting on, signal strength, and so forth.

More ...

Understanding Wireless Neighbourhood Information

The Wireless Neighborhood view shows all access points 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 non-members.

For each neighbour access point, the 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 access point's IP address to get additional statistics about the APs within 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 colour coded table.

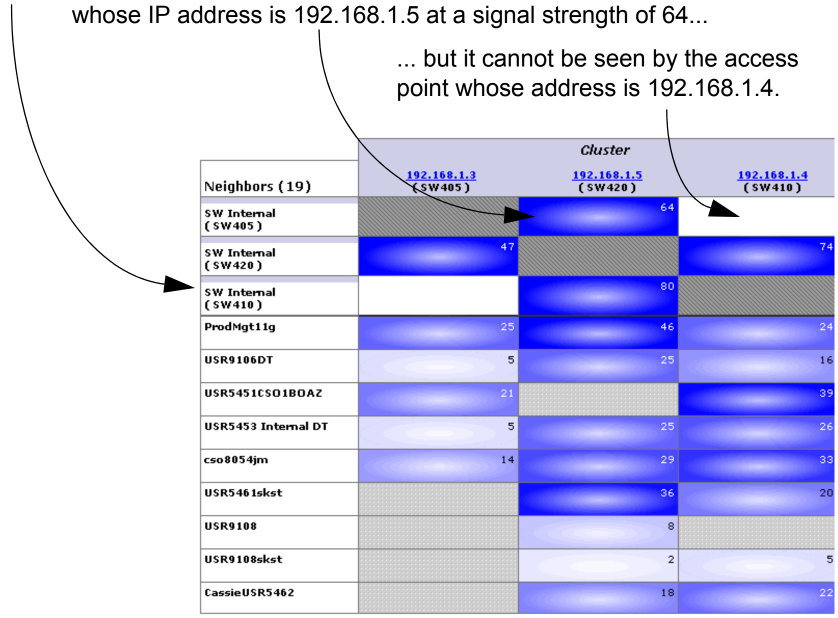
Viewing Wireless Neighborhood

Details about Wireless Neighborhood information shown is described below.

Field	Description
Display neighboring APs	Click one of the following radio buttons to change the view: • **In cluster** - Shows only neighbour APs that are members of the cluster • **Not in cluster** - Shows only neighbour APs that are not cluster members • **Both** - Shows all neighbour 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 menu's Access Points tab described in "Navigating to Access Points Management" on page 34. 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 an IP address to view more details for a particular AP as shown in Figure 6 below.

<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td><b>Neighbors</b></td><td>Access points that are neighbours 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 neighbour of a cluster member can also be a cluster member itself. Neighbours who are also cluster members are always shown at the top of the list with a heavy bar above the name and include a location indicator.

The coloured bars to the right of each AP in the Neighbors list shows the signal strength for each of the neighbour APs as detected by the cluster member whose IP address is shown at the top of the column:
This access point is a cluster member and can be seen by the AP whose IP address is 192.168.1.5 at a signal strength of 64...
... but it cannot be seen by the access point whose address is 192.168.1.4.

<table>
<tr><th></th><th colspan="3"><i>Cluster</i></th></tr>
<tr><th>Neighbors (19)</th><th>192.168.1.3
(SW405)</th><th>192.168.1.5
(SW420)</th><th>192.168.1.4
(SW410)</th></tr>
<tr><td>SW Internal
(SW405)</td><td></td><td>64</td><td></td></tr>
<tr><td>SW Internal
(SW420)</td><td>47</td><td></td><td>74</td></tr>
<tr><td>SW Internal
(SW410)</td><td></td><td>80</td><td></td></tr>
<tr><td>ProdMgt11g</td><td>25</td><td>46</td><td>24</td></tr>
<tr><td>USR9106DT</td><td>5</td><td>25</td><td>16</td></tr>
<tr><td>USR5451CSO1BOAZ</td><td>21</td><td></td><td>39</td></tr>
<tr><td>USR5453 Internal DT</td><td>5</td><td>25</td><td>26</td></tr>
<tr><td>cso8054jm</td><td>14</td><td>29</td><td>33</td></tr>
<tr><td>USR5461skst</td><td></td><td>36</td><td>20</td></tr>
<tr><td>USR9108</td><td></td><td>8</td><td></td></tr>
<tr><td>USR9108skst</td><td></td><td>2</td><td>5</td></tr>
<tr><td>CassieUSR5462</td><td></td><td>18</td><td>22</td></tr>
</table>

• <b>Dark Blue Bar</b> - A dark blue bar and a high signal strength number (for example 50) indicates good signal strength from the neighbour as seen by the AP whose IP address is shown at the top of the column.

• <b>Lighter Blue Bar -</b> A lighter blue bar and a lower signal strength number (for example 20 or lower) indicates medium or weak signal strength from the neighbour as seen by the AP whose IP address is shown at the top of the column.

• <b>White Bar</b> - A white bar and the number 0 indicates that a neighbouring AP that was detected by one of the cluster members cannot be detected by the AP whose IP address is shown at the top of the column.

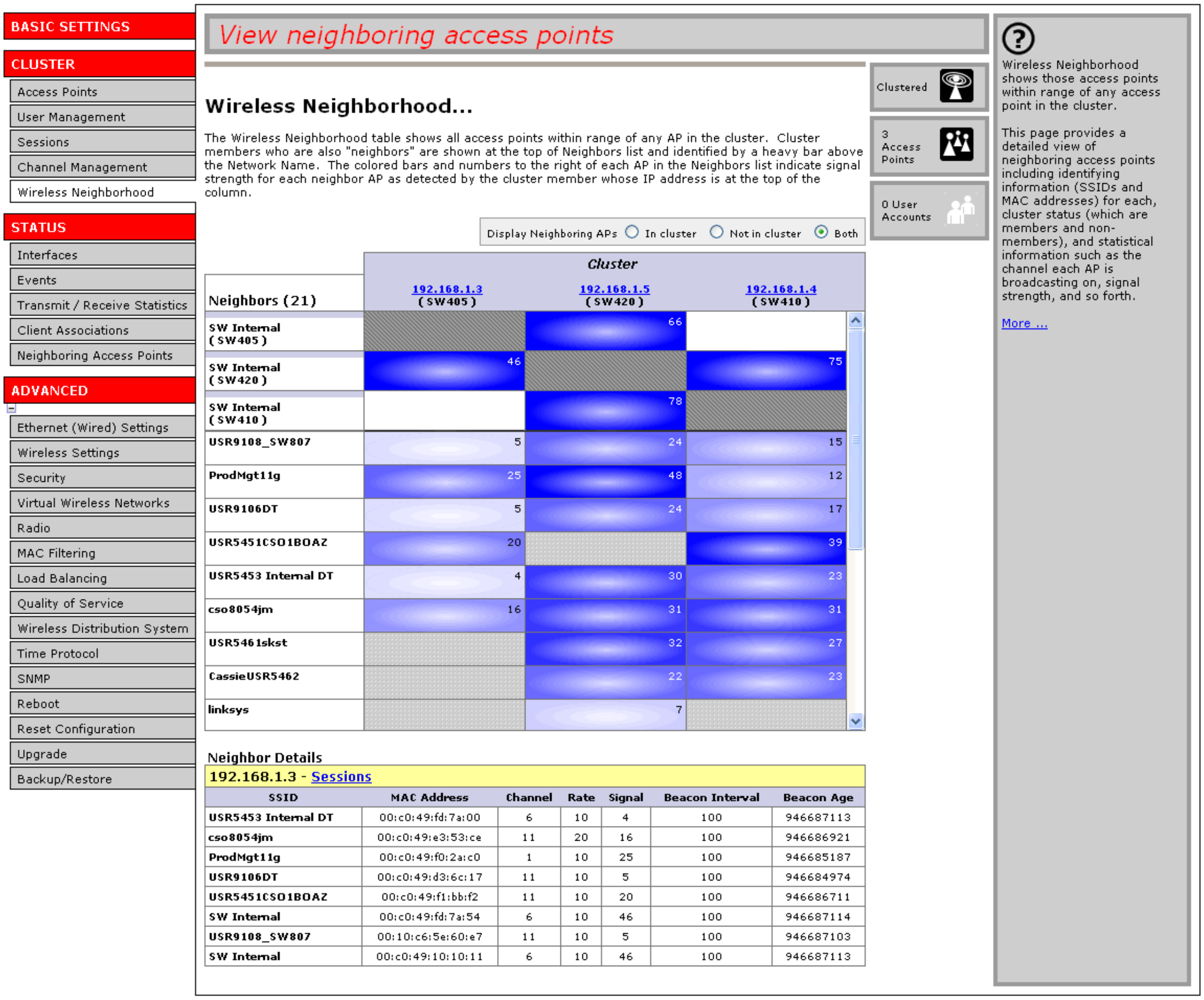
• <b>Light Gray Bar -</b> A light gray bar and no signal strength number indicates a neighbour that is detected by other cluster members but not by the AP whose IP address is shown at the top of the column.

• <b>Dark Gray Bar</b> - A dark gray bar and no signal strength number indicates this <i>is</i> the AP whose IP address is shown at the top of the column.</td></tr>
</table>

Viewing Details for a Cluster Member

To view details on a cluster member AP, click the IP address of a cluster member at the top of the table.

Figure 6. Details for a Cluster Member AP.



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 neighbor AP as detected by the cluster member whose IP address is at the top of the column.

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

	Cluster		
Neighbors (21)	192.168.1.3 (SW405)	192.168.1.5 (SW420)	192.168.1.4 (SW410)
SW Internal (SW405)	▨	66	
SW Internal (SW420)	46	▨	75
SW Internal (SW410)		78	▨
USR9108_SW807	5	24	15
ProdMgt11g	25	48	12
USR9106DT	5	24	17
USR5451CSO1BOAZ	20		39
USR5453 Internal DT	4	30	23
cso8054jm	16	31	31
USR5461skst		32	27
CassieUSR5462		22	23
linksys		7	

Neighbor Details

192.168.1.3 - Sessions

SSID	MAC Address	Channel	Rate	Signal	Beacon Interval	Beacon Age
USR5453 Internal DT	00:c0:49:fd:7a:00	6	10	4	100	946687113
cso8054jm	00:c0:49:e3:53:ce	11	20	16	100	946686921
ProdMgt11g	00:c0:49:f0:2a:c0	1	10	25	100	946685187
USR9106DT	00:c0:49:d3:6c:17	11	10	5	100	946684974
USR5451CSO1BOAZ	00:c0:49:f1:bb:f2	11	10	20	100	946686711
SW Internal	00:c0:49:fd:7a:54	6	10	46	100	946687114
USR9108_SW807	00:10:c6:5e:60:e7	11	10	5	100	946687103
SW Internal	00:c0:49:10:10:11	6	10	46	100	946687113

Wireless Neighborhood shows those access points within range of any access point in the cluster.

This page provides a detailed view of neighboring access points including identifying information (SSIDs and MAC addresses) for each, cluster status (which are members and non-members), and statistical information such as the channel each AP is broadcasting on, signal strength, and so forth.

The following table explains the details shown about the selected AP.

Field	Description
SSID	Shows 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*. The SSID is set in Basic Settings. (See “Basic Settings” on page 25) or on Advanced menu’s Wireless Settings page (see “Wireless Settings” on page 87.) 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 neighbouring 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. The channel is set on the Advanced menu’s Radio Settings page. (See “Radio” on page 119.)
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 behaviour is to send a beacon frame once every 100 milliseconds (or 10 per second). The beacon Interval is set on the Advanced menu’s Radio Settings page. (See “Radio” on page 119.)
Beacon Age	Shows the date and time of the most recent beacon transmission from the access point.

Status

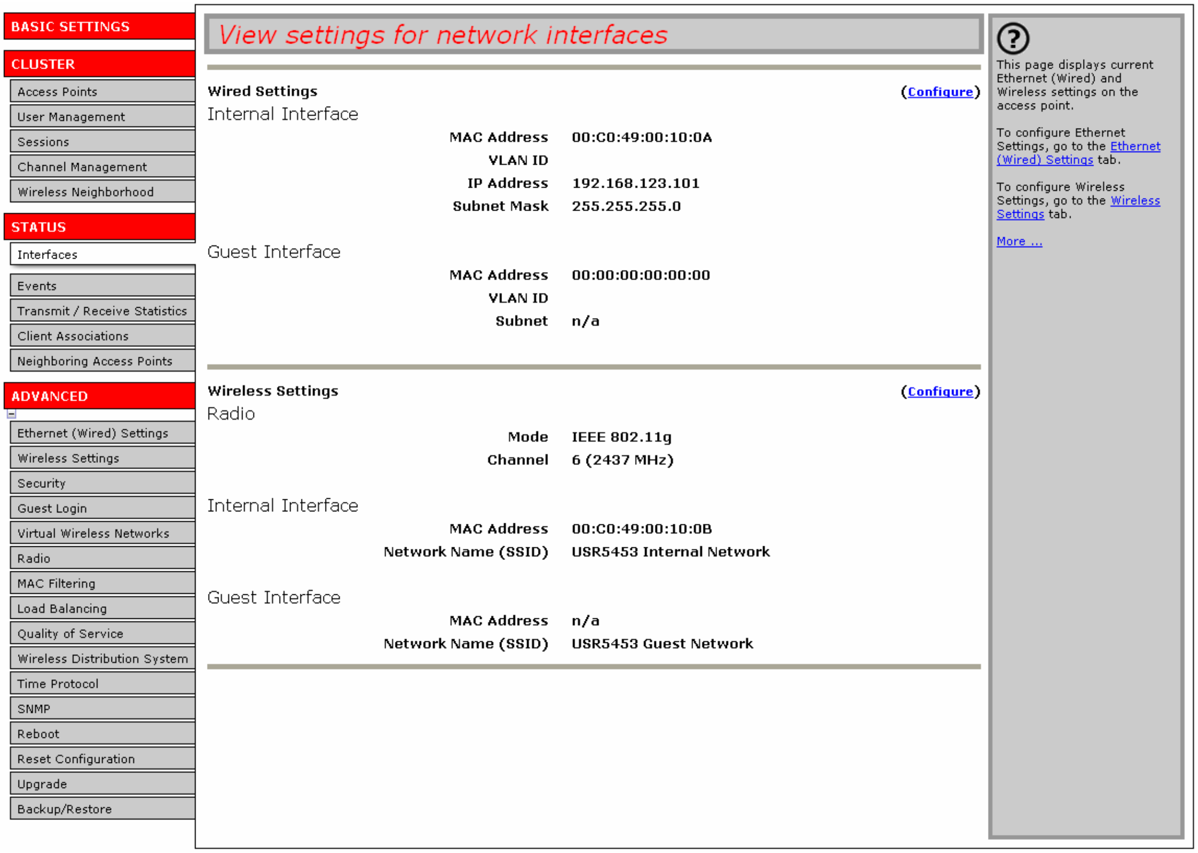
You can view information about an individual access point from the Status menu. Because the Status pages display settings for a specific access point—not for a cluster configuration that is automatically shared by multiple access points—it is important to ensure that you are accessing the Web User Interface for the access point that you want to monitor (see “Navigating to the Web User Interface for a Specific Access Point” on page 40.)

You can use the Status pages to monitor the following aspects of an access point:

- Interfaces
- Events
- Transmit/Receive Statistics
- Client Associations
- Neighboring Access Points

Interfaces

To monitor wired LAN and wireless LAN (WLAN) settings, navigate to the Status menu’s **Interfaces** tab on the Web User Interface for the access point that you want to monitor.



View settings for network interfaces

Wired Settings (Configure)

Internal Interface

MAC Address	00:C0:49:00:10:0A
VLAN ID	
IP Address	192.168.123.101
Subnet Mask	255.255.255.0

Guest Interface

MAC Address	00:00:00:00:00:00
VLAN ID	
Subnet	n/a

Wireless Settings (Configure)

Radio

Mode	IEEE 802.11g
Channel	6 (2437 MHz)

Internal Interface

MAC Address	00:C0:49:00:10:0B
Network Name (SSID)	USR5453 Internal Network

Guest Interface

MAC Address	n/a
Network Name (SSID)	USR5453 Guest Network

This page displays current Ethernet (Wired) and Wireless settings on the access point.

To configure Ethernet Settings, go to the Ethernet (Wired) Settings tab.

To configure Wireless Settings, go to the Wireless Settings tab.

More ...

This page displays the current **Ethernet (Wired) Settings** and **Wireless Settings**.

Ethernet (Wired) Settings

The Internal interface includes the Ethernet MAC Address, VLAN ID, IP Address, and Subnet Mask.

The Guest interface includes the MAC Address, VLAN ID, and Subnet.

If you want to change any of these settings, click the **Configure** link.

Wireless Settings

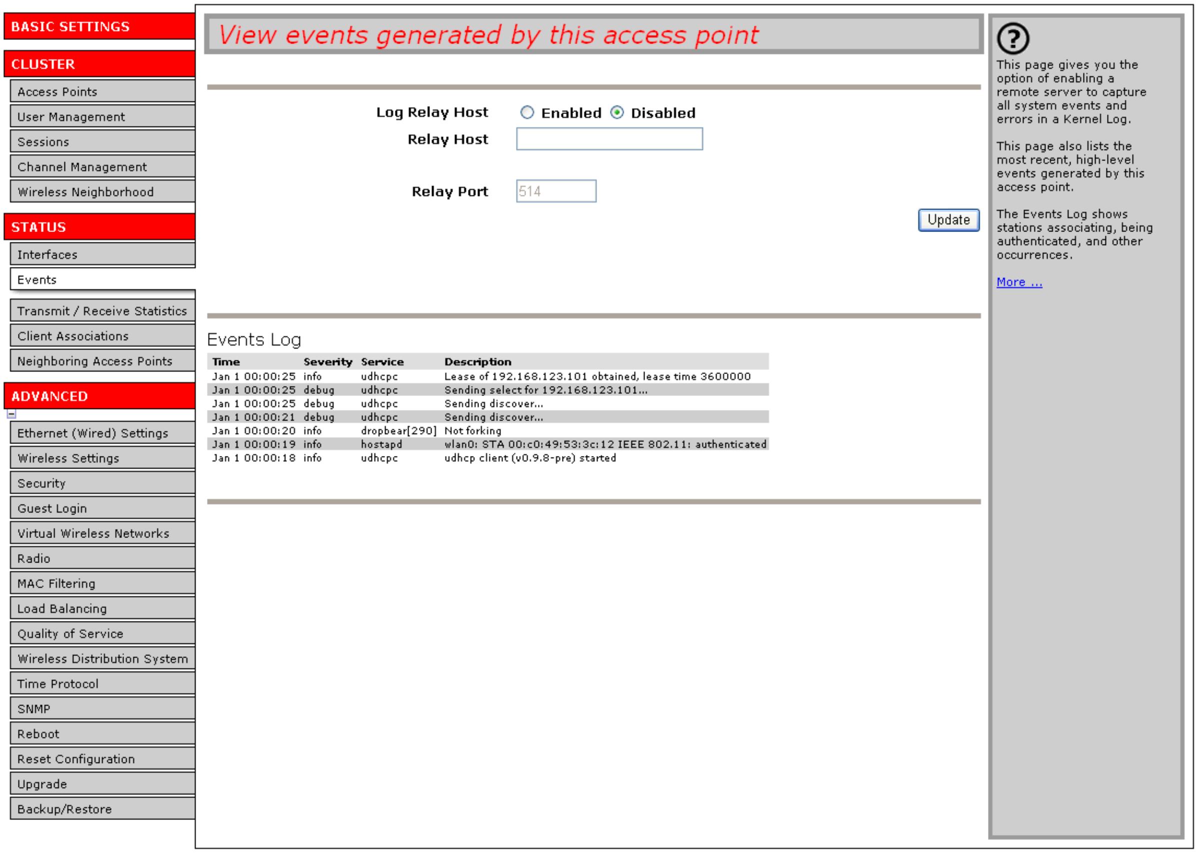
The Radio Interface settings include radio Mode and Channel. Also shown here are MAC addresses and network names for internal and guest interfaces. (See “Wireless Settings” on page 87 and “Radio” on page 119 for more information.)

If you want to change any of these settings, click the **Configure** link.

Events

To view system events and kernel log for a particular access point, navigate to the Status menu’s **Events** tab on the Web User Interface for the access point that you want to monitor

.



View events generated by this access point

Log Relay Host ○ Enabled ● Disabled

Relay Host

Relay Port 514

Events Log

Time	Severity	Service	Description
Jan 1 00:00:25	info	udhcpc	Lease of 192.168.123.101 obtained, lease time 3600000
Jan 1 00:00:25	debug	udhcpc	Sending select for 192.168.123.101...
Jan 1 00:00:25	debug	udhcpc	Sending discover...
Jan 1 00:00:21	debug	udhcpc	Sending discover...
Jan 1 00:00:20	info	dropbear[290]	Not forking
Jan 1 00:00:19	info	hostapd	wlan0: STA 00:c0:49:53:3c:12 IEEE 802.11: authenticated
Jan 1 00:00:18	info	udhcpc	udhcp client (v0.9.8-pre) started

This page gives you the option of enabling a remote server to capture all system events and errors in a Kernel Log.

This page also lists the most recent, high-level events generated by this access point.

The Events Log shows stations associating, being authenticated, and other occurrences.

This page lists the most recent events generated by this access point (see “Events Log” on page 72).

This page also gives you the option of enabling a remote log relay host to capture all system events and errors in a Kernel Log. (This requires setting up a remote relay host first. See “Log Relay Host for Kernel Messages” on page 69).

Note

The Professional Access Point acquires its date and time information using the network time protocol (NTP). This data is reported in UTC format (also known as *Greenwich Mean Time*). You need to convert the reported time to your local time.

For information on setting the network time protocol, see “Time Protocol” on page 151.

Log Relay Host for Kernel Messages

- Understanding Remote Logging
- Setting Up the Log Relay Host

- Enabling and Disabling the Log Relay Host on the Status Menu’s Events Page

Understanding Remote Logging

The *kernel log* is a comprehensive list of system events (shown in the System Log) and kernel messages, such as an error message for dropping frames.

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

Using a remote server to collect access point system log messages affords you several benefits. You can:

- Aggregate system log messages from multiple access points
- Store a longer history of messages than kept on a single access point
- Trigger scripted management operations and alerts

Setting Up the Log Relay Host

To use kernel log relaying, you must configure a remote server to receive the syslog messages. This procedure will vary depending on the type of machine you use as the remote log host. Following is an example of how to configure a remote Linux server using the syslog daemon.

Example of Using Linux syslogd

The following steps activate the syslog daemon on a Linux server. Make sure that you have `root` user identity for these tasks.

1. Log on as `root` to the machine that you want to use as your syslog relay host.

   The following operations require `root` user permissions. If you are not already logged on as `root`, type `su` at the command line prompt to become `root` ("super user").

2. Edit `/etc/init.d/sysklogd` and add "`-r`" to the variable `SYSLOGD` near the top of the file. The line that you edit will look like this:

   ```
   SYSLOGD="-r"
   ```

   Consult the man pages to get more information on `syslogd` command options. (Type `man syslogd` at the command line.)

3. If you want to send all the messages to a file, edit `/etc/syslog.conf`.

   For example you can add this line to send all messages to a log file called *`AP_syslog`*:

   ```
   *.*       -/tmp/AP_syslog
   ```

   Consult the `man` pages to get more information on `syslog.conf` command options. (Type `man syslog.conf` at the command line.)

4. Restart the syslog server by typing the following at the command line prompt:

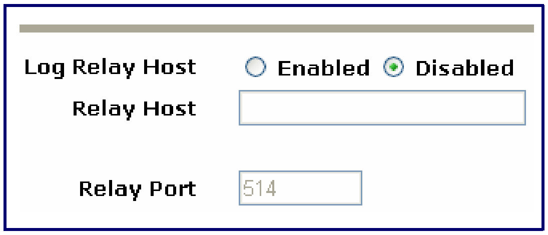
```
/etc/init.d/sysklogd restart
```

Note The syslog process will default to use port 514. USRobotics recommends using this default port.

However, if you choose to reconfigure the log port, make sure that the port number that you assign to syslog is not being used by another process.

Enabling and Disabling the Log Relay Host on the Status Menu's Events Page

To enable and configure log relaying on the Status menu's **Events** page, set the log relay options as described below.



Log Relay Host ○ Enabled ● Disabled

Relay Host

Relay Port 514

Field	Description
Log Relay Host Enabled	Choose to either enable or disable use of the Log Relay Host: • **Enabled** • **Disabled** If you select **Enabled**, the **Relay Host** and **Relay Port** fields are editable.
Relay Host	Specify the IP Address or DNS name of the relay host.
Relay Port	Specify the port number for the syslog process on the relay host. The default port is 514.

Update Settings

To apply your changes, click **Update**.

If you enabled the log relay host, clicking **Update** will activate remote logging. The access point will send its kernel messages 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.

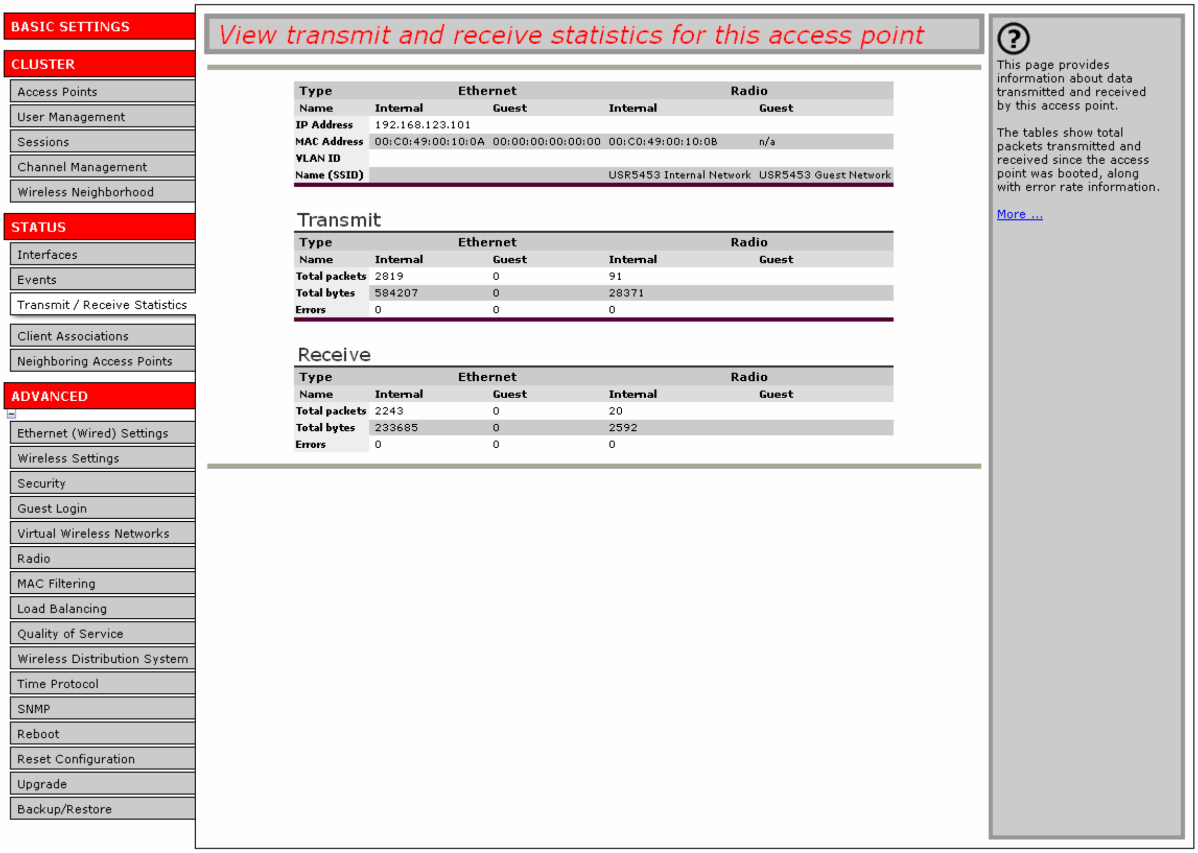
If you disabled the log relay host, clicking **Update** will disable remote logging.

Events Log

The Events Log shows system events on the access point such as stations associating or being authenticated. The real-time Events Log is always shown on the Status menu's Events page for the access point you are monitoring.

Transmit/Receive Statistics

To view transmit/receive statistics for a particular access point, navigate to the Status menu's **Transmit/ Receive Statistics** on the Web User Interface for the access point that you want to monitor.



View transmit and receive statistics for this access point

Type	Ethernet		Radio	
Name	Internal	Guest	Internal	Guest
IP Address	192.168.123.101			
MAC Address	00:C0:49:00:10:0A	00:00:00:00:00:00	00:C0:49:00:10:0B	n/a
VLAN ID				
Name (SSID)			USR5453 Internal Network	USR5453 Guest Network

Transmit

Type	Ethernet		Radio	
Name	Internal	Guest	Internal	Guest
Total packets	2819	0	91	
Total bytes	584207	0	28371	
Errors	0	0	0	

Receive

Type	Ethernet		Radio	
Name	Internal	Guest	Internal	Guest
Total packets	2243	0	20	
Total bytes	233685	0	2592	
Errors	0	0	0	

This page provides information about data transmitted and received by this access point.

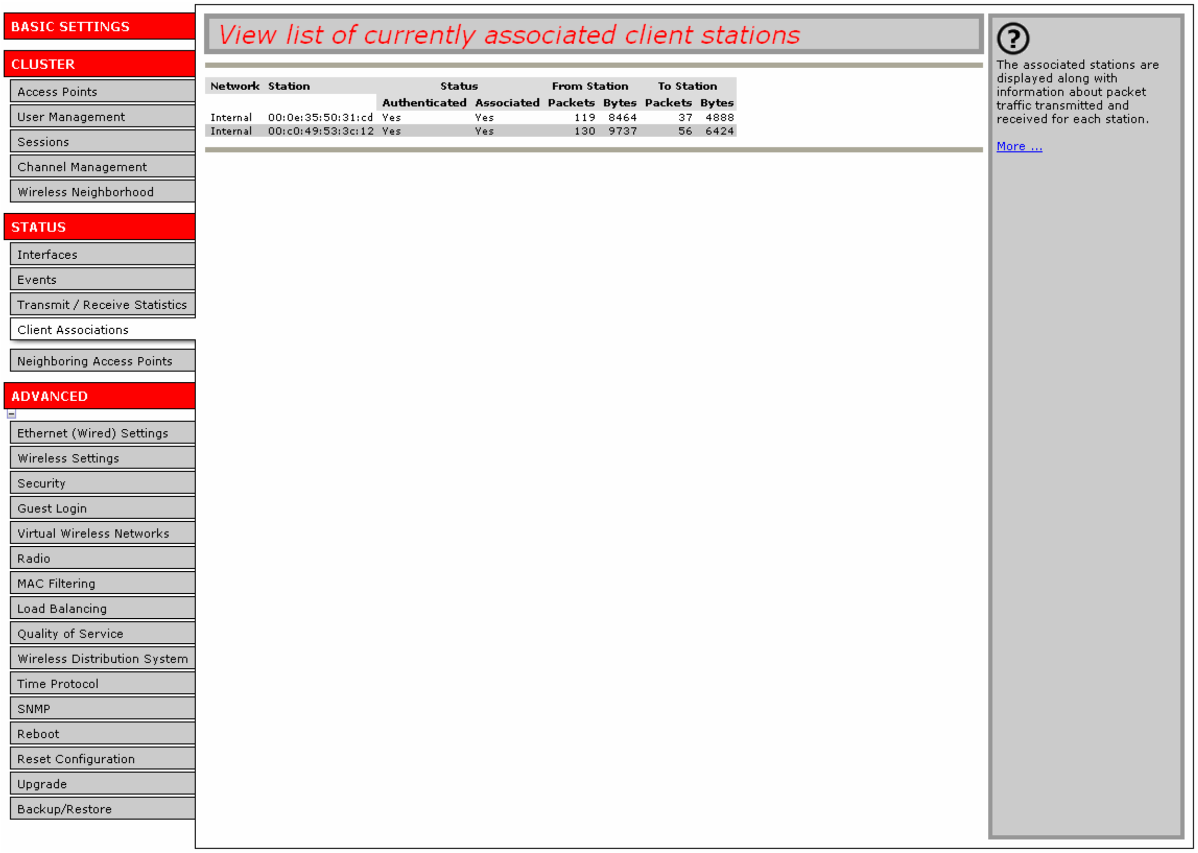
The tables show total packets transmitted and received since the access point was booted, along with error rate information.

This page provides basic information about the current access point and a real-time display of the transmit and receive statistics for this access point as described in the table below. All transmit and receive statistics shown are totals accumulated since the access point was last started. If the access point is rebooted, these figures indicate transmit/receive totals since the reboot.

Field	Description
IP Address	IP Address for the access point.
MAC Address	Media Access Control (MAC) address for the specified interface. The Professional Access Point has a unique MAC address for each interface.
VLAN ID	Virtual LAN (VLAN) ID. A VLAN is a software-based, logical grouping of devices on a network that allow them to act as if they are connected to a single physical network, even though they may not be. VLANs can be used to establish internal and guest networks on the same access point.
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 Basic Settings tab. (See “Provide Administrator Password and Wireless Network Name” on page 28.)
Transmit and Receive Information	
Total Packets	The total count of packets sent (in the **Transmit** table) or received (in the **Received** table) by this access point.
Total Bytes	The total count of bytes sent (in the **Transmit** table) or received (in the **Received** table) by this access point.
Errors	The total count of errors related to sending and receiving data on this access point.

Client Associations

To view the client stations associated with a particular access point, navigate to the Status menu’s **Client Associations** on the Web User Interface for the access point that you want to monitor.



View list of currently associated client stations

Network	Station	Status		From Station		To Station	
		Authenticated	Associated	Packets	Bytes	Packets	Bytes
Internal	00:0e:35:50:31:cd	Yes	Yes	119	8464	37	4888
Internal	00:c0:49:53:3c:12	Yes	Yes	130	9737	56	6424

The associated stations are displayed along with information about packet traffic transmitted and received for each station.

More ...

The associated stations are displayed along with information about packet traffic transmitted and received for each station.

Link Integrity Monitoring

The Professional Access Point provides *link integrity monitoring* to continually verify the access point's connection to each associated client, even when no data exchange is occurring. To perform this verification, the access point sends data packets to clients every few seconds when no other traffic is passing. This allows the access point to detect a client's having gone out of range, even during periods when no normal traffic is exchanged.The client connection is dropped from the list of associated clients within 300 seconds of the client disappearing, even if the client does not disassociate (but went out of range).

What is the Difference Between an Association and a Session?

An *association* describes a client's connection to a particular access point. A *session* describes a client's connection to the network. A client's network connection can shift from one clustered access point to another within the context of the same session. A client station can roam between APs and maintain the session.

For information on monitoring *sessions*, see "Understanding Session Monitoring Information" on page 50.

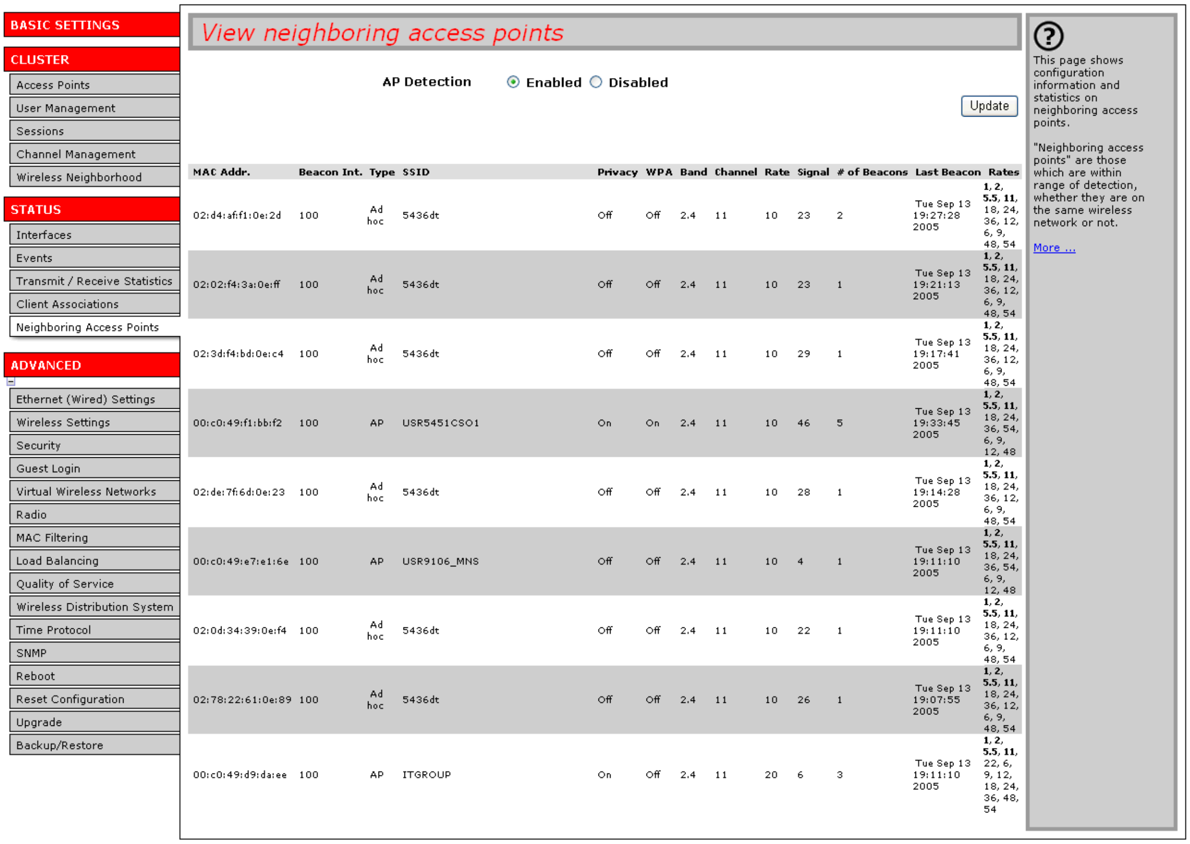
Neighboring Access Points

The status page for neighbouring access points provides real-time statistics for all access points within range of the access point on which you are viewing the Web User Interface.

To view information about other access points on the wireless network,

1. Navigate to the Status menu’s **Neighboring Access Points** tab.

.



View neighboring access points

AP Detection ● Enabled ○ Disabled

MAC Addr.	Beacon Int.	Type	SSID	Privacy	WPA	Band	Channel	Rate	Signal	# of Beacons	Last Beacon	Rates
02:d4:af:f1:0e:2d	100	Ad hoc	5436dt	Off	Off	2.4	11	10	23	2	Tue Sep 13 19:27:28 2005	**1, 2, 5.5, 11,** 18, 24, 36, 12, 6, 9, 48, 54
02:02:f4:3a:0e:ff	100	Ad hoc	5436dt	Off	Off	2.4	11	10	23	1	Tue Sep 13 19:21:13 2005	**1, 2, 5.5, 11,** 18, 24, 36, 12, 6, 9, 48, 54
02:3d:f4:bd:0e:c4	100	Ad hoc	5436dt	Off	Off	2.4	11	10	29	1	Tue Sep 13 19:17:41 2005	**1, 2, 5.5, 11,** 18, 24, 36, 12, 6, 9, 48, 54
00:c0:49:f1:bb:f2	100	AP	USR5451CSO1	On	On	2.4	11	10	46	5	Tue Sep 13 19:33:45 2005	**1, 2, 5.5, 11,** 18, 24, 36, 54, 6, 9, 12, 48
02:de:7f:6d:0e:23	100	Ad hoc	5436dt	Off	Off	2.4	11	10	28	1	Tue Sep 13 19:14:28 2005	**1, 2, 5.5, 11,** 18, 24, 36, 12, 6, 9, 48, 54
00:c0:49:e7:e1:6e	100	AP	USR9106_MNS	Off	Off	2.4	11	10	4	1	Tue Sep 13 19:11:10 2005	**1, 2, 5.5, 11,** 18, 24, 36, 54, 6, 9, 12, 48
02:0d:34:39:0e:f4	100	Ad hoc	5436dt	Off	Off	2.4	11	10	22	1	Tue Sep 13 19:11:10 2005	**1, 2, 5.5, 11,** 18, 24, 36, 12, 6, 9, 48, 54
02:78:22:61:0e:89	100	Ad hoc	5436dt	Off	Off	2.4	11	10	26	1	Tue Sep 13 19:07:55 2005	**1, 2, 5.5, 11,** 18, 24, 36, 12, 6, 9, 48, 54
00:c0:49:d9:da:ee	100	AP	ITGROUP	On	Off	2.4	11	20	6	3	Tue Sep 13 19:11:10 2005	**1, 2, 5.5, 11,** 22, 6, 9, 12, 18, 24, 36, 48, 54

This page shows configuration information and statistics on neighboring access points.

"Neighboring access points" are those which are within range of detection, whether they are on the same wireless network or not.

2. Select **AP Detection Enabled**.

3. Click **Update**.

Information provided for neighbouring access points is described in the following table:

Field	Description
MAC Address	Shows the MAC address of the neighbouring access point. A MAC address is a hardware address that uniquely identifies each node of a network.
Beacon Int.	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 behaviour is to send a beacon frame once every 100 milliseconds (or 10 per second). The Beacon Interval is set on Advanced menu's Radio Settings page. (See "Radio" on page 119.)
Type	Indicates the type of device: • **AP** indicates the neighbouring device is an access point that supports the IEEE 802.11 Wireless Networking Framework in Infrastructure Mode. • **Ad hoc** indicates a neighbouring station running in Ad-hoc Mode. Stations set to ad-hoc mode communicate with each other directly, without the use of a traditional access point. 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 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*. The SSID is set in Basic Settings (see "Basic Settings" on page 25) or on the Advanced menu's Wireless Settings page (see "Wireless Settings" on page 87). A Guest network and an Internal network running on the same access point must always have two different network names.
Privacy	Indicates whether there is any security on the neighbouring device. • **Off** indicates that the Security mode on the neighbouring device is set to **None** (no security). • **On** indicates that the neighbouring device has security in place. Access point security is configured on the Advanced menu's Security page. For more information on security settings, see "Security" on page 91.
WPA	Indicates whether WPA security is on or off for this access point.
Band	Indicates the IEEE 802.11 mode being used on this access point (IEEE 802.11b or IEEE 802.11g).

Field	Description
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. The channel is set on the Advanced menu's Radio Settings page. (See "Radio" on page 119.)
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).
# of Beacons	Shows the total number of beacons transmitted by this access point since the access point was last booted.
Last Beacon	Shows the date and time of the most recent beacon transmission from the access point.
Rates	Shows supported and basic (advertised) rate sets for the neighbouring access point. 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 Advanced menu's Radio Settings page. (See "Radio" on page 119.) The rates shown for an access point will always be the rates currently specified for that access point in its radio settings.

Advanced

Advanced Settings include the following:

- “Ethernet (Wired) Settings” on page 79
- “Wireless Settings” on page 87
- “Security” on page 91
- “Guest Login” on page 111
- “Virtual Wireless Networks” on page 115
- “Radio” on page 119
- “MAC Filtering” on page 125
- “Load Balancing” on page 129
- “Quality of Service” on page 133
- “Wireless Distribution System” on page 143
- “Time Protocol” on page 151
- “SNMP” on page 155
- “Reboot” on page 159
- “Reset Configuration” on page 159
- “Upgrade” on page 160
- “Backup/Restore” on page 162

Ethernet (Wired) Settings

Ethernet (Wired) Settings describe the configuration of your Ethernet local area network (LAN).

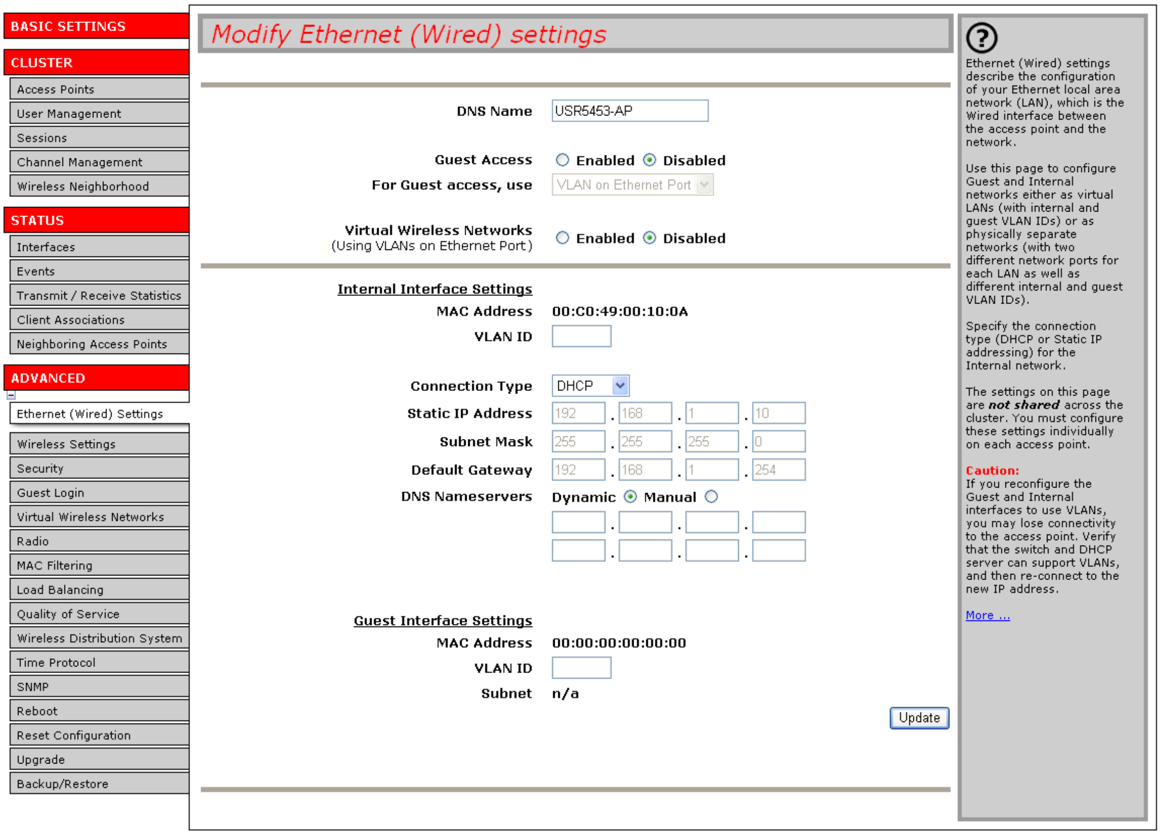
Note The Ethernet settings, including guest access, are not shared across the cluster. These settings must be configured individually on the Administration pages for each access point. To get to the Administration pages for an access point that is a member of the current cluster, click its IP Address link on the Cluster menu’s Access Points page of the current access point. For more information about which settings are shared by the cluster and which are not, see “Which Settings are Shared as Part of the Cluster Configuration and Which Are Not?” on page 35.

The following sections describe how to configure the wired address and related settings on the Professional Access Point:

- Navigating to Ethernet (Wired) Settings
- Setting the DNS Name
- Managing Guest Access
  - Configuring an Internal LAN and a Guest Network
  - Enabling and Disabling Guest Access
  - Specifying a Virtual Guest Network
- Enabling and Disabling Virtual Wireless Networks on the Access Point
- Configuring Internal Interface Ethernet Settings
- Configuring Guest Interface Ethernet (Wired) Settings
- Updating Settings

Navigating to Ethernet (Wired) Settings

To set the wired address for an access point, click the Advanced menu’s **Ethernet (Wired) Settings** tab, and update the fields as described below.



Modify Ethernet (Wired) settings

DNS Name	USR5453-AP
Guest Access	○ Enabled ● Disabled
For Guest access, use	VLAN on Ethernet Port
Virtual Wireless Networks (Using VLANs on Ethernet Port)	○ Enabled ● Disabled
Internal Interface Settings	
MAC Address	00:C0:49:00:10:0A
VLAN ID	
Connection Type	DHCP
Static IP Address	192 . 168 . 1 . 10
Subnet Mask	255 . 255 . 255 . 0
Default Gateway	192 . 168 . 1 . 254
DNS Nameservers	Dynamic ● Manual ○
	. . .
	. . .
Guest Interface Settings	
MAC Address	00:00:00:00:00:00
VLAN ID	
Subnet	n/a

Ethernet (Wired) settings describe the configuration of your Ethernet local area network (LAN), which is the Wired interface between the access point and the network.

Use this page to configure Guest and Internal networks either as virtual LANs (with internal and guest VLAN IDs) or as physically separate networks (with two different network ports for each LAN as well as different internal and guest VLAN IDs).

Specify the connection type (DHCP or Static IP addressing) for the Internal network.

The settings on this page are ***not shared*** across the cluster. You must configure these settings individually on each access point.

Caution:
If you reconfigure the Guest and Internal interfaces to use VLANs, you may lose connectivity to the access point. Verify that the switch and DHCP server can support VLANs, and then re-connect to the new IP address.

More ...

Setting the DNS Name

Field	Description
DNS Name	Enter the DNS name for the access point in the text box. This is the host name. It may be provided by your ISP or network administrator, or you can provide your own. The rules for system names are: • This name can be up to 20 characters long. • Only letters, numbers, and dashes are allowed. • The name must start with a letter and end with either a letter or a number.

Managing Guest Access

You can provide controlled guest access over an isolated network and a secure internal LAN on the same Professional Access Point.

Configuring an Internal LAN and a Guest Network

A *Local Area Network* (LAN) is a communications network covering a limited area, for example, one floor of a building. A LAN connects multiple computers and other network devices like storage and printers.

Ethernet is the most common technology for implementing a LAN. Wi-Fi (IEEE) is another very popular LAN technology.

The Professional Access Point allows you to configure two different LANs on the same access point: one for a secure *internal* LAN and another for a public *guest* network with no security and little or no access to internal resources. To configure these networks, you need to provide both wireless and Ethernet (wired) settings.

Information on how to configure the Ethernet (wired) settings is provided in the sections below.

(For information on how to configure the wireless settings, see “Wireless Settings” on page 87. For an overview of how to set up the Guest interface, see “Guest Login” on page 111.)

Enabling and Disabling Guest Access

The Professional Access Point ships with the Guest Access feature disabled by default. If you want to provide guest access on your access point, enable **Guest Access** on the Ethernet (Wired) Settings tab.

Field	Description
Guest Access	By default, the Professional Access Point ships with Guest Access disabled. • To enable Guest Access, click **Enabled**. • To disable Guest Access, click **Disabled**.

Specifying a Virtual Guest Network

If you enable Guest Access, you must represent both an Internal and a Guest Network on this access point virtually, by connecting the LAN port on the access point to a tagged port on a VLAN-capable switch and then defining two different virtual LANs on the Ethernet (Wired) Settings page. (For more information, see “Guest Login” on page 111.)

Choose virtually separate internal and guest LANs as described below.

Field	Description
Guest Access	• Select **Enabled** to enable Guest Access. (If you choose this option, you must select VLANs on the next setting **For Guest access, use**, and then provide details on VLAN or wired setting for the Guest Network on the rest of the page.) • Select **Disabled** to disable Guest Access
For Guest access, use	Specify a virtually separate guest network on this access point: • Choose **VLAN on Ethernet Port**. This will enable the VLAN settings where you must provide a VLAN ID. See also “Configuring Guest Interface Ethernet (Wired) Settings” on page 85. **Caution:** If you reconfigure the Guest and Internal interfaces to use VLANs, you may lose connectivity to the access point. First, be sure to verify that the switch and DHCP server you are using can support VLANs per the IEEE 802.1Q standard. After configuring the VLAN on the Advanced menu’s Ethernet (Wired) Settings page, physically reconnect the Ethernet cable on the switch to the tagged packet (VLAN) port. Then, reconnect via the Web User Interface to the new IP address. (If necessary, check with the infrastructure support administrator regarding the VLAN and DHCP configurations.)

Enabling and Disabling Virtual Wireless Networks on the Access Point

If you want to configure the Internal network as a VLAN (whether or not you have a Guest network configured), you can enable **Virtual Wireless Networks** on the access point.

You must enable this feature if you want to configure additional virtual networks on VLANs on the Advanced menu’s Virtual Wireless Networks page as described in “Virtual Wireless Networks” on page 115.

Field	Description
Virtual Wireless Networks (Using VLANs on Ethernet Port)	• Select **Enabled** to enable VLANs for the Internal network and for additional networks. If you choose this option, you can run the Internal network on a VLAN whether or not you have Guest Access configured and you can set up additional networks on VLANs using the Advanced menu's Virtual Wireless Networks page as described in "Virtual Wireless Networks" on page 115. • Select **Disabled** to disable the VLAN for the Internal network, and for any additional virtual networks on this access point.

Configuring Internal Interface Ethernet Settings

To configure Ethernet (Wired) settings for the Internal LAN, fill in the fields as described below.

Field	Description
MAC Address	Shows the MAC address for the Internal network interface for the LAN port on this access point. This is a read-only field.
VLAN ID	If you choose to configure Internal and Guest networks by VLANs, this field is enabled. Provide a number between 1 and 4094 for the Internal VLAN. This will cause the access point to send DHCP requests with the VLAN tag. The switch and the DHCP server must support VLAN IEEE 802.1Q frames. The access point must be able to reach the DHCP server.

Field	Description
Connection Type	You can select **DHCP** or **Static IP**. The *Dynamic Host Configuration Protocol* (DHCP) is a protocol that specifies how a centralized server can provide network configuration information to devices on the network. A DHCP server offers a lease to the client. The information supplied includes the IP addresses and netmask plus the address of its DNS servers and gateway. Static IP indicates that all network settings are provided manually. You must provide the IP address for the Professional Access Point, its subnet mask, the IP address of the default gateway, and the IP address of at least one DNS name server. If you select **DHCP**, the Professional Access Point will acquire its IP Address, subnet mask, and DNS and gateway information from the DHCP Servers. If you select **Static IP**, fill in the **Static IP Address**, **Subnet Mask**, and **Default Gateway** fields. **Caution:** If you do not have a DHCP server on the Internal network and do not plan to use one, the first thing you must do after bringing up the access point is change the connection type from DHCP to static IP. When you change the connection type to static IP, you can either assign a new Static IP Address to the access point or continue using the default address. USRobotics recommends assigning a new address so that if later you bring up another Professional Access Point on the same network, the IP addresses for the two APs will be unique. If you need to recover the default static IP address, you can do so by resetting the access point to the factory defaults as described in “Reset Configuration” on page 159.
Static IP Address	Enter the static IP address in the text boxes. This field is enabled only if you selected Static IP as the connection type.
Subnet Mask	Enter the **Subnet Mask** in the text boxes. You must obtain this information from your ISP or network administrator. This field is enabled only if you selected Static IP as the connection type.
Default Gateway	Enter the **Default Gateway** in the text boxes. This field is enabled only if you selected Static IP as the connection type.
DNS Nameservers	The *Domain Name Service* (DNS) is a system that resolves the descriptive name (*domainname*) of a network resource (for example, `www.usr.com`) to its numeric IP address (for example, `66.93.138.219`). A DNS server is called a *Nameserver*. There are usually two Nameservers; a Primary Nameserver and a Secondary Nameserver. You can choose **Dynamic** or **Manual** mode. • If you choose **Manual**, assign static IP addresses for the DNS servers manually. • If you choose **Dynamic**, the IP addresses for the DNS servers will be assigned automatically via DHCP. This option is only available if you specified **DHCP** for the **Connection Type**.

Configuring Guest Interface Ethernet (Wired) Settings

To configure Ethernet (Wired) Settings for the Guest interface, fill in the fields as described below.

Field	Description
MAC Address	Shows the MAC address for the Guest interface for the LAN port on this access point. This is a read-only field.
VLAN ID	If you choose to configure Internal and Guest networks by VLANs, this field will be enabled. Provide a number between 1 and 4094 for the Guest VLAN. Be sure to assign a different VLAN ID than the one used for the Internal network.
Subnet	Shows the subnetwork address for the Guest interface. For example, 192.168.1.0.

Updating Settings

To apply your changes, click **Update**.

Wireless Settings

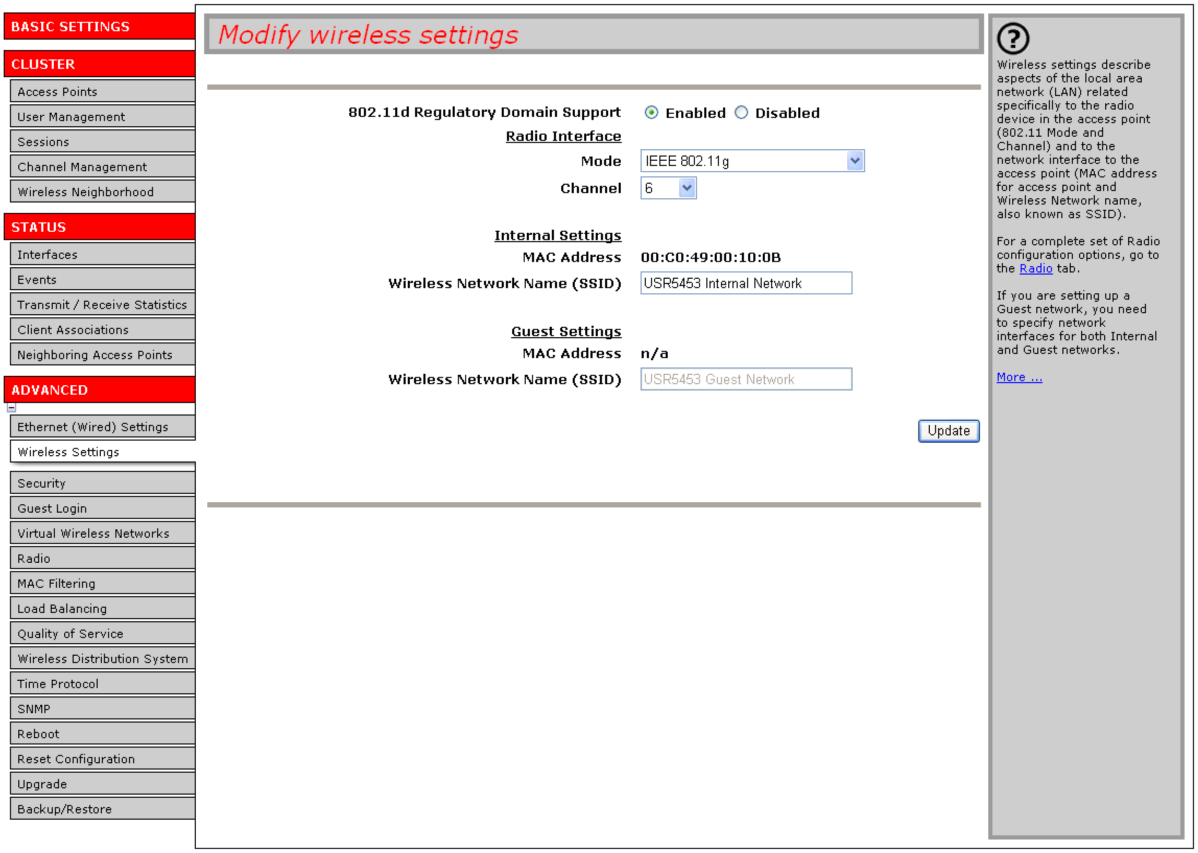
Wireless settings describe aspects of the local area network (LAN) related specifically to the radio device in the access point (802.11 Mode and Channel) and to the network interface to the access point (MAC address for access point and wireless network name, also known as *SSID*).

The following sections describe how to configure the wireless address and related settings on the Professional Access Point:

- Navigating to Wireless Settings
- Configuring 802.11d Regulatory Domain Support
- Configuring the Radio Interface
- Configuring Internal LAN Wireless Settings
- Configuring Guest Network Wireless Settings
- Updating Settings

Navigating to Wireless Settings

To set the wireless address for an access point, click the Advanced menu’s **Wireless Settings** tab, and update the fields as described below.



Modify wireless settings

802.11d Regulatory Domain Support ● Enabled ○ Disabled

Radio Interface

Mode: IEEE 802.11g

Channel: 6

Internal Settings

MAC Address: 00:C0:49:00:10:0B

Wireless Network Name (SSID): USR5453 Internal Network

Guest Settings

MAC Address: n/a

Wireless Network Name (SSID): USR5453 Guest Network

Wireless settings describe aspects of the local area network (LAN) related specifically to the radio device in the access point (802.11 Mode and Channel) and to the network interface to the access point (MAC address for access point and Wireless Network name, also known as SSID).

For a complete set of Radio configuration options, go to the Radio tab.

If you are setting up a Guest network, you need to specify network interfaces for both Internal and Guest networks.

More ...

Configuring 802.11d Regulatory Domain Support

You can enable or disable IEEE 802.11d Regulatory Domain Support to broadcast the access point country code information as described below.

Field	Description
802.11d Regulatory Domain Support	Enabling support for IEEE 802.11d on the access point causes the access point to broadcast which country it is operating in as a part of its beacons: • To enable 802.11d regulatory domain support click **Enabled**. • To disable 802.11d regulatory domain support click **Disabled**. **Note:** IEEE 802.11d defines standard rules for the operation of IEEE 802.11 wireless LANs in any country without reconfiguration. IEEE 802.11d allows client devices to operate in any country without reconfiguration.

Configuring the Radio Interface

The radio interface allows you to set the radio Channel and 802.11 mode as described below.

Field	Description
Mode	The *Mode* defines the *Physical Layer* (PHY) standard being used by the radio. Select one of these modes: • IEEE 802.11b • IEEE 802.11g
Channel	Select the **Channel**. The range of channels is 1 through 11. 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). The default is **Auto**, which picks the least busy channel at startup time.

Configuring Internal LAN Wireless Settings

The **Internal Settings** describe the MAC Address and Network Name (also known as the SSID) for the internal *Wireless LAN* (WLAN) as described below.

Field	Description
MAC Address	Shows the MAC address for the Internal interface for this access point. This is a read-only field that you cannot change. Although this access point is physically a single device, it can be represented on the network as two or more nodes each with a unique MAC Address. This is accomplished by using multiple *Basic Service Set Identifiers* (BSSIDs) for a single access point. The MAC address shown for the Internal access point is the BSSID for the Internal interface.
Wireless Network Name (SSID)	Enter the SSID for the internal WLAN. The *Service Set Identifier* (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*. There are no restrictions on the characters that may be used in an SSID.

Configuring Guest Network Wireless Settings

The **Guest Settings** describe the MAC Address (read-only) and wireless network name (SSID) for the *Guest Network* as described below. Configuring an access point with two different network names (SSIDs) allows you to implement the Guest interface feature on the Professional Access Point. For more information, see “Guest Login” on page 111.

Field	Description
MAC Address	Shows the MAC address for the Guest interface for this access point. This is a read-only field. Although this access is point is physically a single device, it can be represented on the network as two or more nodes each with a unique MAC Address. This is accomplished by using multiple *Basic Service Set Identifiers* (BSSID) for a single access point. The MAC address shown for the Guest access point is the BSSID for the Guest interface.
Wireless Network Name (SSID)	Enter the SSID for the guest network. The *Service Set Identifier* (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*. There are no restrictions on the characters that may be used in an SSID. For the guest network, provide an SSID that is different from the internal SSID and easily identifiable as the guest network.

Updating Settings

To apply your changes, click **Update**.

Security

The following sections describe how to configure security settings on the Professional Access Point:

- Understanding Security Issues on Wireless Networks
  - How Do I Know Which Security Mode to Use?
  - Comparison of Security Modes for Key Management, Authentication and Encryption Algorithms
  - Does Prohibiting the Broadcast of SSID Enhance Security?
  - How Does Station Isolation Protect the Network?
- Navigating to Security Settings
- Configuring Security Settings
  - Broadcast SSID, Station Isolation, and Security Mode
  - None
  - Static WEP
  - IEEE 802.1x
  - WPA/WPA2 Personal (PSK)
  - WPA/WPA2 Enterprise (RADIUS)
- Updating Settings

Understanding Security Issues on Wireless Networks

Wireless mediums are inherently less secure than wired mediums. For example, an Ethernet NIC transmits its packets over a physical medium such as coaxial cable or twisted pair. A wireless NIC broadcasts radio signals over the air allowing a wireless LAN to be easily tapped without physical access or sophisticated equipment. A hacker equipped with a laptop, a wireless NIC, and a bit of knowledge can easily attempt to compromise your wireless network. By using a sophisticated antenna on the client, a hacker may even be able to connect to the network from many miles away.

The Professional Access Point provides a number of authentication and encryption schemes to ensure that your wireless infrastructure is accessed only by the intended users. The details of each security mode are described in the sections below.

How Do I Know Which Security Mode to Use?

In general, USRobotics recommends that on your Internal network you use the most robust security mode that is feasible in your environment. When configuring security on the access point, you first must choose the security mode. Then, in some modes you must choose an authentication algorithm and whether to allow clients not using the specified security mode to associate.

Wi-Fi Protected Access (WPA) with *Remote Authentication Dial-In User Service* (RADIUS) using the CCMP (AES) encryption algorithm provides the best data protection available and is clearly the best choice if all client devices are equipped with WPA supplicants. However, backward compatibility or interoperability issues with clients or even with other access points may require that you configure WPA with RADIUS with a different encryption algorithm or choose one of the other security modes.

However, security may not be as much of a priority on some types of networks. If you are simply providing internet and printer access, as on a guest network, **None** may be the appropriate choice. To prevent clients from accidentally discovering and connecting to your network, you can disable the broadcast SSID so that your network name is not advertised. If the network is sufficiently isolated from access to sensitive information, this may offer enough protection in some situations. This level of protection is the only one offered for guest networks, and also may be the right convenience trade-off for other situations in which the priority is making it as easy as possible for clients to connect. (See “Does Prohibiting the Broadcast of SSID Enhance Security?” on page 96.)

Following is a brief discussion of the factors that make one mode more secure than another, a description of each mode offered, and when to use each mode.

Comparison of Security Modes for Key Management, Authentication and Encryption Algorithms

The major factors that determine the effectiveness of a security protocol are:

- How the protocol manages keys
- Presence or absence of integrated user authentication in the protocol
- Encryption algorithm or formula the protocol uses to encode and decode the data

Following is a list of the security modes available on the Professional Access Point along with a description of the key management, authentication, and encryption algorithms used in each mode. Each discussion includes suggestions as to when one mode might be more appropriate than another.

- When to Use No Security
- When to Use Static WEP
- When to Use IEEE 802.1x
- When to Use WPA/WPA2 Personal (PSK)
- When to Use WPA/WPA2 Enterprise (RADIUS)

When to Use No Security

None is a security mode option. In this mode, the data is not encrypted. Instead, the data is sent as plain text across the network. No key management, data encryption, or user authentication is used.

RECOMMENDATIONS

None is not recommended for regular use on the Internal network because it is not secure.

You must run the Guest network with no security. The Guest network is, by definition, an insecure LAN always virtually separated from any sensitive information on the Internal LAN.

Therefore, use **None** on the Guest network, and on the Internal network for initial setup, testing, or problem solving only.

SEE ALSO

For information on how to configure this mode, see “None” on page 98 under “Configuring Security Settings”.

When to Use Static WEP

Static *Wired Equivalent Privacy* (WEP) is a data encryption protocol for 802.11 wireless networks. All wireless stations and access points on the network are configured with a 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.

Key Management	Encryption Algorithm	User Authentication
Static WEP uses a fixed key that is provided by the administrator. WEP keys are indexed in different slots (up to four on the Professional Access Point). The client devices must have the same key indexed in the same slot to access data on the access point.	An RC4 stream cipher is used to encrypt the frame body and *cyclic redundancy checking* (CRC) of each 802.11 frame.	If you set the **Authentication Algorithm** to **Shared Key**, this protocol provides a rudimentary form of user authentication. However, if the **Authentication Algorithm** is set to **Open System**, no authentication is performed. If the algorithm is set to **Both**, only WEP clients are authenticated.

RECOMMENDATIONS

Static WEP was designed to provide security equivalent of sending unencrypted data through an Ethernet connection, however it has major flaws and it does not provide even this intended level of security.

Therefore, Static WEP is not recommended as a secure mode. The only time to use Static WEP is when interoperability issues make it the only option available to you and you are not concerned with the potential of exposing the data on your network.

SEE ALSO

For information on how to configure Static WEP security mode, see “Static WEP” on page 99 under “Configuring Security Settings”.

When to Use IEEE 802.1x

IEEE 802.1x is the standard for passing the Extensible Authentication Protocol (EAP) over an 802.11 wireless network using a protocol called EAP Encapsulation Over LANs (EAPOL). This is a newer, more secure standard than Static WEP.

Key Management	Encryption Algorithm	User Authentication
IEEE 802.1x provides dynamically-generated keys that are periodically refreshed. There are different Unicast keys for each station.	An RC4 stream cipher is used to encrypt the frame body and *cyclic redundancy checking* (CRC) of each 802.11 frame.	IEEE 802.1x mode supports a variety of authentication methods, like certificates, Kerberos, and public key authentication with a RADIUS server. You have a choice of using the Professional Access Point embedded RADIUS server or an external RADIUS server. The embedded RADIUS server supports Protected EAP (PEAP) and MSCHAP V2.

Recommendations

IEEE 802.1x mode is a better choice than Static WEP because keys are dynamically generated and changed periodically. However, the encryption algorithm used is the same as that of Static WEP and is therefore not as reliable as the more advanced encryption methods such as TKIP and CCMP (AES) used in *Wi-Fi Protected Access* (WPA) or WPA2.

Additionally, compatibility issues may be cumbersome because of the variety of authentication methods supported and the lack of a standard implementation method.

Therefore, IEEE 802.1x mode is not as secure a solution as *Wi-Fi Protected Access* (WPA) or WPA2.

See Also

For information on how to configure IEEE 802.1x security mode, see “IEEE 802.1x” on page 104 under “Configuring Security Settings”.

When to Use WPA/WPA2 Personal (PSK)

Wi-Fi Protected Access 2 (WPA2) Personal *Pre-Shared Key* (PSK) is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes *Advanced Encryption Algorithm* (AES), *Counter mode/ CBC-MAC Protocol* (CCMP), and *Temporal Key Integrity Protocol* (TKIP) mechanisms. This mode offers the same encryption algorithms as WPA 2 with RADIUS but without the ability to integrate a RADIUS server for user authentication.

This security mode is backward compatible for wireless clients that support only the original WPA.

Key Management	Encryption Algorithms	User Authentication
WPA/WPA2 Personal (PSK) provides dynamically-generated keys that are periodically refreshed. There are different Unicast keys for each station.	• *Temporal Key Integrity Protocol* (TKIP) • *Counter mode/CBC-MAC Protocol* (CCMP) *Advanced Encryption Standard* (AES)	The use of a Pre-Shared (PSK) key provides user authentication similar to that of shared keys in WEP.

Recommendations

WPA/WPA2 Personal (PSK) is not recommended for use with the Professional Access Point when WPA/ WPA2 Enterprise (RADIUS) is an option.

USRobotics recommends that you use WPA/WPA2 Enterprise (RADIUS) mode instead, unless you have interoperability issues that prevent you from using this mode.

For example, some devices on your network may not support WPA or WPA2 with EAP talking to a RADIUS server. Embedded printer servers or other small client devices with very limited space for implementation may not support RADIUS. For such cases, USRobotics recommends that you use WPA/ WPA2 Personal (PSK).

See Also

For information on how to configure this security mode, see “WPA/WPA2 Personal (PSK)” on page 105.

When to Use WPA/WPA2 Enterprise (RADIUS)

Wi-Fi Protected Access 2 (WPA2) with *Remote Authentication Dial-In User Service* (RADIUS) is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes *Advanced Encryption Standard* (AES), *Counter mode/CBC-MAC Protocol* (CCMP), and *Temporal Key Integrity Protocol* (TKIP) mechanisms. This mode requires the use of a RADIUS server to authenticate users. WPA/WPA2 Enterprise (RADIUS) provides the best security available for wireless networks.

This security mode also provides backward compatibility for wireless clients that support only the original WPA.

Key Management	Encryption Algorithms	User Authentication
WPA/WPA2 Enterprise (RADIUS) mode provides dynamically-generated keys that are periodically refreshed. There are different Unicast keys for each station.	• *Temporal Key Integrity Protocol* (TKIP) • *Counter mode/CBC-MAC Protocol* (CCMP) *Advanced Encryption Standard* (AES)	*Remote Authentication Dial-In User Service* (RADIUS) You have a choice of using the Professional Access Point embedded RADIUS server or an external RADIUS server. The embedded RADIUS server supports Protected EAP (PEAP) and MSCHAP V2.

Recommendations

WPA/WPA2 Enterprise (RADIUS) mode is the **recommended mode**. The CCMP (AES) and TKIP encryption algorithms used with WPA modes are far superior to the RC4 algorithm used for Static WEP or IEEE 802.1x modes. Therefore, CCMP (AES) or TKIP should be used whenever possible. All WPA modes allow you to use these encryption schemes, so WPA security modes are recommended above the others when using WPA is an option.

Additionally, this mode incorporates a RADIUS server for user authentication, which gives it an edge over WPA/WPA2 Personal (PSK) mode.

Use the following guidelines for choosing options within the WPA/WPA2 Enterprise (RADIUS) mode security mode:

1. The best security you can have to-date on a wireless network is WPA/WPA2 Enterprise (RADIUS) mode using CCMP (AES) encryption algorithm. AES is a symmetric 128-bit block data encryption technique that works on multiple layers of the network. It is the most effective encryption system currently available for wireless networks. If all clients or other APs on the network are WPA/CCMP compatible, use this encryption algorithm. If all clients are WPA2 compatible, choose to support only WPA2 clients.

2. The second best choice is WPA/WPA2 Enterprise (RADIUS) with the encryption algorithm set to **Both** (that is, both TKIP and CCMP). This lets WPA clients without CCMP associate, uses TKIP for encrypting Multicast and Broadcast frames, and allows clients to select whether to use CCMP or TKIP for Unicast (access-point-to-single-station) frames. This WPA configuration allows more interoperability, at the expense of some security. Clients that support CCMP can use it for their Unicast frames. If you encounter access-point-to-station interoperability problems with the **Both** encryption algorithm setting, then you will need to select TKIP instead.

3. The third best choice is WPA/WPA2 Enterprise (RADIUS) with the encryption algorithm set to TKIP. Some clients have interoperability issues with CCMP and TKIP enabled at same time. If you encounter this problem, then choose TKIP as the encryption algorithm. This is the standard WPA mode, and most interoperable mode with client wireless software security features. TKIP is the only encryption algorithm that is being tested in Wi-Fi WPA certification.

SEE ALSO

For information on how to configure this security mode, see “WPA/WPA2 Enterprise (RADIUS)” on page 107 under “Configuring Security Settings”.

Does Prohibiting the Broadcast of SSID Enhance Security?

You can prohibit the broadcast of the AP’s SSID to discourage stations from automatically discovering your access point. When the access point’s SSID broadcast is prohibited, the network name is not displayed in the **List of Available Networks** on a client device. Instead, the client must have the exact network name configured in the supplicant before the client will be able to connect.

Prohibiting the SSID broadcast 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 to monitor insecure traffic.

This offers a minimum 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.

(See also “Guest Network” on page 98.)

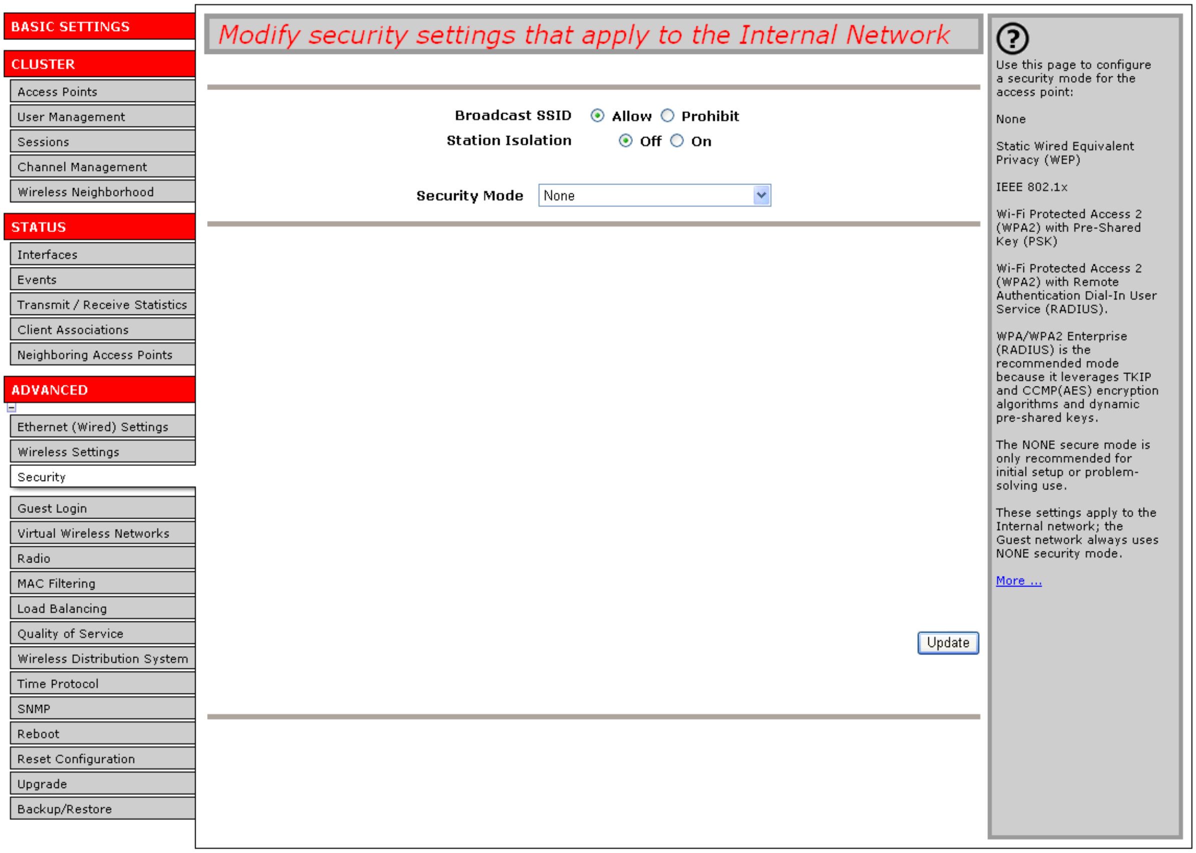
How Does Station Isolation Protect the Network?

When **Station Isolation** is enabled, the access point blocks communication between wireless clients. The access point allows data traffic between its wireless clients and wired devices on the network, but not among wireless clients.

The traffic blocking extends to wireless clients connected to the network via WDS links; these clients cannot communicate with each other when Station Isolation is on. See “Wireless Distribution System” on page 143 for more information about WDS.

Navigating to Security Settings

To set the security mode, click the Advanced menu’s **Security** tab, and update the fields as described below.



Modify security settings that apply to the Internal Network

Broadcast SSID ● Allow ○ Prohibit
Station Isolation ● Off ○ On

Security Mode: None

Use this page to configure a security mode for the access point:

None

Static Wired Equivalent Privacy (WEP)

IEEE 802.1x

Wi-Fi Protected Access 2 (WPA2) with Pre-Shared Key (PSK)

Wi-Fi Protected Access 2 (WPA2) with Remote Authentication Dial-In User Service (RADIUS).

WPA/WPA2 Enterprise (RADIUS) is the recommended mode because it leverages TKIP and CCMP(AES) encryption algorithms and dynamic pre-shared keys.

The NONE secure mode is only recommended for initial setup or problem-solving use.

These settings apply to the Internal network; the Guest network always uses NONE security mode.

Configuring Security Settings

The following configuration information explains how to configure security modes on the access point. Keep in mind that each wireless client that wants to exchange data with the access point must be configured with the same security mode and encryption key settings consistent with access point security.

Notes Security modes other than **None** apply only to configuration of the Internal network. On the Guest network, you can use only **None**. (For more information about guest networks, see “Guest Login” on page 111.)

Broadcast SSID, Station Isolation, and Security Mode

To configure security on the access point, select a security mode and fill in the related fields as described in the following table. You can also allow or prohibit the Broadcast SSID and enable or disable Station

Isolation as extra precautions as mentioned below.

Field	Description
Broadcast SSID	Select the **Broadcast SSID** setting by clicking **Allow** or **Prohibit**. By default, the access point broadcasts the *Service Set Identifier* (SSID) in its beacon frames. You can prohibit this broadcast to discourage stations from automatically discovering your access point. When the access point's broadcast SSID is suppressed, the network name will not be displayed in the **List of Available Networks** on a client device. Instead, the client must have the exact network name configured in the supplicant before the client will be able to connect.
Station Isolation	Select **Off** to disable station isolation or **On** to enable it. • When station isolation is **Off**, wireless clients can communicate with one another normally by sending traffic through the access point. • When station isolation is **On**, the access point blocks communication between wireless clients. The access point allows data traffic between its wireless clients and wired devices on the network, but not among wireless clients. The traffic blocking extends to wireless clients connected to the network via WDS links; these clients cannot communicate with each other when station isolation is on. See "Wireless Distribution System" on page 143 for more information about WDS.
Security Mode	Select the **Security Mode**. Select one of the following: • **None** • **Static WEP** • **IEEE 802.1x** • **WPA/WPA2 Personal (PSK)** • **WPA/WPA2 Enterprise (RADIUS)** For a Guest network, only the **None** setting can be used. (For more information, see "Guest Login" on page 111.) Security modes other than **None** apply only to configuration of the Internal network.

None

None means that any data transferred to and from the Professional Access Point is not encrypted.

There are no further options for this mode.Running without security 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.

Guest Network

None is the only mode in which you can run the Guest network, which is by definition an easily accessible, insecure LAN always virtually separated from any sensitive information on the Internal LAN. For example, the guest network might simply provide internet and printer access for day visitors.

The absence of security on the Guest network is designed to make it as easy as possible for guests to get a connection without having to program any security settings in their clients.

For a minimum level of protection on a guest network, you can choose to prohibit the broadcast of the SSID, discouraging client devices from automatically discovering your access point. (See also “Does Prohibiting the Broadcast of SSID Enhance Security?” on page 96).

For more about the Guest network, see “Guest Login” on page 111.

Static WEP

Wired Equivalent Privacy (WEP) is a data encryption protocol for 802.11 wireless networks. All wireless stations and access points on the network are configured with a 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.

You cannot mix 64-bit and 128-bit WEP keys between the access point and its clients.

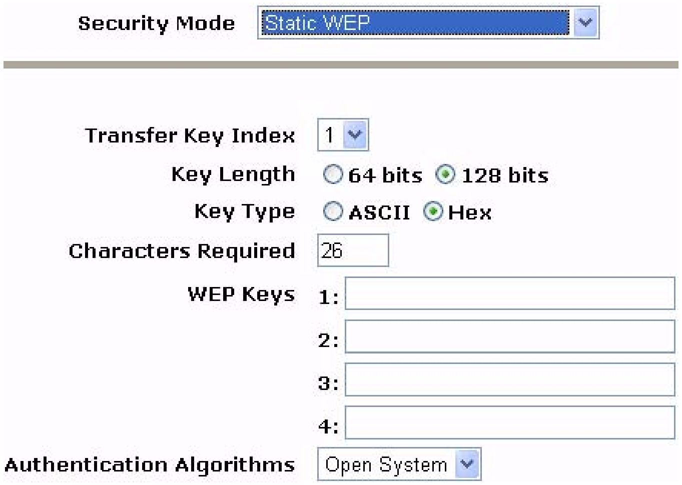
Static WEP is not the most secure mode available, but it offers more protection than **None** as it does prevent an outsider from easily sniffing out unencrypted wireless traffic. (For more secure modes, see the sections on “IEEE 802.1x” on page 104, “WPA/WPA2 Enterprise (RADIUS)” on page 107, or “WPA/WPA2 Personal (PSK)” on page 105.)

WEP encrypts data moving across the wireless network based on a static key. (The encryption algorithm is a stream cipher called *RC4*.)

The access point uses a key to transmit data to the clients. Each client must use that same key to decrypt data it receives from the access point.

Clients can use different keys to transmit data to the access point. (Or they can all use the same key, but this is less secure because it means one station can decrypt the data being sent by another.)

If you selected **Static WEP** as the security mode, provide the following on the access point settings:



Security Mode	Static WEP
Transfer Key Index	1
Key Length	○ 64 bits ● 128 bits
Key Type	○ ASCII ● Hex
Characters Required	26
WEP Keys	1:
	2:
	3:
	4:
Authentication Algorithms	Open System

.

Field	Description
Transfer Key Index	Select a key index. Key indexes 1 through 4 are available. The default is 1. The transfer key index indicates which WEP key the access point will use to encrypt the data it transmits.
Key Length	Specify one of the following lengths for the key: • **64 bits** • **128 bits**
Key Type	Select one of the following key types: • **ASCII** • **Hex**
Characters Required	Indicates the number of characters required in the WEP key. The number is updated automatically based on how you set **Key Length** and **Key Type**.
WEP Keys	You can specify up to four WEP keys. In each text box, enter a string of characters for one key. If you selected **ASCII**, enter any combination of integers and letters `0-9`, `a-z`, and `A-Z`. If you selected **HEX**, enter hexadecimal digits (any combination of `0-9` and `a-f` or `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 must be configured to use one of these same WEP keys in the same slot as specified here on the access point. (See “Rules to Remember for Static WEP” on page 101.)

Field	Description
Authentication Algorithm	The authentication algorithm defines the method used to determine whether a client is allowed to associate with an access point when static WEP is the security mode. Specify the authentication algorithm you want to use by choosing one of the following: • **Open System** • **Shared Key** • **Both** **Open System** authentication allows any client to associate with the access point whether that client has the correct WEP key or not. This algorithm is also used in None, IEEE 802.1x, and WPA modes. When the authentication algorithm is set to **Open System**, any client can associate with the access point. That a client is allowed to *associate* does not ensure that the client can exchange traffic with an access point. A client must have the correct WEP key to be able to successfully access and decrypt data from an access point, and to transmit readable data to the access point. **Shared Key** authentication requires the client 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 will not be able to associate with the access point. **Both** is the default. When the authentication algorithm is set to **Both**: • Clients configured to use WEP in shared key mode must have a valid WEP key in order to associate with the access point. • Clients configured to use WEP in an open system mode (shared key mode not enabled) will be able to associate with the access point even if they do not have the correct WEP key.

Rules to Remember for Static WEP

- All clients must have the Wireless LAN (WLAN) security set to WEP, and all clients must have one of the WEP keys specified on the access point in order to decode access-point-to-station data transmissions.

- The access point must have all keys used by clients for station-to-access-point transmit so that it can decode the station transmissions.

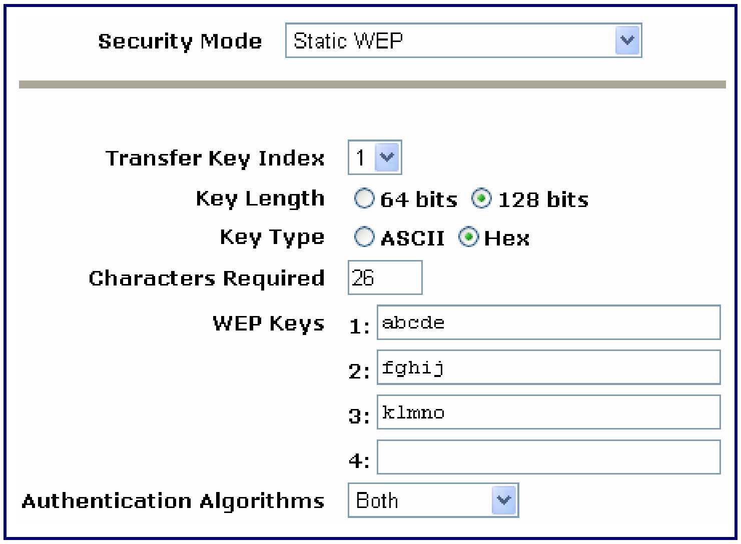
- The same key must occupy the same slot on all nodes (access point and clients). For example, if the access point defines `abc123` key as WEP key 3, then the clients must define that same string as WEP key 3.

- On some wireless client software (like Funk Odyssey), you can configure multiple WEP keys and define a client transfer key index, then set the stations to encrypt the data they transmit using different keys. This ensures that neighbouring APs cannot decode each other’s transmissions.

Example of Using Static WEP

For a simple example, suppose that you configure three WEP keys on the access point. In this example, the Transfer Key Index for the access point is set to 3. This means that the WEP key in slot 3 is the key that the access point will use to encrypt the data it sends.

Figure 7. Setting the Access Point Transfer Key on the Access Point.



Security Mode: Static WEP

Transfer Key Index: 1

Key Length: ○ 64 bits ● 128 bits

Key Type: ○ ASCII ● Hex

Characters Required: 26

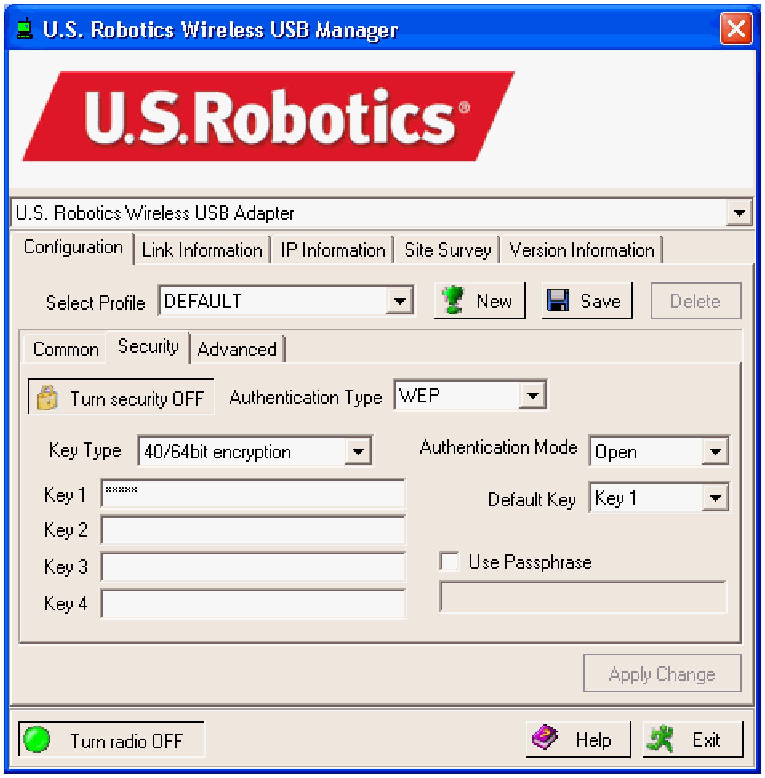
WEP Keys
1: abcde
2: fghij
3: klmno
4:

Authentication Algorithms: Both

You must then set all clients to use WEP and provide each client with one of the slot and key combinations you defined on the access point.

The following example will set WEP key 1 on a Windows client.

Figure 8. Providing a Wireless Client with a WEP Key



U.S. Robotics Wireless USB Adapter

Select Profile: DEFAULT

Authentication Type: WEP

Key Type: 40/64bit encryption

Authentication Mode: Open

Key 1: *****

Key 2:

Key 3:

Key 4:

Default Key: Key 1

□ Use Passphrase

If you have a second client, that client also needs to have one of the WEP keys defined on the access point. You could give it the same WEP key that you gave to the first station. Or, for a more secure solution, you could give the second station a different WEP key (key 2, for example) so that the two stations cannot decrypt each other’s transmissions.

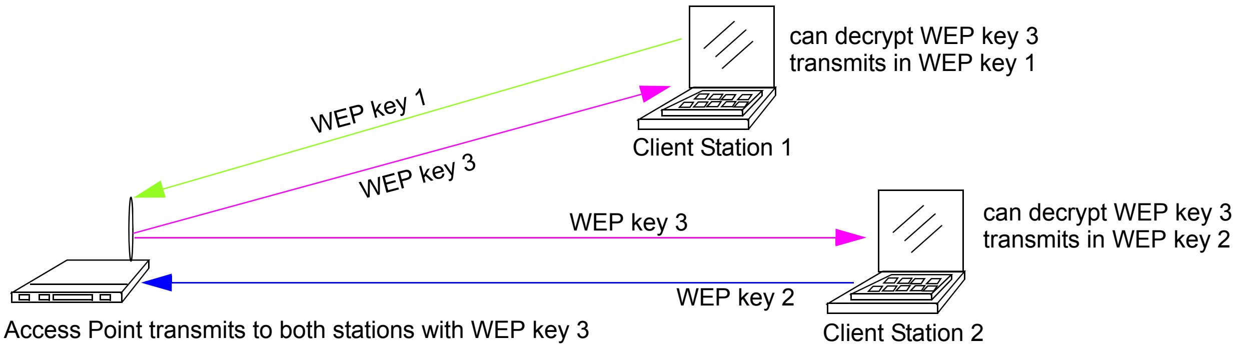
Static WEP with Transfer Key Indexes on Client Devices

Some Wireless client software, such as like Funk Odyssey, lets you configure multiple WEP keys and set a transfer index on the client; then you can specify different keys to be used for station-to-access-point transmissions. (The standard Windows wireless client software does not allow you to do this.)

To build on the previous example, using Funk Odyssey client software you could give each of the clients WEP key 3 so that they can decode the access point transmissions with that key and also give client 1 WEP key 1 and set this as the client 1’s transfer key index. You could then give client 2 WEP key 2 and set this as client 2’s transfer key index.

Figure 9 illustrates the dynamics of the access point and two clients using multiple WEP keys and a transfer key index.

Figure 9. Example of Using Multiple WEP Keys and Transfer Key Index on Client Devices



IEEE 802.1x

IEEE 802.1x is the standard that defines port-based authentication and provides a framework for implementing key management. Extensible Authentication Protocol (EAP) packets are sent over an IEEE 802.11 wireless network using a protocol called EAP Encapsulation Over LANs (EAPOL). IEEE 802.1x provides dynamically-generated keys that are periodically refreshed. An RC4 stream cipher is used to encrypt the frame body and cyclic redundancy checking (CRC) of each 802.11 frame.

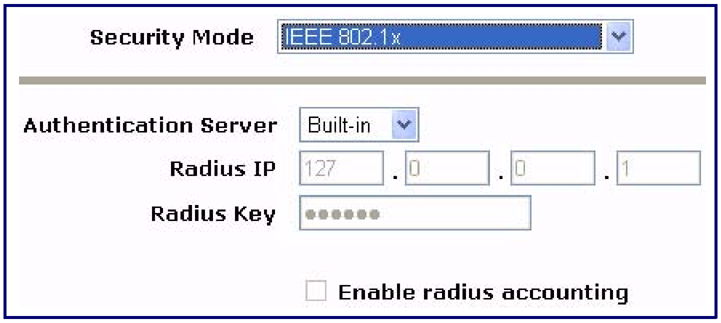
The IEEE 802.1x security mode requires the use of a RADIUS server to authenticate users and requires configuration of user accounts via the Cluster menu’s User Management page.

The access point requires a RADIUS server capable of EAP, such as the Microsoft Internet Authentication Server or the Professional Access Point internal authentication server. To work with Windows clients, the authentication server must support Protected EAP (PEAP) and MSCHAP V2.

When configuring IEEE 802.1x mode, you can use either the embedded RADIUS server or an external RADIUS server that you provide. The Professional Access Point embedded RADIUS server supports Protected EAP (PEAP) and MSCHAP V2.

If you use your own RADIUS server, you can use any of a variety of authentication methods that the IEEE 802.1x mode supports, including certificates, Kerberos, and public key authentication. Keep in mind, however, that the clients must be configured to use the same authentication method being used by the access point.

If you select **IEEE 802.1x** Security Mode, you must provide the following:



Security Mode: IEEE 802.1x

Authentication Server: Built-in

Radius IP: 127 . 0 . 0 . 1

Radius Key: ●●●●●●

□ Enable radius accounting

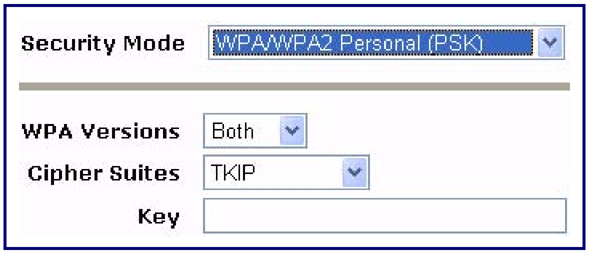
Field	Description
Authentication Server	Select one of the following: • **Built-in**—To use the authentication server provided with the Professional Access Point. If you choose this option, you do not have to provide the Radius IP and Radius Key; they are automatically provided. • **External**—To use an external authentication server. If you choose this option you must supply the Radius IP and Radius Key of the server you want to use. **Note:** The RADIUS server is identified by its IP address and UDP port numbers for the different services it provides.The RADIUS server User Datagram Protocol (UDP) ports used by the access point are not configurable on the Professional Access Point. (The access point is hard-coded to use RADIUS server UDP port 1812 for authentication and port 1813 for accounting.)
Radius IP	Enter the Radius IP in the text box. The *Radius IP* is the IP address of the RADIUS server. The Professional Access Point internal authentication server is `127.0.0.1` For information on setting up user accounts, see “User Management” on page 43.
Radius Key	Enter the Radius Key in the text box. The *Radius Key* is the shared secret key for the RADIUS server. The text you enter will be displayed as "*" characters to prevent others from seeing the RADIUS key as you type. (The Professional Access Point internal authentication server key is `secret`.) This value is never sent over the network.
Enable RADIUS Accounting	Click **Enable RADIUS Accounting** if you want to track and measure the resources that a particular user has consumed. Resources measured include system time, amount of data transmitted and received, and so on.

WPA/WPA2 Personal (PSK)

Wi-Fi Protected Access 2 (WPA2) with *Pre-Shared Key* (PSK) is a Wi-Fi Alliance IEEE 802.11i standard, which includes *Advanced Encryption Algorithm* (AES), *Counter mode/CBC-MAC Protocol* (CCMP), and *Temporal Key Integrity Protocol* (TKIP) mechanisms. The Personal version of WPA2 employs a pre-shared key (instead of using IEEE 802.1x and EAP as is used in the Enterprise WPA2 security mode). The PSK is used for an initial check of credentials only.

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

If you select **WPA/WPA2 Personal (PSK)** Security Mode, you must provide the following:



Security Mode: WPA/WPA2 Personal (PSK)

WPA Versions: Both

Cipher Suites: TKIP

Key:

Field	Description
WPA Versions	Select the types of clients you want to support: • **WPA—**If all clients on the network support the original WPA, but none support the newer WPA2, then select **WPA** • **WPA2—**If all clients on the network support WPA2, USRobotics suggests using **WPA2**, which provides the best security per the IEEE 802.11i standard. • **Both—**If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select **Both**. This option lets both WPA and WPA2 clients 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 you want to use from the list: • **TKIP—**TKIP (*Temporal Key Integrity Protocol*) is the default. TKIP provides a more secure encryption solution than WEP keys. The TKIP process more frequently changes the encryption key used and better ensures that the same key will not be reused to encrypt data (a weakness of WEP). TKIP uses a 128-bit temporal key shared by clients and access points. The temporal key is combined with the client's MAC address and a 16-octet initialization vector to produce the key that will encrypt the data. This ensures that each client uses a different key to encrypt data. TKIP uses RC4 to perform the encryption, which is the same as WEP. But TKIP changes temporal keys every 10,000 packets and distributes them, thereby greatly improving the security of the network. • **CCMP (AES)**—*Counter mode/CBC-MAC Protocol* (CCMP) is an encryption method for IEEE 802.11i that uses the **Advanced Encryption Algorithm** (AES). It uses a CCM combined with Cipher Block Chaining Counter mode (CBC-CTR) and Cipher Block Chaining Message Authentication Code (CBC-MAC) for encryption and message integrity. • **Both**—When the authentication algorithm is set to **Both**, both TKIP and AES clients can associate with the access point. WPA clients must have one of the following to be able to associate with the access point: • A valid TKIP key • A valid CCMP (AES) key Clients not configured to use a WPA-PSK will not be able to associate with the access point.

Field	Description
Key	The *Pre-shared Key* is the shared secret key for WPA-PSK. Enter a string of at least 8 characters to a maximum of 63 characters.

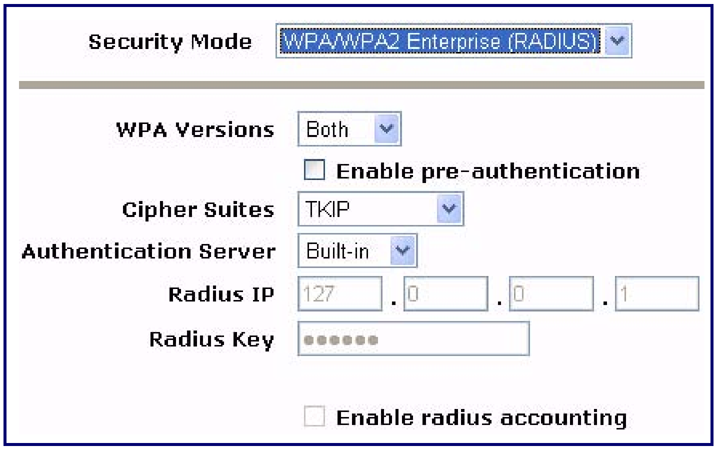
WPA/WPA2 Enterprise (RADIUS)

Wi-Fi Protected Access 2 (WPA2) with *Remote Authentication Dial-In User Service* (RADIUS) is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes *Advanced Encryption Standard* (AES), *Counter mode/CBC-MAC Protocol* (CCMP), and *Temporal Key Integrity Protocol* (TKIP) mechanisms. The Enterprise mode requires the use of a RADIUS server to authenticate users, and configuration of user accounts via the Cluster menu’s User Management page.

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

When configuring WPA2 Enterprise (RADIUS) mode, you can use either the built-in RADIUS server or an external RADIUS server that you provide. The Professional Access Point built-in RADIUS server supports Protected EAP (PEAP) and MSCHAP V2.

If you select **WPA/WPA2 Enterprise (RADIUS)** Security Mode, you must provide the following:



Security Mode	WPA/WPA2 Enterprise (RADIUS)
WPA Versions	Both
	□ Enable pre-authentication
Cipher Suites	TKIP
Authentication Server	Built-in
Radius IP	127 . 0 . 0 . 1
Radius Key	●●●●●●
	□ Enable radius accounting

Field	Description
WPA Versions	Select the types of clients you want to support: • **WPA—**If all clients on the network support the original WPA, but none support the newer WPA2, then select **WPA** • **WPA2—**If all clients on the network support WPA2, USRobotics suggests using **WPA2**, which provides the best security per the IEEE 802.11i standard. • **Both—**If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select **Both**. This option lets both WPA and WPA2 clients 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.

Field	Description
Enable pre-authentication	If for **WPA Versions** you select **WPA2** or **Both**, you can enable pre-authentication for WPA2 clients. Click **Enable pre-authentication** if you want WPA2 wireless clients to send pre-authentication packet. The pre-authentication information will be relayed from the access point the client is currently using to the target access point. Enabling this feature can help speed up authentication for roaming clients who connect to multiple access points. 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 you want to use from the list: • **TKIP—***Temporal Key Integrity Protocol* (TKIP) provides a more secure encryption solution than WEP keys. The TKIP process more frequently changes the encryption key used and better ensures that the same key will not be reused to encrypt data (a weakness of WEP). TKIP uses a 128-bit temporal key shared by clients and access points. The temporal key is combined with the client's MAC address and a 16-octet initialization vector to produce the key that will encrypt the data. This ensures that each client uses a different key to encrypt data. TKIP uses RC4 to perform the encryption, which is the same as WEP. But TKIP changes temporal keys every 10,000 packets and distributes them, thereby greatly improving the security of the network. • **CCMP (AES)**—*Counter mode/CBC-MAC Protocol* (CCMP) is an encryption method for IEEE 802.11i that uses the **Advanced Encryption Algorithm** (AES). It uses a CCM combined with Cipher Block Chaining Counter mode (CBC-CTR) and Cipher Block Chaining Message Authentication Code (CBC-MAC) for encryption and message integrity. • **Both**—The default. When the authentication algorithm is set to **Both**, both TKIP and AES clients can associate with the access point. Clients configured to use WPA with RADIUS must have one of the following to be able to associate with the access point: • A valid TKIP RADIUS IP address and RADIUS Key • A valid CCMP (AES) IP address and RADIUS Key Clients not configured to use WPA with RADIUS will not be able to associate with access point.
Authentication Server	Select one of the following from list: • **Built-in**—To use the authentication server provided with the Professional Access Point. If you choose this option, you do not have to provide the Radius IP and Radius Key; they are automatically provided. • **External**—To use an external authentication server. If you choose this option you must supply a Radius IP and Radius Key of the server you want to use. **Note:** The RADIUS server is identified by its IP address and UDP port numbers for the different services it provides. On the Professional Access Point, the RADIUS server User Datagram Protocol (UDP) ports used by the access point are not configurable. The Professional Access Point is hard-coded to use RADIUS server UDP port 1812 for authentication and port 1813 for accounting.

Field	Description
Radius IP	Enter the Radius IP. The *Radius IP* is the IP address of the RADIUS server. (The Professional Access Point internal authentication server is `127.0.0.1`.) For information on setting up user accounts, see “User Management” on page 43.
Radius Key	Enter the Radius Key. The *Radius Key* is the shared secret key for the RADIUS server. The text you enter will be displayed as "*" characters to prevent others from seeing the RADIUS key as you type. (The Professional Access Point internal authentication server key is `secret`.) This value is never sent over the network.
Enable RADIUS Accounting	Click **Enable RADIUS Accounting** if you want to enforce authentication for WPA clients with user names and passwords for each client. See also “User Management” on page 43.

Updating Settings

To apply your changes, click **Update**.

Guest Login

The Professional Access Point's Guest Interface features allow you to configure the access point for controlled guest access to an isolated network. You can configure the same access point to broadcast and function as two different wireless networks: a secure Internal LAN and a public Guest network.

Guest clients can access the guest network without a user name or password. When guests log in, they see a guest Welcome screen (also known as a *captive portal*).

The following sections are included here:

- Understanding the Guest Interface
- Configuring the Guest Interface
  - Configuring a Guest Network on a Virtual LAN
  - Configuring the Welcome Screen (Captive Portal)
- Using the Guest Network
- Deployment Example

Understanding the Guest Interface

You can define unique parameters for guest connectivity and isolate guest clients from other, more sensitive areas of the network. No security is provided on the guest network; only **None** is allowed as the security mode.

Simultaneously, you can configure a secure internal network (using the same access point as your guest interface) that provides full access to protected information behind a firewall and requires secure logins or certificates for access.

Note The Guest Interface uses the *multiple BSSID* and *Virtual LAN* (VLAN) technologies that are built into the Professional Access Point. The Internal and Guest networks are implemented as multiple BSSIDs on the same access point, each with different network names (SSIDs) on the Wireless interface and different VLAN IDs on the Wired interface.

Configuring the Guest Interface

To configure the Guest interface on the Professional Access Point, perform these configuration steps:

1. Configure the access point to represent two virtually separate networks as described in the section “Configuring a Guest Network on a Virtual LAN” on page 112.

2. Set up the guest Welcome screen for the guest captive portal as described in the section “Configuring

the Welcome Screen (Captive Portal)" on page 113.

Note Guest Interface settings are not shared among access points across the cluster. These settings must be configured individually on the Web User Interface pages for each access point. To get to the Web User Interface for an access point that is a member of the current cluster, click on its IP Address link on the Cluster menu's Access Points page of the current access point. For more information about which settings are shared by the cluster and which are not, see "Which Settings are Shared as Part of the Cluster Configuration and Which Are Not?" on page 35.

Configuring a Guest Network on a Virtual LAN

Notes If you want to configure the Guest and Internal networks on Virtual LAN (VLANs), the switch and DHCP server you are using must support VLANs.

As a prerequisite step, configure a port on the switch for handling VLAN tagged packets as described in the IEEE 802.1Q standard.

Guest Welcome Screen settings are shared among access points across the cluster. When you update these settings for one access point, the configuration will be shared with the other access points in the cluster. For more information about which settings are shared by the cluster and which are not, see "Which Settings are Shared as Part of the Cluster Configuration and Which Are Not?" on page 35.

To configure Internal and Guest networks on virtual LANs, do the following:

1. Use an Ethernet cable to make a wired connection from the LAN port on the access point to the LAN. (Make sure this port is configured to handle VLAN tagged packets.)

2. Configure **Ethernet (Wired) Settings** for Internal and Guest networks on VLANs as described in "Ethernet (Wired) Settings" on page 79.

   (Start by enabling Guest Access and choosing **For Internal and Guest access, use VLAN on Ethernet Port** as described in "Specifying a Virtual Guest Network" on page 82.)

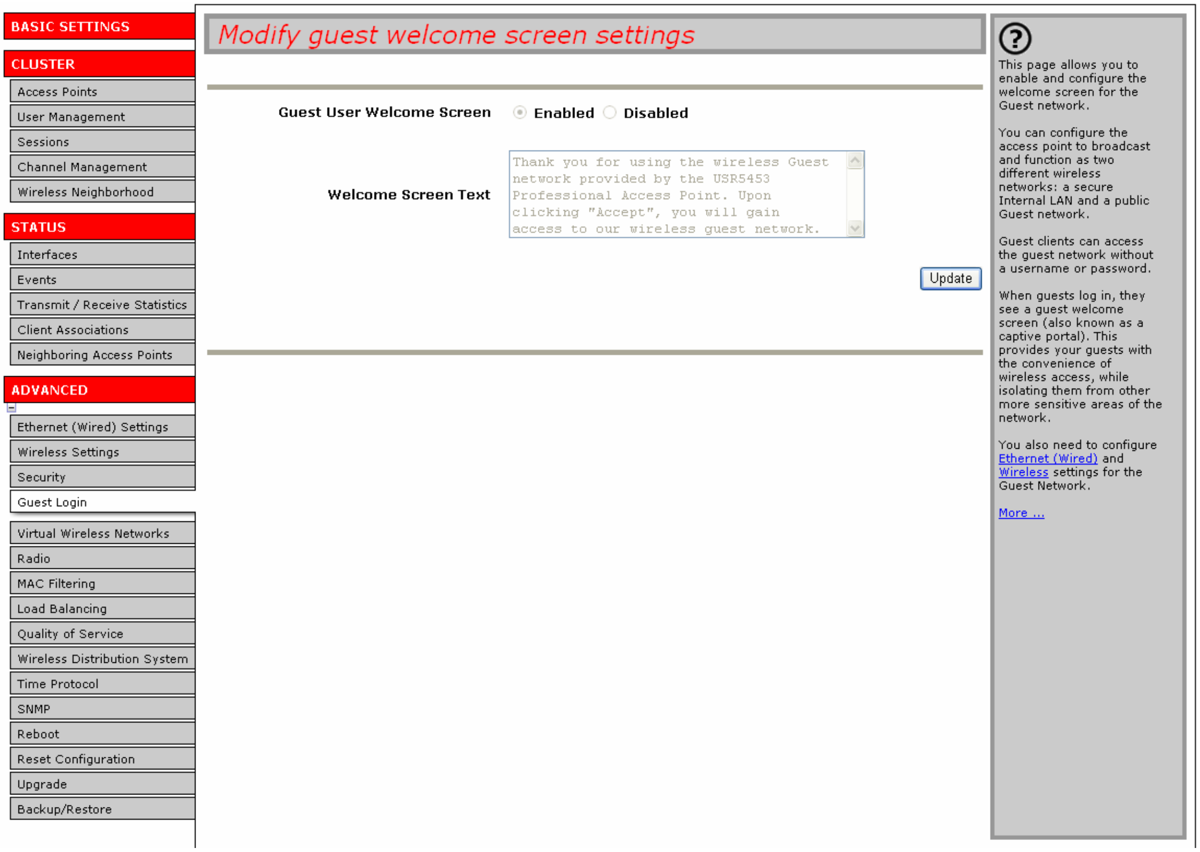
3. Provide the radio interface settings and network names (SSIDs) for both Internal and Guest networks as described in "Wireless Settings" on page 87.

4. Configure the guest splash screen as described below.

Configuring the Welcome Screen (Captive Portal)

You can set up or modify the Welcome screen that guest clients see when they open a Web browser or try to browse the Web. To set up the captive portal, do the following.

1. Click the Advanced menu's **Guest Login** tab.



Modify guest welcome screen settings

Guest User Welcome Screen ● Enabled ○ Disabled

Welcome Screen Text: Thank you for using the wireless Guest network provided by the USR5453 Professional Access Point. Upon clicking "Accept", you will gain access to our wireless guest network.

This page allows you to enable and configure the welcome screen for the Guest network.

You can configure the access point to broadcast and function as two different wireless networks: a secure Internal LAN and a public Guest network.

Guest clients can access the guest network without a username or password.

When guests log in, they see a guest welcome screen (also known as a captive portal). This provides your guests with the convenience of wireless access, while isolating them from other more sensitive areas of the network.

You also need to configure Ethernet (Wired) and Wireless settings for the Guest Network.

More ...

2. Choose **Enabled** to activate the Welcome screen.

3. In the **Welcome Screen Text** field, type the text message that you would like guest clients to see on the captive portal.

4. Click **Update** to apply the changes.

Using the Guest Network

Once the guest network is configured, a client can access the guest network as follows:

1. A guest client enters an area of coverage and scans for wireless networks.

2. The guest network advertises itself via a Guest SSID or a similar name, depending on how the guest SSID is specified in the Web User Interface for the Guest interface.

3. The guest chooses Guest SSID.

4. The guest starts a Web browser and receives a Guest Welcome screen.

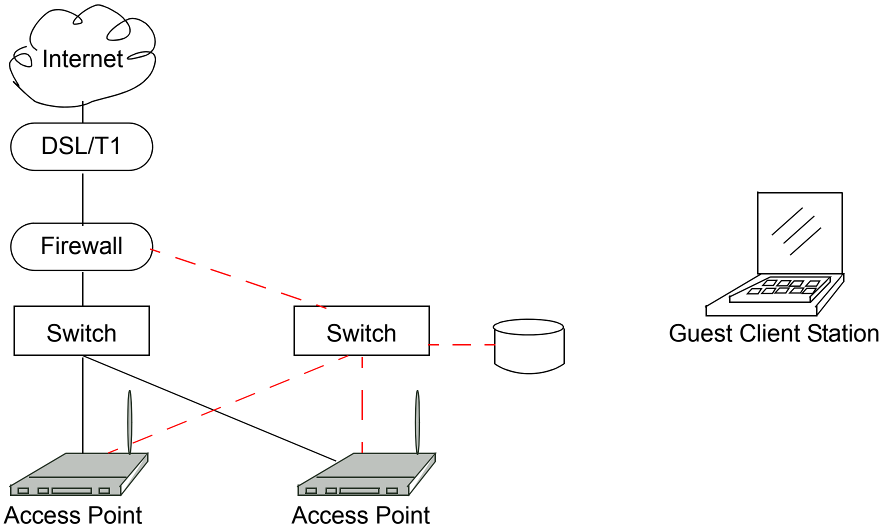
5. The Guest Welcome Screen provides a button for the guest to click to continue.

6. The guest client is now enabled to use the guest network.

Deployment Example

In the figure below, the dotted red lines indicate dedicated guest connections.

All access points and all connections, including guests, are administered from the same Professional Access Point Web User Interface.



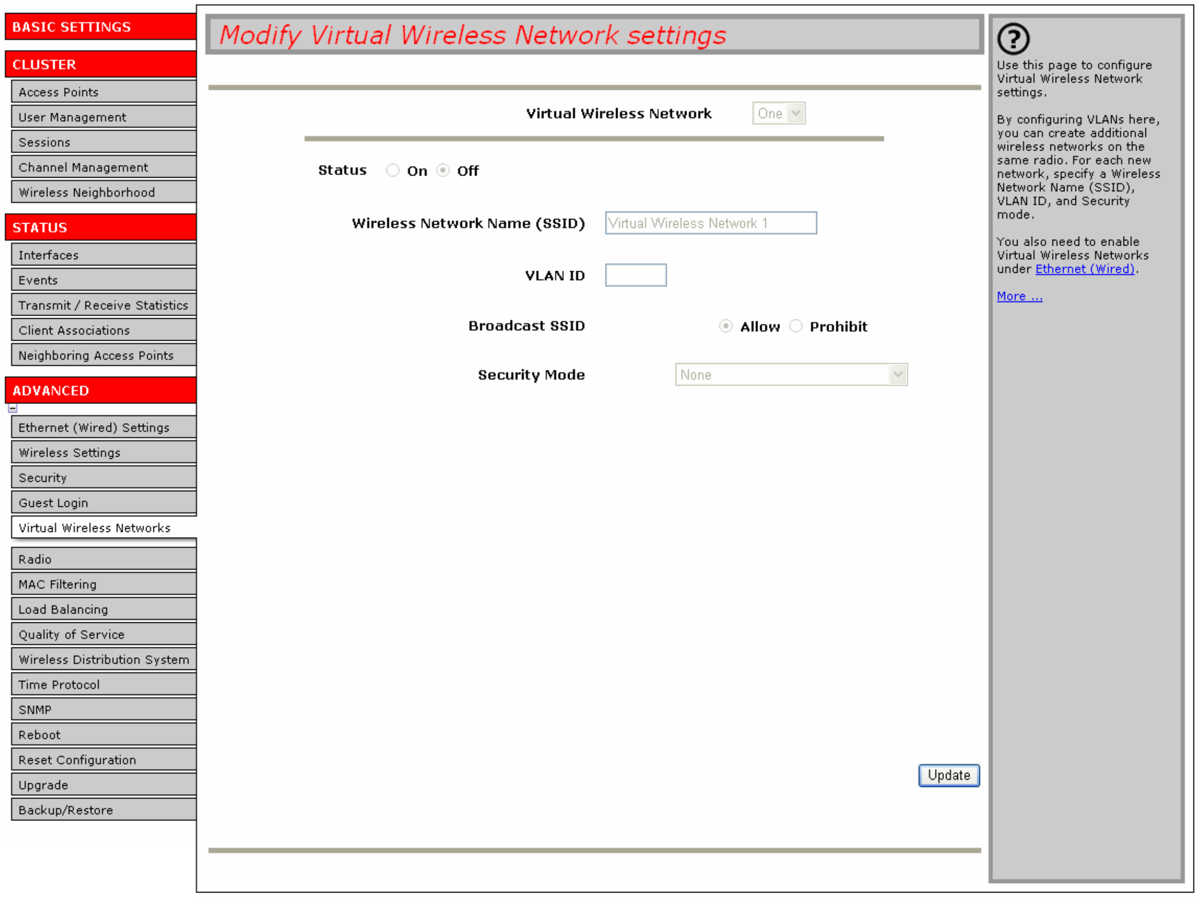
Virtual Wireless Networks

The following sections describe how to configure multiple wireless networks on Virtual LANs (VLANs):

- Navigating to Virtual Wireless Network Settings
- Configuring VLANs
- Updating Settings

Navigating to Virtual Wireless Network Settings

To set up multiple networks on VLANs, click the Advanced menu's **Virtual Wireless Networks** tab, and update the fields as described below.



Modify Virtual Wireless Network settings

Virtual Wireless Network: One

Status ○ On ● Off

Wireless Network Name (SSID): Virtual Wireless Network 1

VLAN ID:

Broadcast SSID ● Allow ○ Prohibit

Security Mode: None

Use this page to configure Virtual Wireless Network settings.

By configuring VLANs here, you can create additional wireless networks on the same radio. For each new network, specify a Wireless Network Name (SSID), VLAN ID, and Security mode.

You also need to enable Virtual Wireless Networks under Ethernet (Wired).

More ...

Configuring VLANs

Notes / Cautions

- To configure additional networks on VLANs, you must first enable Virtual Wireless Networks on the Ethernet (Wired) interface. See “Enabling and Disabling Virtual Wireless Networks on the Access Point” on page 82.
- If you configure VLANs, you may lose connectivity to the access point. First, be sure to verify that the switch and DHCP server you are using can support VLANs per the IEEE 802.1Q standard. After configuring VLANs, physically reconnect the Ethernet cable on the switch to the tagged packet (VLAN) port. Then, reconnect via the Web User Interface to the new IP address. (If necessary, check with the infrastructure support administrator regarding the VLAN and DHCP configurations.)

Field	Description
Virtual Wireless Network	Choose one of the following from the drop-down list to identify an additional network to configure: • **One** • **Two**
Status	You can enable or disable a configured network. • To enable the specified network, click **On**. • To disable the specified network, click **Off**.
Wireless Network Name (SSID)	Enter a name for the wireless network as a character string. This name will apply to all access points on this network. As you add more access points, they will share this SSID. The *Service Set Identifier* (SSID) is an alphanumeric string of up to 32 characters **Note:** If you are connected as a wireless client to the same access point that you are administering, resetting the SSID will cause you to lose connectivity to the access point. You will need to reconnect to the new SSID after you save this new setting.
VLAN ID	Provide a number between 1 and 4094 for the Internal VLAN. This will cause the access point to send DHCP requests with the VLAN tag. The switch and the DHCP server must support VLAN IEEE 802.1Q frames. The access point must be able to reach the DHCP server. Check with the Administrator regarding the VLAN and DHCP configurations.

Field	Description
Broadcast SSID	Select the **Broadcast SSID** setting by clicking the "Allow" or "Prohibit" radio button. By default, the access point broadcasts (allows) the *Service Set Identifier* (SSID) in its beacon frames. You can suppress (prohibit) this broadcast to discourage stations from automatically discovering your access point. When the access point's broadcast SSID is suppressed, the network name will not be displayed in the List of Available Networks on a client device. Instead, the client must have the exact network name configured in the supplicant before it will be able to connect. **Note:** The Broadcast SSID you set here is specifically for this Virtual Network (One or Two). Other networks continue to use the security modes already configured: • Your original Internal network (configured on Advanced menu's Ethernet [Wired] page) uses the Broadcast SSID set on Advanced menu's Security page. • If a Guest network is configured, the Broadcast SSID is always allowed.
Security Mode	Select the **Security Mode** for this VLAN. Select one of the following: • **None** • Static WEP • IEEE 802.1x • WPA/WPA2 Personal (PSK) • WPA/WPA2 Enterprise (RADIUS) **Note:** The Security mode you set here is specifically for this Virtual Network (One or Two). Other networks continue to use the security modes already configured: • Your original Internal network uses the Security mode set on the Advanced menu's Security page. • If a Guest network is configured, it always uses **None**. For a comparison of the available security modes, see "How Do I Know Which Security Mode to Use?" on page 91.

Updating Settings

To apply your changes, click **Update**.

Radio

The following sections describe how to configure Radio Settings on the Professional Access Point:

- Understanding Radio Settings
- Navigating to Radio Settings
- Configuring Radio Settings
- Updating Settings

Understanding Radio Settings

Radio settings directly control the behaviour of the radio device in the access point and its interaction with the physical medium, that is, how and what type of electromagnetic waves the access point emits. You can specify whether the radio is on or off, radio frequency (RF) broadcast channel, beacon interval (amount of time between access point beacon transmissions), transmit power, IEEE 802.11 mode in which the radio operates, and so on.

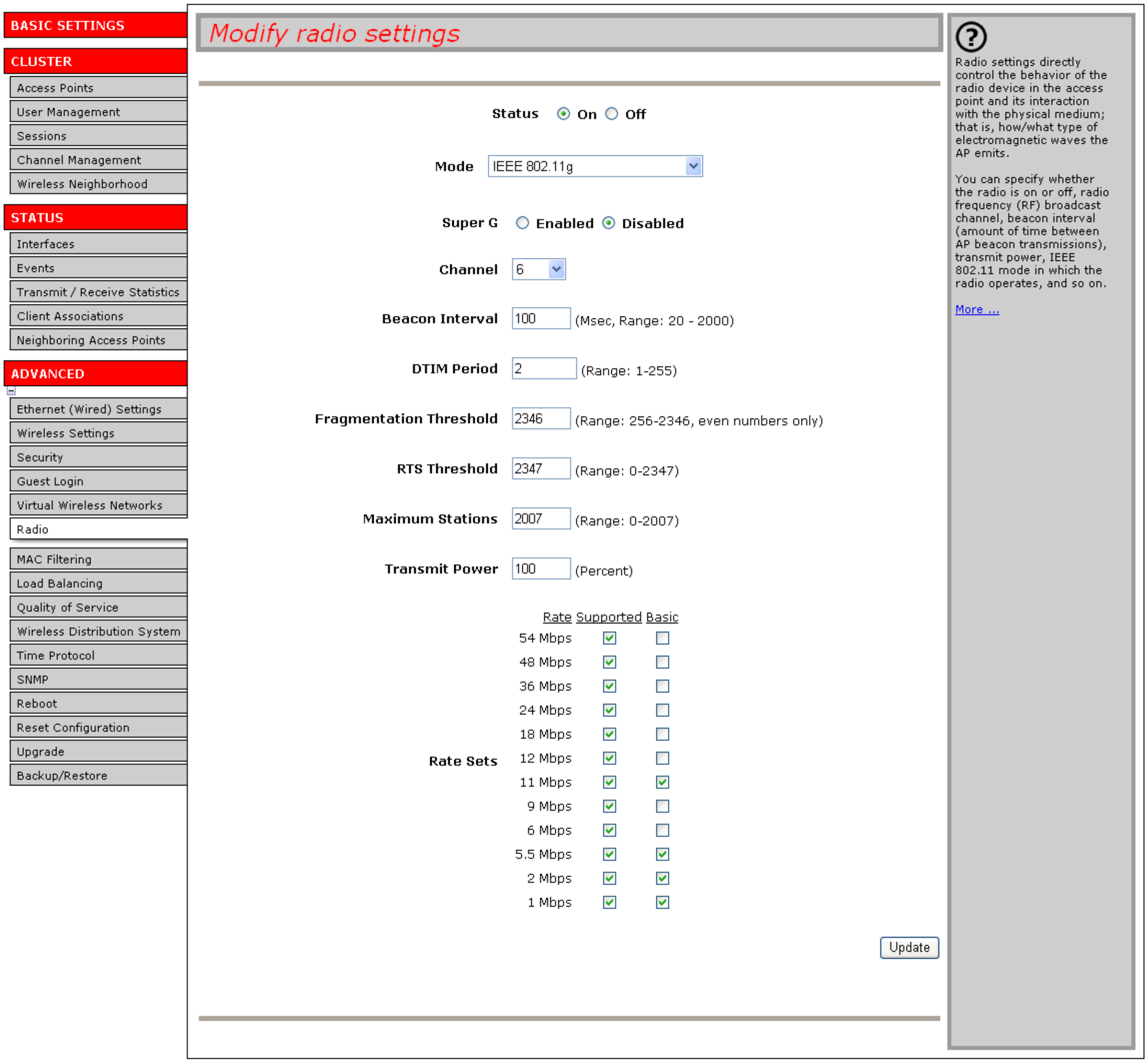
The Professional Access Point can broadcast in the following modes:

- IEEE 802.11b
- IEEE 802.11g

The IEEE mode along with other radio settings are configured as described in “Navigating to Radio Settings” on page 120 and “Configuring Radio Settings” on page 120.

Navigating to Radio Settings

To specify radio settings, click the Advanced menu's **Radio** tab, and update the fields as described below.



Modify radio settings

Status ● On ○ Off

Mode IEEE 802.11g

Super G ○ Enabled ● Disabled

Channel 6

Beacon Interval 100 (Msec, Range: 20 - 2000)

DTIM Period 2 (Range: 1-255)

Fragmentation Threshold 2346 (Range: 256-2346, even numbers only)

RTS Threshold 2347 (Range: 0-2347)

Maximum Stations 2007 (Range: 0-2007)

Transmit Power 100 (Percent)

Rate Sets

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

Radio settings directly control the behavior of the radio device in the access point and its interaction with the physical medium; that is, how/what type of electromagnetic waves the AP emits.

You can specify whether the radio is on or off, radio frequency (RF) broadcast channel, beacon interval (amount of time between AP beacon transmissions), transmit power, IEEE 802.11 mode in which the radio operates, and so on.

Configuring Radio Settings

Field	Description
Status (On/Off)	Specify whether you want the radio on or off by clicking **On** or **Off**.

Field	Description
Mode	The *Mode* defines the *Physical Layer* (PHY) standard being used by the radio. Select one of these modes: • **IEEE 802.11b** • **IEEE 802.11g** (the default). This mode allows both 802.11b and 802.11g clients to connect to the access point. To enable 802.11g clients only and deny acces to 802.11b clients, select a **Basic** rate that is not supported by 802.11b, such as 6Mbps. Basic rate options appear at the bottom of the Radio tab.
Super G	Enabling Super G provides better performance by increasing radio throughput for a radio mode. Keep in mind that with Super G enabled the access point transmissions will consume more bandwidth. • To enable Super G click **Enabled**. • To disable Super G click **Disabled**.
Channel	The Channel defines the portion of the radio spectrum that the radio uses for transmitting and receiving. The range of channels and the default channel are determined by the Mode of the radio interface. For most Modes, the default is **Auto**. Auto is the recommended mode because it automatically detects the best channel choices based on signal strength, traffic loads, and so on.
Beacon Interval	The *Beacon Interval* value is set in milliseconds. Enter a value within the range 20–2000. Beacon frames are transmitted by an access point at regular intervals to announce the existence of the wireless network. The default behaviour is to send a beacon frame once every 100 milliseconds (or 10 per second).
DTIM Period	Specify a DTIM period within the range 1–255. The *Delivery Traffic Information Map* (DTIM) message is an element included in some Beacon frames. It indicates which clients, currently sleeping in low-power mode, have data buffered on the access point awaiting pickup. The DTIM period you specify here indicates how often the clients served by this access point will check for buffered data still on the access point awaiting pickup. The measurement is the count of beacons. For example, if you set the DTIM period to 1, clients will check for buffered data on the access point at every beacon. If you set this to 10, clients will check at every 10th beacon.

Field	Description
Fragmentation Threshold	Specify a number within the range 256–2,346 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 set here, the fragmentation function will be activated and the packet will be sent as multiple 802.11 frames. If the packet being transmitted is equal to or less than the threshold, fragmentation will not be used. Setting the threshold to the largest value (2,346 bytes) effectively disables fragmentation. 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) may help with some interference problems; for example, with microwave ovens. By default, fragmentation is off. USRobotics recommends 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 an RTS Threshold value within the range 0–2347. The RTS threshold specifies the packet size of a request to send (RTS) transmission. This helps control traffic flow through the access point, 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	Enter a value within the range 0–2007. Specify the maximum number of stations allowed to access this access point at any one time.

Field	Description
Transmit Power	Provide a percentage value to set the transmit power for this access point. The default is to have the access point transmit using 100 percent of its power. ▶ Recommendations: • For most cases, USRobotics recommends using the default and having the transmit power set to 100 percent. This is more cost-efficient because it gives the access point 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 will help 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.
Rate Sets	Select the transmission rate sets that you want the access point to support and the basic rate sets you want the access point to advertise. Rates are expressed in megabits per second. • **Supported Rate Sets** indicate rates that the access point supports. You can select multiple rates. The access point will automatically choose the most efficient rate based on factors like error rates and distance of clients from the access point. • **Basic Rate Sets** indicate rates that the access point will advertise to the network for the purposes of setting up communication with other APs and clients on the network. It is generally more efficient to have an access point broadcast a subset of its supported rate sets. The highest basic rate selected is also the access point's multicast rate. To transmit multicast packets at a higher rate than the default of 11Mbps, select a higher **Basic** Rate.

Updating Settings

To apply your changes, click **Update**.

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 `FE:DC:BA:09:87:65`.

Each wireless network interface card (NIC) used by a wireless client has a unique MAC address.

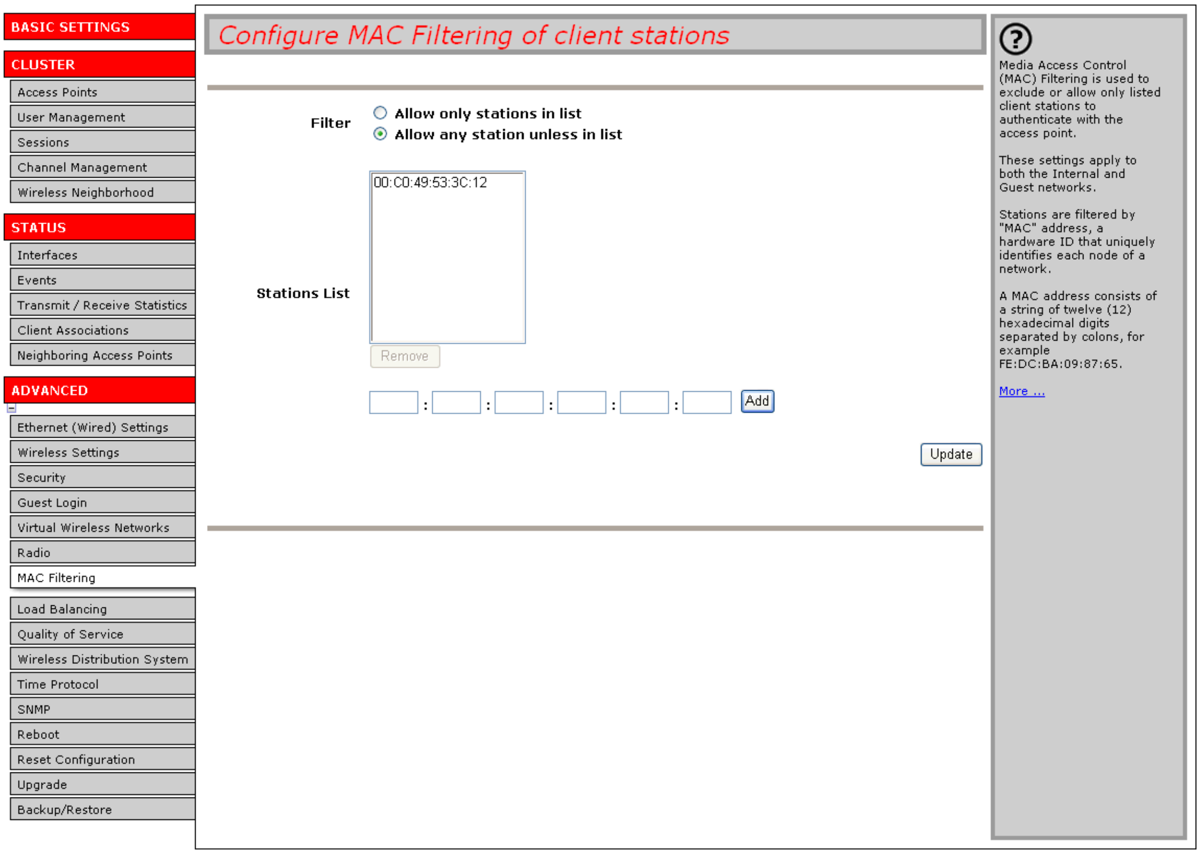
You can control client access to your wireless network by switching on MAC Filtering and specifying a list of approved MAC addresses. When MAC Filtering is on, only clients with approved MAC addresses can access the network.

The following sections describe how to use MAC address filtering on the Professional Access Point:

- Navigating to MAC Filtering Settings
- Using MAC Filtering
- Updating Settings

Navigating to MAC Filtering Settings

To enable filtering by MAC address, click the Advanced menu's **MAC Filtering** tab, and update the fields as described below.



Configure MAC Filtering of client stations

Filter
○ Allow only stations in list
● Allow any station unless in list

Stations List
00:C0:49:53:3C:12

Media Access Control (MAC) Filtering is used to exclude or allow only listed client stations to authenticate with the access point.

These settings apply to both the Internal and Guest networks.

Stations are filtered by "MAC" address, a hardware ID that uniquely identifies each node of a network.

A MAC address consists of a string of twelve (12) hexadecimal digits separated by colons, for example FE:DC:BA:09:87:65.

Using MAC Filtering

This page allows you to control access to Professional Access Point based on *Media Access Control* (MAC) addresses. You can choose to *allow* access by listed MAC addresses or *prevent* access by listed MAC addresses.

For the Guest interface, MAC Filtering settings apply to both BSSes.

Field	Description
Filter	To set the MAC Address **Filter**, select one of the following options: • **Allow only stations in the list** • **Allow any station unless in list**

Field	Description
Stations List	To add a MAC Address to the Stations List, type the 48-bit MAC address into the lower text boxes, then click **Add**. The MAC Address is added to the Stations List. To remove a MAC Address from the Stations List, select its 48-bit MAC address, then click **Remove**. The stations in the list will be either allowed to access or prevented from accessing the access point depending on the value that you chose for **Filter**.

Updating Settings

To apply your changes, click **Update**.

Load Balancing

The Professional Access Point allows you to balance the distribution of wireless client connections across multiple access points. Using load balancing, you can prevent the performance degradation that results when a single access point handles a disproportionate share of the wireless traffic.

The following sections describe how to configure Load Balancing on your wireless network:

- Understanding Load Balancing
    - Identifying the Imbalance: Overworked or Under-utilized Access Points
    - Specifying Limits for Utilization and Client Associations
    - Load Balancing and QoS
- Navigating to Load Balancing Settings
- Configuring Load Balancing
- Updating Settings

Understanding Load Balancing

Like most configuration settings on the Professional Access Point, load balancing settings are shared among clustered access points.

Note In some cases you might want to set limits for only one access point that is consistently over-utilized. You can apply unique settings to an access point if it is operating in standalone mode. (See “Understanding Clustering” on page 34 and “Navigating to Access Points Management” on page 34.)

Identifying the Imbalance: Overworked or Under-utilized Access Points

Comparison of Sessions data for multiple access points allows you to identify an access point that is consistently handling a disproportionately large percentage of wireless traffic. This can happen when location placement or other factors cause one access point to transmit the strongest signal to a majority of clients on a network. By default, that access point will receive most of client requests while the other access points stay idle much of the time.

Imbalances in distribution of wireless traffic across access points will be evident in Sessions statistics, which will show higher utilization rates on overworked APs and higher Idle times on under-utilized APs. An access point that is handling a disproportionate amount of traffic might also show slower data rates or lower transmit and receive rates due to the overload.

Specifying Limits for Utilization and Client Associations

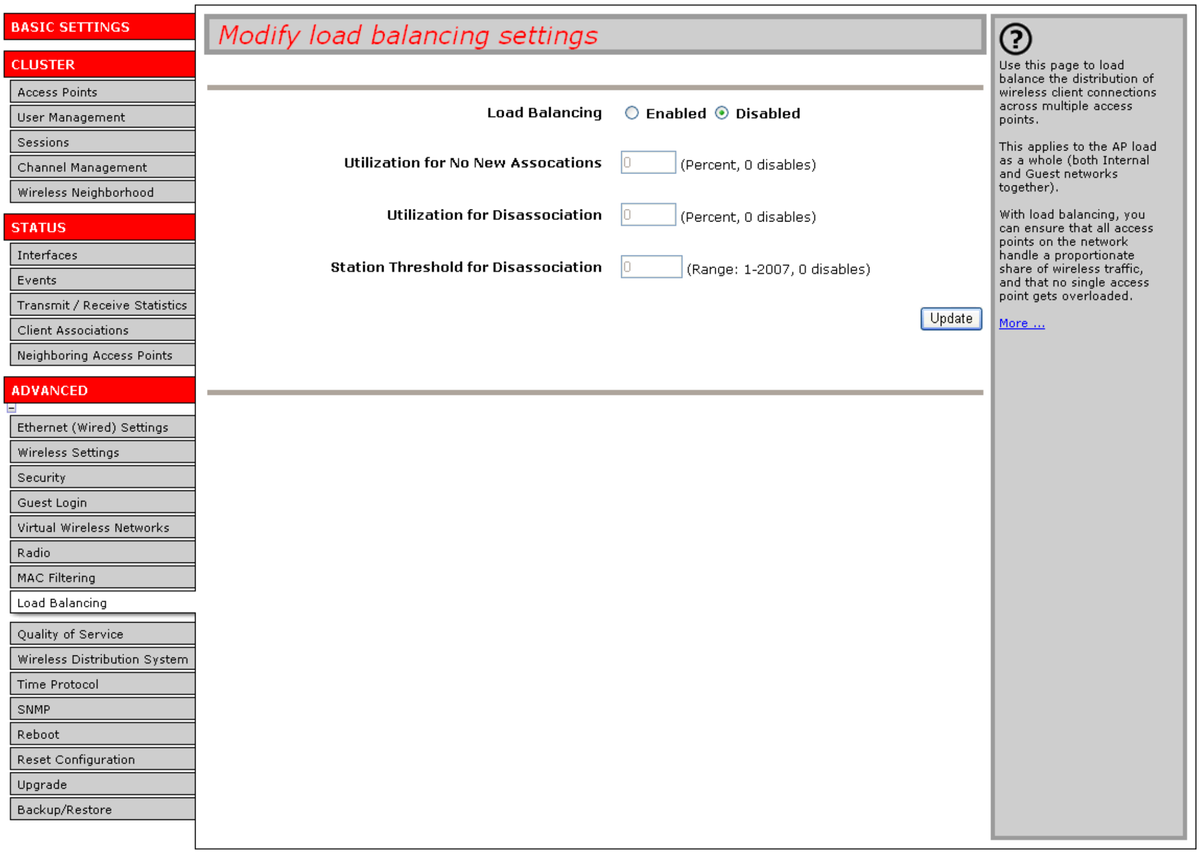
You can correct for imbalances in network access point utilization by enabling load balancing and setting limits on utilization rates and number of client associations allowed per access point.

Load Balancing and QoS

Load balancing contributes to *Quality of Service* (QoS) for *Voice Over IP* (VoIP) and other such time-sensitive applications competing for bandwidth and timely access to the air waves on a wireless network. For more information about configuring your network for QoS, see “Quality of Service” on page 133.

Navigating to Load Balancing Settings

In the Web User Interface, click the Advanced menu’s **Load Balancing** tab, and update the fields as described in the next section.



Modify load balancing settings

Load Balancing ○ Enabled ● Disabled

Utilization for No New Assocations 0 (Percent, 0 disables)

Utilization for Disassociation 0 (Percent, 0 disables)

Station Threshold for Disassociation 0 (Range: 1-2007, 0 disables)

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

This applies to the AP load as a whole (both Internal and Guest networks together).

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.

Configuring Load Balancing

To configure load balancing, enable **Load Balancing** and set limits and behaviour to be triggered by a specified utilization rate of the access point.

Note

- To view the current Utilization Rates for access points, click the Cluster menu’s Sessions tab. (See “Sessions” on page 49.)
- When clients are disassociated from an access point, the network will provide continuous service if another access point is within range of the client. Clients should automatically retry the access points to which they were originally connected and then try other APs on the subnet. Clients who are disassociated from one access point will experience a seamless transition to another access point on the same subnet.
- Load Balancing settings apply to the access point load as a whole. When Guest access is enabled, the settings apply to both Internal and Guest networks together.

Field	Description
Load Balancing	To enable load balancing on this access point, click **Enable**. To disable load balancing on this access point, click **Disable**.
Utilization for No New Associations	Utilization rate limits relate to wireless bandwidth utilization. Provide a bandwidth utilization rate percentage limit for this access point to indicate when to stop accepting new client associations. When the utilization rate for this access point exceeds the specified limit, no new client associations will be allowed on this access point. If you specify 0 in this field, all new associations will be allowed regardless of the utilization rate.
Utilization for Disassociation	Utilization rate limits relate to wireless bandwidth utilization. Provide a bandwidth utilization rate percentage limit for this access point to indicate when to disassociate current clients. When the utilization rate exceeds the specified limit, a client currently associated with this access point will be disconnected. If you specify 0 in this field, current clients will never be disconnected regardless of the utilization rate.
Stations Threshold for Disassociation	Specify the number of clients that you want as a stations threshold for disassociation. If the number of clients associated with the access point at any one time is equal to or less than the number you specify here, no client will be disassociated regardless of the **Utilization for Disassociation** value. Theoretically, the maximum number of clients allowed is 2007. ▶ USRobotics recommends setting the maximum to between 30 and 50 clients . This allows for a workable load on the access point, given that bandwidth is shared among the access point clients.

Updating Settings

To apply your changes, click **Update Settings**.

Quality of Service

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; and traditional IP data.

The following sections describe how to configure Quality of Service queues on the Professional Access Point:

- Understanding QoS
  - QoS and Load Balancing
  - 802.11e and WMM Standards Support
  - QoS Queues and Parameters to Coordinate Traffic Flow
- Navigating to QoS Settings
- Configuring QoS Queues
  - Configuring AP EDCA Parameters
  - Enabling/Disabling Wi-Fi Multimedia
  - Configuring Station EDCA Parameters
- Updating Settings

Understanding QoS

A primary factor that affects QoS is network congestion due to an increased number of clients attempting to access the air waves and higher traffic volume competing for bandwidth during a busy time of day. The most noticeable degradation in service on a busy, overloaded network will be evident in time-sensitive applications like video, *Voice-over-IP* (VoIP), and streaming media.

Unlike typical data files, which are less affected by variability in QoS, video, VoIP and streaming media must be sent in a specific order at a consistent rate and with minimum delay between Packet transmissions. If the quality of service is compromised, the audio or video will be distorted.

QoS and Load Balancing

By using a combination of load balancing (see “Load Balancing” on page 129) and QoS techniques, you can provide a high quality of service for time-sensitive applications, even on a busy network. Load balancing is a way of better distributing the traffic volume across access points. QoS is a means of allocating bandwidth and network access based on transmission priorities for different types of wireless traffic within a single access point.

802.11e and WMM Standards Support

QoS describes a range of technologies for controlling data streams on shared network connections. The

IEEE 802.11e task group is in the process of defining a QoS standard for transmission quality and availability of service on wireless networks. QoS is designed to provide better network service by minimizing network congestion; limiting Jitter, Latency, and Packet Loss; supporting dedicated bandwidth for time-sensitive or mission critical applications; and prioritising wireless traffic for channel access.

As with all IEEE 802.11 working group standards, the goal is to provide a standard way of implementing QoS features so that components from different companies are interoperable.

The Professional Access Point provides QoS based on the *Wireless Multimedia* (WMM) specification and *Wireless Multimedia* (WMM) standards, which are implementations of a subset of 802.11e features.

Both access points and wireless clients can be WMM-enabled.

QoS Queues and Parameters to Coordinate Traffic Flow

Configuring QoS options on the Professional Access Point consists of setting parameters on existing queues for different types of wireless traffic. You can configure different minimum and maximum wait times for the transmission of packets in each queue based on the requirements of the media being sent. Queues automatically provide minimum transmission delay for voice, video, multimedia, and mission-critical applications and rely on best-effort parameters for traditional IP data.

For example, time-sensitive voice, video, and multimedia are given effectively higher priority for transmission (lower wait times for channel access), while other applications and traditional IP data—which are less time-sensitive but often more data-intensive—are expected to tolerate longer wait times.

The Professional Access Point implementation of QoS is based on the IEEE Wireless Multimedia (WMM) standard. A Linux-based queuing class is used to tag packets and establish multiple queues. The queues provided offer built-in prioritisation and routing based on the type of data being transmitted.

The Web User Interface provides a way for you to configure parameters on the queues.

QoS Queues and Type of Service (ToS) on Packets

QoS on the Professional Access Point uses WMM information in the IP packet header related to Type of Service (ToS). Every IP packet sent over the network includes a ToS field in the header that indicates how the data is to be prioritised and transmitted over the network. The ToS field consists of a 3- to 7-bit value with each bit representing a different aspect or degree of priority for this data as well as other meta-information (low delay, high throughput, high reliability, low cost, and so on).

For example, the ToS for FTP data packets is likely to be set for maximum throughput since the critical consideration for FTP is the ability to transmit bulk data. Interactive feedback is a benefit in this situation but certainly is less critical than the FTP data itself. VoIP data packets are set for minimum delay because time is a critical factor in quality and performance for that type of data.

The access point examines the ToS field in the header of each packet that passes through the access point. Based on the value in a packet's ToS field, the access point prioritises the packet for transmission by assigning it to one of the queues. This process occurs automatically, regardless of whether you deliberately configure QoS or not.

A different type of data is associated with each queue. The queue and associated priorities and parameters for transmission are as follows:

- **Data 0 (Voice)**. Highest priority queue, minimum delay. Time-sensitive data such as Voice over IP (VoIP) is automatically sent to this queue.

- **Data 1 (Video)**. High priority queue, minimum delay. Time-sensitive data such as Video and other streaming media are 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).

Packets in a higher priority queue will be transmitted before packets in a lower priority queue. Interactive data in the queues labeled "Data 0" and "Data 1" is always sent first, best effort data in "Data 2" is sent next, and Background (bulk) data in "Data 3" is sent last. Each lower-priority queue (class of traffic) gets bandwidth that is left over after the higher classes of traffic have been sent. At an extreme end if you have enough interactive data to keep the access point busy all the time, low priority traffic would never get sent.

Using the QoS settings in the Web User Interface, you can configure *Enhanced Distributed Channel Access* (EDCA) parameters that determine how each queue is treated when it is sent by the access point to the client or by the client to the access point.

Note Wireless traffic travels:

- Downstream from the access point to the client
- Upstream from client to access point
- Upstream from access point to network
- Downstream from network to access point

With WMM enabled, QoS settings on the Professional Access Point affect the first two of these; *downstream* traffic flowing from the access point to client (access point EDCA parameters) and the *upstream* traffic flowing from the client to the access point (station EDCA parameters).

With WMM disabled, you can still set some parameters on the downstream traffic flowing from the access point to the client (access point EDCA parameters).

Traffic flow to and from the network is not under control of the QoS settings on the access point.

EDCF Control of Data Frames and Arbitration Interframe Spaces

Data is transmitted over 802.11 wireless networks in *frames*. A *Frame* consists of a discrete portion of data along with descriptive meta-information packaged for transmission on a wireless network.

Note A Frame is similar in concept to a *Packet*, the difference being that a packet operates on the Network layer (layer 3 in the OSI model) whereas a frame operates on the Data-Link layer (layer 2 in the OSI model).

Each frame includes a source and destination MAC address, a control field with protocol version, frame type, frame sequence number, frame body (with the actual information to be transmitted) and frame check sequence for error detection.

The 802.11 standard defines various frame types for management and control of the wireless infrastructure, and for data transmission. 802.11 frame types are (1) *management frames*, (2) *control frames*, and (3) *data frames*. Management and control frames, which manage and control the availability of the wireless infrastructure, automatically have higher priority for transmission.

802.11e uses *interframe spaces* to regulate which frames get access to available channels and to coordinate wait times for transmission of different types of data.

Management and control frames wait a minimum amount of time for transmission: they wait a *short interframe space* (SIF). These wait times are built into 802.11 as infrastructure support and are not configurable.

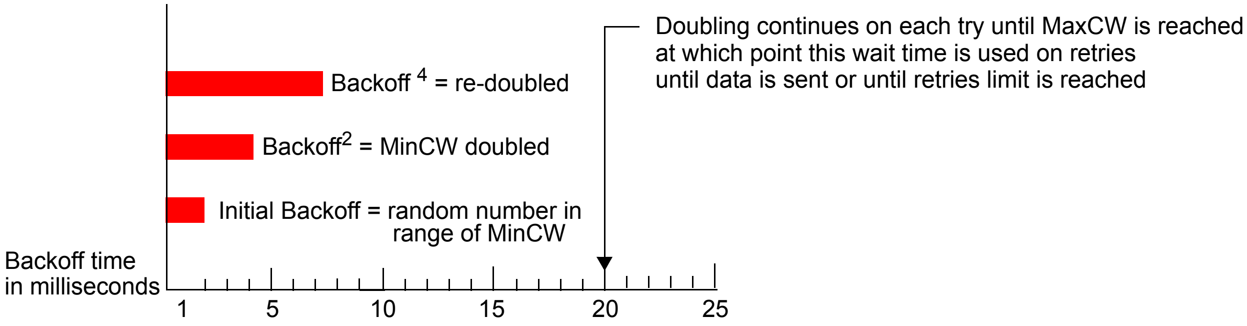
The Professional Access Point supports the *Enhanced Distribution Coordination Function* (EDCF) as defined by the 802.11e standard. EDCF, which is an enhancement to the DCF standard and is based on CSMA/CA protocol, defines the interframe space (IFS) between *data frames*. Data frames wait for an amount of time defined as the *arbitration interframe space* (AIFS) before transmitting. The AIFS parameter is configurable.

(Note that sending data frames in AIFS allows higher priority management and control frames to be sent in SIFs first.)

The AIFS ensures that multiple access points do not try to send data at the same time but instead wait until a channel is free.

Random Backoff and Minimum / Maximum Contention Windows

If an access point detects that the medium is in use, it uses the DCF *random backoff* timer to determine the amount of time to wait before attempting to access a given channel again. Each access point waits a random period of time between retries. The wait time (initially a random value within a range specified as the *Minimum Contention Window*) increases exponentially up to a specified limit (*Maximum Contention Window*). The random delay avoids most of the collisions that would occur if multiple APs got access to the medium at the same time and tried to transmit data simultaneously. The greater the number of active users on a network, the more significant the performance gains of the backoff timer will be due to the reduction in the number of collisions and retransmissions.


Backoff 4 = re-doubled
Backoff2 = MinCW doubled
Initial Backoff = random number in range of MinCW
Backoff time in milliseconds
1
5
10
15
20
25
Doubling continues on each try until MaxCW is reached at which point this wait time is used on retries until data is sent or until retries limit is reached

The random backoff used by the access point is a configurable parameter. To describe the random delay, a Minimum Contention Window (**cwMin**) and a Maximum Contention Window (**cwMax**) is defined.

- The value specified for the Minimum Contention Window is the upper limit of a range for the initial random backoff wait time. The number used in the random backoff is initially a random number between 0 and the number defined for the Minimum Contention Window.

- If the first random backoff time ends before successful transmission of the data frame, the access point increments a retry counter, and doubles the value of the random backoff window. The value specified in the Maximum Contention Window is the upper limit for this doubling of the random backoff. This doubling continues until either the data frame is sent or the Maximum Contention Window size is reached.

Packet Bursting for Better Performance

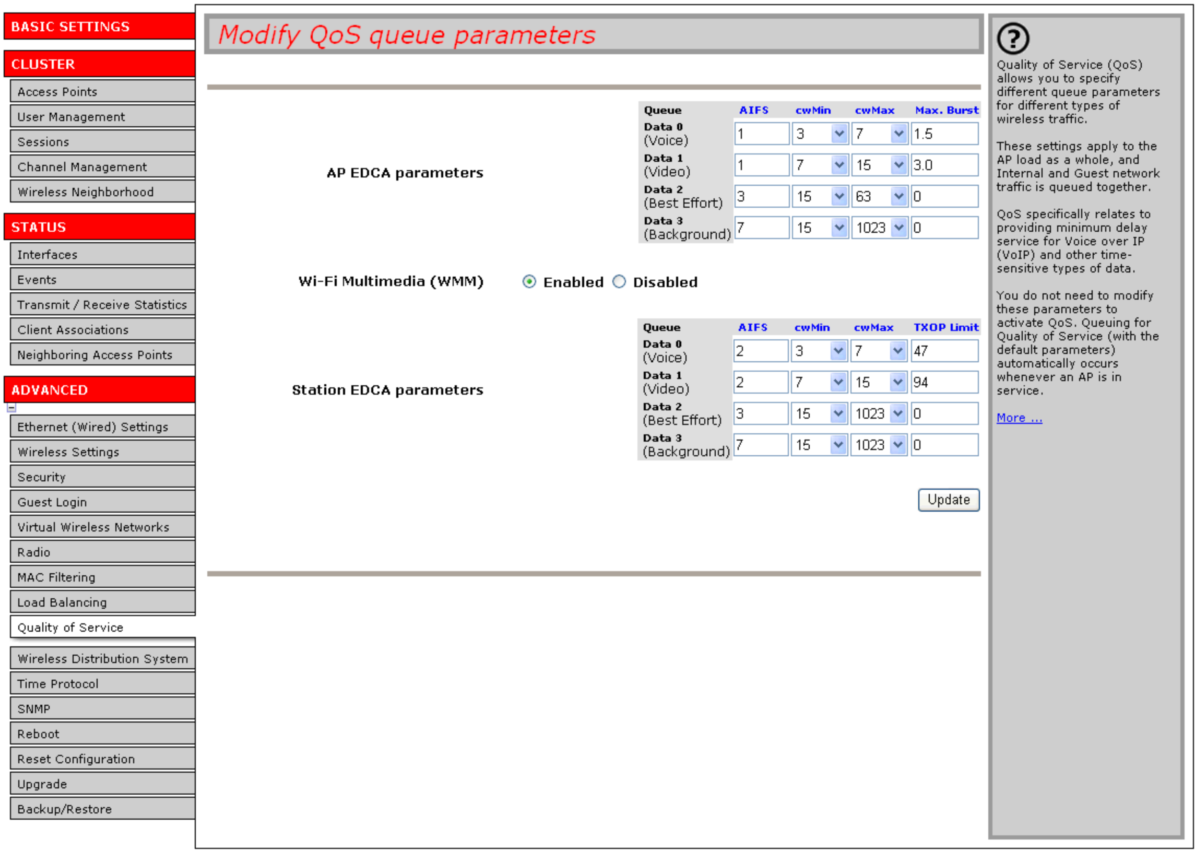
The Professional Access Point includes 802.11e based *packet bursting* technology that increases data throughput and speed of transmission over the wireless network. Packet bursting enables the transmission of multiple packets without the extra overhead of header information. The effect of this is to increase network speed and data throughput. The size of packet bursts allowed (maximum burst length) is a configurable parameter.

Transmission Opportunity (TXOP) Interval for Client Stations

The *Transmission Opportunity* (TXOP) is an interval of time when a Wi-Fi Multimedia (WMM) client station has the right to initiate transmissions onto the wireless medium (WM).

Navigating to QoS Settings

To set up queues for QoS, click the Advanced menu’s **Quality of Service** tab, and configure settings as described below.



Modify QoS queue parameters

AP 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

Quality of Service (QoS) allows you to specify different queue parameters for different types of wireless traffic.

These settings apply to the AP load as a whole, and Internal and Guest network traffic is queued together.

QoS specifically relates to providing minimum delay service for Voice over IP (VoIP) and other time-sensitive types of data.

You do not need to modify these parameters to activate QoS. Queuing for Quality of Service (with the default parameters) automatically occurs whenever an AP is in service.

Configuring QoS Queues

Configuring Quality of Service (QoS) on the Professional Access Point consists of setting parameters on existing queues for different types of wireless traffic, and effectively specifying minimum and maximum wait times (via *Contention Windows*) for transmission. The settings described here apply to data transmission behaviour on the access point only, not to that of the client stations.

Notes

- For the Guest interface, QoS queue settings apply to the access point load as a whole (both BSSes together).
- Internal and Guest network traffic is always queued together.

Configuring Quality of Service includes:

- Configuring AP EDCA Parameters
- Enabling/Disabling Wi-Fi Multimedia
- Updating Settings

Configuring AP EDCA Parameters

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

Field	Description
Queue	Queues are defined for different types of data transmitted from the access point-to the client station: **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). For more information, see “QoS Queues and Parameters to Coordinate Traffic Flow” on page 134.
AIFS **(Inter-Frame Space)**	The *Arbitration Inter-Frame Spacing* (**AIFS**) specifies a wait time in milliseconds for data frames. Valid values for AIFS are 1 through 255. For more information, see “EDCF Control of Data Frames and Arbitration Inter-frame Spaces” on page 135.

Field	Description
cwMin **(Minimum Contention Window)**	This parameter is input to the algorithm that determines the initial random backoff wait time for retry of a transmission. Select a value from the list. The value selected for **cwMin** 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 in **cwMin**. 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. For more information, see “Random Backoff and Minimum / Maximum Contention Windows” on page 136.
cwMax **(Maximum Contention Window)**	Select a value that is higher than **cwMin**. The value specified for **cwMax** 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. For more information, see “Random Backoff and Minimum / Maximum Contention Windows” on page 136.
Max. Burst **(Maximum Burst Length)**	**AP EDCA Parameter Only**. The **Max. Burst Length** applies only to traffic flowing from the access point 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 999.9. For more information, see “Packet Bursting for Better Performance” on page 137.

Enabling/Disabling Wi-Fi Multimedia

By default, Wi-Fi MultiMedia (WMM) is enabled on the access point. With WMM enabled, QoS prioritisation and coordination of wireless medium access is on. With WMM enabled, QoS settings on the Professional Access Point control *downstream* traffic flowing from the access point to client station (access point EDCA parameters) and the *upstream* traffic flowing from the station to the access point (station EDCA parameters).

Disabling WMM will deactivate QoS control of station EDCA parameters on *upstream* traffic flowing from the station to the access point

With WMM disabled, you can still set some parameters on the downstream traffic flowing from the access point to the client station (access point EDCA parameters).

- To disable WMM extensions, click **Disabled**.
- To enable WMM extensions, click **Enabled**.

Configuring Station EDCA Parameters

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

Field	Description
Queue	Queues are defined for different types of data transmitted from the client station to the access point: **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). For more information, see “QoS Queues and Parameters to Coordinate Traffic Flow” on page 134.
AIFS **(Inter-Frame Space)**	The *Arbitration Inter-Frame Spacing* (AIFS) specifies a wait time (in milliseconds) for *data frames*. For more information, see “EDCF Control of Data Frames and Arbitration Interframe Spaces” on page 135.

Field	Description
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 here in the *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. For more information, see “Random Backoff and Minimum / Maximum Contention Windows” on page 136.
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. For more information, see “Random Backoff and Minimum / Maximum Contention Windows” on page 136.
TXOP Limit **(Transmission Opportunity Limit)**	**Station EDCA Parameter Only** (The TXOP Limit applies only to traffic flowing from the client station to the access point.) The *Transmission Opportunity* (TXOP) is an interval of time when a WME client station has the right to initiate transmissions onto the wireless medium (WM). This value specifies (in milliseconds) the *Transmission Opportunity* (TXOP) for client stations; that is, the interval of time when a WMM client station has the right to initiate transmissions on the wireless network.

Updating Settings

To apply your changes, click **Update**.

Wireless Distribution System

The Professional Access Point lets you connect multiple access points using a Wireless Distribution System (WDS). WDS allows access points to communicate with one another wirelessly in a standardized way. This capability is critical to 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.

The following sections describe how to configure the WDS on the Professional Access Point:

- Understanding the Wireless Distribution System
    - Using WDS to Bridge Distant Wired LANs
    - Using WDS to Extend the Network Beyond the Wired Coverage Area
    - Backup Links and Unwanted Loops in WDS Bridges
    - Security Considerations Related to WDS Bridges
- Navigating to WDS Settings
- Configuring WDS Settings
    - Example of Configuring a WDS Link
- Updating Settings

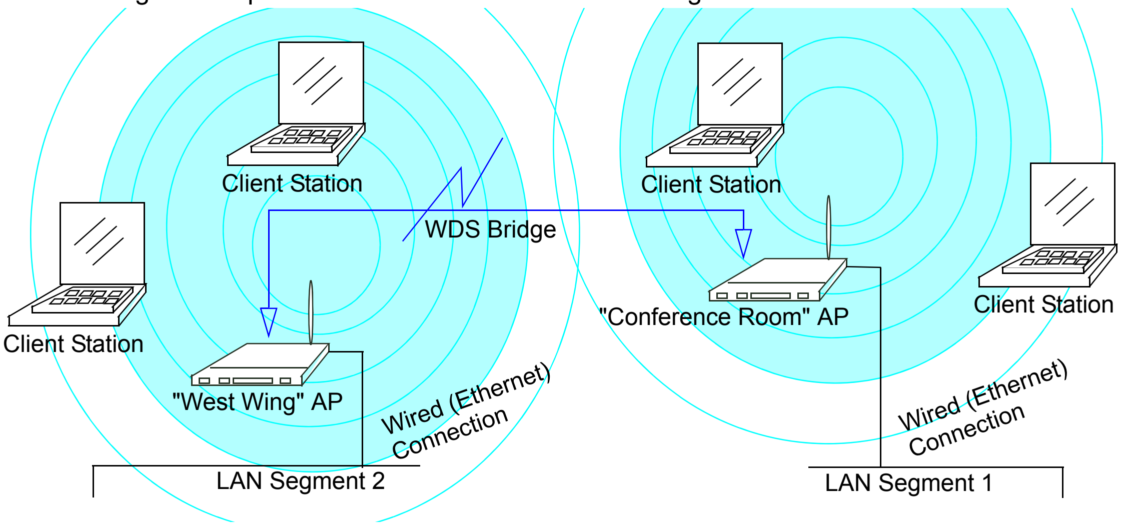
Understanding the Wireless Distribution System

A *Wireless Distribution System* (WDS) is an 802.11f technology that wirelessly connects access points, known as Basic Service Sets (BSS), to form what is known as an *Extended Service Set* (ESS).

Note A BSS generally equates to an access point deployed as a single-access-point wireless network. In cases where multi-BSSID features make a single access point look like two or more access points to the network, the access point has multiple unique BSSIDs.

Using WDS to Bridge Distant Wired LANs

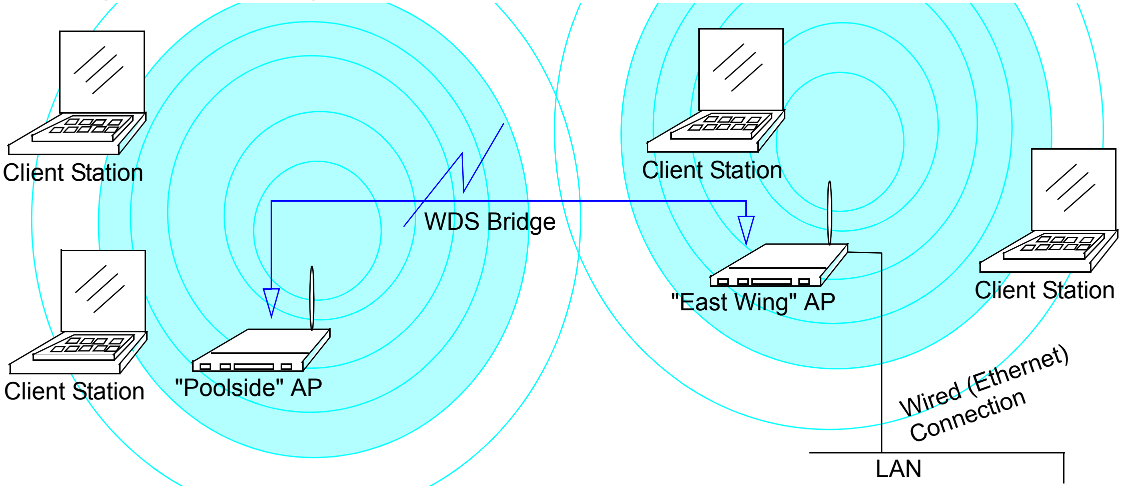
In an ESS—a network of multiple access points—each access point serves part of an area that is too large for a single access point to cover. You can use WDS to bridge distant Ethernets to create a single LAN. For example, suppose that you have one access point that is connected to the network by Ethernet and serving multiple clients in the Conference Room (LAN Segment 1), and another Ethernet-wired access point serving stations in the West Wing offices (LAN Segment 2). You can bridge the Conference Room and West Wing access points with a WDS link to create a single network for clients in both areas.



Using WDS to Extend the Network Beyond the Wired Coverage Area

An ESS can extend the reach of the network into areas where cabling would be difficult, costly, or inefficient.

For example, suppose you have an access point which is connected to the network by Ethernet and serving multiple clients in one area ("East Wing" in this example) but cannot reach other clients which are out of range. Suppose also that it is too difficult or too costly to wire the distant area with Ethernet cabling. You can solve this problem by placing a second access point closer to second group of stations ("Poolside" in this example) and bridge the two APs with a WDS link. This *extends* your network wirelessly by providing an extra hop to get to distant stations.



Backup Links and Unwanted Loops in WDS Bridges

Another use for WDS bridging, the creation of backup links, is not supported by the Professional Access Point. The topic is included here to emphasize that you should not try to use WDS in this way; backup links will result in unwanted, endless loops of data traffic.

If an access point provides *Spanning Tree Protocol* (STP), WDS can be used to configure backup paths between access points across the network. For example, between two access points you could have both a primary path via Ethernet and a secondary (backup) wireless path via a WDS link. If the Ethernet connection goes down, STP would reconfigure its map of the network and effectively fix the down network segment by activating the backup wireless path.

The Professional Access Point does not provide STP. Without STP, it is possible that both connections, or paths, may be active at the same time, resulting in an endless loop of traffic on the LAN.

Therefore, be sure not create loops with either WDS bridges or combinations of Wired (Ethernet) connections and WDS bridges.

For more information, see the "Do not create loops" note under “Configuring WDS Settings” on page 146.

Security Considerations Related to WDS Bridges

Static *Wired Equivalent Privacy* (WEP) is a data encryption protocol for 802.11 wireless networks. Both access points in a given WDS link must be configured with the same security settings. For static WEP, either a static 64-bit (40-bit secret key + 24-bit initialization vector (IV)) or 128-bit (104-bit secret key + 24-bit IV) Shared Key is specified for data encryption.

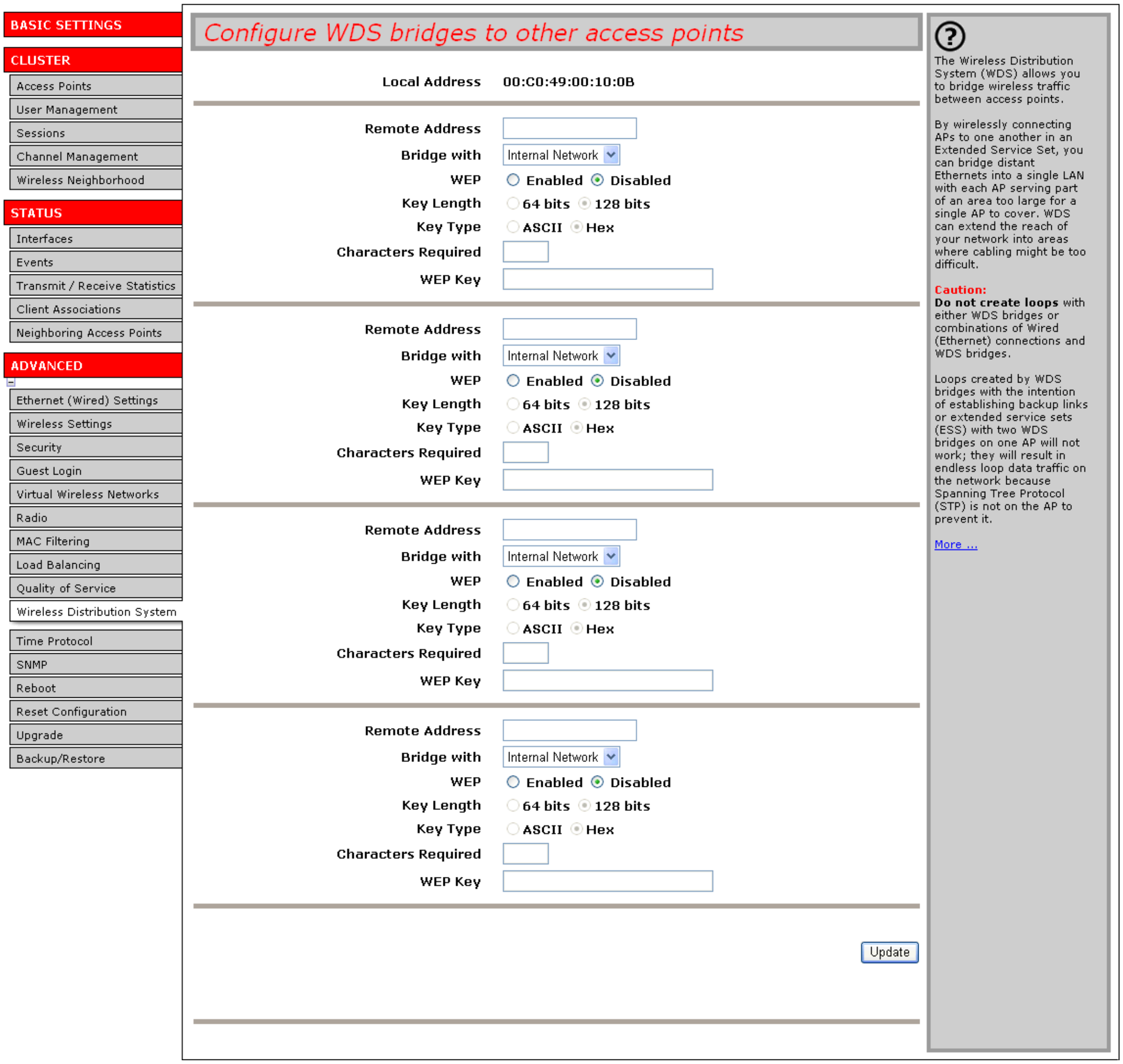
You can enable Static WEP on the WDS link (bridge). When WEP is enabled, all data exchanged between the two access points in a WDS link is encrypted using a fixed WEP key that you provide.

Static WEP is the only security mode available for the WDS link, and it does not provide effective data protection to the level of other security modes available for service to clients. If you use WDS on a LAN intended for secure wireless traffic you are putting your network at risk. Therefore, USRobotics recommends using WDS to bridge the Guest network only. Do not use WDS to bridge access points on the Internal network unless you are not concerned about the security risk for data traffic on that network.

For more information about the effectiveness of different security modes, see “Security” on page 91. This topic also covers use of **None** as the security mode for access-point-to-station traffic on the Guest network, which is intended for less sensitive data traffic.

Navigating to WDS Settings

To specify the details of traffic exchange from this access point to others, click the Advanced menu’s **Wireless Distribution System** tab, and update the fields as described below.



Configure WDS bridges to other access points

Local Address	00:C0:49:00:10:0B

Remote Address	
Bridge with	Internal Network
WEP	○ Enabled ● Disabled
Key Length	○ 64 bits ● 128 bits
Key Type	○ ASCII ● Hex
Characters Required	
WEP Key	

Remote Address	
Bridge with	Internal Network
WEP	○ Enabled ● Disabled
Key Length	○ 64 bits ● 128 bits
Key Type	○ ASCII ● Hex
Characters Required	
WEP Key	

Remote Address	
Bridge with	Internal Network
WEP	○ Enabled ● Disabled
Key Length	○ 64 bits ● 128 bits
Key Type	○ ASCII ● Hex
Characters Required	
WEP Key	

Remote Address	
Bridge with	Internal Network
WEP	○ Enabled ● Disabled
Key Length	○ 64 bits ● 128 bits
Key Type	○ ASCII ● Hex
Characters Required	
WEP Key	

The Wireless Distribution System (WDS) allows you to bridge wireless traffic between access points.

By wirelessly connecting APs to one another in an Extended Service Set, you can bridge distant Ethernets into a single LAN with each AP serving part of an area too large for a single AP to cover. WDS can extend the reach of your network into areas where cabling might be too difficult.

Caution:
Do not create loops with either WDS bridges or combinations of Wired (Ethernet) connections and WDS bridges.

Loops created by WDS bridges with the intention of establishing backup links or extended service sets (ESS) with two WDS bridges on one AP will not work; they will result in endless loop data traffic on the network because Spanning Tree Protocol (STP) is not on the AP to prevent it.

More ...

Configuring WDS Settings

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

Notes

- The only security mode available on the WDS link is Static WEP, which is not particularly secure. Therefore, USRobotics recommends using WDS to bridge the Guest network only. Do not use WDS to bridge access points on the Internal network unless you are not concerned about the security risk for data traffic on that network.
- When using WDS, be sure to configure WDS settings on *both* access points participating in the WDS link.
- You can have only one WDS link between any pair of access points. That is, a remote MAC address may appear only once on the WDS page for a particular access point.
- Both access points participating in a WDS link must be on the same radio channel and use the same IEEE 802.11 mode. (See “Radio” on page 119 for information on configuring the Radio mode and channel.)
- **Do not create loops** with either WDS bridges or combinations of Wired (Ethernet) connections and WDS bridges. *Spanning Tree Protocol* (STP), which manages path redundancy and prevent unwanted loops, is not available in the Professional Access Point. Keep these rules in mind when working with WDS on the access point:

  Any two access points can be connected by only a single path; either a WDS bridge (wireless) or an Ethernet connection (wired), but not both.

  Do not create backup links.

  If you can trace more than one path between any pair of APs going through any combination of Ethernet or WDS links, you have a loop.

  You can only extend or bridge either the Internal or Guest network but not both.

To configure WDS on this access point, describe each access point intended to receive hand-offs and send information to this access point. Each destination access point needs the following description:

Field	Description
Local Address	Indicates the Media Access Control (MAC) addresses for this access point. This is a read-only field.
Remote Address	Specify the MAC address of the destination access point; that is, the access point to which data will be sent and from which data will be received.
Bridge with	The Professional Access Point provides the capability of setting up guest and internal networks on the same access point. (See “Guest Login” on page 111.) The guest network typically provides internet access but isolates guest clients from more sensitive areas of your internal network. It is common to have security disabled on the guest network to provide open access. In contrast, the internal network provides full access to protected information behind a firewall and requires secure logins or certificates for access. When using WDS to link one access point to another, you need to identify the network within which you want the data exchange to occur. Specify the network to which you want to bridge this access point: • **Internal Network** • **Guest Network**

Field	Description
WEP	Specify whether you want Wired Equivalent Privacy (WEP) encryption enabled for the WDS link. • **Enabled** • **Disabled** Wired Equivalent Privacy (WEP) is a data encryption protocol for 802.11 wireless networks. Both access points on the WDS link must be configured with the same security settings. For static WEP, a 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.
Key Length	If WEP is enabled, specify the length of the WEP key: • **64 bits** • **128 bits**
Key Type	If WEP is enabled, specify the WEP key type: • **ASCII** • **Hex**
Characters Required	Indicates the number of characters required in the WEP key. The number of characters required updates automatically based on how you set key length and key type.
WEP Key	Enter a string of characters. • If you selected **ASCII** as your key type, enter any combination of `0-9`, `a-z`, and `A-Z`. • If you selected **HEX** as your key type, enter hexadecimal digits (any combination of `0-9` and `a-f` or `A-F`). These are the RC4 encryption keys shared with the stations using the access point.

Example of Configuring a WDS Link

When using WDS, be sure to configure WDS settings on both access points on the WDS link.

For example, to create a WDS link between the pair of access points `MyAP1` and `MyAP2` do the following:

1. Open the Web User Interface for MyAP1 by entering the IP address for MyAP1 as a URL in the Web browser address bar in the following form:

   ```
   http://IPAddressOfAccessPoint
   ```

   where *`IPAddressOfAccessPoint`* is the address of MyAP1.

2. Navigate to the WDS tab on MyAP1 Web User Interface.

The MAC address for MyAP1 (the access point you are currently viewing) will appear as the **Local Address** at the top of the page.

3. Configure a WDS interface for data exchange with MyAP2.

   Start by entering the MAC address for MyAP2 as the **Remote Address**, and fill in the rest of the fields to specify the network (guest or internal), security, and so on. Save the settings by clicking **Update**.

4. Navigate to the radio settings on the Web User Interface (Advanced menu's **Radio** tab) to verify or set the mode and the radio channel on which you want MyAP1 to broadcast.

   Remember that the two access points participating in the link, MyAP1 and MyAP2, must be set to the same mode and be transmitting on the same channel.

   For this example, suppose that you are using IEEE 802.11b mode and broadcasting on Channel 6. (Choose **Mode** and **Channel** from the drop-down lists on the Radio tab.)

5. Now repeat steps 1–4 for MyAP2:

   - Open the Web User Interface for MyAP2 by using MyAP2's IP address in a URL.

   - Navigate to the WDS tab on MyAP2 Web User Interface. MyAP2's MAC address will show as the **Local Address**.

   - Configure a WDS interface for data exchange with MyAP1, starting with the MAC address for MyAP1.

   - Navigate to the radio settings for MyAP2 to verify that it is using the same mode and broadcasting on the same channel as MyAP1. In this example, Mode is 802.11b and the channel is 6.

   - Be sure to save the settings by clicking **Update**.

Updating Settings

To apply your changes, click **Update**.

Time Protocol

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.

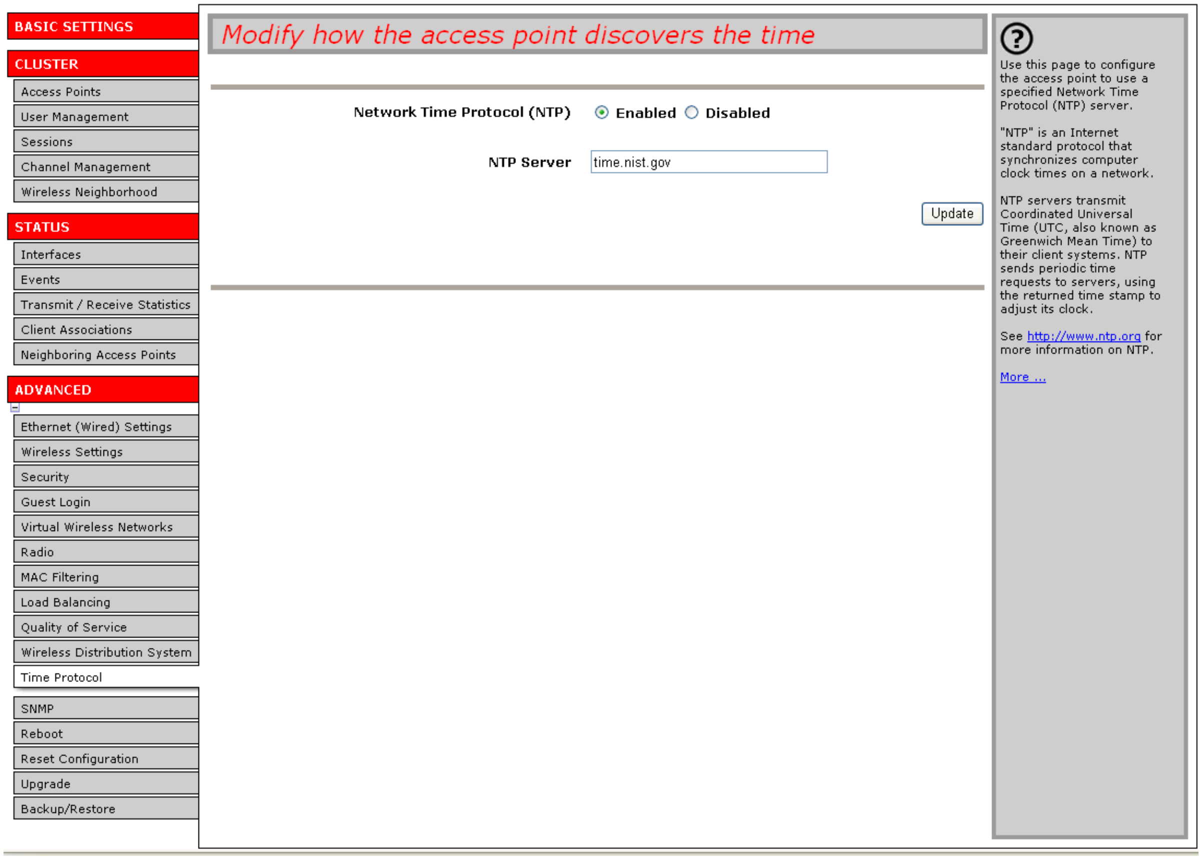
See http://www.ntp.org for more general information on NTP.

The following sections describe how to configure the Professional Access Point to use a specified NTP server:

- Navigating to Time Protocol Settings
- Enabling and Disabling a Network Time Protocol (NTP) Server
- Updating Settings

Navigating to Time Protocol Settings

To enable an NTP server, click the Advanced menu’s **Time Protocol** tab, and update the fields as described below.



Modify how the access point discovers the time

Network Time Protocol (NTP) ● Enabled ○ Disabled

NTP Server time.nist.gov

Use this page to configure the access point to use a specified Network Time Protocol (NTP) server.

"NTP" is an Internet standard protocol that synchronizes computer clock times on a 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.

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

Enabling and Disabling a Network Time Protocol (NTP) Server

To configure your access point to use a network time protocol (NTP) server, first *enable* the use of NTP, and then select the NTP server you want to use. (To shut down NTP service on the network, disable NTP on the access point.

)

Field	Description
Network Time Protocol (NTP)	NTP provides a way for the access point to obtain and maintain its time from a server on the network. Using an NTP server gives your access point the ability to provide the correct time of day in log messages and session information. (See http://www.ntp.org for more general information on NTP.) Choose either to enable or to disable the use of a network time protocol (NTP) server: • **Enabled** • **Disabled**
NTP Server	If NTP is enabled, select the NTP server that you want to use. You can specify the NTP server by host name or IP address. However, using the host name is recommended because host names tend to be more constant than IP addresses.

Updating Settings

To apply your changes, click **Update**.