



LevelOne

**WAP-6002**

150Mbps N Wireless Access Point

User Manual

V1.2.0



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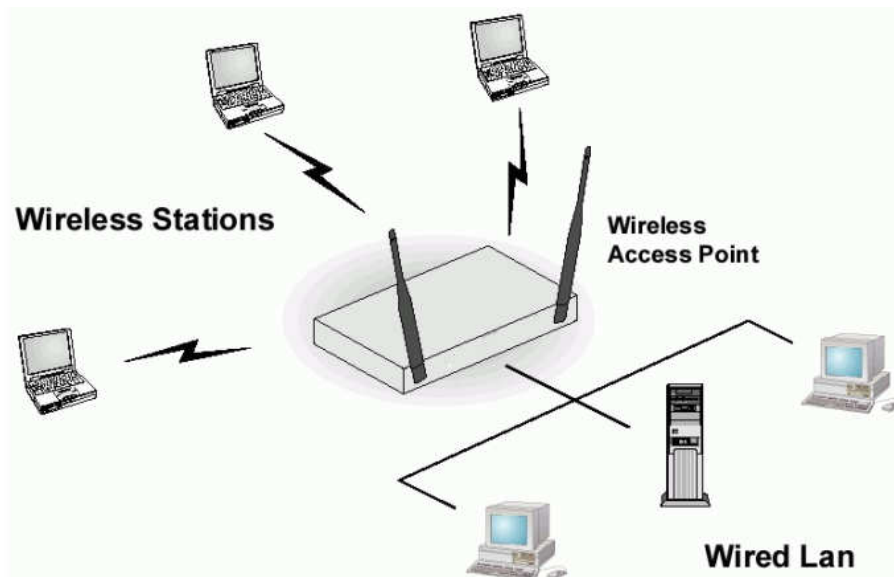
# Chapter 1

## Introduction

# 1

*This Chapter provides an overview of the Wireless Access Point's features and capabilities.*

Congratulations on the purchase of your new Wireless Access Point. The Wireless Access Point links your Wireless Stations to your wired LAN. The Wireless stations and devices on the wired LAN are then on the same network, and can communicate with each other without regard for whether they are connected to the network via a Wireless or wired connection.



**Figure 1: Wireless Access Point**

The auto-sensing capability of the Wireless Access Point allows packet transmission up to 300Mbps for maximum throughput, or automatic speed reduction to lower speeds when the environment does not permit maximum throughput.

### Features of your Wireless Access Point

The Wireless Access Point incorporates many advanced features, carefully designed to provide sophisticated functions while being easy to use.

- **Standards Compliant.** The Wireless Access Point complies with the IEEE802.11g and IEEE802.11n 2.0 specifications for Wireless LANs.
- **Supports 11n Wireless Stations.** The 802.11n standard provides for backward compatibility with the 802.11b standard, so 802.11n, 802.11b and 802.11g Wireless stations can be used simultaneously.
- **Bridge Mode Support.** The Wireless Access Point can operate in Bridge Mode, connecting to another Access Point. Both PTP (Point to Point) and PTMP (Point to Multi-Point) Bridge modes are supported.  
**And you can even use both Bridge Mode and Access Point Mode simultaneously!**

**WPS Support.** WPS (Wi-Fi Protected Setup) can simplify the process of connecting any device to the wireless network by using the push button configuration (PBC) on the Wireless Access Point, or entering PIN code if there's no button.

- **DHCP Client Support.** Dynamic Host Configuration Protocol provides a dynamic IP address to PCs and other devices upon request. The Wireless Access Point can act as a **DHCP Client**, and obtain an IP address and related information from your existing DHCP Server.
- **Upgradeable Firmware.** Firmware is stored in a flash memory and can be upgraded easily, using only your Web Browser.

## Security Features

- **Virtual APs.** For maximum flexibility, wireless security settings are stored in Virtual AP. Up to 7 Virtual APs can be defined and used as any time.
- **Multiple SSIDs.** Because each Virtual AP has its own SSID and beacon, and up to 7 Virtual APs can be active simultaneously, multiple SSIDs are supported. Different clients can connect to the Wireless Access Point using different SSIDs, with different security settings.
- **Virtual APs Isolation.** If desired, PCs and devices connecting to different Virtual APs can be isolated from each other.
- **WEP support.** Support for WEP (Wired Equivalent Privacy) is included. Both 64 Bit, 128 Bit, and 152 Bit keys are supported.
- **WPA support.** Support for WPA is included. WPA is more secure than WEP, and should be used if possible. Both TKIP and AES encryption methods are supported.
- **802.1x Support.** Support for 802.1x mode is included, providing for the industrial-strength wireless security of 802.1x authentication and authorization.
- **Radius Client Support.** The Wireless Access Point can login to your existing Radius Server (as a Radius client).
- **Password - protected Configuration.** Optional password protection is provided to prevent unauthorized users from modifying the configuration data and settings.

## Advanced Features

- **SNMP Support.** SNMP (Simple Network Management Protocol) is supported, allowing you to use a SNMP program to manage the Wireless Access Point.
- **WDS Support.** Support for WDS (Wireless Distribution System) allows the Wireless Access Point to act as a Wireless Bridge. Both Point-to-Point and Multi-Point Bridge modes are supported.

## Package Contents

The following items should be included:

- WAP-6002 150Mbps N Wireless Access Point
- Power Adapter
- Quick Start Guide
- CD-ROM containing the on-line manual and setup utility.

If any of the above items are damaged or missing, please contact your dealer immediately.

## Physical Details

### Front Panel LEDs



**Figure 2: Front Panel**

<b>Security</b>	<p><b>Off</b> - WPS feature is not in use.</p> <p><b>On (White)</b> - If the LED is on for a while and then off, WPS is processing successfully.</p> <p><b>Blinking (White)</b> - WPS feature is currently in use.</p>
<b>WPS Button</b>	<p>Push the WPS button on the device and on your other wireless device to perform WPS function that easily creates an encryption-secured wireless connection automatically.</p>
<b>Wireless</b>	<p><b>On</b> - Idle</p> <p><b>Off</b> - Wireless connection is not available.</p>
<b>LAN</b>	<p><b>On</b> - The LAN port is active.</p> <p><b>Off</b> - No active connection on the LAN (Ethernet) port.</p>
<b>Power</b>	<p><b>On</b> - Normal operation.</p> <p><b>Off</b> - No power</p>

**Reset Button** This button has two (2) functions:

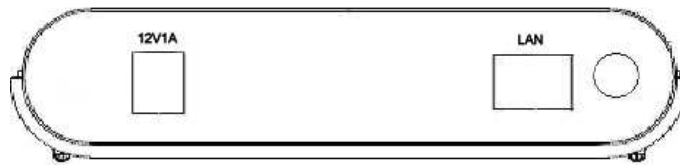
- **Reboot.** When pressed and released, the Wireless Access Point will reboot (restart).
- **Reset to Factory Defaults.** This button can also be used to clear ALL data and restore ALL settings to the factory default values.

To Clear All Data and restore the factory default values:

1. Hold the Reset Button for more than 5 seconds.
2. Release the Reset Button.  
The factory default configuration has now been restored, and the Access Point is ready for use.

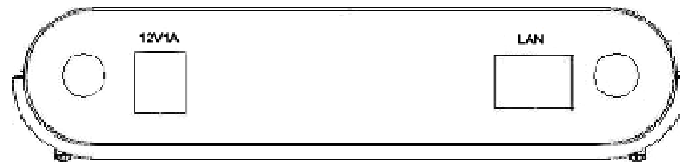


## Rear Panel



**Figure 3: Rear Panel**

or



**Figure 4: Rear Panel**

<b>LAN</b>	Use a standard LAN cable (RJ45 connectors) to connect this port to a 10BaseT or 100BaseT hub/switch on your LAN.
<b>Power port</b>	Connect the supplied power adapter (12V@1A) here.
<b>Antenna</b>	The antenna differs according to the different models.

# Chapter 2

## Installation

# 2

*This Chapter covers the physical installation of the Wireless Access Point.*

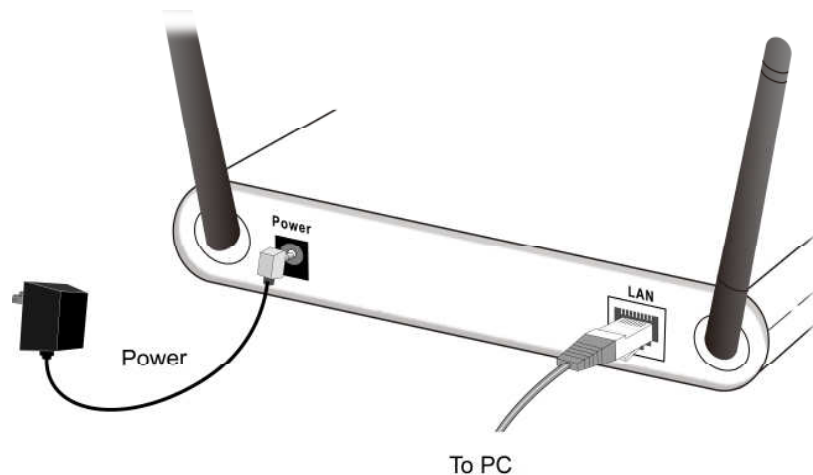
### Requirements

#### Requirements:

- TCP/IP network
- Ethernet cable with RJ-45 connectors
- Installed Wireless network adapter for each PC that will be wirelessly connected to the network

### Procedure

1. Select a suitable location for the installation of your Wireless Access Point. To maximize reliability and performance, follow these guidelines:
  - Use an elevated location, such as wall mounted or on the top of a cubicle.
  - Place the Wireless Access Point near the center of your wireless coverage area.
  - If possible, ensure there are no thick walls or metal shielding between the Wireless Access Point and Wireless stations.



**Figure 5: Installation Diagram**

2. Use a standard LAN cable to connect the "LAN" port on the Wireless Access Point to a 10/100BaseT hub/switch on your LAN.
3. Connect the supplied power adapter to the Wireless Access Point and a convenient power outlet, and power up.
4. Check the LEDs:
  - The *Power* LED should be ON.
  - The *LAN* and *Wireless* LEDs should be ON.

For more information, refer to *Front Panel LEDs* in Chapter 1.

# Chapter 3

## Access Point Setup



*This Chapter provides details of the Setup process for Basic Operation of your Wireless Access Point.*

### Overview

This chapter describes the setup procedure to make the Wireless Access Point a valid device on your LAN, and to function as an Access Point for your Wireless Stations.

Wireless Stations may also require configuration. For details, see *Chapter 4 - Wireless Station Configuration*.

The Wireless Access Point can be configured using your Web Browser.

### Setup using a Web Browser

**Your Browser must support JavaScript.** The configuration program has been tested on the following browsers:

- MAC OS X/Linux
- Windows98SE/ME/2000(SP4)/XP SP2/Vista/7

### Setup Procedure

Before commencing, install the Wireless Access Point in your LAN, as described previously.

1. Check the Wireless Access Point to determine its *Default Name*. This is shown on a label on the base or rear
2. Use a PC which is already connected to your LAN, either by a wired connection or another Access Point.
  - Until the Wireless Access Point is configured, establishing a Wireless connection to it may be not possible.
  - If your LAN contains a Router or Routers, ensure the PC used for configuration is on the same LAN segment as the Wireless Access Point.
3. Start your Web browser.
4. In the *Address* box, enter "HTTP://" and the IP Address of the 11N Wireless Access Point, as in this example, which uses the Wireless Access Point's default IP Address:  
HTTP://192.168.0.1
5. You should then see a login prompt, which will ask for a *User Name* and *Password*. Enter **admin** for the *User Name*, and **password** for the *Password*. These are the default values. The password can and should be changed. Always enter the current user name and password, as set on the *Admin Login* screen.

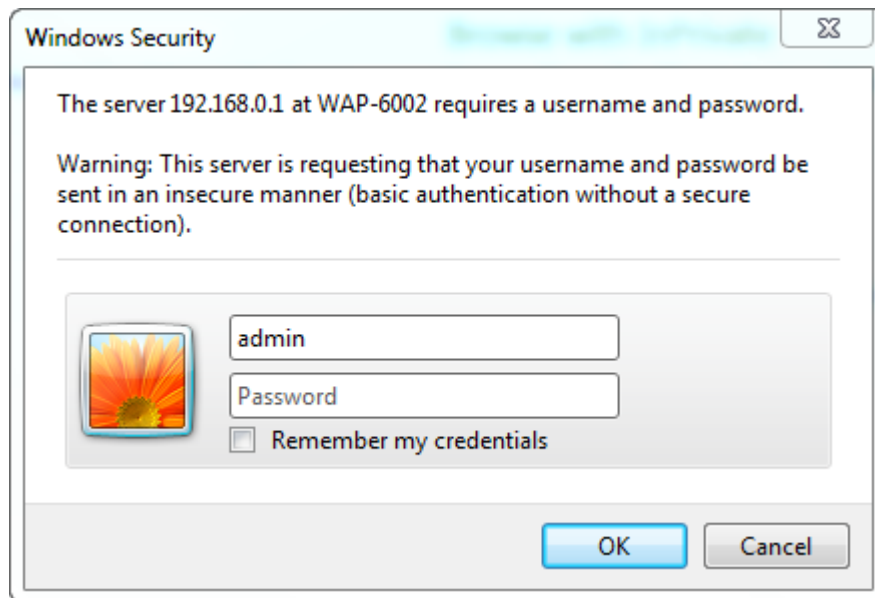


Figure 6: Password Dialog

6. You will then see the *Home* screen, which displays the current settings and status. No data input is possible on this screen.

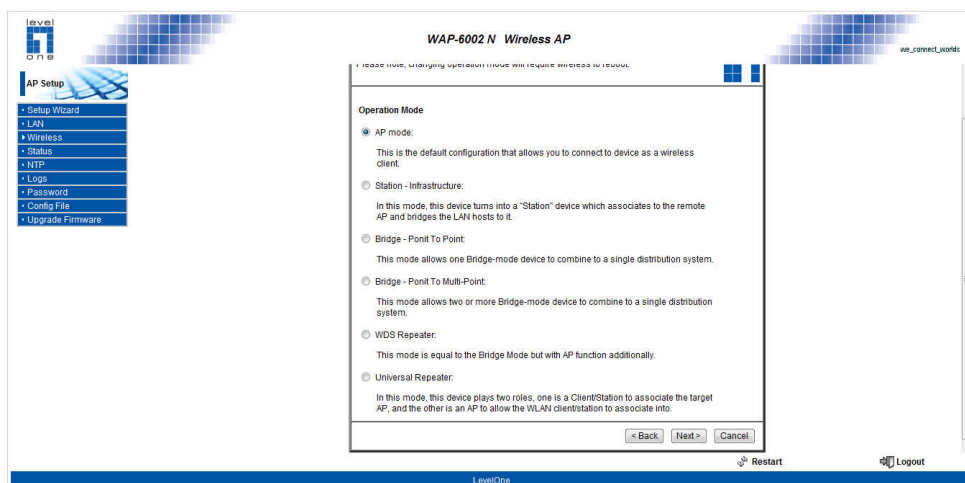


Figure 7: Home Screen

7. From the menu, check the following screens, and configure as necessary for your environment. Details of these screens and settings are described in the following sections of this chapter.
8. You may also wish to set the admin password and administration connection options. These are on the *Password* screen accessed from the **main** menu.
9. Use the **Log Out** and **Restart** buttons on the menu to apply your changes and restart the Wireless Access Point.

Setup is now complete.

Wireless stations must now be set to match the Wireless Access Point. See Chapter 4 for details.

#### **If you can't connect:**

It is likely that your PC's IP address is incompatible with the Wireless Access Point's IP address. This can happen if your LAN does not have a DHCP Server. The default IP address of the Wireless Access Point is 192.168.0.1, with a Network Mask of 255.255.255.0.

If your PC's IP address is not compatible with this, you must change your PC's IP address to an unused value in the range 192.168.0.1 ~ 192.168.0.254, with a Network Mask of 255.255.255.0. See *Appendix C - Windows TCP/IP* for details for this procedure.

## **Setup Wizard**

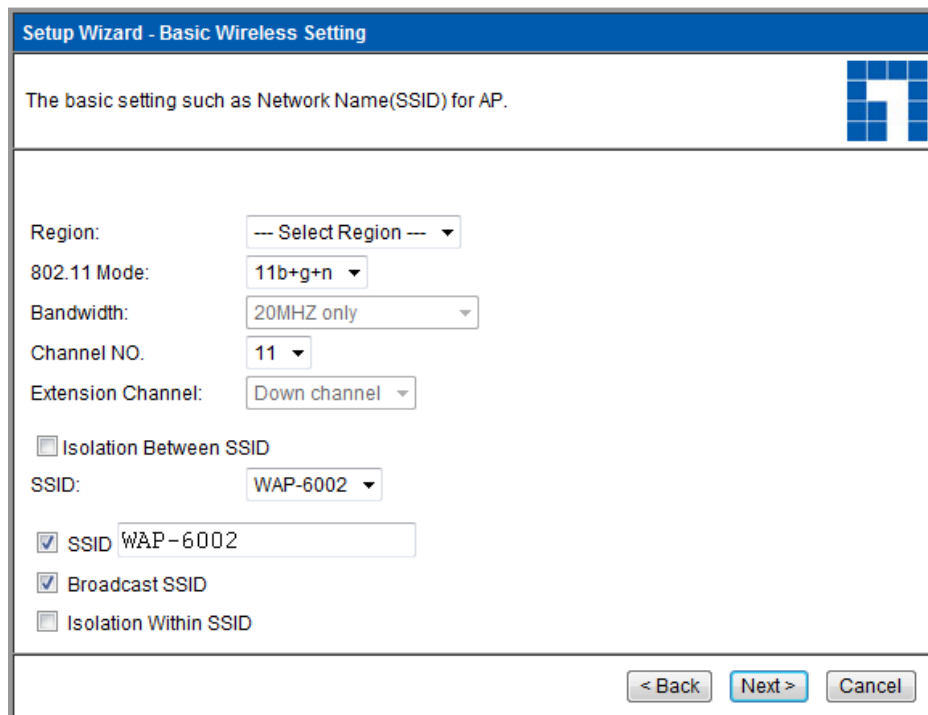
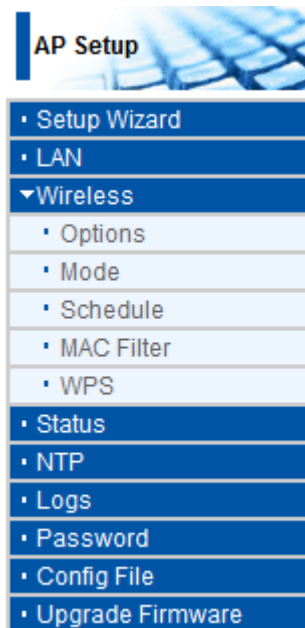
Click *Setup Wizard* in the main menu to help you simplify the configuration.

10. Step through the Wizard until finished.
  - You need to know the SSID and security settings used by the APs. Check the data carefully.
  - Refer to the Wireless Mode Screen for more details.
11. If the connection fails:
  - Check your data and all connections.
  - Check that you have entered all data correctly.

## Wireless Setting Screens

The settings on this screen must match the settings used by Wireless Stations.

Click *Wireless Setting* on the main menu to view a screen like the following.

A screenshot of the 'Setup Wizard - Basic Wireless Setting' screen. The screen displays the following settings:

- Region: --- Select Region ---
- 802.11 Mode: 11b+g+n
- Bandwidth: 20MHZ only
- Channel NO.: 11
- Extension Channel: Down channel
- Isolation Between SSID
- SSID: WAP-6002
- SSID WAP-6002
- Broadcast SSID
- Isolation Within SSID

At the bottom right, there are three buttons: '< Back', 'Next >', and 'Cancel'.

Figure 8: Wireless Setting Screen

**Data - Wireless Setting Screen**

<b>Region</b>	
<b>Region</b>	Select the country or domain matching your current location.
<b>Options</b>	
<b>802.11 Mode</b>	<p>Select the desired option:</p> <ul style="list-style-type: none"> <li>• <b>Off</b> - select this if for some reason you do not this AP to transmit or receive at all.</li> <li>• <b>B only</b> - if selected, only 802.11b connections are allowed. 802.11g wireless stations will only be able to connect if they are fully backward-compatible with the 802.11b standard.</li> <li>• <b>G only</b> - only 802.11g connections are allowed. If you only have 802.11g, selecting this option may provide a performance improvement over using the default setting.</li> <li>• <b>11b/g/n</b> - this is the default, and will allow connections by 802.11n, 802.11b and 802.11g wireless stations.</li> </ul>
<b>Channel No</b>	<p>If "Automatic" is selected, the Access Point will select the best available Channel.</p> <p>If you experience interference (shown by lost connections and/or slow data transfers) you may need to experiment with manually setting different channels to see which is the best.</p>
<b>Extension Channel</b>	Select the desired option from the drop-down list.
<b>Isolation between SSID</b>	If Enabled, devices that have the different SSIDs will not be able to communicate with each other.
<b>WMM Support</b>	Enable or disable this feature as required.
<b>Channel Bandwidth</b>	Select the desired bandwidth from the list.

## Wireless Mode Screen

Clicking the *Wireless Mode* link on the main menu will result in a screen like the following.

The screenshot shows the 'Wireless Mode' configuration interface. On the left is a navigation menu under 'AP Setup' with options like 'Setup Wizard', 'LAN', 'Wireless', 'Options', 'Mode', 'Schedule', 'MAC Filter', 'WPS', 'Status', 'NTP', 'Logs', 'Password', 'Config File', and 'Upgrade Firmware'. The 'Wireless' section is expanded. The main configuration area has a title bar 'Wireless Mode' and a sub-section 'Wireless Mode'. It includes a 'Mode' dropdown set to 'AP mode', an 'SSID' dropdown set to 'WAP-6002' with a text input field containing 'WAP-6002', and checkboxes for 'SSID', 'Broadcast SSID', and 'Isolation Within SSID'. The 'Security Setting' is set to 'Disabled' with a 'Configure SSID' button. At the bottom are 'Save', 'Cancel', and 'Help' buttons.

Figure 9: Wireless Mode Screen

### Data - Wireless Mode Screen

Wireless Mode	
<b>Mode</b>	<p>Select the desired mode:</p> <ul style="list-style-type: none"> <li>• <b>AP mode</b> - operate as a normal Access Point</li> <li>• <b>Station - Infrastructure</b> - Enter the SSID of the access point whose signal you would like to join or click on Site Survey to see a list of available access points.</li> <li>• <b>Bridge - Point-to-Point</b> - Bridge to a single AP. You must provide the MAC address of the other AP in the PTP Bridge AP MAC Address field.</li> <li>• <b>Bridge - Multi-Point</b> - Select this only if this AP is the "Master" for a group of Bridge-mode APs. The other Bridge-mode APs must be set to Point-to-Point Bridge mode, using this AP's MAC address. They then send all traffic to this "Master".</li> <li>• <b>WDS Repeater</b> - act as a repeater for another Access Point. If selected, you must provide the address (MAC address) of the other AP in the <b>Remote AP MAC Address</b> field. In this mode, all traffic is sent to the specified AP.</li> <li>• <b>Universal Repeater</b> - act as an universal repeater for another Access Point. If selected, you must provide the address (MAC address) of the other AP in the <b>Remote AP MAC Address</b> field. In this mode, all traffic is sent to the specified AP.</li> </ul>



**AP Mode**

**Wireless Mode**

▼ **Wireless Mode**

Mode:

SSID:

SSID

Broadcast SSID

Isolation Within SSID

Security Setting:

Figure 10: AP Mode

cd

<b>AP Mode</b>	
<b>SSID</b>	<p>With Multiple SSIDs, you can have 2 SSIDs on one AP. For example, a Guest SSID without encryption for visitors to have Internet access only, and a Admin SSID with encryption for private use to secure your company resources.</p> <p>Select the desired SSID from the list to configure.</p>
<b>Broadcast SSID</b>	<p>If enabled, the Wireless ADSL Router will broadcast its SSID. This allows PCs and other wireless stations to detect this Access Point and use the correct SSID.</p> <p>If disabled, PC users will have to manually enter the SSID and other details of the wireless interface before they can connect to this Access Point.</p>
<b>Isolation within SSID</b>	<p>If Enabled, devices that have the same SSID will not be able to see each other.</p>
<b>Security Setting</b>	<p>The current Wireless security is displayed. The default value is Disabled.</p>
<b>Configure SSID Button</b>	<p>Click this button to access the Wireless security sub-screen, and view or change the settings. See the following section for details.</p>

## Station - Infrastructure

**Wireless Mode**

▼ Wireless Mode

Mode:	Station - Infrastructure ▼
AP SSID:	<input type="text"/>
Security Setting:	Disabled <span style="margin-left: 20px;">Security Setting</span>
Site Survey:	<span style="margin-left: 20px;">Site Survey</span>

Save
Cancel
Help

**Figure 11: Station - Infrastructure**

<b>Station - Infrastructure</b>	
<b>AP SSID</b>	Enter the desired SSID. Each profile must have a unique SSID.
<b>Security Setting</b>	The current Wireless security is displayed. The default value is Disabled. Click <i>Security Setting</i> button to access the Wireless security sub-screen, and view or change the settings. See the following section for details.
<b>Site Survey</b>	Click the <i>Site Survey</i> button to see a list of available access points.

## Bridge - Point To Point

**Wireless Mode**

▼ **Wireless Mode**

Mode:

Security Setting:

**MAC Address**

AP:

**Figure 12: Bridge - Point To Point**

Bridge - Point To Point	
<b>Security Setting</b>	The current Wireless security is displayed. The default value is Disabled. Click <i>Security Setting</i> button to access the Wireless security sub-screen, and view or change the settings. See the following section for details.
<b>MAC Address</b>	Enter the MAC address of the AP into the field to allow the following access point to be connected to the device.

## Bridge - Point To Multi-Point

Wireless Mode

Mode: Bridge - Point To Multi-Point

Security Setting: Disabled [Security Setting](#)

**MAC Address List**

AP 1:

AP 2:

AP 3:

AP 4:

[Save](#) [Cancel](#) [Help](#)

**Figure 13: Bridge - Point To Multi-Point**

Bridge - Point To Multi-Point	
<b>Security Setting</b>	The current Wireless security is displayed. The default value is Disabled. Click <i>Security Setting</i> button to access the Wireless security sub-screen, and view or change the settings. See the following section for details.
<b>MAC Address List</b>	Enter the MAC address(es) of the AP(s) into the fields to allow the following access points to be connected to the device.

## WDS Repeater

**Wireless Mode**

Mode: WDS Repeater ▾

---

SSID: WAP-6002 ▾

SSID WAP-6002

Broadcast SSID

Isolation Within SSID

Security Setting: Disabled Configure SSID

---

**MAC Address List**

AP 1:	
AP 2:	
AP 3:	
AP 4:	

---

**Figure 14: WDS Repeater**

<b>WDS Repeater</b>	
<b>SSID</b>	Enter the desired SSID. Each Profile must have a unique SSID.
<b>Broadcast SSID</b>	<p>If enabled, the Wireless ADSL Router will broadcast its SSID. This allows PCs and other wireless stations to detect this Access Point and use the correct SSID.</p> <p>If disabled, PC users will have to manually enter the SSID and other details of the wireless interface before they can connect to this Access Point.</p>
<b>Isolation within SSID</b>	If Enabled, devices that have the same SSID will not be able to see each other.
<b>Security Setting</b>	The current Wireless security is displayed. The default value is Disabled.
<b>Configure SSID Button</b>	Click this button to access the Wireless security sub-screen, and view or change the settings. See the following section for details.
<b>MAC Address List</b>	Enter the MAC address(es) of the AP(s) into the fields to allow the following access points to be connected to the device.

## Universal Repeater

The screenshot shows a configuration page for a Universal Repeater. It features a 'Wireless Mode' dropdown set to 'Universal Repeater'. Below this, the SSID is set to 'WAP-6002'. There are three checkboxes: 'SSID' (checked), 'Broadcast SSID' (checked), and 'Isolation Within SSID' (unchecked). The 'Security Setting' is 'Disabled', with a 'Configure SSID' button next to it. There is also an 'AP Client SSID' field, its 'Security Setting' is 'Disabled' with a 'Security Setting' button, and a 'Site Survey' button. At the bottom of the form are 'Save', 'Cancel', and 'Help' buttons.

**Figure 15: Universal Repeater**

Universal Repeater	
<b>SSID</b>	Enter the desired SSID. Each Profile must have a unique SSID.
<b>Broadcast SSID</b>	<p>If enabled, the Wireless ADSL Router will broadcast its SSID. This allows PCs and other wireless stations to detect this Access Point and use the correct SSID.</p> <p>If disabled, PC users will have to manually enter the SSID and other details of the wireless interface before they can connect to this Access Point.</p>
<b>Isolation within SSID</b>	If Enabled, devices that have the same SSID will not be able to see each other.
<b>Security Setting</b>	The current Wireless security is displayed. The default value is Disabled.
<b>Configure SSID Button</b>	Click this button to access the Wireless security sub-screen, and view or change the settings. See the following section for details.
<b>AP Client SSID</b>	Enter the desired SSID. Each profile must have a unique SSID.
<b>Security Setting</b>	<p>The current Wireless security is displayed. The default value is Disabled.</p> <p>Click <i>Security Setting</i> button to access the Wireless security sub-screen, and view or change the settings. See the following section for details.</p>

## Security Settings

Select the desired option, and then enter the settings for the selected method.

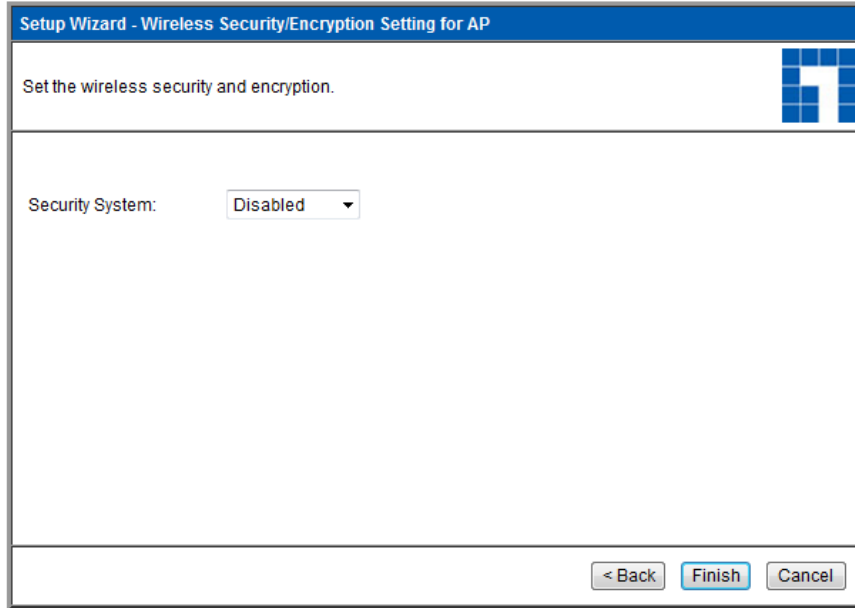
The available options are:

- **None** - No security is used. Anyone using the correct SSID can connect to your network.
- **WEP** - The 802.11b standard. Data is encrypted before transmission, but the encryption system is not very strong.
- **WPA-PSK** - Like WEP, data is encrypted before transmission. WPA is more secure than WEP, and should be used if possible. The PSK (Pre-shared Key) must be entered on each Wireless station. The 256Bit encryption key is derived from the PSK, and changes frequently.
- **WPA2-PSK** - This is a further development of WPA-PSK, and offers even greater security, using the AES (Advanced Encryption Standard) method of encryption.
- **802.1x** - This uses the 802.1x standard for client authentication, and WEP for data encryption.

If this option is selected:

- This Access Point must have a "client login" on the Radius Server.
- Each user must have a "user login" on the Radius Server.
- Each user's wireless client must support 802.1x and provide the login data when required.
- All data transmission is encrypted using the WEP standard. You only have to select the WEP key size; the WEP key is automatically generated.

## Security Settings - None



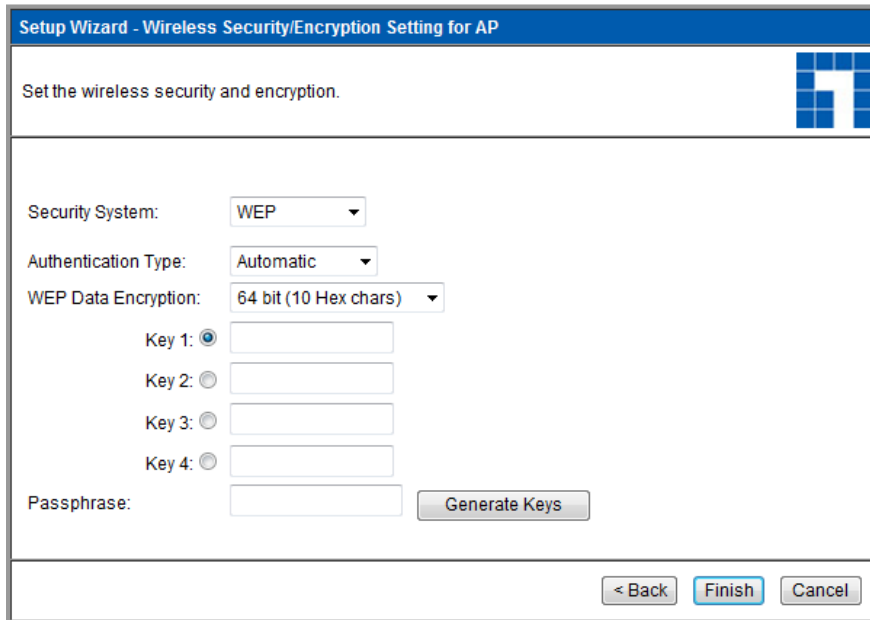
The screenshot shows a window titled "Setup Wizard - Wireless Security/Encryption Setting for AP". The main heading is "Set the wireless security and encryption." Below this, there is a "Security System:" label followed by a dropdown menu currently set to "Disabled". At the bottom right of the window, there are three buttons: "< Back", "Finish", and "Cancel".

**Figure 16: Wireless Security - None**

No security is used. Anyone using the correct SSID can connect to your network.

## Security Settings - WEP

This is the 802.11b standard. Data is encrypted before transmission, but the encryption system is not very strong.



The screenshot shows the same window as Figure 16, but with WEP settings. The "Security System:" dropdown is set to "WEP". Below it, "Authentication Type:" is set to "Automatic" and "WEP Data Encryption:" is set to "64 bit (10 Hex chars)". There are four radio buttons labeled "Key 1:", "Key 2:", "Key 3:", and "Key 4:", each followed by an empty text input field. "Key 1:" is selected. Below the keys is a "Passphrase:" label followed by an empty text input field and a "Generate Keys" button. At the bottom right, there are three buttons: "< Back", "Finish", and "Cancel".

**Figure 17: WEP Wireless Security Screen**



## Data - WEP Screen

WEP	
<b>Authentication</b>	<p>Normally, you can leave this at "Automatic", so that Wireless Stations can use either method ("Open System" or "Shared Key").</p> <p>If you wish to use a particular method, select the appropriate value - "Open System" or "Shared Key". All Wireless stations must then be set to use the same method.</p>
<b>Data Encryption</b>	<p>Select the desired option, and ensure your Wireless stations have the same setting:</p> <ul style="list-style-type: none"> <li>• <b>64 Bit (10 Hex char)</b> - Keys are 10 Hex (5 ASCII) characters.</li> <li>• <b>128 Bit (26 Hex char)</b> - Keys are 26 Hex (13 ASCII) characters.</li> </ul>
<b>Key</b>	<p>Select the key you wish to be the default. Transmitted data is ALWAYS encrypted using the Default Key; the other Keys are for decryption only.</p> <p>You must enter a <b>Key Value</b> for the <b>Default Key</b>.</p>
<b>Key Value</b>	<p>Enter the key value or values you wish to use. The <b>Key</b> is required, the other keys are optional. Other stations must have the same key.</p>
<b>Passphrase</b>	<p>If desired, you can generate a key from a phrase, instead of entering the key value directly. Enter the desired phrase, and click the "Generate Keys" button.</p>

## Security Settings - WPA-PSK

Like WEP, data is encrypted before transmission. WPA is more secure than WEP, and should be used if possible. The PSK (Pre-shared Key) must be entered on each Wireless station. The 256Bit encryption key is derived from the PSK, and changes frequently.

Setup Wizard - Wireless Security/Encryption Setting for AP

Set the wireless security and encryption.

Security System:

PSK:

Encryption:

< Back Finish Cancel

Figure 18: WPA-PSK Wireless Security Screen

## Data - WPA-PSK Screen

WPA-PSK	
<b>PSK</b>	Enter the key value. Data is encrypted using a 256Bit key derived from this key. Other Wireless Stations must use the same key.
<b>Encryption</b>	<u><a href="#">The WPA-PSK standard allows different encryption methods to be used. Select the desired option. Wireless Stations must use the same encryption method.</a></u>

## Security Settings - WPA2-PSK

This is a further development of WPA-PSK, and offers even greater security, using the AES (Advanced Encryption Standard) method of encryption.

The screenshot shows a web-based configuration interface titled "Setup Wizard - Wireless Security/Encryption Setting for AP". The main heading is "Set the wireless security and encryption." Below this, there are three configuration fields: "Security System:" with a dropdown menu currently showing "WPA2-PSK", "PSK:" with an empty text input field, and "Encryption:" with a dropdown menu currently showing "TKIP". At the bottom right of the form, there are three buttons: "< Back", "Finish", and "Cancel".

Figure 19: WPA2-PSK Wireless Security Screen

### Data - WPA2-PSK Screen

WPA2-PSK	
PSK	Enter the key value. Data is encrypted using a 256Bit key derived from this key. Other Wireless Stations must use the same key.
Encryption	<u>The WPA2-PSK standard allows different encryption methods to be used. Select the desired option. Wireless Stations must use the same encryption method.</u>

## Security Settings - 802.1x

This uses the 802.1x standard for client authentication, and WEP for data encryption. If this option is selected:

- This Access Point must have a "client login" on the Radius Server.
- Each user must have a "user login" on the Radius Server. Normally, a Certificate is used to authenticate each user. See Chapter4 for details of user configuration.
- Each user's wireless client must support 802.1x.
- All data transmission is encrypted using the WEP standard. You only have to select the WEP key size; the WEP key is automatically generated.

The screenshot shows a web-based configuration window titled "Setup Wizard - Wireless Security/Encryption Setting for AP". The main heading is "Set the wireless security and encryption." Below this, there are several configuration fields:

- Security System:** A dropdown menu with "WPA-802.1x" selected.
- Server Address:** An empty text input field.
- Radius Port:** A text input field containing the value "1812".
- Shared Key:** An empty text input field.
- Encryption:** A dropdown menu with "TKIP" selected.

At the bottom right of the window, there are three buttons: "< Back", "Finish", and "Cancel".

**Figure 20: 802.1x Wireless Security Screen**

### Data - 802.1x Screen

<b>Server Address</b>	Enter the server address here.
<b>Radius Port</b>	Enter the port number used for connections to the Radius Server.
<b>Shared Key</b>	Enter the shared key. Data is encrypted using a key derived from the network key. Other Wireless Stations must use the same key. The key must be from 8 to 63 characters in length.
<b>Encryption</b>	The encryption method is TKIP. Wireless Stations must also use TKIP.

## MAC Filter

Use this feature to determine which Wireless stations can use the Access Point.

Click *MAC Filter* on the main menu to view a screen like the following.

**Figure 21: MAC Filter Screen**

### Data - MAC Filter Screen

MAC Filter	
<b>Allow access by ...</b>	<p>Use this feature to determine which Wireless stations can use the Access Point. The options are:</p> <ul style="list-style-type: none"> <li>• <b>All Wireless Stations</b> - All wireless stations can use the access point, provided they have the correct SSID and security settings.</li> <li>• <b>Trusted Wireless stations only</b> - Only wireless stations you designate as "Trusted" can use the Access Point, even if they have the correct SSID and security settings.</li> </ul> <p>This feature uses the MAC address to identify Wireless stations. The MAC address is a low-level network identifier which is unique to each PC or network device. To define the trusted wireless stations, use the "Set Stations" button.</p>
<b>Set Stations Button</b>	Click this button to manage the trusted PC database.

**Noted:** The maximum amount of MAC addresses is 20, no more can be added.

## Trusted Wireless Stations

To change the list of trusted wireless stations, use the *Modify List* button on the *Access Control* screen. You will see a screen like the sample below.

Figure 22: Trusted Wireless Stations

### Data - Trusted Wireless Stations

<b>Trusted Wireless Stations</b>	This lists any Wireless Stations which you have designated as "Trusted".
<b>Other Wireless Stations</b>	This list any Wireless Stations detected by the Access Point, which you have not designated as "Trusted".
<b>Name</b>	The name assigned to the Trusted Wireless Station. Use this when adding or editing a Trusted Station.
<b>Address</b>	The MAC (physical) address of the Trusted Wireless Station. Use this when adding or editing a Trusted Station.
<b>Buttons</b>	
<<	<p>Add a Trusted Wireless Station to the list (move from the "Other Stations" list).</p> <ul style="list-style-type: none"> <li>Select an entry (or entries) in the "Other Stations" list, and click the "&lt;&lt;" button.</li> <li>Enter the Address (MAC or physical address) of the wireless station, and click the "Add" button.</li> </ul>
>>	<p>Delete a Trusted Wireless Station from the list (move to the "Other Stations" list).</p> <ul style="list-style-type: none"> <li>Select an entry (or entries) in the "Trusted Stations" list.</li> <li>Click the "&gt;&gt;" button.</li> </ul>

---

<b>Edit</b>	To change an existing entry in the "Trusted Stations" list, select it and click this button. <ol style="list-style-type: none"><li>1. Select the Station in the "Trusted Station" list.</li><li>2. Click the "Edit" button. The address will be copied to the "Address" field, and the "Add" button will change to "Update".</li><li>3. Edit the address (MAC or physical address) as required.</li><li>4. Click "Update" to save your changes.</li></ol>
<b>Add</b>	To add a Trusted Station which is not in the "Other Wireless Stations" list, enter the required data and click this button.
<b>Clear</b>	Clear the <i>Name</i> and <i>Address</i> fields.

## Wi-Fi Protected Setup

Click *WiFi Protected Setup* on the main menu to view a screen like the following:

**Figure 23: WPS Screen**

### Data - WPS Screen

WPS	
<b>Enable WPS</b>	WPS (Wi-Fi Protected Setup) was created and developed by the Wi-Fi Alliance. This feature can help to simplify the procedure of configuring security on a wireless network instead of entering all the required data manually. WPS only works with either WPA-PSK or WPA2-PSK encryption method.
<b>AP PIN Code</b>	Enter the desired pin value manually or click the <i>Generate</i> button to have the new pin code displayed in the field.
<b>Input Client PIN Code</b>	Enter the PIN code from the client device in this field and click <i>OK</i> button.
<b>Push Button Config</b>	Push a simulated push button in the software on the wireless client to initiate WPS mode. You will also need to press the actual WPS button of the Wireless access Point. Click the <i>Start PBC</i> button.



# Chapter 4

## PC and Server Configuration



*This Chapter details the PC Configuration required for each PC on the local LAN.*

### Overview

All Wireless Stations need to have settings which match the Wireless Access Point. These settings depend on the mode in which the Access Point is being used.

- If using WEP or WPA-PSK, it is only necessary to ensure that each Wireless station's settings match those of the Wireless Access Point, as described below.
- For 802.1x modes, configuration is much more complex. The Radius Server must be configured correctly, and setup of each Wireless station is also more complex.

### Using WEP

For each of the following items, each Wireless Station must have the same settings as the Wireless Access Point.

<b>Mode</b>	On each PC, the mode must be set to <i>Infrastructure</i> .
<b>SSID (ESSID)</b>	This must match the value used on the Wireless Access Point. The default value is <b>wireless</b> <b>Note! The SSID is case sensitive.</b>
<b>Wireless Security</b>	<ul style="list-style-type: none"><li>• Each Wireless station must be set to use WEP data encryption.</li><li>• The Key size (64 bit, 128 bit, 152 bit) must be set to match the Access Point.</li><li>• The keys values on the PC must match the key values on the Access Point.</li></ul> <b>Note:</b> On some systems, the key sizes may be shown as 40bit, 104bit, and 128bit instead of 64 bit, 128 bit and 152bit. This difference arises because the key input by the user is 24 bits less than the key size used for encryption.

## Using WPA-PSK/WPA2-PSK

For each of the following items, each Wireless Station must have the same settings as the Wireless Access Point.

<b>Mode</b>	On each PC, the mode must be set to <i>Infrastructure</i> .
<b>SSID (ESSID)</b>	This must match the value used on the Wireless Access Point. The default value is <b>wireless</b> <b>Note! The SSID is case sensitive.</b>
<b>Wireless Security</b>	On each client, Wireless security must be set to WPA-PSK. <ul style="list-style-type: none"> <li>• The <b>Pre-shared Key</b> entered on the Access Point must also be entered on each Wireless client.</li> <li>• The <b>Encryption</b> method (e.g. TKIP, AES) must be set to match the Access Point.</li> </ul>

## 802.1x Server Setup (Windows 2000 Server)

This section describes using *Microsoft Internet Authentication Server* as the Radius Server, since it is the most common Radius Server available that supports the EAP-TLS authentication method.

The following services on the Windows 2000 Domain Controller (PDC) are also required:

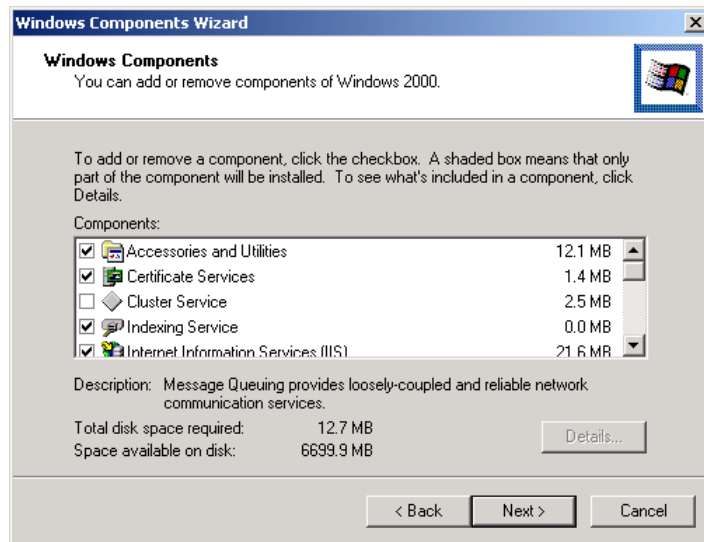
- dhcpcd
- dns
- rras
- webservice (IIS)
- Radius Server (Internet Authentication Service)
- Certificate Authority

### Windows 2000 Domain Controller Setup

1. Run *dcpromo.exe* from the command prompt.
2. Follow all of the default prompts, ensure that DNS is installed and enabled during installation.

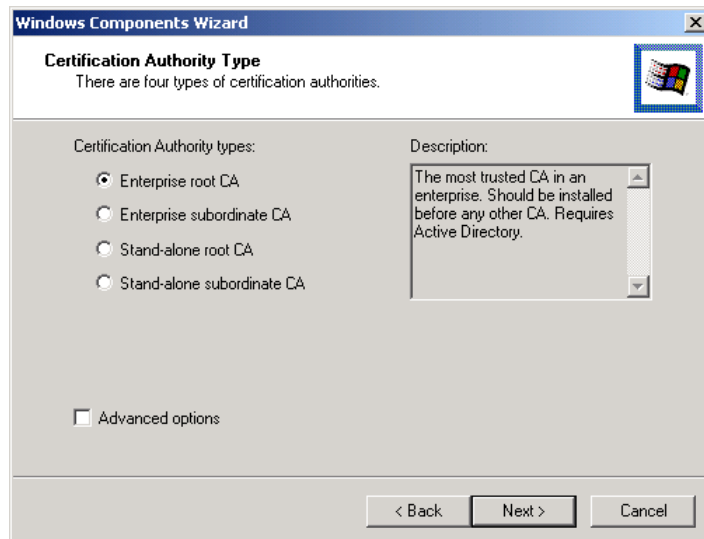
### Services Installation

1. Select the *Control Panel - Add/Remove Programs*.
2. Click *Add/Remove Windows Components* from the left side.
3. Ensure that the following components are activated (selected):
  - *Certificate Services*. After enabling this, you will see a warning that the computer cannot be renamed and joined after installing certificate services. Select *Yes* to select certificate services and continue
  - *World Wide Web Server*. Select *World Wide Web Server* on the *Internet Information Services (IIS)* component.
  - From the *Networking Services* category, select *Dynamic Host Configuration Protocol (DHCP)*, and *Internet Authentication Service* (DNS should already be selected and installed).



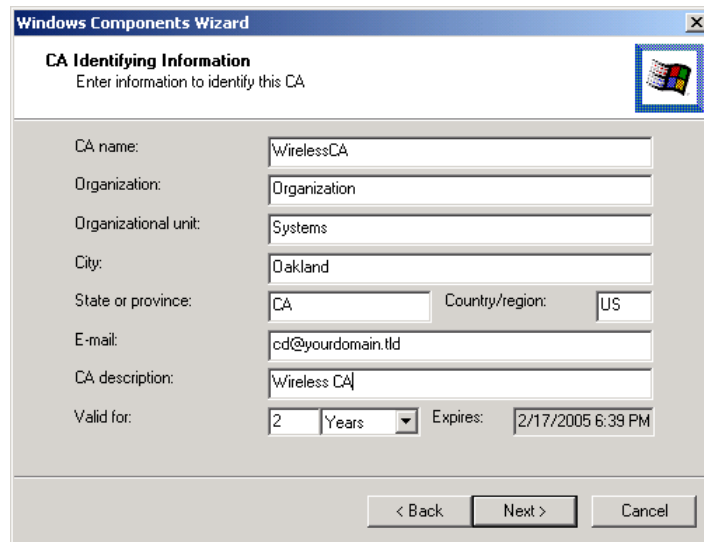
**Figure 24: Components Screen**

4. Click *Next*.
5. Select the *Enterprise root CA*, and click *Next*.



**Figure 25: Certification Screen**

6. Enter the information for the Certificate Authority, and click *Next*.

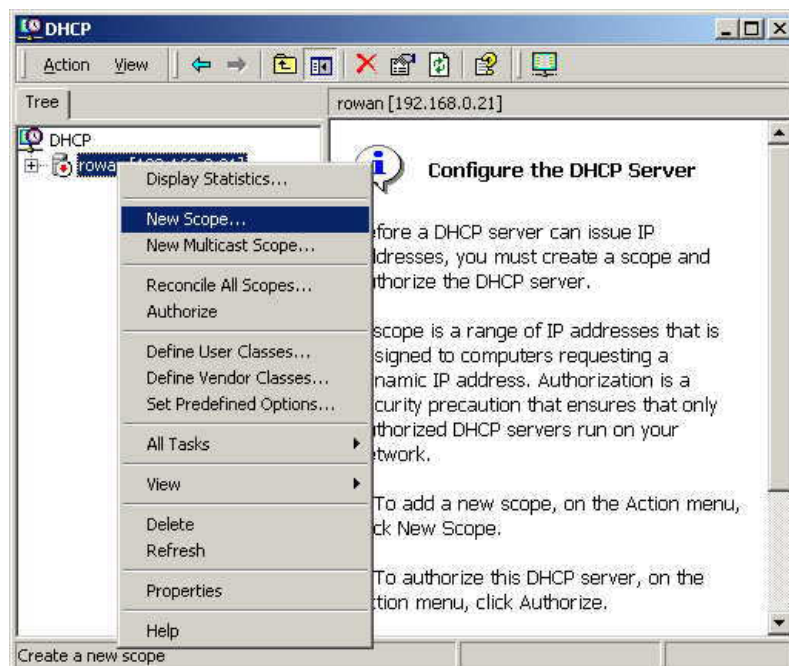


**Figure 26: CA Screen**

7. Click *Next* if you don't want to change the CA's configuration data.
8. Installation will warn you that Internet Information Services are running, and must be stopped before continuing. Click *Ok*, then *Finish*.

## DHCP server configuration

1. Click on the *Start - Programs - Administrative Tools - DHCP*
2. Right-click on the server entry as shown, and select *New Scope*.



**Figure 27: DHCP Screen**

3. Click *Next* when the New Scope Wizard Begins.
4. Enter the name and description for the scope, click *Next*.
5. Define the IP address range. Change the subnet mask if necessary. Click *Next*.

**Figure 28: IP Address Screen**

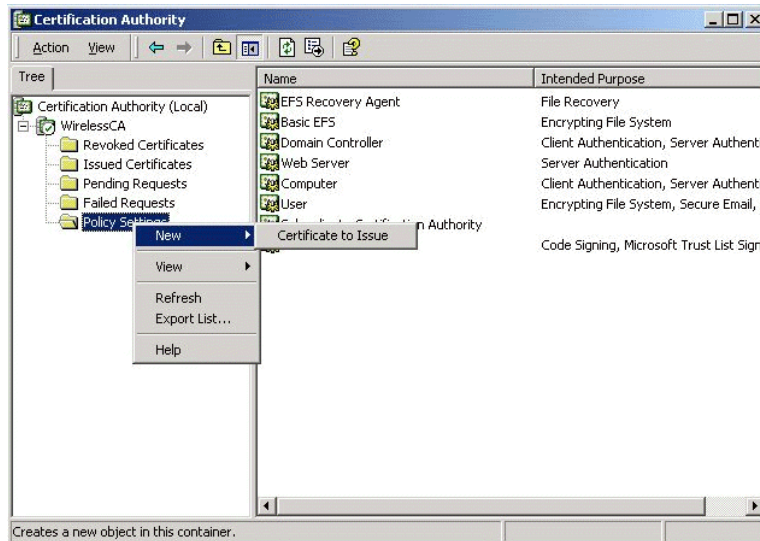
6. Add exclusions in the address fields if required. If no exclusions are required, leave it blank. Click *Next*.
7. Change the *Lease Duration* time if preferred. Click *Next*.
8. Select *Yes, I want to configure these options now*, and click *Next*.
9. Enter the router address for the current subnet. The router address may be left blank if there is no router. Click *Next*.
10. For the Parent domain, enter the domain you specified for the domain controller setup, and enter the server's address for the IP address. Click *Next*.

**Figure 29: DNS Screen**

11. If you don't want a WINS server, just click *Next*.
12. Select *Yes, I want to activate this scope now*. Click *Next*, then *Finish*.
13. Right-click on the server, and select *Authorize*. It may take a few minutes to complete.

## Certificate Authority Setup

1. Select *Start - Programs - Administrative Tools - Certification Authority*.
2. Right-click *Policy Settings*, and select *New - Certificate to Issue*.



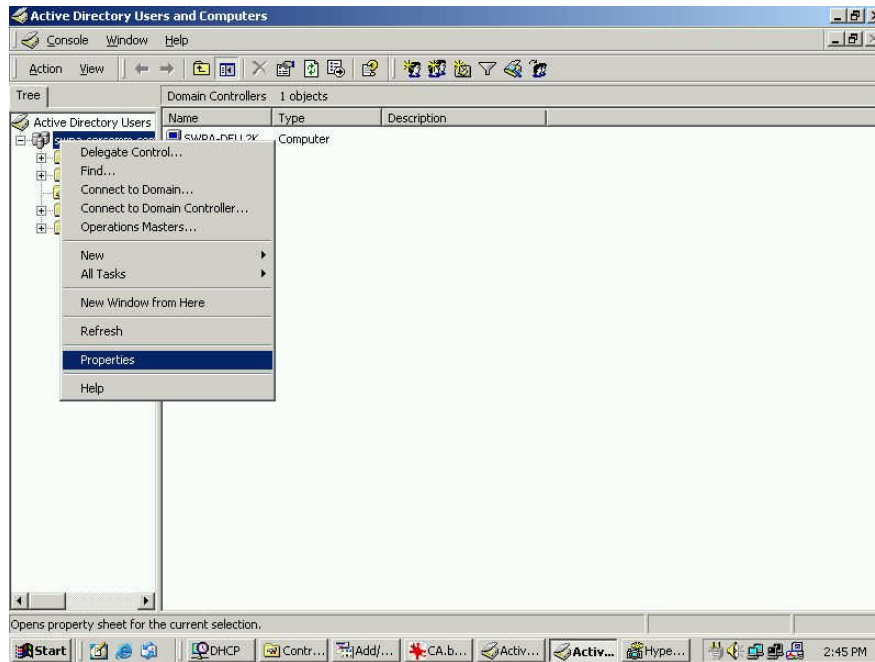
**Figure 30: Certificate Authority Screen**

3. Select *Authenticated Session* and *Smartcard Logon* (select more than one by holding down the Ctrl key). Click *OK*.



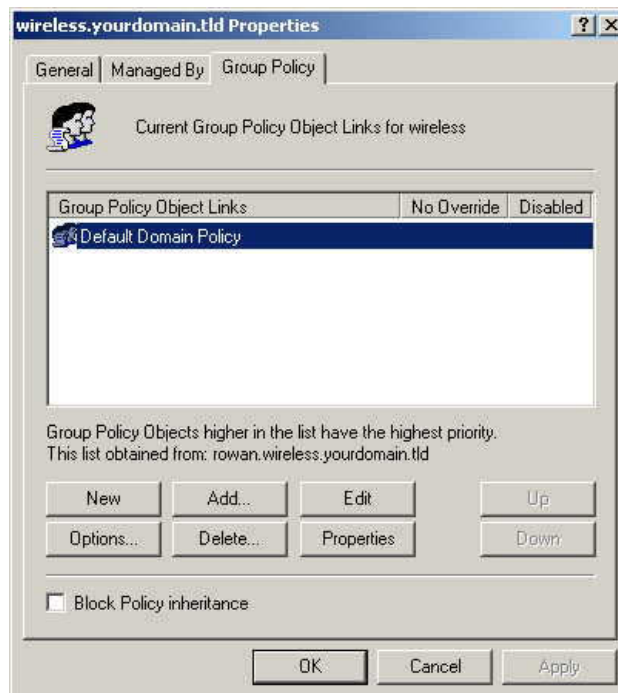
**Figure 31: Template Screen**

4. Select *Start - Programs - Administrative Tools - Active Directory Users and Computers*.
5. Right-click on your active directory domain, and select *Properties*.



**Figure 32: Active Directory Screen**

6. Select the *Group Policy* tab, choose *Default Domain Policy* then click *Edit*.



**Figure 33: Group Policy Tab**

7. Select *Computer Configuration - Windows Settings - Security Settings - Public Key Policies*, right-click *Automatic Certificate Request Settings - New - Automatic Certificate Request*.



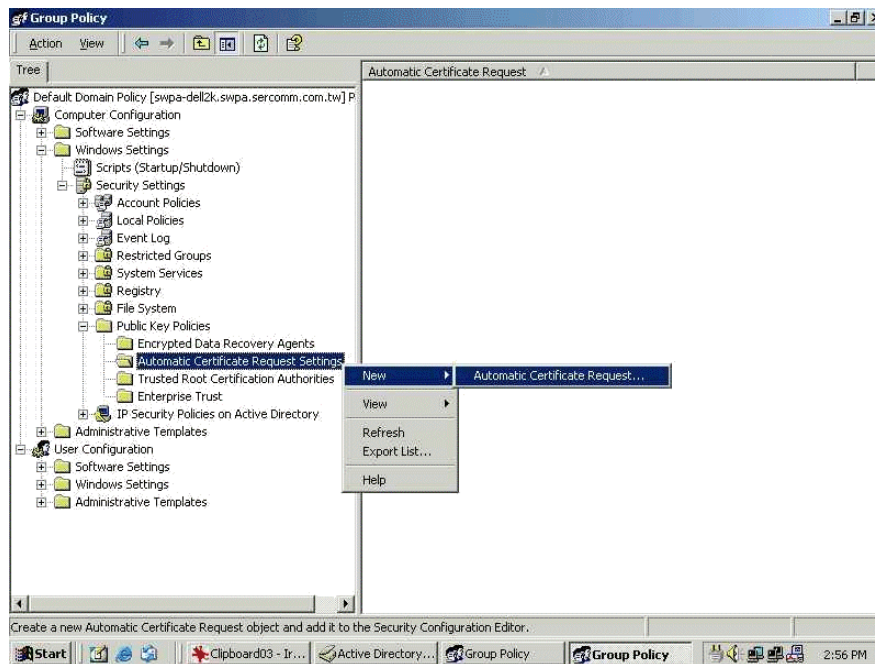


Figure 34: Group Policy Screen

8. When the Certificate Request Wizard appears, click *Next*.
9. Select *Computer*, then click *Next*.

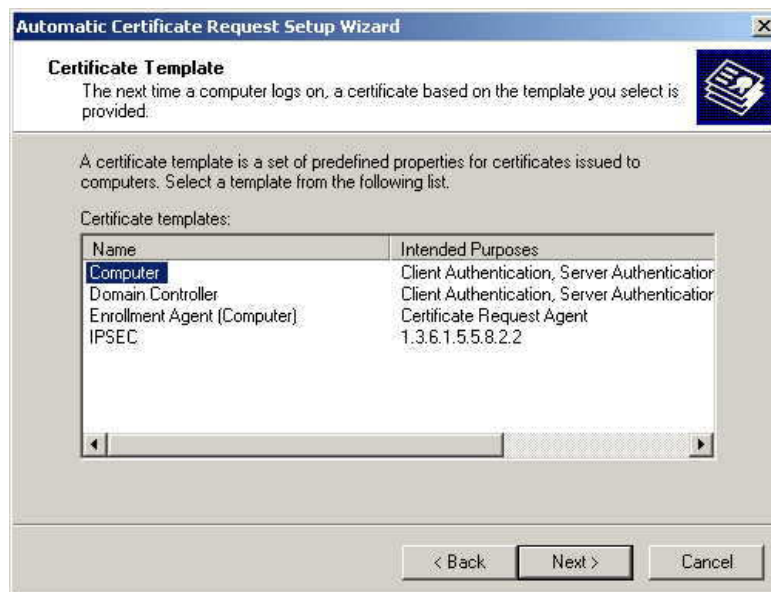
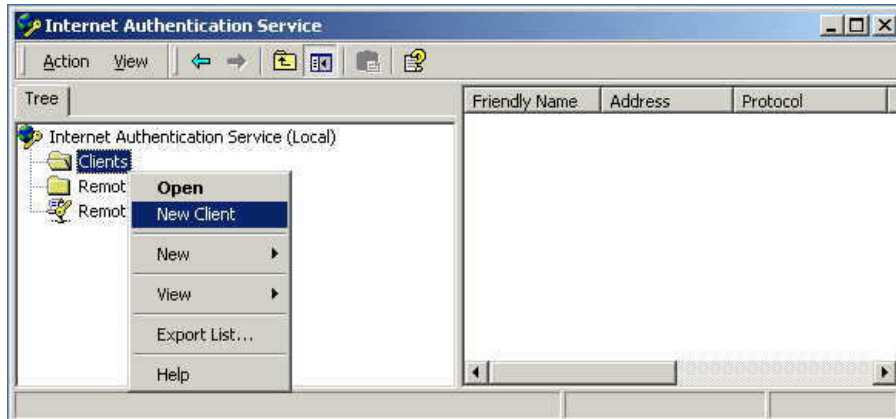


Figure 35: Certificate Template Screen

10. Ensure that your certificate authority is checked, then click *Next*.
11. Review the policy change information and click *Finish*.
12. Click *Start - Run*, type `cmd` and press enter.  
 Enter `secdit /refreshpolicy machine_policy`  
 This command may take a few minutes to take effect.

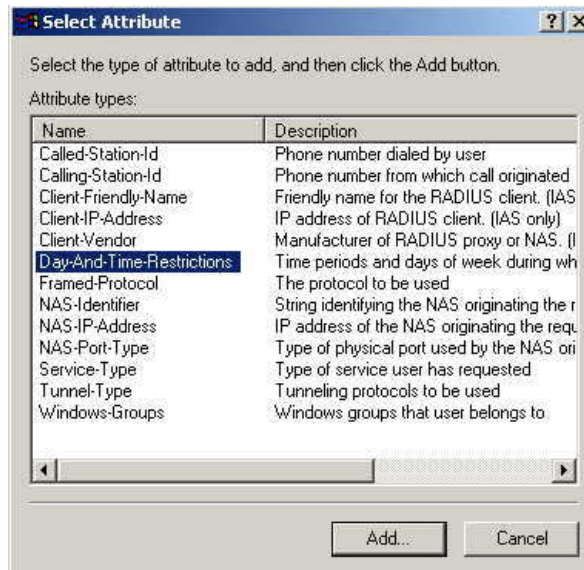
## Internet Authentication Service (Radius) Setup

1. Select *Start - Programs - Administrative Tools - Internet Authentication Service*
2. Right-click on *Clients*, and select *New Client*.



**Figure 36: Service Screen**

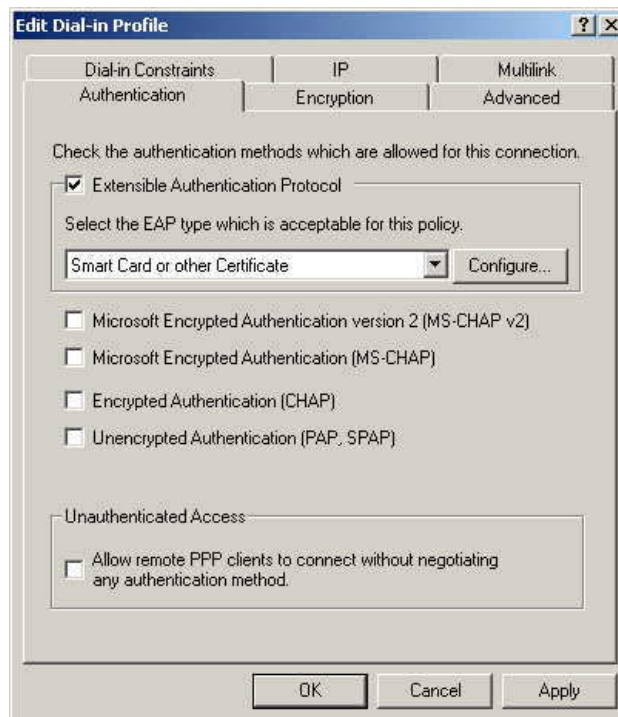
3. Enter a name for the access point, click *Next*.
4. Enter the address or name of the Wireless Access Point, and set the shared secret, as entered on the *Security Settings* of the Wireless Access Point.
5. Click *Finish*.
6. Right-click on *Remote Access Policies*, select *New Remote Access Policy*.
7. Assuming you are using EAP-TLS, name the policy `eap-tls`, and click *Next*.
8. Click *Add...*  
If you don't want to set any restrictions and a condition is required, select *Day-And-Time-Restrictions*, and click *Add...*



**Figure 37: Attribute Screen**

9. Click *Permitted*, then *OK*. Select *Next*.
10. Select *Grant remote access permission*. Click *Next*.

11. Click *Edit Profile...* and select the *Authentication* tab. Enable *Extensible Authentication Protocol*, and select *Smart Card or other Certificate*. Deselect other authentication methods listed. Click *OK*.



**Figure 38: Authentication Screen**

12. Select *No* if you don't want to view the help for EAP. Click *Finish*.

## Remote Access Login for Users

1. Select *Start - Programs - Administrative Tools- Active Directory Users and Computers*.
2. Double click on the user who you want to enable.
3. Select the *Dial-in* tab, and enable *Allow access*. Click *OK*.

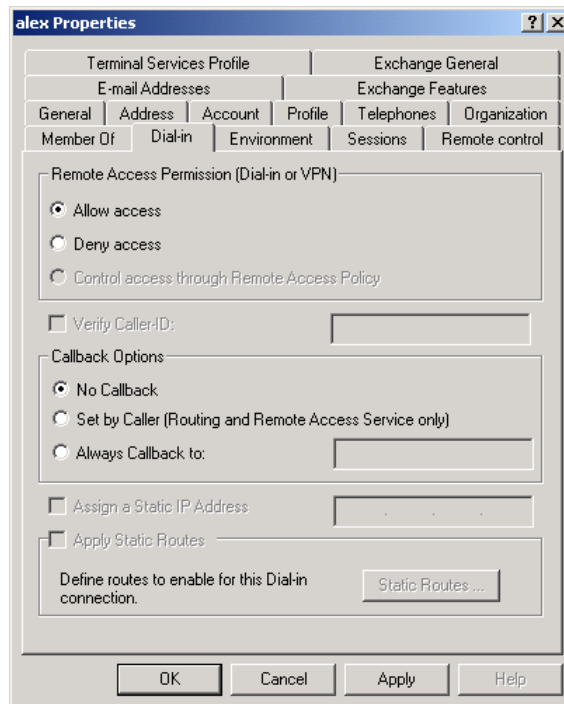


Figure 39: Dial-in Screen

## 802.1x Client Setup on Windows XP

Windows XP ships with a complete 802.1x client implementation. If using Windows 2000, you can install SP3 (Service Pack 3) to gain the same functionality.

If you don't have either of these systems, you must use the 802.1x client software provided with your wireless adapter. Refer to your vendor's documentation for setup instructions.

The following instructions assume that:

- You are using Windows XP
- You are connecting to a Windows 2000 server for authentication.
- You already have a login (User name and password) on the Windows 2000 server.

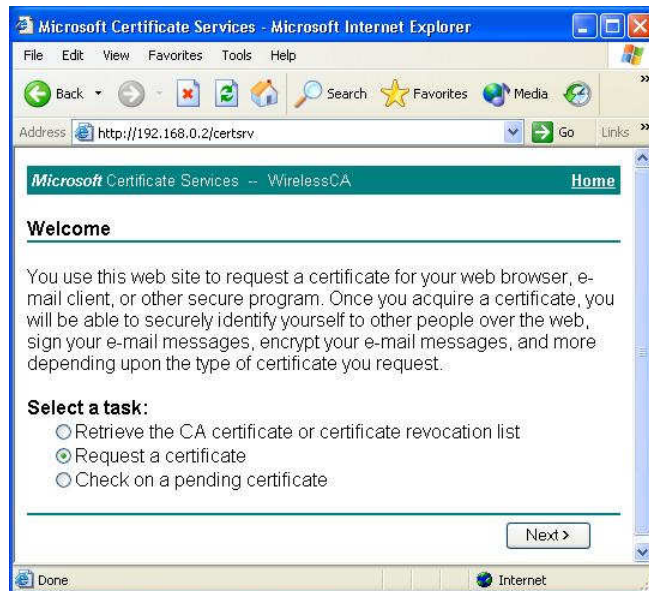
### Client Certificate Setup

1. Connect to a network which doesn't require port authentication.
2. Start your Web Browser. In the *Address* box, enter the IP address of the Windows 2000 Server, followed by */certsrv*  
e.g `http://192.168.0.2/certsrv`
3. You will be prompted for a user name and password. Enter the *User name* and *Password* assigned to you by your network administrator, and click *OK*.



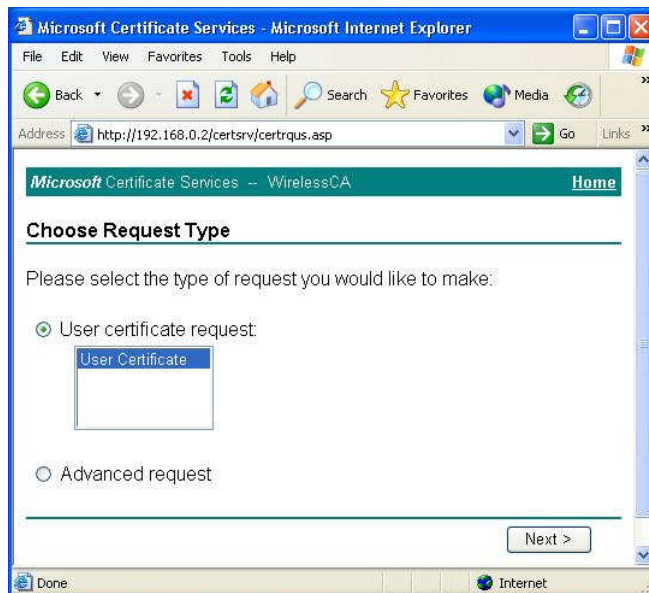
**Figure 40: Connect Screen**

4. On the first screen (below), select *Request a certificate*, click *Next*.



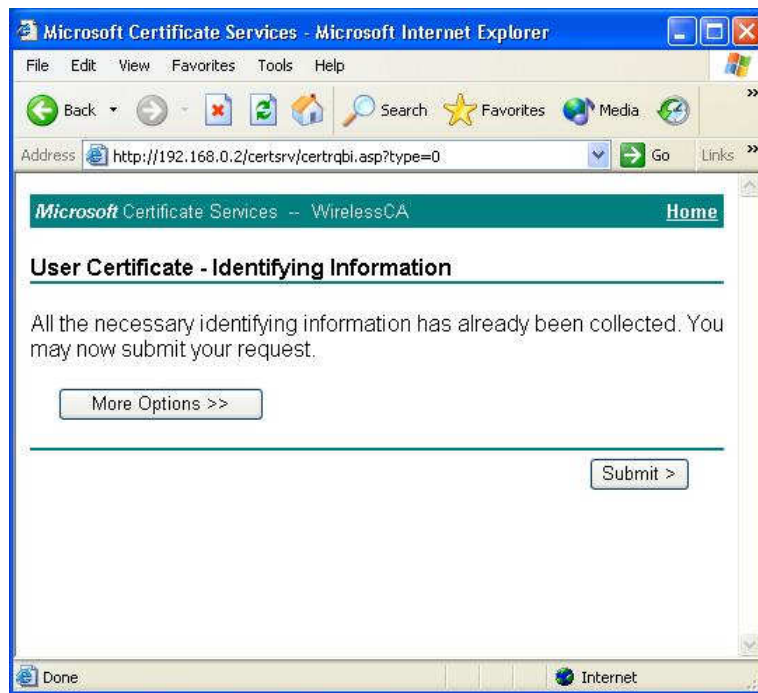
**Figure 41: Wireless CA Screen**

5. Select *User certificate request* and select *User Certificate*, then click *Next*.



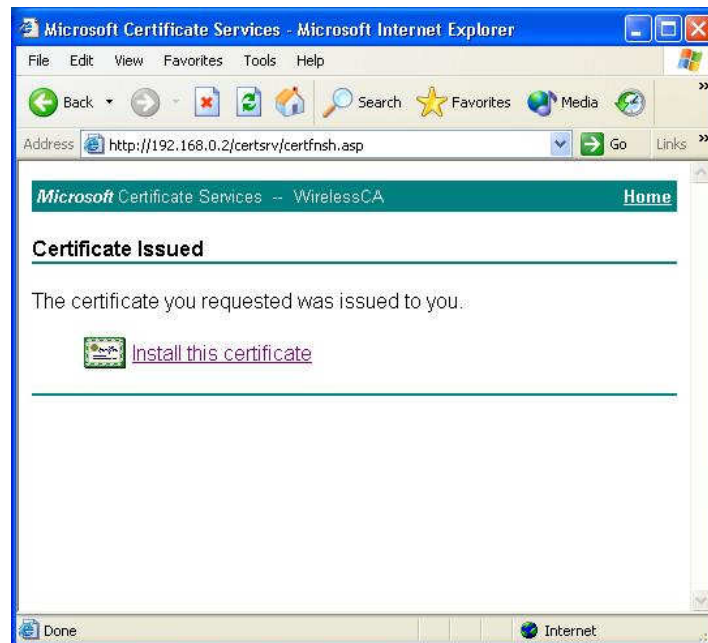
**Figure 42: Request Type Screen**

6. Click *Submit*.



**Figure 43: Identifying Information Screen**

7. A message will be displayed, then the certificate will be returned to you. Click *Install this certificate*.



**Figure 44: Certificate Issued Screen**

8. . You will receive a confirmation message. Click *Yes*.



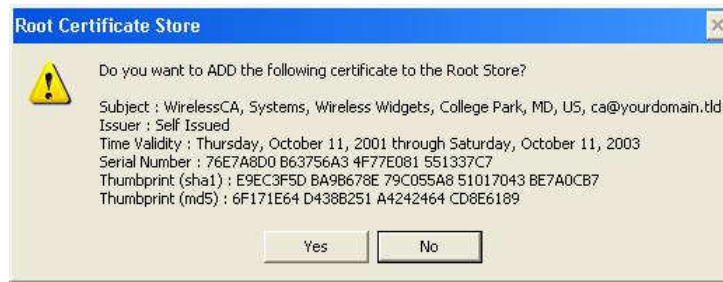


Figure 45: Root Certificate Screen

9. Certificate setup is now complete.

## 802.1x Authentication Setup

1. Open the properties for the wireless connection, by selecting *Start - Control Panel - Network Connections*.
2. Right Click on the *Wireless Network Connection*, and select *Properties*.
3. Select the *Authentication* Tab, and ensure that *Enable network access control using IEEE 802.1X* is selected, and *Smart Card or other Certificate* is selected from the EAP type.

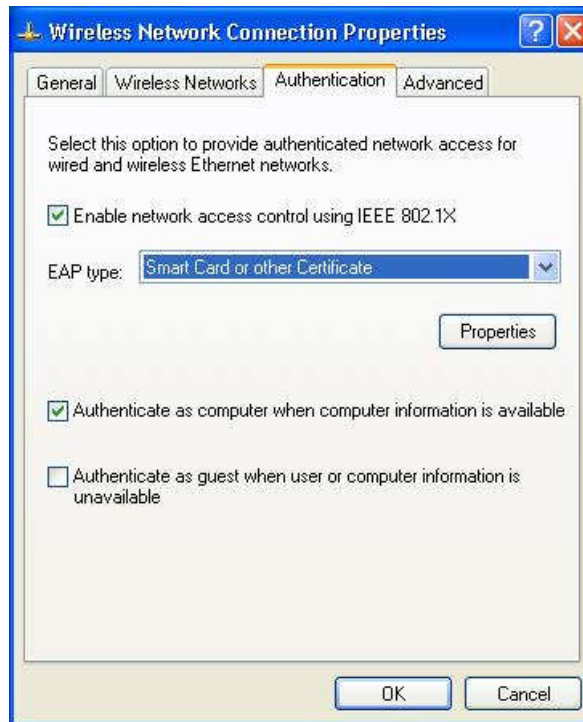


Figure 46: Authentication Tab

## Encryption Settings

The Encryption settings must match the APs (Access Points) on the Wireless network you wish to join.

- Windows XP will detect any available Wireless networks, and allow you to configure each network independently.

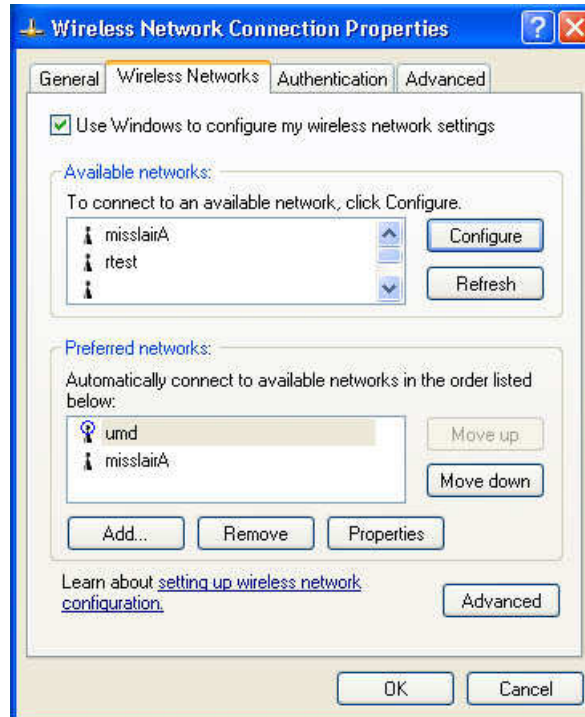


- Your network administrator can advise you of the correct settings for each network. 802.1x networks typically use EAP-TLS. This is a dynamic key system, so there is no need to enter key values.

## Enabling Encryption

To enable encryption for a wireless network, follow this procedure:

1. Click on the *Wireless Networks* tab.



**Figure 47: Wireless Networks Screen**

2. Select the wireless network from the *Available Networks* list, and click *Configure*.
3. Select and enter the correct values, as advised by your Network Administrator. For example, to use EAP-TLS, you would enable *Data encryption*, and click the checkbox for the setting *The key is provided for me automatically*, as shown below.



**Figure 48: Properties Screen**

Setup for Windows XP and 802.1x client is now complete.

## Using 802.1x Mode (without WPA)

This is very similar to using WPA-Enterprise.

The only difference is that on your client, you must NOT enable the setting *The key is provided for me automatically*.

Instead, you must enter the WEP key manually, ensuring it matches the WEP key used on the Access Point.

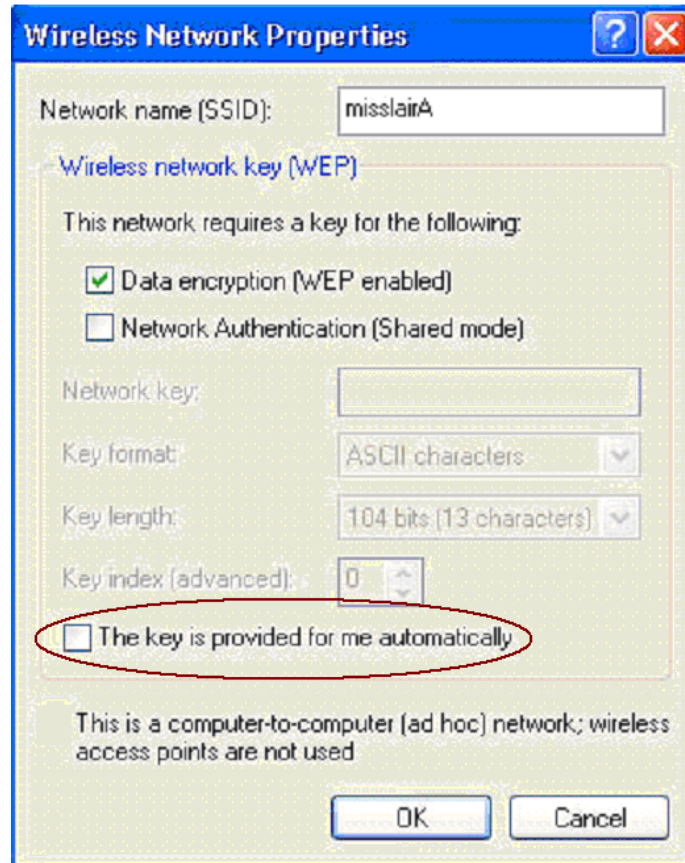


Figure 49: Properties Screen

**Note:**

On some systems, the "64 bit" WEP key is shown as "40 bit" and the "128 bit" WEP key is shown as "104 bit". This difference arises because the key input by the user is 24 bits less than the key size used for encryption.

# Chapter 5

## Access Point Management



*This Chapter explains when and how to use the Wireless Access Point's "Management" Features.*

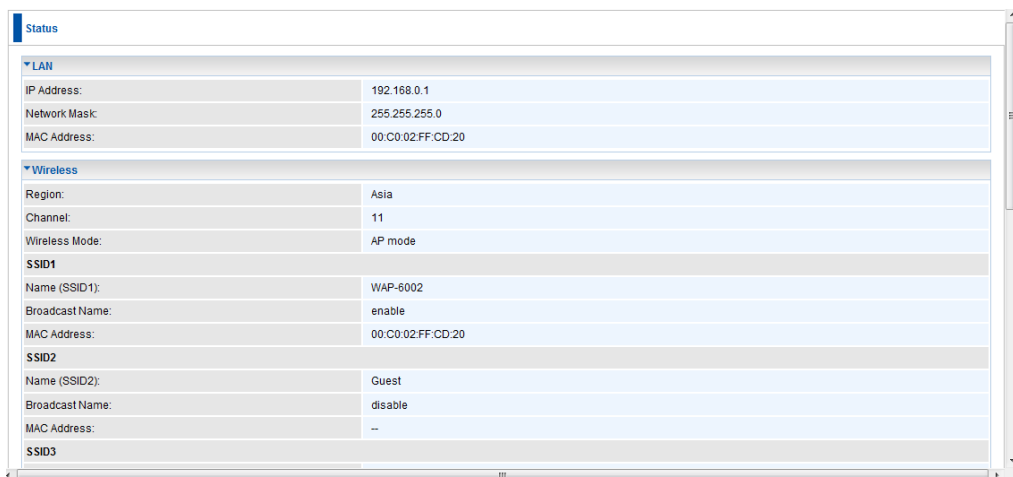
### Overview

This Chapter covers the following features, available on the Wireless Access Point's *Management* menu.

- Status
- Password
- Config File
- Upgrade Firmware

### Status Screen

Use the *Status* link on the main menu to view this screen.



**Figure 50: Status Screen**

**Data - Status Screen**

<b>Ether</b>	
<b>IP Address</b>	The IP Address of the Wireless Access Point.
<b>Network Mask</b>	The Network Mask (Subnet Mask) for the IP Address above.
<b>MAC Address</b>	The MAC (physical) address of the Wireless Access Point.
<b>Wireless</b>	
<b>Region</b>	The current region, as set on the Wireless screen.
<b>Channel</b>	This shows the Channel currently used, as set on the Wireless screen.
<b>Wireless AP</b>	This indicates whether or not the Wireless Access Point feature is enabled.
<b>Name (SSID 1/2)</b>	It displays the name of the SSID 1/2.
<b>Broadcast Name</b>	This indicates whether or not the SSID is Broadcast. This setting is on the Wireless screen.
<b>MAC Address</b>	The MAC (physical) address of the Wireless Access Point.
<b>System</b>	
<b>Device Name</b>	The current name of the Wireless Access Point. This name is also the "hostname" for users with an "@Home" type connection.
<b>Firmware Version</b>	The version of the current firmware installed.
<b>Current Time</b>	It displays the current time of the system.
<b>Buttons</b>	
<b>Refresh Screen</b>	Update the data displayed on screen.

## Password Screen

The *Password* screen allows you to assign a password to the Wireless Access Point. This password limits access to the configuration interface. The default password is *password*. It is recommended that this be changed, using this screen.

**Figure 51: Password Screen**

### Data - Password Screen

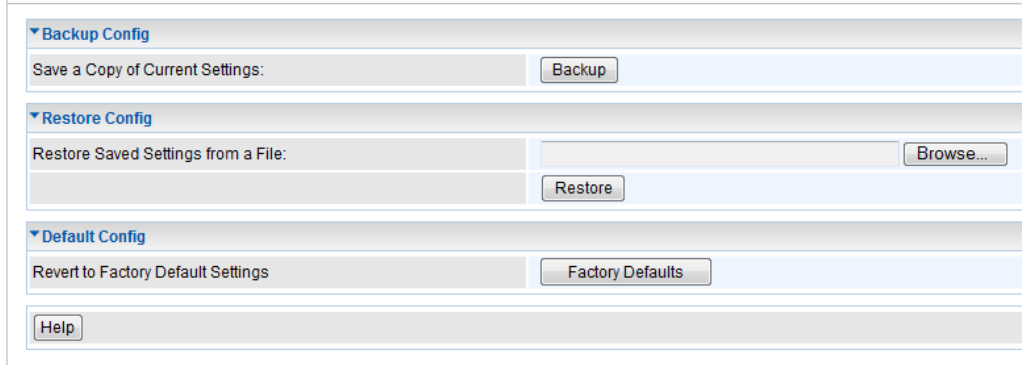
Login	
<b>Old Password</b>	If you wish to change the Admin password, check this field and enter the new login password in the fields below.
<b>New Password</b>	Enter the desired login password.
<b>Verify Password</b>	Re-enter the desired login password.

## Config File

This screen allows you to Backup (download) the configuration file, and to restore (upload) a previously-saved configuration file.

You can also set the Wireless Access Point back to its factory default settings.

To reach this screen, select *Config File* in the main menu.



**Figure 52: Config File Screen**

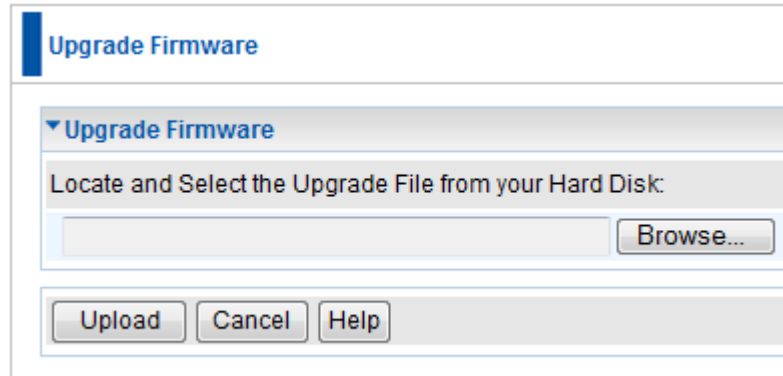
### Data - Config File Screen

Backup	
<b>Save a copy of current settings</b>	<p>Once you have the Access Point working properly, you should back up the settings to a file on your computer. You can later restore the Access Point's settings from this file, if necessary.</p> <p>To create a backup file of the current settings:</p> <ul style="list-style-type: none"> <li>• Click <b>Backup</b>.</li> <li>• If you don't have your browser set up to save downloaded files automatically, locate where you want to save the file, re-name it if you like, and click <b>Save</b>.</li> </ul>
Restore	
<b>Restore saved settings from a file</b>	<p>To restore settings from a backup file:</p> <ol style="list-style-type: none"> <li>1. Click <b>Browse</b>.</li> <li>2. Locate and select the previously saved backup file.</li> <li>3. Click <b>Restore</b></li> </ol>
Defaults	
<b>Revert to factory default settings</b>	<p>To erase the current settings and restore the original factory default settings, click <b>Factory Defaults</b> button.</p> <p><b>Note!</b></p> <ul style="list-style-type: none"> <li>• This will terminate the current connection. The Access Point will be unavailable until it has restarted.</li> <li>• By default, the Access Point will act as a DHCP client, and automatically obtain an IP address. You will need to determine its new IP address in order to re-connect.</li> </ul>

## Firmware Upgrade

The firmware (software) in the Wireless Access Point can be upgraded using your Web Browser.

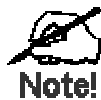
You must first download the upgrade file, and then select *Upgrade Firmware* in the main menu. You will see a screen like the following.



**Figure 53: Firmware Upgrade Screen**

### To perform the Firmware Upgrade:

1. Click the *Browse* button and navigate to the location of the upgrade file.
2. Select the upgrade file. Its name will appear in the *Upgrade File* field.
3. Click the *Upload* button to commence the firmware upgrade.



**Note!**

**The Wireless Access Point is unavailable during the upgrade process, and must restart when the upgrade is completed. Any connections to or through the Wireless Access Point will be lost.**



# Appendix A

## Specifications



### Wireless Access Point

#### Hardware Specifications

SDRAM	16 Mbytes
Flash ROM	4 Mbytes
LAN port	1 x Auto-MDIX RJ 45 for 10/100Mbps Ethernet
Operating temperature	0° C to 40° C
Storage temperature	-20° C to 70° C
Power Adapter	12VDC 1A External
Dimensions	125mm(W) * 123mm(D) * 31mm(H)

#### Wireless Specifications

Standard	Network Standard IEEE 802.11n 2.0, IEEE 802.11b and IEEE 802.11g compliance
Transfer Rate	IEEE802.11b 11M/5.5M/2M/1M
	IEEE802.11g 54M/48M/36M/24M/18M/12M/11M/9M/6M
	IEEE802.11n 2.0 300M/270M/243M/240M/216M/180M/162M/120M/108 Mbps in 40Mhz mode 145M/130M/117M/104M/78Mbps in 20Mhz mode
Bandwidth	IEEE802.11b: Over 5Mbps
	IEEE802.11g: Over 20Mbps
	IEEE802.11n 2.0: Over 60Mbps (20Mhz mode ) /100 Mbps (40Mhz mode)
Channels	2.4GHz ~ 2.485GHz / 1~13 channels
Transmission mode	IEEE802.11b: CCK (11 Mbps, 5.5 Mbps), DQPSK (2 Mbps), DBPSK (1 Mbps)
	IEEE802.11g: OFDM
	IEEE802.11n 2.0: OFDM
Transmit Range	Indoor 200~280m/outdoor 450~600m
Modulation	IEEE802.11b DBPSK / DQPSK / CCK

	IEEE802.11g BPSK / QPSK / 16-QAM/64-QAM/ OFDM
	IEEE802.11n 2.0 BPSK / QPSK / 16-QAM/64-QAM/ OFDM
Security	WEP (64/128), WPA/WPA-PSK (Personal), WPA2/WPA-PSK (Personal), TKIP, AES, Stealth AP (Hidden ESSID), MAC address filtering, WPS button support, Wireless client Isolation, 802.1x w/Radius
Antenna power	1.8dBi

## Firmware Specifications

Feature	Details
Wireless	<ul style="list-style-type: none"> <li>Windows98SE/ME/2000(SP4)/XP SP2/Vista/7/MAC OSX/Linux</li> </ul>
Recommended browser	<ul style="list-style-type: none"> <li>Microsoft Internet Explorer, Safari Ver1.2</li> </ul>
Protocol Support	<ul style="list-style-type: none"> <li>NTP (Network Time Protocol)</li> </ul>
Management	<ul style="list-style-type: none"> <li>Web based configuration</li> <li>SNMP v1/v2c</li> </ul>
Wireless Security	<ul style="list-style-type: none"> <li>WEP (64/128bit), WPA, WPA-PSK, and WPA2-PSK authentication</li> <li>802.1x w/Radius</li> <li>MAC address filtering</li> <li>TKIP</li> <li>AES</li> </ul>
Firmware Upgrade	<ul style="list-style-type: none"> <li>HTTP upgrade</li> </ul>
Operation Mode	<ul style="list-style-type: none"> <li>AP Mode</li> <li>AP Client Mode</li> <li>Bridge Mode</li> <li>WDS Mode</li> <li>Repeater Mode</li> </ul>

## **FCC Statement**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

To assure continued compliance, any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment. (Example - use only shielded interface cables when connecting to computer or peripheral devices).

## **FCC Radiation Exposure Statement**

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

# Appendix B

## Troubleshooting



### Overview

This chapter covers some common problems that may be encountered while using the Wireless Access Point and some possible solutions to them. If you follow the suggested steps and the Wireless Access Point still does not function properly, contact your dealer for further advice.

### General Problems

**Problem 1:** Can't connect to the Wireless Access Point to configure it.

**Solution 1:** Check the following:

- The Wireless Access Point is properly installed, LAN connections are OK, and it is powered ON. Check the LEDs for port status.
- Ensure that your PC and the Wireless Access Point are on the same network segment. (If you don't have a router, this must be the case.)
- If your PC is set to "Obtain an IP Address automatically" (DHCP client), restart it.
- You can use the following method to determine the IP address of the Wireless Access Point, and then try to connect using the IP address, instead of the name.

#### To Find the Access Point's IP Address

1. Open a MS-DOS Prompt or Command Prompt Window.
2. Use the Ping command to "ping" the Wireless Access Point. Enter ping followed by the Default Name of the Wireless Access Point. e.g.  
`ping SC003318`
3. Check the output of the ping command to determine the IP address of the Wireless Access Point, as shown below.

```
Microsoft Windows [Version 5.00.2195]
(C) Copyright 1985-2000 Microsoft Corp.

C:\>ping sc003318

Pinging sc003318 [192.168.0.51] with 32 bytes of data:

Reply from 192.168.0.51: bytes=32 time<10ms TTL=64
Reply from 192.168.0.51: bytes=32 time<10ms TTL=64
Reply from 192.168.0.51: bytes=32 time<10ms TTL=64
Reply from 192.168.0.51: bytes=32 time<10ms TTL=64
```

**Figure 54: Ping**

If your PC uses a Fixed (Static) IP address, ensure that it is using an IP Address which is compatible with the Wireless Access Point. (If no DHCP Server is found, the Wireless Access Point will default to an IP Address and Mask of 192.168.0.1 and 255.255.255.0.) On Windows PCs, you can use *Control Panel-Network* to check the *Properties* for the TCP/IP protocol.

**Problem 2:** My PC can't connect to the LAN via the Wireless Access Point.

**Solution 2** Check the following:

- The SSID and WEP settings on the PC match the settings on the Wireless Access Point.
- On the PC, the wireless mode is set to "Infrastructure"
- If using the *Access Control* feature, the PC's name and address is in the *Trusted Stations* list.
- If using 802.1x mode, ensure the PC's 802.1x software is configured correctly. See Chapter 4 for details of setup for the Windows XP 802.1x client. If using a different client, refer to the vendor's documentation.

# Appendix C

## Windows TCP/IP



### Overview

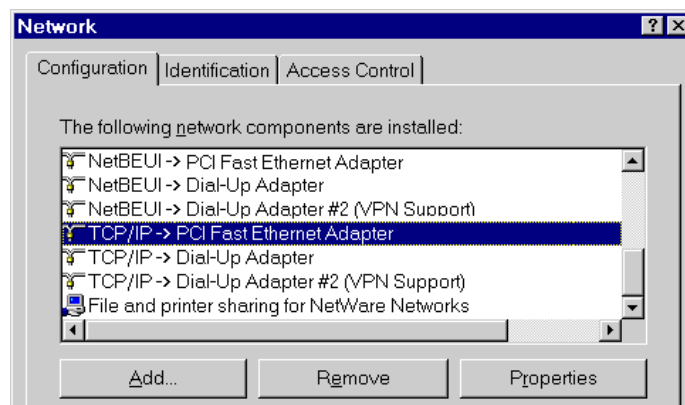
Normally, no changes need to be made.

- By default, the Wireless Access Point will act as a DHCP client, automatically obtaining a suitable IP Address (and related information) from your DHCP Server.
- If using Fixed (specified) IP addresses on your LAN (instead of a DHCP Server), there is no need to change the TCP/IP of each PC. Just configure the Wireless Access Point to match your existing LAN.

The following sections provide details about checking the TCP/IP settings for various types of Windows, should that be necessary.

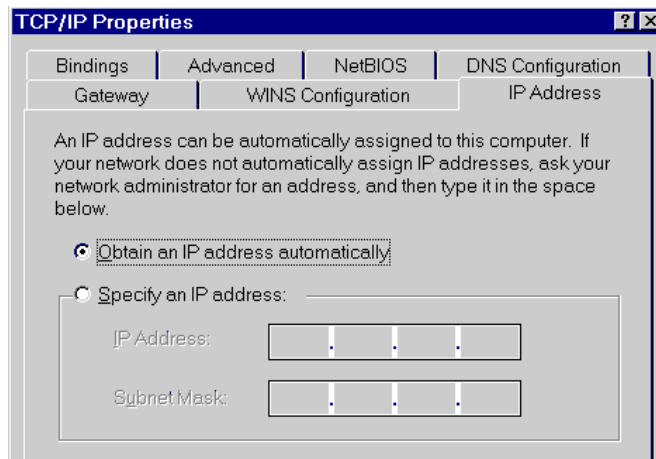
### Checking TCP/IP Settings - Windows 9x/ME:

1. Select *Control Panel - Network*. You should see a screen like the following:



**Figure 55: Network Configuration**

2. Select the *TCP/IP* protocol for your network card.
3. Click on the *Properties* button. You should then see a screen like the following.



**Figure 56: IP Address (Win 95)**

Ensure your TCP/IP settings are correct, as follows:

### **Using DHCP**

To use DHCP, select the radio button *Obtain an IP Address automatically*. This is the default Windows settings. To work correctly, you need a DHCP server on your LAN.

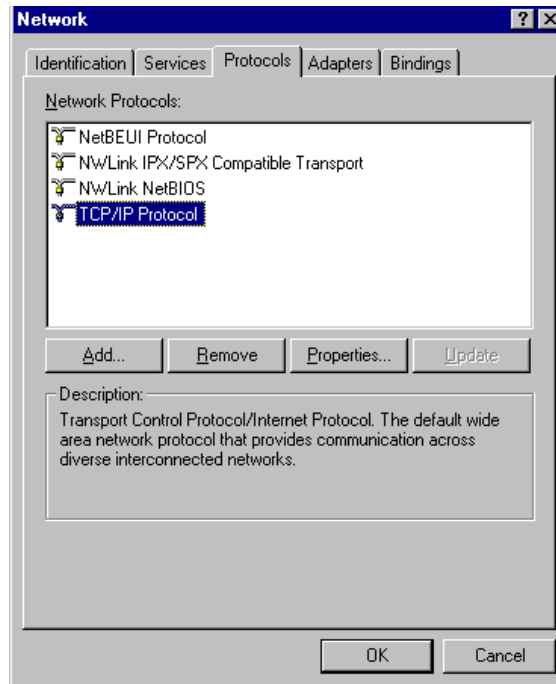
### **Using "Specify an IP Address"**

If your PC is already configured for a fixed (specified) IP address, no changes are required.

(The Administrator should configure the Wireless Access Point with a fixed IP address from the same address range used on the PCs.)

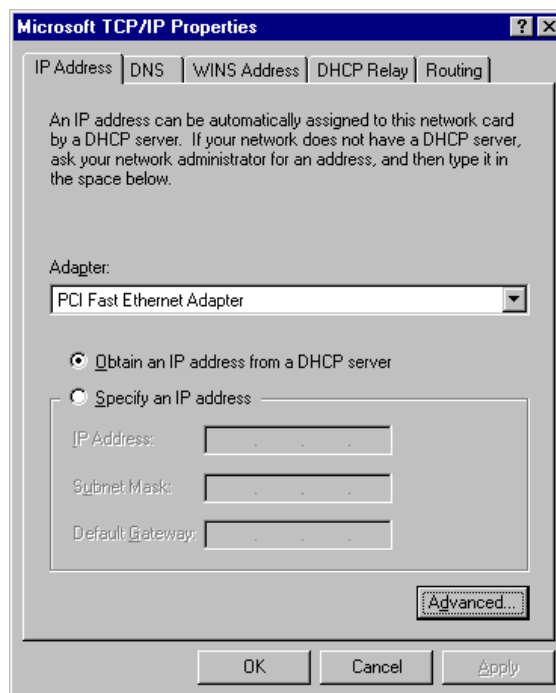
## Checking TCP/IP Settings - Windows NT4.0

1. Select *Control Panel - Network*, and, on the *Protocols* tab, select the TCP/IP protocol, as shown below.



**Figure 57: Windows NT4.0 - TCP/IP**

2. Click the *Properties* button to see a screen like the one below.



**Figure 58: Windows NT4.0 - IP Address**



3. Select the network card for your LAN.
4. Select the appropriate radio button - *Obtain an IP address from a DHCP Server* or *Specify an IP Address*, as explained below.

### **Obtain an IP address from a DHCP Server**

This is the default Windows setting. This is the default Windows settings. To work correctly, you need a DHCP server on your LAN.

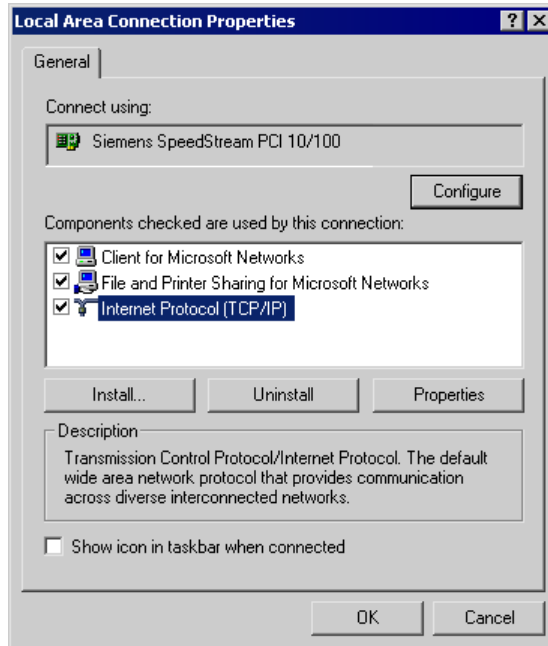
### **Using "Specify an IP Address"**

If your PC is already configured for a fixed (specified) IP address, no changes are required.

(The Administrator should configure the Wireless Access Point with a fixed IP address from the same address range used on the PCs.)

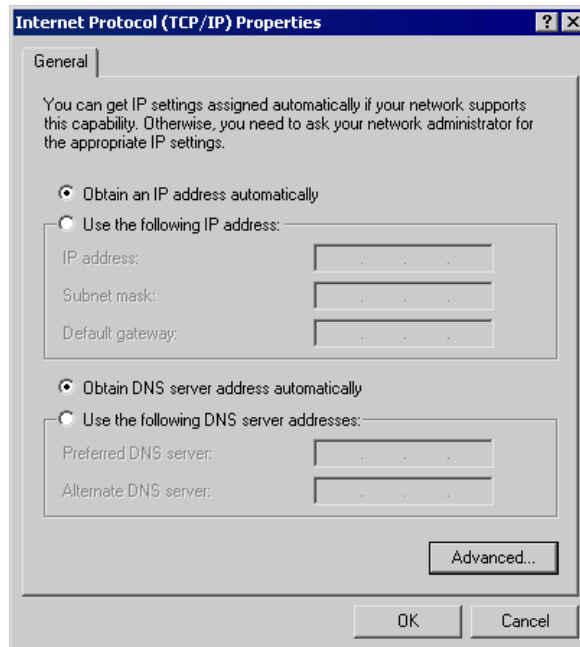
## Checking TCP/IP Settings - Windows 2000

1. Select *Control Panel - Network and Dial-up Connection*.
2. Right click the *Local Area Connection* icon and select *Properties*. You should see a screen like the following:



**Figure 59: Network Configuration (Win 2000)**

3. Select the *TCP/IP* protocol for your network card.
4. Click on the *Properties* button. You should then see a screen like the following.



**Figure 60: TCP/IP Properties (Win 2000)**

5. Ensure your TCP/IP settings are correct:

### **Using DHCP**

To use DHCP, select the radio button *Obtain an IP Address automatically*. This is the default Windows setting. This is the default Windows settings. To work correctly, you need a DHCP server on your LAN.

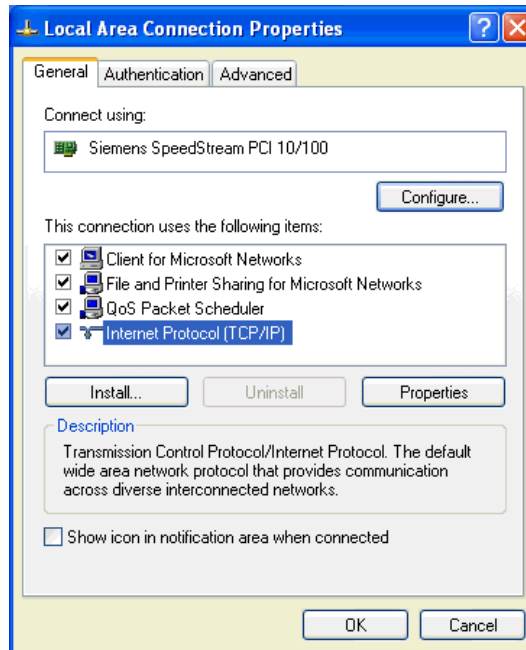
### **Using a fixed IP Address ("Use the following IP Address")**

If your PC is already configured for a fixed (specified) IP address, no changes are required.

(The Administrator should configure the Wireless Access Point with a fixed IP address from the same address range used on the PCs.)

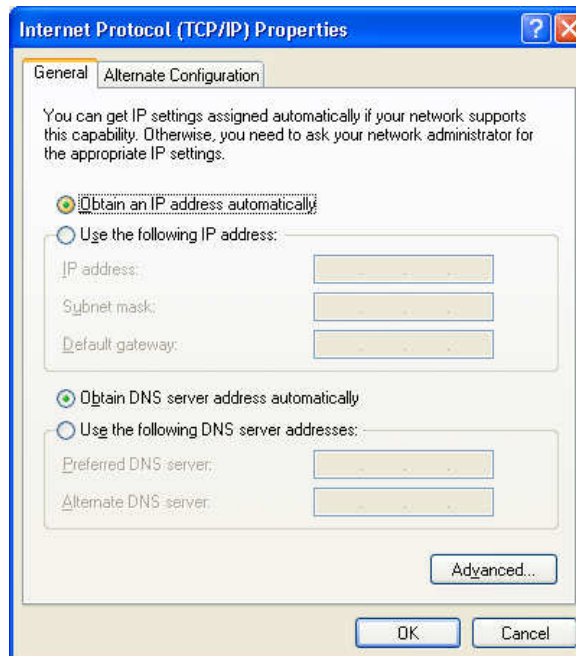
## Checking TCP/IP Settings - Windows XP

1. Select *Control Panel - Network Connection*.
2. Right click the *Local Area Connection* and choose *Properties*. You should see a screen like the following:



**Figure 61: Network Configuration (Windows XP)**

3. Select the *TCP/IP* protocol for your network card.
4. Click on the *Properties* button. You should then see a screen like the following.



**Figure 62: TCP/IP Properties (Windows XP)**

5. Ensure your TCP/IP settings are correct.

### **Using DHCP**

To use DHCP, select the radio button *Obtain an IP Address automatically*. This is the default Windows setting. To work correctly, you need a DHCP server on your LAN.

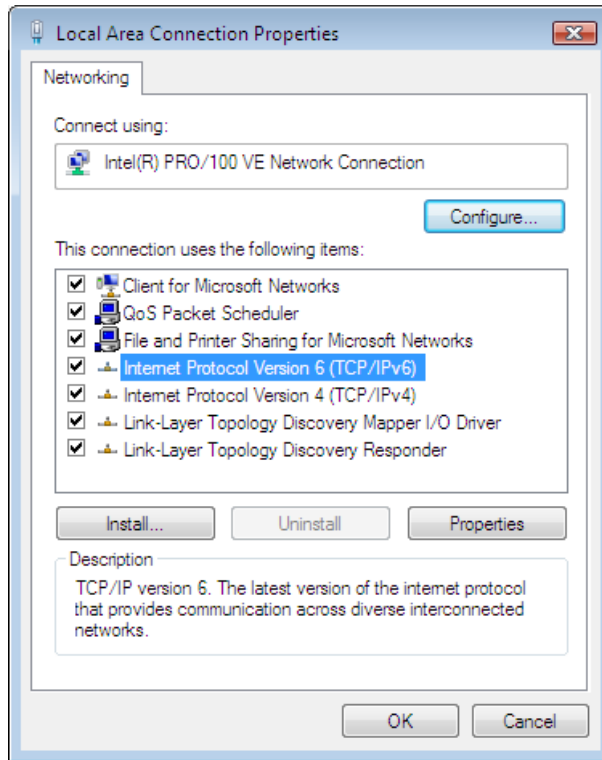
### **Using a fixed IP Address ("Use the following IP Address")**

If your PC is already configured for a fixed (specified) IP address, no changes are required.

(The Administrator should configure the Wireless Access Point with a fixed IP address from the same address range used on the PCs.)

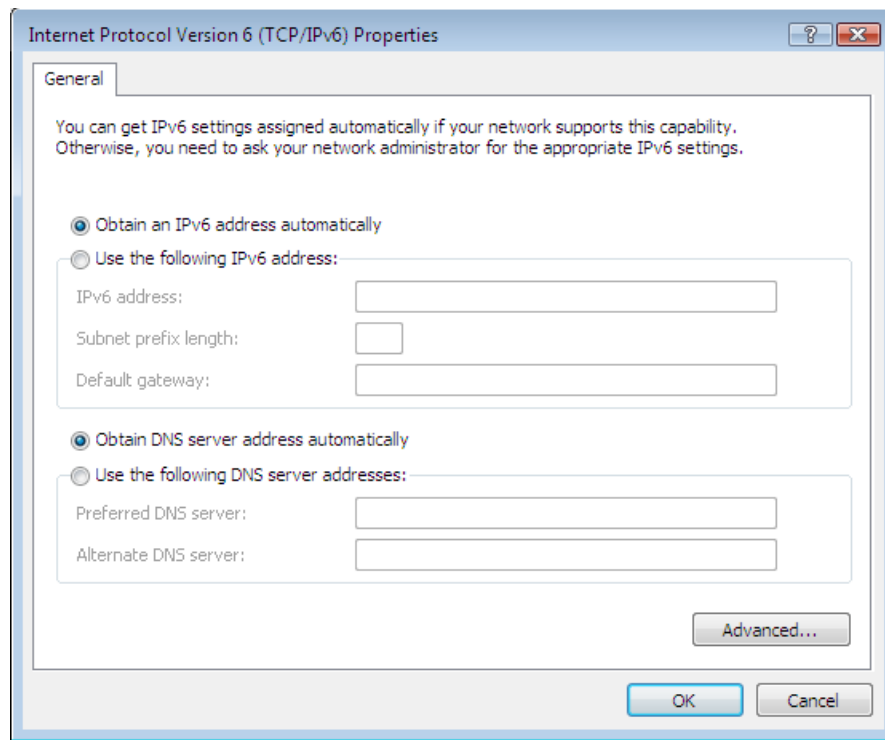
## Checking TCP/IP Settings - Windows Vista/7

1. Select Control Panel - Network Connections.
2. Right click the *Local Area Connection Status* and choose *Properties*. Click *Continue* to the *User Account Control* dialog box, then you should see a screen like the following:



**Figure 63: Network Configuration (Windows Vista/7)**

3. Select the *TCP/IP* protocol for your network card.
4. Click on the *Properties* button. You should then see a screen like the following.



**Figure 64: TCP/IP Properties (Windows Vista/7)**

5. Ensure your TCP/IP settings are correct.

### Using DHCP

To use DHCP, select the radio button *Obtain an IP Address automatically*. This is the default Windows setting. To work correctly, you need a DHCP server on your LAN.

### Using a fixed IP Address ("Use the following IP Address")

If your PC is already configured for a fixed (specified) IP address, no changes are required.

(The Administrator should configure the Wireless Access Point with a fixed IP address from the same address range used on the PCs.)



## Overview

Wireless networks have their own terms and jargon. It is necessary to understand many of these terms in order to configure and operate a Wireless LAN.

## Wireless LAN Terminology

### Modes

Wireless LANs can work in either of two (2) modes:

- Ad-hoc
- Infrastructure

#### Ad-hoc Mode

Ad-hoc mode does not require an Access Point or a wired (Ethernet) LAN. Wireless Stations (e.g. notebook PCs with wireless cards) communicate directly with each other.

#### Infrastructure Mode

In Infrastructure Mode, one or more Access Points are used to connect Wireless Stations (e.g. Notebook PCs with wireless cards) to a wired (Ethernet) LAN. The Wireless Stations can then access all LAN resources.



**Note!**

**Access Points can only function in "Infrastructure" mode, and can communicate only with Wireless Stations which are set to "Infrastructure" mode.**

## SSID/ESSID

### BSS/SSID

A group of Wireless Stations and a single Access Point, all using the same ID (SSID), form a Basic Service Set (BSS).

**Using the same SSID is essential.** Devices with different SSIDs are unable to communicate with each other. However, some Access Points allow connections from Wireless Stations which have their SSID set to "any" or whose SSID is blank ( null ).

### ESS/ESSID

A group of Wireless Stations, and multiple Access Points, all using the same ID (ESSID), form an Extended Service Set (ESS).

Different Access Points within an ESS can use different Channels. To reduce interference, it is recommended that adjacent Access Points **SHOULD** use different channels.



As Wireless Stations are physically moved through the area covered by an ESS, they will automatically change to the Access Point which has the least interference or best performance. This capability is called **Roaming**. (Access Points do not have or require Roaming capabilities.)

## Channels

The Wireless Channel sets the radio frequency used for communication.

- Access Points use a fixed Channel. You can select the Channel used. This allows you to choose a Channel which provides the least interference and best performance. For 802.11g, 13 channels are available in the USA and Canada., but 11 channels are available in North America if using 802.11b.
- If using multiple Access Points, it is better if adjacent Access Points use different Channels to reduce interference. The recommended Channel spacing between adjacent Access Points is 5 Channels (e.g. use Channels 1 and 6, or 6 and 11).
- In "Infrastructure" mode, Wireless Stations normally scan all Channels, looking for an Access Point. If more than one Access Point can be used, the one with the strongest signal is used. (This can only happen within an ESS.)
- If using "Ad-hoc" mode (no Access Point), all Wireless stations should be set to use the same Channel. However, most Wireless stations will still scan all Channels to see if there is an existing "Ad-hoc" group they can join.

## WEP

WEP (Wired Equivalent Privacy) is a standard for encrypting data before it is transmitted. This is desirable because it is impossible to prevent snoopers from receiving any data which is transmitted by your Wireless Stations. But if the data is encrypted, then it is meaningless unless the receiver can decrypt it.

**If WEP is used, the Wireless Stations and the Wireless Access Point must have the same settings.**

## WPA-PSK

Like WEP, data is encrypted before transmission. WPA is more secure than WEP, and should be used if possible. The PSK (Pre-shared Key) must be entered on each Wireless station. The 256Bit encryption key is derived from the PSK, and changes frequently.

## WPA2-PSK

This is a further development of WPA-PSK, and offers even greater security, using the AES (Advanced Encryption Standard) method of encryption.

## 802.1x

This uses the 802.1x standard for client authentication, and WEP for data encryption. If possible, you should use WPA-Enterprise instead, because WPA encryption is much stronger than WEP encryption.

If this option is used:

- The Access Point must have a "client login" on the Radius Server.

- Each user must have a "user login" on the Radius Server.
- Each user's wireless client must support 802.1x and provide the login data when required.
- All data transmission is encrypted using the WEP standard. You only have to select the WEP key size; the WEP key is automatically generated.