

ZyXEL G-302 v3

802.11g Wireless PCI Adapter

User's Guide

Version 2.00

Edition 2

5/2007

The logo for ZyXEL, featuring the word "ZyXEL" in a bold, blue, sans-serif font. The "y" is lowercase and has a distinctive shape, while "XEL" is uppercase. The letters are closely spaced and have a slight shadow or depth.

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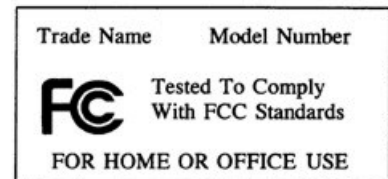
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	sales@zyxel.com	+1-714-632-0858	ftp.us.zyxel.com	

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		sales@zyxel.no	+47-22-80-61-81		
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		sales@zyxel.ru	+7-095-542-89-25		
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		sales@zyxel.co.uk	+44-1344 303034	ftp.zyxel.co.uk	

+" is the (prefix) number you enter to make an international telephone call.

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Preface

Congratulations on your purchase of the ZyXEL G-302 v3 802.11g Wireless PCI Adapter.

Your G-302 v3 is easy to install and configure.

About This User's Guide

This manual is designed to guide you through the configuration of your G-302 v3 for its various applications.

Related Documentation

- Supporting Disk
Refer to the included CD for support documents.
- Quick Start Guide
The Quick Start Guide is designed to help you get up and running right away. They contain hardware installation/connection information.
- ZyXEL Glossary and Web Site
Please refer to www.zyxel.com for an online glossary of networking terms and additional support documentation.







User Guide Feedback

Help us help you. E-mail all User Guide-related comments, questions or suggestions for improvement to techwriters@zyxel.com.tw or send regular mail to The Technical Writing Team, ZyXEL Communications Corp., 6 Innovation Road II, Science-Based Industrial Park, Hsinchu, 300, Taiwan. Thank you.

Syntax Conventions

- “Enter” means for you to type one or more characters. “Select” or “Choose” means for you to use one predefined choice.
- Mouse action sequences are denoted using a comma. For example, “In Windows, click **Start, Settings** and then **Control Panel**” means first click the **Start** button, then point your mouse pointer to **Settings** and then click **Control Panel**.
- “e.g.” is a shorthand for “for instance”, and “i.e.” means “that is” or “in other words”.
- The ZyXEL G-302 v3 802.11g Wireless PCI Adapter may be referred to as the G-302 v3 in this user's guide.

Graphics Icons Key

Access Point 	Computer 	Notebook Computer 
Server 	Internet Cloud 	Wireless Signal 

CHAPTER 1

Getting Started

This chapter introduces the G-302 v3 and prepares you to use the ZyXEL utility.

1.1 About Your G-302 v3

The G-302 v3 is an IEEE 802.11b/g compliant wireless LAN adapter.

The following lists the main features of your G-302 v3. See the product specifications in the appendix for detailed features.

- Automatic rate selection.
- Security: WEP (Wired Equivalent Privacy), WPA-PSK, WPA (Wi-Fi Protected Access), WPA2-PSK and WPA2

Note: You can use WPA and WPA2 with the G-302 v3 only in Microsoft Windows XP or Windows 2000.

- A built-in antenna
- Driver and utility support for Windows 98 Second Edition, Windows ME, Windows 2000 and Windows XP.

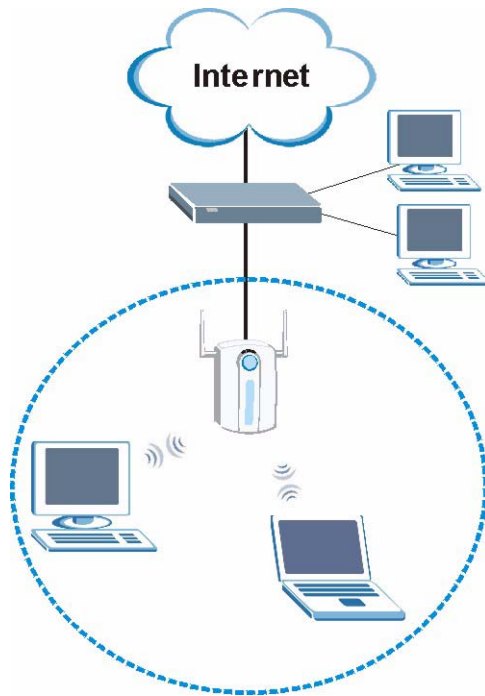
1.1.1 Application Overview

This section describes some network applications for the G-302 v3.

1.1.1.1 Infrastructure

To connect to a network via an Access Point (AP), set the G-302 v3 network type to **Infrastructure**. Through the AP, you can access the Internet or the wired network behind the AP.

Figure 1 Application: Infrastructure

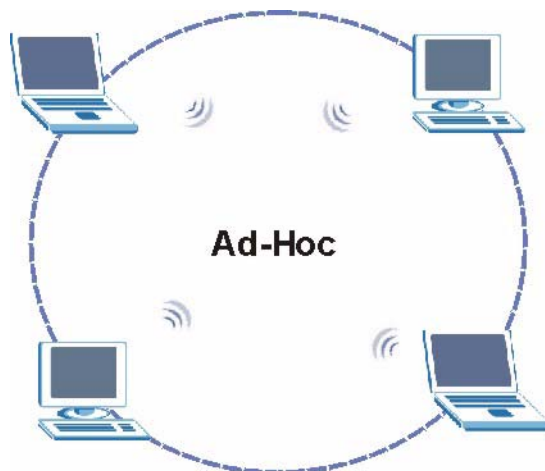


1.1.1.2 Ad-Hoc

In case you prefer to set up a small independent wireless workgroup without an AP, use the Ad-Hoc mode.

Ad-hoc mode does not require an AP or a wired network. Two or more wireless clients communicate directly to each other.

Figure 2 Application: Ad-Hoc



1.2 G-302 v3 Hardware and Utility Installation

Follow the instructions in the Quick Start Guide to install the ZyXEL utility and make hardware connections.

1.3 Configuration Methods

To configure your G-302 v3, use one of the following applications:

- Wireless Zero Configuration (WZC) (recommended for Windows XP)
- ZyXEL Utility (This guide shows you how to configure the G-302 v3 using the ZyXEL utility)
- Odyssey Client Manager (not supplied)

Refer to the Odyssey Client Manager documentation for more information.

Note: Do NOT use WZC or the Odyssey Client Manager and the ZyXEL utility at the same time.

1.4 Windows XP Users Only

Note: When you use the ZyXEL utility, it automatically disables the Windows XP wireless configuration tool.



To disable the ZyXEL utility and use WZC to configure the G-302 v3, right-click the utility icon () in the system tray and select **Use Windows Zero Configuration**. To activate the ZyXEL utility again, double-click the  icon and click **OK**.

Figure 3 Enable WZC

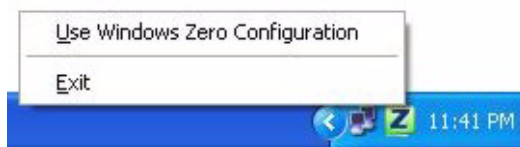
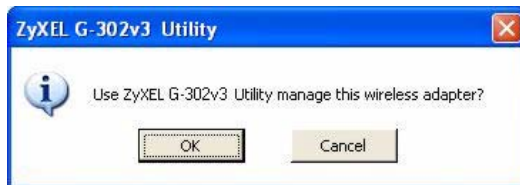


Figure 4 Enable ZyXEL Utility



Refer to the appendices on how to use WZC to manage the G-302 v3.

1.5 Accessing the ZyXEL Utility

After you install and start the ZyXEL utility, an icon for the ZyXEL utility appears in the system tray.

Note: When the ZyXEL utility system tray icon displays, the G-302 v3 is installed properly.

When you use the ZyXEL utility, it automatically disables the Windows XP wireless configuration tool.

Figure 5 ZyXEL Utility: System Tray Icon




The color of the ZyXEL utility system tray icon indicates the status of the G-302 v3. Refer to the following table for details.

Table 1 ZyXEL Utility: System Tray Icon

COLOR	DESCRIPTION
Red	The G-302 v3 is not connected to a wireless network or is searching for an available wireless network.
Green	The G-302 v3 is connected to a wireless network.

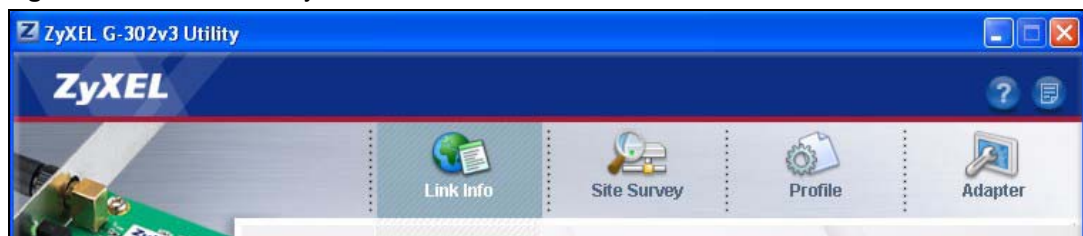
Double-click on the ZyXEL wireless LAN utility icon in the system tray to open the ZyXEL utility. The ZyXEL utility screens are similar in all Microsoft Windows versions. Screens for Windows XP are shown in this User's Guide.

Note: Click the  icon (located in the top right corner) to display the online help window.

1.6 ZyXEL Utility Screen Summary

This sections describes the ZyXEL utility screens.

Figure 6 Menu Summary



The following table describes the menus.

Table 2 ZyXEL Utility: Menu Screen Summary

TAB	DESCRIPTION
Link Info	Use this screen to see your current connection status, configuration and data rate statistics.
Site Survey	Use this screen to <ul style="list-style-type: none"> • scan for a wireless network. • configure wireless security (if activated on the selected network). • connect to a wireless network.
Profile	Use this screen to add, delete, edit or activate a profile with a set of wireless and security settings.
Adapter	Use this screen to configure a transfer rate and enable power saving.

1.7 Connecting to a Wireless LAN

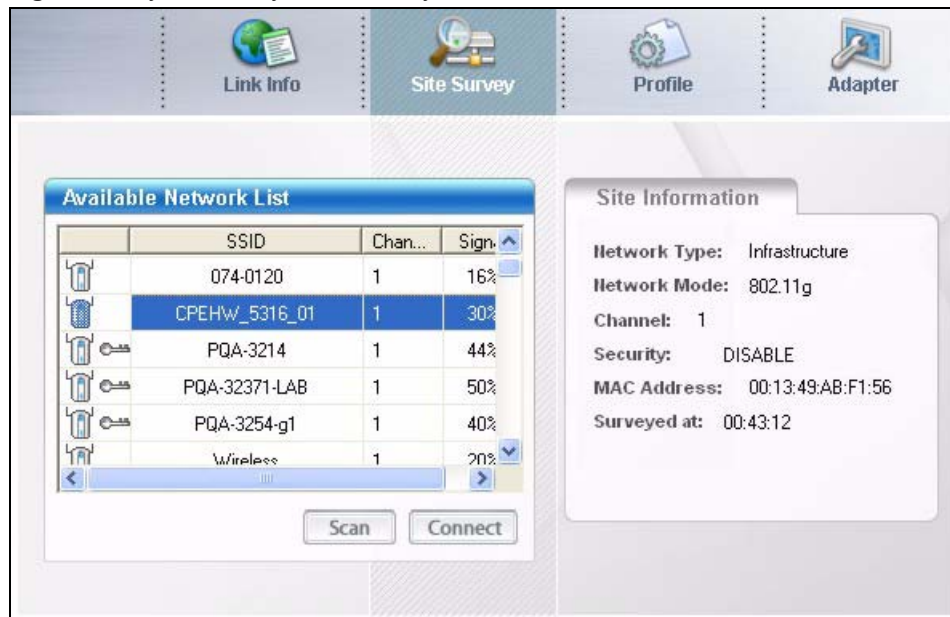
The following sections show you how to associate with a network using the ZyXEL utility. You can either manually connect to a network or configure a profile to have the G-302 v3 automatically connect to a specific network. Otherwise, configure nothing and leave the G-302 v3 to automatically scan for and connect to any other available network without security.

See the next chapters for detailed field descriptions.

1.7.1 Site Survey

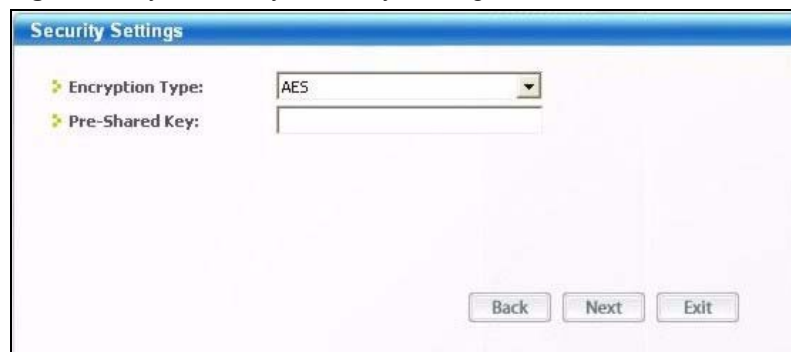
After you install the ZyXEL utility and then insert the G-302 v3, follow the steps below to connect to a network using the **Site Survey** screen.

- 1** Make sure a wireless network is available and within range.
- 2** Open the ZyXEL utility and click the **Site Survey** tab to open the screen as shown next.
- 3** Click **Scan** to search for available wireless networks.

Figure 7 ZyXEL Utility: Site Survey

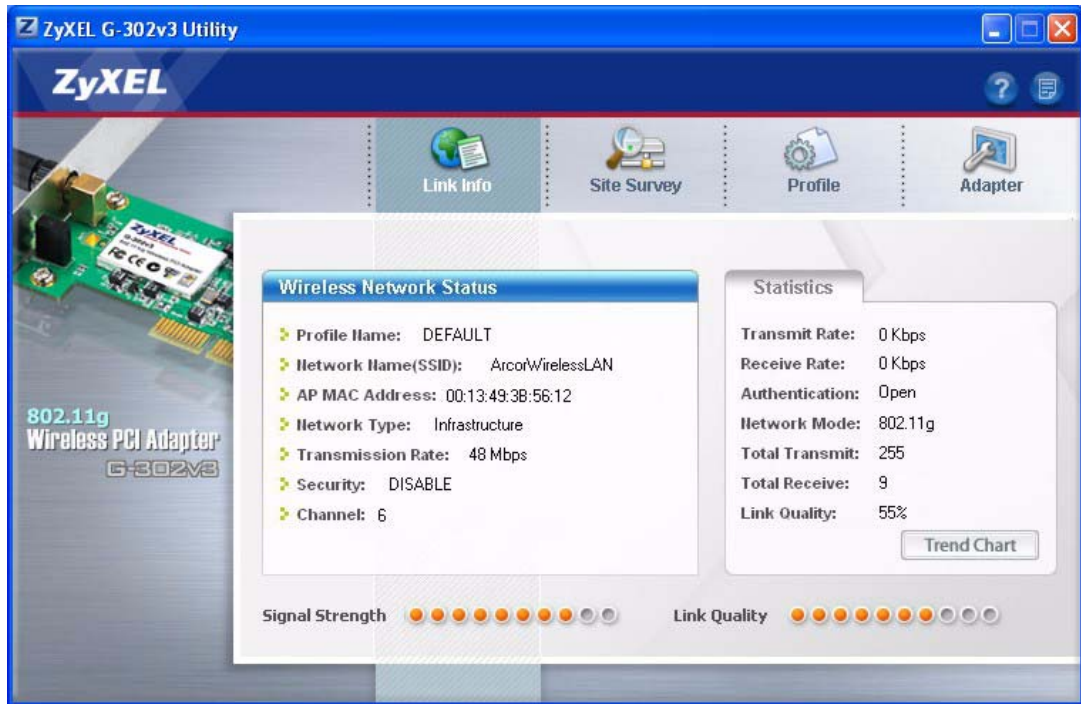
- 4 To join a network, either click an entry in the table and then click **Connect**.
- 5 If the wireless security is activated for the selected wireless network, the **Security Settings** screen displays. This screen varies according to the network's encryption method. Configure the same security settings as the associated network.

Note: If the selected network is unavailable or security settings are not correct, the G-302 v3 cannot connect to a network.

Figure 8 ZyXEL Utility: Security Settings

- 6 Verify that you have successfully connected to the selected network and check the network information in the **Link Info** screen. If the G-302 v3 is not connected to a network, the fields in this screen are blank.

Figure 9 ZyXEL Utility: Link Info



CHAPTER 2

Wireless LAN Network

This chapter provides background information on wireless LAN network.

2.1 Wireless LAN Overview

This section describes the wireless LAN network terms and applications.

2.1.1 SSID

The SSID (Service Set Identity) is a unique name shared among all wireless devices in a wireless network. Wireless devices must have the same SSID to communicate with each other.

2.1.2 Channel

A radio frequency used by a wireless device is called a channel.

2.1.3 Transmission Rate

When the communication quality drops below a certain level, the G-302 v3 automatically switches to a lower transmission (data) rate. Transmission at lower data speeds is usually more reliable. When the communication quality improves again, the G-302 v3 gradually increases the transmission (data) rate again until it reaches the highest available transmission rate.

Note: Actual speeds attained also depend on the distance from the AP, noise, etc.

2.2 Wireless LAN Security Overview

Wireless LAN security is vital to your network to protect wireless communications.

Configure the wireless LAN security using the **Profile Security Settings** screen. If you do not enable any wireless security on your G-302 v3, the G-302 v3's wireless communications are accessible to any wireless networking device that is in the coverage area.

2.2.1 Data Encryption with WEP

WEP (Wired Equivalent Privacy) encryption scrambles all data packets transmitted between the G-302 v3 and the AP or other wireless stations to keep network communications private. Both the wireless stations and the access points must use the same WEP key for data encryption and decryption.

There are two ways to create WEP keys in your G-302 v3.

- Automatic WEP key generation based on a “password phrase” called a passphrase. The passphrase is case sensitive. You must use the same passphrase for all WLAN adapters with this feature in the same WLAN.

For WLAN adapters without the passphrase feature, you can still take advantage of this feature by writing down the four automatically generated WEP keys from the **Security Settings** screen of the ZyXEL utility and entering them manually as the WEP keys in the other WLAN adapter(s).

- Enter the WEP keys manually.

Your G-302 v3 allows you to configure up to four 64-bit or 128-bit WEP keys and only one key is used as the default key at any one time.

2.2.2 IEEE 802.1x

The IEEE 802.1x standard outlines enhanced security methods for both the authentication of wireless stations and encryption key management. Authentication can be done using an external RADIUS server.

2.2.2.1 EAP Authentication

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE 802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, an access point helps a wireless station and a RADIUS server perform authentication.

The type of authentication you use depends on the RADIUS server and an intermediary AP(s) that supports IEEE 802.1x. The G-302 v3 supports EAP-TLS, EAP-TTLS and EAP-PEAP. Refer to [Appendix C on page 63](#) for descriptions.

For EAP-TLS authentication type, you must first have a wired connection to the network and obtain the certificate(s) from a certificate authority (CA). A certificate (also called digital IDs) can be used to authenticate users and a CA issues certificates and guarantees the identity of each certificate owner.

2.2.3 WPA and WPA2

Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Key differences between WPA(2) and WEP are improved data encryption and user authentication.

If both an AP and the wireless clients support WPA2 and you have an external RADIUS server, use WPA2 for stronger data encryption. If you don't have an external RADIUS server, you should use WPA2-PSK (WPA2-Pre-Shared Key) that only requires a single (identical) password entered into each access point, wireless gateway and wireless client. As long as the passwords match, a wireless client will be granted access to a WLAN.

If the AP or the wireless clients do not support WPA2, just use WPA or WPA-PSK depending on whether you have an external RADIUS server or not.

Select WEP only when the AP and/or wireless clients do not support WPA or WPA2. WEP is less secure than WPA or WPA2.

2.2.3.1 Encryption

Both WPA and WPA2 improve data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. WPA and WPA2 use Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP) to offer stronger encryption than TKIP.

The encryption mechanisms used for WPA(2) and WPA(2)-PSK are the same. The only difference between the two is that WPA(2)-PSK uses a simple common password, instead of user-specific credentials. The common-password approach makes WPA(2)-PSK susceptible to brute-force password-guessing attacks but it's still an improvement over WEP as it employs a consistent, single, alphanumeric password to derive a PMK which is used to generate unique temporal encryption keys. This prevent all wireless devices sharing the same encryption keys. (a weakness of WEP)

2.2.3.2 User Authentication

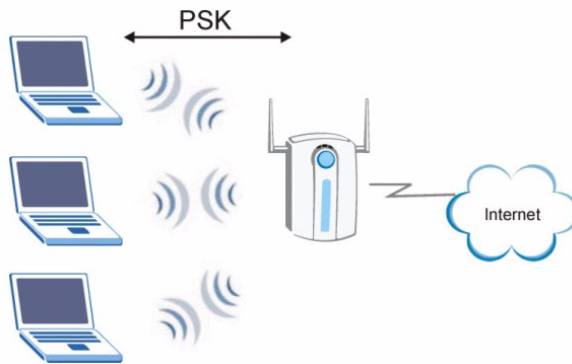
WPA and WPA2 apply IEEE 802.1x and Extensible Authentication Protocol (EAP) to authenticate wireless stations using an external RADIUS database. WPA2 reduces the number of key exchange messages from six to four (CCMP 4-way handshake) and shortens the time required to connect to a network. Other WPA2 authentication features that are different from WPA include key caching and pre-authentication. These two features are optional and may not be supported in all wireless devices.

2.2.4 WPA(2)-PSK Application Example

A WPA(2)-PSK application looks as follows.

- 1 First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).
- 2 The AP checks each client's password and (only) allows it to join the network if it matches its password.
- 3 The AP and wireless clients use the pre-shared key to generate a common PMK.
- 4 The AP and wireless clients use the TKIP or AES encryption process to encrypt data exchanged between them.

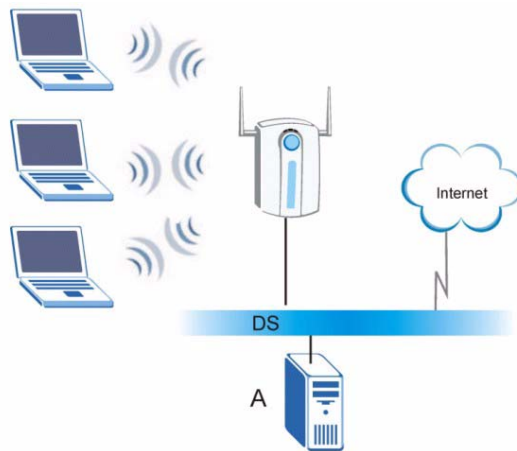
Figure 10 WPA(2)-PSK Authentication



2.2.5 WPA(2) with RADIUS Application Example

You need the IP address of the RADIUS server, its port number (default is 1812), and the RADIUS shared secret. A WPA(2)-RADIUS application example with an external RADIUS server looks as follows. "A" is the RADIUS server. "DS" is the distribution system.

- 1 The AP passes the wireless client's authentication request to the RADIUS server.
- 2 The RADIUS server then checks the user's identification against its database and grants or denies network access accordingly.
- 3 The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the pair-wise key to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients.

Figure 11 WPA(2) with RADIUS Application Example

2.3 Authentication Type

The IEEE 802.11b/g standard describes a simple authentication method between the wireless stations and AP. Two authentication types are defined: an **Open** system mode and a **Shared** key mode.

- **Open** system mode is implemented for ease-of-use and when security is not an issue. The wireless station and the AP or peer computer do *not* share a secret key. Thus the wireless stations can associate with any AP or peer computer and listen to any transmitted data that is not unencrypted.
- **Shared** key mode involves a shared secret key to authenticate the wireless station to the AP or peer computer. This requires you to enable the wireless LAN security and use same settings on both the wireless station and the AP or peer computer.

2.4 Preamble Type

Preamble is used to signal that data is coming to the receiver.

Short preamble increases performance as less time sending preamble means more time for sending data. All IEEE 802.11b/g compliant wireless adapters support long preamble, but not all support short preamble.

Select **Auto** to have the G-302 v3 automatically use short preamble when access point/wireless stations support it, otherwise the G-302 v3 uses long preamble.

Note: The G-302 v3 and the access point/wireless stations **MUST** use the same preamble mode in order to communicate.

CHAPTER 3

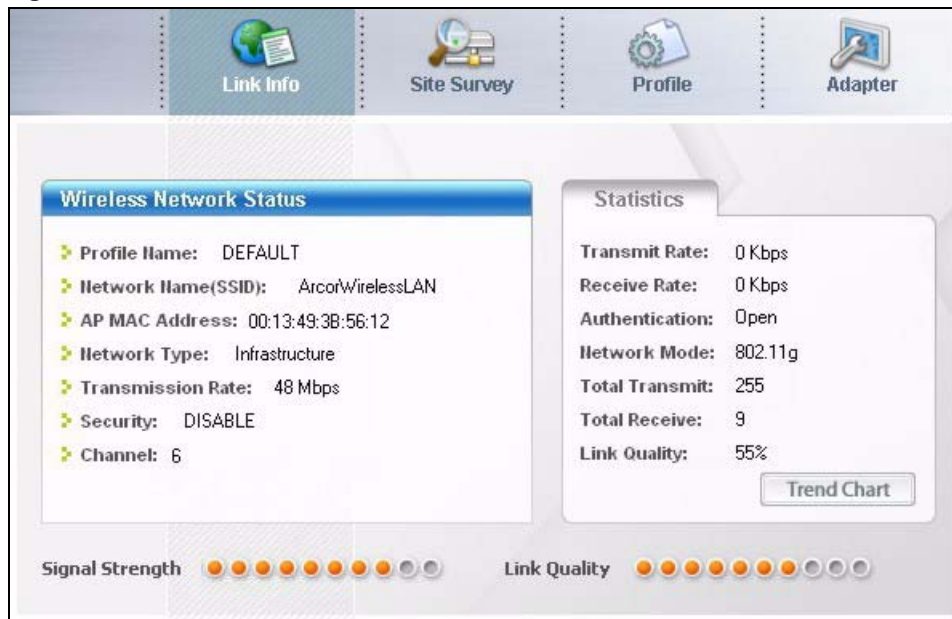
ZyXEL Utility Configuration

This chapter shows you how to configure your G-302 v3 in wireless station mode.

3.1 The Link Info Screen

When the ZyXEL utility starts, the **Link Info** screen displays, showing the current configuration and connection status of your G-302 v3.

Figure 12 Link Info



The following table describes the labels in this screen.

Table 3 Link Info

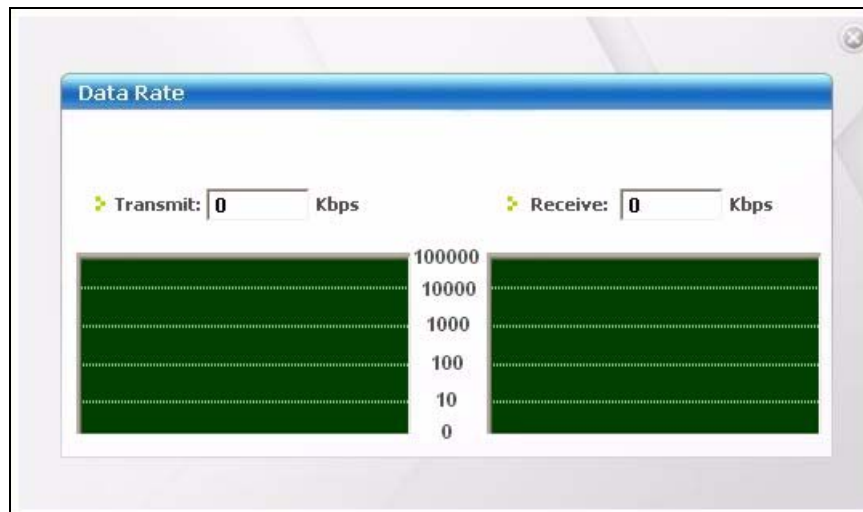
LABEL	DESCRIPTION
Wireless Network Status	
Profile Name	This is the name of the profile you are currently using.
Network Name (SSID)	The SSID identifies the Service Set to which a wireless station is associated. This field displays the name of the wireless device to which the G-302 v3 is associated.
AP MAC Address	This field displays the MAC address of the wireless device to which the G-302 v3 is associated.
Network Type	This field displays the network type (Infrastructure or Ad Hoc) of the wireless network.

Table 3 Link Info (continued)

LABEL	DESCRIPTION
Transmission Rate	This field displays the current transmission rate of the G-302 v3 in megabits per second (Mbps).
Security	This field displays whether data encryption is activated (WEP , WPA , WPA2 , WPA-PSK or WPA2-PSK) or inactive (DISABLE).
Channel	This field displays the radio channel the G-302 v3 is currently using.
Statistics	
Transmit Rate	This field displays the current data transmission rate in kilobits per second (Kbps).
Receive Rate	This field displays the current data receiving rate in kilobits per second (Kbps).
Authentication	This field displays the authentication method of the G-302 v3.
Network Mode	This field displays the network standard (802.11b or 802.11g) of the wireless device.
Total Transmit	This field displays the total number of data frames transmitted.
Total Receive	This field displays the total number of data frames received.
Link Quality	This field displays the quality of the signal of the G-302 v3.
Trend Chart	Click this button to display the real-time statistics of the data rate in kilobits per second (Kbps).
Signal Strength	The status bar shows the strength of the signal.
Link Quality	The status bar shows the quality of the signal.

3.1.1 Trend Chart

Click **Trend Chart** in the **Link Info** screen to display a screen as shown below. Use this screen to view real-time data traffic statistics.

Figure 13 Link Info: Trend Chart

The following table describes the labels in this screen.

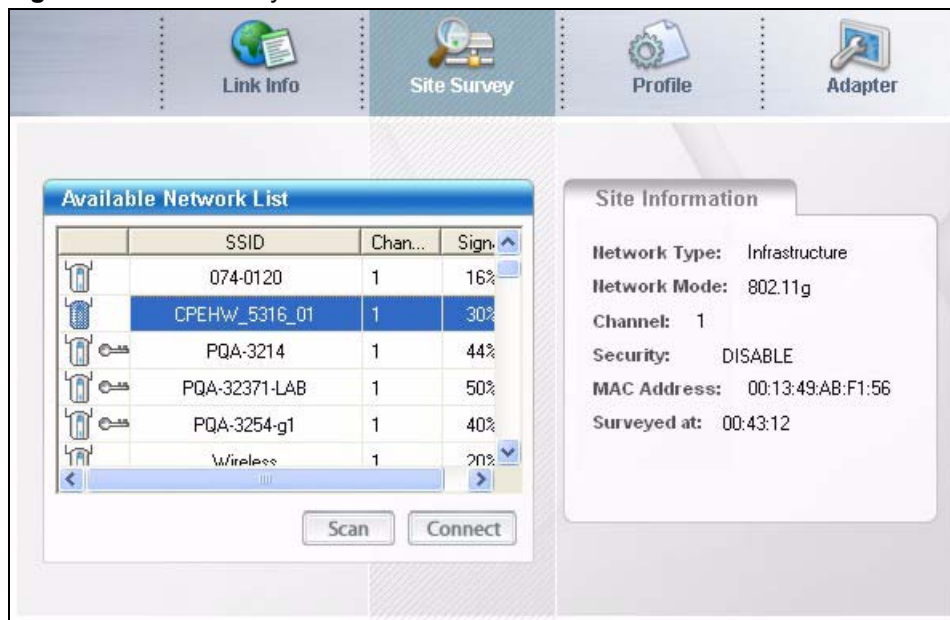
Table 4 Link Info: Trend Chart

LABEL	DESCRIPTION
Transmit	This field displays the current data transmission rate in kilobits per second (Kbps).
Receive	This field displays the current data receiving rate in kilobits per second (Kbps).

3.2 The Site Survey Screen

Use the **Site Survey** screen to scan for and connect to a wireless network automatically.

Figure 14 Site Survey



The following table describes the labels in this screen.

Table 5 Site Survey

LABEL	DESCRIPTION
Available Network List	Click a column heading to sort the entries.
	denotes that the wireless device is in infrastructure mode and the wireless security is activated.
	denotes that the wireless device is in infrastructure mode but the wireless security is deactivated.
or	denotes that the wireless device is in Ad-Hoc mode and the wireless security is activated.
	denotes that the wireless device is in Ad-Hoc mode but the wireless security is deactivated.
SSID	This field displays the SSID (Service Set Identifier) of each wireless device.

Table 5 Site Survey (continued)

LABEL	DESCRIPTION
Channel	This field displays the channel number used by each wireless device.
Signal	This field displays the signal strength of each wireless device.
Scan	Click Scan to search for available wireless devices within transmission range.
Connect	Click Connect to associate to the selected wireless device.
Site Information	Click an entry in the Available Network List table to display the information of the selected wireless device.
Network Type	This field displays the network type (Infrastructure or Ad Hoc) of the wireless device.
Network Mode	This fields displays the network standard (802.11g or 802.11b) of the wireless device.
Channel	This field displays the channel number used by each wireless device.
Security	This field shows whether data encryption is activated (WEP , WPA , WPA2 , WPA-PSK or WPA2-PSK) or inactive (DISABLE).
MAC Address	This field displays the MAC address of the wireless device.
Surveyed at	This field displays the time when the wireless device is scanned.

3.2.1 Connecting to a WLAN Network

Follow the steps below to connect to a WLAN network using the **Site Survey** screen.

- 1 Click **Scan** to search for all available wireless networks within range.
- 2 To join a network, click an entry in the table to select a wireless network and then click **Connect**.
- 3 If the WEP encryption is activated for the selected wireless network, the **Security Settings** screen displays. You must set the related fields in the **Security Settings** screen to the same security settings as the associated wireless device. Refer to [Section 3.2.2 on page 34](#) for more information.

Otherwise click the **Back** or **Exit** button and connect to another wireless network without data encryption.
- 4 Verify that you have successfully connected to the selected network and check the network information in the **Link Info** screen.

3.2.2 Security Settings

When you configure the G-302 v3 to connect to a network with wireless security activated and the security settings are disabled on the G-302 v3, the screen varies according to the encryption method used by the selected network.

3.2.2.1 WEP Encryption

Figure 15 Security Settings: WEP

The following table describes the labels in this screen.

Table 6 Security Settings: WEP

LABEL	DESCRIPTION
WEP	Select 64 Bits or 128 Bits to activate WEP encryption and then fill in the related fields.
Authentication Type	Select an authentication type. Choices are Open and Shared . Refer to Section 2.3 on page 29 for more information.
Pass Phrase	Enter a passphrase of up to 63 case-sensitive printable characters. As you enter the passphrase, the G-302 v3 automatically generates four different WEP keys and displays it in the key field below. Refer to Section 2.2.1 on page 26 for more information. At the time of writing, you cannot use passphrase to generate 152-bit WEP keys.
Transmit Key	Select a default WEP key to use for data encryption. The key displays in the field below.
Key x (where x is a number between 1 and 4)	Select this option if you want to manually enter the WEP keys. Enter the WEP key in the field provided. If you select 64 Bits in the WEP field. Enter either 10 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 11AA22BB33) for HEX key type. or Enter 5 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey) for ASCII key type. If you select 128 Bits in the WEP field, Enter either 26 hexadecimal digits in the range of "A-F", "a-f" and "0-9" (for example, 00112233445566778899AABBCC) for HEX key type or Enter 13 ASCII characters (case sensitive) ranging from "a-z", "A-Z" and "0-9" (for example, MyKey12345678) for ASCII key type. Note: The values for the WEP keys must be set up exactly the same on all wireless devices in the same wireless LAN. ASCII WEP keys are case sensitive.
Back	Click Back to go to the Site Survey screen to select and connect to other network.

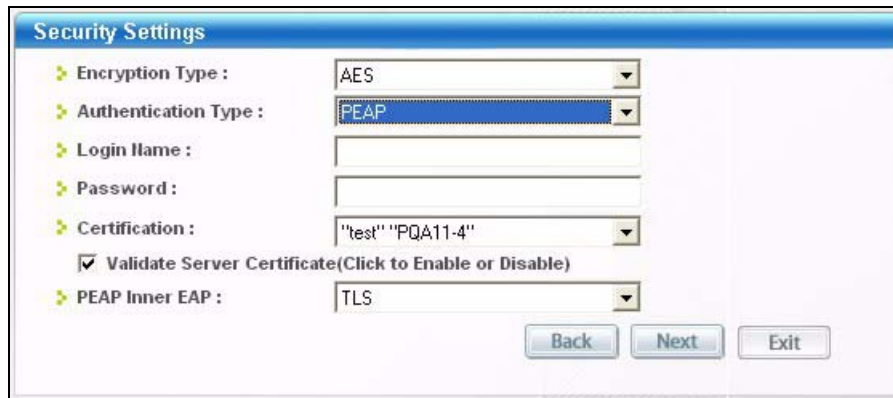
Table 6 Security Settings: WEP (continued)

LABEL	DESCRIPTION
Next	Click Next to confirm your selections and advance to the Confirm Save screen. Refer to Section 3.2.3 on page 38 .
Exit	Click Exit to return to the Site Survey screen without saving.

3.2.2.2 WPA/WPA2

Note: You can use WPA and WPA2 with the G-302 v3 only in Microsoft Windows XP or Windows 2000.

Figure 16 Security Settings: WPA/WPA2



The following table describes the labels in this screen.

Table 7 Security Settings: WPA/WPA2

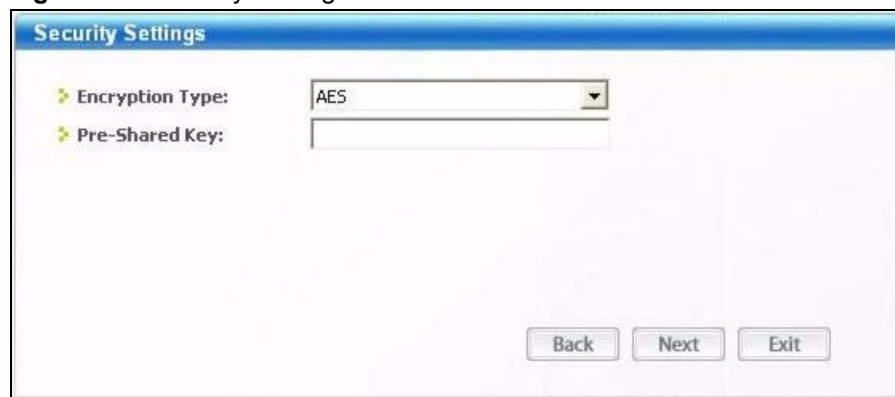
LABEL	DESCRIPTION
Encryption Type	The encryption mechanisms used for WPA/WPA2 and WPA-PSK/WPA2-PSK are the same. The only difference between the two is that WPA-PSK/WPA2-PSK uses a simple common password, instead of user-specific credentials. Select the encryption type (TKIP or AES) for data encryption. Refer to Section 2.2.3 on page 27 for more information.
Authentication Type	Select an authentication method from the drop down list. Options are TLS , TTLS and PEAP .
Login Name	Enter a user name. This is the user name that you or an administrator set up on a RADIUS server.
Password	This field is not available when you select TLS in the Authentication Type field. Enter the password associated with the user name above.
Certification	This field is only available when you select TLS in the Authentication Type field. Select a certificate used by the authentication server to authenticate the G-302 v3. Note: You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA).
Validate Server Certificate	Select the check box to check the certificate of the authentication server.

Table 7 Security Settings: WPA/WPA2

LABEL	DESCRIPTION
PEAP Inner EAP	This field is only available when you select PEAP in the Authentication Type field. Select a PEAP protocol. Options are TLS and MS CHAP-V2 .
TTLS Inner authentication	This field is only available when you select TTLS in the Authentication Type field. Select a TTLS protocol that the RADIUS server uses. Options are CHAP, MS CHAP, MS CHAP-V2 and PAP .
Back	Click Back to go to the Site Survey screen to select and connect to other network.
Next	Click Next to confirm your selections and advance to the Confirm Save screen. Refer to Section 3.2.3 on page 38 .
Exit	Click Exit to return to the Site Survey screen without saving.

3.2.2.3 WPA-PSK/WPA2-PSK

Note: You can use WPA and WPA2 with the G-302 v3 only in Microsoft Windows XP or Windows 2000.

Figure 17 Security Settings: WPA-PSK/WPA2-PSK

The following table describes the labels in this screen.

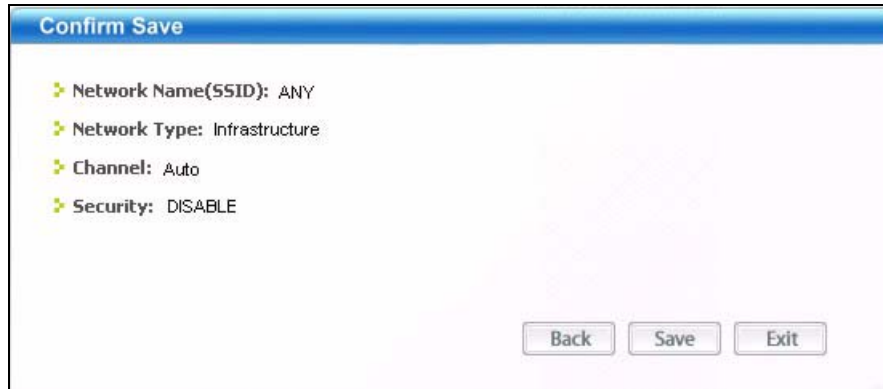
Table 8 Security Settings: WPA-PSK/WPA2-PSK

LABEL	DESCRIPTION
Encryption Type	The encryption mechanisms used for WPA/WPA2 and WPA-PSK/WPA2-PSK are the same. The only difference between the two is that WPA-PSK/WPA2-PSK uses a simple common password, instead of user-specific credentials. Select the encryption type (TKIP or AES) for data encryption. Refer to Section 2.2.3 on page 27 for more information.
Pre-Shared Key	Type a pre-shared key (same as the AP or peer device) of between 8 and 63 case-sensitive ASCII characters (including spaces and symbols).
Back	Click Back to go to the Site Survey screen to select and connect to other network.
Next	Click Next to confirm your selections and advance to the Confirm Save screen. Refer to Section 3.2.3 on page 38 .
Exit	Click Exit to return to the Site Survey screen without saving.

3.2.3 Confirm Save Screen

Use this screen to confirm and save the security settings.

Figure 18 Confirm Save Screen



The following table describes the labels in this screen.

Table 9 Confirm Save Screen

LABEL	DESCRIPTION
Network Name (SSID)	This field displays the SSID previously entered.
Network Type	This field displays the network type (Infrastructure or Ad Hoc) of the wireless device.
Channel	This field displays the channel number used by the profile.
Security	This field shows whether data encryption is activated (WEP , WPA , WPA2 , WPA-PSK or WPA2-PSK) or inactive (DISABLE).
Back	Click Back to return to the previous screen.
Save	Click Save to save the changes back to the G-302 v3 and display the Link Info screen.
Exit	Click Exit to discard changes and return to the Site Survey screen.

3.3 The Profile Screen

A profile is a set of wireless parameters that you need to connect to a wireless network. With a profile activated, each time you start the G-302 v3, it automatically scans for the specific SSID and joins that network with the pre-defined wireless security settings. If the specified network is not available, the G-302 v3 will be disconnected.

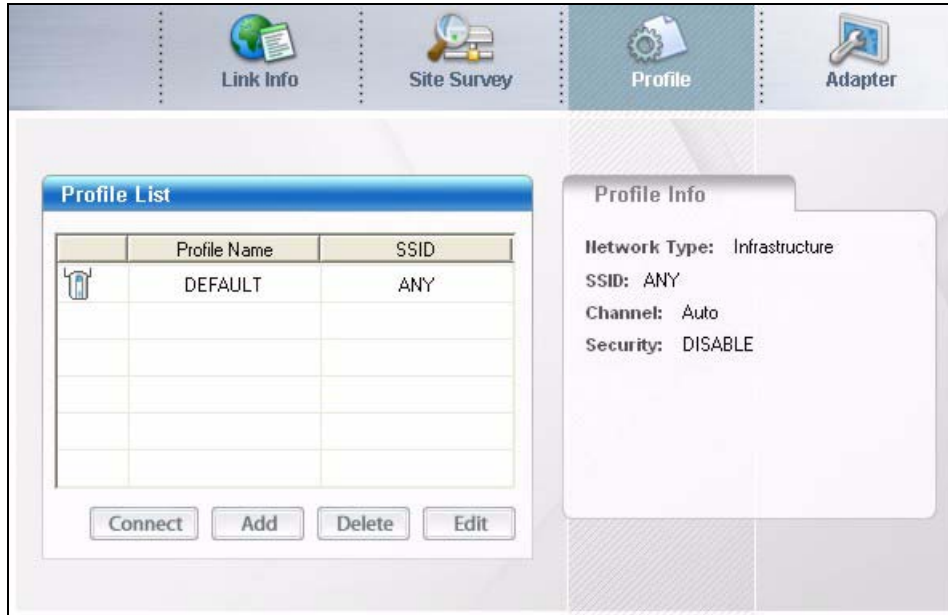
If you do not configure and activate a profile, each time you start the G-302 v3, the G-302 v3 uses the default profile to connect to any available network with security disabled.

The default profile is a profile that allows you to connect to any SSID without security.

Click the **Profile** tab in the ZyXEL utility to display the **Profile** screen as shown next.

The profile function allows you to save the wireless network settings in this screen, or use one of the pre-configured network profiles.

Figure 19 Profile Screen



The following table describes the labels in this screen.

Table 10 Profile Screen









LABEL	DESCRIPTION
Profile List	Click a column heading to sort the entries.
 ,  ,  or 	 denotes that the wireless device is in infrastructure mode and the wireless security is activated.  denotes that the wireless device is in infrastructure mode but the wireless security is deactivated.  denotes that the wireless device is in Ad-Hoc mode and the wireless security is activated.  denotes that the wireless device is in Ad-Hoc mode but the wireless security is deactivated.
Profile Name	This is the name of the pre-configured profile.
SSID	This is the SSID of the wireless network to which the selected profile associate.
Connect	To use a previously saved network profile, select a pre-configured profile name in the table and click Connect .
Add	To add a new profile into the table, click Add .
Delete	To delete an existing wireless network configuration, select a profile in the table and click Delete .
Edit	To edit an existing wireless network configuration, select a profile in the table and click Edit .

Table 10 Profile Screen (continued)

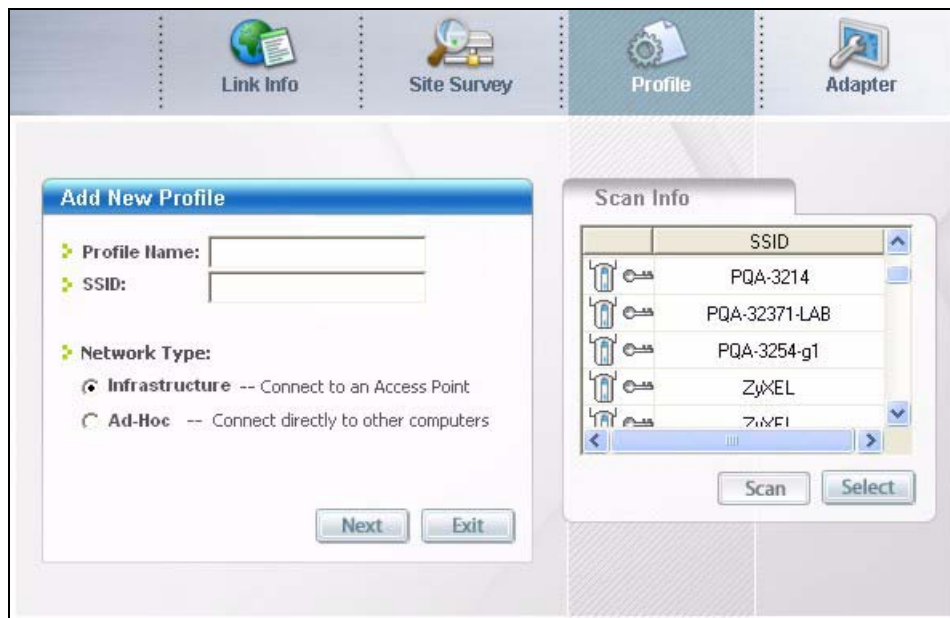
LABEL	DESCRIPTION
Profile Info	The following fields display detail information of the selected profile in the Profile List table.
Network Type	This field displays the network type (Infrastructure or Ad Hoc) of the profile.
Channel	This field displays the channel number used by the profile.
Security	This field shows whether data encryption is activated (WEP, WPA, WPA-PSK, WPA2, WPA2-PSK) or inactive (DISABLE).

3.3.1 Adding a New Profile

Follow the steps below to add a new profile.

- 1 Click **Add** in the **Profile** screen. An **Add New Profile** screen displays as shown next. Click **Next** to continue.

Figure 20 Profile: Add New Profile

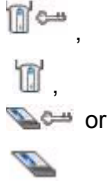







The following table describes the labels in this screen.

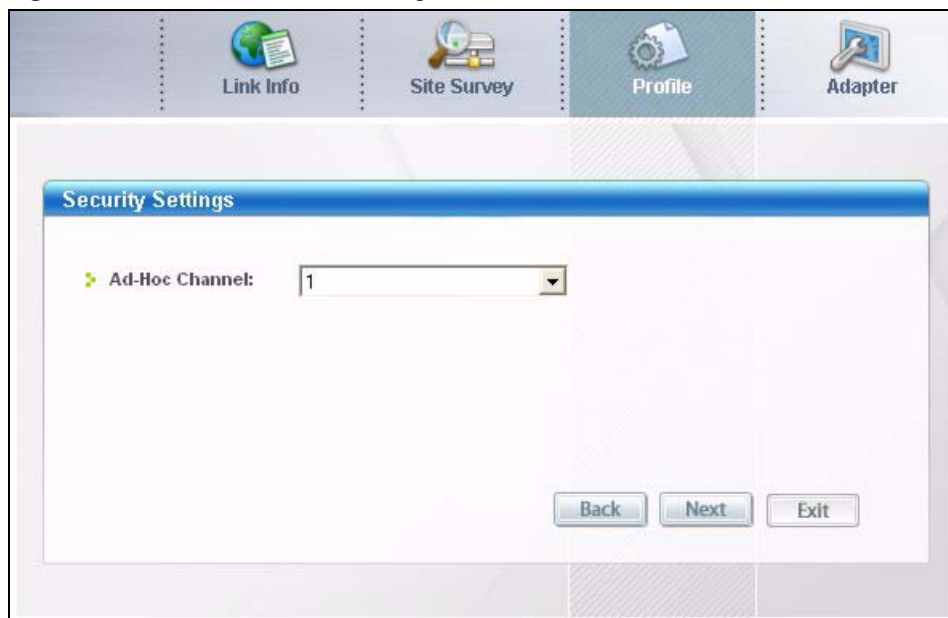
Table 11 Profile: Add New Profile

LABEL	DESCRIPTION
Add New Profile	
Profile Name	Enter a descriptive name in this field.
SSID	Select an available wireless device in the Scan Info table and click Select , or enter the SSID of the wireless device to which you want to associate in this field manually. Otherwise, enter Any to have the G-302 v3 associate to or roam between any infrastructure wireless networks.

Table 11 Profile: Add New Profile (continued)

LABEL	DESCRIPTION
Network Type	Select the Infrastructure radio button to associate to an AP. Select the Ad-Hoc radio button to associate to a peer computer.
Next	Click Next to go to the next screen.
Exit	Click Exit to go back to the previous screen without saving.
Scan Info	This table displays the information of the available wireless networks within the transmission range.
	 denotes that the wireless device is in infrastructure mode and the wireless security is activated.  denotes that the wireless device is in infrastructure mode but the wireless security is deactivated.  or  denotes that the wireless device is in Ad-Hoc mode and the wireless security is activated.  denotes that the wireless device is in Ad-Hoc mode but the wireless security is deactivated.
SSID	This field displays the SSID (Service Set Identifier) of each wireless device.
Scan	Click Scan to search for available wireless devices within transmission range.
Select	Select an available wireless device in the table and click Select to add it to this profile. Whenever you activate this profile, the G-302 v3 associates to the selected wireless network only.

- 2** If you select the **Infrastructure** network type in the previous screen, skip to step 3. If you select the **Ad-Hoc** network type in the previous screen, a screen displays as follows. Select a channel number and click **Next** to continue.

Figure 21 Profile: Wireless Setting: Select a Channel

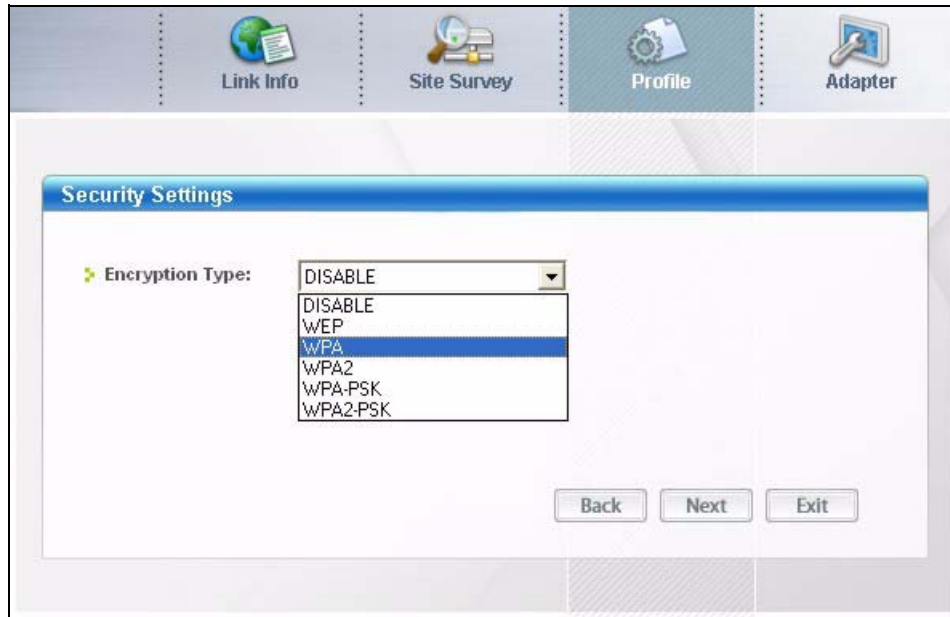
The following table describes the labels in this screen.

Table 12 Profile: Wireless Setting: Select a Channel

LABEL	DESCRIPTION
Wireless Setting	
Ad-Hoc Channel	Select a channel number from the drop-down list box. To associate to an ad-hoc network, you must use the same channel as the peer computer.
Back	Click Back to return to the Add New Profile screen.
Next	Click Next to confirm your selection and advance to the Encryption Type screen.
Exit	Click Exit to discard changes and return to the Add New Profile screen.

- If you select **Infrastructure** network type in the first screen, select **WEP**, **WPA**, **WPA2**, **WPA-PSK** or **WPA2-PSK** from the drop-down list box to enable data encryption. If you select **Ad-Hoc** network type in the first screen, you can only use **WEP** encryption method. Otherwise, select **DISABLE** to allow the G-302 v3 to communicate with the access points or other peer wireless computers without any data encryption and skip to step 6.

Figure 22 Profile: Security Setting: Encryption Type



- The screen varies depending on the encryption method you select in the previous screen. The settings must be exactly the same on the APs or other peer wireless computers as they are on the G-302 v3. Refer to [Section 3.2.2 on page 34](#) for detailed information on wireless security configuration.

Figure 23 Profile: Security Setting

- 5 This read-only screen shows a summary of the new profile settings. Verify that the settings are correct. Click **Save** to save and go to the next screen. Click **Back** to return to the previous screen. Otherwise, click **Exit** to go back to the **Profile** screen without saving.

Figure 24 Profile: Confirm New Settings

- 6 To use this network profile, click the **Activate Now** button. Otherwise, click the **Activate Later** button.

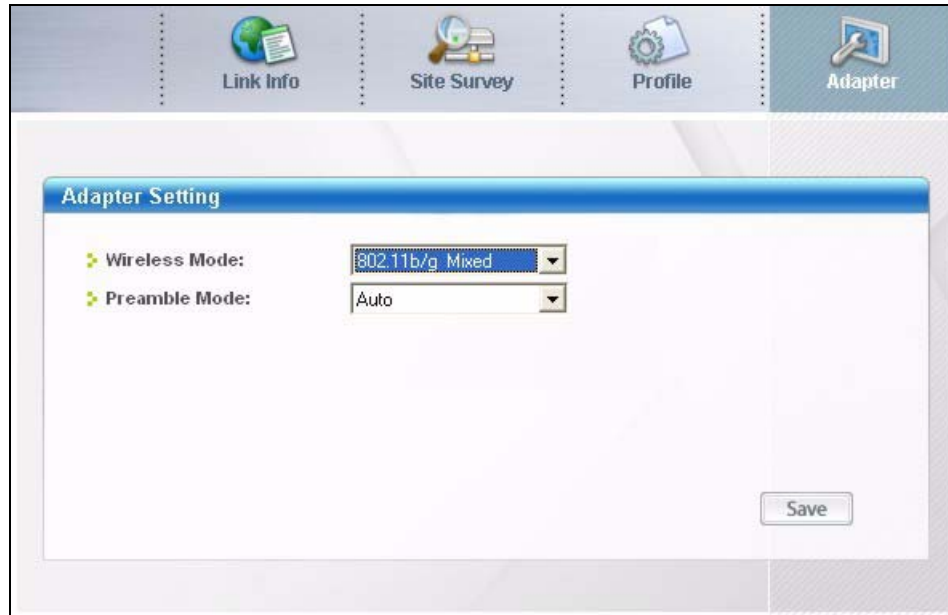
Note: Once you activate a profile, the ZyXEL utility will use that profile the next time it is started.

Figure 25 Profile: Activate the Profile

3.4 The Adapter Screen

To set the advanced features on the G-302 v3, click the **Adapter** tab.

Figure 26 Adapter Screen



The following table describes the labels in this screen.

Table 13 Adapter

LABEL	DESCRIPTION
Adapter Setting	
Wireless Mode	Select 802.11b Only to have the G-302 v3 connect to an IEEE 802.11b wireless device. Select 802.11b/g Mixed to have the G-302 v3 connect to either an IEEE 802.11g or IEEE 802.11b wireless device
Preamble Mode	Select a preamble type. Choices are Long , Short and Auto .The default setting is Auto . Refer to Section 2.4 on page 29 for more information.
Save	Click Save to save the changes back to the G-302 v3.

CHAPTER 4

Maintenance

This chapter describes how to uninstall or upgrade the ZyXEL utility.

4.1 The About Screen


The **About** screen displays related version numbers of the G-302 v3. To display the screen as shown below, click the about () button.

Figure 27 About



The following table describes the read-only fields in this screen.

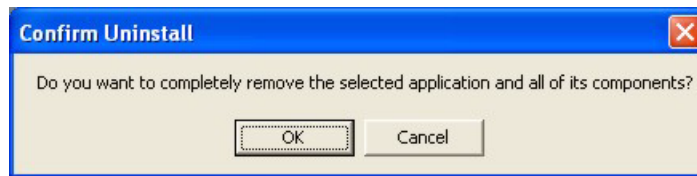
Table 14 About

LABEL	DESCRIPTION
Driver Version	This field displays the version number of the G-302 v3 driver.
Utility Version	This field displays the version number of the ZyXEL utility.

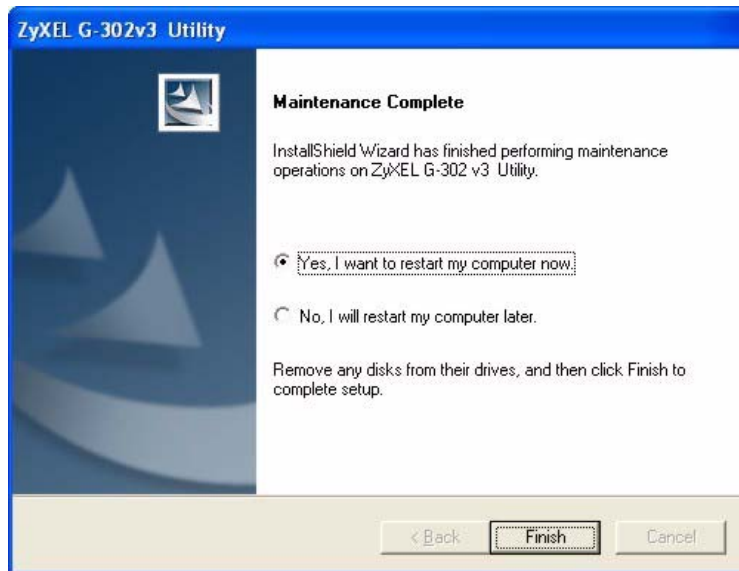
4.2 Uninstalling the ZyXEL Utility

Follow the steps below to remove (or uninstall) the ZyXEL utility from your computer.

- 1** Click **Start, Programs, ZyXEL G-302 v3 Utility, Uninstall ZyXEL G-302 v3 Utility**.
- 2** When prompted, click **OK** or **Yes** to remove the driver and the utility software.

Figure 28 Uninstall: Confirm

- 3 Click **Finish** to complete uninstalling the software and restart the computer when prompted.

Figure 29 Uninstall: Finish

4.3 Upgrading the ZyXEL Utility

Note: Before you uninstall the ZyXEL utility, take note of your current wireless configurations.

To perform the upgrade, follow the steps below.

- 1 Download the latest version of the utility from the ZyXEL web site and save the file on your computer.
- 2 Follow the steps in [Section 4.2 on page 45](#) to remove the current ZyXEL utility from your computer.
- 3 Restart your computer when prompted.
- 4 Disconnect the G-302 v3 from your computer.
- 5 Double-click on the setup program for the new utility to start the ZyXEL utility installation.
- 6 Insert the G-302 v3 and check the version numbers in the **About** screen to make sure the new utility is installed properly.

CHAPTER 5

Troubleshooting

This chapter covers potential problems and the possible remedies. After each problem description, some instructions are provided to help you to diagnose and to solve the problem.

5.1 Problems Starting the ZyXEL Utility

Table 15 Troubleshooting Starting ZyXEL Utility

PROBLEM	CORRECTIVE ACTION
Cannot start the ZyXEL wireless LAN utility	<p>Make sure the G-302 v3 is properly inserted and the LED is on.</p> <p>Use the Device Manager to check for possible hardware conflicts. Click Start, Settings, Control Panel, System, Hardware and Device Manager. Verify the status of the G-302 v3 under Network Adapter. (Steps may vary depending on the version of Windows).</p> <p>Install the G-302 v3 in another computer.</p> <p>If the error persists, you may have a hardware problem. In this case, you should contact your local vendor.</p>
The ZyXEL utility icon does not display.	<p>If you install the Funk Odyssey Client software on the computer, uninstall (remove) both the Funk Odyssey Client software and ZyXEL utility, and then install the ZyXEL utility again after restarting the computer.</p>

5.2 Problem with the Link Quality

Table 16 Troubleshooting Link Quality

PROBLEM	CORRECTIVE ACTION
The link quality and/or signal strength is poor all the time.	<p>Search and connect to another AP with a better link quality using the Site Survey screen.</p> <p>Move your computer closer to the AP or the peer computer(s) within the transmission range.</p> <p>There may be too much radio interference (for example microwave or another AP using the same channel) around your wireless network. Relocate or reduce the radio interference.</p>

5.3 Problems Communicating With Other Computers

Table 17 Troubleshooting Communication Problem

PROBLEM	CORRECTIVE ACTION
In wireless station mode, the computer with the G-302 v3 installed cannot communicate with the other computer(s).	<p>In Infrastructure Mode</p> <ul style="list-style-type: none">• Make sure that the AP and the associated computers are turned on and working properly.• Make sure the G-302 v3 computer and the associated AP use the same SSID.• Change the AP and the associated wireless clients to use another radio channel if interference is high.• Make sure that the computer and the AP share the same security option and key. Verify the settings in the Profile Security Settings screen. <p>In Ad-Hoc (IBSS) Mode</p> <ul style="list-style-type: none">• Verify that the peer computer(s) is turned on.• Make sure the G-302 v3 computer and the peer computer(s) are using the same SSID and channel.• Make sure that the computer and the peer computer(s) share the same security settings.• Change the wireless clients to use another radio channel if interference is high.

APPENDIX A

Product Specifications

Table 18 Product Specifications

PHYSICAL AND ENVIRONMENTAL	
Product Name	ZyXEL G-302 v3 802.11g Wireless PCI Adapter
Interface	3.3V 32-bit PCI V2.2
Standards	IEEE 802.11b IEEE 802.11g
Network Architectures	Infrastructure Ad-Hoc
Antenna	One 2 dBi Dipole Antenna
Operating Temperature	0 ~ 50 degrees Centigrade
Storage Temperature	-10 ~ 70 degrees Centigrade
Operating Humidity	20 ~ 95% (non-condensing)
Storage Humidity	20 ~ 95% (non-condensing)
Power Consumption	TX: <340mA RX: <330mA
Voltage	3.3V
Weight	45.5g
Dimension	(W) 18 mm × (L) 122 mm × (H) 120 mm
RADIO SPECIFICATIONS	
Media Access Protocol	IEEE 802.11
Frequency	USA (FCC) & Canada 11 Channels: 2.412GHz~2.462GHz Europe (ETSI) 13 Channels: 2.412GHz~2.472GHz Japan (TELEC) 14 Channels: 2.412GHz~2.483GHz
Data Rate	IEEE 802.11g: Orthogonal Frequency Division Multiplexing (OFDM): 54, 48, 36, 24, 18, 12, 9, 6 Mbps IEEE 802.11b: 11, 5.5, 2, 1 Mbps
Modulation	IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK) IEEE 802.11b: PBCC, Direct Sequence Spread Spectrum (DSSS), (CCK, DQPSK, DBPSK)
Output Power	14dBm (typical) at 54 Mbps 17dBm (typical) at 11 Mbps
RX Sensitivity	IEEE 802.11g (OFDM): 54 Mbps: < -69 dBm (typical) IEEE 802.11b (CCK): 11 Mbps: < -86 dBm (typical)
SOFTWARE SPECIFICATIONS	
Device Drivers	Microsoft Windows 98 Second Edition, Windows ME, Windows 2000, Windows XP

Table 18 Product Specifications (continued)

ZyXEL Utility	ZyXEL Wireless Configuration Tool
Security	64/128/256-bit WEP WPA/WPA-PSK/WPA2/WPA2-PSK IEEE 802.1x

APPENDIX B

Management with Wireless Zero Configuration

This appendix shows you how to manage your ZyXEL wireless LAN adapter using the Windows XP wireless zero configuration tool.

Be sure you have the Windows XP service pack 2 installed on your computer. Otherwise, you should at least have the Windows XP service pack 1 already on your computer and download the support patch for WPA from the Microsoft web site.

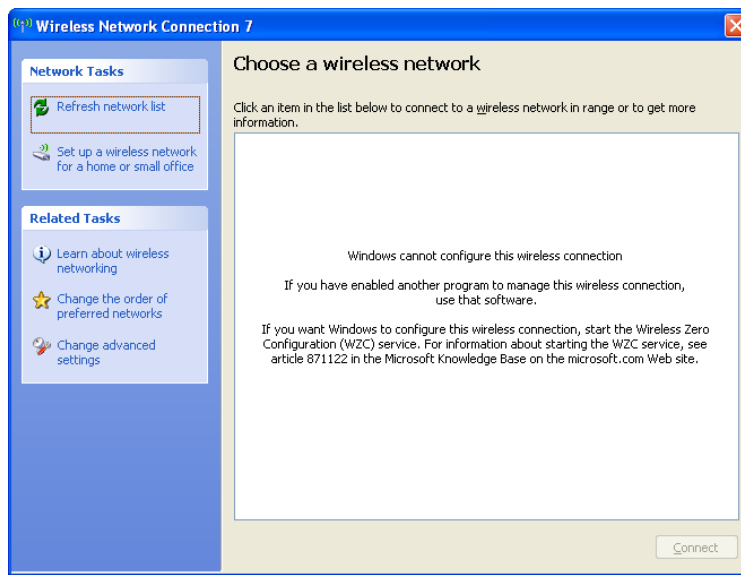
Windows XP SP2 screen shots are shown unless otherwise specified. Click the help icon (?) in most screens, move the cursor to the item that you want the information about and click to view the help.

Activating Wireless Zero Configuration

Make sure the **Use Windows to configure my wireless network settings** check box is selected in the **Wireless Network Connection Properties** screen. Refer to [Appendix B on page 53](#).

If you see the following screen, refer to article 871122 on the Microsoft web site for information on starting WZC.

Figure 30 Windows XP SP2: WZC Not Available



Connecting to a Wireless Network

- 1 Double-click the network icon for wireless connections in the system tray to open the Wireless Network Connection Status screen.

Figure 31 Windows XP SP2: System Tray Icon



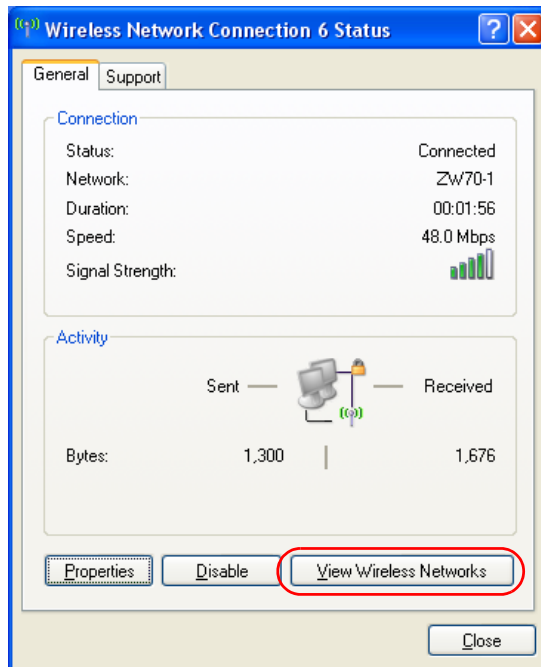
The type of the wireless network icon in Windows XP SP2 indicates the status of the ZyXEL wireless LAN adapter. Refer to the following table for details.

Table 19 Windows XP SP2: System Tray Icon

ICON	DESCRIPTION
	The ZyXEL wireless LAN adapter is connected to a wireless network.
	The ZyXEL wireless LAN adapter is in the process of connecting to a wireless network.
	The connection to a wireless network is limited because the network did not assign a network address to the computer.
	The ZyXEL wireless LAN adapter is not connected to a wireless network.

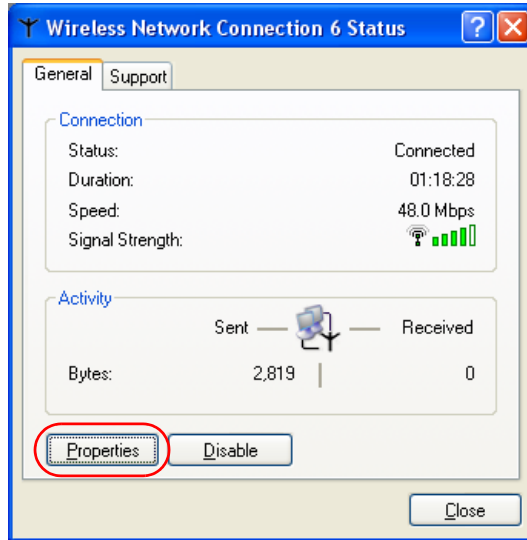
- 2 Windows XP SP2: In the **Wireless Network Connection Status** screen, click **View Wireless Networks** to open the **Wireless Network Connection** screen.

Figure 32 Windows XP SP2: Wireless Network Connection Status



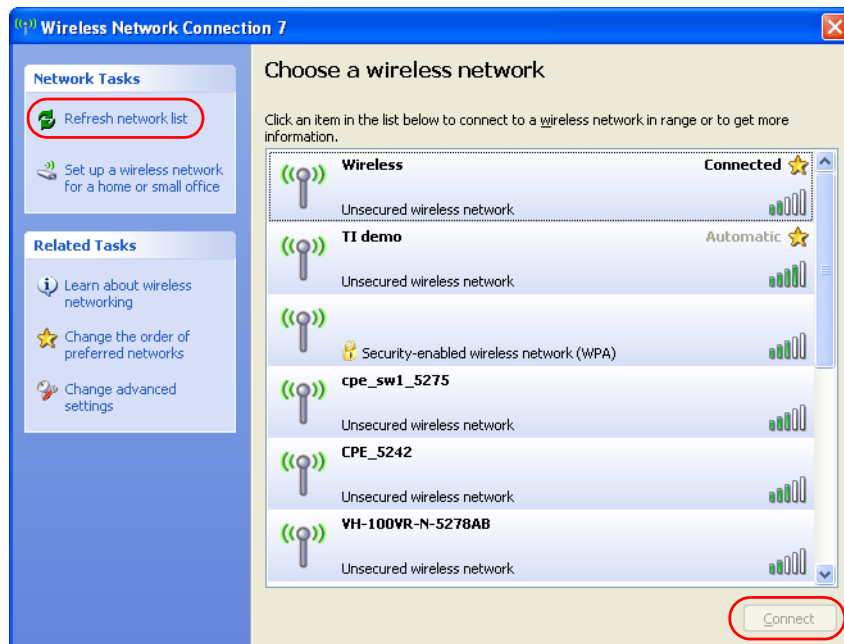
Windows XP SP1: In the **Wireless Network Connection Status** screen, click **Properties** and the **Wireless Networks** tab to open the **Wireless Network Connection Properties** screen.

Figure 33 Windows XP SP1: Wireless Network Connection Status






- 3 Windows XP SP2: Click **Refresh network list** to reload and search for available wireless devices within transmission range. Select a wireless network in the list and click **Connect** to join the selected wireless network.

Figure 34 Windows XP SP2: Wireless Network Connection



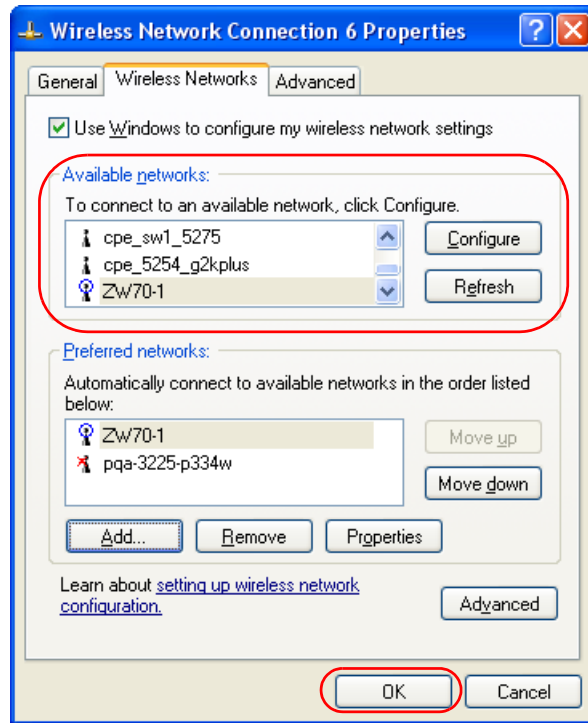
The following table describes the icons in the wireless network list.

Table 20 Windows XP SP2: Wireless Network Connection

ICON	DESCRIPTION
	This denotes that wireless security is activated for the wireless network.
	This denotes that this wireless network is your preferred network. Ordering your preferred networks is important because the ZyXEL wireless LAN adapter tries to associate to the preferred network first in the order that you specify. Refer to the section on ordering the preferred networks for detailed information.
	This denotes the signal strength of the wireless network. Move your cursor to the icon to see details on the signal strength.

Windows XP SP1: Click **Refresh** to reload and search for available wireless devices within transmission range. Select a wireless network in the **Available networks** list, click **Configure** and set the related fields to the same security settings as the associated AP to add the selected network into the **Preferred** networks table. Click **OK** to join the selected wireless network. Refer to the section on security settings (discussed later) for more information.

Figure 35 Windows XP SP1: Wireless Network Connection Properties



4. Windows XP SP2: If the wireless security is activated for the selected wireless network, the **Wireless Network Connection** screen displays. You must set the related fields in the **Wireless Network Connection** screen to the same security settings as the associated AP and click **Connect**. Refer to the section about security settings for more information. Otherwise click **Cancel** and connect to another wireless network without data encryption.

If there is no security activated for the selected wireless network, a warning screen appears. Click **Connect Anyway** if wireless security is not your concern.

Figure 36 Windows XP SP2: Wireless Network Connection: WEP or WPA-PSK

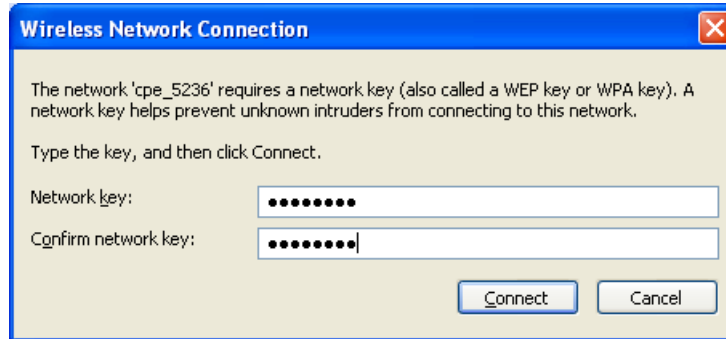
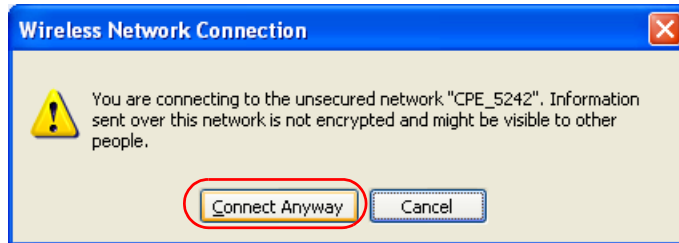


Figure 37 Windows XP SP2: Wireless Network Connection: No Security



- 5 Verify that you have successfully connected to the selected network and check the connection status in the wireless network list or the connection icon in the **Preferred networks** or **Available networks** list.

The following table describes the connection icons.

Table 21 Windows XP: Wireless Networks

ICON	DESCRIPTION
	This denotes the wireless network is an available wireless network.
	This denotes the ZyXEL wireless LAN adapter is associated to the wireless network.
	This denotes the wireless network is not available.

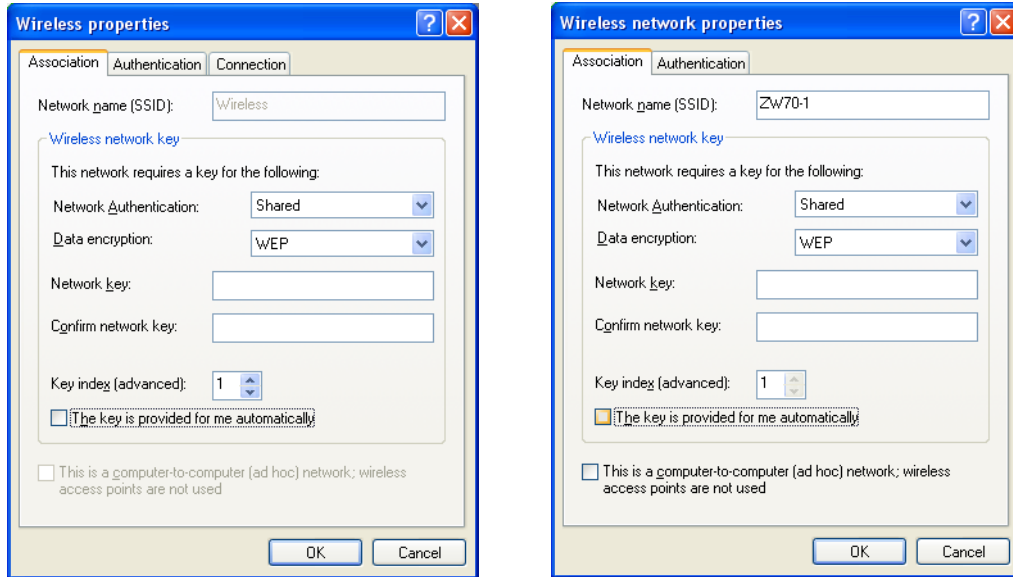
Security Settings

When you configure the ZyXEL wireless LAN adapter to connect to a secure network but the security settings are not yet enabled on the ZyXEL wireless LAN adapter, you will see different screens according to the authentication and encryption methods used by the selected network.

Association

Select a network in the Preferred networks list and click Properties to view or configure security.

Figure 38 Windows XP: Wireless (network) properties: Association



The following table describes the labels in this screen.

Table 22 Windows XP: Wireless (network) properties: Association

LABEL	DESCRIPTION
Network name (SSID)	This field displays the SSID (Service Set Identifier) of each wireless network.
Network Authentication	This field automatically shows the authentication method (Share , Open , WPA or WPA-PSK) used by the selected network.
Data Encryption	This field automatically shows the encryption type (TKIP , WEP or Disable) used by the selected network.
Network Key	Enter the pre-shared key or WEP key. The values for the keys must be set up exactly the same on all wireless devices in the same wireless LAN.
Confirm network key	Enter the key again for confirmation.
Key index (advanced)	Select a default WEP key to use for data encryption. This field is available only when the network use WEP encryption method and the The key is provided for me automatically check box is not selected.
The key is provided for me automatically	If this check box is selected, the wireless AP assigns the ZyXEL wireless LAN adapter a key.

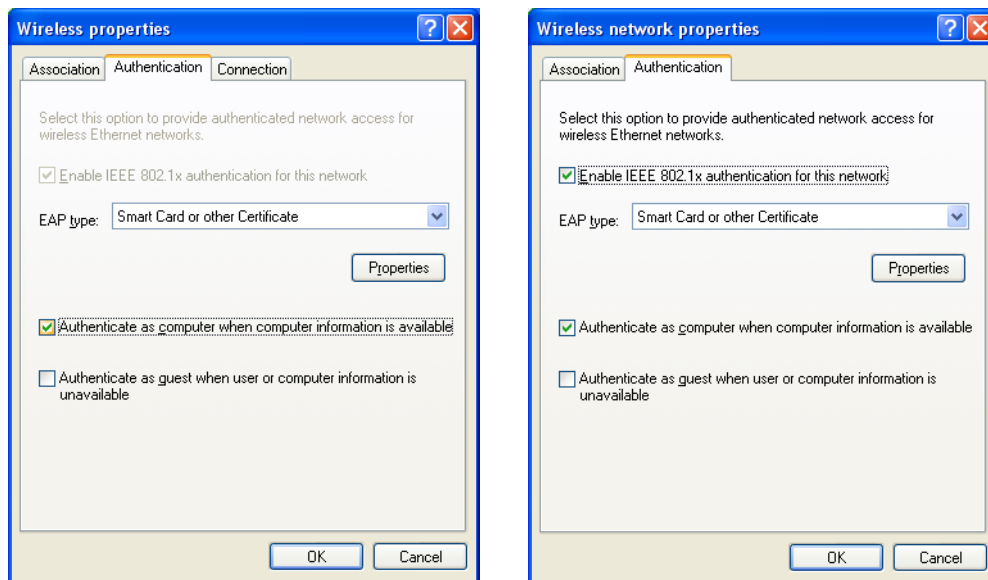
Table 22 Windows XP: Wireless (network) properties: Association (continued)

LABEL	DESCRIPTION
This is a computer-to-computer (ad hoc) network; wireless access points are not used	If this check box is selected, you are connecting to another computer directly.
OK	Click OK to save your changes.
Cancel	Click Cancel to leave this screen without saving any changes you may have made.

Authentication

Click the **Authentication** tab in the **Wireless (network) properties** screen to display the screen shown next. The fields on this screen are grayed out when the network is in Ad-Hoc mode or data encryption is disabled.

Figure 39 Windows XP: Wireless (network) properties: Authentication



The following table describes the labels in this screen.

Table 23 Windows XP: Wireless (network) properties: Authentication

LABEL	DESCRIPTION
Enable IEEE 802.1x authentication for this network	This field displays whether the IEEE 802.1x authentication is active. If the network authentication is set to Open in the previous screen, you can choose to disable or enable this feature.
EAP Type	Select the type of EAP authentication. Options are Protected EAP (PEAP) and Smart Card or other Certificate .
Properties	Click this button to open the properties screen and configure certificates. The screen varies depending on what you select in the EAP type field.

Table 23 Windows XP: Wireless (network) properties: Authentication (continued)

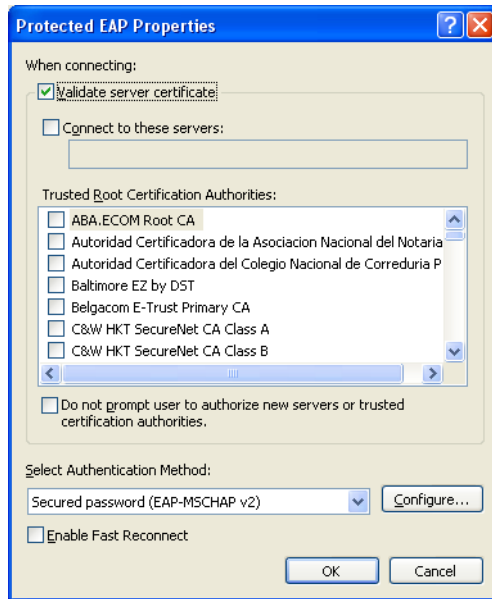
LABEL	DESCRIPTION
Authenticate as computer when computer information is available	Select this check box to have the computer send its information to the network for authentication when a user is not logged on.
Authenticate as guest when user or computer information is unavailable	Select this check box to have the computer access to the network as a guest when a user is not logged on or computer information is not available.
OK	Click OK to save your changes.
Cancel	Click Cancel to leave this screen without saving any changes you may have made.

Authentication Properties

Select an EAP authentication type in the **Wireless (network) properties: Authentication** screen and click the **Properties** button to display the following screen.

Protected EAP Properties

Figure 40 Windows XP: Protected EAP Properties



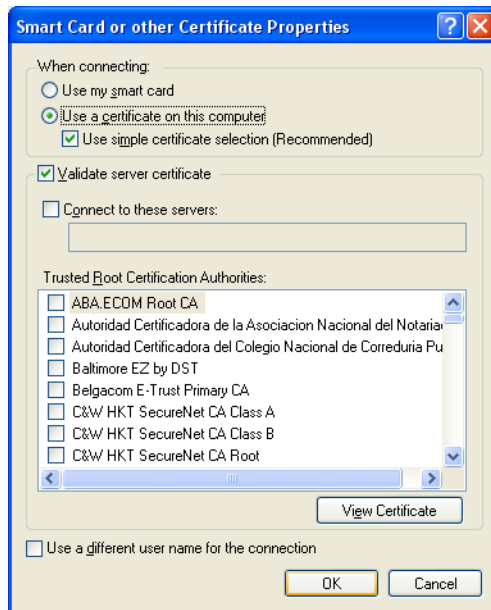
The following table describes the labels in this screen.

Table 24 Windows XP: Protected EAP Properties

LABEL	DESCRIPTION
Validate server certificate	Select the check box to verify the certificate of the authentication server.
Connect to these servers	Select the check box and specify a domain in the field below to have your computer connect to a server which resides only within this domain.
Trusted Root Certification Authorities:	Select a trusted certification authority from the list below. Note: You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA). Consult your network administrator for more information.
Do not prompt user to authorize new server or trusted certification authorities.	Select this check box to verify a new authentication server or trusted CA without prompting. This field is available only if you installed the Windows XP server pack 2.
Select Authentication Method:	Select an authentication method from the drop-down list box and click Configure to do settings.
Enable Fast Reconnect	Select the check box to automatically reconnect to the network (without re-authentication) if the wireless connection goes down.
OK	Click OK to save your changes.
Cancel	Click Cancel to leave this screen without saving any changes you may have made.

Smart Card or other Certificate Properties

Figure 41 Windows XP: Smart Card or other Certificate Properties



The following table describes the labels in this screen.

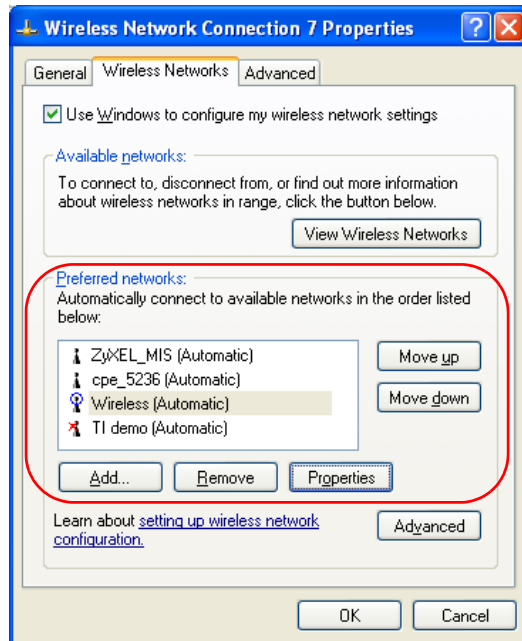
Table 25 Windows XP: Smart Card or other Certificate Properties

LABEL	DESCRIPTION
Use my smart card	Select this check box to use the smart card for authentication.
Use a certificate on this computer	Select this check box to use a certificate on your computer for authentication.
Validate server certificate	Select the check box to check the certificate of the authentication server.
Connect to these servers	Select the check box and specify a domain in the field below to have your computer connect to a server which resides only within this domain.
Trusted Root Certification Authorities:	Select a trusted certification authority from the list below. Note: You must first have a wired connection to a network and obtain the certificate(s) from a certificate authority (CA). Consult your network administrator for more information.
View Certificate	Click this button if you want to verify the selected certificate.
Use a different user name for the connection:	Select the check box to use a different user name when the user name in the smart card or certificate is not the same as the user name in the domain that you are logged on to.
OK	Click OK to save your changes.
Cancel	Click Cancel to leave this screen without saving any changes you may have made.

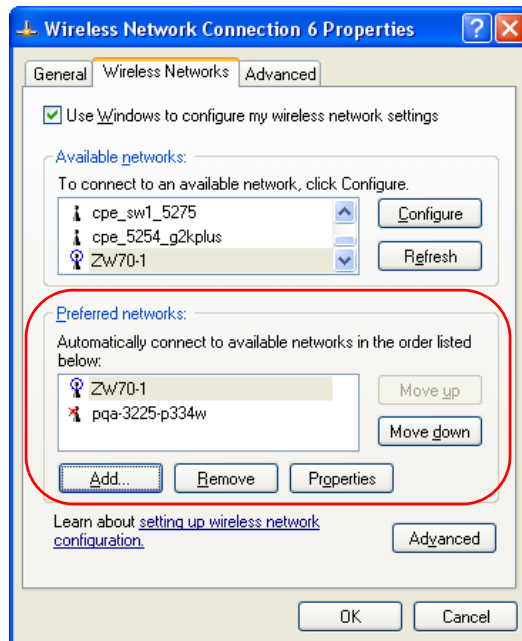
Ordering the Preferred Networks

Follow the steps below to manage your preferred networks.

- 1 Windows XP SP2: Click **Change the order of preferred networks** in the **Wireless Network Connection** screen (see [Figure 34 on page 53](#)). The screen displays as shown.

Figure 42 Windows XP SP2: Wireless Networks: Preferred Networks

Windows XP SP1: In the **Wireless Network Connection Status** screen, click **Properties** and the **Wireless Networks** tab to open the screen as shown.

Figure 43 Windows XP SP1: Wireless Networks: Preferred Networks

- Whenever the ZyXEL wireless LAN adapter tries to connect to a new network, the new network is added in the **Preferred networks** table automatically. Select a network and click **Move up** or **Move down** to change its order, click **Remove** to delete it or click **Properties** to view the security, authentication or connection information of the selected network. Click **Add** to add a preferred network into the list manually.

APPENDIX C

Wireless Security

Types of EAP Authentication

This section discusses some popular authentication types: EAP-MD5, EAP-TLS, EAP-TTLS, PEAP and LEAP.

The type of authentication you use depends on the RADIUS server or the AP. Consult your network administrator for more information. Your wireless LAN device may not support all authentication types.

EAP-MD5 (Message-Digest Algorithm 5)

MD5 authentication is the simplest one-way authentication method. The authentication server sends a challenge to the wireless station. The wireless station 'proves' that it knows the password by encrypting the password with the challenge and sends back the information. Password is not sent in plain text.

However, MD5 authentication has some weaknesses. Since the authentication server needs to get the plaintext passwords, the passwords must be stored. Thus someone other than the authentication server may access the password file. In addition, it is possible to impersonate an authentication server as MD5 authentication method does not perform mutual authentication. Finally, MD5 authentication method does not support data encryption with dynamic session key. You must configure WEP encryption keys for data encryption.

EAP-TLS (Transport Layer Security)

With EAP-TLS, digital certifications are needed by both the server and the wireless stations for mutual authentication. The server presents a certificate to the client. After validating the identity of the server, the client sends a different certificate to the server. The exchange of certificates is done in the open before a secured tunnel is created. This makes user identity vulnerable to passive attacks. A digital certificate is an electronic ID card that authenticates the sender's identity. However, to implement EAP-TLS, you need a Certificate Authority (CA) to handle certificates, which imposes a management overhead.

EAP-TTLS (Tunneled Transport Layer Service)

EAP-TTLS is an extension of the EAP-TLS authentication that uses certificates for only the server-side authentications to establish a secure connection. Client authentication is then done by sending username and password through the secure connection, thus client identity is protected. For client authentication, EAP-TTLS supports EAP methods and legacy authentication methods such as PAP, CHAP, MS-CHAP and MS-CHAP v2.

PEAP (Protected EAP)

Like EAP-TTLS, server-side certificate authentication is used to establish a secure connection, then use simple username and password methods through the secured connection to authenticate the clients, thus hiding client identity. However, PEAP only supports EAP methods, such as EAP-MD5, EAP-MSCHAPv2 and EAP-GTC (EAP-Generic Token Card), for client authentication. EAP-GTC is implemented only by Cisco.

LEAP

LEAP (Lightweight Extensible Authentication Protocol) is a Cisco implementation of IEEE 802.1x.

Dynamic WEP Key Exchange

The AP maps a unique key that is generated with the RADIUS server. This key expires when the wireless connection times out, disconnects or reauthentication times out. A new WEP key is generated each time reauthentication is performed.

If this feature is enabled, it is not necessary to configure a default encryption key in the Wireless screen. You may still configure and store keys here, but they will not be used while Dynamic WEP is enabled.

Note: EAP-MD5 cannot be used with Dynamic WEP Key Exchange

For added security, certificate-based authentications (EAP-TLS, EAP-TTLS and PEAP) use dynamic keys for data encryption. They are often deployed in corporate environments, but for public deployment, a simple user name and password pair is more practical. The following table is a comparison of the features of authentication types.

Table 26 Comparison of EAP Authentication Types

	EAP-MD5	EAP-TLS	EAP-TTLS	PEAP	LEAP
Mutual Authentication	No	Yes	Yes	Yes	Yes
Certificate – Client	No	Yes	Optional	Optional	No
Certificate – Server	No	Yes	Yes	Yes	No
Dynamic Key Exchange	No	Yes	Yes	Yes	Yes
Credential Integrity	None	Strong	Strong	Strong	Moderate

Table 26 Comparison of EAP Authentication Types

	EAP-MD5	EAP-TLS	EAP-TTLS	PEAP	LEAP
Deployment Difficulty	Easy	Hard	Moderate	Moderate	Moderate
Client Identity Protection	No	No	Yes	Yes	No

WPA(2)

Wi-Fi Protected Access (WPA) is a subset of the IEEE 802.11i standard. WPA2 (IEEE 802.11i) is a wireless security standard that defines stronger encryption, authentication and key management than WPA.

Key differences between WPA(2) and WEP are improved data encryption and user authentication.

If both an AP and the wireless clients support WPA2 and you have an external RADIUS server, use WPA2 for stronger data encryption. If you don't have an external RADIUS server, you should use WPA2-PSK (WPA2-Pre-Shared Key) that only requires a single (identical) password entered into each access point, wireless gateway and wireless client. As long as the passwords match, a wireless client will be granted access to a WLAN.

If the AP or the wireless clients do not support WPA2, just use WPA or WPA-PSK depending on whether you have an external RADIUS server or not.

Select WEP only when the AP and/or wireless clients do not support WPA or WPA2. WEP is less secure than WPA or WPA2.

Encryption

Both WPA and WPA2 improve data encryption by using Temporal Key Integrity Protocol (TKIP), Message Integrity Check (MIC) and IEEE 802.1x. WPA and WPA2 use Advanced Encryption Standard (AES) in the Counter mode with Cipher block chaining Message authentication code Protocol (CCMP) to offer stronger encryption than TKIP.

TKIP uses 128-bit keys that are dynamically generated and distributed by the authentication server. AES (Advanced Encryption Standard) is a block cipher that uses a 256-bit mathematical algorithm called Rijndael. They both include a per-packet key mixing function, a Message Integrity Check (MIC) named Michael, an extended initialization vector (IV) with sequencing rules, and a re-keying mechanism.

WPA and WPA2 regularly change and rotate the encryption keys so that the same encryption key is never used twice.

The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless stations. This all happens in the background automatically.

The Message Integrity Check (MIC) is designed to prevent an attacker from capturing data packets, altering them and resending them. The MIC provides a strong mathematical function in which the receiver and the transmitter each compute and then compare the MIC. If they do not match, it is assumed that the data has been tampered with and the packet is dropped.

By generating unique data encryption keys for every data packet and by creating an integrity checking mechanism (MIC), with TKIP and AES it is more difficult to decrypt data on a Wi-Fi network than WEP and difficult for an intruder to break into the network.

The encryption mechanisms used for WPA(2) and WPA(2)-PSK are the same. The only difference between the two is that WPA(2)-PSK uses a simple common password, instead of user-specific credentials. The common-password approach makes WPA(2)-PSK susceptible to brute-force password-guessing attacks but it's still an improvement over WEP as it employs a consistent, single, alphanumeric password to derive a PMK which is used to generate unique temporal encryption keys. This prevent all wireless devices sharing the same encryption keys. (a weakness of WEP)

User Authentication

WPA and WPA2 apply IEEE 802.1x and Extensible Authentication Protocol (EAP) to authenticate wireless stations using an external RADIUS database. WPA2 reduces the number of key exchange messages from six to four (CCMP 4-way handshake) and shortens the time required to connect to a network. Other WPA2 authentication features that are different from WPA include key caching and pre-authentication. These two features are optional and may not be supported in all wireless devices.

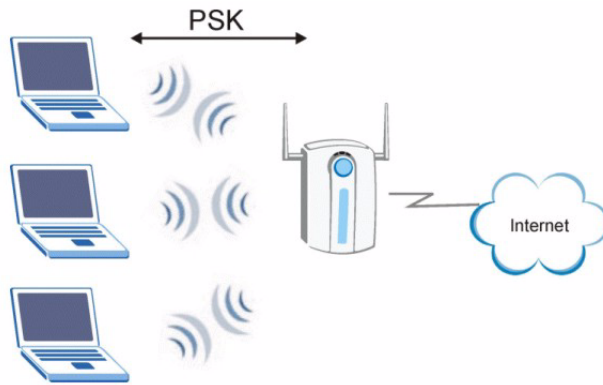
Key caching allows a wireless client to store the PMK it derived through a successful authentication with an AP. The wireless client uses the PMK when it tries to connect to the same AP and does not need to go with the authentication process again.

Pre-authentication enables fast roaming by allowing the wireless client (already connecting to an AP) to perform IEEE 802.1x authentication with another AP before connecting to it.

WPA(2)-PSK Application Example

A WPA(2)s-PSK application looks as follows.

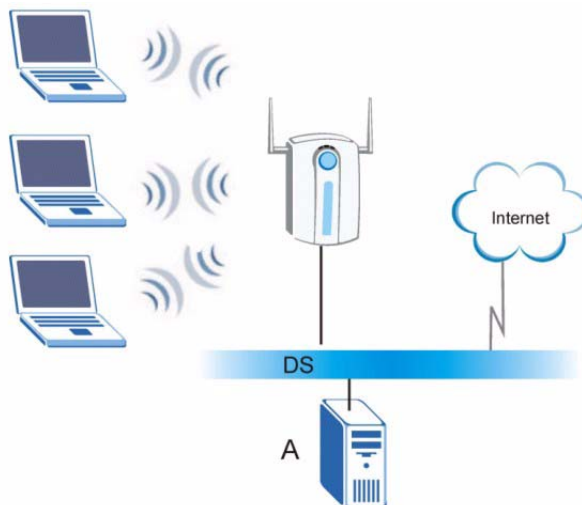
- 1** First enter identical passwords into the AP and all wireless clients. The Pre-Shared Key (PSK) must consist of between 8 and 63 ASCII characters or 64 hexadecimal characters (including spaces and symbols).
- 2** The AP checks each client's password and (only) allows it to join the network if it matches its password.
- 3** The AP and wireless clients use the pre-shared key to generate a common PMK.
- 4** The AP and wireless clients use the TKIP or AES encryption process to encrypt data exchanged between them.

Figure 44 WPA-PSK Authentication

WPA(2) with RADIUS Application Example

You need the IP address of the RADIUS server, its port number (default is 1812), and the RADIUS shared secret. A WPA(2) application example with an external RADIUS server looks as follows. "A" is the RADIUS server. "DS" is the distribution system.

- 1 The AP passes the wireless client's authentication request to the RADIUS server.
- 2 The RADIUS server then checks the user's identification against its database and grants or denies network access accordingly.
- 3 The RADIUS server distributes a Pairwise Master Key (PMK) key to the AP that then sets up a key hierarchy and management system, using the pair-wise key to dynamically generate unique data encryption keys to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients.

Figure 45 WPA(2) with RADIUS Application Example

Security Parameters Summary

Refer to this table to see what other security parameters you should configure for each Authentication Method/ key management protocol type. MAC address filters are not dependent on how you configure these security features.

Table 27 Wireless Security Relational Matrix

AUTHENTICATION METHOD/ KEY MANAGEMENT PROTOCOL	ENCRYPTION METHOD	ENTER MANUAL KEY	IEEE 802.1X
Open	None	No	Disable
			Enable without Dynamic WEP Key
Open	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
Shared	WEP	No	Enable with Dynamic WEP Key
		Yes	Enable without Dynamic WEP Key
		Yes	Disable
WPA	TKIP/AES	No	Enable
WPA-PSK	TKIP/AES	Yes	Disable
WPA2	TKIP/AES	No	Enable
WPA2-PSK	TKIP/AES	Yes	Disable

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