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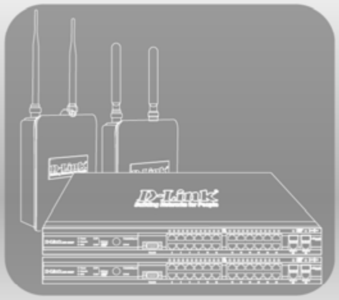


UNIFIED WIRED & WIRELESS ACCESS SYSTEM

UNIFIED ACCESS POINT (AP) ADMINISTRATOR'S GUIDE

PRODUCT MODEL: DWL-3500AP /DWL-8500AP
VERSION 2.20

About This Document

This guide describes setup, configuration, administration and maintenance for the D-Link DWL-3500AP and DWL-8500AP access points on a wireless network.

Document Organization

The *D-Link Access Point Administrator’s Guide* contains the following information:

- Chapter 1, "Overview of the D-Link Access Point"
- Chapter 2, "Preparing to Install the Access Point"
- Chapter 3, "Installing the Access Point"
- Chapter 4, "Configuring Access Point Security"
- Chapter 5, "Managing the Access Point"
- Chapter 6, "Configuring Access Point Services"
- Chapter 7, "Maintaining the Access Point"
- Chapter 8, "Configuring the Access Point for Managed Mode"
- Chapter 9, "Viewing Access Point Status"
- Appendix A, "Wireless Client Settings and RADIUS Server Setup"
- Appendix B, "CLI for AP Configuration"

Audience

This guide is intended for the following audience:

- System administrators who are responsible for configuring and operating a network using D-Link Access Point software
- Level 1 and/or Level 2 Support providers

To obtain the greatest benefit from this guide, you should also have basic knowledge of Ethernet and wireless networking concepts.

Document Conventions

This section describes the conventions this document uses.

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

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

This guide uses the typographical conventions that Typographical Conventions describes.

Table 1. Typographical Conventions

Symbol	Example	Description
Bold	Click **Update** to save your settings.	Menu titles, page names, and button names
Blue Text	See Doc.	Hyperlinked text.
`courier font`	`WLAN-AP#`	Screen text, file names.
`courier bold`	**`show network`**	Commands, user-typed command-line entries
`courier font italics`	*`value`*	Command parameter, which might be a variable or fixed value.
<> Angle brackets	*`<value>`*	Indicates a parameter is a variable. You must enter a value in place of the brackets and text inside them.
[ ] Square brackets	*`[value]`*	Indicates an optional fixed parameter.
[< >] Angle brackets within square brackets	*`[<value>]`*	Indicates an optional variable.
{} curly braces	*`{choice1 | choice2}`*	Indicates that you must select a parameter from the list of choices.
| Vertical bars	*`choice1 | choice2`*	Separates the mutually exclusive choices.
[{}] Braces within square brackets	*`[{choice1 | choice2}]`*	Indicate a choice within an optional element.

Online Help, Supported Browsers, and Limitations

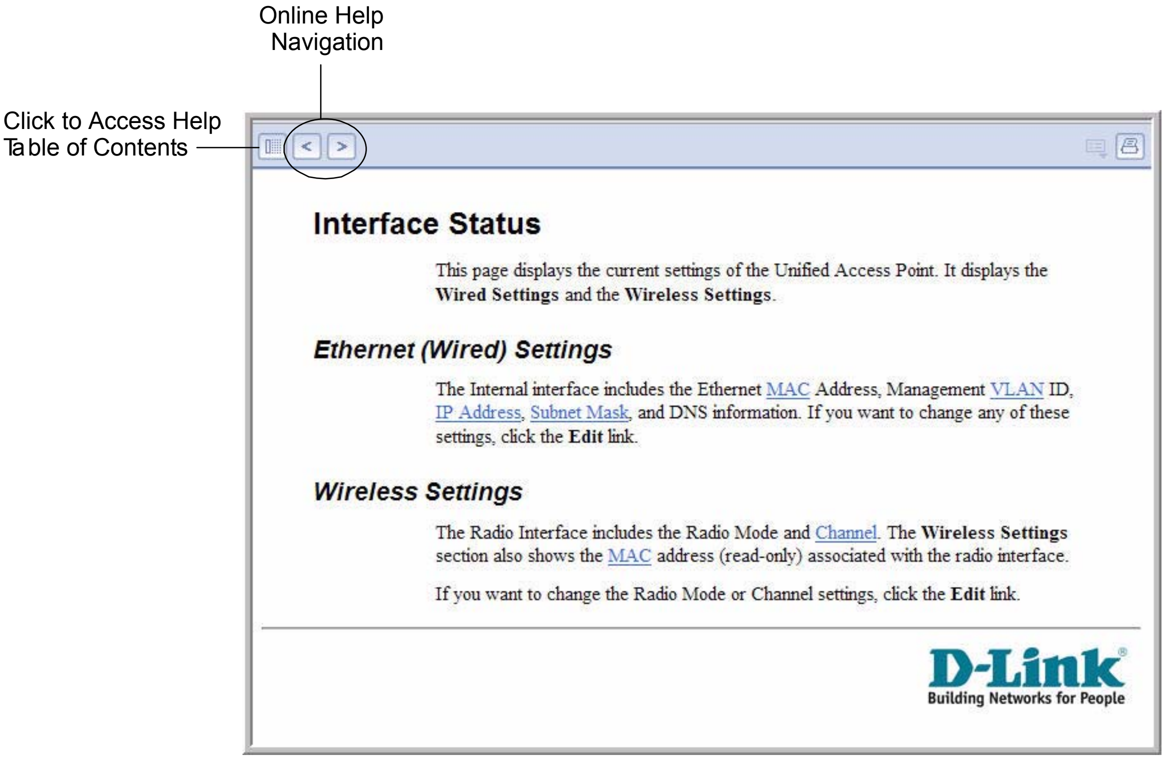
Online help for the D-Link AP Administration Web pages provides information about all fields and features available from the user interface (UI). The information in the online help is a subset of the information available in the *D-Link Access Point Administrator's Guide*.

Online help information corresponds to each page on the D-Link Access Point Administration UI.

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

Administrator UI Online Help shows an example of the online help available from the links on the user interface.

Figure 1. Administrator UI Online Help



Interface Status

This page displays the current settings of the Unified Access Point. It displays the **Wired Settings** and the **Wireless Settings**.

Ethernet (Wired) Settings

The Internal interface includes the Ethernet MAC Address, Management VLAN ID, IP Address, Subnet Mask, and DNS information. If you want to change any of these settings, click the **Edit** link.

Wireless Settings

The Radio Interface includes the Radio Mode and Channel. The **Wireless Settings** section also shows the MAC address (read-only) associated with the radio interface.

If you want to change the Radio Mode or Channel settings, click the **Edit** link.

1

Overview of the D-Link Access Point

The D-Link DWL-3500AP and DWL-8500AP access points provide continuous, high-speed access between wireless devices and Ethernet devices. It is an advanced, standards-based solution for wireless networking in businesses of any size. The D-Link AP enables wireless local area network (WLAN) deployment while providing state-of-the-art wireless networking features.

The D-Link AP can operate in two modes: Standalone Mode or Managed Mode. In Standalone Mode, the AP acts as an individual access point in the network, and you manage it by using the Administrator Web User Interface (UI) or the command-line interface (CLI). In Managed Mode, the Unified Access Point is part of the D-Link Unified Wired/Wireless Access System, and you manage it by using the D-Link Unified Switch. If an AP is in Managed Mode, the Administrator Web UI, Telnet, and SSH services are disabled.

This document describes how to perform the setup, management, and maintenance of the DWL-3500AP and DWL-8500AP in Standalone Mode. For information about configuring the access points in Managed Mode by using the D-Link Unified Switch, see the *D-Link Unified Wired/Wireless Access System User Manual*.

The DWL-3500AP supports one radio, and the DWL-8500AP supports two radios. The DWL-3500AP radio and one of the DWL-8500AP radios operate in IEEE 802.11g mode. The second radio on the DWL-8500AP operates in IEEE 802.11a mode.

Each access point supports up to eight virtual access points (VAPs) on each radio. The VAP feature allows you to segment each physical access point into eight logical access points (per radio) that each support a unique SSID, VLAN ID, and security policy.

Features and Benefits

This section lists the DWL-3500AP and DWL-8500AP features and benefits, which are in the following categories:

IEEE Standards Support

-
- Wireless Features

Security Features

-
- Networking
- Maintainability
- Access Point Hardware

IEEE Standards Support

The DWL-3500AP comes configured as a single-band access point with one radio and is capable of broadcasting in the following modes:

- IEEE 802.11b mode
- IEEE 802.11g mode
- Dynamic Turbo 2.4 GHz

The DWL-8500AP comes configured as a dual-band access point with two radios and is capable of broadcasting in the following modes:

- IEEE 802.11b mode
- IEEE 802.11g mode
- IEEE 802.11a mode
- Dynamic Turbo 5 GHz
- Dynamic Turbo 2.4 GHz

The DWL-3500AP and DWL-8500AP access points provide bandwidth of up to 54 Mbps for IEEE 802.11a or IEEE 802.11g, 108 Mbps for IEEE 802.11a Turbo, and 11 Mbps for IEEE 802.11b.

Wireless Features

The following list describes some of the DWL-3500AP and DWL-8500AP wireless features:

- Auto channel selection at startup
- Transmit power adjustment
- 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
- Wi-Fi Multimedia (WMM) compliance for QoS

- 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 AP-to-AP interference on the network and maximize Wi-Fi bandwidth
- Neighboring access point detection (also known as “rogue” AP detection)
- Support for IEEE 802.11d Regulatory Domain selection (country codes for global operation)
- Support for IEEE 802.11h, incorporating TPC and DFS
- Support for Super AG technology, which can increase WLAN speed and throughput
- SpectraLink Voice Priority (SVP)

  SpectraLink Voice Priority (SVP) is a QoS approach for Wi-Fi deployments. SVP is an open specification that is compliant with the IEEE 802.11b standard. SVP minimizes delay and prioritizes voice packets over data packets on the WLAN, which increases the probability of better network performance.

Security Features

The DWL-3500AP and DWL-8500AP access points provide several different security levels and options:

- Prevent SSID Broadcast
- Weak Initialization Vector (IV) avoidance
- Wireless Equivalent Privacy (WEP)
- Wi-Fi Protected Access (WPA/WPA2)
- WPA Personal
- WPA Enterprise
- IEEE 802.11i Architecture Support
- Advanced Encryption Standard (AES)
- MAC address filtering
- Secure Sockets Shell (SSH)
- Secure Sockets Layer (SSL)
- IEEE 802.1X Supplicant

Networking

The DWL-3500AP and DWL-8500AP access points have the following networking features:

- Dynamic Host Configuration Protocol (DHCP) support for dynamically obtaining network configuration information.
- Virtual Local Area Network (VLAN) support
- Eight virtual access points (VAPs) per radio

  For each VAP, you can configure a unique SSID name, a default VLAN ID, a security mode, external RADIUS server information, and radio association. Additionally, you can configure dynamic VLANs on an external RADIUS server.

- HTTP, HTTPS, Telnet, and SSH
- Spanning Tree Protocol (STP)
- 802.1p

Maintainability

You can perform many maintenance and monitoring tasks from the DWL-3500AP and DWL-8500AP Administrator Web UI:

- 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 by using HTTP or TFTP
- Backup and restore of access point configuration by using HTTP or TFTP

Access Point Hardware

The Unified Access Point software supports the following hardware features:

- Power port and power adapter
- Reset button

For more information about the specifics of your Access Point, see the information provided by the manufacturer.

2

Preparing to Install the Access Point

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

This chapter contains the following sections:

- Default Settings for the Unified Access Point

Administrator’s Computer Requirements

-

Wireless Client Requirements

-

Dynamic and Static IP Addressing on the AP

-
- Using the Reset Button

Default Settings for the Unified Access Points

When you first power on a Unified Access Point, it has the default settings that AP Default Settings shows

Table 2. AP Default Settings

Feature		Default
System Information		
	User Name	admin
	Password	admin
Ethernet Interface Settings		
	Connection Type	DHCP
	DHCP	Enabled
	IP Address	10.90.90.91 (if no DHCP server is available)
	Subnet Mask	255.0.0.0
	DNS Name	None
	Management VLAN ID	1
	Untagged VLAN ID	1
Radio Settings: DWL-8500AP		
	Radio (1 and 2)	On
	Radio 1 IEEE 802.11 Mode	802.11a
	Radio 2 IEEE 802.11 Mode	802.11g
	802.11b/g Channel	Auto
	802.11a Channel	Auto
Radio Settings: DWL-3500AP		
	Radio	On
	Radio IEEE 802.11 Mode	802.11g

	802.11b/g Channel	Auto
Radio Settings: DWL-3500 AP and DWL-8500AP		
	Beacon Interval	100
	DTIM Period	2
	Fragmentation Threshold	2346
	RTS Threshold	2347
	MAX Wireless Clients	256
	Transmit Power	100 percent
	Rate Sets Supported (Mbps)	IEEE 802.1a: 54, 48, 36, 24, 18, 12, 9, 6 IEEE 802.1g: 54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1 Turbo 5 GHz: 108, 96, 72, 48, 36, 24, 18, 12
	Rate Sets (Mbps) (Basic/Advertised)	IEEE 802.1a: 24, 12, 6 IEEE 802.1g: 11, 5.5, 2, 1 Turbo 5 GHz: 48, 24, 12
Virtual Access Point Settings		
	Status	VAP0 is enabled on both radios, all other VAPs disabled
	Network Name (SSID)	"DLINK VAP" for VAP0 SSID for all other VAPs is "Virtual Access Point *x*" where *x* is the VAP number.
	Broadcast SSID	Allow
	Security Mode	None (plain text)
	Authentication Type	None
	RADIUS IP Address	10.90.90.1
	RADIUS Key	secret
	RADIUS Accounting	Disabled
Other Default Settings		
	MAC Authentication	No stations in list
	Load Balancing	Disabled
	Managed Mode	Disabled
	HTTP Access	Enabled; disabled in Managed Mode
	HTTPS Access	Enabled; disabled in Managed Mode
	Telnet Access	Enabled; disabled in Managed Mode

SSH Access	Enabled; disabled in Managed Mode
802.1X Supplicant	Disabled
WMM	Enabled
Network Time Protocol (NTP)	None

NOTE: The Unified 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 Requirements

The following table describes the minimum requirements for the administrator’s computer for configuration and administration of the Unified Access Point through a Web-based user interface (UI).

Table 3. Requirements for the Administrator’s Computer

Required Software or Component	Description
Ethernet Connection to the Access Point	The computer used to configure the first access point must be connected to the access point by an Ethernet cable. For more information on this step, see “Installing the Access Point” on page 25.
Wireless Connection to the Network	After initial configuration and launch of the first access point on your new wireless network, you can make subsequent configuration changes through the Administration Web pages using a wireless connection to the internal network. For wireless connection to the access point, your administration device will need Wi-Fi capability similar to that of any wireless client: • Portable or built-in Wi-Fi client adapter that supports one or more of the IEEE 802.11 modes in which you plan to run the access point. • Wireless client software configured to associate with the Unified Access Point.
Web Browser and Operating System	Configuration and administration of the Unified Access Point is provided through a Web-based user interface hosted on the access point. We recommend using Microsoft Internet Explorer version 6.0 or7.x (with up-to-date patch level for either major version) on Microsoft Windows XP or Microsoft Windows 2000 The administration Web browser must have JavaScript enabled to support the interactive features of the administration interface.
Security Settings	Ensure that security is disabled on the wireless client used to initially configure the access point.

Wireless Client Requirements

The DWL-3500AP and DWL-8500AP provide wireless access to any client with a properly configured Wi-Fi client adapter for the 802.11 mode in which the access point is running. The AP supports multiple client operating systems. Clients can be laptop or desktop computers, personal digital assistants (PDAs), or any other hand-held, portable or stationary device equipped with a Wi-Fi adapter and supporting drivers.

In order to connect to the access point, wireless clients need the software and hardware described in Requirements for Wireless Clients.

Table 4. Requirements for Wireless Clients

Required Component	Description
Wi-Fi Client Adapter	Portable or built-in Wi-Fi client adapter that supports one or more of the IEEE 802.11 modes in which you plan to run the access point. (IEEE 802.11a, 802.11b, 802.11g, and Dynamic Turbo modes are supported.)
Wireless Client Software	Client software, such as Microsoft Windows Supplicant, configured to associate with the Unified Access Point.
Client Security Settings	Security should be disabled on the client used to do initial configuration of the access point. If the Security mode on the access point is set to anything other than plain text, wireless clients will need to set a profile to the authentication mode used by the access point and provide a valid username and password, certificate, or similar user identity proof. Security modes are Static WEP, IEEE 802.1X, WPA with RADIUS server, and WPA-PSK. For information about configuring security on the access point, see "Configuring Access Point Security" on page 39.

Dynamic and Static IP Addressing on the AP

When you power on the access point, the built-in DHCP client searches for a DHCP server on the network in order to obtain an IP Address and other network information. If the AP does not find a DHCP server on the network, the AP continues to use its default Static IP Address (10.90.90.91) until you re-assign it a new static IP address (and specify a static IP addressing policy) or until the AP successfully receives network information from a DHCP server.

To change the connection type and assign a static IP address, see "Configuring the Ethernet Interface" on page 31.

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

Recovering an IP Address

If you experience trouble communicating with the access point, you can recover a static IP address by resetting the AP configuration to the factory defaults (see "Resetting the Factory Default Configuration" on page 82), or you can get a dynamically assigned address by connecting the AP to a network that has a DHCP server.

Discovering a Dynamically Assigned IP Address

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

If you do not have access to the DHCP server that assigned the IP address to the AP or do not know the MAC address of the AP, you might need to use the CLI to find out what the new IP address is. For information about how to discover a dynamically assigned IP address, see "Using the CLI to View the IP Address" on page 30.

Using the Reset Button

The reset button is located on the rear panel of the access point and is labeled **Reset**. Use the reset button to manually reboot the AP or to reset the AP back to the factory default settings, as Reset describes.

Table 5. **Reset Button**

Function	Action
Reboot	Press reset button for < 2 seconds
Reset to factory defaults	Press and hold reset button for > 5 seconds

3

Installing the Access Point

This chapter describes the basic steps required to setup and deploy the D-Link Access Point and contains the following sections:

- Installing the Unified Access Point
- Using the CLI to View the IP Address
- Configuring the
- Configuring
- Verifying the Installation

To manage the DWL-3500AP and DWL-8500AP access points by using the Web interface or by using the CLI through Telnet or SSH, the AP needs an IP address. If you use VLANs or IEEE 802.1X Authentication (port security) on your network, you might need to configure additional settings on the AP before it can connect to the network.

Installing the Unified Access Point

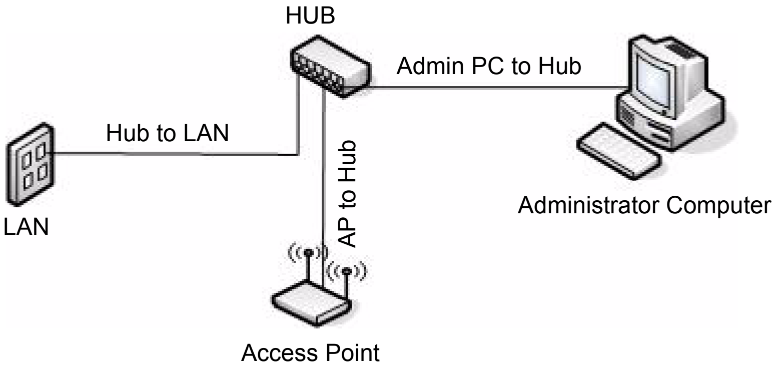
To access the Administration Web UI, you enter the IP address of the access point into a Web browser. You can use the default IP address of the AP (10.90.90.91) to log on to the AP and assign a static IP address, or you can use a DHCP server on you network to assign network information to the AP. The DHCP client on the AP is enabled by default.

To install the Unified Access Point, use the following steps:

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

To use a LAN connection, connect one end of an Ethernet cable to the network port on the access point and the other end to the same hub where your PC is connected, as shown in Figure 2: LAN.

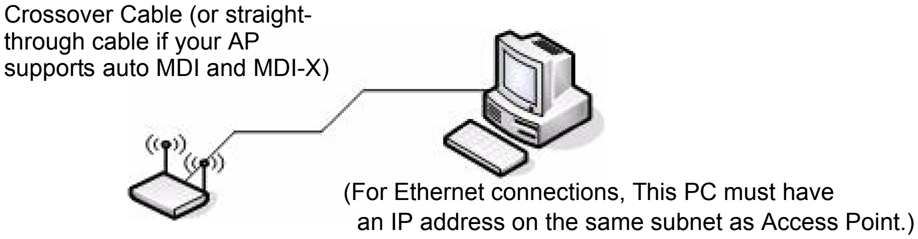
Figure 2: LAN Connection for DHCP-Assigned IP



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

To use a direct-cable connection, connect one end of an Ethernet straight-through or crossover cable to the network port on the access point and the other end of the cable to the Ethernet port on the PC, as shown in Ethernet Connection for Static IP Assignment.

Figure 3. Ethernet Connection for Static IP Assignment


Crossover Cable (or straight-through cable if your AP supports auto MDI and MDI-X)
(For Ethernet connections, This PC must have an IP address on the same subnet as Access Point.)

For initial configuration with a direct Ethernet connection and no DHCP server, be sure to set your PC to a static IP address in the same subnet as the default IP address on the access point. (The default IP address for the access point is 10.90.90.91.)

If you use this method, you will need to reconfigure the cabling for subsequent startup and deployment of the access point so that the access point is no longer connected directly to the PC but instead is connected to the LAN (either by using a hub, as shown in Figure 2: LAN or directly).

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

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

   If the AP did not acquire an IP address from a DHCP server on your network, enter 10.90.90.91 in the address field of your browser, which is the default IP address of the AP.

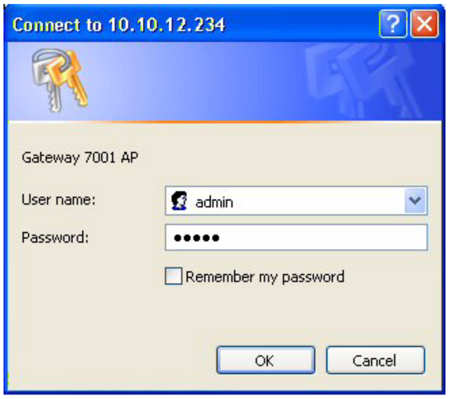
   If you used a DHCP server on your network to automatically configure network information for the AP, enter the new IP address of the AP into the Web browser.

   If you used a DHCP server and you do not know the new IP address of the AP, use the following procedures to obtain the information:

   A. Connect a serial cable from the administrative computer to the AP and use a terminal emulation program to access the command-line interface (CLI).
   B. At the login prompt, enter **`admin`** for the user name and **`admin`** for the password. At the command prompt, enter:

      ```
      get management
      ```

      The command output displays the IP address of the AP. Enter this address in the address field of your browser.
4. When prompted, enter **`admin`** for the user name and **`admin`** for the password, then click **OK**.



Connect to 10.10.12.234

Gateway 7001 AP

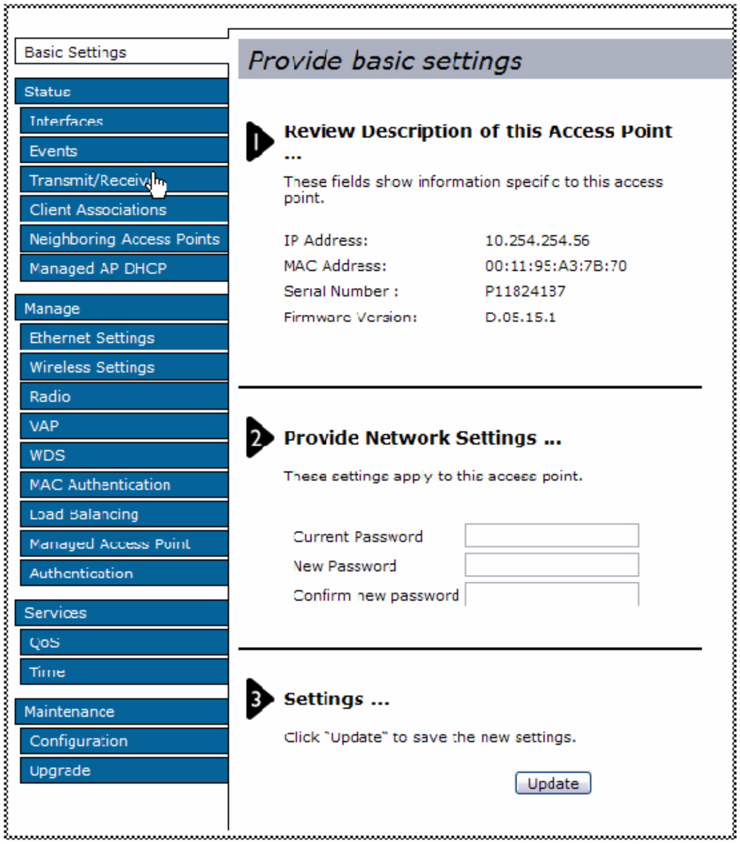
User name: admin

Password: •••••

□ Remember my password

   When you first log in, the **Basic Settings** page for the Unified Access Point administration is displayed.
5. Verify the settings on the **Basic Settings** page.

Figure 4. Basic Settings



Provide basic settings

1 Review Description of this Access Point ...

These fields show information specific to this access point.

IP Address: 10.254.254.56
MAC Address: 00:11:95:A3:7B:70
Serial Number : P11824137
Firmware Version: D.05.15.1

2 Provide Network Settings ...

These settings apply to this access point.

Current Password
New Password
Confirm new password

3 Settings ...

Click "Update" to save the new settings.

A. Review access point description and provide a new administrator password for the access point if you do not want to use the default password, which is **`admin`**.

B. Click the **Update** button to activate the wireless network with these new settings.

NOTE: The changes you make are not saved or applied until you click **Update**. Changing some access point settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change access point settings when WLAN traffic is low.

For more information about the fields and configuration options on the **Basic Settings** page, see Viewing Basic Settings.

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

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

7. If your network uses VLANs, you might need to configure the management VLAN ID or untagged VLAN ID on the D-Link Access Point in order for it to work with your network.

For information about how to configure VLAN information, see Configuring the .

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

   For information about how to configure the 802.1X user name and password, see Configuring .

Viewing Basic Settings

From the **Basic Settings** page, you can view IP and MAC address information and configure the administrator password for the access point. describes the fields and configuration options on the **Basic Settings** page.

Table 6. Basic Settings

Field	Description
IP Address	Shows the IP address assigned to the AP. This field is not editable on this page because the IP address is already assigned (either by DHCP, or statically through the **Ethernet Settings** page as described in Configuring the).
MAC Address	Shows the MAC address of the access point. The address shown here is the MAC address associated with the management interface. This is the address by which the AP is known externally to other networks.
Serial Number	Shows the serial number of the AP.
Firmware Version	Shows version information about the firmware currently installed on the access point. As new versions of the Unified Access Point firmware become available, you can upgrade the firmware on your access points. For instructions about how to upgrade the firmware, see "Upgrading the Firmware" on page 85.
Current Password	Enter the current administrator password. You must correctly enter the current password before you are able to change it.
New Password	Enter a new administrator password. The characters you enter are 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. **NOTE:** As an immediate first step in securing your wireless network, we recommend that you change the administrator password from the default.
Confirm New Password	Re-enter the new administrator password to confirm that you typed it as intended.

Using the CLI to View the IP Address

The DHCP client on the Unified Access Point is enabled by default. If you connect the access point to a network with a DHCP server, the AP automatically acquires an IP address. To manage the access point by using the Administrator UI, you must enter the IP address of the access point into a Web browser.

If a DHCP server on your network assigns an IP address to the access point, and you do not know the IP address, use the following steps to view the IP address of the access point:

1. Using a null-modem cable, connect a VT100/ANSI terminal or a workstation to the console (serial) port.

   If you attached a PC, Apple, or UNIX workstation, start a terminal-emulation program, such as HyperTerminal or TeraTerm.

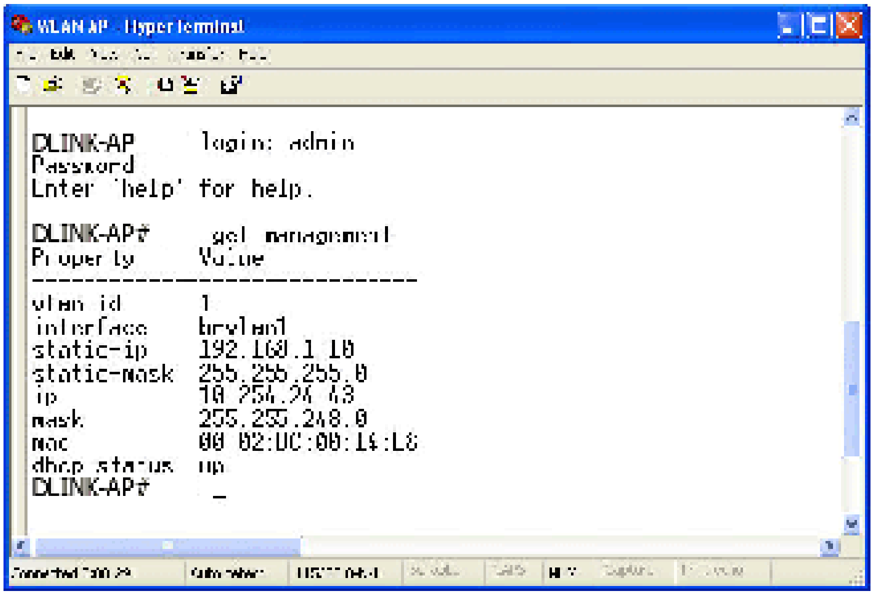
2. Configure the terminal-emulation program to use the following settings:
   - Baud rate: 115200 bps
   - Data bits: 8
   - Parity: none
   - Stop bit: 1
   - Flow control: none
3. Press the return key, and a login prompt should appear.

   The login name is **admin**. The default password is **admin**.

   After a successful login, the screen shows the (*Access Point Name*)# prompt.

4. At the login prompt, enter `get management`.

   Information similar to the following prints to the screen:



```
DLINK-AP      login: admin
Password
Enter 'help' for help.

DLINK-AP#      get management
Property      Value
-------------------------------
vlan id       1
interface     brvlan1
static-ip     192.168.1.10
static-mask   255.255.255.0
ip            10.254.24.43
mask          255.255.248.0
mac           00 02:DC:00:14:E8
dhcp status   up
DLINK-AP#      _
```

Configuring the Ethernet Interface

The default Ethernet interface settings, which include DHCP and VLAN information, might not work for all networks. This section describes how to change the default settings.

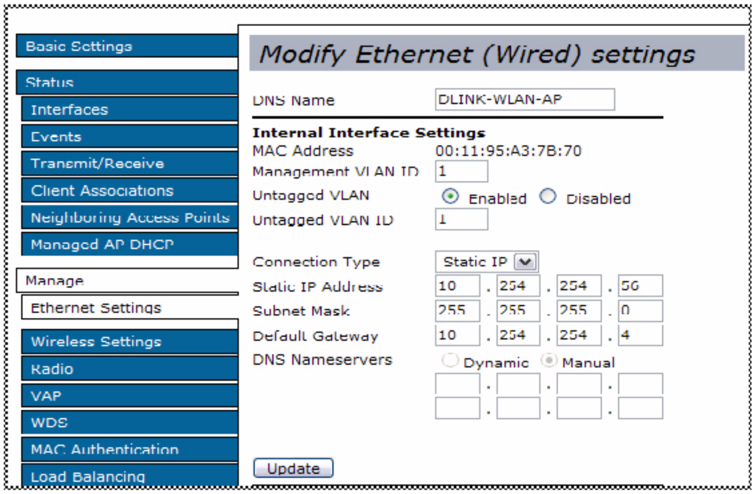
By default, the DHCP client on the D-Link Access Point automatically broadcasts requests for network information. If you want to use a static IP address, you must disable the DHCP client and manually configure the IP address and other network information.

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

Using the Web UI to configure Ethernet Settings

The Ethernet interface is the interface that is connected to your LAN. To set network information for the access point by using the Web interface, click **Ethernet Settings**.

Figure 5. LAN Interface Configuration



Modify Ethernet (Wired) settings

DNS Name: DLINK-WLAN-AP

Internal Interface Settings

MAC Address: 00:11:95:A3:7B:70
Management VLAN ID: 1
Untagged VLAN: ● Enabled ○ Disabled
Untagged VLAN ID: 1

Connection Type: Static IP
Static IP Address: 10 . 254 . 254 . 56
Subnet Mask: 255 . 255 . 255 . 0
Default Gateway: 10 . 254 . 254 . 4
DNS Nameservers: ○ Dynamic ● Manual

Ethernet Settings describes the fields and configuration options on the **Ethernet Settings** page.

Table 7. Ethernet Settings

Field	Description
DNS Name	Enter the DNS name (host name) for the access point in the text box. The DNS name has the following requirements: • Maximum of 20 characters • Only letters, numbers and dashes • Must start with a letter and end with either a letter or a number.
MAC Address	Shows the MAC address for the LAN interface for the Ethernet port on this access point. This is a read-only field that you cannot change.
Management VLAN ID	The management VLAN is the VLAN associated with the IP address you use to access the AP. The default management VLAN ID is 1. Provide a number between 1 and 4094 for the management VLAN ID.
Untagged VLAN	If you disable untagged VLANs, all traffic is tagged with a VLAN ID. By default all traffic on the Unified Access Point uses VLAN 1, which is the default untagged VLAN. This means that all traffic is untagged until you disable untagged VLANs, change the untagged traffic VLAN ID, or change the VLAN ID for a virtual access point (VAP) or a client using RADIUS.
Untagged VLAN ID	Provide a number between 1 and 4094 for the untagged VLAN ID. Traffic on the VLAN that you specify in this field will not be tagged with a VLAN ID.
Connection Type	If you select DHCP, the access point acquires its IP address, subnet mask, DNS, and gateway information from a DHCP server. If you select Static IP, you must enter information in the Static IP Address, Subnet Mask, and Default Gateway fields.
Static IP Address	Enter the static IP address in the text boxes. This field is disabled if you use DHCP as the connection type.
Subnet Mask	Enter the subnet mask in the text boxes.
Default Gateway	Enter the default gateway in the text boxes.
DNS Nameservers	Select the mode for the DNS. • In Dynamic mode, the IP addresses for the DNS servers are assigned automatically via DHCP. (This option is only available if you specified DHCP for the Connection Type.) • In Manual mode, you must assign static IP addresses to resolve domain names.

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

Using the CLI to Configure Ethernet Settings

Use the commands in Ethernet Settings to view and set values for the Ethernet (wired) interface. For more information about each setting, see the description for the field in Ethernet Settings.

Table 8. CLI Commands for Ethernet Settings

Action	Command
Get the DNS Name	**`get host id`**

Set the DNS Name	**`set host id <`***`host_name`*`>`
	For example:
	`set host id vicky-ap`

Get Current Settings for the Ethernet (Wired) Internal Interface	**`get management`**
Set the management VLAN ID	**`set management vlan-id`** *`<1-4094>`*
View untagged VLAN information	**`get untagged-vlan`**
Enable the untagged VLAN	**`set untagged-vlan status up`**
Disable the untagged VLAN	**`set untagged-vlan status down`**
Set the untagged VLAN ID	**`set untagged-vlan vlan-id`** *`<1-4094>`*
View the connection type	**`get management dhcp-status`**
Use DHCP as the connection type	**`set management dhcp-client status up`**
Use a Static IP as the connection type	**`set management dhcp-client status down`**

Set the Static IP address	**`set management static-ip`** *`<ip_address>`*
	Example:
	`set management static-ip 10.10.12.221`

Set a Subnet Mask	**`set management static-mask`** *`<netmask>`*
	Example:
	`set management static-mask 255.0.0.0`

Set the Default Gateway	**set static-ip-route gateway** *<ip_address>* Example: **set static-ip-route gateway 10.254.0.1** Note that there is no need to set static-ip-route mask or static-ip-route destination when setting the default gateway. In general, the static-ip-route mask should be set as the netmask for the destination net: “255.255.255.255” for a host or left as “0.0.0.0” for the default route.

View the DNS Nameserver mode
Dynamic= up
Manual=down
	get host dns-via-dhcp

Set DNS Nameservers to Use Static IP Addresses (Dynamic to Manual Mode)	**set host dns-via-dhcp down** **set host static-dns-1** *<ip_address>* **set host static-dns-2** *<ip_address>* Example: **set host static-dns-1 192.168.23.45**
Set DNS Nameservers to Use DHCP IP Addressing (Manual to Dynamic Mode)	**set host dns-via-dhcp up**

In the following example, the administrator uses the CLI to set the management VLAN ID to 123 and to disable untagged VLANs so that all traffic is tagged with a VLAN ID.

```
DLINK-WLAN-AP# set management vlan-id 123
DLINK-WLAN-AP# set untagged-vlan status down

DLINK-WLAN-AP# get management
Property    Value
------------------------------
vlan-id     123
interface   brvlan123
static-ip   10.90.90.91
static-mask  255.0.0.0
ip         10.254.24.43
mask       255.0.248.0
mac        00:02:BC:00:14:E8
dhcp-status  up

DLINK-WLAN-AP# get untagged-vlan
Property  Value
---------------
vlan-id   1
status    down
DLINK-WLAN-AP#
```

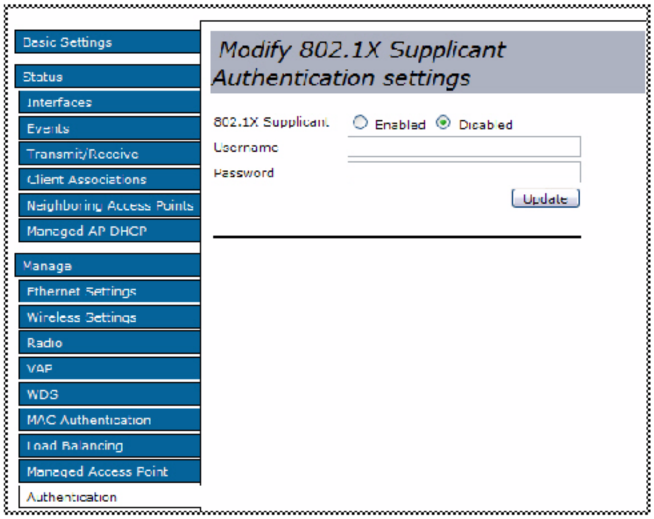
Configuring IEEE 802.1X Authentication

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

Using the Web UI to Configure 802.1X Authentication Information

To configure the Unified Access Point 802.1X supplicant user name and password by using the Web interface, click the **Authentication** tab and configure the fields shown in IEEE 80.

Figure 6. IEEE 802.1X Authentication



Modify 802.1X Supplicant Authentication settings

802.1X Supplicant ○ Enabled ● Disabled

Username

Password

Table 9. IEEE 802.1X Supplicant Authentication

Field	Description
802.1X Supplicant	Click **Enabled** to enable the Administrative status of the 802.1X Supplicant Click **Disabled** to disable the Administrative status of the 802.1X Supplicant.
Username	Enter the user name for the AP to use when responding to requests from an 802.1X authenticator.
Password	Enter the password for the AP to use when responding to requests from an 802.1X authenticator.

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

Using the CLI to Configure 802.1X Authentication Information

CLI Commands for the 802.1X Supplicant shows the commands you can use to configure 802.1X supplicant information by using the CLI.

Table 10. CLI Commands for the 802.1X Supplicant

Action	Command
View 802.1X supplicant settings	**get dot1x-supplicant**
Enable 802.1X supplicant	**set dot1x-supplicant status up**
Disable 802.1X supplicant	**set dot1x-supplicant status down**
Set the 802.1X user name	**set dot1x-supplicant user** *<name>*
Set the 802.1X password	**set dot1x-supplicant password** *<password>*

In the following example, the administrator enables the 802.1X supplicant and sets the user name to wlanAP and the password to test1234.

```
DLINK-WLAN-AP# set dot1x-supplicant status up
DLINK-WLAN-AP# set dot1x-supplicant user wlanAP
DLINK-WLAN-AP# set dot1x-supplicant password test1234
DLINK-WLAN-AP# get dot1x-supplicant
Property  Value
----------------
status    up
user     wlanAP
```

Verifying the Installation

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

1. Connect the access point to the LAN

   If you configured the access point and administrator PC by connecting both into a network hub, then your access point is already connected to the LAN. The next step is to test some wireless clients.

If you configured the access point by using a direct cable connection from your computer to the access point, do the following procedures:

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

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

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

2. Test LAN connectivity with wireless clients.

   Test the access point by trying to detect it and associate with it from some wireless client devices. For information about requirements for these clients, see “Wireless Client Requirements” on page 22 in the Preparing to Install the Access Point chapter.

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

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

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

By default, no security is in place on the access point, so any wireless client can associate with it and access your LAN. An important next step is to configure security, as described in “Configuring Virtual Access Point Security” on page 43.

4

Configuring Access Point Security

This chapter describes DWL-3500AP and DWL-8500AP security options and how to configure security on the virtual access points (VAPs) to prevent unauthorized and unauthenticated clients from accessing the WLAN. This chapter contains the following sections:

Understanding Security on Wireless Networks

-
  - Choosing a Security Mode
  - Comparing Security Modes
  - Enabling Station Isolation
- Configuring Virtual Access Point Security
  - Static WEP

IEEE 802.1X

-
- WPA Personal
- WPA Enterprise
- Prohibiting the SSID Broadcast

Understanding Security on Wireless Networks

The DWL-3500AP and DWL-8500AP access points provide several 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 following sections.

Some of the security modes use an external RADIUS server for client authentication. For information about configuring an external RADIUS server, see “Wireless Client Settings and RADIUS Server Setup” on page 101.

Choosing a Security Mode

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

Wi-Fi Protected Access (WPA) Enterprise with Remote Authentication Dial-In User Service (RADIUS) using the Advanced Encryption Standard (AES) encryption algorithm using Counter Mode with Cipher Block Chaining Message Authentication Code Protocol (CCMP) provides the best data protection available and is the best choice if all client stations are equipped with WPA supplicants. To use WPA Enterprise, you must have an external RADIUS server on your network. Additionally, 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.

For some networks, security might not be a priority. If you are simply providing Internet and printer access, as on a guest network, setting the security mode to “None (Plain-text)” might 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 might offer enough protection in some situations. For more information, see Prohibiting the SSID Broadcast.

Comparing Security Modes

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

- How the protocol manages keys
- What kind of encryption algorithm or formula the protocol uses to encode and decode the data
- Whether the protocol has integrated user authentication

The following sections describe the security modes available on the DWL-3500AP and DWL-8500AP along with a description of the key management, authentication, and encryption algorithms used in each mode.

- When to Use Unencrypted (No Security)
- When to Use Static WEP
- When to Use IEEE 802.1X
- When to Use WPA Personal
- When to Use WPA Enterprise

This guide also includes some suggestions as to when one mode might be more appropriate than another.

When to Use Unencrypted (No Security)

Setting the security mode to “None (Plain-text)” by definition provides no security. In this mode, the data is not encrypted but rather sent as “plain text” across the network. No key management, data encryption, or user authentication is used.

Recommendations

Unencrypted mode, i.e. None (Plain-text), is **not recommended** for networks with sensitive or private information because it is not secure. Therefore, only set the security mode to “None (Plain-text)” on the internal network for initial setup, testing, or problem solving.

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)), 128-bit (104-bit secret key + 24-bit IV), or 152-bit (128-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 access point). The client stations 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.	This protocol provides a rudimentary form of user authentication when the client uses a shared key algorithm.

Recommendations

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

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.

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 Temporal Key Integrity Protocol (TKIP) and AES-CCMP 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 WPA or WPA2. A better solution than using IEEE 802.1X mode is to **use WPA Enterprise mode**.

When to Use WPA Personal

Wi-Fi Protected Access Personal Pre-Shared Key (PSK) is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes AES-CCMP and 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 backwards-compatible for wireless clients that support only the original WPA.

Key Management	Encryption Algorithms	User Authentication
WPA Personal provides dynamically-generated keys that are periodically refreshed. There are different Unicast keys for each station.	TKIP AES-CCMP	The use of a PSK provides user authentication similar to that of shared keys in WEP.

Recommendations

WPA Personal is not recommended for use with the Unified Access Point when WPA Enterprise is an option.

We recommend that you use WPA Enterprise mode instead, unless you have interoperability issues that prevent you from using this mode. For example, some devices on your network might 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 might not support RADIUS. For such cases, we recommend that you use WPA Personal.

When to Use WPA Enterprise

Wi-Fi Protected Access Enterprise with RADIUS is an implementation of the Wi-Fi Alliance IEEE 802.11i standard, which includes AES-CCMP and TKIP mechanisms. This mode requires the use of a RADIUS server to authenticate users. On the Unified Access Point, WPA Enterprise provides the best security available for wireless networks.

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

Key Management	Encryption Algorithms	User Authentication
WPA Enterprise mode provides dynamically-generated keys that are periodically refreshed. There are different Unicast keys for each station.	TKIP AES-CCMP	RADIUS

Recommendations

WPA Enterprise mode is the **recommended mode**. The AES-CCMP 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, AES-CCMP 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 other modes when using WPA is an option.

Additionally, this mode incorporates a RADIUS server for user authentication which makes WPA Enterprise more secure than WPA Personal mode.

Use the following guidelines for choosing options within the WPA Enterprise mode security mode:

1. Currently, the best security you can have on a wireless network is WPA Enterprise mode using AES-CCMP 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 Enterprise with the encryption algorithm set to both TKIP and CCMP. This lets WPA client stations without CCMP associate, uses TKIP

for encrypting Multicast and Broadcast frames, and allows clients to select whether to use CCMP or TKIP for Unicast (AP-to-single-station) frames. This WPA configuration allows more interoperability, at the expense of some security. Client stations that support CCMP can use it for their Unicast frames. If you encounter AP-to-station interoperability problems with the “Both” encryption algorithm setting, then you will need to select TKIP instead. (See next bullet.)

3. The third best choice is WPA Enterprise 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 is usually interoperable with client Wireless software security features.

Enabling Station Isolation

When Station Isolation is enabled, the access point blocks communication between wireless clients associated with the same radio on the access point. The access point still allows data traffic between its wireless clients and wired devices on the network, but not among wireless clients. You enable station isolation on the Wireless settings page. For more information, see “Setting the Wireless Interface” on page 55.

Configuring Virtual Access Point Security

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

VAPs segment the wireless LAN into multiple broadcast domains and are the wireless equivalent of Ethernet VLANs. You can configure each VAP with a unique SSIDs so that each VAP represents a different wireless network for clients to access. By configuring VAPs, you can maintain better control over broadcast and multicast traffic, which affects network performance.

This section describes the security options available for VAPs and how to configure VAP security. For more information about configuring VAPs, including VLAN configuration, see “Configuring Virtual Access Points” on page 62.

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

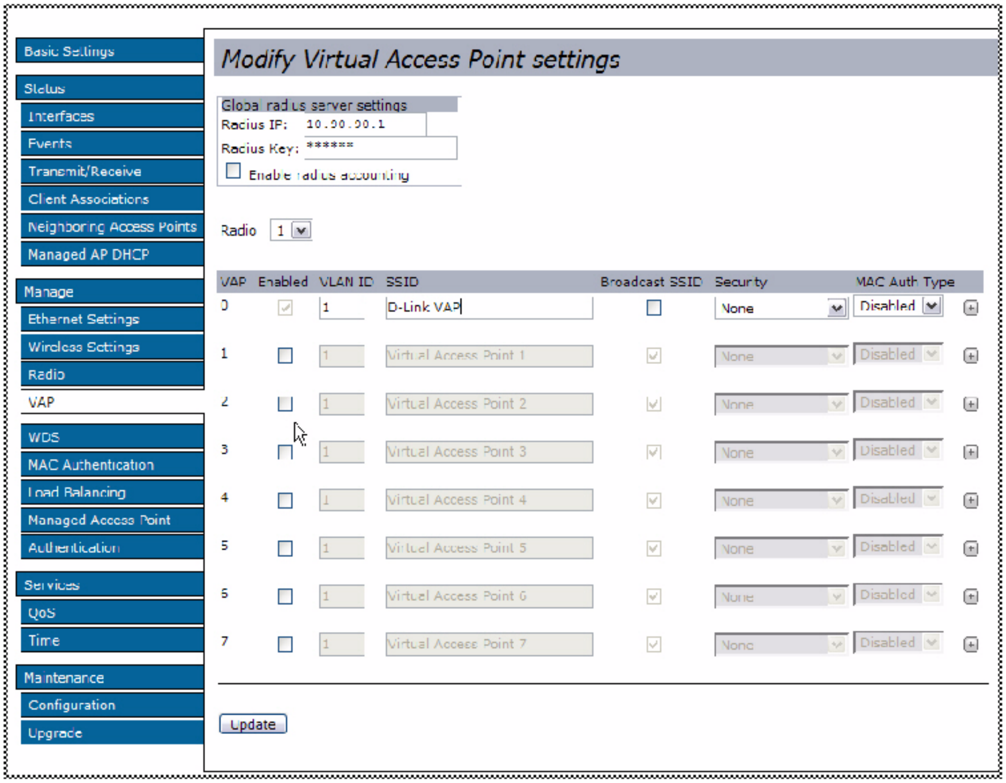
- VLAN ID: 1
- Broadcast SSID: Enabled
- SSID: DLINK VAP
- Security: None
- MAC Authentication Type: None

All other VAPs are disabled by default. The default SSID for VAPs 1-7 is “Virtual Access Point *x*” where *x* is the VAP ID.

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

To change VAP 0 or to enable and configure additional VAPs, select the **VAP** tab in the **Manage** section.

Figure 7. Virtual Access Point Page.



Modify Virtual Access Point settings

Global radius server settings

Radius IP: 10.90.90.1

Radius Key: ******

□ Enable radius accounting

Radio 1

VAP	Enabled	VLAN ID	SSID	Broadcast SSID	Security	MAC Auth Type
0	☑	1	D-Link VAP	□	None	Disabled
1	□	1	Virtual Access Point 1	☑	None	Disabled
2	□	1	Virtual Access Point 2	☑	None	Disabled
3	□	1	Virtual Access Point 3	☑	None	Disabled
4	□	1	Virtual Access Point 4	☑	None	Disabled
5	□	1	Virtual Access Point 5	☑	None	Disabled
6	□	1	Virtual Access Point 6	☑	None	Disabled
7	□	1	Virtual Access Point 7	☑	None	Disabled

VAP 0 through VAP 7 are listed in rows, and the column headings contain the configuration options, which are described in "Configuring Virtual Access Points" on page 62. The drop-down menu in the Security column contains the following security mode options:

- None
- Static WEP
- IEEE 802.1X
- WPA Personal
- WPA Enterprise

When you select a security mode other than None, additional fields appear. The following sections describe how to configure each security mode.

None (Plain-text)

If you select **None** as your security mode, no further options are configurable on the AP. This mode means that any data transferred to and from the access point is not encrypted.

This security mode can be useful during initial network configuration or for problem solving, but it is not recommended for regular use on the internal network because it is not secure.

Static WEP

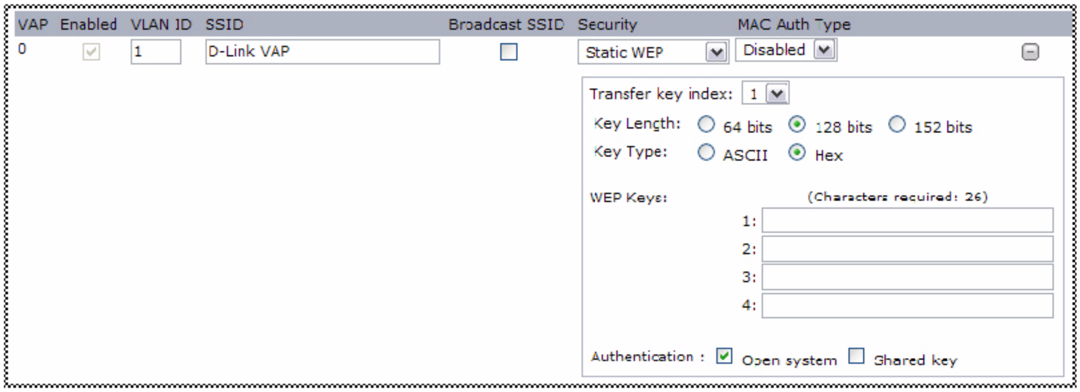
Static WEP is not the most secure mode available, but it offers more protection than setting the security mode to None because it prevents an outsider from easily sniffing out unencrypted wireless traffic. (For more secure modes, see the sections on IEEE 802.1X

, WPA Personal, or WPA Enterprise.)

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

If you select Static WEP as the Security Mode, additional fields display, as Static WEP Configuration shows.

Figure 8. Static WEP Configuration



VAP	Enabled	VLAN ID	SSID	Broadcast SSID	Security	MAC Auth Type
0	☑	1	D-Link VAP	□	Static WEP	Disabled

Transfer key index: 1

Key Length: ○ 64 bits ● 128 bits ○ 152 bits

Key Type: ○ ASCII ● Hex

WEP Keys: (Characters required: 26)

1:

2:

3:

4:

Authentication : ☑ Open system □ Shared key

describes the configuration options for static WEP.

Table 11. Static WEP

Field	Description
Transfer Key Index	Select a key index from the drop-down menu. 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 the length of the key by clicking one of the radio buttons: • 64 bits • 128 bits • 152 bits

Key Type

Select the key type by clicking one of the radio buttons:

- ASCII
- Hex

WEP Keys

You can specify up to four WEP keys. In each text box, enter a string of characters for each key. The characters you enter depend on the Key Type:

- **ASCII**—Includes upper and lower case alphabetic letters, the numeric digits, and special symbols such as @ and #. Spaces are not permitted.
- **Hex—**Includes digits 0 to 9 and the letters A to F.

Use the same number of characters for each key as specified in the "Characters Required" field. These are the RC4 WEP keys shared with the stations using the access point.

Each client station must be configured to use one of these same WEP keys in the same slot as specified here on the AP. (See Static WEP Rules.)

Characters Required: The number of characters you enter into the WEP Key fields is determined by the Key length and Key type you select. For example, if you use 128-bit ASCII keys, you must enter 26 characters in the WEP key. The number of characters required updates automatically based on how you set Key Length and Key Type.

Authentication

The authentication algorithm defines the method used to determine whether a client station 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 options:

- Open System
- Shared Key

Note: You can also select both the Open System and Shared Key check boxes.

Open System authentication allows any client station to associate with the access point whether that client station has the correct WEP key or not. This algorithm is also used in plain text, IEEE 802.1X, and WPA modes. When the authentication algorithm is set to "Open System," any client can associate with the access point.

Note that just because a client station is allowed to *associate* does not ensure it can exchange traffic with an access point. A station 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 station to have the correct WEP key in order to associate with the access point. When the authentication algorithm is set to "Shared Key," a station with an incorrect WEP key will not be able to associate with the access point.

Both Open System and Shared Key. When you select both authentication algorithms, client stations configured to use WEP in shared key mode must have a valid WEP key in order to associate with the access point. Also, client stations configured to use WEP as an open system (shared key mode not enabled) will be able to associate with the access point even if they do not have the correct WEP key.

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

Static WEP Rules

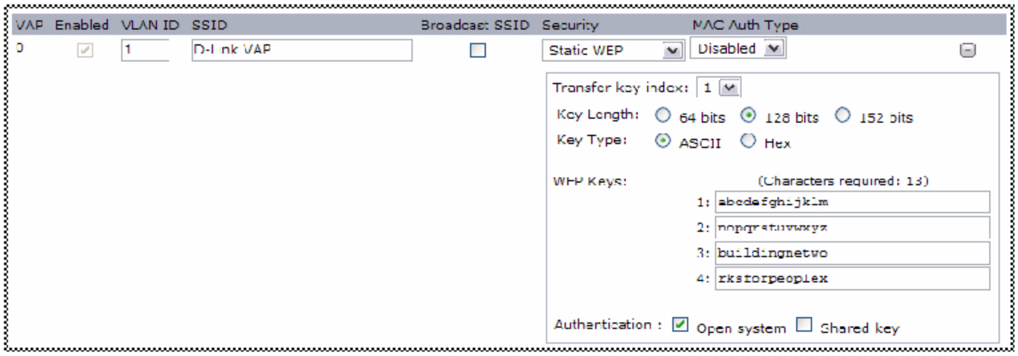
If you use Static WEP, the following rules apply:

- All client stations must have the Wireless LAN (WLAN) security set to WEP and all clients must have one of the WEP keys specified on the AP in order to de-code AP-to-station data transmissions.
- The AP must have all keys used by clients for station-to-AP transmit so that it can de-code the station transmissions.
- The same key must occupy the same slot on all nodes (AP and clients). For example if the AP defines `abc123` key as WEP key 3, then the client stations must define that same string as WEP key 3.
- Client stations 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.)
- On some wireless client software, you can configure multiple WEP keys and define a client station "transfer key index", and then set the stations to encrypt the data they transmit using different keys. This ensures that neighboring APs cannot decode each other's transmissions.
- You cannot mix 64-bit, 128-bit, and 152-bit WEP keys between the access point and its client stations.

Example of Using Static WEP

In this example, the administrator configures three WEP keys on the access point and sets the Transfer Key Index to "3." This means that the WEP key in slot "3" is the key the access point uses to encrypt the data it sends.

Figure 9. Static WEP Example



VAP	Enabled	VLAN ID	SSID	Broadcast SSID	Security	MAC Auth Type
0	☑	1	D-Link VAP	☐	Static WEP	Disabled

Transfer key index: 1

Key Length: ○ 64 bits ● 128 bits ○ 152 bits

Key Type: ● ASCII ○ Hex

WEP Keys: (Characters required: 13)

1: abcdefghijklm

2: nopqrstuvwxyz

3: buildingnetwo

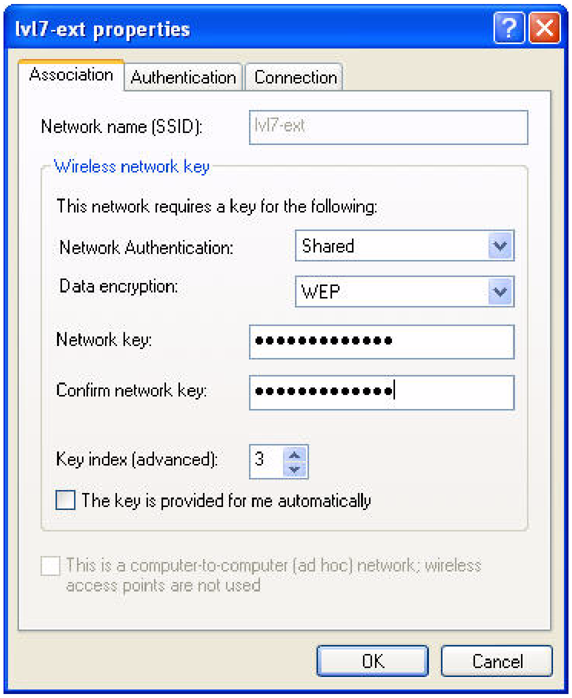
4: rksforpeoplex

Authentication : ☑ Open system ☐ Shared key

The administrator must then set all wireless client stations to use WEP and provide each client with one of the slot/key combinations defined on the AP.

For this example, the administrator sets WEP key 3 in the wireless network properties of a Windows client.

Figure 10. Providing a Wireless Client with a WEP Key



Network name (SSID): lvl7-ext

Wireless network key

This network requires a key for the following:

Network Authentication: Shared

Data encryption: WEP

Network key: •••••••••••••

Confirm network key: •••••••••••••

Key index (advanced): 3

□ The key is provided for me automatically

□ This is a computer-to-computer (ad hoc) network; wireless access points are not used

Additional wireless clients also need to have one of the WEP keys defined on the AP. The administrator can assign the same WEP key that the first client has, or the administrator can give the second station a different WEP key (key 2, for example) so that the two stations cannot decrypt each other's transmissions.

IEEE 802.1X

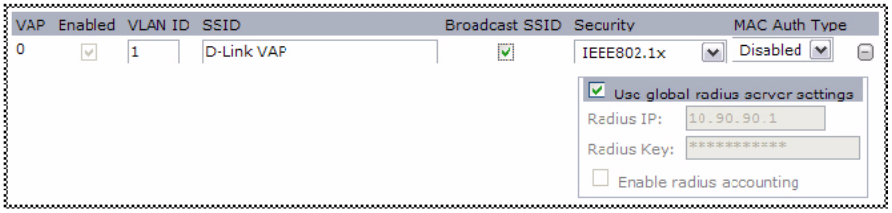
IEEE 802.1X is the standard defining port-based authentication and infrastructure for doing key management. Extensible Authentication Protocol (EAP) messages are sent over an IEEE 802.11 wireless network using a protocol called EAP Encapsulation Over LANs (EAPOL). IEEE 802.1X provides dynamically-generated keys that are periodically refreshed. An RC4 stream cipher is used to encrypt the frame body and perform a cyclic redundancy check (CRC) on each 802.11 frame.

This mode requires the use of an external RADIUS server to authenticate users. The access point requires a RADIUS server capable of EAP, such as the Microsoft Internet Authentication Server. To work with Windows clients, the authentication server must support Protected EAP (PEAP) and MSCHAP V2.

You can use any of a variety of authentication methods that the IEEE 802.1X mode supports, including certificates, Kerberos, and public key authentication. You must configure the client stations to use the same authentication method the access point uses.

If you select IEEE 802.1X as the Security Mode, additional fields display, as IEEE 80 shows.

Figure 11. IEEE 802.1X Configuration



VAP	Enabled	VLAN ID	SSID	Broadcast SSID	Security	MAC Auth Type
0	☑	1	D-Link VAP	☑	IEEE802.1x	Disabled

☑ Use global radius server settings

Radius IP: 10.90.90.1

Radius Key: ***********

☐ Enable radius accounting

IEEE 802.1X describes the configuration options for the IEEE 802.1X security mode.

Table 12. IEEE 802.1X

Field	Description
Use Global RADIUS Server Settings	By default each VAP uses the global RADIUS settings that you define for the AP at the top of the VAP page. • To use the global RADIUS server settings, make sure the check box is selected. • To use a separate RADIUS server for the VAP, clear the check box and enter the RADIUS server IP address and key in the following fields.
RADIUS IP	If the Use Global RADIUS Server Settings check box is cleared, enter the RADIUS IP in the text box. The *RADIUS IP* is the IP address of the RADIUS server.
RADIUS Key	If the Use Global RADIUS Server Settings check box is cleared, 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. You can use up to 63 standard alphanumeric and special characters. The key is case sensitive, and you must configure the same key on the AP and on your RADIUS server.
Enable RADIUS accounting	If the Use Global RADIUS Server Settings check box is cleared, click the **Enable RADIUS accounting** check box to track and measure the resources a particular user has consumed, such as system time, amount of data transmitted and received, and so on.

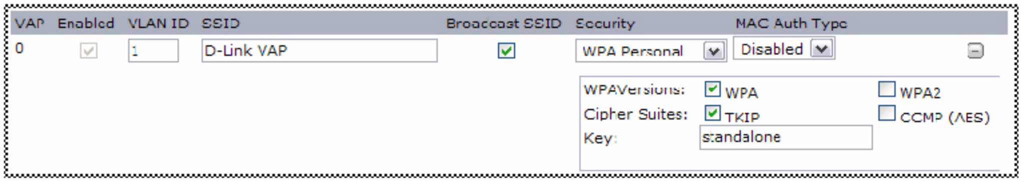
NOTE: After you configure the security settings, you must click **Update** to apply the changes and to save the settings. Changing some access point settings might cause the AP to stop and restart system processes. If this happens, wireless clients will temporarily lose connectivity. We recommend that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

WPA Personal

WPA Personal is an implementation of the IEEE 802.11i standard, which includes AES-CCMP and TKIP mechanisms. The Personal version of WPA employs a pre-shared key (PSK) instead of using IEEE 802.1X and EAP as is used in the Enterprise WPA security mode). The PSK is used for an initial check of credentials only. This security mode is backwards-compatible for wireless clients that support the original WPA.

If you select WPA Personal as the Security Mode, additional fields display, as WPA Personal Configuration shows.

Figure 12. WPA Personal Configuration



VAP	Enabled	VLAN ID	SSID	Broadcast SSID	Security	MAC Auth Type
0	☑	1	D-Link VAP	☑	WPA Personal	Disabled

WPAVersions: ☑ WPA ☐ WPA2

Cipher Suites: ☑ TKIP ☐ CCMP (AES)

Key: standalone

describes the configuration options for the WPA Personal security mode.

Table 13. WPA Personal

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

Cipher Suites	Select the cipher suite you want to use: • TKIP • CCMP (AES) • TKIP and CCMP (AES) 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 AP: • A valid TKIP key • A valid AES-CCMP key Clients not configured to use WPA Personal will not be able to associate with the AP.
Key	The pre-shared key is the shared secret key for WPA Personal. Enter a string of at least 8 characters to a maximum of 63 characters. Acceptable characters include upper and lower case alphabetic letters, the numeric digits, and special symbols such as @ and #. Spaces are not permitted.

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

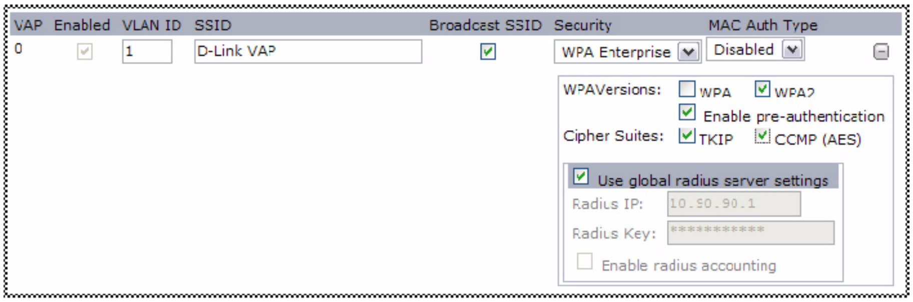
WPA Enterprise

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

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

If you select WPA Enterprise as the Security Mode, additional fields display as WPA Enterprise Configuration shows.

Figure 13. WPA Enterprise Configuration



VAP	Enabled	VLAN ID	SSID	Broadcast SSID	Security	MAC Auth Type
0	☑	1	D-Link VAP	☑	WPA Enterprise	Disabled

WPAVersions: □ WPA ☑ WPA2

☑ Enable pre-authentication

Cipher Suites: ☑ TKIP ☑ CCMP (AES)

☑ Use global radius server settings

Radius IP: 10.90.90.1

Radius Key: **********

□ Enable radius accounting

WPA Enterprise describes the configuration options for the WPA Enterprise security mode.

Table 14. **WPA Enterprise**

Field	Description
WPA Versions	Select the types of client stations you want to support: • **WPA.** If all client stations on the network support the original WPA but none support the newer WPA2, then select WPA. • **WPA2.** If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard. • **WPA and WPA2.** If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select both WPA and WPA2. This lets both WPA and WPA2 client stations associate and authenticate but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.
Enable pre-authentication	If for WPA Versions you select only WPA2 or both WPA and WPA2, you can enable pre-authentication for WPA2 clients. Click **Enable pre-authentication** if you want WPA2 wireless clients to send pre-authentication packets. 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 suite you want to use: • TKIP • CCMP (AES) • TKIP and CCMP (AES) By default both TKIP and CCMP are selected. When both TKIP and CCMP are selected, client stations configured to use WPA with RADIUS must have one of the following: • A valid TKIP RADIUS IP address and RADIUS Key • A valid CCMP (AES) IP address and RADIUS Key
Use Global RADIUS Server Settings	By default each VAP uses the global RADIUS settings that you define for the AP at the top of the VAP page. • To use the global RADIUS server settings, make sure the check box is selected. • To use a separate RADIUS server for the VAP, clear the check box and enter the RADIUS server IP address and key in the following fields.
RADIUS IP	If the Use Global RADIUS Server Settings check box is cleared, enter the RADIUS IP in the text box. The *RADIUS IP* is the IP address of the RADIUS server.

RADIUS Key	If the Use Global RADIUS Server Settings check box is cleared, 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. You can use up to 63 standard alphanumeric and special characters. The key is case sensitive, and you must configure the same key on the AP and on your RADIUS server.
Enable RADIUS accounting	If the Use Global RADIUS Server Settings check box is cleared, click the **Enable RADIUS accounting** check box to track and measure the resources a particular user has consumed, such as system time, amount of data transmitted and received, and so on.

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

Prohibiting the SSID Broadcast

The column to the left of the Security modes allows you to enable or disable the SSID broadcast. You can suppress (prohibit) the SSID broadcast to discourage stations from automatically discovering your access point. When the broadcast SSID of the AP is suppressed, the network name is not displayed in the list of available networks on a client station. Instead, the client must have the exact network name configured in the supplicant before it is able to connect.

Disabling the broadcast SSID is sufficient to prevent clients from accidentally connecting to your network, but it will not prevent even the simplest of attempts by a hacker to connect or monitor unencrypted traffic.

Suppressing the SSID broadcast offers a very minimal level of protection on an otherwise exposed network (such as a guest network) where the priority is making it easy for clients to get a connection and where no sensitive information is available.

5

Managing the Access Point

This chapter describes how to manage the Unified Access Point and contains the following sections:

- Setting the
- Configuring
- Configuring
- Controlling Access by
- Configuring

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

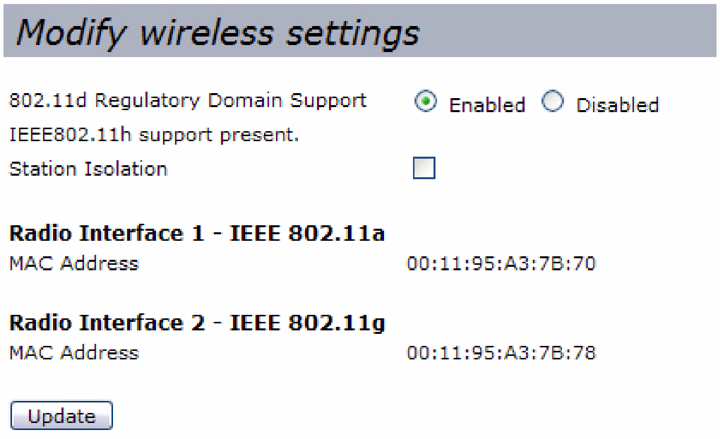
Setting the Wireless Interface

Wireless settings describe aspects of the LAN related specifically to the radio device in the access point (802.11 mode) and to the network interface to the access point (access point MAC address).

To configure the wireless interface, click the **Wireless Settings** tab.

NOTE: Wir shows the **Wireless Settings** page for the DWL-8500AP.

Figure 14. Wireless Interface Configuration



Modify wireless settings

802.11d Regulatory Domain Support ● Enabled ○ Disabled

IEEE802.11h support present.

Station Isolation □

Radio Interface 1 - IEEE 802.11a

MAC Address 00:11:95:A3:7B:70

Radio Interface 2 - IEEE 802.11g

MAC Address 00:11:95:A3:7B:78

NOTE: For the DWL-8500AP, radio interface settings apply to both **Radio Interface 1** and **Radio Interface 2**.

Wireless Settings describes the fields and configuration options available on the Wireless Settings page.

Table 15. Wireless Settings

Field	Description
802.11d Regulatory Domain Support	Enabling support for IEEE 802.11d (World Mode) on the access point causes the AP to broadcast its operational country code as a part of its beacons and probe responses. This allows client stations to operate in any country without reconfiguration. • To enable 802.11d regulatory domain support, click **Enabled**. • To disable 802.11d regulatory domain support, click **Disabled**.
IEEE 802.11h Support	The Administration UI shows whether IEEE 802.11h regulatory domain control is in effect on the AP. IEEE 802.11h cannot be modified. For more information, see Using the 802.11h Wireless Mode. IEEE 802.11h is a standard that provides two services required to satisfy certain regulatory domains for the 5 GHz band. These two services are Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS). **Note:** The 802.11h mode is automatically enabled if the AP is configured to work in any country that requires 802.11h as a minimum standard.
Station Isolation	To enable station isolation, select the option directly beside it. • When Station Isolation is disabled, wireless clients can communicate with one another normally by sending traffic through the access point. • When Station Isolation is enabled, the access point blocks communication between wireless clients. The access point still allows data traffic between its wireless clients and wired devices on the network, but not among wireless clients.
Radio Interface	The mode following the radio interface defines the IEEE wireless networking standard of the radio.

MAC Address	Indicates the Media Access Control (MAC) addresses for the interface. For the DWL-8500AP, this page shows the MAC addresses for Radio Interface One and Radio Interface Two. A MAC address is a permanent, unique hardware address for any device that represents an interface to the network. The MAC address is assigned by the manufacturer. You cannot change the MAC address. It is provided here for informational purposes as a unique identifier for an interface.

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

Using the 802.11h Wireless Mode

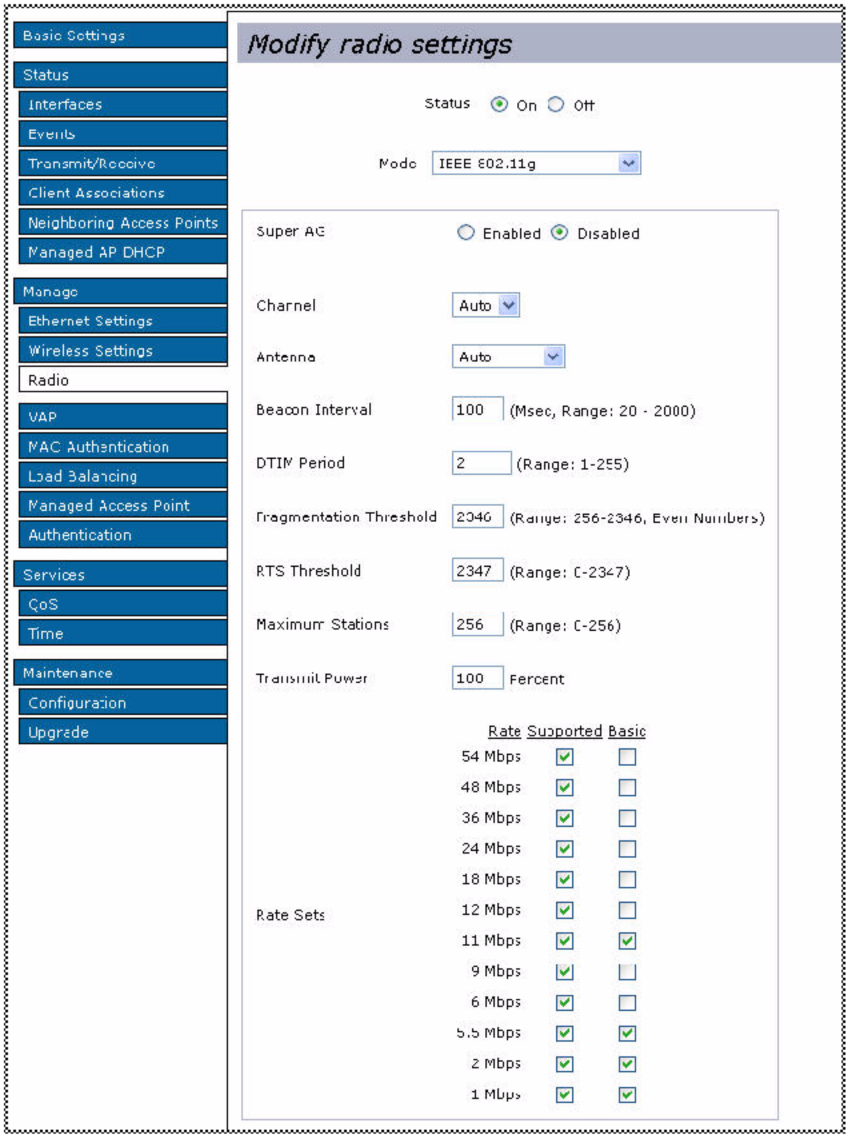
There are a number of key points about the IEEE 802.11h standard:

- 802.11h only works for the 802.11a band. It is not required for 802.11b or 802.11g.
- If you are operating in an 802.11h enabled domain, the AP attempts to use the channel you assign. If the channel has been blocked by a previous radar detection, or if the AP detects a radar on the channel, then the AP automatically selects a different channel.
- When 802.11h is enabled, the initial bootup time increases by a minimum of sixty seconds. This is the minimum time required to scan the selected channel for radar interference.

Configuring Radio Settings

Radio settings directly control the behavior of an IEEE 802.11-compliant radio device in the access point. Specifically, a user can control operational mode, power level, frequency, and other per-radio IEEE 802.11 configuration options.

To specify radio settings, click the **Radio** tab.



Modify radio settings

Status ● On ○ Off

Mode IEEE 802.11g

Super AG ○ Enabled ● Disabled

Channel Auto

Antenna Auto

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

DTIM Period 2 (Range: 1-255)

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

RTS Threshold 2347 (Range: 0-2347)

Maximum Stations 256 (Range: 0-256)

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 describes the fields and configuration options for the **Radio Settings** page.

Table 16. Radio Settings

Field	Description
Radio **(DWL-8500AP only)**	Select Radio 1 or Radio 2 to specify which radio to configure. The rest of the settings on this tab apply to the radio you select in this field. Be sure to configure settings for both radios. **Note**: this field is not available on the DWL-3500AP because it only has one radio.

Status (On/Off)	Specify whether you want the radio on or off by clicking On or Off. If you turn off a radio, the AP sends disassociation frames to all the wireless clients it is currently supporting so that the radio can be gracefully shutdown and the clients can start the association process with other available APs.
Mode (DWL-8500AP Radio 1 only)	The Mode defines the wireless network standard the radio uses. • IEEE 802.11a • Dynamic Turbo 5 GHz
Mode (DWL-3500 and DWL-8500AP Radio 2)	The Mode defines the wireless network standard the radio uses. • IEEE 802.11g • Dynamic Turbo 2.4 GHz
Super AG	Super AG is a radio mode that attempts to increases performance through bursting and frame compression. Performance increases when the AP communicates with Super AG-enabled clients. However, with Super AG enabled, the access point transmissions consume more bandwidth. • To enable Super AG, click Enabled. • To disable Super AG, click Disabled.
Channel	Select the channel. The range of available channels is determined by the mode of the radio interface and the country code setting. If you select Auto for the channel setting, the access point scans available channels and selects a channel where no traffic is detected. The Channel defines the portion of the radio spectrum the radio uses for transmitting and receiving. Each mode offers a number of channels, depending on how the spectrum is licensed by national and transnational authorities such as the Federal Communications Commission (FCC) or the International Telecommunication Union (ITU-R).
Antenna	Select the antenna use to receive and transmit wireless traffic: • Auto: This mode is not operational. Select the Primary or Secondary mode. • Primary: Use the primary antenna to send and receive traffic. • Secondary: Use the secondary antenna to send and receive traffic.
Beacon Interval	Enter a value from 20 to 2000 milliseconds. Beacon frames are transmitted by an access point at regular intervals to announce the existence of the wireless network. The default behavior is to send a beacon frame once every 100 milliseconds (or 10 per second).

DTIM Period	Specify a DTIM period from 1-255 beacons. The Delivery Traffic Information Map (DTIM) message is an element included in some Beacon frames. It indicates which client stations, currently sleeping in low-power mode, have data buffered on the access point awaiting pick-up. The DTIM period you specify indicates how often the clients served by this access point should check for buffered data still on the AP awaiting pickup. The measurement is in beacons. For example, if you set this field to 1, clients will check for buffered data on the AP at every beacon. If you set this field to 10, clients will check on every 10th beacon.
Fragmentation Threshold	Specify a number between 256 and 2,346 to set the frame size threshold in bytes. The fragmentation threshold is a way of limiting the size of frames transmitted over the network. If a packet exceeds the fragmentation threshold, the fragmentation function is activated and the packet is sent as multiple 802.11 frames. If the packet being transmitted is equal to or less than the threshold, fragmentation is not used. Setting the threshold to the largest value (2,346 bytes) effectively disables fragmentation. Fragmentation involves more overhead both because of the extra work of dividing up and reassembling of frames it requires, and because it increases message traffic on the network. However, fragmentation can help *improve* network performance and reliability if properly configured. Sending smaller frames (by using lower fragmentation threshold) might help with some interference problems; for example, it might help with microwave oven interference. By default, fragmentation is off. We recommend not using fragmentation unless you suspect radio interference. The additional headers applied to each fragment increase the overhead on the network and can greatly reduce throughput.
RTS Threshold	Specify an RTS Threshold value between 0 and 2347. The RTS threshold specifies the packet size of the minimum packet for which a request to send (RTS) frame will be sent. 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	Specify the maximum number of stations allowed to associate to this radio at any one time. You can enter a value between 0 and 256.
Transmit Power	Enter a percentage value for the transmit power level for this access point. The default value, which is 100%, can be more cost-efficient than a lower percentage since 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 helps reduce overlap and interference among APs. A lower transmit power setting can also keep your network more secure because weaker wireless signals are less likely to propagate outside of the physical location of your network.
Rate Sets	Check the transmission rate sets 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 check multiple rates (click an option to select or de-select a rate). The AP will automatically choose the most efficient rate based on factors like error rates and distance of client stations from the AP. • Basic Rate Sets indicate rates that the access point will advertise to the network for the purposes of setting up communication with other APs and client stations on the network. It is generally more efficient to have an AP broadcast a subset of its supported rate sets.

For the DWL-8500AP, use the **Radio Settings** page to configure both Radio One and Radio Two. The settings on the page apply only to the radio that you select from the Radio list. After you configure settings for one of the radios, click **Update** and then select and configure the other radio. Be sure to click **Update** to apply the second set of configuration settings for the other radio.

NOTE: After you configure the radio settings, you must click **Update** to apply the changes and to save the settings. Changing these access point settings might cause the AP to stop and restart system processes. Additionally, changing the Super AG setting will cause the AP to reset. If this happens, wireless clients will temporarily lose connectivity. We recommend that you change access point settings when WLAN traffic is low.

Configuring Virtual Access Points

You can configure virtual access points (VAPs) to segment the wireless LAN into multiple broadcast domains that are the wireless equivalent of Ethernet VLANs. You can configure up to eight VAPs on a radio. The VAPs simulate multiple APs in one physical access point.

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

You can configure each VAP to use a different VLAN, or you can configure multiple VAPs to use the same VLAN. VAP0 is always enabled and is assigned to VLAN 1 by default.

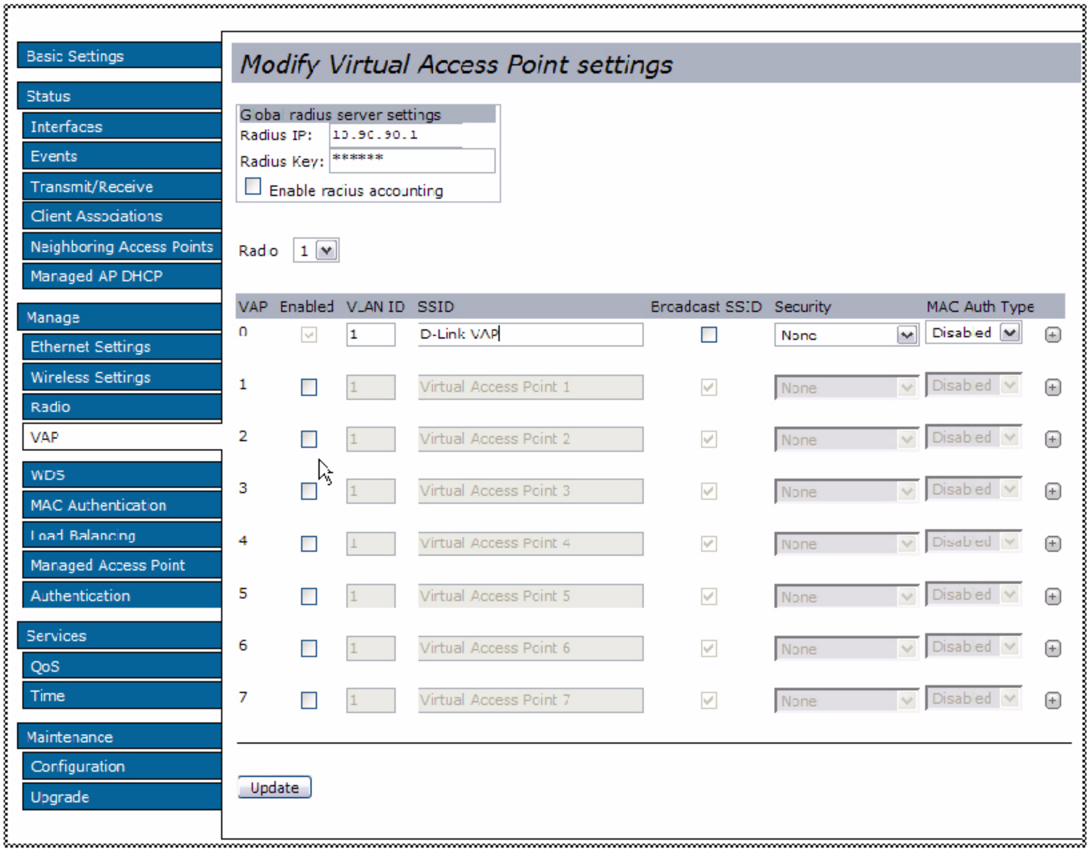
For the DWL-8500AP, VAP0 is always enabled on both radios, and VAPs can use a VLAN whether the VLAN is on the same radio or on a different radio.

The access point adds VLAN ID tags to wireless client traffic based on the VLAN ID you configure on the VAP page or by using the RADIUS server assignment. If you use an external RADIUS server, you can configure multiple VLANs on each VAP. The external RADIUS server assigns wireless clients to the VLAN when the clients associate and authenticate. For more information about using a RADIUS server to manage VLANs, see “Configuring the RADIUS Server for VLAN Tags” on page 122.

If wireless clients use a security mode that does not communicate with the RAIDUS server, or if the RADIUS server does not provide the VLAN information, you can assign a VLAN ID to each VAP. If the wireless client is not assigned a VLAN through any other method, the AP assigns the VLAN ID specified in the VAP to all wireless clients that connect to the AP through that VAP.

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

To set up multiple virtual access points, Click the **VAP** tab.



Modify Virtual Access Point settings

Global radius server settings

Radius IP: 10.90.90.1

Radius Key: ******

□ Enable radius accounting

Radio 1

VAP	Enabled	VLAN ID	SSID	Broadcast SSID	Security	MAC Auth Type
0	☑	1	D-Link VAP	□	None	Disabled
1	□	1	Virtual Access Point 1	☑	None	Disabled
2	□	1	Virtual Access Point 2	☑	None	Disabled
3	□	1	Virtual Access Point 3	☑	None	Disabled
4	□	1	Virtual Access Point 4	☑	None	Disabled
5	□	1	Virtual Access Point 5	☑	None	Disabled
6	□	1	Virtual Access Point 6	☑	None	Disabled
7	□	1	Virtual Access Point 7	☑	None	Disabled

VAP describes the fields and configuration options on the **VAP** page.

Table 17. VAP Configuration

Field	**Description**
RADIUS IP	By default each VAP uses the global RADIUS settings that you define for the AP at the top of the VAP page. Enter the IP address of the RADIUS server on your network that all VAPs use by default. The *RADIUS IP* is the IP address of the global RADIUS server.
RADIUS Key	Enter the RADIUS Key in the text box. The *RADIUS Key* is the shared secret key for the global RADIUS server. The text you enter will be displayed as "*" characters to prevent others from seeing the RADIUS key as you type.
Enable RADIUS Accounting	Click this option if you want to log accounting information for clients with user names and passwords.
Radio (DWL-8500AP only)	Select the radio to configure. VAPs are configured independently on each radio.
VAP	You can configure up to 8 VAPs on a radio. VAP0 is the physical radio interface, so to disable VAP0, you must disable the radio.

Enabled	You can enable or disable a configured network. • To enable the specified network, click the **Enabled** option beside the appropriate VAP. • To disable the specified network, clear the **Enabled** option beside the appropriate VAP. If you disable the specified network, you will lose the VLAN ID you entered.
VLAN ID	When a wireless client connects to the AP by using this VAP, the AP tags all traffic from the wireless client with the VLAN ID you enter in this field unless you enter the untagged VLAN ID or use a RADIUS server to assign a wireless client to a VLAN. The range for the VLAN ID is 1-4094. If you use RADIUS-based authentication for clients, you can optionally add the following attributes to configure a VLAN for the client: • "Tunnel-Type" • "Tunnel-Medium-Type" • "Tunnel-Private-Group-ID" The RADIUS-assigned VLAN ID overrides the VLAN ID you configure on the VAP page. **Note:** Any RADIUS-assigned VLAN cannot be the same as the management VLAN. You configure the untagged and management VLAN IDs on the Ethernet Settings page. For more information, see "Configuring the Ethernet Interface" on page 31.
SSID	Enter a name for the wireless network. The SSID is an alphanumeric string of up to 32 characters. You can use the same SSID for multiple VAPs, or you can choose a unique SSID for each VAP. **Note:** If you are connected as a wireless client to the same AP that you are administering, resetting the SSID will cause you to lose connectivity to the AP. You will need to reconnect to the new SSID after you save this new setting.
Broadcast SSID	To enable the SSID broadcast, click the **Broadcast SSID** option. By default, the access point broadcasts (allows) the *Service Set Identifier* (SSID) in its beacon frames. For information about turing off the SSID broadcast, see "Prohibiting the SSID Broadcast" on page 54.
Security	Select one of the following **Security** modes for this VAP: • None • Static WEP • WPA Personal • IEEE 802.1X • WPA Enterprise If you select a security mode other than None, additional fields appear. **Note:** The Security mode you set here is specifically for this Virtual Access Point. For more information about the security options, see "Configuring Virtual Access Point Security" on page 43.

MAC Authentication Type	You can configure a global list of MAC addresses that are allowed or denied access to the network. The menu for this feature allows you to select the type of MAC Authentication to use: • Disabled—Do not use MAC Authentication. • Local—Use the MAC Authentication list that you configure on the MAC Authentication page. • RADIUS—Use the MAC Authentication list on the external RADIUS server. For more information about MAC Authentication, see Controlling Access by .

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

Table 18. Static WEP

Field	Description
Transfer Key Index	Select a key index from the menu. 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 the length of the key by clicking one of the buttons: • 64 bits • 128 bits • 152 bits
Key Type	Select the key type by clicking one of the buttons: • ASCII • Hex
WEP Keys	You can specify up to four WEP keys. In each text box, enter a string of characters for each key. The characters you enter depend on the Key Type: • **ASCII**—Includes upper and lower case alphabetic letters, the numeric digits, and special symbols such as @ and #. Spaces are not permitted. • **Hex**—Includes digits 0 to 9 and the letters A to F. Use the same number of characters for each key as specified in the Characters Required field. These are the RC4 WEP keys shared with the stations using the access point. Each client station must be configured to use one of these same WEP keys in the same slot as specified here on the AP. **Characters Required:** The number of characters you enter into the WEP Key fields is determined by the Key length and Key type you select. For example, if you use 128-bit ASCII keys, you must enter 26 characters in the WEP key. The number of characters required updates automatically based on how you set Key Length and Key Type.

Authentication	The authentication algorithm defines the method used to determine whether a client station 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 options: • Open System • Shared Key **Note:** You can also select both the Open System and Shared Key check boxes. **Open System** authentication allows any client station to associate with the access point whether that client station has the correct WEP key or not. This algorithm is also used in plaintext, IEEE 802.1X, and WPA modes. When the authentication algorithm is set to Open System, any client can associate with the access point. Note that just because a client station is allowed to *associate* does not ensure it can exchange traffic with an access point. A station 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 station to have the correct WEP key in order to associate with the access point. When the authentication algorithm is set to Shared Key, a station with an incorrect WEP key will not be able to associate with the access point. **Both Open System and Shared Key**. When you select both authentication algorithms: Client stations configured to use WEP in shared key mode must have a valid WEP key in order to associate with the access point. Client stations configured to use WEP as an open system (shared key mode not enabled) will be able to associate with the access point even if they do not have the correct WEP key.

Table 19. IEEE 802.1X

Field	Description
Use Global RADIUS Server Settings	By default each VAP uses the global RADIUS settings that you define for the AP at the top of the VAP page. • To use the global RADIUS server settings, make sure the option is selected. • To use a separate RADIUS server for the VAP, clear the option and enter the RADIUS server IP address and key in the following fields.
RADIUS IP	If the Use Global RADIUS Server Settings option is cleared, enter the RADIUS IP in the text box. The *RADIUS IP* is the IP address of the RADIUS server.

RADIUS Key	If the Use Global RADIUS Server Settings option is cleared, 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. You can use up to 63 standard alphanumeric and special characters. The key is case sensitive, and you must configure the same key on the AP and on your RADIUS server.
Enable RADIUS accounting	If the Use Global RADIUS Server Settings option is cleared, click the **Enable RADIUS accounting** option to track and measure the resources a particular user has consumed, such as system time, amount of data transmitted and received, and so on.

Table 20. **WPA Personal**

Field	Description
WPA Versions	Select the types of client stations you want to support: • **WPA.** If all client stations on the network support the original WPA but none support the newer WPA2, then select WPA. • **WPA2.** If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard. • **WPA and WPA2.** If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select both of the options. This lets both WPA and WPA2 client stations associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.
Cipher Suites	Select the cipher suite you want to use: • TKIP • CCMP (AES) • TKIP and CCMP (AES) 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 AP: • A valid TKIP key • A valid AES-CCMP key Clients not configured to use WPA Personal will not be able to associate with the AP.
Key	The pre-shared key is the shared secret key for WPA Personal. Enter a string of at least 8 characters to a maximum of 63 characters. Acceptable characters include upper and lower case alphabetic letters, the numeric digits, and special symbols such as @ and #. Spaces are not permitted.

Table 21. **WPA Enterprise**

Field	Description
WPA Versions	Select the types of client stations you want to support: • **WPA.** If all client stations on the network support the original WPA but none support the newer WPA2, then select WPA. • **WPA2.** If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard. • **WPA and WPA2.** If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select both WPA and WPA2. This lets both WPA and WPA2 client stations associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.
Enable pre-authentication	If for WPA Versions you select only WPA2 or both WPA and WPA2, you can enable pre-authentication for WPA2 clients. Click **Enable pre-authentication** if you want WPA2 wireless clients to send 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 suite you want to use: • TKIP • CCMP (AES) • TKIP and CCMP (AES) By default both TKIP and CCMP are selected. When both TKIP and CCMP are selected, client stations configured to use WPA with RADIUS must have one of the following: • A valid TKIP RADIUS IP address and RADIUS Key • A valid CCMP (AES) IP address and RADIUS Key
Use Global RADIUS Server Settings	By default each VAP uses the global RADIUS settings that you define for the AP at the top of the VAP page. • To use the global RADIUS server settings, make sure the option is selected. • To use a separate RADIUS server for the VAP, clear the option and enter the RADIUS server IP address and key in the following fields.
RADIUS IP	If the Use Global RADIUS Server Settings option is cleared, enter the RADIUS IP in the text box. The *RADIUS IP* is the IP address of the RADIUS server.

RADIUS Key	If the Use Global RADIUS Server Settings option is cleared, 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. You can use up to 63 standard alphanumeric and special characters. The key is case sensitive, and you must configure the same key on the AP and on your RADIUS server.
Enable RADIUS accounting	If the Use Global RADIUS Server Settings option is cleared, click the **Enable RADIUS accounting** option to track and measure the resources a particular user has consumed, such as system time, amount of data transmitted and received, and so on.

Controlling Access by MAC Authentication

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

You can use the Administrator UI on the access point or use an external RADIUS server to control access based on the MAC address of the wireless client. This feature is called MAC Authentication or MAC Filtering. To control access locally, you configure a global list of MAC addresses that are allowed or denied access to the network. To use the RADIUS server, you configure authentication based on the MAC address of the client. When a wireless client attempts to associate with an AP, the AP looks up the client’s MAC address on the RADIUS server. If it is found, the global “allow” or “deny” setting is applied. If it is not found, the opposite is applied.

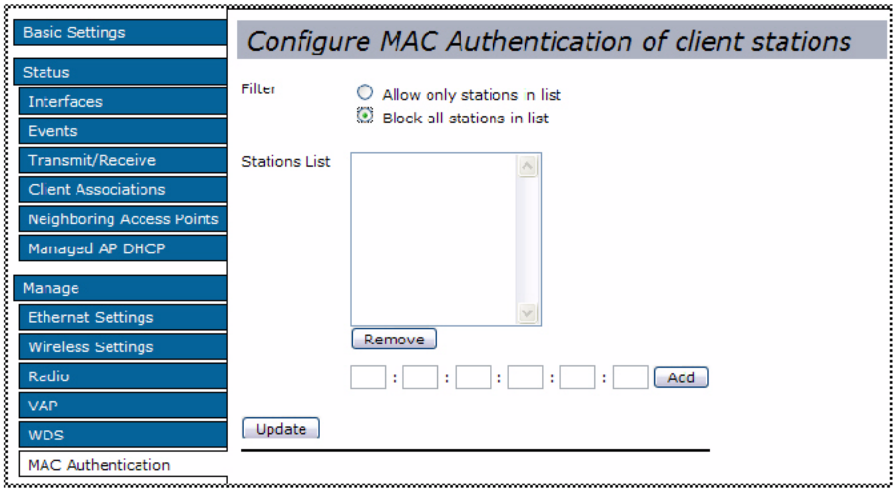
You choose whether to use local or RADIUS-based MAC Authentication, local MAC Authentication, or no MAC Authentication on the VAP page. For more information, see Configuring .

Configuring a MAC Filter List on the AP

The **MAC Authentication** page allows you to control access to the access point based on MAC addresses. Based on how you set the filter, you can *allow* only client stations with a listed MAC address or *deny* access to the stations listed.

When you enable MAC Authentication and specify a list of approved MAC addresses, only clients with a listed MAC address can access the network. If you specify MAC addresses to deny, all clients can access the network except for the clients on the *deny* list.

To enable filtering by MAC address, click the **MAC Authentication** tab.



Configure MAC Authentication of client stations

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

Stations List

NOTE: Global MAC Authentication settings apply to all VAPs. For the DWL-8500AP, the settings apply to all VAPs on both radios.

MAC Au describes the fields and configuration options available on the **MAC Authentication** page.

Table 22. MAC Authentication

Field	Description
Filter	To set the MAC Address Filter, click one of the following buttons: • Allow only stations in the list • Block all stations in list This setting applies to both RADIUS and local MAC authentication.
Stations List	To add a MAC Address to Stations List, enter its 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 either be allowed or denied AP access based on how you set the Filter.

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

Configuring MAC Authentication on the RADIUS Server

If you use RADIUS MAC authentication for MAC-based access control, you must configure MAC entries in the RADIUS server, as described in RADIUS Server Attributes for MAC Authentication.

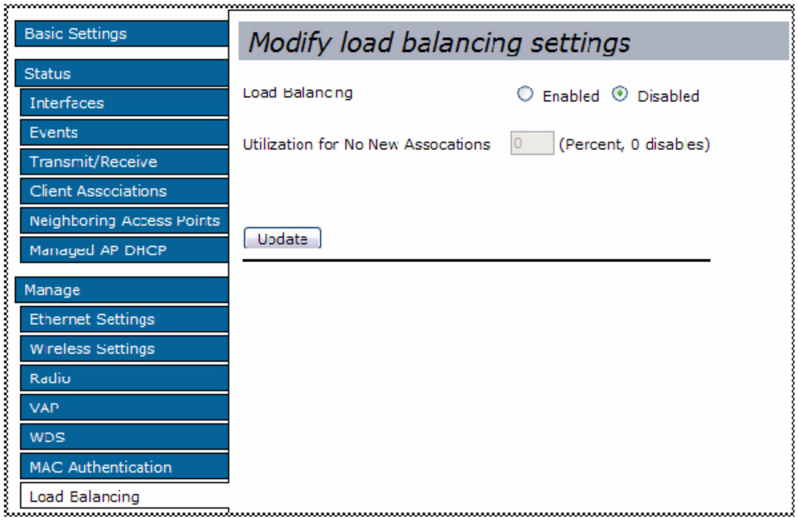
Table 23. RADIUS Server Attributes for MAC Authentication

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

Configuring Load Balancing

You can set network utilization thresholds on the access point to maintain the speed and performance of the wireless network as clients associate and disassociate with the AP. For the DWL-8500AP, the load balancing settings apply to both radios.

To configure load balancing and set limits and behavior to be triggered by a specified utilization rate of the access point, click the **Load Balancing** tab and update the fields shown in Load Balancing.



Modify load balancing settings

Load Balancing ○ Enabled ● Disabled

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

Table 24. **Load Balancing**

Field	Description
Load Balancing	Enable or disable 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	Provide the percentage of network bandwidth utilization allowed on the radio before the AP stops accepting new client associations. The default is 0, which means that all new associations will be allowed regardless of the utilization rate.

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

6

Configuring Access Point Services

This chapter describes how to configure services on the DWL-3500AP and DWL-8500AP and contains the following sections:

- Configuring
- Enabling the Network T

Configuring Quality of Service (QoS)

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

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 transmission. 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 “Configuring Load Balancing” on page 68) and QoS techniques, you can provide a high quality of service for time-sensitive applications even on a busy network. Load balancing sets thresholds for client associations and AP utilization. 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 prioritizing 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 Unified Access Point provides QoS based on the *Wireless Multimedia* (WMM) specification, which implements a subset of 802.11e features.

Both access points and wireless clients (laptops, consumer electronics products) can be WMM-enabled by the Wi-Fi Alliance.

QoS Queues and Parameters to Coordinate Traffic Flow

Configuring QoS options on the Unified 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 Unified Access Point implements QoS 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 prioritization and routing based on the type of data being transmitted.

The Administration UI provides a way for you to configure parameters on the queues.

QoS Queues and Diff-Serve Code Points (DSCP) on Packets

QoS on the Unified Access Point leverages WMM information in the IP packet header related to Diff-Serv Code Point (DSCP). Every IP packet sent over the network includes a DSCP field in the header that indicates how the data should be prioritized and transmitted over the network. The DSCP field consists of a 6 bit value defined by the local administration. For WMM, the Wi-Fi Alliance suggests a particular mapping for DSCP values

The access point examines the DSCP field in the headers of all packets that pass through the AP. Based on the value in a packet's DSCP field, the AP prioritizes 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).

Using the QoS settings on the Administration UI, 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.

Wireless traffic travels:

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

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

The other phases of the traffic flow (to and from the network) are not under control of the QoS settings on the AP.

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 some descriptive meta-information packaged for transmission on a wireless network.

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.

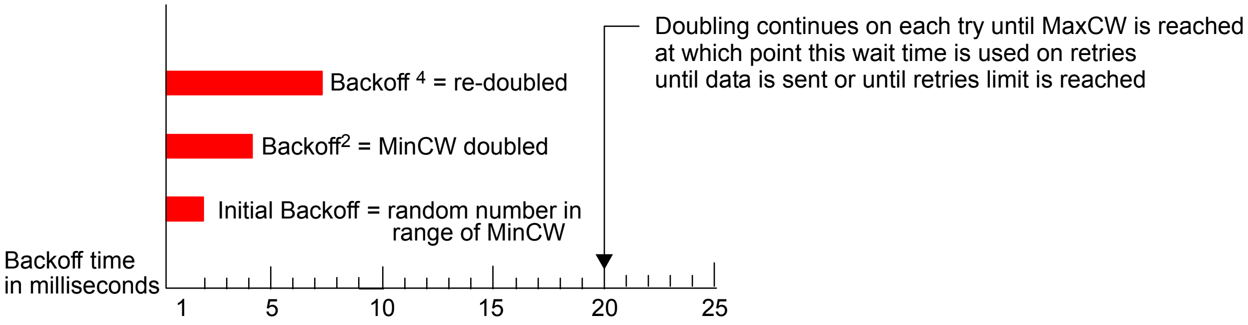
Management and control frames wait a minimum amount of time for transmission; they wait a *short interframe space* (SIF). These wait times are built-in to 802.11 as infrastructure support and are not configurable.

The Unified 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.

This parameter is configurable.

Random Backoff and Minimum / Maximum Contention Windows

If an access point detects that the medium is in use (busy), 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 some 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 more active users you have on a network, the more significant the performance gains of the backoff timer will be in reducing the number of collisions and retransmissions.


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
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

The random backoff used by the access point is a configurable parameter. To describe the random delay, a “Minimum Contention Window” (MinCW) and a “Maximum Contention Window” (MaxCW) 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 Unified 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).

802.1p and DSCP tags

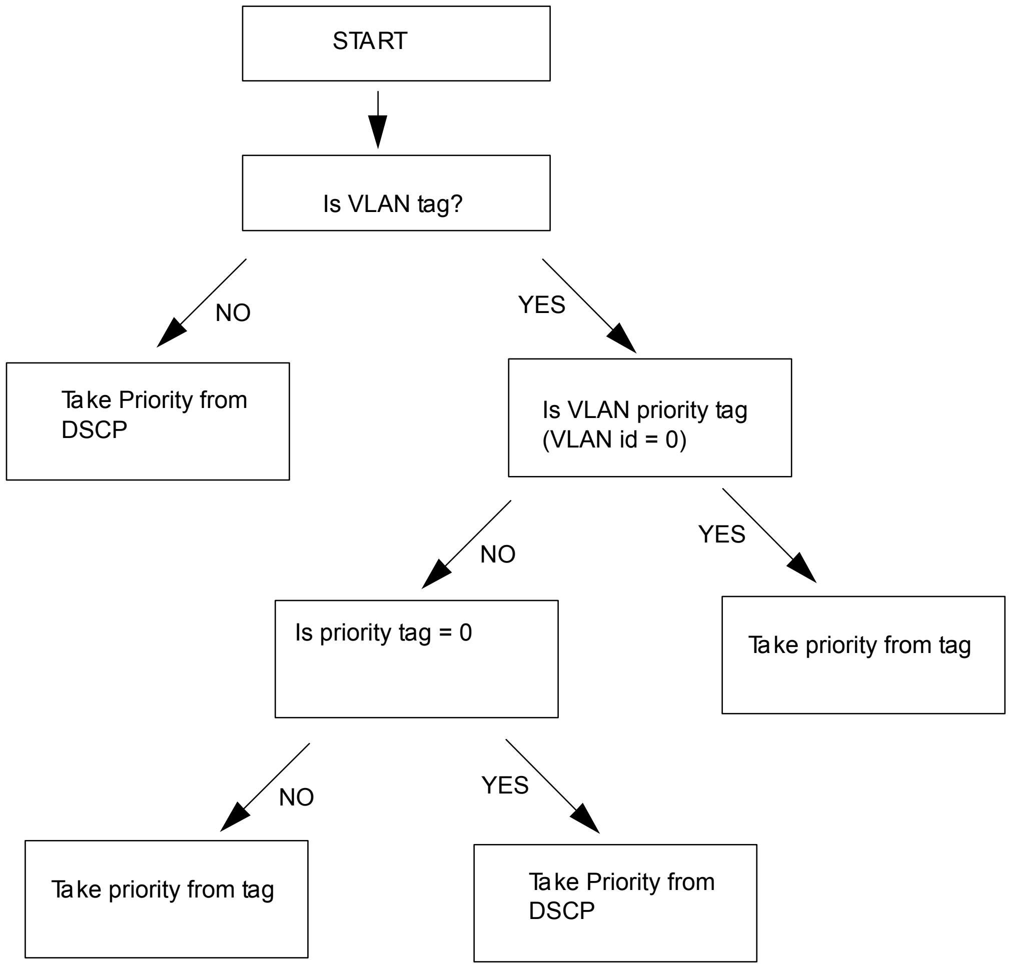
IEEE 802.1p is an extension of the IEEE 802 standard and is responsible for QoS provision. One purpose of 802.1p is to prioritize network traffic at the data link/ MAC layer.

The 802.1q tag includes a three-bit field for prioritization, which allows packets to be grouped into various traffic classes. Eight priority levels are defined. The highest priority is seven, which might go to network critical traffic (voice). The lowest priority level is zero, this is used as a best-effort default, it is invoked automatically when no other value has been set.

NOTE: IEEE 802.1p prioritization will not work unless QoS and WMM are enabled. WMM must be enabled on both the AP and on the client connecting to the AP.

Traffic Prioritization outlines the way in which tags are retrieved and traffic prioritized on a network.

Figure 15. Traffic Prioritization



VLAN Priority Tags outlines the VLAN priority and DSCP values.

Table 21. VLAN Priority Tags

VLAN Priority	Priority	DSCP Value
0	Best Effort	0
1	Background	16
2	Background	8
3	Best Effort	24
4	Video	32
5	Video	40
6	Voice	48
7	Voice	56

Configuring QoS Settings

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

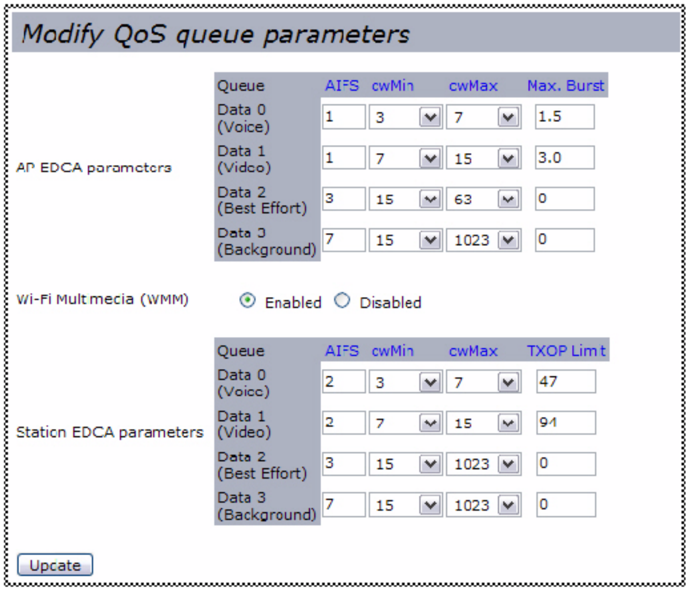
AP Enhanced Distributed Channel Access (EDCA) Parameters affect traffic flowing from the access point to the client station.

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

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

NOTE: For the DWL-8500AP, the QoS settings apply to both radios but the traffic for each radio is queued independently.

To set up queues for QoS, click the **QoS** tab under the **Services** heading and configure settings as described in 錯誤! 找不到參照來源。.



Modify QoS queue parameters

	Queue	AIFS	cwMin	cwMax	Max. Burst
AP EDCA parameters	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

	Queue	AIFS	cwMin	cwMax	TXOP Limit
Station EDCA parameters	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

Table 22. **QoS Settings**

Field	Description
AP EDCA Parameters	
Queue	Queues are defined for different types of data transmitted from AP-to-station: • **Data 0 (Voice)**—High priority queue, minimum delay. Time-sensitive data such as VoIP and streaming media are automatically sent to this queue. • **Data 1(Video)**—High priority queue, minimum delay. Time-sensitive video data is automatically sent to this queue. • **Data 2 (best effort)**—Medium priority queue, medium throughput and delay. Most traditional IP data is sent to this queue. • **Data 3 (Background)**—Lowest priority queue, high throughput. Bulk data that requires maximum throughput and is not time-sensitive is sent to this queue (FTP data, for example).
AIFS **(Inter-Frame Space)**	The Arbitration Inter-Frame Spacin*g* (AIFS) specifies a wait time (in milliseconds) for data frames. Valid values for AIFS are 1 through 255.
cwMin **(Minimum Contention Window)**	This parameter is input to the algorithm that determines the initial random backoff wait time (“window”) for retry of a transmission. The value specified for Minimum Contention Window is the upper limit (in milliseconds) of a range from which the initial random backoff wait time is determined. The first random number generated will be a number between 0 and the number specified here. If the first random backoff wait time expires before the data frame is sent, a retry counter is incremented and the random backoff value (window) is doubled. Doubling will continue until the size of the random backoff value reaches the number defined in the Maximum Contention Window. Valid values for **cwMin** are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1023. The value for cwMin can be equal to or lower than the value for cwMax.
cwMax **(Maximum Contention Window)**	The value specified for the Maximum Contention Window is the upper limit (in milliseconds) for the doubling of the random backoff value. This doubling continues until either the data frame is sent or the Maximum Contention Window size is reached. Once the Maximum Contention Window size is reached, retries will continue until a maximum number of retries allowed is reached. Valid values for **cwMax** are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1023. The value for cwMax can be equal to or higher than the value for cwMin.

Max. Burst Length

The **Max. Burst Length** is an AP EDCA parameter and only applies to traffic flowing from the 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.

Wi-Fi MultiMedia

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

Disabling WMM deactivates 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 (AP EDCA parameters).

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

Station EDCA Parameters

Queue

Queues are defined for different types of data transmitted from station-to-AP:

- **Data 0 (Voice)** - Highest priority queue, minimum delay. Time-sensitive data such as VoIP and streaming media are automatically sent to this queue.
- **Data 1(Video)** - Highest priority queue, minimum delay. Time-sensitive video data is automatically sent to this queue.
- **Data 2 (best effort)** - Medium priority queue, medium throughput and delay. Most traditional IP data is sent to this queue.
- **Data 3 (Background)** - Lowest priority queue, high throughput. Bulk data that requires maximum throughput and is not time-sensitive is sent to this queue (FTP data, for example).

AIFS
(Inter-Frame Space)

The Arbitration Inter-Frame Spacing (AIFS) specifies a wait time (in milliseconds) for data frames.

Valid values for AIFS are 1 through 255.

cwMin (Minimum Contention Window)	This parameter is input to the algorithm that determines the initial random backoff wait time (“window”) for retry of a transmission. The value specified 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. Valid values for **cwMin** are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1023. The value for cwMin can be equal to or lower than the value for cwMax.
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. Valid values for **cwMax** are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1023. The value for cwMax can be equal to or higher than the value for cwMin.
TXOP Limit	The TXOP Limit is a station EDCA parameter and only applies to traffic flowing from the client station to the access point. The Transmission Opportunity (TXOP) is an interval of time when a WMM client station has the right to initiate transmissions onto the wireless medium. This value specifies 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. The TXOP Limit range is 0 to 65535. The value is in units of 32-microsecond periods.

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

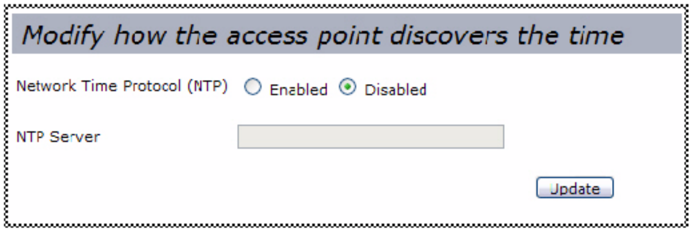
Enabling the Network Time Protocol Server

The Network Time Protocol (NTP) is an Internet standard protocol that synchronizes computer clock times on your network. NTP servers transmit Coordinated Universal

Time (UTC, also known as Greenwich Mean Time) to their client systems. NTP sends periodic time requests to servers, using the returned time stamp to adjust its clock. The timestamp is used to indicate the date and time of each event in log messages.

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

To configure the address of the NTP server that the AP uses, click the **Time** tab and update the fields as described in SNTP Settings.



Modify how the access point discovers the time

Network Time Protocol (NTP) ○ Enabled ● Disabled

NTP Server

Enabling or 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 identify the NTP server you want to use.

Table 23. **SNTP Settings**

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 AP the ability to provide the correct time of day in log messages and session information. Choose to either enable or disable use of a network time protocol (NTP) server: • To permit the AP to poll an NTP server, click **Enabled**. • To prevent the AP from polling an NTP server, click **Disabled**.
NTP Server	If NTP is enabled, select the NTP server you want to use. You can specify the NTP server by host name or IP address, although using the IP address is not recommended as these can change more readily.

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

7

Maintaining the Access Point

This chapter describes how to maintain the Unified Access Point and contains the following sections:

- Managing the
- 錯誤! 找不到參照來源。

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

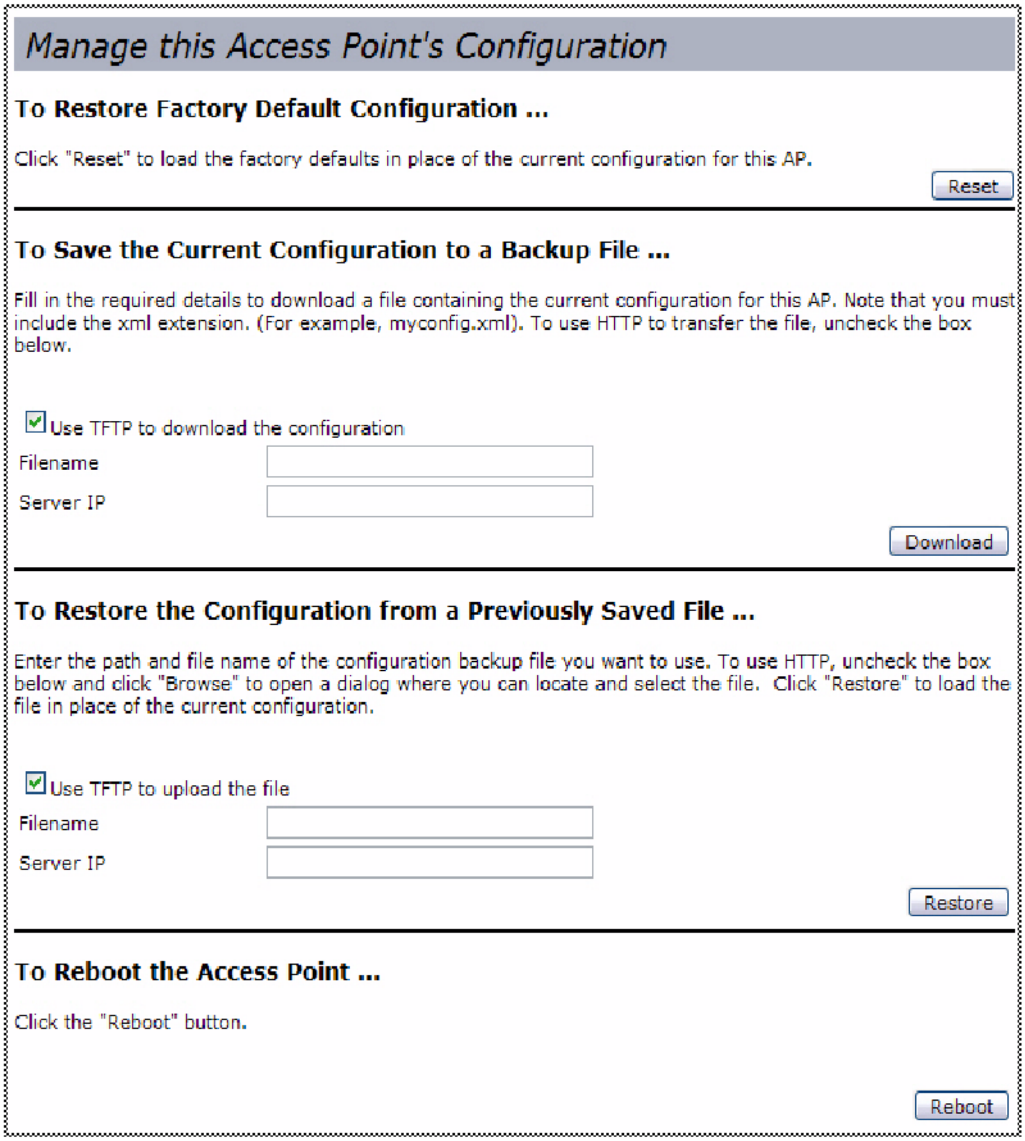
- Restore the factory default configuration.
- Create a backup of the running configuration file on to a management station.
- Restore the AP configuration from a backup file.
- Upgrade the firmware.
- Reboot the AP.

Managing the Configuration File

The Unified Access Point configuration file is in XML format and contains all of the information about the AP settings. You can download the configuration file to a management station as a back-up copy or to manually edit the content. When you upload a configuration file to the AP, the configuration information in the XML file is applied to the AP.

Click the **Configuration** tab to access the configuration management page, which Con shows.

Figure 16. Configuration Management



Manage this Access Point's Configuration

To Restore Factory Default Configuration ...

Click "Reset" to load the factory defaults in place of the current configuration for this AP.

To Save the Current Configuration to a Backup File ...

Fill in the required details to download a file containing the current configuration for this AP. Note that you must include the xml extension. (For example, myconfig.xml). To use HTTP to transfer the file, uncheck the box below.

☑ Use TFTP to download the configuration

Filename

Server IP

To Restore the Configuration from a Previously Saved File ...

Enter the path and file name of the configuration backup file you want to use. To use HTTP, uncheck the box below and click "Browse" to open a dialog where you can locate and select the file. Click "Restore" to load the file in place of the current configuration.

☑ Use TFTP to upload the file

Filename

Server IP

To Reboot the Access Point ...

Click the "Reboot" button.

The following sections describe the fields and options on the **Configuration** page.

Resetting the Factory Default Configuration

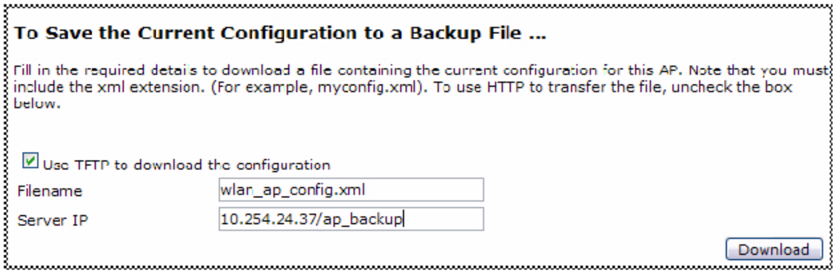
If you are experiencing problems with the Unified Access Point and have tried all other troubleshooting measures, click **Reset**. This restores factory defaults and clears all settings, including settings such as a new password or wireless settings. You can also use the reset button on the back panel to reset the system to the default configuration. For information about the reset button, see “Using the Reset Button” on page 23.

Saving the Current Configuration to a Backup File

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

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

1. If it is not already selected, click the option for using TFTP to download the file.
2. Enter a name for the backup file in the **Filename** field, including the .xml file name extension.
3. Enter the IP address of the TFTP server, including the path to the directory where you want to save the file.



To Save the Current Configuration to a Backup File ...

Fill in the required details to download a file containing the current configuration for this AP. Note that you must include the xml extension. (For example, myconfig.xml). To use HTTP to transfer the file, uncheck the box below.

☑ Use TFTP to download the configuration

Filename	wlan_ap_config.xml
Server IP	10.254.24.37/ap_backup

4. Click **Download** to save the file.

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

1. Uncheck the **Use TFTP to download the configuration** box.

   When you clear the option, the Filename and Server IP fields are disabled.

2. Click the **Download** button.

   A File Download or Open dialog box displays.

3. From the dialog box, choose the **Save** option.

   A file browser dialog box opens.

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

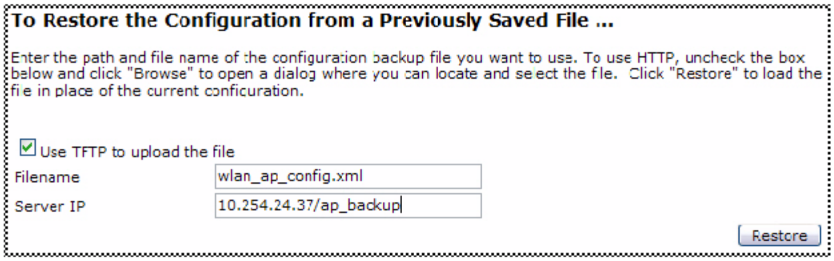
   You can keep the default file name (config.xml) or rename the backup file, but be sure to save the file with an .xml extension.

Restoring the Configuration from a Previously Saved File

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

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

1. If it is not already selected, click the option to use TFTP to upload the file.
2. Enter a name for the backup file in the **Filename** field, including the .xml file name extension.
3. Enter the IP address of the TFTP server, including the path to the directory, that contains the configuration file to upload.



To Restore the Configuration from a Previously Saved File ...

Enter the path and file name of the configuration backup file you want to use. To use HTTP, uncheck the box below and click "Browse" to open a dialog where you can locate and select the file. Click "Restore" to load the file in place of the current configuration.

☑ Use TFTP to upload the file

Filename: wlan_ap_config.xml

Server IP: 10.254.24.37/ap_backup

4. Click the **Restore** button.

   The AP reboots.

   A “reboot” confirmation dialog and follow-on “rebooting” status message displays. Please wait for the reboot process to complete, which might take several minutes.

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

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

1. Uncheck the **Use TFTP to upload the file** box.

   When you clear the option, the Server IP field is disabled.

2. Enter the name of the file to restore.
3. Click the **Restore** button.

   A File Upload or Choose File dialog box displays.

4. Navigate to the directory that contains the file, then select the file to upload and click **Open**.

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

5. Click the **Restore** button.

   The AP reboots.

   A "reboot" confirmation dialog and follow-on "rebooting" status message displays. Please wait for the reboot process to complete, which might take several minutes.

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

Rebooting the Access Point

For maintenance purposes or as a troubleshooting measure, you can reboot the Unified Access Point. To reboot the access point, click the **Reboot** button on the **Configuration** page.

Upgrading the Firmware

As new versions of the DWL-3500AP and DWL-8500AP firmware become available, you can upgrade the firmware on your devices to take advantages of new features and enhancements. The AP uses a TFTP client for firmware upgrades. You can also use HTTP to perform firmware upgrades.

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

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

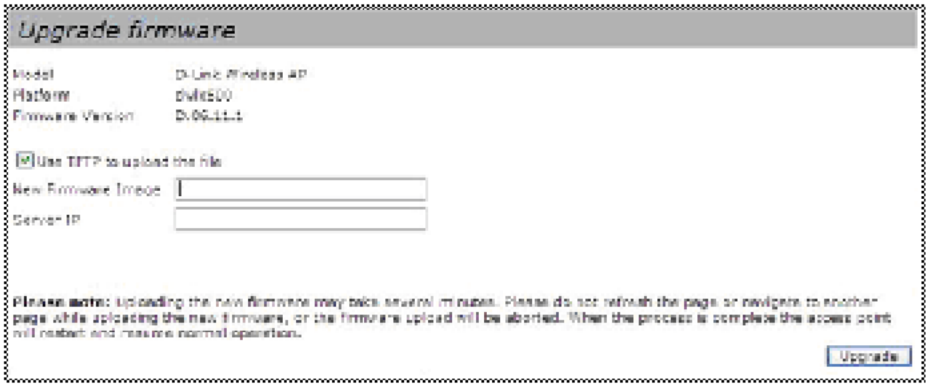
1. Click the **Upgrade** tab in the Maintenance section.

   Information about the current firmware version is displayed and an option to upgrade a new firmware image is provided.

2. Make sure the **Use TFTP to upload the file** option is selected.
3. Enter a name for the image file in the **New Firmware Image** field, including the .tar file name extension.

   The firmware upgrade file supplied must be in the format *`<FileName>.upgrade.tar`*. Do not attempt to use *`<FileName>.bin`* files or files of other formats for the upgrade; these types of files will not work.

4. Enter the IP address of the TFTP server, including the path to the directory, that contains the image to upload.



Upgrade firmware

Model	D-Link Wireless AP
Platform	dwl8600
Firmware Version	D.06.11.1

☑ Use TFTP to upload the file

New Firmware Image

Server IP

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

5. Click **Upgrade**.

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

6. Click **OK** to confirm the upgrade and start the process.

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

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

7. To verify that the firmware upgrade completed successfully, check the firmware version shown on the **Upgrade** tab (and also on the **Basic Settings** tab). If the upgrade was successful, the updated version name or number is indicated.

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

1. Uncheck the **Use TFTP to upload the file** box.

   When you clear the option, the Server IP field is disabled.

2. If you know the path to the **New Firmware Image** file, enter it in the **New Firmware Image** textbox. Otherwise, click the **Browse** button and locate the firmware image file.

   The firmware upgrade file supplied must be in the format *`<FileName>.tar`*. Do not attempt to use *`<FileName>.bin`* files or files of other formats for the upgrade; these will not work.

3. Click **Upgrade** to apply the new firmware image.

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

4. Click **OK** to confirm the upgrade and start the process.

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

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

5. To verify that the firmware upgrade completed successfully, check the firmware version shown on the **Upgrade** tab (and also on the **Basic Settings** tab). If the upgrade was successful, the updated version name or number is indicated.

8

Configuring the Access Point for Managed Mode

The Unified Access Point can operate in two modes: Standalone Mode or Managed Mode. In Standalone Mode, the Unified Access Point acts as an individual access point in the network, and you manage it by using the Administrator Web User Interface (UI) or the CLI. In Managed Mode, the access point is part of the D-Link Unified Wired/Wireless Access System and you manage it by using the D-Link Unified Switch. If an AP is in Managed Mode, the Administrator Web UI, Telnet, and SSH services are disabled.

This chapter contains the following sections:

- Transitioning Between Modes
- Configuring
- Viewin

Transitioning Between Modes

Every 30 seconds, the D-Link Unified Switch sends a keepalive message to all of the access points it manages. Each AP checks for the keepalive messages on the SSL TCP connection. As long as the AP maintains communication with the switch through the keepalive messages, it remains in Managed Mode.

If the AP does not receive a message within 45 seconds of the last keepalive message, the AP assumes the switch has failed and terminates its TCP connection to the switch, and the AP enters Standalone Mode.

Once the AP transitions to Standalone Mode, it continues to forward traffic without any loss. The AP uses the configuration on the VAPs configured in VLAN Forwarding mode (the standard, non-tunneled mode).

While the AP is in Standalone Mode, you can manage it by using the Web interface or the CLI (through Telnet).

For any clients that are connected to the AP through tunneled VAPs, the AP sends disassociate messages and disables the tunneled VAPs.

As long as the Managed AP Administrative Mode is set to Enabled, as Managed Access Point Settings shows, the AP starts discovery procedures. If the AP establishes a connection with a wireless switch, which may or may not be the same switch it was connected to before, the switch sends the AP its configuration and the AP sends the wireless switch information about all currently associated clients.

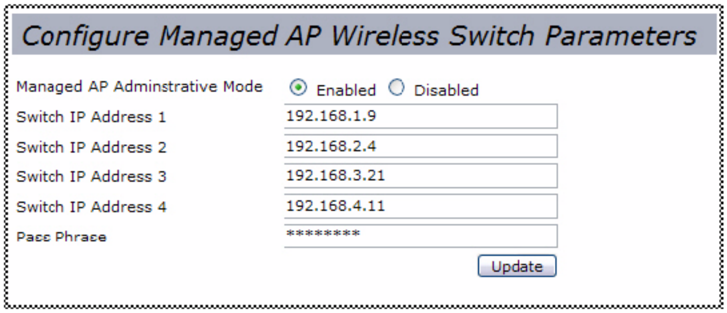
After the configuration from the switch is applied, the AP radios restart. Client traffic is briefly interrupted until the radios are up and the clients are re-associated.

Configuring Managed Access Point Settings

On the Unified Access Point, you can configure the IP addresses of up to four D-Link Unified Switches that can manage it. In order to manage the AP, the Unified Switch and AP must discover each other. There are multiple ways for a Unified Switch to discover an AP. Adding the IP address of the Unified Switch to the AP while it is in Standalone Mode is one way to enable switch-to-AP discovery.

To add the IP address of a D-Link Unified Switch to the AP, click the **Managed Access Point** tab under the **Manage** heading and update the fields shown in Managed Access Point.

Figure 17. Managed Access Point Settings



Configure Managed AP Wireless Switch Parameters

Managed AP Adminstrative Mode	● Enabled ○ Disabled
Switch IP Address 1	192.168.1.9
Switch IP Address 2	192.168.2.4
Switch IP Address 3	192.168.3.21
Switch IP Address 4	192.168.4.11
Pass Phrase	********

Table 24. Managed Access Point

Field	Description
Managed AP Administrative Mode	Click **Enabled** to allow the AP and Unified Switch to discover each other. If the AP successfully authenticates itself with a Unified Switch, you will not be able to access the Administrator UI. Click **Disabled** to prevent the AP from contacting wireless switches.

Switch IP address	Enter the IP address of up to four wireless switches that can manage the AP. You can enter the IP address in dotted format or as an DNS name. You can view a list of wireless switches on your network that were configured by using a DHCP server. For more information, see Configuring . The AP attempts to contact Switch IP Address 1 first.
Pass Phrase	Enter a pass phrase to allow the Access Point to authenticate itself with the Unified Switch. The pass phrase can be up to 32 alphanumeric characters. You must configure the same pass phrase on the Unified Switch.

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

If the Unified Access Point successfully authenticates with a D-Link Unified Switch, you will loose access to the AP through the Administrator UI.

Viewing Managed AP DHCP Information

The Unified Access Point can learn about D-Link Unified Switches on the network through DHCP responses to its initial DHCP request. The **Managed AP DHCP** page displays the DNS names or IP addresses of up to four D-Link Unified Switches that the AP learned about from a DHCP server on your network.

For information about how to configure a DHCP server to respond to AP DHCP requests with the Unified Switch IP address information, see the *D-Link Unified Wired/Wireless Access System User Manual.*

9

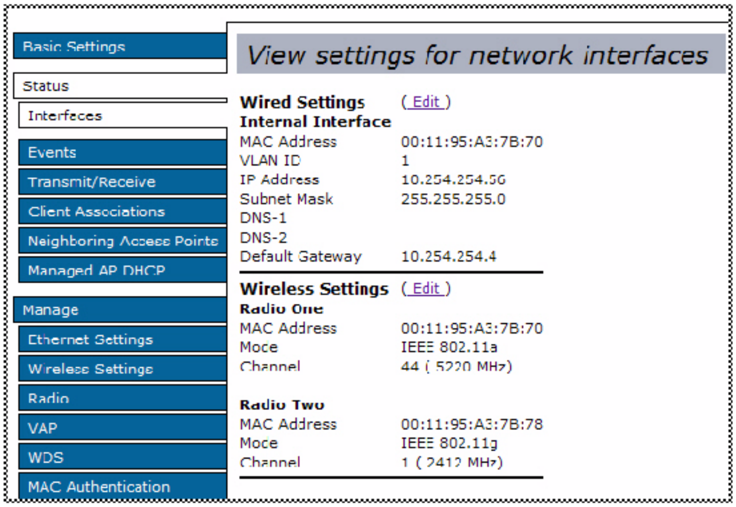
Viewing Access Point Status

This chapter describes the information you can view from the tabs under the **Status** heading on the Administration Web UI. This chapter contains the following sections:

- Viewing
- Viewing
- Vie
- 錯誤! 找不到參照來源。
- 錯誤! 找不到參照來源。

Viewing Interface Status

To monitor Ethernet LAN and wireless LAN (WLAN) settings, click the **Interfaces** tab.



View settings for network interfaces

Wired Settings

Internal Interface

MAC Address	00:11:95:A3:7B:70
VLAN ID	1
IP Address	10.254.254.56
Subnet Mask	255.255.255.0
DNS-1	
DNS-2	
Default Gateway	10.254.254.4

Wireless Settings

Radio One

MAC Address	00:11:95:A3:7B:70
Mode	IEEE 802.11a
Channel	44 (5220 MHz)

Radio Two

MAC Address	00:11:95:A3:7B:78
Mode	IEEE 802.11g
Channel	1 (2412 MHz)

This page displays the current settings of the Unified Access Point. It displays the **Wired Settings** and the **Wireless Settings**.

Ethernet (Wired) Settings

The Internal interface includes the Ethernet MAC Address, Management VLAN ID, IP Address, Subnet Mask, and DNS information. If you want to change any of these settings, click the **Edit** link.

For information about configuring these settings, see “Configuring the Ethernet Interface” on page 31.

Wireless Settings

The Radio Interface includes the Radio Mode and Channel. The **Wireless Settings** section also shows the MAC address (read-only) associated with the radio interface.

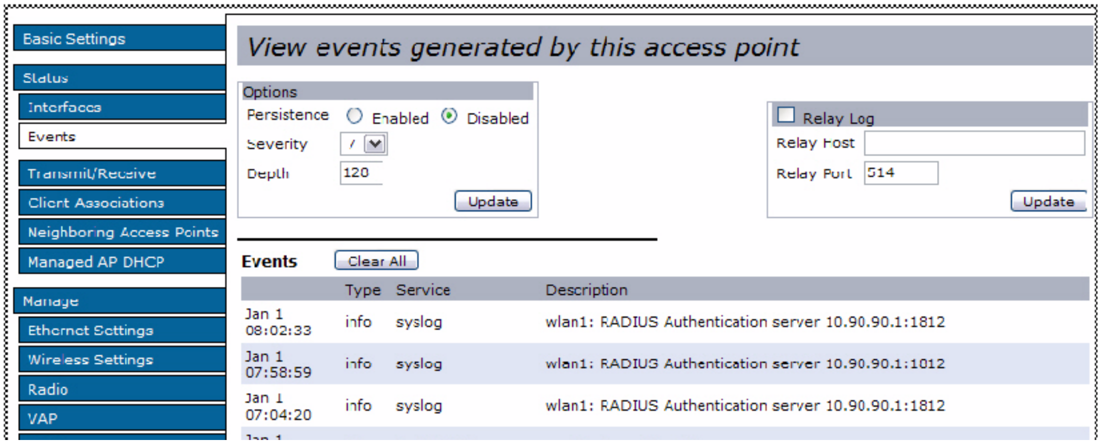
If you want to change the Radio Mode or Channel settings, click the **Edit** link. For information about configuring these settings, see “Setting the Wireless Interface” on page 55 and “Configuring Radio Settings” on page 58.

Viewing Events Logs

The Events Log shows real-time system events on the access point such as wireless clients associating with the AP and being authenticated.

To view system events, click the **Events** tab.

Figure 18. Viewing and Configuring System Events



View events generated by this access point

Options

Persistence ○ Enabled ● Disabled

Severity 7

Depth 120

□ Relay Log

Relay Host

Relay Port 514

Events

	Type	Service	Description
Jan 1 08:02:33	info	syslog	wlan1: RADIUS Authentication server 10.90.90.1:1812
Jan 1 07:58:59	info	syslog	wlan1: RADIUS Authentication server 10.90.90.1:1012
Jan 1 07:04:20	info	syslog	wlan1: RADIUS Authentication server 10.90.90.1:1812
Jan 1			

From the **Events** page, you can view the most recent events generated by this access point and configure logging settings. You can enable and configure persistent logging to write system event logs to non-volatile memory so that the events are not erased when the system reboots. This page also gives you the option of enabling a remote “log relay host” to capture all system events and errors in a Kernel Log.

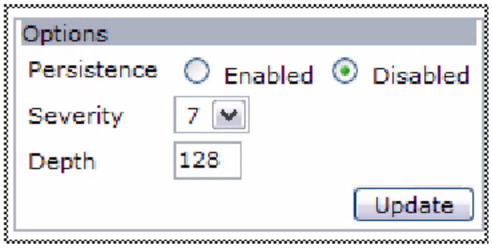
NOTE: The Unified Access Point acquires its date and time information using the network time protocol (NTP). This data is reported in UTC format (also known as Greenwich Mean Time). You need to convert the reported time to your local time. For information on setting the network time protocol, see "Enabling the Network Time Protocol Server" on page 79.

Configuring Persistent Logging Options

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

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

To configure persistent logging on the **Events** page, set the persistence, severity, and depth options as described in Log Relay Host, and then click **Update**.



Options

Persistence ○ Enabled ● Disabled

Severity 7

Depth 128

Table 25. **Logging Options**

Field	Description
Persistence	Choose **Enabled** to save system logs to non-volatile memory so that the logs are not erased when the AP reboots. Choose **Disabled** to save system logs to volatile memory. Logs in volatile memory are deleted when the system reboots.
Severity	Specify the severity level of the log messages to write to non-volatile memory. For example, if you specify 2, critical, alert, and emergency logs are written to non-volatile memory. Error messages with a severity level of 3-7 are written to volatile memory. • 0—emergency • 1—alert • 2—critical • 3—error • 4—warning • 5—notice • 6—info • 7—debug

Depth	You can store up to 128 messages in non-volatile memory. Once the number you configure in this field is reached, the oldest log event is overwritten by the new log event.

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

Configuring the Log Relay Host for Kernel Messages

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

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

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

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

To use Kernel Log relaying, you must configure a remote server to receive the syslog messages. The procedure to configure a remote log host depends on the type of system you use as the remote host. The following example describes 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 you have **`root`** user identity for these tasks.

1. Log on as `root` to the machine 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 you edit will look like this:

   ```
   SYSLOGD=“-r”
   ```

   To view the Linux manual page to get more information about the SYSLOGD command options, enter **`man syslogd`** at the command prompt.

3. To send all the messages to a file, edit **`/etc/syslog.conf`**.

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

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

To view the Linux manual page to get more information about the syslog.conf command options, enter **man syslogd** at the command prompt.

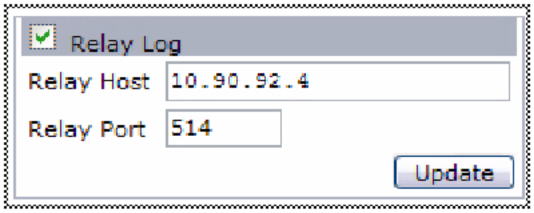
4. Restart the syslog server by typing the following at the command line prompt:

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

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

Enabling or Disabling the Log Relay Host on the Events Page

To enable and configure Log Relaying on the **Events** page, set the Log Relay options as described in Log Relay Host, and then click **Update**.



☑ Relay Log

Relay Host: 10.90.92.4

Relay Port: 514

Table 26. **Log Relay Host**

Field	Description
Relay Log	Choose to either enable or disable use of the Log Relay Host. If you select the **Relay Log** option, the Log Relay Host is enabled and the Relay Host and Relay Port fields are editable.
Relay Host	Specify the IP Address or DNS name of the remote log server.
Relay Port	Specify the Port number for the syslog process on the Relay Host. The default port is 514.

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

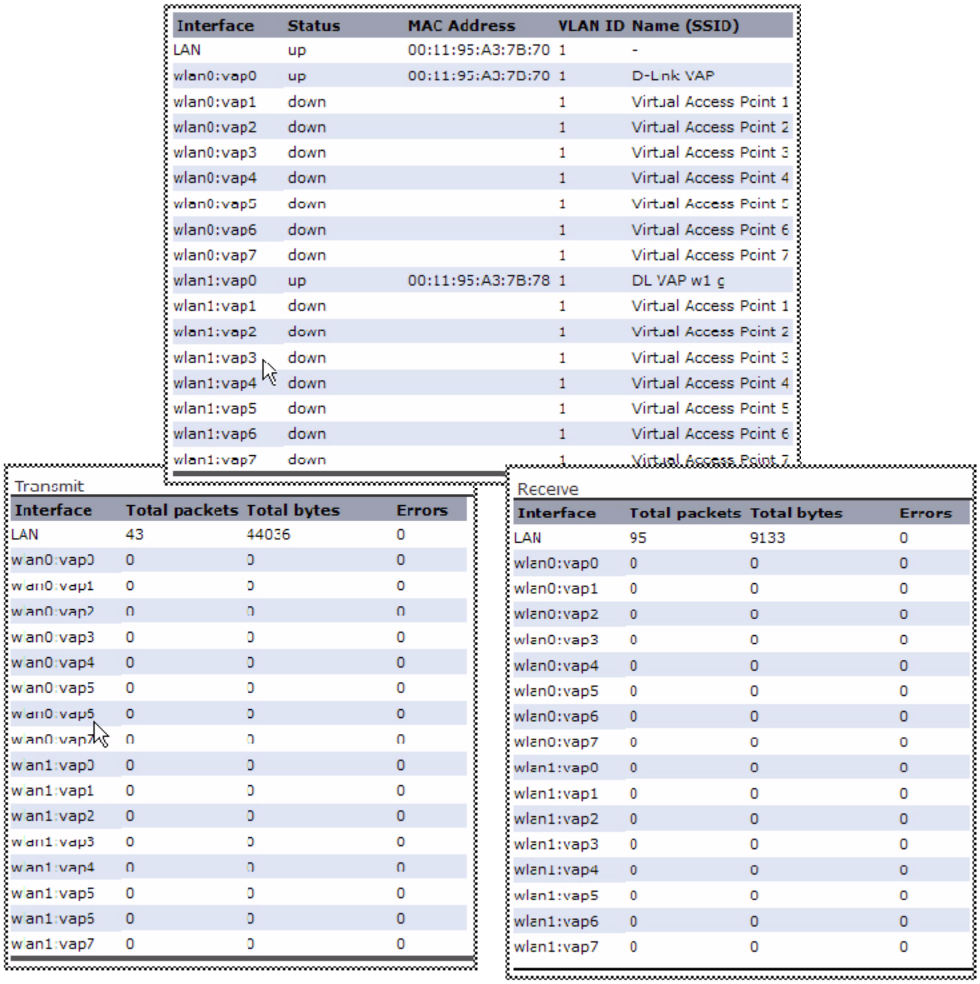
If you enabled the Log Relay Host, clicking **Update** will activate remote logging. The access point will send its kernel messages real-time for display to the remote log server monitor, a specified kernel log file, or other storage, depending on how you configured the Log Relay Host.

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

Viewing Transmit and Receive Statistics

The **Transmit/Receive** page provides some basic information about the current access point and a real-time display of the transmit and receive statistics for the Ethernet interface on the access point and for all VAPs on the radio interface (and for both radio interfaces on the DWL-8500AP). All transmit and receive statistics shown are totals since the access point was last started. If you reboot the AP, these figures indicate transmit and receive totals since the reboot.

To view transmit and receive statistics for the access point, click the **Transmit/Receive** tab.



Interface	Status	MAC Address	VLAN ID	Name (SSID)
LAN	up	00:11:95:A3:7B:70	1	-
wlan0:vap0	up	00:11:95:A3:7B:70	1	D-Link VAP
wlan0:vap1	down		1	Virtual Access Point 1
wlan0:vap2	down		1	Virtual Access Point 2
wlan0:vap3	down		1	Virtual Access Point 3
wlan0:vap4	down		1	Virtual Access Point 4
wlan0:vap5	down		1	Virtual Access Point 5
wlan0:vap6	down		1	Virtual Access Point 6
wlan0:vap7	down		1	Virtual Access Point 7
wlan1:vap0	up	00:11:95:A3:7B:78	1	DL VAP w1 g
wlan1:vap1	down		1	Virtual Access Point 1
wlan1:vap2	down		1	Virtual Access Point 2
wlan1:vap3	down		1	Virtual Access Point 3
wlan1:vap4	down		1	Virtual Access Point 4
wlan1:vap5	down		1	Virtual Access Point 5
wlan1:vap6	down		1	Virtual Access Point 6
wlan1:vap7	down		1	Virtual Access Point 7

Transmit

Interface	Total packets	Total bytes	Errors
LAN	43	44036	0
wlan0:vap0	0	0	0
wlan0:vap1	0	0	0
wlan0:vap2	0	0	0
wlan0:vap3	0	0	0
wlan0:vap4	0	0	0
wlan0:vap5	0	0	0
wlan0:vap6	0	0	0
wlan0:vap7	0	0	0
wlan1:vap0	0	0	0
wlan1:vap1	0	0	0
wlan1:vap2	0	0	0
wlan1:vap3	0	0	0
wlan1:vap4	0	0	0
wlan1:vap5	0	0	0
wlan1:vap6	0	0	0
wlan1:vap7	0	0	0

Receive

Interface	Total packets	Total bytes	Errors
LAN	95	9133	0
wlan0:vap0	0	0	0
wlan0:vap1	0	0	0
wlan0:vap2	0	0	0
wlan0:vap3	0	0	0
wlan0:vap4	0	0	0
wlan0:vap5	0	0	0
wlan0:vap6	0	0	0
wlan0:vap7	0	0	0
wlan1:vap0	0	0	0
wlan1:vap1	0	0	0
wlan1:vap2	0	0	0
wlan1:vap3	0	0	0
wlan1:vap4	0	0	0
wlan1:vap5	0	0	0
wlan1:vap6	0	0	0
wlan1:vap7	0	0	0

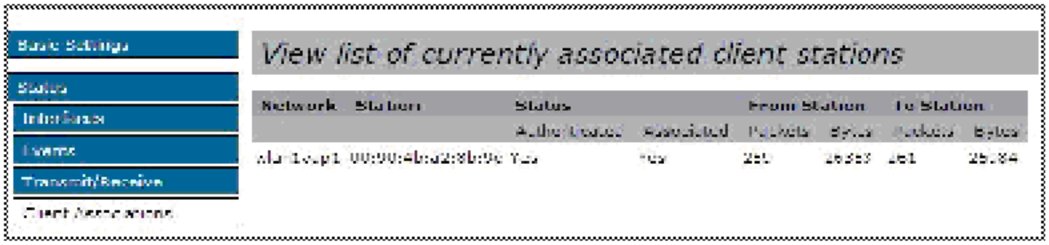
Table 27. Transmit/Receive Statistics

Field	Description
Interface	The name of the Ethernet or VAP interface.
Status	Shows whether the interface is up or down.

MAC Address	MAC address for the specified interface. The access point has a unique MAC address for each interface. For the DWL-8500AP, each radio has a different MAC address for every interface on each of its two radios.
VLAN ID	Virtual LAN (VLAN) ID. You can use VLANs to establish multiple internal and guest networks on the same access point. The VLAN ID is set on the VAP tab. (See “Configuring Virtual Access Points” on page 62.)
Name (SSID)	Wireless network name. Also known as the SSID, this alphanumeric key uniquely identifies a wireless local area network. The SSID is set on the VAP tab. (See “Configuring Virtual Access Points” on page 62.)
Transmit and Receive Information	
Total Packets	Indicates total packets sent (in Transmit table) or received (in Received table) by this access point.
Total Bytes	Indicates total bytes sent (in Transmit table) or received (in Received table) by this access point.
Errors	Indicates total errors related to sending and receiving data on this access point.

Viewing Client Association Information

To view the client stations associated with a particular access point, click the **Client Associations** tab.



View list of currently associated client stations

Network	Station	Status		From Station		To Station	
		Authenticated	Associated	Packets	Bytes	Packets	Bytes
wlan1vap1	00:90:4b:a2:8b:9c	Yes	Yes	261	26383	261	25384

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

Associated Clients describes the fields on the **Client Associations** page.

Table 28. **Associated Clients**

Field	Description
Network	Shows which virtual access point the client is associated with. For example, an entry of wlan0vap2 means the client is associated with Radio 1, VAP 2. An entry of wlan0 means the client is associated with VAP 0 on Radio 1. For the DWL-8500AP, an entry of wlan1 means the client is associated with VAP 0 on Radio 2.
Station	Shows the MAC address of the associated wireless client.
Status	The “Authenticated” and “Associated” Status shows the underlying IEEE 802.11 authentication and association status, which is present no matter which type of security the client uses to connect to the AP. This status does not show IEEE 802.1X authentication or association status. Some points to keep in mind with regard to this field are: • If the AP security mode is None or Static WEP, the authentication and association status of clients showing on the Client Associations tab will be in line with what is expected; that is, if a client shows as authenticated to the AP, it will be able to transmit and receive data. (This is because Static WEP uses only IEEE 802.11 authentication.) • If the AP uses IEEE 802.1X or WPA security, however, it is possible for a client association to show on this tab as authenticated (via the IEEE 802.11 security) but actually not be authenticated to the AP via the second layer of security.
From Station	Shows the number of packets and bytes received from the wireless client.
To Station	Shows the number of packets and bytes transmitted from the AP to the wireless client.

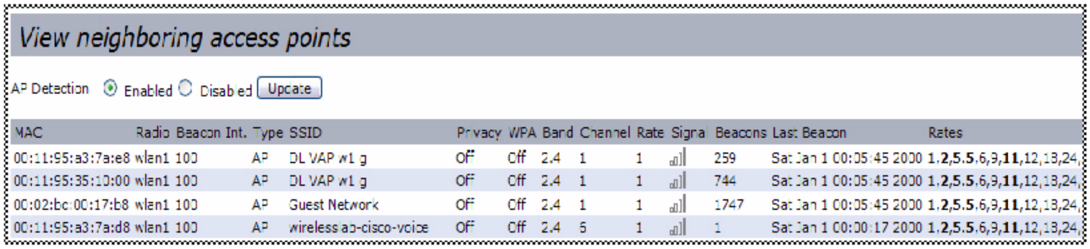
Link Integrity Monitoring

The Unified Access Point provides link integrity monitoring to continually verify its connection to each associated client. To do this monitoring, 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 within 300 seconds if these data packets are not acknowledged, even if no disassociation message is received.

Viewing Neighboring Access Points

The status page for **Neighboring Access Points** provides real-time statistics for all access points within range of the access point on which you are viewing the Administration Web pages.

To view information about other access points on the wireless network, click the **Neighboring Access Points** tab.



View neighboring access points

AP Detection ● Enabled ○ Disabled Update

MAC	Radio	Beacon Int.	Type	SSID	Privacy	WPA	Band	Channel	Rate	Signal	Beacons	Last Beacon	Rates
00:11:95:a3:7a:e8	wlan1	100	AP	DL VAP w1 g	Off	Off	2.4	1	1	📶	259	Sat Jan 1 00:05:45 2000	**1**,**2**,**5.5**,6,9,**11**,12,18,24,
00:11:95:35:10:00	wlan1	100	AP	DL VAP w1 g	Off	Off	2.4	1	1	📶	744	Sat Jan 1 00:05:45 2000	**1**,**2**,**5.5**,6,9,**11**,12,18,24,
00:02:bc:00:17:b8	wlan1	100	AP	Guest Network	Off	Off	2.4	1	1	📶	1747	Sat Jan 1 00:05:45 2000	**1**,**2**,**5.5**,6,9,**11**,12,18,24,
00:11:95:a3:7a:d8	wlan1	100	AP	wirelesslab-cisco-voice	Off	Off	2.4	6	1	📶	1	Sat Jan 1 00:00:17 2000	**1**,**2**,**5.5**,6,9,**11**,12,18,24,

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

Neighboring Access Points describes the information provided on neighboring access points.

Table 29. Neighboring Access Points

Field	Description
AP Detection	To enable neighbor access point detection and collect information about neighbor APs, click **Enabled**. To disable neighbor AP detection, click **Disabled**.
MAC Address	Shows the MAC address of the neighboring access point.
Radio	The Radio field indicates which radio detected the neighboring AP: • wlan0 (Radio 1 - DWL-8500AP only) • wlan1 (Radio 2)
Beacon Interval	Shows the Beacon interval being used by this access point. Beacon frames are transmitted by an access point at regular intervals to announce the existence of the wireless network. The default behavior is to send a beacon frame once every 100 milliseconds (or 10 per second). The Beacon Interval is set on the **Radio** tab page. (See “Configuring Radio Settings” on page 58.)
Type	Indicates the type of device: • **AP** indicates the neighboring device is an access point that supports the IEEE 802.11 Wireless Networking Framework in Infrastructure Mode. • **Ad hoc** indicates a neighboring station running in Ad hoc Mode. Stations set to ad hoc mode communicate with each other directly, without the use of a traditional 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 on the VAP tab. (See “Configuring Virtual Access Points” on page 62.)
Privacy	Indicates whether there is any security on the neighboring device. • **Off** indicates that the Security mode on the neighboring device is set to “None” (no security). • **On** indicates that the neighboring device has some security in place. Security is configured on the AP from the **VAP** page. For more information about security settings, see “Configuring Access Point Security” on page 39.
WPA	Indicates whether WPA security is “on” or “off” for this access point.
Band	This indicates the IEEE 802.11 mode being used on the neighboring access point. (For example, IEEE 802.11a or IEEE 802.11g.). The number shown indicates the mode according to the following map: • **2.4** indicates IEEE 802.11b mode, IEEE 802.11g mode, or 2.4 GHz Dynamic Turbo • **5** indicates IEEE 802.11a mode or 5 GHz Dynamic Turbo • **5 Turbo** indicates Turbo 5 GHz mode (this option displays only if your AP and the neighbor AP are both configured for “Turbo 5 GHz” and are operating in the same channel)
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 in Radio Settings. (See “Configuring Radio Settings” on page 58.)
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).
Beacons	Shows the total number of beacons received from this access point since it was first discovered.
Last Beacon	Shows the date and time of the last beacon received from this access point.
Rates	Shows supported and basic (advertised) rate sets for the neighboring 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 **Radio Settings** page. (See “Configuring Radio Settings” on page 58.)

A

Wireless Client Settings and RADIUS Server Setup

Typically, users configure security on their wireless clients for access to many different networks (access points). The list of available wireless networks changes depending on the location of the client and which APs are online and detectable in that location.[1] Once an AP has been detected by the client and security is configured for it, it remains in the client's list of networks but shows as either reachable or unreachable depending on the situation. For each network (AP) you want to connect to, configure security settings on the client to match the security mode being used by that network.

The following sections describe how to set up each of the supported security modes on wireless clients of a network served by the Unified Access Point:

- Accessing Wireless Client Security Settings
- Configuring a Client to Access an Unsecure Network

Configuring Static WEP Security on a Client

-

Configuring WPA/WPA2 Personal on a Client

-
- Using an External Authentication Server

Configuring IEEE 802.1X Security on a Client

-

[1] 1. The exception to this is if the access point is set to prohibit the broadcast of its network name. In this case the SSID will not show up in the list of Available Networks on the client. Instead, the client must have the exact network name configured in the network connection properties before it will be able to connec

Configuring WPA/WPA2 Enterprise (RADIUS)

-
- Configuring the RADIUS Server

Obtaining a TLS-EAP Certificate for a Client

-
- Configuring the RADIUS Server for VLAN Tags

NOTE: The recommended sequence for security configuration is (1) set up security on the access point, and (2) configure security on each of the wireless clients.

A typical method to configure security is to connect to an access point that has no security set (None) from an unsecure wireless client. With this initial connection, you can access the **Security** page on the AP Administration Web UI and configure a security mode.

When you re-configure the access point with a security setting and click **Update**, your wireless client will be disassociated and you will lose connectivity to the AP Administration Web pages. In some cases, you may need to make additional changes to the AP security settings before you configure the client. Therefore, you must have a backup Ethernet (wired) connection.

This appendix describes security setup on a client that uses Microsoft Windows client software for wireless connectivity. The Windows client software is used as the example because of its widespread availability on Windows computers and laptops. These procedures will vary slightly if you use different software on the client, but the configuration information you need to provide is the same.

Before you start to configure wireless clients, make sure that the software on the wireless clients is current. Software updates for wireless clients might include service packs, patches, and new releases of drivers and other supporting technologies. A common problem encountered in client security setup is not having the right driver or updates to it on the client. Even many client cards currently available do not ship from the factory with the latest drivers.

Accessing Wireless Client Security Settings

The procedures in this section describe how to access the wireless security settings on a Microsoft Windows XP system and might not apply to all wireless clients, even if they are running Microsoft Windows. You can use the following procedures to access the security settings dialogue:

1. Open the Wireless Network Connection Properties.

   From the wireless connection icon on the Windows task bar:

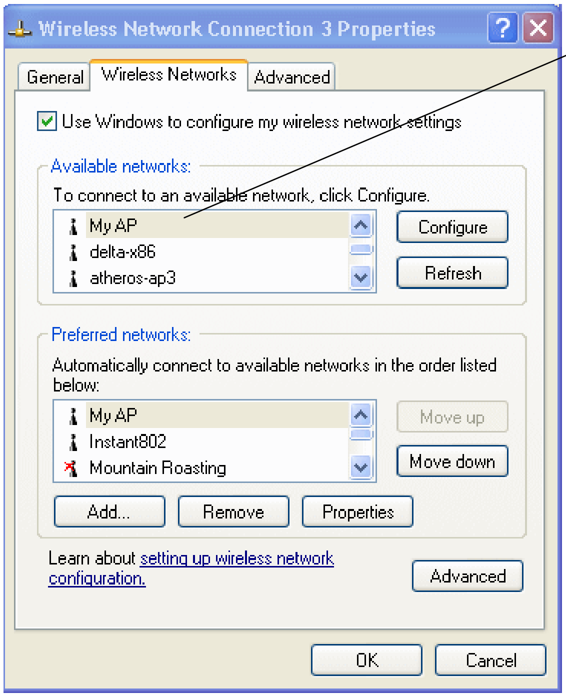
- Right-click on the Wireless connection icon in your Windows task bar and select **View available wireless networks**.
- Select the SSID of the network to which you want to connect and click **Advanced** to open the Wireless Network Connection Properties dialog.

Or

From the Windows Start menu at the left end of the task bar:

- From the Windows Start menu on the task bar, choose **Start** > **My Network Places** to bring up the Network Connections window.
- From the Network Tasks menu on the left, click **View Network Connections** to bring up the Network Connections window.
- Select the Wireless Network Connection you want to configure, right-mouse click and choose **View available wireless networks**.
- Select the SSID of the network to which you want to connect and click **Advanced** to bring up the Wireless Network Connection Properties dialog.

  The Wireless Networks tab (which should be automatically displayed) lists Available networks and Preferred networks.



☑ Use Windows to configure my wireless network settings

Available networks:

To connect to an available network, click Configure.

- My AP
- delta-x86
- atheros-ap3

Preferred networks:

Automatically connect to available networks in the order listed below:

- My AP
- Instant802
- Mountain Roasting

Learn about setting up wireless network configuration.

List of available networks will change depending on client location. Each network (or access point) that that is detected by the client shows up in this list. (efresh?updates the list with current information.)

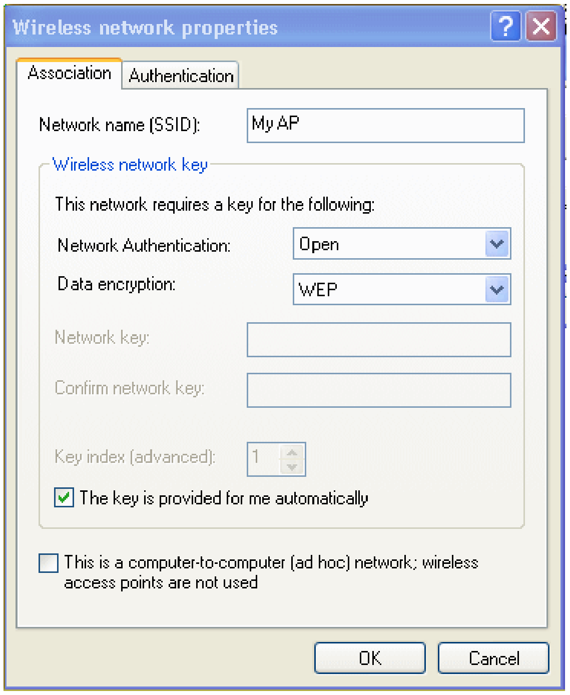
For each network you want to connect to, configure security settings on the client to match the security mode being used by that network.

Note: The exception to this is if the AP is configured to prohibit broadcast of its network name, the name will not show on this list. In that case you would need to type in the exact network name to be able to connect to it.

2. From the list of available networks, select the SSID of the network to which you want to connect and click **Configure**.

   If you do not see the list of available networks or the network that you want to use is not listed, click **Add** to manually add and configure the network.

   The Wireless Network Connection Properties dialog with the Association and Authentication tabs for the selected network displays.



Network name (SSID): My AP

Wireless network key

This network requires a key for the following:

Network Authentication: Open

Data encryption: WEP

Network key:

Confirm network key:

Key index (advanced): 1

☑ The key is provided for me automatically

□ This is a computer-to-computer (ad hoc) network; wireless access points are not used

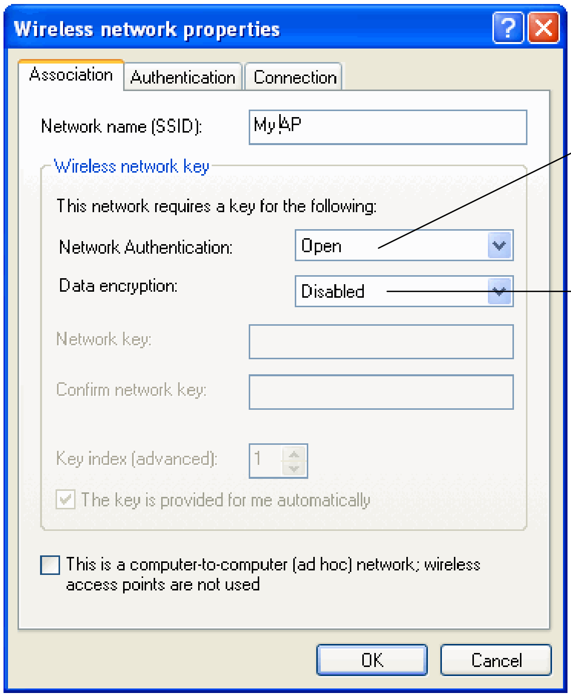
Use this dialog for configuring all the different types of client security described in the following sections. Make sure that the wireless network properties you configure are for the network name (SSID) for the network you want to reach on the wireless client.

Configuring a Client to Access an Unsecure Network

If the access point or wireless network to which you want to connect is configured as "None", that is, no security, you need to configure the client accordingly. A client using no security to connect is configured with Network Authentication "Open" to that network and Data Encryption "Disabled" as described below.

If you do have security configured on a client for properties of an unsecure network, the security settings can prevent successful access to the network because of the mismatch between client and access point security configurations.

To configure the client to not use any security, bring up the client Network Properties dialog and configure the following



Wireless network properties

Network name (SSID): My AP

Wireless network key

This network requires a key for the following:

Network Authentication: Open

Data encryption: Disabled

Network key:

Confirm network key:

Key index (advanced): 1

☑ The key is provided for me automatically

□ This is a computer-to-computer (ad hoc) network; wireless access points are not used

Set Network Authentication to pen□

Set Data Encryption to isabled□

Table 30. Wireless Client with No Security

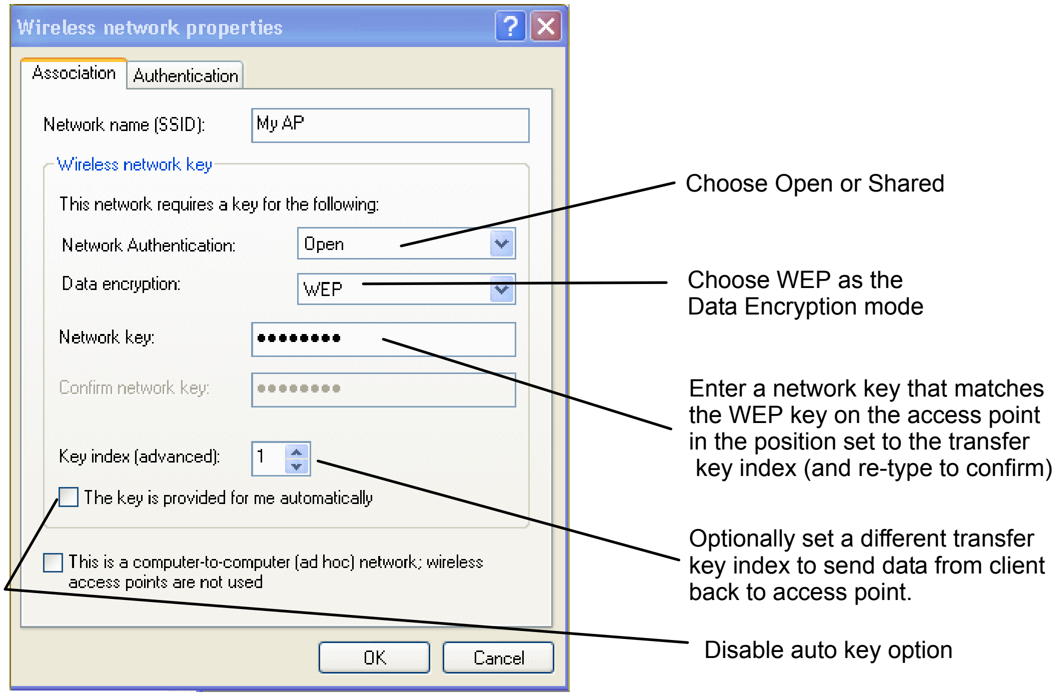
Network Authentication	Open
Data Encryption	Disabled

Configuring Static WEP Security on a Client

Static Wired Equivalent Privacy (WEP) encrypts data moving across a wireless network based on a static (non-changing) key. The encryption algorithm is a “stream” cipher called RC4. The access point uses a key to transmit data to the client stations. Each client must use that same key to decrypt data it receives from the access point. Different 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 configured the Unified Access Point to use Static WEP security mode, perform the following steps:

1. Configure WEP security on each client.



Network name (SSID): My AP

Wireless network key

This network requires a key for the following:

Network Authentication: Open

Data encryption: WEP

Network key: ••••••••

Confirm network key: ••••••••

Key index (advanced): 1

☐ The key is provided for me automatically

☐ This is a computer-to-computer (ad hoc) network; wireless access points are not used

Choose Open or Shared

Choose WEP as the
Data Encryption mode

Enter a network key that matches the WEP key on the access point in the position set to the transfer key index (and re-type to confirm)

Optionally set a different transfer key index to send data from client back to access point.

Disable auto key option

2. Configure the fields in the Associations Tab as described in the following table:

Network Authentication	"Open" or "Shared", depending on how you configured this option on the access point. **Note:** When the Authentication Algorithm on the access point is set to "Both", clients set to either Shared or Open can associate with the AP. Clients configured to use WEP in Shared mode must have a valid WEP key in order to associate with the AP. Clients configured to use WEP as an Open system can associate with the AP even without a valid WEP key (but a valid key will be required to actually view and exchange data). For more information, see Administrators Guide and Online Help on the access point.
Data Encryption	WEP
Network Key	Provide the WEP key you entered on the access point Security settings in the Transfer Key Index position. For example, if the Transfer Key Index on the access point is set to "1", then for the client Network Key specify the WEP Key you entered as WEP Key 1 on the access point.
Key Index	Set key index to indicate which of the WEP keys specified on the access point Security page will be used to transfer data from the client back to the access point. For example, you can set this to 1, 2, 3, or 4 if you have all four WEP keys configured on the access point.
The key is provided for me automatically	Disable this option (click to uncheck the box).

2.

3. Configure the fields in the Authentication Tab as described in the following table

Enable IEEE 802.1X authentication for this network	Make sure that IEEE 802.1X authentication is disabled (box should be unchecked). (Setting the encryption mode to WEP should automatically disable authentication.)

3.

4. Click **OK** on the Wireless Network Properties dialog to close it and save your changes.

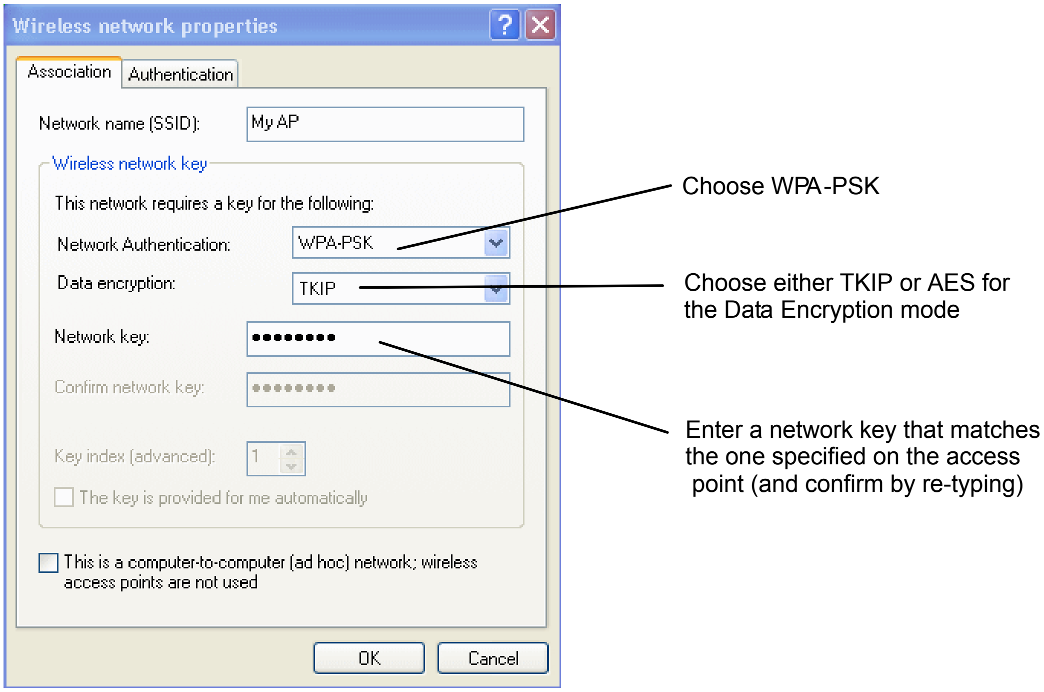
Static WEP clients should now be able to associate and authenticate with the access point. As a client, you will not be prompted for a WEP key. The WEP key configured on the client security settings is automatically used when you connect.

Configuring WPA/WPA2 Personal on a Client

WPA with Pre-Shared Key (PSK) is a Wi-Fi Alliance subset of IEEE 802.11i, which includes Temporal Key Integrity Protocol (TKIP), Advanced Encryption Algorithm (AES), and Counter mode/CBC-MAC Protocol (CCMP) mechanisms. PSK employs a pre-shared key for an initial check of client credentials.

If you configured the Unified Access Point to use WPA/WPA2 Personal (PSK) security mode, perform the following steps:

1. Configure WPA/WPA2 Personal (PSK) security on each client as follows.



Network name (SSID): My AP

This network requires a key for the following:

Network Authentication: WPA-PSK

Data encryption: TKIP

Network key: ●●●●●●●●●

Confirm network key: ●●●●●●●●●

Key index (advanced): 1

□ The key is provided for me automatically

□ This is a computer-to-computer (ad hoc) network; wireless access points are not used

Choose WPA-PSK

Choose either TKIP or AES for the Data Encryption mode

Enter a network key that matches the one specified on the access point (and confirm by re-typing)

Network Authentication	WPA-PSK

Data Encryption	TKIP or AES depending on how this option is configured on the access point. **Note:** When the Cipher Suite on the access point is set to "Both", then TKIP clients with a valid TKIP key and AES clients with a valid CCMP (AES) key can associate with the access point.
Network Key	Provide the key you entered on the access point Security settings for the cipher suite you are using. For example, if the key on the access point is set to use a TKIP key of "012345678", then a TKIP client specify this same string as the network key.
The key is provided for me automatically	This box should be disabled automatically based on other settings.

2. Configure the following settings on the Association tab on the Network Properties dialog.
3. Configure the following settings on the Authentication tab on the Network Properties dialog.

Enable IEEE 802.1X authentication for this network	Make sure that IEEE 802.1X authentication is disabled (unchecked). (Setting the encryption mode to WEP should automatically disable authentication.)

4. Click **OK** on the Wireless Network Properties dialog to close it and save your changes.

WPA-PSK clients should now be able to associate and authenticate with the access point. As a client, you will not be prompted for a key. The TKIP or AES key you configured on the client security settings is automatically used when you connect.

Using an External Authentication Server

The 802.1X and WPA Enterprise security modes require an external authentication server. Network security configurations including Public Key Infrastructures (PKI), Remote Authentication Dial-in User Server (RADIUS) servers, and Certificate Authority (CA) can vary a great deal from one organization to the next in terms of how they provide Authentication, Authorization, and Accounting (AAA). Ultimately, your network infrastructure determines how clients should configure security to access the wireless network. This appendix provides general guidelines about each type of client configuration supported by the Unified Access Point and does not attempt to describe every network configuration or scenario.

This appendix assumes that you know how to configure client security options appropriate to your security infrastructure beyond the fundamental suggestions given here. Topics covered here that particularly relate to client security configuration in a RADIUS - PKI environment are:

IEEE 802.1X Client Using EAP/TLS Certificate

-

WPA/WPA2 Enterprise (RADIUS) Client Using EAP-TLS Certificate

-
- Configuring the RADIUS Server

Obtaining a TLS-EAP Certificate for a Client

-

This appendix does not describe how to configure an EAP-PEAP client with a RADIUS server.

Configuring IEEE 802.1X Security on a Client

IEEE 802.1X is the standard defining port-based authentication and infrastructure for doing key management. Extensible Authentication Protocol (EAP) messages 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.

IEEE 802.1X Client Using EAP/TLS Certificate

Extensible Authentication Protocol (EAP) Transport Layer Security (TLS), or EAP-TLS, is an authentication protocol that supports the use of smart cards and certificates. You have the option of using EAP-TLS with both WPA/WPA2 Enterprise (RADIUS) and IEEE 802.1X modes if you have an external RADIUS server on the network to support it.

To use IEEE 802.1X mode with EAP-TLS certificates for authentication and authorization of clients, you must have an external RADIUS server and a Public Key Authority Infrastructure (PKI), including a Certificate Authority (CA), server configured on your network. It is beyond the scope of this document to describe these configuration of the RADIUS server, PKI, and CA server. Consult the documentation for those products.

For more information about Microsoft Windows PKI software, see the Microsoft Web site: http://support.microsoft.com.

To use this type of security, you must perform the following steps:

1. Add the access point to the list of RADIUS server clients. (See Configuring the RADIUS Server .)

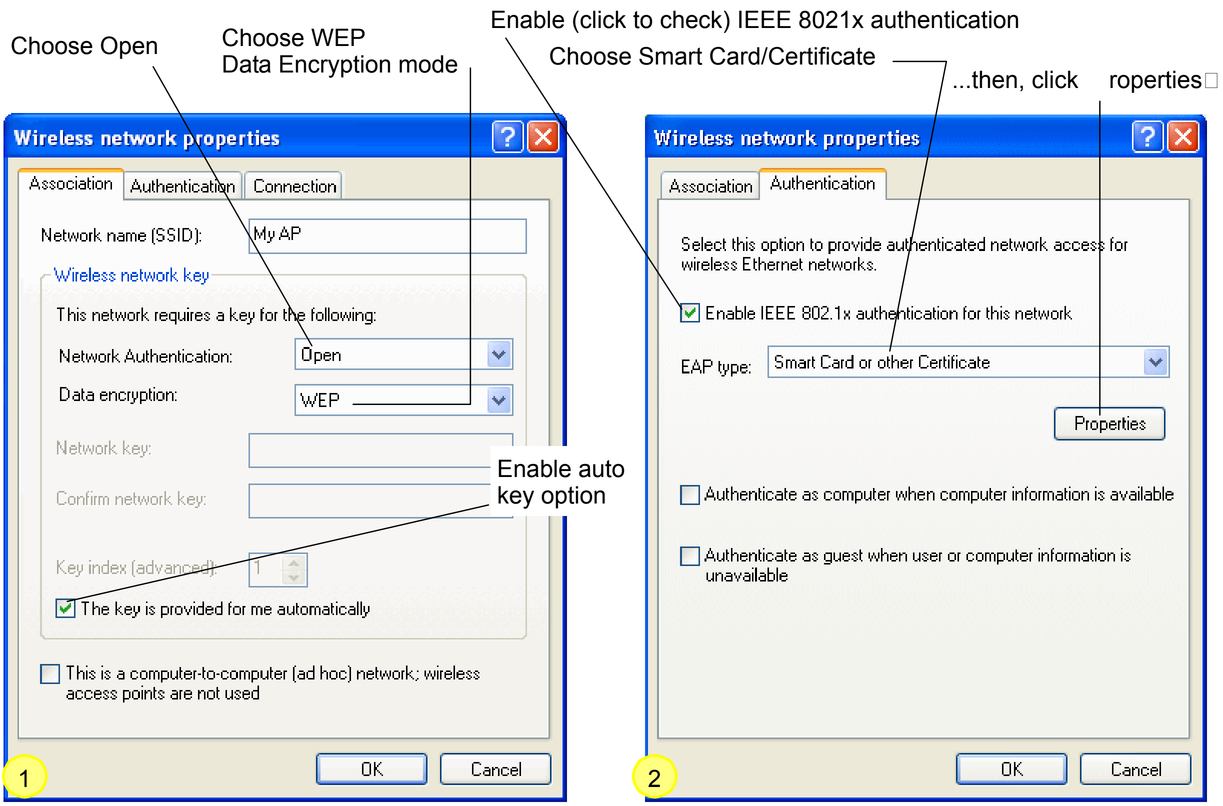
2. Configure the access point to use your RADIUS server (by providing the RADIUS server IP address as part of the "IEEE 802.1X" security mode settings).
3. Configure wireless clients to use IEEE 802.1X security and "Smart Card or other Certificate" as described in this section.

Obtain a certificate for this client as described in Obtaining a TLS-EAP Certificate for a Client

4. .

If you configured the access point to use IEEE 802.1X security mode with an external RADIUS server, perform the following steps:

1. Configure IEEE 802.1X security with certificate authentication on each client as follows.



Choose Open

Choose WEP
Data Encryption mode

Enable (click to check) IEEE 8021x authentication

Choose Smart Card/Certificate

...then, click roperties□

Enable auto
key option

1

Wireless network properties

Association | Authentication | Connection

Network name (SSID): My AP

Wireless network key

This network requires a key for the following:

Network Authentication: Open

Data encryption: WEP

Network key:

Confirm network key:

Key index (advanced): 1

☑ The key is provided for me automatically

□ This is a computer-to-computer (ad hoc) network; wireless access points are not used

OK | Cancel

2

Wireless network properties

Association | Authentication

Select this option to provide authenticated network access for wireless Ethernet networks.

☑ Enable IEEE 802.1x authentication for this network

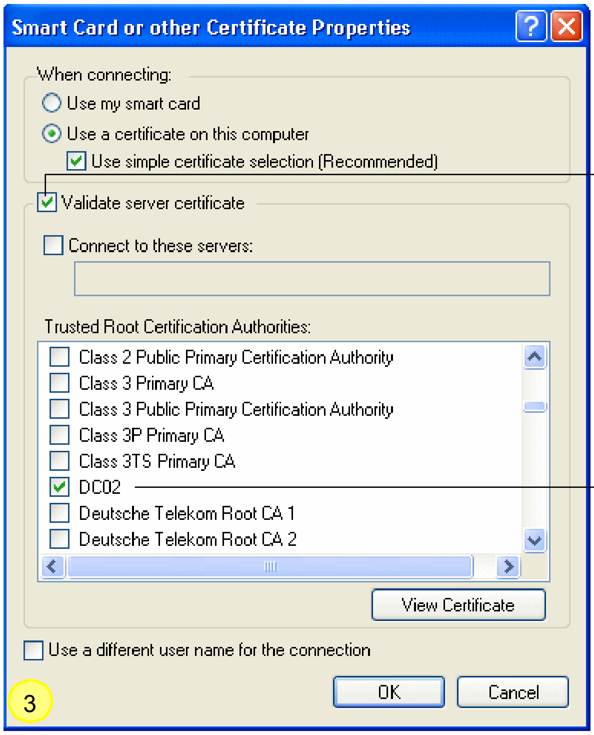
EAP type: Smart Card or other Certificate

Properties

□ Authenticate as computer when computer information is available

□ Authenticate as guest when user or computer information is unavailable

OK | Cancel



Smart Card or other Certificate Properties

When connecting:

○ Use my smart card

● Use a certificate on this computer

☑ Use simple certificate selection (Recommended)

☑ Validate server certificate

□ Connect to these servers:

Trusted Root Certification Authorities:

- □ Class 2 Public Primary Certification Authority
- □ Class 3 Primary CA
- □ Class 3 Public Primary Certification Authority
- □ Class 3P Primary CA
- □ Class 3TS Primary CA
- ☑ DC02
- □ Deutsche Telekom Root CA 1
- □ Deutsche Telekom Root CA 2

□ Use a different user name for the connection

Enable (click to check)
alidate server certificate□

Select (check) the name of certificate
on this client (downloaded from
RADIUS server in a prerequisite procedure)

2. Configure the following settings on the Association tab on the Network Properties dialog.

Network Authentication	Open
Data Encryption	WEP **Note:** An RC4 stream cipher is used to encrypt the frame body and cyclic redundancy checking (CRC) of each IEEE 802.11 frame. This is the same encryption algorithm as is used for Static WEP; therefore, the data encryption method configured on the client for this mode is WEP.
This key is provided for me automatically	Enable (click to check) this option.

2.

3. Configure these settings on the Authentication tab.

Enable IEEE 802.1X authentication for this network	Enable (click to check) this option.
EAP Type	Choose Smart Card or other Certificate.

3.

4. Click **Properties** to bring up the Smart Card or other Certificate Properties dialog and enable the “Validate server certificate” option.

Validate Server Certificate	Enable this option (click to check the box).
Certificates	In the certificate list shown, select the certificate for this client.

4.

Click **OK** on all dialogs to close and save your changes.

To complete the client configuration you must now obtain a certificate from the RADIUS server and install it on this client. For information on how to do this see Obtaining a TLS-EAP Certificate for a Client

5. .

IEEE 802.1X clients should now be able to connect to the access point using their TLS certificates. The certificate you installed is used when you connect, so you will not be prompted for login information. The certificate is automatically sent to the RADIUS server for authentication and authorization.

Configuring 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.

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

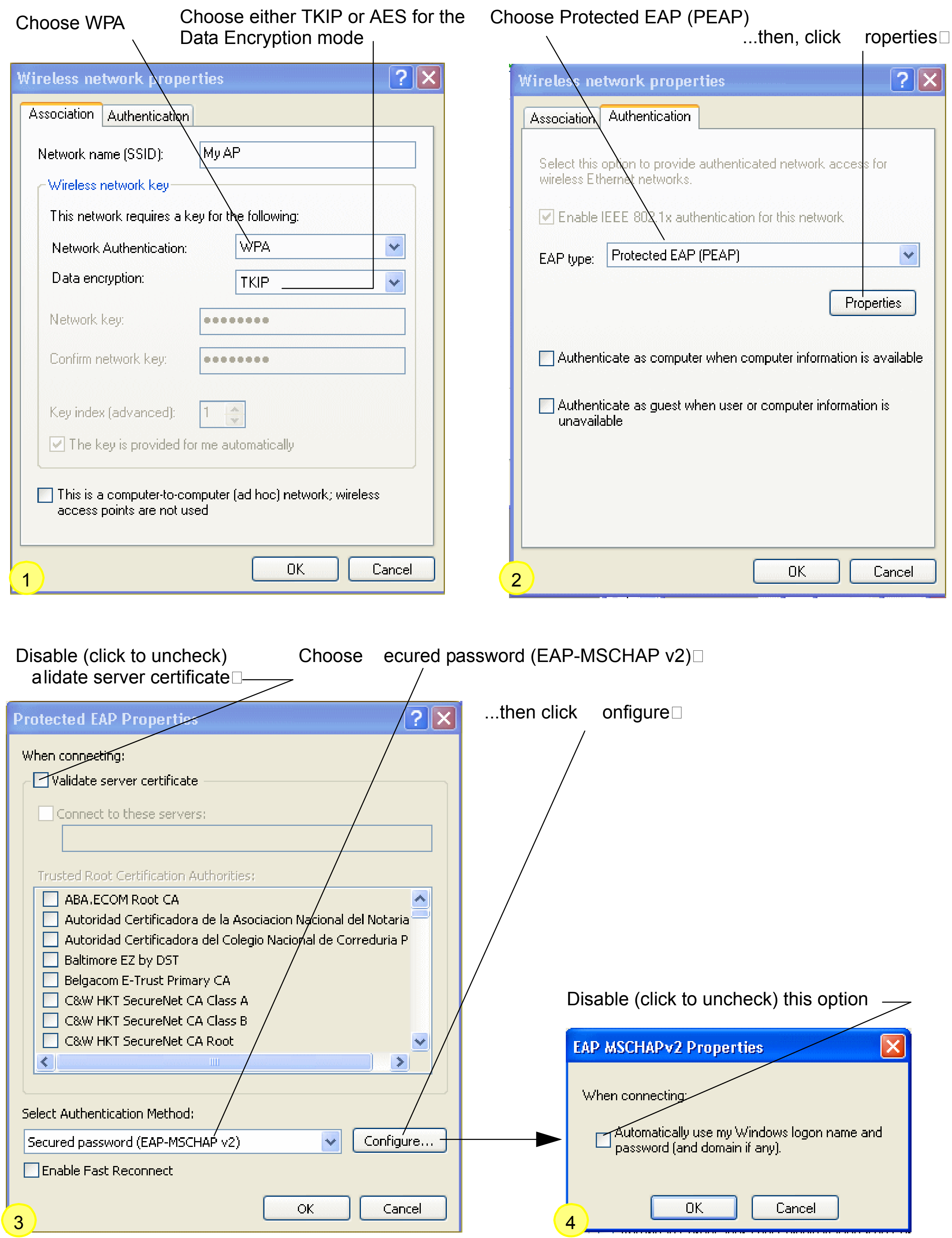
If you configure the access point to use this security mode with an external RADIUS server, you must configure the client stations to use WPA/WPA2 Enterprise (RADIUS) and whichever security protocol your RADIUS server is configured to use.

WPA/WPA2 Enterprise (RADIUS) Client Using EAP/PEAP

If you have an external RADIUS server that uses EAP/PEAP, you will need to (1) add the access point to the list of RADIUS server clients, and (2) configure your “WPA/WPA2 Enterprise (RADIUS)” wireless clients to use PEAP.

If you configured the access point to use WPA/WPA2 Enterprise (RADIUS) security mode and an external RADIUS server that uses EAP/PEAP, perform the following steps.

1. Configure WPA security with PEAP authentication on each client as follows.



Choose WPA

Choose either TKIP or AES for the Data Encryption mode

Choose Protected EAP (PEAP)

...then, click roperties□

1

Wireless network properties

Association | Authentication

Network name (SSID): My AP

Wireless network key

This network requires a key for the following:

Network Authentication: WPA

Data encryption: TKIP

Network key: ••••••••

Confirm network key: ••••••••

Key index (advanced): 1

☑ The key is provided for me automatically

☐ This is a computer-to-computer (ad hoc) network; wireless access points are not used

OK | Cancel

2

Wireless network properties

Association | Authentication

Select this option to provide authenticated network access for wireless Ethernet networks.

☑ Enable IEEE 802.1x authentication for this network

EAP type: Protected EAP (PEAP)

Properties

☐ Authenticate as computer when computer information is available

☐ Authenticate as guest when user or computer information is unavailable

OK | Cancel

Disable (click to uncheck) alidate server certificate□

Choose ecured password (EAP-MSCHAP v2)□

...then click onfigure□

3

Protected EAP Properties

When connecting:

☐ Validate server certificate

☐ Connect to these servers:

Trusted Root Certification Authorities:

☐ ABA.ECOM Root CA
☐ Autoridad Certificadora de la Asociacion Nacional del Notaria
☐ Autoridad Certificadora del Colegio Nacional de Correduria P
☐ Baltimore EZ by DST
☐ Belgacom E-Trust Primary CA
☐ C&W HKT SecureNet CA Class A
☐ C&W HKT SecureNet CA Class B
☐ C&W HKT SecureNet CA Root

Select Authentication Method:

Secured password (EAP-MSCHAP v2) | Configure...

☐ Enable Fast Reconnect

OK | Cancel

Disable (click to uncheck) this option

4

EAP MSCHAPv2 Properties

When connecting:

☐ Automatically use my Windows logon name and password (and domain if any).

OK | Cancel

2. Configure the following settings on the Association and Authentication tabs on the Network Properties dialog.

Network Authentication	WPA

Data Encryption	TKIP or AES depending on how this option is configured on the access point. **Note:** When the Cipher Suite on the access point is set to “Both”, then TKIP clients with a valid TKIP key and AES clients with a valid CCMP (AES) key can associate with the access point. For more information, see Administrators Guide and Online Help on the access point.

2.

3. Configure this setting on the Authentication tab.

EAP Type	Choose “Protected EAP (PEAP)”

3.

4. Click **Properties** to bring up the Protected EAP Properties dialog and configure the following settings.

Validate Server Certificate	Disable this option (click to uncheck the box). **Note:** This example assumes you are using the Built-in Authentication server on the AP. If you are setting up EAP/PEAP on a client of an AP that is using an external RADIUS server, you might certificate validation and choose a certificate, depending on your infrastructure.
Select Authentication Method	Choose “Secured password (EAP-MSCHAP v2)”

4.

5. Click **Configure** to bring up the EAP MSCHAP v2 Properties dialog.

   On this dialog, disable (click to uncheck) the option to “Automatically use my Windows login name...” so that upon login you will be prompted for user name and password.

6. Click **OK** on all dialogs (starting with the EAP MSCHAP v2 Properties dialog) to close and save your changes.

“WPA/WPA2 Enterprise (RADIUS)” PEAP clients should now be able to associate with the access point. Client users will be prompted for a user name and password to authenticate with the network.

WPA/WPA2 Enterprise (RADIUS) Client Using EAP-TLS Certificate

Extensible Authentication Protocol (EAP) Transport Layer Security (TLS), or EAP-TLS, is an authentication protocol that supports the use of smart cards and certificates. You have the option of using EAP-TLS with both WPA/WPA2 Enterprise (RADIUS) and IEEE 802.1X modes if you have an external RADIUS server on the network to support it.

If you want to use IEEE 802.1X mode with EAP-TLS certificates for authentication and authorization of clients, you must have an external RADIUS server and a *Public Key Authority Infrastructure* (PKI), including a *Certificate Authority* (CA), server configured on your network. It is beyond the scope of this document to describe these configuration of the RADIUS server, PKI, and CA server. Consult the documentation for those products.

For more information about Microsoft Windows PKI software, see the Microsoft Web site: http://support.microsoft.com.

To use this type of security, you must perform the following steps:

1. Add the access point to the list of RADIUS server clients. (See Configuring the RADIUS Server .)
2. Configure the access point to use your RADIUS server (by providing the RADIUS server IP address as part of the "WPA/WPA2 Enterprise [RADIUS]" security mode settings).
3. Configure wireless clients to use WPA security and "Smart Card or other Certificate" as described in this section.

Obtain a certificate for this client as described in Obtaining a TLS-EAP Certificate for a Client

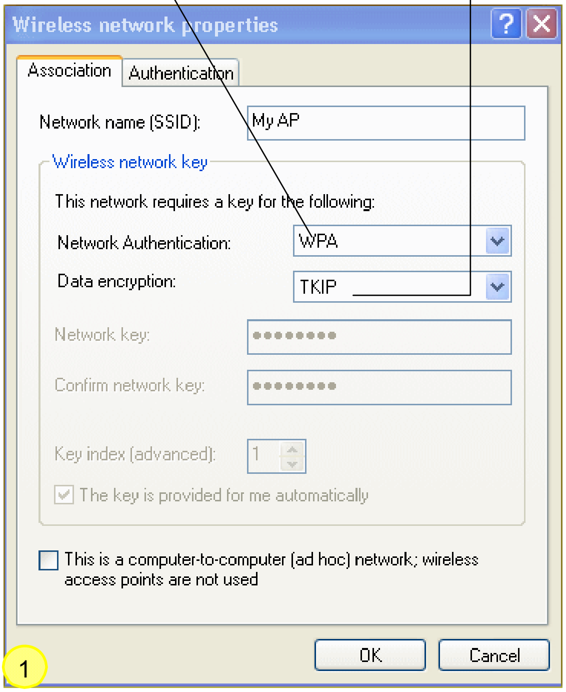
4. .

If you configured the access point to use WPA/WPA2 Enterprise (RADIUS) security mode with an external RADIUS server, perform the following steps:

1. Configure WPA security with certificate authentication on each client as follows.

Choose WPA

Choose either TKIP or AES for the Data Encryption mode



1

Wireless network properties

Association | Authentication

Network name (SSID): My AP

Wireless network key

This network requires a key for the following:

Network Authentication: WPA

Data encryption: TKIP

Network key: ●●●●●●●●

Confirm network key: ●●●●●●●●

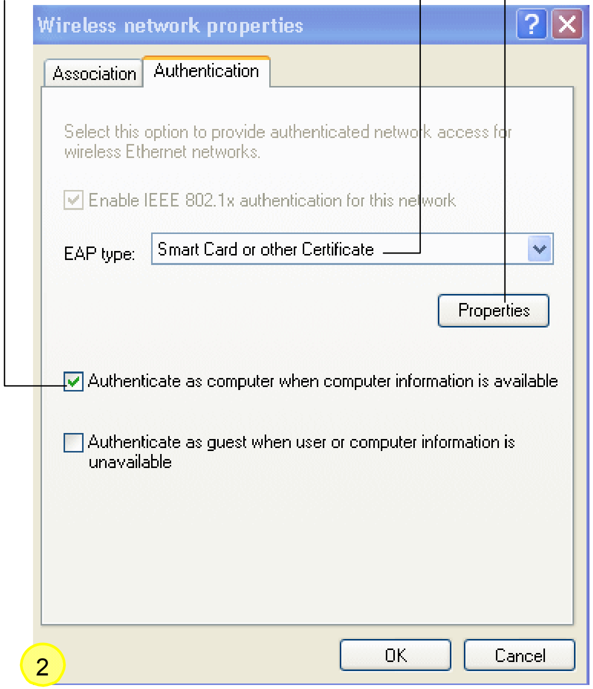
Key index (advanced): 1

☑ The key is provided for me automatically

☐ This is a computer-to-computer (ad hoc) network; wireless access points are not used

Choose Smart Card or other certificate and enable uthenticate as computer when info is available□

...then, click roperties□



2

Wireless network properties

Association | Authentication

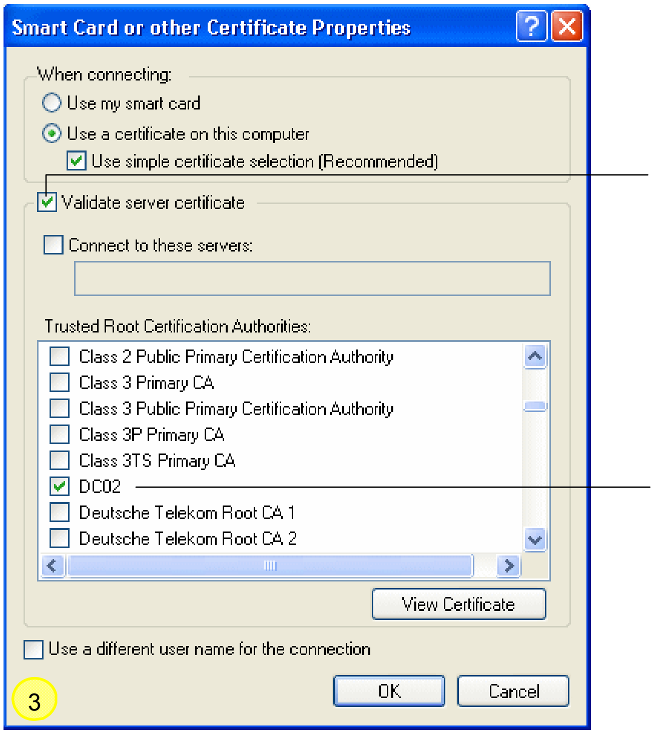
Select this option to provide authenticated network access for wireless Ethernet networks.

☑ Enable IEEE 802.1x authentication for this network

EAP type: Smart Card or other Certificate

☑ Authenticate as computer when computer information is available

☐ Authenticate as guest when user or computer information is unavailable



Smart Card or other Certificate Properties

When connecting:

○ Use my smart card

● Use a certificate on this computer

☑ Use simple certificate selection (Recommended)

☑ Validate server certificate

□ Connect to these servers:

Trusted Root Certification Authorities:

- □ Class 2 Public Primary Certification Authority
- □ Class 3 Primary CA
- □ Class 3 Public Primary Certification Authority
- □ Class 3P Primary CA
- □ Class 3TS Primary CA
- ☑ DC02
- □ Deutsche Telekom Root CA 1
- □ Deutsche Telekom Root CA 2

□ Use a different user name for the connection

Enable (click to check)
alidate server certificate□

Select (check) the name of certificate
on this client (downloaded from
RADIUS server in a prerequisite procedure)

2. Configure the following settings on the Association tab on the Network Properties dialog.

Network Authentication	WPA
Data Encryption	TKIP or AES depending on how this option is configured on the access point. **Note:** When the Cipher Suite on the access point is set to “Both”, then TKIP clients with a valid TKIP key and AES clients with a valid CCMP (AES) key can associate with the access point. For more information, see Administrators Guide and Online Help on the access point.

2.

3. Configure these settings on the Authentication tab.

Enable IEEE 802.1X authentication for this network	Enable (click to check) this option.
EAP Type	Choose Smart Card or other Certificate.

3.

4. Click **Properties** to bring up the Smart Card or other Certificate Properties dialog and enable the “Validate server certificate” option.

Validate Server Certificate	Enable this option (click to check the box).
Certificates	In the certificate list shown, select the certificate for this client.

4.

Click **OK** on all dialogs to close and save your changes.

To complete the client configuration you must now obtain a certificate from the RADIUS server and install it on this client. For information on how to do this see Obtaining a TLS-EAP Certificate for a Client

5. .

WPA clients should now be able to connect to the access point using their TLS certificates. The certificate you installed is used when you connect, so you will not be prompted for login information. The certificate is automatically sent to the RADIUS server for authentication and authorization.

Configuring the RADIUS Server for Authentication

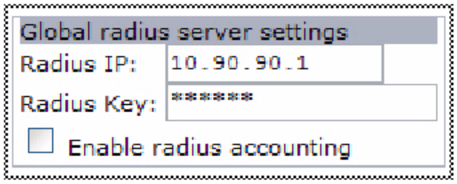
An external RADIUS server running on the network can support of EAP-TLS smart card/certificate distribution to clients in a Public Key Infrastructure (PKI) as well as EAP-PEAP user account setup and authentication.

This section provides an example of configuring an external RADIUS server for the purposes of authenticating and authorizing TLS-EAP certificates from wireless clients of a particular Unified Access Point configured for either “WPA/WPA2 Enterprise (RADIUS)” or “IEEE 802.1X” security modes. The intention of this section is to provide some idea of what this process will look like; procedures will vary depending on the RADIUS server you use and how you configure it. This example uses the Internet Authentication Service that comes with Microsoft Windows 2003 server.

NOTE: This appendix does not describe how to set up Administrative users on the RADIUS server. This example assumes you have already configured RADIUS server user accounts. You need a RADIUS server user name and password for both this procedure and the following one that describes how to obtain and install a certificate on the wireless client. Please consult the documentation for your RADIUS server for information about setting up user accounts.

The purpose of this procedure is to identify your Unified Access Point as a “client” to the RADIUS server. The RADIUS server can then handle authentication and authorization of wireless clients for the AP. This procedure is required *per access point*. If you have more than one access point with which you plan to use an external RADIUS server, you need to follow these steps for each of those APs.

The information you need to provide to the RADIUS server about the access point corresponds to settings on the access point (Security) and vice versa. You should have already provided the RADIUS server IP Address to the AP; in the steps that follow you will provide the access point IP address to the RADIUS server. The RADIUS Key provided on the AP is the “shared secret” you will provide to the RADIUS server.



Global radius server settings

Radius IP: 10.90.90.1

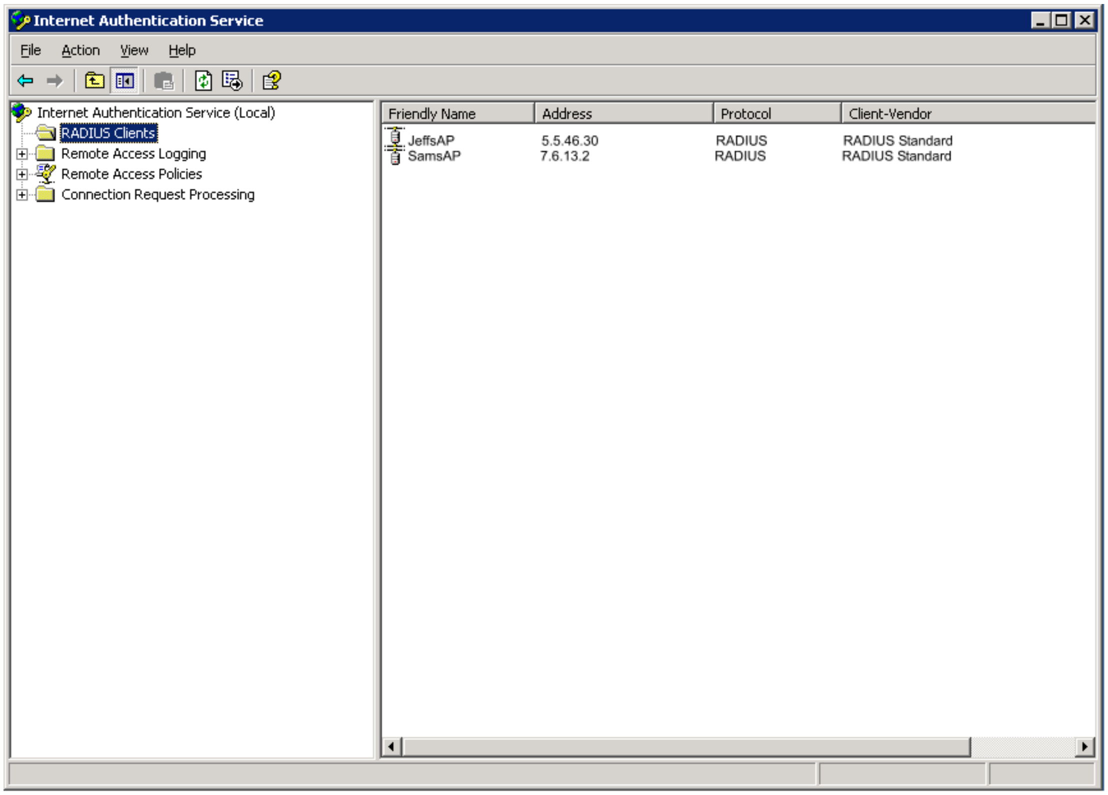
Radius Key: ******

□ Enable radius accounting

NOTE: The RADIUS server is identified by its IP address and UDP port numbers for the different services it provides. On the current release of the Unified Access Point software, the RADIUS server User Datagram Protocol (UDP) ports used by the access point are not configurable. (The Unified Access Point is hard-coded to use RADIUS server UDP port 1812 for authentication and port 1813 for accounting.)

To configure the external RADIUS server, perform the following steps:

1. Log on to the system hosting your RADIUS server and bring up the Internet Authentication Service.



- Internet Authentication Service (Local)
  - RADIUS Clients
  - Remote Access Logging
  - Remote Access Policies
  - Connection Request Processing

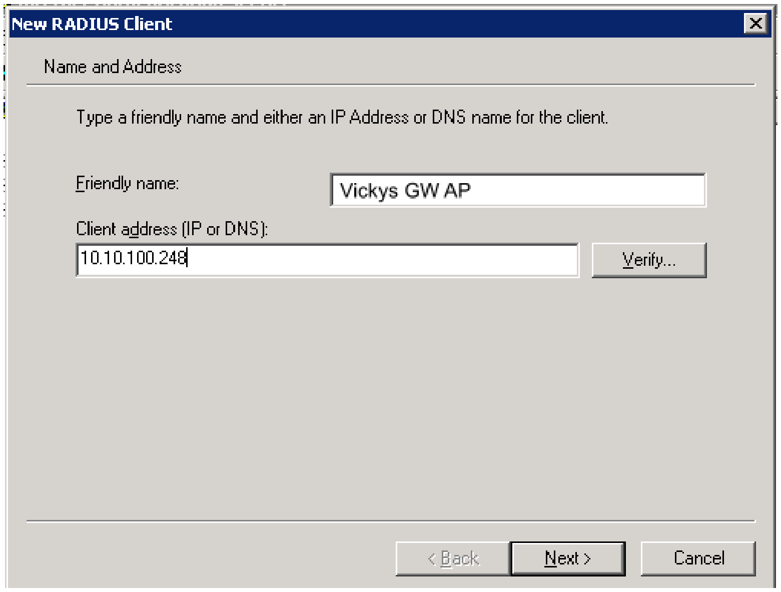
Friendly Name	Address	Protocol	Client-Vendor
JeffsAP	5.5.46.30	RADIUS	RADIUS Standard
SamsAP	7.6.13.2	RADIUS	RADIUS Standard

2. In the left panel, right click on “RADIUS Clients” node and choose **New** > **RADIUS Client** from the popup menu.

3. On the first screen of the New RADIUS Client wizard provide information about the access point to which you want your clients to connect:

   - A logical (friendly) name for the access point. (You might want to use DNS name or location.)

- IP address for the access point.


New RADIUS Client

Name and Address

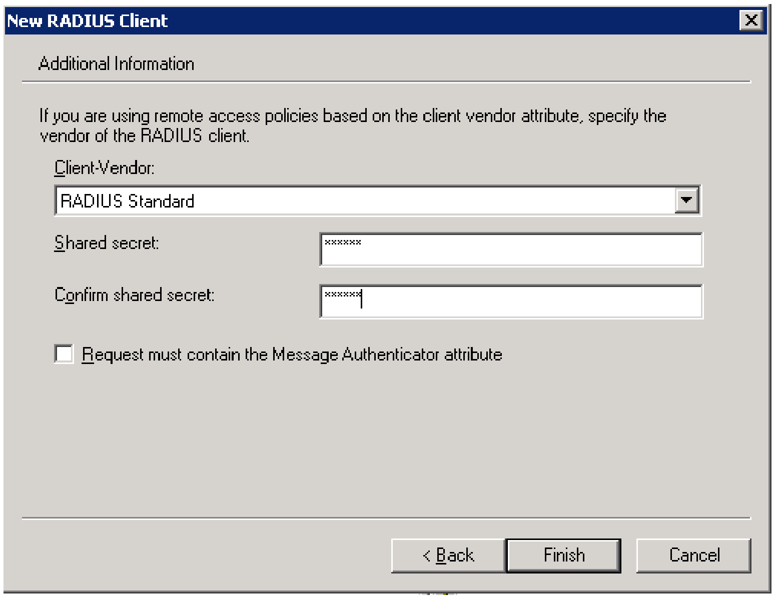
Type a friendly name and either an IP Address or DNS name for the client.

Friendly name: Vickys GW AP

Client address (IP or DNS): 10.10.100.248

Click **Next**.

4. For the “Shared secret” enter the RADIUS Key you provided to the access point (on the Security page)


New RADIUS Client

Additional Information

If you are using remote access policies based on the client vendor attribute, specify the vendor of the RADIUS client.

Client-Vendor: RADIUS Standard

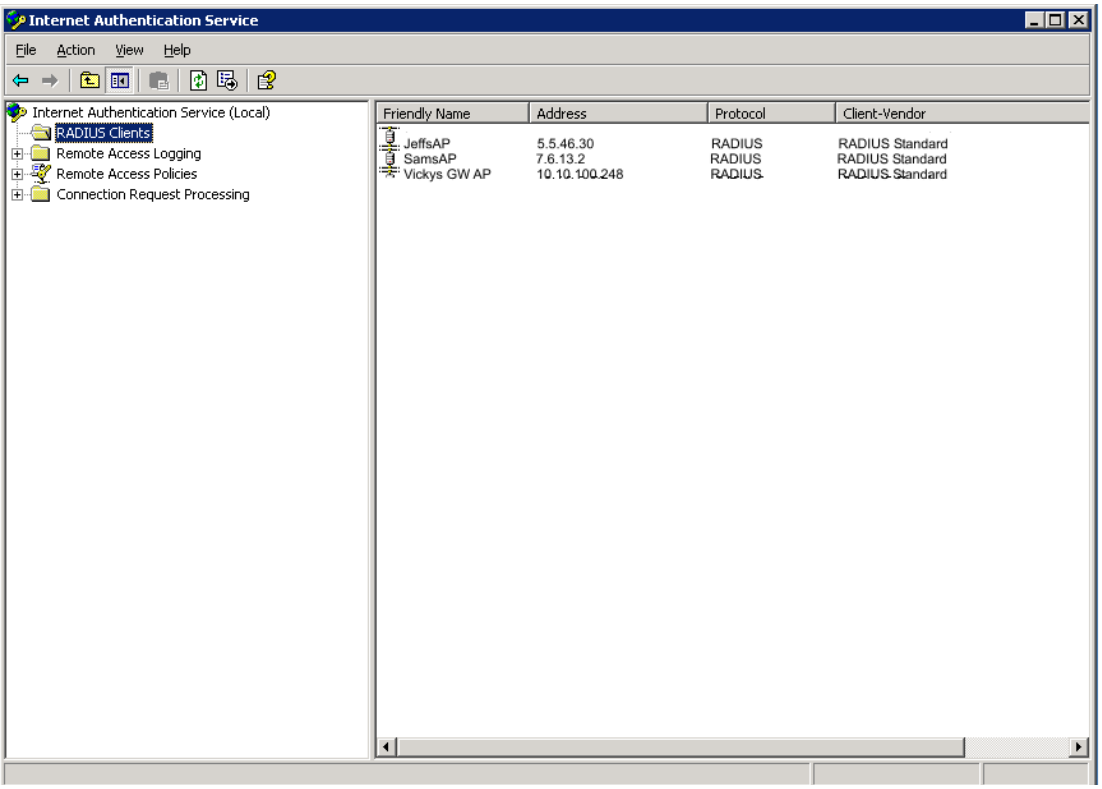
Shared secret: ******

Confirm shared secret: ******

□ Request must contain the Message Authenticator attribute

Re-type the key to confirm.

5. Click **Finish**.


Internet Authentication Service
File
Action
View
Help
Internet Authentication Service (Local)
RADIUS Clients
Remote Access Logging
Remote Access Policies
Connection Request Processing

Friendly Name	Address	Protocol	Client-Vendor
JeffsAP	5.5.46.30	RADIUS	RADIUS Standard
SamsAP	7.6.13.2	RADIUS	RADIUS Standard
Vickys GW AP	10.10.100.248	RADIUS	RADIUS Standard

The access point is now displayed as a client of the Authentication Server.

Obtaining a TLS-EAP Certificate for a Client

If you want to use IEEE 802.1X mode with EAP-TLS certificates for authentication and authorization of clients, you must have an external RADIUS server and a *Public Key Authority Infrastructure* (PKI), including a *Certificate Authority* (CA), server configured on your network. It is beyond the scope of this document to describe these configuration of the RADIUS server, PKI, and CA server. Consult the documentation for those products.

For information about configuring Microsoft Windows PKI software or installing a CA, see the Microsoft Web site: http://support.microsoft.com/.

Wireless clients configured to use either “WPA/WPA2 Enterprise (RADIUS)” or “IEEE 802.1X” security modes with an external RADIUS server that supports TLS-EAP certificates must obtain a TLS certificate from the RADIUS server.

This is an initial one-time step that must be completed on each client that uses either of these modes with certificates. This example uses the Microsoft Certificate Server.

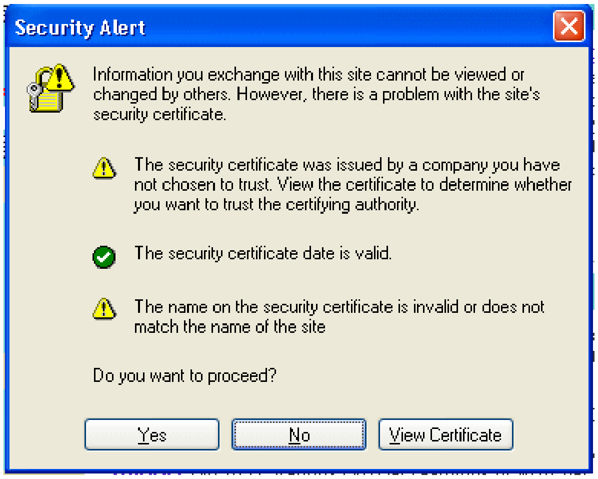
To obtain a certificate for a client, follow these steps.

1. Enter the following URL in a Web browser:

https://<*IPAddressOfServer*>/certsrv/

Where <*IPAddressOfServer*> is the IP address of your external RADIUS server, or of the *Certificate Authority* (CA), depending on the configuration of your infrastructure.

2. Click "Yes" to proceed to the secure Web page for the server.



Security Alert

Information you exchange with this site cannot be viewed or changed by others. However, there is a problem with the site's security certificate.

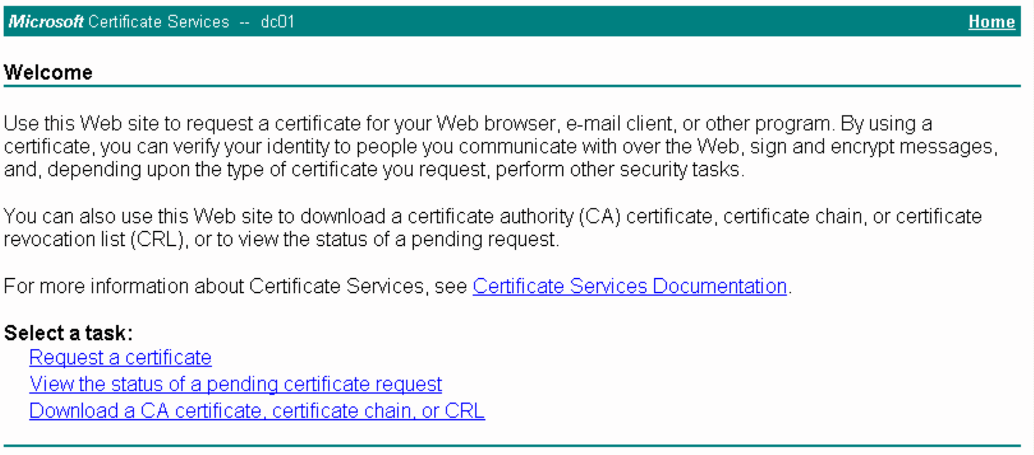
⚠ The security certificate was issued by a company you have not chosen to trust. View the certificate to determine whether you want to trust the certifying authority.

✓ The security certificate date is valid.

⚠ The name on the security certificate is invalid or does not match the name of the site

Do you want to proceed?

The Welcome screen for the Certificate Server is displayed in the browser.



Microsoft Certificate Services -- dc01 Home

Welcome

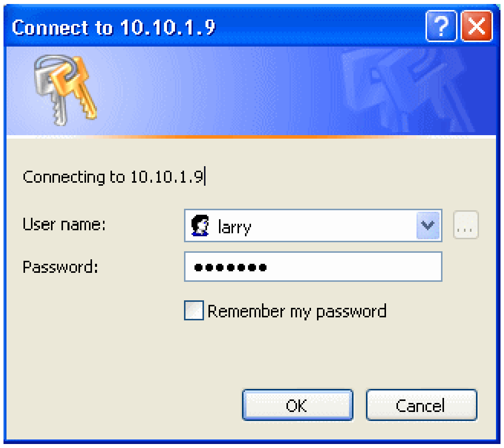
Use this Web site to request a certificate for your Web browser, e-mail client, or other program. By using a certificate, you can verify your identity to people you communicate with over the Web, sign and encrypt messages, and, depending upon the type of certificate you request, perform other security tasks.

You can also use this Web site to download a certificate authority (CA) certificate, certificate chain, or certificate revocation list (CRL), or to view the status of a pending request.

For more information about Certificate Services, see Certificate Services Documentation.

Select a task:
Request a certificate
View the status of a pending certificate request
Download a CA certificate, certificate chain, or CRL

3. Click "Request a certificate" to get the login prompt for the RADIUS server.
4. Provide a valid user name and password to access the RADIUS server.



Connecting to 10.10.1.9

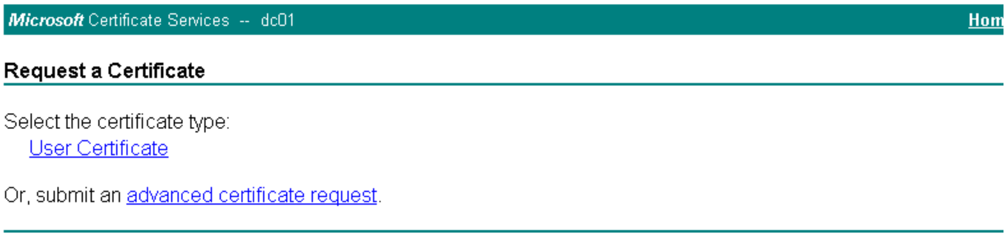
User name: larry

Password: ●●●●●●●

□ Remember my password

NOTE: The user name and password you need to provide here is for access to the RADIUS server, for which you will already have user accounts configured at this point. This document does not describe how to set up Administrative user accounts on the RADIUS server. Please consult the documentation for your RADIUS server for these procedures.

5. Click “User Certificate” on the next page displayed.



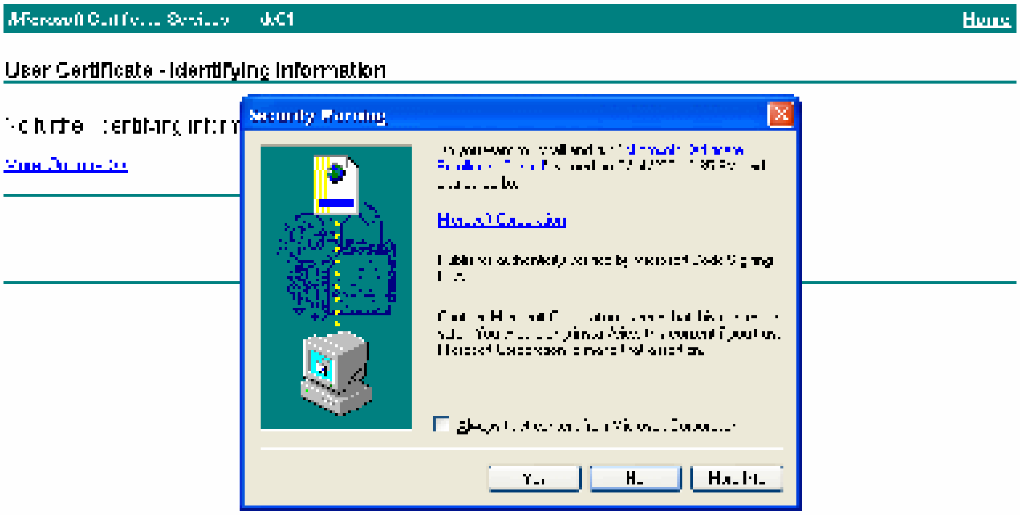
Microsoft Certificate Services -- dc01

Request a Certificate

Select the certificate type:
User Certificate

Or, submit an advanced certificate request.

6. Click “Yes” on the dialog displayed to install the certificate.



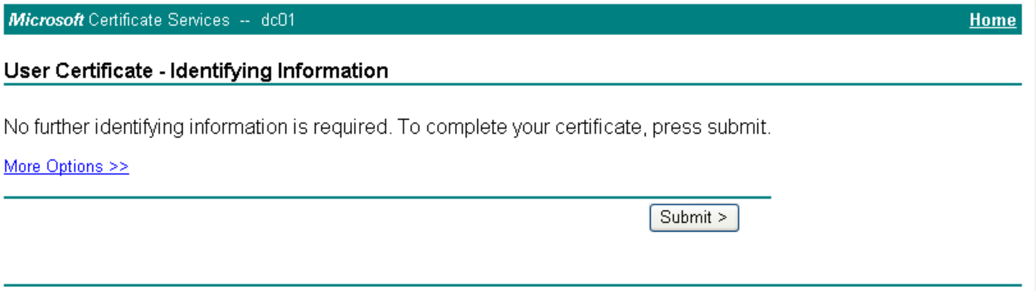
Microsoft Certificate Services -- dc01

User Certificate - Identifying Information

[illegible]

6.

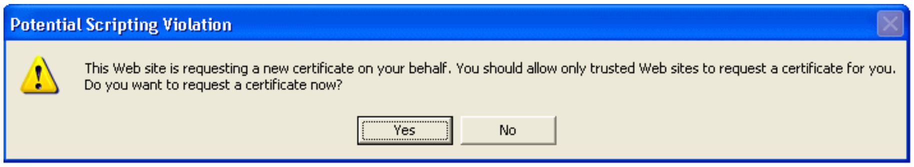
7. Click “Submit” to complete and click “Yes” to confirm the submittal on the popup dialog



Microsoft Certificate Services -- dc01

User Certificate - Identifying Information

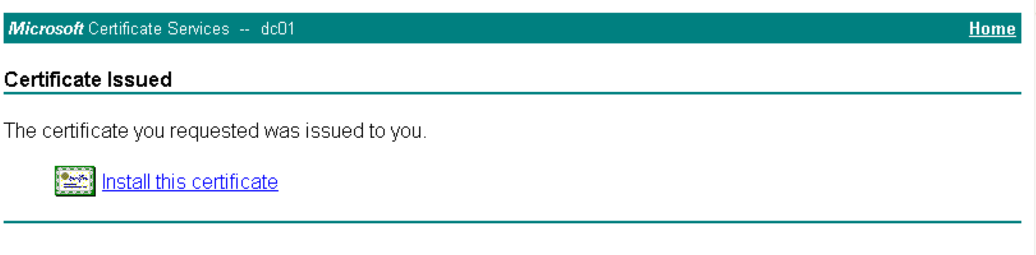
No further identifying information is required. To complete your certificate, press submit.



Potential Scripting Violation

This Web site is requesting a new certificate on your behalf. You should allow only trusted Web sites to request a certificate for you.
Do you want to request a certificate now?

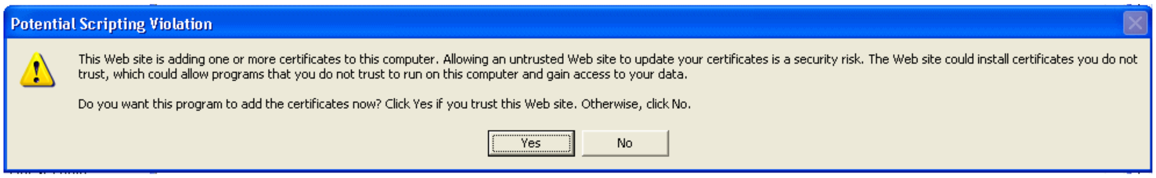
8. Click “Install this certificate” to install the newly issued certificate on your client station. (Also, click “Yes” on the popup windows to confirm the install and to add the certificate to the Root Store.)



Microsoft Certificate Services -- dc01

Certificate Issued

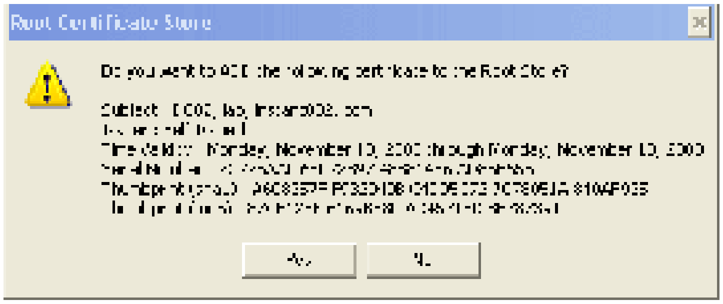
The certificate you requested was issued to you.



Potential Scripting Violation

This Web site is adding one or more certificates to this computer. Allowing an untrusted Web site to update your certificates is a security risk. The Web site could install certificates you do not trust, which could allow programs that you do not trust to run on this computer and gain access to your data.

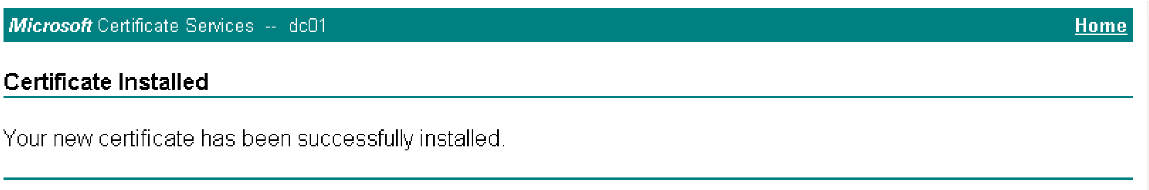
Do you want this program to add the certificates now? Click Yes if you trust this Web site. Otherwise, click No.



Root Certificate Store

Do you want to ADD the following certificate to the Root Store?

Subject: [illegible]
Issuer: [illegible]
Time Validity: Monday, November 10, 2003 through Monday, November 10, 2003
Serial Number: [illegible]
Thumbprint (sha1): [illegible]
Thumbprint (md5): [illegible]



Microsoft Certificate Services -- dc01

Certificate Installed

Your new certificate has been successfully installed.

A success message is displayed indicating the certificate is now installed on the client.

Configuring the RADIUS Server for VLAN Tags

A VLAN is a grouping of ports on a switch or a grouping of ports on different switches. Dynamic VLANs allow you to assign a user to a VLAN, and switches dynamically use this information to configure the port on the switch automatically. Selection of the VLAN is usually based on the identity of the user. The RADIUS server informs the network access server (NAS), which might be the access point, of the selected VLAN as part of the authentication. This setup enables users of Dynamic VLANs to move from one location to another without intervention and without having to make any changes to the switches.

In the case of the Unified Access Point, if you configure an external RADIUS server on the **VAP** page, then an External RADIUS server will try to authenticate the user. A user’s authentication credentials are passed to a RADIUS server. If these credentials are found to be valid, the NAS configures the port to the VLAN indicated by the RADIUS authentication server.

A RADIUS server needs to be configured to use Tunnel attributes in Access-Accept messages, in order to inform the access point about the selected VLAN. These attributes are defined in RFC 2868 and their use for dynamic VLAN is specified in RFC 3580.

If you use an external RADIUS server to manage VLANs, the server must use the following VLAN attributes (as defined in RFC3580):

- Tunnel-Type = VLAN (13)
- Tunnel-Medium-Type = 802
- Tunnel-Private-Group-ID = VLANID

To create a user and assign the user to a particular VLAN by using FreeRADIUS, open the `etc/raddb/users` file, which contains the user account information, and add the new user.

The following example shows the entry for a user in the `users` file. The username is “johndoe,” the password is “test1234.” The user is assigned to VLAN 77.

```
johndoe Auth-Type: = EAP, User-Password == “test1234"
        Tunnel-Type = “VLAN”,
        Tunnel-Medium-Type = “IEEE-802”,
        Tunnel-Private-Group-ID = “77”,
```

Tunnel-Type and Tunnel-Medium-Type use the same values for all stations. Tunnel-Private-Group-ID is the selected VLAN ID and can be different for each user.

NOTE: Do not use the management VLAN ID for the value of the Tunnel-Private-Group-ID. The dynamically-assigned RADIUS VLAN cannot be the same as the management VLAN. If the RADIUS server attempts to assign a dynamic VLAN that is also the management VLAN, the AP ignores the dynamic VLAN assignment, and a newly associated client is assigned to the default VLAN for that VAP. A re-authenticating client retains its previous VLAN ID.

B

CLI for AP Configuration

In addition to the Web based user interface, the Unified Access Point includes a command line interface (CLI) for administering the access point. The CLI lets you view and modify status and configuration information.

The following topics provide an introduction to the class structure upon which the CLI is based, CLI commands, and examples of using the CLI to get or set configuration information on an access point:

- How to Access the Ac
- Commands and Syntax

Getting Help on Commands at the CLI

-

Interface Naming Conventions

-

Saving Configuration Changes

-
- Acc

CLI Classes and Properties Reference

-

How to Access the Access Point CLI

You can use any of the following methods to access the command line interface (CLI) for the access point or wireless network:

- Telnet Connection to the AP
- SSH Connection to the AP

Telnet Connection to the AP

If you already deployed the network and know the IP address of your access point, you can use a remote Telnet connection to the access point to view the system console over the network.

Using a Telnet connection gives you remote access to the AP system console. The only disadvantage of using Telnet is that with Telnet you cannot access the system console until the AP is fully initialized. Therefore, you cannot view AP startup messages. However, once the AP is operational, you can use a Telnet connection to view the AP system console and enter CLI commands. To use Telnet, you need a Telnet client, such as PuTTY.

To use the Microsoft Windows command window for Telnet access to the AP, use the following instructions:

1. Open a command window on your PC.

   (For example, from the system tray on the desktop choose **`Start > Run`** to bring up the Run dialog, and type **`cmd`** in the Open property, then click **OK**.)

2. At the command prompt, type the following:

   ```
   telnet <ip_address>
   ```

   where <*ip_address*> is the address of the access point you want to monitor.

   (If your Domain Name Server is configured to map domain names to IP addresses via DHCP, you can also telnet to the domain name of the AP.)

3. When the login prompt appears, enter the username and password.

   The login name is **admin**, and the default password is **admin**.

   After a successful login, the screen shows the (*Access Point Name*)# prompt. You are now ready to enter CLI commands at the command line prompt.

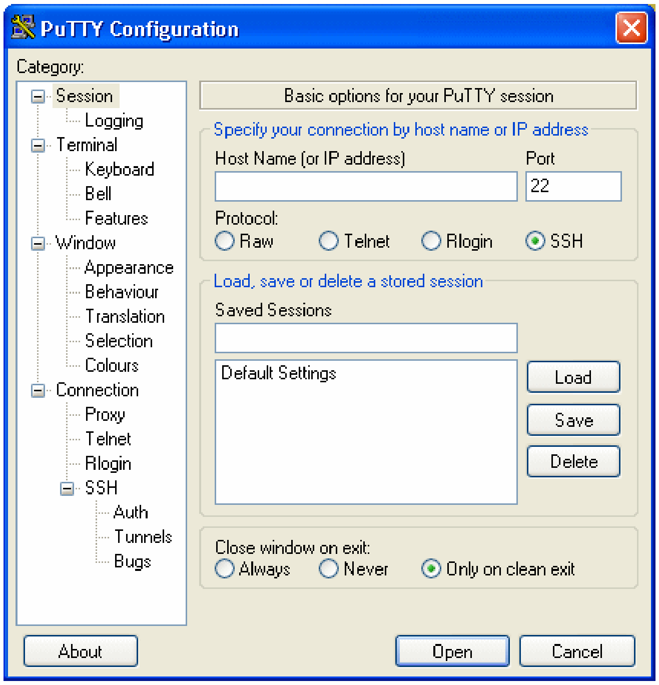
SSH Connection to the AP

If you already deployed your network and know the IP address of your access point, you can use a remote Secure Shell (SSH) connection to the access point to view the system console over the network.

Using an SSH connection to the access point is similar to “Telnet” in that it gives you remote access to the system console and CLI. SSH has the added advantage of being a secure connection traffic encrypted.

To use an SSH connection, you need to have SSH software installed on your PC. The examples in this guide use PuTTY, which is available as a free download from the Internet.

1. Start your SSH application. (We use PuTTY as an example.)



Specify your connection by host name or IP address

Host Name (or IP address)

Port: 22

Protocol: ○ Raw ○ Telnet ○ Rlogin ● SSH

Saved Sessions

Default Settings

Close window on exit: ○ Always ○ Never ● Only on clean exit

2. Enter the IP address of access point and click **Open**.

   (If your Domain Name Server is configured to map domain names to IP addresses via DHCP, you can enter the domain name of the AP instead of an IP address.)

   This brings up the SSH command window and establishes a connection to the access point. The login prompt is displayed.

3. When the login prompt appears, enter the username and password.

   The login name is **admin**. If you did not change the default password, press ENTER when you are prompted for a password. The default password is blank.

   After a successful login, the screen shows the (*Access Point Name*)# prompt. You are now ready to enter CLI commands at the command line prompt.

Commands and Syntax

The CLI for the DWL-3500AP and DWL-8500AP provides the following commands for manipulating objects:

- get
- set
- add
- remove

Settings updated from the CLI (with `get`, `set`, `add`, `remove` commands) will not be saved to the startup configuration unless you explicitly save them via the `save-running` command. For a description of configurations maintained on the AP and details on how to save your updates, see

Saving Configuration Changes

CAUTION: .

Using the get Command

The “get” command allows you to get the property values of existing instances of a class. Classes can be “named” or “unnamed.” The command syntax is:

```
get unnamed-class [ property ... | detail ]
get named-class [ instance | all [ property ... | name | detail ] ]
```

The rest of the command line is optional. If provided, it is either a list of one or more `properties`, or the keyword **detail**.

The following example uses the “get” command on an unnamed class with a single instance: **`get log`**
There is only one log on the AP, so the command returns information on the log file.

The following example uses the “get” command on an unnamed class with multiple instances: **`get log-entry`**
There are multiple log entries but they are not named, so this command returns all log entries.

The following example uses the “get” command on a named class with multiple instances:
`get bss wlan0bssvap0`
There are multiple BSSes and they are named, so this command returns information on the BSS named “wlan0bssvap0.”

The following example uses the “get” command on a named class to get all instances:

```
get mac-acl all mac
get mac-acl all
```

NOTE: **`wlan0bssvap0`** is the name of the basic service set (BSS) on the **`wlan0`** interface. For information on *interfaces*, see Interface Naming Convention.

Using the set Command

The “set” command allows you to set the property values of existing instances of a class and has the following syntax

```
set unnamed-class [ with qualifier-property qualifier-value ... to ] property
value . . .
```

The first argument is an unnamed class in the configuration.

After this is an optional qualifier that restricts the set to only some instances. For singleton classes (with only one instance) no qualifier is needed. If there is a qualifier, it starts with the keyword **with**, then has a sequence of one or more *qualifier-property qualifier-value* pairs, and ends with the keyword **to**. If these are included, then only instances whose present value of *qualifier-property* is *qualifier-value* will be set. The *qualifier-value* arguments cannot contain spaces. Therefore, you cannot select instances whose desired *qualifier-value* has a space in it.

The rest of the command line contains *property-value* pairs.

```
set named-class instance | all [ with qualifier-property qualifier-value ...
to ] property value...
```

The first argument is either a named class in the configuration.

The next argument is either the name of the *instance* to set, or the keyword **all**, which indicates that all instances should be set. Classes with multiple instances can be set consecutively in the same command line as shown in Example 4 below. The *qualifier-value* arguments cannot contain spaces.

The following examples show **set** commands. Bold text indicates class names, property names or keywords; the text that is not bold shows the property values.

1. **set interface wlan0 ssid** “Vicky's AP”
2. **set radio all beacon-interval** 200
3. **set tx-queue wlan0 with queue data0 to aifs** 3
4. **set tx-queue wlan0 with queue data0 to aifs** 7 **cwmin** 15 **cwmax** 1024 **burst** 0
5. **set vap vap2 with radio wlan0 to vlan-id** 123

NOTE: For information on interfaces used in this example (such as wlan0 or vap2) see Interface Naming Convention.

Using the add Command

The “add” command allows you to add a new instance or group of instances of a class and has the following syntax:

```
add unique-named-class instance [ property value ... ]
add group-named-class instance [ property value ... ]
add anonymous-class [ property value ... ]
```

For example:

```
add mac-acl default mac 00:01:02:03:04:05
```

NOTE: If you’re adding an instance to a unique-named class, you must assign the instance a name not already in use by any other instance of that class. If you add instances to group-named classes, you can form groups by creating instances and assigning them identical names. All instances of a group-named class that have the same name form a group of instances.

Using the remove Command

The "remove" command allows you to remove an existing instance of a class and has the following syntax:

```
remove unnamed-class [ property value . . . ]
remove named-class instance | all [ property value . . .]
```

For example:

```
remove mac-acl default mac 00:01:02:03:04:05
```

Additional CLI Commands

The CLI also includes the following commands for maintenance tasks:

Table 31. Additional CLI Commands

Command	Description
save-running	The **`save-running`** command saves the running configuration as the startup configuration. **For more information, see Saving Configuration Changes** .
reboot	The **`reboot`** command restarts the access point (a "soft" reboot).
factory-reset	The **`factory-reset`** command resets the AP to factory defaults and reboots.
firmware-upgrade	Use the **`firmware-upgrade`** command to upload a new AP image.
config	Use the **`config`** command to upload or download the AP configuration file.

For information about classes, instances, and properties, see CLI Classes and Properties Reference

Getting Help on Commands at the CLI

The CLI provides keyboard shortcuts to help you navigate the command line and build valid commands, along with “tab completion” hints on available commands that match what you have typed so far. Using the CLI will be easier if you use the tab completion help and learn the keyboard shortcuts.

Tab Completion

Help on commands can be requested at the CLI by using the TAB key. This is a quick way to see all valid completions for a class. Entering TAB once will attempt to complete the current command.

If multiple completions exist, a beep will sound and no results will be displayed. Enter TAB again to display all available completions.

Example 1: At a blank command line, enter TAB twice to get a list of all commands.

```
DLINK-WLAN-AP#
add             Add an instance to the running configuration
config           Upload/Download the running configuration
factory-reset     Reset the system to factory defaults
firmware-upgrade  Upgrade the firmware
get             Get property values of the running configuration
reboot           Reboot the system
remove           Remove instances in the running configuration
save-running      Save the running configuration
set             Set property values of the running configuration
```

Example 2: Type **`remove`** TAB TAB (including a space after **`remove`**) to see a list of all property options for the **`remove`** command.

```
DLINK-WLAN-AP# remove
basic-rate      Basic rates of radios
bridge-port     Bridge ports of bridge interfaces
bss            Basic Service Set of radios
interface       Network interface
mac-acl        MAC address access list item
snmp-group      SNMP user groups
snmp-target     SNMPv3 targets to receive traps
snmp-user       SNMPv3 users
snmp-view       SNMP MIB views
supported-rate   Supported rates of radios
traphost        Destination host for SNMP traps
```

Example 3: Type **`get system v`** TAB. This will result in completion with the only matching property, **`get system version`**. Press ENTER to display the output results of the command.

Keyboard Shortcuts

The CLI provides keyboard shortcuts to help you navigate the command line and build valid commands. Keyboard Shortcuts describes the keyboard shortcuts available from the CLI.

Table 32. Keyboard Shortcuts

Keyboard Shortcut	Action on CLI
Ctrl-a	Move the cursor to the beginning of the current line
Ctrl-e	Move the cursor to the end of the current line
Ctrl-b Left Arrow key	Move the cursor back on the current line, one character at a time
Ctrl-f Right Arrow Key	Move the cursor forward on the current line, one character at a time
Ctrl-c	Start over at a blank command prompt (abandons the input on the current line)
Ctrl-h Backspace	Remove one character on the current line.
Ctrl-w	Remove the last word in the current command. (Clears one word at a time from the current command line, always starting with the last word on the line.)
Ctrl-k	Remove characters starting from cursor location to end of the current line. (Clears the current line from the cursor forward.)
Ctrl-u	Remove all characters before the cursor. (Clears the current line from the cursor back to the CLI prompt.)
Ctrl-p Up Arrow key	Display previous command in history. (Ctrl-p and Ctrl-n let you cycle through a history of all executed commands like Up and Down arrow keys typically do. Up/Down arrow keys also work for this.)
Ctrl-n Down Arrow key	Display next command in history. (Ctrl-p and Ctrl-n let you cycle through a history of all executed commands like Up and Down arrow keys typically do. Up/Down arrow keys also work for this.)
Ctrl-d	Exit the CLI. (At a blank command prompt, typing Ctrl-d closes the CLI.) (Typing Ctrl-d within command text also removes characters, one at a time, at cursor location like Ctrl-h.)

Interface Naming Conventions

The following summary of interface names is provided to help clarify the related CLI commands and output results. These names are not exposed on the Web UI, but are used throughout the CLI. You **`get`** and **`set`** many configuration values on the AP by referring to interfaces. In order to configure the AP through the CLI, you need to understand which interfaces are available on the AP, what role they play (corresponding setting on the Web UI), and how to refer to them. To view a list of the interface names and an associated description, use **`get interface all description`**.

Interface Naming Convention describes the interface naming conventions for the DWL-3500AP and DWL-8500AP.

NOTE: Use the `get interface` command to display common information on all interfaces, including IP addresses

Table 33. Interface Naming Convention

Interface	Description
brvlan*x*	Bridge for VLAN *x*. These interfaces are used for the management interface and dynamic VLANs. By default, brvlan1 is the management VLAN interface.
brtrunk	Internal bridge trunk interface.
lo	Local loopback for data meant for the access point itself.
eth0	The Ethernet interface connected to the Internal network.
vlan1	The VLAN interface associated with the default virtual access point.
wlan0	The default wireless interface on radio 1 - 802.11a radio. This is the interface for virtual access point (VAP) 0. The DWL-3500AP does not have this interface.
wlan1	The default wireless interface on radio 2 - 802.11b/g radio. This is the interface for VAP 0.
wlan0vap*x*	The wireless interface for the *x* VAP on radio 1 - 802.11a radio. The value for *x* ranges from 1-7. The DWL-3500AP does not have this interface.
wlan1vap*x*	The wireless interface for the *x* VAP on radio 2 - 802.11b/g radio. The value for *x* ranges from 1-7.
wlan0bssvap*x*	The basic service set interface for the x VAP on radio 1 - 802.11a radio. The value for *x* ranges from 0-7. The DWL-3500AP does not have this interface.
wlan1bssvap*x*	The basic service set interface for the x VAP on radio 2 - 802.11b/g radio. The value for *x* ranges from 0-7.

NOTE:

NOTE: The commands and examples in this appendix use radio 1. To configure and view information about the second radio, replace the “wlan0” portion of the interface name with wlan1. Use the command `get radio all` to view information about the radios on the Unified Access Point.

Saving Configuration Changes

The Unified Access Point maintains three different configurations.

- **Factory Default Configuration -** This configuration consists of the default settings shipped with the access point (as specified in "Default Settings for the Unified Access Points" on page 19).

  You can always return the AP to the factory defaults by using the **`factory-reset`** command.

- **Startup Configuration -** The startup configuration contains the settings with which the AP will use the next time it starts up (for example, upon reboot).

  To save configuration updates made from the CLI to the *startup* configuration, you must execute the **`save-running`** or **`set config startup running`** command from the CLI after making changes.

- **Running Configuration -** The running configuration contains the settings with which the AP is currently running.

  When you view or update configuration settings through the command line interface (CLI) using **`get`**, **`set`**, **`add`**, and **`remove`** commands, you are viewing and changing values on the *running* configuration only. If you do not save the configuration (by executing the **`save-running`** or "**`set config startup running`**" command at the CLI), you will lose any changes you submitted via the CLI upon reboot.

The **`save-running`** command saves the *running* configuration as the startup configuration. (The **`save-running`** command is a shortcut command for **`set config startup running`**, which accomplishes the same thing)

Settings updated from the CLI (with **`get`**, **`set`**, **`add`**, **`remove`** commands) will not be saved to the startup configuration unless you explicitly save them via the **`save-running`** command. This gives you the option of maintaining the *startup* configuration and trying out values on the *running* configuration that you can discard (by not saving).

By contrast, configuration changes updated from the Web UI are automatically saved to both the *running* and *startup* configurations. If you make changes from the Web UI that you do not want to keep, your only option is to reset to factory defaults. The previous startup configuration will be lost.

Access Point CLI Commands

This section describes the commands you use to view and configure the Unified Access Point. The CLI commands correspond to tasks you can accomplish by using the

Web-based user interface (UI). In some cases, the CLI `get` command provides additional details not available through the Web UI.

NOTE: CLI commands for MAC Authentication and Load Balancing are not available. You must use the Web interface to view and configure these features on the access point.

The CLI performs validation on individual property values in a `set` or `add`, but does not check to see if different property values are consistent with each other. For example, it would not provide any error if a radio's mode was set to “a” and its channel was set to “1”. (Even though “1” is not a valid channel in “a” mode, it is a valid channel in “g” mode.) In cases where the configuration is left in an inconsistent state, the services associated with the configuration may not be operational. Therefore, it is important to consult the class and property reference to understand the acceptable values for properties given the values of other properties. For more information, see CLI Classes and Properties Reference

.

Configuring Basic Settings

The following CLI command examples correspond to tasks you can accomplish on the Basic Settings tab of the Web UI for access points.

NOTE: Before you configure the basic settings, make sure you are familiar with the names of the interfaces as described in Interface Naming Convention. The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal network, or to radio “one” or radio “two.”

Table 34. **Basic Setting Commands**

Action	Command

Get the following information about the management interface on the AP:
• VLAN ID
• Interface Name
• Static IP address (if DHCP is not used)
• Static Subnet Mask
• IP Address
• Subnet Mask
• MAC Address
• DHCP Status
	To show all settings:
	`get management`
	To show specific settings:
	`get management vlan-id`
	`get management interface`
	`get management static-ip`
	`get management static-mask`
	`get management ip`
	`get management mask`
	`get management mac`
	`get management dhcp-status`

Get the Firmware Version	**`get system version`**
Get the serial number	**`get system serial-number`**

Set the Password	**`set system password`** *`<password>`*
	Example:
	`set system password test1234`

NOTE:

Status

The command tasks and examples in this section show status information on access points. These settings correspond to what is shown on the Status tabs in the Web UI.

NOTE: Make sure you are familiar with the names of the interfaces as described in Interface Naming Convention. The interface name you reference in a **`get`** command determines whether the command output shows a wired or wireless interface, the Internal network, or to radio "one" or radio two."

Table 35. **Status Commands**

Action	Command
Global command to get all detail on a Basic Service Set (BSS). This is a useful command to use to get a comprehensive picture of how the AP is currently configured.	**`get bss all detail`**
Get information about the wired and WLAN interfaces	**`get interface`**

Get the MAC Address for the Wired Internal Interface	`get interface wlan0 mac`
Get the VLAN ID for the wired interface	`get management vlan-id`
Get the Network Name (SSID) for the default virtual access point.	`get interface wlan0 ssid`
Get the Current IEEE 802.11 Radio Mode	`get radio wlan0 mode`
Get the Channel the AP is Currently Using	`get radio wlan0 channel`

Get Basic Radio Settings for the Internal Interface	`get radio wlan0`
	`get radio wlan0 detail`

Get Status on Events	`get log-entry detail`
Enable Remote Logging and Specify the Log Relay Host for the Kernel Log	As a prerequisite to remote logging, the Log Relay Host must be configured first as described in "Viewing Events Logs" on page 92. Logging command examples: `set log relay-enabled 1` enables remote logging `set log relay-enabled 1` disables remote logging `get log` `set log` TAB TAB shows values you can set on the log
Get Transmit / Receive Statistics for all interfaces Note: You can also view all transmit and receive statistics individually.	`get interface all ip mac ssid tx-packets tx-bytes tx-errors rx-packets rx-bytes rx-errors`
Get Client Associations	`get association detail`
Get neighboring access points	`get detected-ap detail`
Get information about switches that can discover and manage the AP	`get managed-ap`

NOTE:

Ethernet Settings

Use the commands in this section to view and set values for the Ethernet (wired) interface.

Before configuring this feature, make sure you are familiar with the names of the interfaces as described in Interface Naming Conventions

NOTE: . The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal network, or to radio “one” or radio “two”.

Table 36. Ethernet Setting Commands

Action	Command
Get Summary View of Internal Interfaces	**`get bss`**
Get the DNS Name	**`get host id`**

Set the DNS Name	**`set host id`** `<`*`host_name`*`>`
	For example:
	`set host id vicky-ap`

Get Current Settings for the Ethernet (Wired) Internal Interface	**`get management`**
Set the management VLAN ID	**`set management vlan-id`** *`<1-4094>`*
View untagged VLAN information	**`get untagged-vlan`**
Enable the untagged VLAN	**`set untagged-vlan status up`**
Disable the untagged VLAN	**`set untagged-vlan status down`**
Set the untagged VLAN ID	**`set untagged-vlan vlan-id`** *`<1-4094>`*
View the connection type	**`get management dhcp-status`**
Use DHCP as the connection type	**`set management dhcp-client status up`**
Use a Static IP as the connection type	**`set management dhcp-client status down`**

Set the Static IP address	**`set management static-ip`** *`<ip_address>`*
	Example:
	`set management static-ip 10.10.12.221`

Set a Subnet Mask	**`set management static-mask`** *`<netmask>`*
	Example:
	`set management static-mask 255.0.0.0`

Set the Default Gateway	**`set static-ip-route gateway`** *`<ip_address>`*
	Example:
	`set static-ip-route gateway 10.10.12.1`

View the DNS Nameserver mode
Dynamic= up
Manual=down
	get host dns-via-dhcp

Set DNS Nameservers to Use Static IP Addresses (Dynamic to Manual Mode)	**set host dns-via-dhcp down** **set host static-dns-1** <*ip_address*> **set host static-dns-2** <*ip_address*> Example: **set host static-dns-1 192.168.23.45**
Set DNS Nameservers to Use DHCP IP Addressing (Manual to Dynamic Mode)	**set host dns-via-dhcp up**

NOTE:

Wireless Interface

To set up a wireless (radio) interface, configure the Radio Mode and Radio Channel on each interface. The commands in this table use radio 1 (**wlan0**). To change the wireless settings for radio 2, use **wlan1**.

Table 37. Wireless Setting Commands

Action	Command
Enable or Disable 802.11d regulatory domain support	**set dot11 dot11d up** **set dot11 dot11d down**
Enable or Disable Station Isolation	**set radio wlan0 station-isolation on** **set radio wlan0 station-isolation off**
View the current radio mode	**get radio wlan0 mode**
Set the radio mode to Dynamic Turbo 5 GHz	**set radio wlan0 mode dynamic-turbo-a (only applicable for radio interface wlan0)**
Set the radio mode to Dynamic Turbo 2.4 GHz	**set radio wlan0 mode dynamic-turbo-g (only applicable for radio interface wlan1)**
View the radio channel.	**get radio wlan0 channel**
Set the radio channel to a static channel.	**set radio wlan0 channel-policy static** **set radio wlan0 static-channel** <*channel*>
Set the radio channel to “Auto”	**set radio wlan0 channel-policy best**

Radio Settings

Radio Setting Commands shows the Radio Settings commands. The commands in this table use radio 1 (**`wlan0`**). To change the wireless settings for radio 2, use **`wlan1`**.

Table 38. Radio Setting Commands

Action	Command
View a description of the radio interfaces	**`get radio all description`**
Turn the radio on	**`set radio wlan0 status on`**
Turn the radio off	**`set radio wlan0 status off`**
View the current radio mode	**`get radio wlan0 mode`**
Set the radio mode to IEEE 802.11b	**`set radio wlan1 mode b (only applicable for radio interface wlan1)`**
Set the radio mode to IEEE 802.11g	**`set radio wlan1 mode g (only applicable for radio interface wlan1)`**
Set the radio mode to IEEE 802.11a	**`set radio wlan0 mode a (only applicable for radio interface wlan0)`**
Set the radio mode to Dynamic Turbo 5 GHz	**`set radio wlan0 mode dynamic-turbo-a (only applicable for radio interface wlan0)`**
Set the radio mode to Dynamic Turbo 2.4 GHz	**`set radio wlan0 mode dynamic-turbo-g (only applicable for radio interface wlan1)`**
Enable Super-AG Mode	**`set radio wlan0 super-ag yes`**
Disable Super-AG Mode	**`set radio wlan0 super-ag no`**
View the radio channel.	**`get radio wlan0 channel`**

Set the radio channel to a static channel.	**`set radio wlan0 channel-policy static`**
	`set radio wlan0 static-channel` *`<channel>`*

Set the radio channel to “Auto”	**`set radio wlan0 channel-policy best`**
Set the Beacon Interval	**`set radio wlan0 beacon-interval`** *`<20-1000>`*
Set the DTIM Interval	**`set radio wlan0 dtim-period`** *`<1-255>`*
Set the Fragmentation Length Threshold	**`set radio wlan0 fragmentation-threshold`** *`<256-2346>`*
Set the RTS Threshold	**`set radio wlan0 rts-threshold`** *`<0-2347>`*
Set the maximum number of clients allowed to associate (VAP 0 radio 0)	**`set bss wlan0bssvap0 max-stations`** *`<0-256>`*

Set the power transmission level (percent)	**set radio wlan0 tx-power** *<0-100>*
Select the antenna to use for sending and receiving traffic	**set radio wlan0 antenna-diversity {auto | primary | secondary}**
Add a basic rate set	**add basic-rate wlan0 rate** *integer*
Get current basic rates	**get basic-rate**
Add supported rate	**add supported-rate wlan0 rate** *integer*
Get current supported rates	**get supported-rate wlan0**

Virtual Access Points

Use the commands in this section to view and configure security settings on the access point. These settings correspond to those available from the VAP tab on the Web UI. For a detailed discussion of security concepts and configuration options, see "Configuring Access Point Security" on page 39.

Before configuring this feature, make sure you are familiar with the names of the interfaces as described in Interface Naming Conventions

NOTE: . The interface name you reference in a command determines whether a setting applies to a wired or wireless interface, the Internal network, or to radio "one" or radio "two".

This table shows the commands you use to configure VAPs.

Table 39. VAP Commands

Action	**Command**
Global RADIUS IP address	**set global-radius-server radius-ip** *<ip_address>*
Global RADIUS key	**set global-radius-server radius-key** *<key_value>*
Enable or disable global RADIUS accounting	**set global-radius-server radius-accounting on** **set global-radius-server radius-accounting off**
View information about all VAPs	**get vap all detail**

Enable or disable a VAP on both radios	**`set vap`** *`<vapID>`* **`status up`**
	`set vap` *`<vapID>`* **`status down`**
	Example:
	`set vap vap4 status up`

Enable or disable a VAP on one radio
Note: This example uses radio 1. For radio 2, use **`wlan1`**
	`set vap` *`<vapID>`* **`with radio wlan0 to status up`**
	`set vap` *`<vapID>`* **`with radio wlan0 to status down`**
	Example:
	`set vap vap4 with radio wlan0 status up`

Set the VLAN ID for a VAP on both radios	**`set vap`** *`<vapID>`* **`vlan-id`** *`<vlan_id>`*
	Example:
	`set vap vap4 vlan-id 123`

Set the VLAN ID for a VAP on one radio
Note: This example uses radio 1. For radio 2, use **`wlan1`**
	`set vap` *`<vapID>`* **`with radio wlan0 to vlan-id`** *`<vlan_id>`*
	Example:
	`set vap vap4 with radio wlan0 to vlan-id 123`

View the wireless network name (SSID)	For VAP 0 on radio 1: **`get interface wlan0 ssid`** For VAP 3 on radio 2: **`get interface wlan1vap3 ssid`**

Set the SSID
Note: For VAP 0, use **`wlan`***x*, where *x* is the radio. For VAPs 1-7, use **`wlan`***x***`vap`***y*, where *x* is the radio, and *y* is the VAP ID.
	`set interface wlan0 ssid` *`<ssid_name>`*
	For example:
	`set interface wlan0 ssid Engineering`
	`set interface wlan0 ssid “Engineering’s AP”`
	For VAP 3 on radio 2:
	`set interface wlan1vap3 ssid Engineering`

Get the current security mode	For VAP 0 on radio 1: **`get interface wlan0 security`** For VAP 3 on radio 2: **`get interface wlan1vap3 security`**
Get detailed description of current security settings	For VAP 0 on radio 1: **`get interface wlan0 detail`** For VAP 3 on radio 2: **`get interface wlan1vap3 detail`**

Set security to plain text	**`set interface wlan0 security plain-text`**
	`set interface wlan1vap3 security plain-text`

Set security to static WEP	See the detailed example in Set Security to Static WEP.
Set security to IEEE 802.1X	See detailed example in Set Security to IEEE 802.1X
Set security to WPA/WPA2 Personal (PSK)	See detailed example in Set Security to WPA/WPA2 Personal (PSK)
Set security to WPA/WPA2 Enterprise (RADIUS)	See detailed example in Set Security to WPA/WPA2 Enterprise (RADIUS)
Set the MAC authentication type to disabled.	**`set bss wlan0vap0 mac-acl-auth-type disable`**

Set the MAC authentication type to local.	**set bss wlan0vap0 mac-acl-auth-type local**
Set the MAC authentication type to RADIUS.	**set bss wlan0vap0 mac-acl-auth-type radius**

Set Security to Static WEP

To configure Static WEP as the security mode, you need to issue multiple commands. This section describes the commands and procedures to configure Static WEP.

NOTE: This example shows how to configure static WEP on VAP 0 on radio 1 (**wlan0**). For interface commands on VAPs 1-7, use **wlan***x***vap***y*, where *x* is the radio, and *y* is the VAP ID. For example, to configure security on VAP 3 on radio 2, use **wlan1vap3** instead of **wlan0** in all of the following commands.

1. Set the security mode.

```
DLINK-AP# set interface wlan0 security static-wep
```

2. Set the Transfer Key Index.

   The range for the transfer key index is 1-4. The following command sets the Transfer Key Index to 4.

```
DLINK-AP# set interface wlan0 wep-default-key 4
```

3. Set the Key Length

   For the CLI, valid values for Key Length are 40 bits, 104 bits, or 128 bits.The Key Length values used by the CLI do not include the initialization vector in the length. On the Web UI, longer Key Length values may be shown which include the 24-bit initialization vector.

   To set the WEP Key Length to 64-bits, enter the following command:

```
set interface wlan0 wep-key-length 40
```

   To set the WEP Key Length to 128-bits, enter the following command:

```
set interface wlan0 wep-key-length 104
```

   To set the WEP Key Length to 156-bits, enter the following command:

```
set interface wlan0 wep-key-length 128
```

4. Set the Key Type

   Valid values for Key Type are ASCII or Hex. The following commands set the Key Type.

To se the key type to ASCII, enter the following command:

```
set interface wlan0 wep-key-ascii yes
```

To se the key type to Hex, enter the following command:

```
set interface wlan0 wep-key-ascii no
```

5. Set the WEP keys.

   The number of characters required for each WEP key depends on how you set Key Length and Key Type:

   - If Key Length is 40 bits and the Key Type is “ASCII”, then each WEP key must be 5 characters long.
   - If Key Length is 40 bits and Key Type is “Hex”, then each WEP key must be 10 characters long.
   - If Key Length is 104 bits and Key Type is “ASCII”, then each WEP Key must be 13 characters long.
   - If Key Length is 104 bits and Key Type is “Hex”, then each WEP Key must be 26 characters long.
   - If Key Length is 128 bits and Key Type is “ASCII”, then each WEP Key must be 16 characters long.
   - If Key Length is 128 bits and Key Type is “Hex”, then each WEP Key must be 32 characters long.

   Although the CLI will allow you to enter WEP keys of any number of characters, you must use the correct number of characters for each key to ensure a valid security configuration.

   In the following example, the key length is 40-bits, and the key type is ASCII:

```
DLINK-AP# set interface wlan0 wep-key-1 abcde
DLINK-AP# set interface wlan0 wep-key-2 fghi
DLINK-AP# set interface wlan0 wep-key-3 klmno
DLINK-AP# set interface wlan0 wep-key-4 pqrst
```

6. Select the type of authentication to use.

   For open system authentication:

```
DLINK-AP# set bss wlan0bssvap0 open-system-authentication on
```

   For shared key authentication:

```
DLINK-AP# set bss wlan0bssvap0 shared-key-authentication on
```

   To use both authentication types, use both of the preceding commands. To turn either of the authentication types off, replace the keyword `on` with `off`.

7. View the security settings.

   Use the “get” command to view the updated security configuration and see the results of our new settings.

```
DLINK-AP# get interface wlan0 security
```

The following command gets details about how the internal network is configured, including security details.

```
DLINK-AP# get bss wlan0bssvap0 detail
```

The following command gets details about the interface and shows the WEP Key settings, specifically.

```
DLINK-AP# get interface wlan0 detail
```

Set Security to IEEE 802.1X

To configure IEEE 802.1X as the security mode, you need to issue multiple commands. This section describes the commands and procedures to configure IEEE 802.1X.

NOTE: This example shows how to configure 802.1X on VAP 0 on radio 1 (**`wlan0`**). For VAPs 1-7 interface commands, use **`wlan`***x***`vap`***y*, where *x* is the radio, and *y* is the VAP ID. For example, to configure security on VAP 3 on radio 2, use **`wlan1vap3`** instead of **`wlan0`** in all of the following commands.

1. Set the security mode

```
DLINK-AP# set interface wlan0 security dot1x
```

2. Set the Authentication Server.

If you do not want to use the global RADIUS server for this VAP, you must disable the global RADIUS server and specify an IP address and RADIUS key for the VAP, as shown in the following commands:

```
DLINK-AP# set bss wlan0bssvap0 radius-ip 10.23.6.13
DLINK-AP# set bss wlan0bssvap0 radius-key thisISmyKey
```

You can enable RADIUS Accounting if you want to track and measure the resources a particular user has consumed such system time, amount of data transmitted and received, and so on. To enable RADIUS accounting on the VAP, enter the following command:

```
set bss wlan0bssvap0 radius-accounting on
```

3. View the security settings.

Use the “get” command to view the updated security configuration and see the results of the new settings.

```
DLINK-AP# get interface wlan0 security
```

The following command gets details about how the internal network is configured, including security details.

```
DLINK-AP# get bss wlan0bssvap0 detail
```

The following command gets details about the interface and shows the WEP Key settings, specifically.

```
DLINK-AP# get interface wlan0 detail
```

Set Security to WPA/WPA2 Personal (PSK)

To configure WPA/WPA2 Personal as the security mode, you need to issue multiple commands. This section describes the commands and procedures to configure WPA/WPA2 Personal.

NOTE: This example shows how to configure WPA/WPA2 Personal on VAP 0 on radio 1 (**`wlan0`**). For VAPs 1-7, use **`wlan`***`x`***`vap`***`y`*, where *x* is the radio, and *y* is the VAP ID. For example, to configure security on VAP 3 on radio 2, use **`wlan1vap3`** instead of **`wlan0`** in all of the following commands.

1. Set the Security Mode

```
DLINK-AP# set interface wlan0 security wpa-personal
```

2. Set the WPA versions based on what types of client stations you want to support.

- **WPA**—If all client stations on the network support the original WPA but none support the newer WPA2, then use WPA.

```
set bss wlan0bssvap0 wpa-allowed on
set bss wlan0bssvap0 wpa2-allowed off
```

- **WPA2**—If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard.

```
set bss wlan0bssvap0 wpa-allowed off
set bss wlan0bssvap0 wpa2-allowed on
```

- **WPA and WPA2**—If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select both. This lets both WPA and WPA2 client stations associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.

```
set bss wlan0bssvap0 wpa-allowed on
set bss wlan0bssvap0 wpa2-allowed on
```

3. Set the Cipher Suite you want to use.

- **TKIP Only**: Temporal Key Integrity Protocol (TKIP).

```
set bss wlan0bssvap0 wpa-cipher-tkip on
set bss wlan0bssvap0 wpa-cipher-ccmp off
```

- **CCMP (AES) Only**—Counter mode/CBC-MAC Protocol (CCMP) is an encryption method for IEEE 802.11i that uses the Advanced Encryption Algorithm (AES).

```
set bss wlan0bssvap0 wpa-cipher-tkip off
set bss wlan0bssvap0 wpa-cipher-ccmp on
```

- **TKIP and CCMP (AES)**—When you enable both authentication algorithms, both TKIP and AES clients can associate with the access point. WPA clients must have either a valid TKIP key or a valid CCMP (AES) key to be able to associate with the AP.

```
set bss wlan0bssvap0 wpa-cipher-tkip on
set bss wlan0bssvap0 wpa-cipher-ccmp on
```

4. Set the Pre-shared 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. Following are two examples; the first sets the key to “**SeCret !**“, the second sets the key to “**KeepSecret**”.

   ```
   DLINK-AP# set interface wlan0 wpa-personal-key "SeCret !"
   ```

   or

   ```
   DLINK-AP# set interface wlan0 wpa-personal-key KeepSecret
   ```

   Shared secret keys can include spaces and special characters if the key is placed inside quotation marks as in the first example above. If the key is a string of characters with no spaces or special characters in it, the quotation marks are not necessary as in the second example above.

5. View the security settings.

   Use the “get” command to view the updated security configuration and see the results of the new settings.

   ```
   DLINK-AP# get interface wlan0 security
   ```

   The following command gets details about how the internal network is configured, including security details.

   ```
   DLINK-AP# get bss wlan0bssvap0 detail
   ```

   The following command gets details about the interface and shows the WEP Key settings, specifically.

   ```
   DLINK-AP# get interface wlan0 detail
   ```

Set Security to WPA/WPA2 Enterprise (RADIUS)

To configure WPA/WPA2 Enterprise as the security mode, you need to issue multiple commands. This section describes the commands and procedures to configure WPA/WPA2 Enterprise.

NOTE: This example shows how to configure WPA/WPA2 Personal on VAP 0 on radio 1 (**wlan0**). For VAPs 1-7, use **wlan***x***vap***y*, where *x* is the radio, and *y* is the VAP ID. For example, to configure security on VAP 3 on radio 2, use **wlan1vap3** instead of **wlan0** in all of the following commands.

1. Set the Security Mode

   ```
   DLINK-AP# set interface wlan0 security wpa-enterprise
   ```

2. Set the WPA versions based on what types of client stations you want to support.
   - **WPA**—If all client stations on the network support the original WPA but none support the newer WPA2, then use WPA.

     ```
     set bss wlan0bssvap0 wpa-allowed on
     set bss wlan0bssvap0 wpa2-allowed off
     ```

- **WPA2**—If all client stations on the network support WPA2, we suggest using WPA2 which provides the best security per the IEEE 802.11i standard.

  ```
  set bss wlan0bssvap0 wpa-allowed off
  set bss wlan0bssvap0 wpa2-allowed on
  ```

- **WPA and WPA2**—If you have a mix of clients, some of which support WPA2 and others which support only the original WPA, select both. This lets both WPA and WPA2 client stations associate and authenticate, but uses the more robust WPA2 for clients who support it. This WPA configuration allows more interoperability, at the expense of some security.

  ```
  set bss wlan0bssvap0 wpa-allowed on
  set bss wlan0bssvap0 wpa2-allowed on
  ```

3. Enable Pre-Authentication

   If you set WPA versions to “WPA2” or “Both”, you can enable *pre-authentication* for WPA2 clients.

   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.

   To enable pre-authentication for WPA2 clients, enter the following command:

   ```
   set bss wlan0bssvap0 rsn-preauthentication on
   ```

   To disable pre-authentication for WPA2 clients, enter the following command:

   ```
   set bss wlan0bssvap0 rsn-preauthentication on
   ```

The pre-authentication option does not apply if you set the WPA Version to support “WPA” clients because the original WPA does not support this pre-authentication

4. Set the Cipher Suite you want to use.

   - **TKIP Only**: Temporal Key Integrity Protocol (TKIP).

     ```
     set bss wlan0bssvap0 wpa-cipher-tkip on
     set bss wlan0bssvap0 wpa-cipher-ccmp off
     ```

   - **CCMP (AES) Only**—Counter mode/CBC-MAC Protocol (CCMP) is an encryption method for IEEE 802.11i that uses the Advanced Encryption Algorithm (AES).

     ```
     set bss wlan0bssvap0 wpa-cipher-tkip off
     set bss wlan0bssvap0 wpa-cipher-ccmp on
     ```

   - **TKIP and CCMP (AES)**—When you enable both authentication algorithms, both TKIP and AES clients can associate with the access point. WPA clients must have either a valid TKIP key or a valid CCMP (AES) key to be able to associate with the AP.

     ```
     set bss wlan0bssvap0 wpa-cipher-tkip on
     set bss wlan0bssvap0 wpa-cipher-ccmp on
     ```

5. Set the Authentication Server.

If you do not want to use the global RADIUS server for this VAP, you must disable the global RADIUS server and specify an IP address and RADIUS key for the VAP, as shown in the following commands:

```
DLINK-AP# set bss wlan0bssvap0 radius-ip 10.23.6.13
DLINK-AP# set bss wlan0bssvap0 radius-key thisISmyKey
```

You can enable RADIUS Accounting if you want to track and measure the resources a particular user has consumed such system time, amount of data transmitted and received, and so on. To enable RADIUS accounting on the VAP, enter the following command:

```
set bss wlan0bssvap0 radius-accounting on
```

6. View the security settings.

Use the “get” command to view the updated security configuration and see the results of the new settings.

```
DLINK-AP# get interface wlan0 security
```

The following command gets details about how the internal network is configured, including security details.

```
DLINK-AP# get bss wlan0bssvap0 detail
```

The following command gets details about the interface and shows the WEP Key settings, specifically.

```
DLINK-AP# get interface wlan0 detail
```

Table 40. **MAC Authentication Commands**

Action	**Command**
Allow access to stations in the list	`set bss wlan0bssvap0 mac-acl-mode accept-list`
Block access to stations in the list	`set bss wlan0bssvap0 mac-acl-mode deny-list`
Add client to the list	**add mac-acl wlan0bssvap0 mac** *<mac_address>* Example: **add mac-acl wlan0bssvap0 mac 00:01:02:03:04:06**
Remove client from the list	**remove mac-acl wlan0bssvap0 mac** *<mac_address>* Example: **remove mac-acl wlan0bssvap0 mac 00:01:02:03:04:04**
View the list mode	`get bss wlan0bssvap0 mac-acl-mode`
View the clients in the list	`get mac-acl`

Table 41. **Load Balancing Commands**

Action	Command
Set the utilization for no new associations (in percent)	**set radio wlan0 load-balance-no-association-utilization** *<0-100>*

Managed Access Point

You can use a D-Link Unified Switch to manage one or more access points on your network. To allow a Unified Switch to manage the AP the switch and AP must discover each other. The commands in show how to change the AP mode from Standalone to Managed and how to configure the IP address of a D-Link Unified Switch so that the AP can discover it. You can configure a pass phrase on the AP and on the switch so that only authenticated APs can associate with the switch.

Table 42. **Managed Access Point Commands**

Action	Command
View Managed AP settings	**get managed-ap**
Set the AP to Managed mode	**set managed-ap mode up**
Set the AP to Standalone mode	**set managed-ap mode down**
Set the pass phrase for AP-to-switch authentication	**set managed-ap pass-phrase** *<password>* **Note:** The phrase you enter must match the local authentication password you configure for Valid APs on the D-Link Unified Switch
Configure the IP address of up to four D-Link Unified Switches on your network.	**set managed-ap switch-address-1** *<ip_address>* **set managed-ap switch-address-2** *<ip_address>* **set managed-ap switch-address-3** *<ip_address>* **set managed-ap switch-address-4** *<ip_address>* Example: **set managed-ap switch-address-1 192.168.2.123**

IEEE 802.1X Supplicant Authentication

Use the 802.1X Supplicant Authentication settings to configure the access point to authenticate to a secured wired network.

Table 43. **IEEE 802.1X Supplicant Commands**

Action	Command
Enable 802.1X supplicant	**set dot1x-supplicant status up**

Disable 802.1X supplicant	**set dot1x-supplicant status down**
Set the 802.1X user name	**set dot1x-supplicant user** *<name>*
Set the 802.1X password	**set dot1x-supplicant password** *<password>*

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 as well as traditional IP data over the access point.

AP Enhanced Distributed Channel Access (EDCA) Parameters affect traffic flowing from the access point to the client station (AP-to-station). To get and set QoS settings on the access point (AP), use "**tx-queue**" class name in the command.

Station Enhanced Distributed Channel Access (EDCA) Parameters affect traffic flowing from the client station to the access point (station-to-AP). Keep in mind that station-to-AP parameters apply only when WMM is enabled. To get and set QoS settings on the client station, use the "**wme-queue**" class name in the command.

QoS Commands shows QOS commands. For valid **<***Queue_Name***>** values, see Valid Queue Name Values. For other variable values, see

Table 44. QoS Commands

Action	Command
Enable/Disable Wi-Fi Multimedia	**set radio wlan0 wme off** **set radio wlan0 wme on**
Get QoS Settings on the AP (AP EDCA parameters)	**get tx-queue**
Get QoS Settings on the Client Station (Station EDCA parameters)	**get wme-queue**
Set Arbitration Interframe Spaces (AIFS) on the AP	**set tx-queue wlan0 with queue <***Queue_Name***> to aifs** *<1-255>* Example: **set tx-queue wlan0 with queue data0 to aifs 13**
Set Arbitration Interframe Spaces (AIFS) on a client station	**set wme-queue wlan0 with queue <***Queue_Name***> to aifs** *<1-255>* Example: **set wme-queue wlan0 with queue vo to aifs 14**

Setting Minimum and Maximum Contention Windows (cwmin, cwmax) on the AP	On the AP: **set tx-queue wlan0 with queue** <*Queue_Name*> **to cwmin** <*cwmin_Value*> **cwmax** <*cwmax_Value*> Example: **set tx-queue wlan0 with queue data1 cwmin 15 cwmax 31**
Setting Minimum and Maximum Contention Windows (cwmin, cwmax) on a client station	**set wme-queue wlan0 with queue** <*Queue_Name*> **to cwmin** <*cwmin_Value*> **cwmax** <*cwmax_Value*> Example: **set wme-queue wlan0 with queue vi cwmin 7 cwmax 15**
Valid values for the “**cwmin**” are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1024. The value for “**cwmin**” must be lower than the value for “**cwmax**”. Valid values for the “**cwmax**” are 1, 3, 7, 15, 31, 63, 127, 255, 511, or 1024. The value for “**cwmax**” must be higher than the value for “**cwmin**”.	
Set the Maximum Burst Length (burst) on the AP	**set tx-queue wlan0 with queue** <*Queue_Name*> **to burst** <*0.0-999.9*> Example: **set tx-queue wlan0 with queue data2 to burst 0.5**
Set Transmission Opportunity Limit (txop-limit) for WMM client stations	**set wme-queue wlan0 with queue** <*Queue_Name*> **to txop-limit** <*txop-limit_Value*> Example: **set wme-queue wlan0 with queue vo to txop-limit 49**

The same types of queues are defined for different kinds of data transmitted from AP-to-station and station-to-AP but they are referenced by differently depending on whether you are configuring AP or station parameters.

Table 45. Valid Queue Name Values

Data	AP	Station
Voice - High priority queue, minimum delay. Time-sensitive data such as VoIP and streaming media are automatically sent to this queue.	**data0**	**vo**
Video - High priority queue, minimum delay. Time-sensitive video data is automatically sent to this queue.	**data1**	**vi**
Best Effort - Medium priority queue, medium throughput and delay. Most traditional IP data is sent to this queue.	**data2**	**be**
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).	**data3**	**bk**

Time

Time Rel shows the commands you use to view the system uptime and to enable and manage the Network Time Protocol (NTP) server on the access point.

Table 46. **Time Related Commands**

Action	Command
View the system uptime	**`uptime`**
View NTP server settings	**`get ntp detail`**
Enable the NTP Server	**`set ntp status up`**
Disable the NTP server	**`set ntp status down`**

Set the NTP server hostname or IP address	**`set ntp-server server`** *`[<hostname> | <ip_address>]`*
	Example:
	`set ntp-server server time.foo.com`
	or
	`set ntp-server server 192.168.34.201`

System Management

System Management shows the commands you use to manage the configuration file and firmware on the AP.

Table 47. **System Management**

Action	Command
Restore the factory default settings	**`factory-reset`**

Save the configuration to a backup file	**`config download <url>`**
	Example:
	`config download tftp://1.2.3.4/defaultcfg.xml`

Restore the configuration from a previously saved file	**`config upload <url>`**
	`Example:`
	`config upload tftp://1.2.3.4/defaultcfg.xml`

Reboot the system	**`reboot`**

Upgrade the firmware (requires a reboot)	**`firmware-upgrade`** *`<url>`*
	Example:
	`firmware-upgrade tftp://1.2.3.4/upgrade.tar`
	`firmware-upgrade file://1.2.3.4/tmp/upgrade.tar`

CLI Classes and Properties Reference

Configuration information for the Unified Access Point is represented as a set of classes and objects. The following is a general introduction to the CLI classes and properties.

Different kinds of information uses different classes. For example, information about a network interface is represented by the “interface” class, while information about an NTP client is represented by the “ntp” class.

Depending on the type of class, there can be multiple instances of a class. For example, there is one instance of the “interface” class for each network interface the AP has (Ethernet, radio, and so on), while there is just a singleton instance of the “ntp” class, since an AP needs only a single NTP client. Some classes require their instances to have names to differentiate between them; these are called *named classes*. For example, one interface might have a name of **`eth0`** to indicate that it is an Ethernet interface, while another interface could have a name of **`wlan0`** to indicate it is a wireless LAN (WLAN) interface. Instances of singleton classes do not have names, since they only have a single instance. Classes that can have multiple instances but do not have a name are called anonymous classes. Together, singleton and anonymous classes are called unnamed classes. Some classes require their instances to have names, but the multiple instances can have the same name to indicate that they are part of the same group. These are called group classes.

Table 48. **CLI Class Instances**

has name? \ # of instances?	one	multiple
no	singleton	anonymous
yes - unique	n/a	unique named
yes - non-unique	n/a	group named

Each class defines a set of properties that describe the actual information associated with a class. Each instance of a class has a value for each property that contains the information. For example, the interface class has properties such as “ip” and “mask.” For one instance, the **`ip`** property might have a value of 10.90.90.91 while the **`mask`** property has a value of 255.0.0.0; another instance might have an **`ip`** property with a value of 10.0.0.1 and **`mask`** property with a value of 255.0.0.0. To view the IP address and mask for a specific interface, you must identify the instance in the command.

The following table is a comprehensive list of all classes and their properties. Some of the commands allow you to view or configure settings that are not available from the Web interface. Use `get` or `set` to build commands based on the class and property. If the class is a named class, you must include the name. For example, interface is a named class.

Table 49. AP CLI Commands

Class	Property
system	password
	model
	version
	platform
	country
	base-mac
	base-mac-status
	serial-number
	country-code-is-configurable
	country-code-is-configured
host	id
	dns-1
	dns-2
	static-dns-1
	static-dns-2
	dns-via-dhcp
interface	type
	status
	description
	mac
	static-mac
	ip
	mask
	static-ip
	static-mask

	rx-bytes
	rx-packets
	rx-errors
	tx-bytes
	tx-packets
	tx-errors
	stp
	fd
	hello
	priority
	port-isolation
	ssid
	bss
	security
	wpa-personal-key
	wep-key-ascii
	wep-key-length
	wep-default-key
	wep-key-1
	wep-key-2
	wep-key-3
	wep-key-4
	wep-key-mapping-length
	vlan-interface
	vlan-id
	radio
	remote-mac
	wep-key
	wds-ssid
	wds-security-policy

	wds-wpa-psk-key
management	vlan-id
	interface
	static-ip
	static-mask
	ip
	mask
	mac
	dhcp-status
vap	radio
	status
	vlan-id
	description
global-radius-server	radius-accounting
	radius-ip
	radius-key
dot11	status
	debug
	dot11d
radio	status
	description
	channel-policy
	mode
	static-channel
	channel
	tx-power
	beacon-interval
	rts-threshold
	fragmentation-threshold
	super-ag

	wlan-util
bss	status
	description
	radio
	ignore-broadcast-ssid
	radius-accounting
	radius-ip
	radius-key
	vlan-tagged-interface
	open-system-authentication
	shared-key-authentication
	wpa-allow-non-wpa-stations
	wpa-cipher-tkip
	wpa-cipher-ccmp
	wpa-allowed
	wpa2-allowed
	rsn-preauthentication
bridge-port	interface
	path-cost
	priority
	stp-state
static-ip-route	destination
	mask
	gateway
ip-route	destination
	mask
	gateway
	persistence
	severity
	remove

	relay-enabled
	relay-host
	relay-port
log-entry	number
	priority
	time
	daemon
	message
association	interface
	station
	authenticated
	associated
	rx-packets
	tx-packets
	rx-bytes
	tx-bytes
	listen-interval
	last-rssi
basic-rate	rate
supported-rate	rate
	mac
detected-ap	radio
	beacon-interval
	capability
	type
	privacy
	ssid
	wpa
	phy-type
	band

	channel
	rate
	signal
	erp
	beacons
	last-beacon
	supported-rates
serial	status
telnet	status
firmware-upgrade	upgrade-url
untagged-vlan	vlan-id
	status
managed-ap	mode
	ap-state
	switch-address-1
	switch-address-2
	switch-address-3
	switch-address-4
	pass-phrase
	dhcp-switch-address-1
	dhcp-switch-address-2
	dhcp-switch-address-3
	dhcp-switch-address-4
dot1x-supplicant	status
	user
	password

Glossary

0-9 A 錯誤! 找不到參照來源。 **C D E F G H I J K L M N O P Q R S** 錯誤! 找不到參照來源。 **U V W X Y Z**

0-9

802

IEEE 802 (IEEE Std. 802-2001) is a family of standards for peer-to-peer communication over a LAN. These technologies use a shared-medium, with information broadcast for all stations to receive. The basic communications capabilities provided are packet-based. The basic unit of transmission is a sequence of data octets (8-bits), which can be of any length within a range that is dependent on the type of LAN.

Included in the 802 family of IEEE standards are definitions of bridging, management, and security protocols.

802.1X

IEEE 802.1X (IEEE Std. 802.1X-2001) is a standard for passing EAP packets over an 錯誤! 找不到參照來源。 wireless network using a protocol called *EAP Encapsulation Over LANs* (EAPOL). It establishes a framework that supports multiple authentication methods.

IEEE 802.1X authenticates users not machines.

802.2

IEEE 802.2 (IEEE Std. 802.2.1998) defines the LLC layer for the 錯誤! 找不到參照來源。 family of standards.

802.3

IEEE 802.3 (IEEE Std. 802.3-2002) defines the MAC layer for networks that use CSMA/CA. Ethernet is an example of such a network.

802.11

IEEE 802.11 (IEEE Std. 802.11-1999) is a medium access control (MAC) and physical layer (PHY) specification for wireless connectivity for fixed, portable, and moving stations within a local area. It uses direct sequence spread spectrum (DSSS) in the 2.4 GHz ISM band and supports raw data rates of 1 and 2 Mbps. It was formally adopted in 1997 but has been mostly superseded by 錯誤! 找不到參照來源。.

IEEE 802.11 is also used generically to refer to the family of IEEE standards for wireless local area networks.

802.11a

IEEE 802.11a (IEEE Std. 802.11a-1999) is a PHY standard that specifies operating in the 5 GHz U-NII band using orthogonal frequency division multiplexing (OFDM). It supports data rates ranging from 6 to 54 Mbps.

802.11a Turbo

IEEE 802.11a Turbo is a proprietary variant of the 錯誤! 找不到參照來源。 standard from Atheros Communications. It supports accelerated data rates ranging from 6 to 108Mbps. Atheros Turbo 5 GHz is IEEE 802.11a Turbo mode. Atheros Turbo 2.4 GHz is

IEEE 802.11g Turbo mode.

802.11b

IEEE 802.11b (IEEE Std. 802.11b-1999) is an enhancement of the initial 錯誤! 找不到參照來源。 PHY to include 5.5 Mbps and 11 Mbps data rates. It uses direct sequence spread spectrum (DSSS) or frequency hopping spread spectrum (FHSS) in the 2.4 GHz ISM band as well as complementary code keying (CCK) to provide the higher data rates. It supports data rates ranging from 1 to 11 Mbps.

802.11d

IEEE 802.11d defines standard rules for the operation of IEEE 802.11 wireless LANs in any country without reconfiguration. PHY requirements such as provides frequency hopping tables, acceptable channels, and power levels for each country are provided. Enabling support for IEEE 802.11d on the access point causes the AP to broadcast which country it is operating in as a part of its beacons. Client stations then use this information. This is particularly important for AP operation in the 5GHz IEEE 802.11a bands because use of these frequencies varies a great deal from one country to another.

802.11e

IEEE 802.11e is a developing IEEE standard for MAC enhancements to support QoS. It provides a mechanism to prioritize traffic within 錯誤! 找不到參照來源。. It defines allowed changes in the Arbitration Interframe Space, a minimum and maximum Contention Window size, and the maximum length (in kμsec) of a burst of data.

IEEE 802.11e is still a draft IEEE standard (most recent version is D5.0, July 2003). A currently available subset of 802.11e is the *Wireless Multimedia Enhancements* (WMM) standard.

802.11f

IEEE 802.11f (IEEE Std. 802.11f-2003) is a standard that defines the inter access point protocol (IAPP) for access points (wireless hubs) in an extended service set (ESS). The standard defines how access points communicate the associations and re-associations of their mobile stations.

802.11g

IEEE 802.11g (IEEE Std. 802.11g-2003) is a higher speed extension (up to 54 Mbps) to the 錯誤! 找不到參照來源。 PHY, while operating in the 2.4 GHz band. It uses orthogonal frequency division multiplexing (OFDM). It supports data rates ranging from 1 to 54 Mbps.

802.11h

IEEE 802.11h is a standard used is to resolve the issue of interference which was prevalent in 錯誤! 找不到參照來源。. The two schemes used to minimize interference in 802.11h are Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS). DFS detects other APs on the same frequency and redirects these to another channel. TPC reduces the network frequency output power of the AP, thus reducing the chance of any interference. This is a required standard in Europe, Japan, and the U.S.

802.11i

IEEE 802.11i is a comprehensive IEEE standard for security in a wireless local area network (WLAN) that describes Wi-Fi *Protected Access 2* (WPA2). It defines enhancements to the MAC Layer to counter the some of the weaknesses of WEP. It incorporates stronger encryption techniques than the original Wi-Fi *Protected Access* (WPA), such as Advanced Encryption Standard (AES).

The original WPA, which can be considered a subset of 802.11i, uses *Temporal Key Integrity Protocol* (錯誤! 找不到參照來源。) for encryption. WPA2 is backwards-compatible with products that support the original WPA

IEEE 802.11i / WPA2 was finalized and ratified in June of 2004.

802.11j

IEEE 802.11j standardizes chipsets that can use both the 4.9 and 5 GHz radio bands according to rules specified by the Japanese government to open both bands to indoor, outdoor and mobile wireless LAN applications. The regulations require companies to adjust the width of those channels. IEEE 802.11j allows wireless devices to reach some previously unavailable channels by taking advantage of new frequencies and operating modes. This is an attempt to mitigate the crowding on the airwaves, and has tangential relationships to IEEE 802.11h.

802.11k

IEEE 802.11k is a developing IEEE standard for wireless networks (WLANs) that helps auto-manage network Channel selection, client Roaming, and Access Point (AP) utilization. 802.11k capable networks will automatically load balance network traffic across APs to improve network performance and prevent under or over-utilization of any one AP. 802.11k will eventually complement the 錯誤! 找不到參照來源。 quality of service (QoS) standard by ensuring QoS for multimedia over a wireless link.

802.1p

802.1p is an extension of the IEEE 802 standard and is responsible for QoS provision. The primary purpose of 802.1p is to prioritize network traffic at the data link/ MAC layer.

802.1p offers the ability to filter multicast traffic to ensure it doesn’t increase over layer 2 switched networks. It uses tag frames for the prioritization scheme.

To be compliant with this standard, layer 2 switches must be capable of grouping incoming LAN packets into separate traffic classes.

802.1Q

IEEE 802.1Q is the IEEE standard for *Virtual Local Area Networks* (VLANs) specific to wireless technologies. (See http://www.ieee802.org/1/pages/802.1Q.html.)

The standard addresses the problem of how to break large networks into smaller parts to prevent broadcast and multicast data traffic from consuming more bandwidth than is necessary. 802.11Q also provides for better security between segments of internal networks. The 802.1Q specification provides a standard method for inserting VLAN membership information into Ethernet frames.

A

Access Point

An *access point* is the communication hub for the devices on a WLAN, providing a connection or bridge between wireless and wired network devices. It supports a Wireless Networking Framework called Infrastructure Mode .

When one access point is connected to a wired network and supports a set of wireless stations, it is referred to as a basic service set (BSS). An extended service set (ESS) is created by combining two or more BSSs.

Ad hoc Mode

Ad hoc mode is a Wireless Networking Framework in which stations communicate directly with each other. It is useful for quickly establishing a network in situations where formal infrastructure is not required.

Ad hoc mode is also referred to as *peer-to-peer mode* or an independent basic service set (IBSS).

AES

The *Advanced Encryption Standard* (AES) is a symmetric 128-bit block data encryption technique developed to replace DES encryption. AES works at multiple network layers simultaneously.

Further information is available on the NIST Web site.

B

Basic Rate Set

The *basic rate set* defines the transmission rates that are mandatory for any station wanting to join this wireless network. All stations must be able to receive data at the rates listed in this set.

Beacon

Beacon frames provide the “heartbeat” of a WLAN, announcing the existence of the network, and enabling stations to establish and maintain communications in an orderly fashion. It carries the following information (some of which is optional):

- The *Timestamp* is used by stations to update their local clock, enabling synchronization among all associated stations.
- The *Beacon interval* defines the amount of time between transmitting beacon frames. Before entering power save mode, a station needs the beacon interval to know when to wake up to receive the beacon.
- The *Capability Information* lists requirements of stations that want to join the WLAN. For example, it indicates that all stations must use WEP.
- The *Service Set Identifier* (錯誤! 找不到參照來源。).
- The 錯誤! 找不到參照來源。 is a bitmap that lists the rates that the WLAN supports.
- The optional *Parameter Sets* indicates features of the specific signaling methods in use (such as frequency hopping spread spectrum, direct sequence spread spectrum, etc.).
- The optional *Traffic Indication Map* (TIM) identifies stations, using power saving mode, that have data frames queued for them.

Bridge

A connection between two local area networks (LANs) using the same protocol, such as Ethernet or IEEE 錯誤! 找不到參照來源。.

Broadcast

A *Broadcast* sends the same message at the same time to everyone. In wireless networks, broadcast usually refers to an interaction in which the access point sends data traffic in the form of IEEE 錯誤! 找不到參照來源。 Frames to all client stations on the network.

Some wireless security modes distinguish between how unicast, multicast, and broadcast frames are encrypted or whether they are encrypted.

See also Unicast and Multicast.

Broadcast Address

See IP Address.

BSS

A *basic service set* (BSS) is an Infrastructure Mode Wireless Networking Framework with a single access point. Also see extended service set (ESS) and independent basic service set (IBSS).

BSSID

In Infrastructure Mode , the *Basic Service Set Identifier* (BSSID) is the 48-bit MAC address of the wireless interface of the Access Point.

C

CCMP

Counter mode/CBC-MAC Protocol (CCMP) is an encryption method for 802.11i that uses AES. It employs a *CCM* mode of operation, combining the Cipher Block Chaining Counter mode (CBC-CTR) and the Cipher Block Chaining Message Authentication Code (CBC-MAC) for encryption and message integrity.

AES-CCMP requires a hardware coprocessor to operate.

CGI

The *Common Gateway Interface* (CGI) is a standard for running external programs from an HTT server. It specifies how to pass arguments to the executing program as part of the HTT request. It may also define a set of environment variables.

A CGI program is a common way for an HTT server to interact dynamically with users. For example, an HTML page containing a form can use a CGI program to process the form data after it is submitted.

Channel

The *Channel* defines the portion of the radio spectrum the radio uses for transmitting and receiving. Each 錯誤! 找不到參照來源。 standard offers a number of channels, dependent on how the spectrum is licensed by national and transnational authorities such as the Federal Communications Commission (FCC), the European Telecommunications Standards Institute (ETSI), the Korean Communications Commission, or the Telecom Engineering Center (TELEC).

CSMA/CA

Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) is a low-level network arbitration/contention protocol. A station listens to the media and attempts to transmit a packet when the channel is quiet. When it detects that the channel is idle, the station transmits the packet. If it detects that the channel is busy, the station waits a random amount of time and then attempts to access the media again.

CSMA/CA is the basis of the IEEE 802.11e Distributed Control Function (DCF). See also RTS and CTS.

The CSMA/CA protocol used by 錯誤! 找不到參照來源。 networks is a variation on CSMA/CD (used by Ethernet networks). In CSMA/CD the emphasis is on collision *detection* whereas with CSMA/CA the emphasis is on collision *avoidance*.

CTS

A *clear to send* (CTS) message is a signal sent by an IEEE 錯誤! 找不到參照來源。 client station in response to an *request to send* (RTS) message. The CTS message indicates that the channel is clear for the sender of the RTS message to begin data transfer. The other stations will wait to keep the air waves clear. This message is a part of the IEEE 802.11 CSMA/CA protocol. (See also RTS.)

D

DCF

The *Distribution Control Function* is a component of the IEEE 802.11e Quality of Service (QoS) technology standard. The DCF coordinates channel access among multiple stations on a wireless network by controlling wait times for channel access. Wait times are determined by a random backoff timer which is configurable by defining minimum and maximum contention windows. See also EDCF.

DHCP

The *Dynamic Host Configuration Protocol* (DHCP) is a protocol specifying how a central server can dynamically provide network configuration information to clients. A DHCP server “offers” a “lease” (for a pre-configured period of time—see Lease Time) to the client system. The information supplied includes the client's IP addresses and netmask plus the address of its DNS servers and Gateway.

DNS

The *Domain Name Service* (DNS) is a general-purpose query service used for translating *fully-qualified names* into Internet addresses. A fully-qualified name consists of the hostname of a system plus its domain name. For example, `www` is the host name of a Web server and `www.dlink.com` is the fully-qualified name of that server. DNS translates the domain name `www.dlink.com` to some IP address, for example `66.93.138.219`.

A *domain name* identifies one or more IP addresses. Conversely, an IP address may map to more than one domain name.

A domain name has a suffix that indicates which *top level domain* (TLD) it belongs to. Every country has its own top-level domain, for example `.de` for Germany, `.fr` for France, `.jp` for Japan, `.tw` for Taiwan, `.uk` for the United Kingdom, `.us` for the U.S.A., and so on. There are also `.com` for commercial bodies, `.edu` for educational institutions, `.net` for network operators, and `.org` for other organizations as well as `.gov` for the U. S. government and `.mil` for its armed services.

DOM

The *Document Object Model* (DOM) is an interface that allows programs and scripts to dynamically access and update the content, structure, and style of documents. The DOM allows you to model the objects in an HTML or XML document (text, links, images, tables), defining the attributes of each object and how they can be manipulated.

Further details about the DOM can be found at the W3C.

DTIM

The *Delivery Traffic Information Map* (DTIM) message is an element included in some 錯誤! 找不到參照來源。 frames. It indicates which stations, currently sleeping in low-power mode, have data buffered on the Access Point awaiting pick-up. Part of the DTIM message indicates how frequently stations must check for buffered data.

Dynamic IP Address

See IP Address.

E

EAP

The *Extensible Authentication Protocol* (EAP) is an authentication protocol that supports multiple methods, such as token cards, Kerberos, one-time passwords, certificates, public key authentication, and smart cards.

Variations on EAP include EAP Cisco Wireless (LEAP), Protected EAP (PEAP), EAP-TLS, and EAP Tunnelled TLS (EAP-TTLS).

EDCF

Enhanced Distribution Control Function is an extension of DCF. EDCF, a component of the IEEE Wireless Multimedia (WMM) standard, provides prioritized access to the wireless medium.

ESS

An *extended service set* (ESS) is an Infrastructure Mode Wireless Networking Framework with multiple access points, forming a single subnetwork that can support more clients than a basic service set (BSS). Each access point supports a number of wireless stations, providing broader wireless coverage for a large space, for example, an office.

Ethernet

Ethernet is a local-area network (LAN) architecture supporting data transfer rates of 10 Mbps to 1 Gbps. The Ethernet specification is the basis for the IEEE 錯誤! 找不到參照來源。 standard, which specifies the physical and lower software layers. It uses the CSMA/CA access method to handle simultaneous demands.

Ethernet supports data rates of 10 Mbps, *Fast Ethernet* supports 100 Mbps, and *Gigabit Ethernet* supports 1 Gbps. Its cables are classified as *“X*base*Y”*, where *X* is the data rate in Mbps and *Y* is the category of cabling. The original cable was *10base5* (Thicknet or “Yellow Cable”). Some others are *10base2* (Cheapernet), *10baseT* (Twisted Pair), and *100baseT* (Fast Ethernet). The latter two are commonly supplied using *CAT5* cabling with *RJ-45* connectors. There is also *1000baseT* (Gigabit Ethernet).

ERP

The *Extended Rate Protocol* refers to the protocol used by IEEE 802.11g stations (over 20 Mbps transmission rates at 2.4GHz) when paired with Orthogonal Frequency Division Multiplexing (OFDM). Built into ERP and the IEEE 802.11g standard is a scheme for effective interoperability of IEEE 802.11g stations with IEEE 802.11b nodes on the same channel.

Legacy IEEE 802.11b devices cannot detect the ERP-OFDM signals used by IEEE 802.11g stations, and this can result in collisions between data frames from IEEE 802.11b and IEEE 802.11g stations.

If there is a mix of 802.11b and 802.11g nodes on the same channel, the IEEE 802.11g stations detect this via an ERP flag on the access point and enable *request to send* (RTS) and *clear to send* (CTS) protection before sending data.

See also CSMA/CA protocol.

F

Frame

A *Frame* consists of a discrete portion of data along with some descriptive meta-information packaged for transmission on a wireless network. 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. 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).

G

Gateway

A *gateway* is a network node that serves as an entrance to another network. A gateway also often provides a proxy server and a firewall. It is associated with both a router, which use headers and forwarding tables to determine where packets are sent, and a switch or bridge, which provides the actual path for the packet in and out of the gateway.

Before a host on a LAN can access the Internet, it needs to know the address of its *default gateway*.

H

HTTP

The *Hypertext Transfer Protocol* (HTTP) defines how messages are formatted and transmitted on the World Wide Web. An HTTP message consists of a URL and a command (`GET`, `HEAD`, `POST`, etc.), a request followed by a response.

HTTPS

The Secure Hypertext Transfer Protocol (HTTPS) is the secure version of HTTP, the communication protocol of the World Wide Web. HTTPS is built into the browser. If you are using HTTPS you will notice a closed lock icon at the bottom corner of your browser page.

All data sent via HTTPS is encrypted, thus ensuring secure transactions take place.

I

IAPP

The *Inter Access Point Protocol* (IAPP) is an IEEE standard (802.11f) that defines communication between the access points in a “distribution system”. This includes the exchange of information about mobile stations and the maintenance of bridge forwarding tables, plus securing the communications between access points.

IBSS

An *independent basic service set* (IBSS) is an Ad hoc Mode Wireless Networking Framework in which stations communicate directly with each other.

IEEE

The Institute of Electrical and Electronic Engineers (IEEE) is an international standards body that develops and establishes industry standards for a broad range of technologies, including the 802 family of networking and wireless standards. (See 錯誤! 找不到參照來源。, 錯誤! 找不到參照來源。, 錯誤! 找不到參照來源。, 錯誤! 找不到參照來源。, 錯誤! 找不到參照來源。, 錯誤! 找不到參照來源。, 802.11f, 802.11g, and 802.11i.)

For more information about IEEE task groups and standards, see http://standards.ieee.org/.

Infrastructure Mode

Infrastructure Mode is a Wireless Networking Framework in which wireless stations communicate with each other by first going through an Access Point. In this mode, the wireless stations can communicate with each other or can communicate with hosts on a wired network. The access point is connected to a wired network and supports a set of wireless stations.

An infrastructure mode framework can be provided by a single access point (BSS) or a number of access points (ESS).

Intrusion Detection

The *Intrusion Detection System* (IDS) inspects all inbound network activity and reports suspicious patterns that may indicate a network or system attack from someone attempting to break into the system. It reports access attempts using unsupported or known insecure protocols.

IP

The *Internet Protocol* (IP) specifies the format of packets, also called datagrams, and the addressing scheme. IP is a connectionless, best-effort packet switching protocol. It provides packet routing, fragmentation and re-assembly. It is combined with higher-level protocols, such as 錯誤! 找不到參照來源。 or UDP, to establish the virtual connection between destination and source.

The current version of IP is *IPv4*. A new version, called IPv6 or IPng, is under development. IPv6 is an attempt to solve the shortage of IP addresses.

IP Address

Systems are defined by their *IP address*, a four-byte (octet) number uniquely defining each host on the Internet. It is usually shown in form `10.90.90.91`. This is called dotted-decimal notation.

An IP address is partitioned into two portions: the network prefix and a host number on that network. A 錯誤! 找不到參照來源。 is used to define the portions. There are two special host numbers:

- The Network Address consists of a host number that is all zeroes (for example, `10.90.2.0`).
- The Broadcast Address consists of a host number that is all ones (for example, `10.90.2.255`).

There are a finite number of IP addresses that can exist. Therefore, a local area network typically uses one of the IANA-designated address ranges for use in private networks. These address ranges are:

`10.0.0.0` to `10.255.255.255`
`172.16.0.0` to `172.31.255.255`
`192.168.0.0` to `192.168.255.255`

A Dynamic IP Address is an IP address that is automatically assigned to a host by a DHCP server or similar mechanism. It is called dynamic because you may be assigned a different IP address each time you establish a connection.

A 錯誤! 找不到參照來源。 is an IP address that is hard-wired for a specific host. A static address is usually required for any host that is running a server, for example, a Web server.

IPSec

IP Security (IPSec) is a set of protocols to support the secure exchange of packets at the IP layer. It uses shared public keys. There are two encryption modes: Transport and Tunnel.

- *Transport* mode encrypts only the data portion (payload) of each packet, but leaves the headers untouched.
- The more secure *Tunnel* mode encrypts both the header and the payload.

ISP

An *Internet Service Provider* (ISP) is a company that provides access to the Internet to individuals and companies. It may provide related services such as virtual hosting, network consulting, Web design, etc.

J

Jitter

Jitter is the difference between the latency (or delay) in packet transmission from one node to another across a network. If packets are not transmitted at a consistent rate (including Latency), QoS for some types of data can be affected. For example, inconsistent transmission rates can cause distortion in VoIP and streaming media. QoS is designed to reduce jitter along with other factors that can impact network performance.

L

Latency

Latency, also known as *delay*, is the amount of time it takes to transmit a Packet from sender to receiver. Latency can occur when data is transmitted from the access point to a client and vice versa. It can also occur when data is transmitted from access point to the Internet and vice versa. Latency is caused by *fixed network* factors such as the time it takes to encode and decode a packet, and also by *variable network* factors such as a busy or overloaded network. QoS features are designed to minimize latency for high priority network traffic.

LAN

A *Local Area Network* (LAN) is a communications network covering a limited area, for example, the computers in your home that you want to network together or a couple of floors in a building. A LAN connects multiple computers and other network devices such as storage and printers. Ethernet is the most common technology implementing a LAN.

Wireless Ethernet (錯誤! 找不到參照來源。) is another very popular LAN technology (also see WLAN).

LDAP

The *Lightweight Directory Access Protocol* (LDAP) is a protocol for accessing on-line directory services. It is used to provide an authentication mechanism. It is based on the X.500 standard, but less complex.

Lease Time

The *Lease Time* specifies the period of time the DHCP Server gives its clients an IP Address and other required information. When the lease expires, the client must request a new lease. If the lease is set to a short span, you can update your network information and propagate the information provided to the clients in a timely manner.

LLC

The *Logical Link Control* (LLC) layer controls frame synchronization, flow control, and error checking. It is a higher level protocol over the PHY layer, working in conjunction with the MAC layer.

M

MAC

The *Media Access Control* (MAC) layer handles moving data packets between NICs across a shared channel. It is a higher level protocol over the PHY layer. It provides an arbitration mechanism in an attempt to prevent signals from colliding.

It uses a hardware address, known as the *MAC address*, that uniquely identifies each node of a network. IEEE 錯誤! 找不到參照來源。 network devices share a common 48-bit MAC address format, displayed as a string of twelve (12) hexadecimal digits separated by colons, for example `FE:DC:BA:09:87:65`.

Managed Mode

In Managed Mode, the D-Link Access Point is part of the D-Link Unified Wired/Wireless Access System, and you manage it by using the D-Link Unified Switch. If an AP is in Managed Mode, the Administrator Web UI is disabled.

MDI and MDI-X

Medium Dependent Interface (MDI) and *MDI crossover* (MDIX) are twisted pair cabling technologies for Ethernet ports in hardware devices. Built-in twisted pair cabling and auto-sensing enable connection between like devices with the use of a standard Ethernet cable. (For example, if a wireless access point supports MDI/MDIX, one can successfully connect a PC and that access point with an Ethernet cable rather than having to use a crossover cable).

MIB

Management Information Base (MIB) is a virtual database of objects used for network management. SSI agents along with other SNMP tools can be used to monitor any network device defined in the MIB.

MSCHAP V2

Microsoft Challenge Handshake Authentication Protocol Version 2 (MSCHAP V2) provides authentication for PPP connections between a Windows-based computer and an Access Point or other network access device.

MTU

The *Maximum Transmission Unit* is the largest physical packet size, measured in bytes, that a network can transmit. Any messages larger than the MTU are fragmented into smaller packets before being sent.

Multicast

A *Multicast* sends the same message to a select group of recipients. Sending an e-mail message to a mailing list is an example of multicasting. In wireless networks, multicast usually refers to an interaction in which the access point sends data traffic in the form of IEEE 錯誤! 找不到參照來源。 Frames to a specified set of client stations (MAC addresses) on the network.

Some wireless security modes distinguish between how unicast, multicast, and broadcast frames are encrypted or whether they are encrypted.

See also Unicast and 錯誤! 找不到參照來源。.

N

NAT

Network Address Translation is an Internet standard that masks the internal IP addresses being used in a LAN. A NAT server running on a gateway maintains a translation table that maps all internal IP addresses in outbound requests to its own address and converts all inbound requests to the correct internal host.

NAT serves three main purposes: it provides security by obscurity by hiding internal IP addresses, enables the use of a wide range of internal IP addresses without fear of conflict with the addresses used by other organizations, and it allows the use of a single Internet connection.

Network Address

See IP Address.

NIC

A *Network Interface Card* is an adapter or expansion board inserted into a computer to provide a physical connection to a network. Most NICs are designed for a particular type of network, protocol, and media, for example, Ethernet or wireless.

NTP

The *Network Time Protocol* assures accurate synchronization of the system clocks in a network of computers. NTP servers transmit *Coordinated Universal Time* (UTC, also known as *Greenwich Mean Time*) to their client systems. An NTP client sends periodic time requests to servers, using the returned time stamp to adjust its clock.

O

OSI

The *Open Systems Interconnection* (OSI) reference model is a framework for network design. The OSI model consists of seven layers:

- Layer 1, the Physical layer, identifies the physical medium used for communication between nodes. In the case of wireless networks, the physical medium is air, and radio frequency (RF) waves are a components of the physical layer.

- Layer 2, the Data-Link layer, defines how data for transmission will be structured and formatted, along with low-level protocols for communication and addressing. For example, protocols such as CSMA/CA and components like MAC addresses, and Frames are all defined and dealt with as a part of the Data-Link layer.

- Layer 3, the Network layer, defines the how to determine the best path for information traversing the network. Packets and logical IP Addresses operate on the network layer.

- Layer 4, the Transport layer, defines connection oriented protocols such as 錯誤!

找不到參照來源。 and UDP.

- Layer 5, the Session layer, defines protocols for initiating, maintaining, and ending communication and transactions across the network. Some common examples of protocols that operate on this layer are network file system (NFS) and structured query language (SQL). Also part of this layer are communication flows like single mode (device sends information bulk), half-duplex mode (devices take turns transmitting information in bulk), and full-duplex mode (interactive, where devices transmit and receive simultaneously).

- Layer 6, the Presentation layer, defines how information is presented to the application. It includes meta-information about how to encrypt/decrypt and compress/decompress the data. JPEG and TIFF file formats are examples of protocols at this layer.

- Layer 7, the Application layer, includes protocols like hypertext transfer protocol (HTT), simple mail transfer protocol (SMTP), and file transfer protocol (FTP).

P

Packet

Data and media are transmitted among nodes on a network in the form of *packets*. Data and multimedia content is divided up and packaged into *packets*. A packet includes a small chunk of the content to be sent along with its destination address and sender address. Packets are pushed out onto the network and inspected by each node. The node to which it is addressed is the ultimate recipient.

Packet Loss

Packet Loss describes the percentage of packets transmitted over the network that did not reach their intended destination. A 0 percent package loss indicates no packets were lost in transmission. QoS features are designed to minimize packet loss.

PHY

The Physical Layer (PHY) is the lowest layer in the network layer model (see OSI). The Physical Layer conveys the bit stream - electrical impulse, light or radio signal -- through the network at the electrical and mechanical level. It provides the hardware means of sending and receiving data on a medium, including defining cables, NICs, and physical aspects.

Ethernet and the **錯誤!** 找不到參照來源。 family are protocols with physical layer components.

PID

The *Process Identifier* (PID) is an integer used by Linux to uniquely identify a process. A PID is returned by the `fork()` system call. It can be used by `wait()` or `kill()` to perform actions on the given process.

Port Forwarding

Port Forwarding creates a ‘tunnel’ through a firewall, allowing users on the Internet access to a service running on one of the computers on your LAN, for example, a Web server, an FTP or SSH server, or other services. From the outside user’s point of view, it looks like the service is running on the firewall.

PPP

The *Point-to-Point Protocol* is a standard for transmitting network layer datagrams (IP packets) over serial point-to-point links. PPP is designed to operate both over asynchronous connections and bit-oriented synchronous systems.

PPPoE

Point-to-Point Protocol over Ethernet (PPPoE) is a specification for connecting the users on a LAN to the Internet through a common broadband medium, such as a single DSL or cable modem line.

PPtP

Point-to-Point Tunneling Protocol (PPtP) is a technology for creating a *Virtual Private Network* (VPN) within the *Point-to-Point Protocol* (PPP). It is used to ensure that data transmitted from one VPN node to another are secure.

Proxy

A *proxy* is server located between a client application and a real server. It intercepts requests, attempting to fulfill them itself. If it cannot, it forwards them to the real server. Proxy servers have two main purposes: improve performance by spreading requests over several machines and filter requests to prevent access to specific servers or services.

PSK

Pre-Shared Key (PSK), see Shared Key.

Public Key

A *public key* is used in public key cryptography to encrypt a message which can only be decrypted with the recipient's private or secret key. Public key encryption is also called asymmetric encryption, because it uses two keys, or Diffie-Hellman encryption. Also see Shared Key.

Q

QoS

Quality of Service (QoS) defines the performance properties of a network service, including guaranteed throughput, transit delay, and priority queues. QoS is designed to minimize Latency, Jitter, Packet Loss, and network congestion, and provide a way of allocating dedicated bandwidth for high priority network traffic.

The IEEE standard for implementing QoS on wireless networks is currently in-work by the 錯誤! 找不到參照來源。 task group. A subset of 錯誤! 找不到參照來源。 features is described in the WMM specification.

R

RADIUS

The *Remote Authentication Dial-In User Service* (RADIUS) provides an authentication and accounting system. It is a popular authentication mechanism for many ISPs.

RC4

A symmetric stream cipher provided by RSA Security. It is a variable key-size stream cipher with byte-oriented operations. It allows keys up to 2048 bits in length.

Roaming

In IEEE 錯誤! 找不到參照來源。 parlance, *roaming clients* are mobile client stations or devices on a wireless network (WLAN) that require use of more than one Access Point (AP) as they move out of and into range of different base station service areas. IEEE 802.11f defines a standard by which APs can communicate information about client associations and disassociations in support of roaming clients.

Router

A *router* is a network device which forwards packets between networks. It is connected to at least two networks, commonly between two local area networks (LANs) or between a LAN and a wide-area network (WAN), for example, the Internet. Routers are located at gateways—places where two or more networks connect.

A router uses the content of headers and its tables to determine the best path for forwarding a packet. It uses protocols such as the Internet Control Message Protocol (ICMP), Routing Information Protocol (RIP), and Internet Router Discovery Protocol (IRDP) to communicate with other routers to configure the best route between any two hosts. The router performs little filtering of data it passes.

RSSI

The *Received Signal Strength Indication* (RSSI) an 錯誤! 找不到參照來源。 value that calculates voltage relative to the received signal strength. RSSI is one of several ways of measuring and indicating *radio frequency* (RF) signal strength. Signal strength can also be measured in mW (milliwatts), dBms (decibel milliwatts), and a percentage value.

RTP

Real-Time Transport Protocol (RTP) is an Internet protocol for transmitting real-time data like audio and video. It does not guarantee delivery but provides support mechanisms for the sending and receiving applications to enable streaming data. RTP typically runs on top of the UDP protocol, but can support other transport protocols as well.

RTS

A *request to send* (RTS) message is a signal sent by a client station to the access point, asking permission to send a data packet and to prevent other wireless client stations from grabbing the radio waves. This message is a part of the IEEE 802.11 CSMA/CA protocol. (See also RTS Threshold and CTS.)

RTS Threshold

The *RTS threshold* specifies the packet size of a request to send (RTS) transmission. This helps control traffic flow through the access point, and is especially useful for performance tuning on an access point with a many clients.

S

Shared Key

A *shared key* is used in conventional encryption where one key is used both for encryption and decryption. It is also called *secret-key* or *symmetric-key* encryption.

Also see Public Key.

SSID

The *Service Set Identifier* (SSID) is a thirty-two character alphanumeric key 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.

Standalone Mode

In Standalone Mode, the D-Link AP acts as an individual access point in the network, and you manage it by using the Administrator Web User Interface (UI) or the CLI.

Static IP Address

See IP Address.

STP

The *Spanning Tree Protocol* (STP) is an IEEE 802.1 standard protocol (related to network management) for MAC bridges that manages path redundancy and prevents undesirable loops in the network created by multiple active paths between client stations. Loops occur when there are multiple routes between access points. STP creates a tree that spans all of the switches in an extended network, forcing redundant paths into a standby or blocked state. STP allows only one active path at a time between any two network devices (this prevents the loops), but establishes the redundant links as a backup if the initial link should fail. If STP costs change, or if one network segment in the STP becomes unreachable, the spanning tree algorithm reconfigures the spanning tree topology and reestablishes the link by activating the standby path. Without STP in place, it is possible that both connections may be simultaneously live, which could result in an endless loop of traffic on the LAN.

Subnet Mask

A *Subnet Mask* is a number that defines which part of an IP address is the network address and which part is a host address on the network. It is shown in dotted-decimal notation (for example, a 24-bit mask is shown as `255.0.0.0`) or as a number appended to the IP address (for example, `10.90.90.91/24`).

The subnet mask allows a router to quickly determine if an IP address is local or needs to be forwarded by performing a bitwise AND operation on the mask and the IP address. For example, if an IP address is `192.168.2.128` and the netmask is `255.255.255.0`, the resulting Network address is `192.168.2.0`.

The bitwise AND operator compares two bits and assigns 1 to the result only if both bits are 1.

Supported Rate Set

The *supported rate set* defines the transmission rates that are available on this wireless network. A station may be able to receive data at any of the rates listed in this set. All stations must be able to receive data at the rates listed in the **錯誤! 找不到參照來源。**.

SVP

SpectraLink Voice Priority (SVP) is a QoS approach to Wi-Fi deployments. SVP is an open specification that is compliant with the IEEE **錯誤! 找不到參照來源。** standard. SVP minimizes delay and prioritizes voice packets over data packets on the Wireless LAN, thus increasing the probability of better network performance.

T

TCP

The *Transmission Control Protocol* (TCP) is built on top of Internet Protocol (IP). It adds reliable communication (guarantees delivery of data), flow-control, multiplexing (more than one simultaneous connection), and connection-oriented transmission (requires the receiver of a packet to acknowledge receipt to the sender). It also guarantees that packets will be delivered in the same order in which they were sent.

TCP/IP

The Internet and most local area networks are defined by a group of protocols. The most important of these is the *Transmission Control Protocol over Internet Protocol* (TCP/IP), the de facto standard protocols. TCP/IP was originally developed by Defense Advanced Research Projects Agency (DARPA, also known as ARPA, an agency of the US Department of Defense).

Although 錯誤! 找不到參照來源。 and IP are two specific protocols, TCP/IP is often used to refer to the entire protocol suite based upon these, including ICMP, ARP, UDP, and others, as well as applications that run upon these protocols, such as telnet, FTP, etc.

TKIP

The *Temporal Key Integrity Protocol* (TKIP) provides an extended 48-bit initialization vector, per-packet key construction and distribution, a Message Integrity Code (MIC, sometimes called “Michael”), and a re-keying mechanism. It uses a RC4 stream cipher to encrypt the frame body and CRC of each 錯誤! 找不到參照來源。 frame before transmission. It is an important component of the WPA and 802.11i security mechanisms.

ToS

錯誤! 找不到參照來源。 packet headers include a 3-to-5 bit Type *of Service* (ToS) field set by the application developer that indicates the appropriate type of service for the data in the packet. The way the bits are set determines whether the packet is queued for sending with minimum delay, maximum throughput, low cost, or mid-way “best-effort” settings depending upon the requirements of the data. The ToS field is used by the D-Link AP to provide configuration control over *Quality of Service* (QoS) queues for data transmitted from the AP to client stations.

U

UDP

The *User Datagram Protocol* (UDP) is a transport layer protocol providing simple but unreliable datagram services. It adds port address information and a checksum to an IP packet.

UDP neither guarantees delivery nor does it require a connection. It is lightweight and efficient. All error processing and retransmission must be performed by the application program.

Unicast

A *Unicast* sends a message to a single, specified receiver. In wireless networks, unicast usually refers to an interaction in which the access point sends data traffic in the form of IEEE 錯誤! 找不到參照來源。 Frames directly to a single client station MAC address on the network.

Some wireless security modes distinguish between how unicast, multicast, and broadcast frames are encrypted or whether they are encrypted.

See also Multicast and 錯誤! 找不到參照來源。.

URL

A *Uniform Resource Locator* (URL) is a standard for specifying the location of objects on the Internet, such as a file or a newsgroup. URLs are used extensively in HTML documents to specify the target of a hyperlink which is often another HTML document (possibly stored on another computer). The first part of the URL indicates what protocol to use and the second part specifies the IP address or the domain name where that resource is located.

For example, `ftp://ftp.dlink.com/downloads/myfile.tar.gz` specifies a file that should be fetched using the FTP protocol; `http://www.dlink.com/index.html` specifies a Web page that should be fetched using the HTT protocol.

V

VLAN

A *virtual* LAN (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. The nodes in a VLAN share resources and bandwidth, and are isolated on that network. The Unified Access Point supports the configuration of a wireless VLAN. This technology is leveraged on the access point for the “virtual” guest network feature.

VPN

A *Virtual Private Network* (VPN) is a network that uses the Internet to connect its nodes. It uses encryption and other mechanisms to ensure that only authorized users can access its nodes and that data cannot be intercepted.

W

WAN

A *Wide Area Network* (WAN) is a communications network that spans a relatively large geographical area, extending over distances greater than one kilometer. A WAN is often connected through public networks, such as the telephone system. It can also be connected through leased lines or satellites.

The Internet is essentially a very large WAN.

WEP

Wired Equivalent Privacy (WEP) is a data encryption protocol for 錯誤! 找不到參照來源。 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. It uses a RC4 stream cipher to encrypt the frame body and CRC of each 錯誤! 找不到參照來源。 frame before transmission.

Wi-Fi

A test and certification of interoperability for WLAN products based on the IEEE 錯誤! 找不到參照來源。 standard promoted by the Wi-Fi Alliance, a non-profit trade organization.

WINS

The *Windows Internet Naming Service* (WINS) is a server process for resolving Windows-based computer names to IP addresses. It provides information that allows these systems to browse remote networks using the *Network Neighborhood*.

Wireless Networking Framework

There are two ways of organizing a wireless network:

- Stations communicate directly with one another in an Ad hoc Mode network, also known as an independent basic service set (IBSS).
- Stations communicate through an Access Point in an Infrastructure Mode network. A single access point creates an infrastructure basic service set (BSS) whereas multiple access points are organized in an extended service set (ESS).

WLAN

Wireless Local Area Network (WLAN) is a LAN that uses high-frequency radio waves rather than wires to communicate between its nodes.

WMM

Wireless Multimedia (WMM) is a IEEE technology standard designed to improve the quality of audio, video and multimedia applications on a wireless network. Both access points and wireless clients (laptops, consumer electronics products) can be WMM-enabled. WMM features are based on is a subset of the WLAN IEEE 錯誤! 找不到參照來源。 draft specification. Wireless products that are built to the standard and pass a set of quality tests can carry the "Wi-Fi certified for WMM" label to ensure interoperability with other such products. For more information, see the WMM page on the Wi-Fi Alliance Web site: http://www.wi-fi.org/OpenSection/wmm.asp.

WPA

Wi-Fi Protected Access (WPA) is a Wi-Fi Alliance version of the draft IEEE 802.11i standard. It provides more sophisticated data encryption than WEP and also provides user authentication. WPA includes 錯誤! 找不到參照來源。 and 錯誤! 找不到參照來源。 mechanisms.

WPA2

WiFi Protected Access (WPA2) is an enhanced security standard, described in IEEE 802.11i, that uses Advanced Encryption Standard (AES) for data encryption.

The original WPA uses Temporal Key Integrity Protocol (錯誤! 找不到參照來源。) for data encryption. WPA2 is backwards-compatible with products that support the original WPA.

WPA2, like the original WPA, supports an *Enterprise* and *Personal* version. The Enterprise version requires use of IEEE 錯誤! 找不到參照來源。 security features and *Extensible Authentication Protocol* (EAP) authentication with a RADIUS server.

The Personal version does not require IEEE 錯誤! 找不到參照來源。 or EAP. It uses a *Pre-Shared Key* (PSK) password to generate the keys needed for authentication.

WRAP

Wireless Robust Authentication Protocol (WRAP) is an encryption method for 802.11i that uses AES but another encryption mode (OCB) for encryption and integrity.

X

XML

The *Extensible Markup Language* (XML) is a specification developed by the W3C. XML is a simple, flexible text format derived from *Standard Generalized Markup Language* (SGML), which is defined in ISO 8879:1986, designed especially for electronic publishing.