WPA-1000

802.11g Wireless Projector Adapter

User's Guide

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Edition 1

ZyXEL

www.zyxel.com

About This User's Guide

Intended Audience

This manual is intended for people who want to configure the WPA-1000 using the web configurator. You should have at least a basic knowledge of TCP/IP networking concepts and topology.

Related Documentation

- Quick Start Guide
  The Quick Start Guide is designed to help you get up and running right away. It contains information on setting up your network and configuring for Internet access.
- Web Configurator Online Help
  Embedded web help for descriptions of individual screens and supplementary information.

It is recommended you use the web configurator to configure the WPA-1000.

- Supporting Disk
  Refer to the included CD for support documents.
- ZyXEL Web Site
  Please refer to www.zyxel.com for additional support documentation and product certifications.

User Guide Feedback

Help us help you. Send all User Guide-related comments, questions or suggestions for improvement to the following address, or use e-mail instead. Thank you!

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Document Conventions

Warnings and Notes

These are how warnings and notes are shown in this User's Guide.

Warnings tell you about things that could harm you or your device.

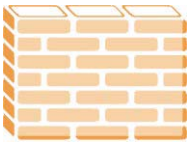
Notes tell you other important information (for example, other things you may need to configure or helpful tips) or recommendations.

Syntax Conventions

- The ZyWALL 1050 may be referred to as the "WPA-1000", the "device", the "system" or the "product" in this User's Guide.
- Product labels, screen names, field labels and field choices are all in **bold** font.
- A key stroke is denoted by square brackets and uppercase text, for example, [ENTER] means the "enter" or "return" key on your keyboard.
- "Enter" means for you to type one or more characters and then press the [ENTER] key. "Select" or "choose" means for you to use one of the predefined choices.
- A right angle bracket (>) within a screen name denotes a mouse click. For example, **Maintenance > Log > Log Setting** means you first click **Maintenance** in the navigation panel, then the **Log** sub menu and finally the **Log Setting** tab to get to that screen.
- Units of measurement may denote the "metric" value or the "scientific" value. For example, "k" for kilo may denote "1000" or "1024", "M" for mega may denote "1000000" or "1048576" and so on.
- "e.g.," is a shorthand for "for instance", and "i.e.," means "that is" or "in other words".

Icons Used in Figures

Figures in this User's Guide may use the following generic icons. The WPA-1000 icon is not an exact representation of your device.

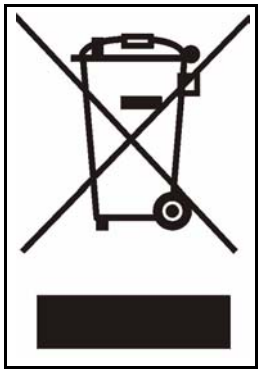
WPA-1000 	Computer 	Notebook computer 
Server 	DSLAM 	Firewall 
Telephone 	Switch 	Router 

Safety Warnings

For your safety, be sure to read and follow all warning notices and instructions.

- Do NOT use this product near water, for example, in a wet basement or near a swimming pool.
- Do NOT expose your device to dampness, dust or corrosive liquids.
- Do NOT store things on the device.
- Do NOT install, use, or service this device during a thunderstorm. There is a remote risk of electric shock from lightning.
- Connect ONLY suitable accessories to the device.
- Do NOT open the device or unit. Opening or removing covers can expose you to dangerous high voltage points or other risks. ONLY qualified service personnel should service or disassemble this device. Please contact your vendor for further information.
- Make sure to connect the cables to the correct ports.
- Place connecting cables carefully so that no one will step on them or stumble over them.
- Always disconnect all cables from this device before servicing or disassembling.
- Use ONLY an appropriate power adaptor or cord for your device. Connect it to the right supply voltage (for example, 110V AC in North America or 230V AC in Europe).
- Do NOT allow anything to rest on the power adaptor or cord and do NOT place the product where anyone can walk on the power adaptor or cord.
- Do NOT use the device if the power adaptor or cord is damaged as it might cause electrocution.
- If the power adaptor or cord is damaged, remove it from the device and the power source.
- Do NOT attempt to repair the power adaptor or cord. Contact your local vendor to order a new one.)
- Do not use the device outside, and make sure all the connections are indoors. There is a remote risk of electric shock from lightening.
- Do NOT obstruct the device ventilation slots, as insufficient airflow may harm your device.
- Antenna Warning! This device meets ETSI and FCC certification requirements when using the included antenna(s). Only use the included antenna(s).
- If you wall mount your device, make sure that no electrical lines, gas or water pipes will be damaged.

This product is recyclable. Dispose of it properly.



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PART I
Introduction

1

Introducing the WPA-1000

This chapter introduces the main applications of the WPA-1000. It also introduces the ways you can manage the WPA-1000.

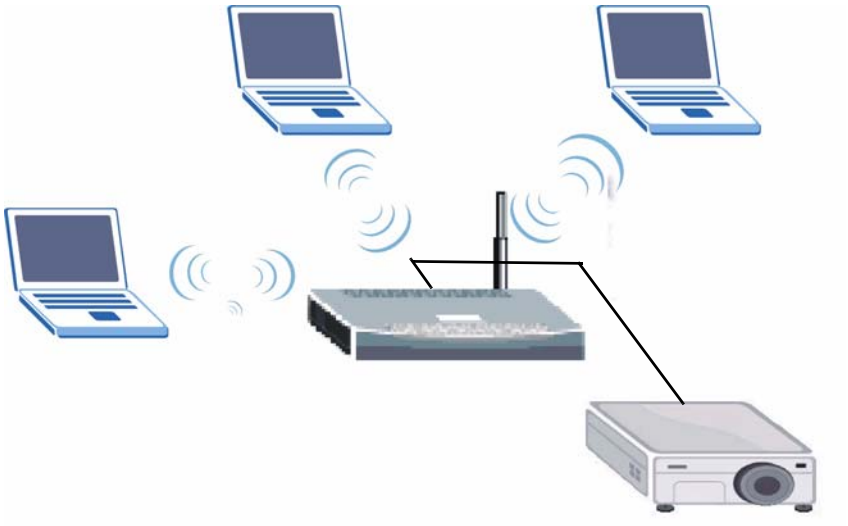
1.1 Overview

Your WPA-1000 supports a wireless connection from any computer with IEEE 802.11b/g support (see the application diagram below). Multiple meeting participants connect wirelessly to the WPA-1000 allowing them to take turns giving presentations without having to change connections to the projector.

1.1.1 AP Mode (Standalone)

Meeting participants can connect to the WPA-1000 in **AP Mode.** In this situation the WPA-1000 acts as the access point (AP) in a standalone wireless network.

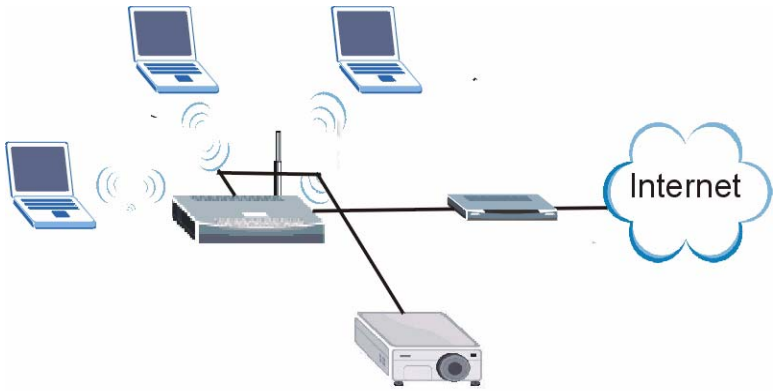
Figure 1 AP Mode (Standalone)



1.1.2 AP Mode (with Internet Access)

Meeting participants can connect to the Internet through the WPA-1000 in **AP Mode.** In this situation connect the WPA-1000 LAN port to a broadband modem for Internet access.

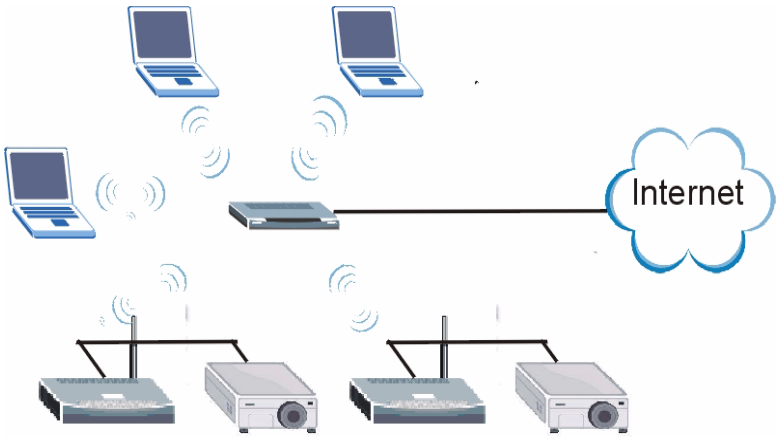
Figure 2 AP Mode (With Internet Access)



1.1.3 Infrastructure Mode (with Internet Access)

Meeting participants can also connect to the Internet and multiple projectors through the WPA-1000 in **Infrastructure Mode**. In this mode meeting participants can connect wirelessly to their own AP which may then connect (wirelessly) to a range of WPA-1000s.

Figure 3 Infrastructure Mode (With Internet Access)



1.2 Managing the WPA-1000

Web Configurator. This is recommended for everyday management of the WPA-1000 using a (supported) web browser. See Section 2.4 on page 27.

1.3 Good Habits for Managing the WPA-1000

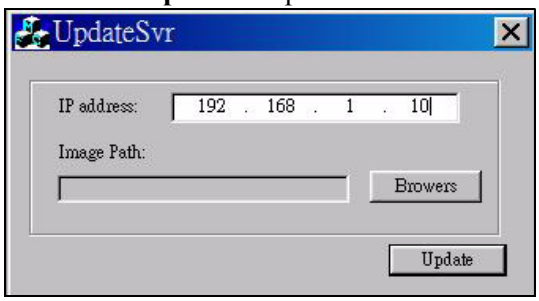
Do the following things regularly to make the WPA-1000 more secure and to manage the WPA-1000 more effectively.

- Change the password and keep a record of the password in a safe place . Use a password that's not easy to guess and that consists of different types of characters, such as numbers and letters.
- Configure wireless settings before enabling wireless and write down the wireless settings.

1.4 Firmware Upgrade

In the ZyXEL Support CD you can find the **Firmware update tool**. This tool updates your firmware. To update your firmware follow these steps.

1. Connect your computer to your WPA-1000 on the LAN port.
2. Locate your new firmware. You can find the latest firmware for your device from **www.zyxel.com → Download Library → Firmware Download.**
3. Download the new firmware to a location on your computer.
4. Click **Tools** > **Firmware Update Tool** on the CD.
5. Type the IP address of your WPA-1000.
6. Click **Browse** to use the **Firmware Update Tool** to browse to the firmware file you saved on your computer.
7. Click **Update** to upload the firmware to the WPA-1000.



8. Wait while the WPA-1000 is being updated.
9. Restart the WPA-1000 when prompted.

2

WPA-1000 Connections

2.1 Rear Panel Connections

Figure 4 Hardware Connections

The table below describes the labels in the screen.

Table 1 Hardware Connections Description

LABEL	DESCRIPTION
POWER	Use the power adapter that came with the package to connect your WPA-1000 to a power source.
ON/OFF	Press this button in to turn your device on or off.
VGA	Use the grey VGA cable from the package to connect your WPA-1000 to a projector.
RESET	To reset the WPA-1000 to its default settings, press this button down for more than 30 seconds. While pressing RESET, turn your device off and then on to reset your device to default settings. Default settings include: • **Device Name** (WPA-1000) • **ESSID** (ZyXEL) • **IP address** (192.168.1.10) • **admin** password (admin) • WEP **Key** (no value) • **Mode** (AP Mode)
LAN	Connect your computer to the LAN port using the red LAN cable that came with the package.

2.2 The LEDs

Figure 5 LEDs

The table below describes the labels in the screen.

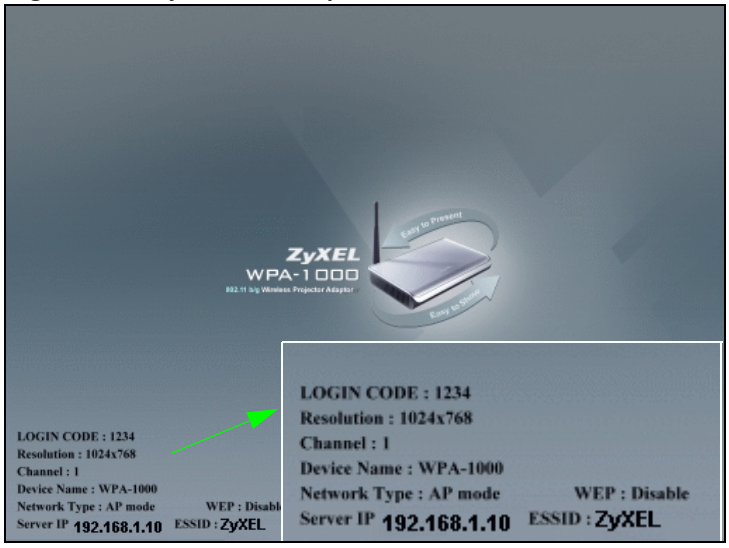
Table 2 LED Description

LED	COLOR	STATUS	DESCRIPTION
STATUS	Green	On	The WPA-1000 is ready to project.
	Orange	On	The device is starting.
		Off	The device is not starting.
PLAY	Green	Blinking	The device is projecting.
		Off	The device is not projecting.
LAN	Green	On	The device has a successful LAN connection.
		Blinking	The WPA-1000 is sending/receiving data.
		Off	The LAN is not connected.
WLAN	Green	On	The device has a successful wireless connection.
		Blinking	The device is sending/receiving data through the wireless LAN.
		Off	The device has no wireless connection.

2.3 Connecting to the Projector

Connect the WPA-1000 to the projector (see the Quick Start Guide for instructions). The following image will appear on the projector screen.

Figure 6 Projector Standby Screen



The table below describes the labels on the screen.

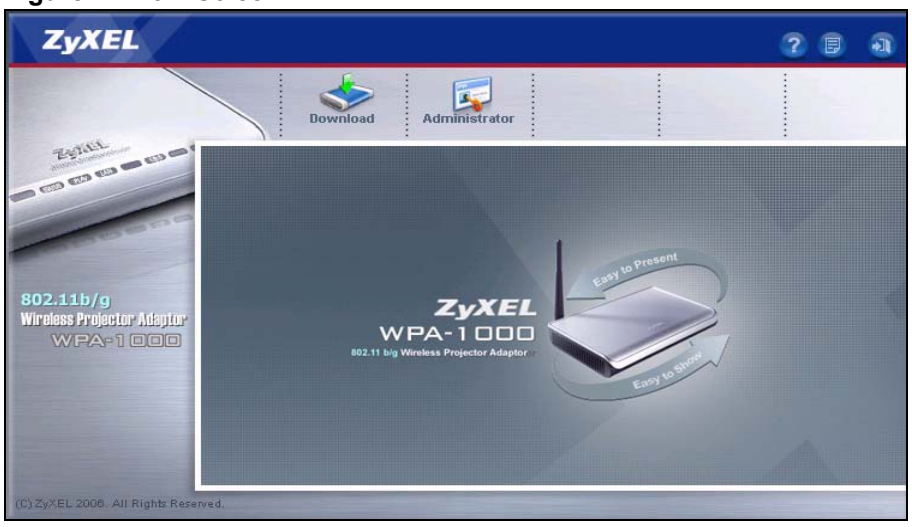
Table 3 Projector Standby Screen

LABEL	DESCRIPTION
Login Code	Use this four digit number to log in to the WPA-1000 utility.
Resolution	The WPA-1000 supports a screen resolution of 1024 * 768.
Channel	This is the wireless channel used by the WPA-1000 to connect to other wireless devices. To connect with each other, all wireless devices must be set to the same channel. The default channel is 1.
Device Name	This is the name given to the WPA-1000. This name is displayed in the user's WPA-1000 utility when a user tries to connect to it.
Network Type	This is the wireless mode for the WPA-1000. It can be either **AP mode** (default) or **Infrastructure mode**. Use **AP mode** to connect wirelessly to the WPA-1000 directly or use **Infrastructure mode** to connect to the WPA-1000 via another AP.
WEP	This shows the security mode. It shows either **Enable** or **Disable**.
Server IP	This is the current IP address for your WPA-1000. It's default is 192.168.1.10. If this value is not available it is 192.168.1.5.
ESSID	This is the ID for this device used for wireless search and login.

2.4 Main screen

Connect your computer to the WPA-1000 and open the web configurator (see the Quick Start Guide for instructions). The main screen appears. Use this screen to download the WPA-1000 utility and to configure administrator settings.

Figure 7 Main Screen



2.4.1 Download and Install the WPA-1000 Utility

See the Quick Start Guide for instructions on downloading and operating the projection utility.

2.4.2 Administrator

Click on **Administrator** in the main screen. Type your user name and password in the screen below to access the administrator screen.

Default Login Information

user name	admin
password	admin

Change the user name and password for better security. See Section 4.2 on page 33 for more information.

See the chapters in the Administrator section for more information on configuring administrator settings.

PART II Administrator

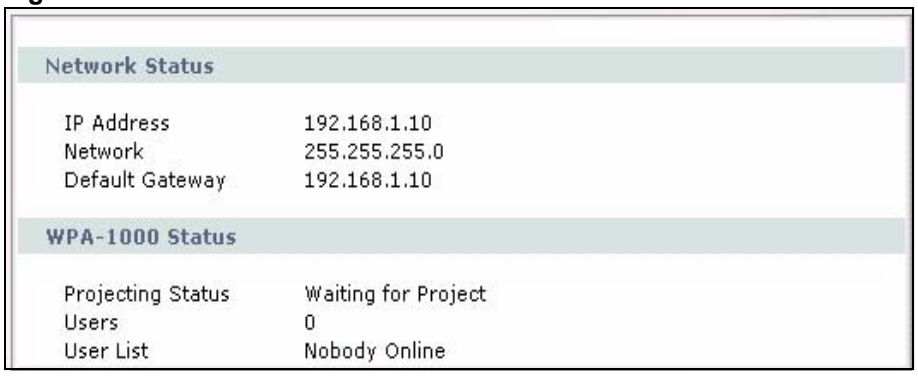
3

Status and Conference Control

3.1 Status

Use this screen to check the status of your device.

Figure 8 Status



The table below describes the labels on the screen.

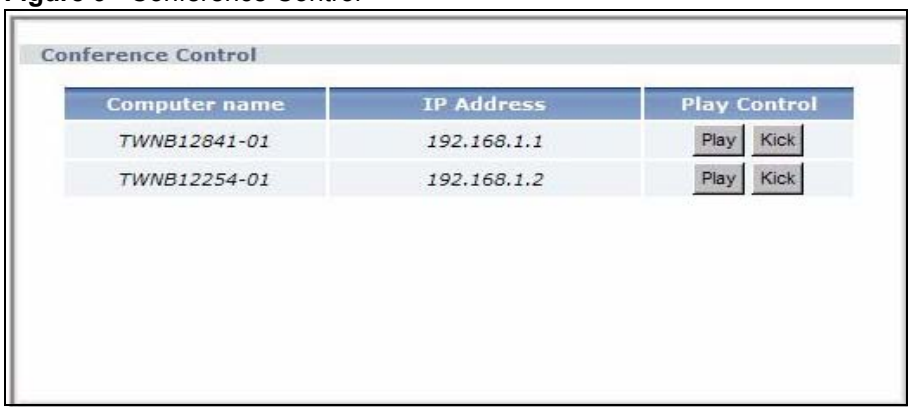
Table 4 Status

LABEL	DESCRIPTION
Network Status	
IP Address	This is the current IP address of the WPA-1000.
Network	This is the subnet mask for WPA-1000.
Default Gateway	This is the IP address of the gateway. The gateway is an immediate neighbor of your WPA-1000 that will forward the packet to the destination.
WPA-1000 Status	
Projecting Status	This is the status of the connected projector. It can be either **Waiting for Project** or **Projecting**.
Users	This shows how many people are logged into the WPA-1000. The maximum number of meeting participants allowed to log in at one time is 254.
User List	This shows a list of meeting participants who are logged into the device. The user highlighted in red is currently projecting.

3.2 Conference Control

Use this screen to manage users.

Figure 9 Conference Control



The table below describes the labels on the screen.

Table 5 Conference Control

LABEL	DESCRIPTION
Conference Control	
Computer Name	This list shows the computer name of each computer logged on to the WPA-1000.
IP Address	This is the IP address for each computer that is logged on to the device.
Play Control	• Click **Play** to begin or resume a user's presentation • Click **Stop** to cut a user's presentation. • Click **Kick** to disconnect a user from the network.

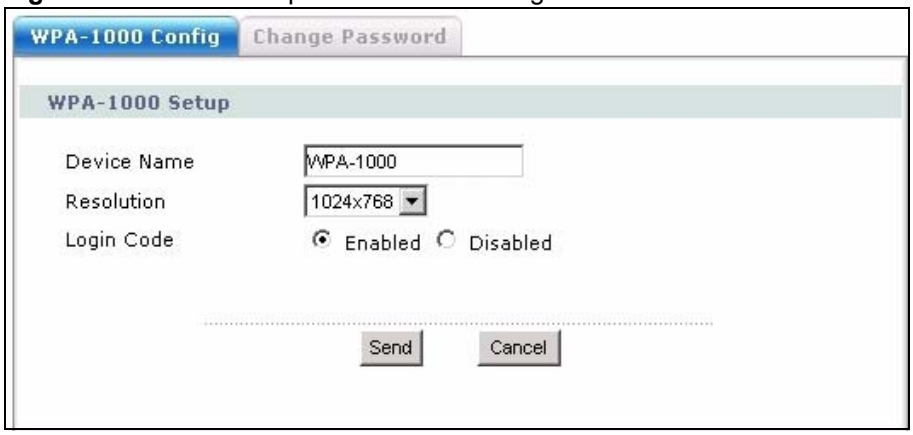
4

Device Setup

4.1 WPA-1000 Config

Use this screen to configure the settings on your WPA-1000.

Figure 10 Device Setup > WPA-1000 Config



The table below describes the labels on the screen.

Table 6 Device Setup > WPA-1000 Config

LABEL	DESCRIPTION
WPA-1000 Setup	
Device Name	Set your own device name for your device. The default is WPA-1000.
Resolution	Your WPA-1000 supports 1024*768 resolution only at the time of writing.
Login Code	The login code is a password that allows a meeting participant access to the WPA-1000 utility in order to show a presentation. • Select **Enabled** to require meeting participants to log in to the device. • Select **Disabled** if you do not require meeting participants to enter a code to log in.
Send	Click **Send** to apply your settings.
Cancel	Click **Cancel** to return to the previous settings.

4.2 Change Password

Use this screen to change the administrator's password.

Figure 11 Device Setup > Change Password

The table below describes the labels on the screen.

Table 7 Device Setup > Change Password

LABEL	DESCRIPTION
System Password	
Enter New Password	Type a new password here. Use a combination of letters and digits without a space, up to 16 characters long.
Confirm New Password	Type exactly the same password here to confirm your password
Send	Click **Send** to apply your settings.
Cancel	Click **Cancel** to return to the previous settings

5

Network

5.1 Network Overview

Your WPA-1000 supports a standalone network where users connect to a single projector, without an Internet connection in **AP Mode**. It also supports a network with an Internet connection in two modes: **Infrastructure Mode** and **AP Mode**.

5.1.1 AP Mode (Standalone)

In this mode users connect to the WPA-1000 either through the LAN port or wirelessly, without an Internet connection. Enable the **DHCP server** to allow the allocation of user IP addresses.

See Figure 1 on page 21 for an example.

5.1.2 AP Mode (With Internet Access)

To access the Internet, connect the WPA-1000's LAN port to a broadband modem for Internet access. In this mode meeting participants can take turns using the projector via the WPA-1000 and also access the Internet. Disable the **DHCP Server** if another DHCP server, such as your ISP, assigns IP addresses to computers on your network.

See Figure 2 on page 22 for an example.

5.1.3 Infrastructure Mode

In **Infrastructure Mode** users connect to the WPA-1000 through an access point (AP). The AP can have a connection to many wireless projection adapters (WPA) like the WPA-1000. Once the user has connected to the AP's network, the user can change projectors without having to join a new wireless network. Disable the **DHCP Server** if another DHCP server, such as your ISP, assigns IP addresses to computers on your network.

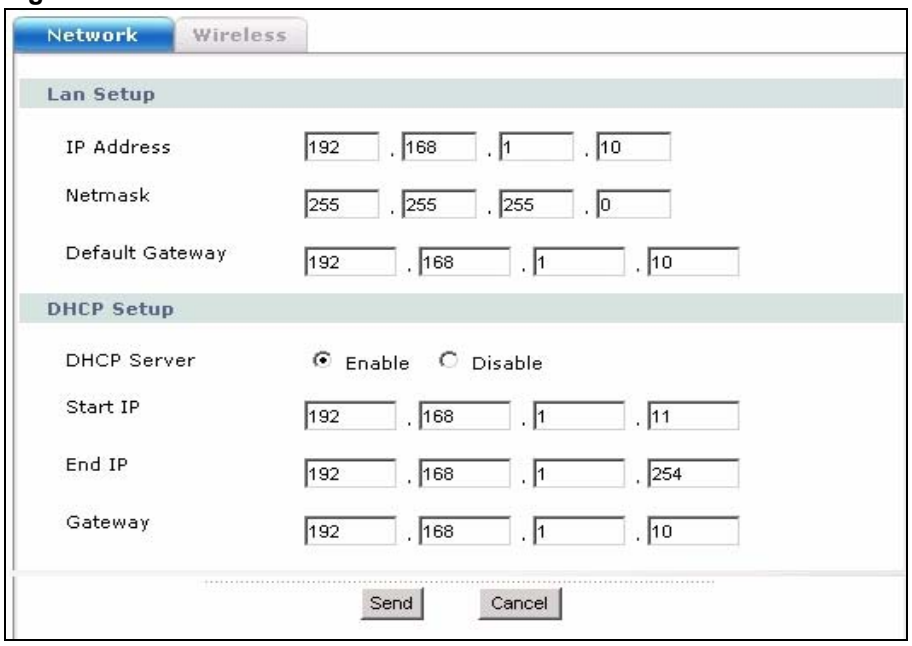
See Figure 3 on page 22 for an example.

In **Infrastructure Mode** the Ethernet port is disabled. Users and the AP must connect wirelessly to the WPA-1000.

The AP must use the same security settings as the WPA-1000 to connect to it. The WPA-1000 only supports WEP at the time of writing.

Use this screen to configure how users network with your device.

Figure 12 Network > Network



The following table describes the labels in the screen.

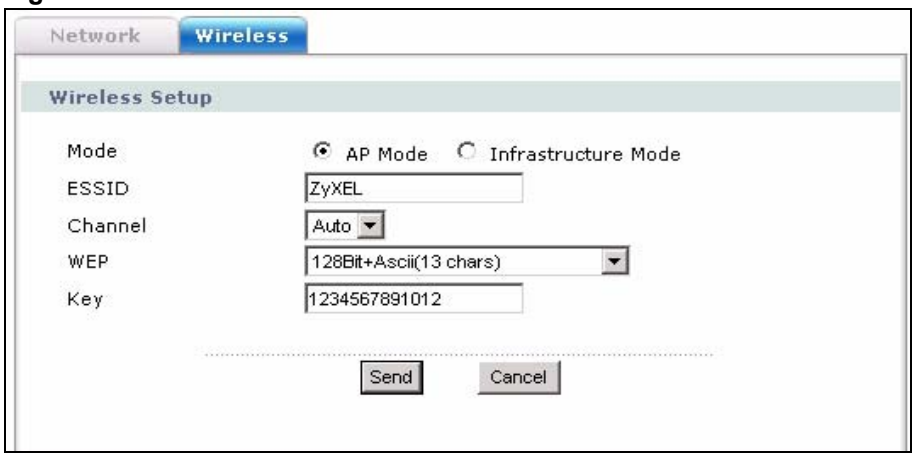
Table 8 Network > Network

LABEL	DESCRIPTION
LAN Setup	
IP Address	Set a static IP address for the WPA-1000 The default is 192.168.1.10.
Netmask	This is the subnet mask setup for the WPA-1000. Keep this set at 255.255.255.0.
Default Gateway	This is the IP address of the gateway. The gateway is an immediate neighbor of your WPA-1000 that will forward the packet to the destination. Type your Internet gateway's IP address here to make it the default.
DHCP Setup	DHCP (Dynamic Host Configuration Protocol, RFC 2131 and RFC 2132) allows individual clients (computers) to obtain TCP/IP configuration at startup from a server. When configured as a server, the WPA-1000 provides TCP/IP configuration for the clients. If not, DHCP service is disabled and you must have another DHCP server on your network, or else the computers must be manually configured.
DHCP Server	Select **Enable** the **DHCP Server** if you are not connected to another network. Complete the following fields below. Select **Disable** the **DHCP Server** if you are connected to the Internet or another network which has a **DHCP Server** on it.
Start IP	This field specifies the first of the contiguous addresses in the IP address pool. To avoid an IP address conflict, the IP address range should not include your WPA-1000's IP address.

LABEL	DESCRIPTION
End IP	This field specifies the last of the contiguous addresses in the IP address pool.
Gateway	Set the IP address of the gateway on your network. The default IP address is 192.168.1.10.
Send	Click **Send** to apply your settings.
Cancel	Click **Cancel** to return to the previous settings.

Use this screen to set up your wireless connection.

Figure 13 Network > Wireless



The following table describes the labels in the screen.

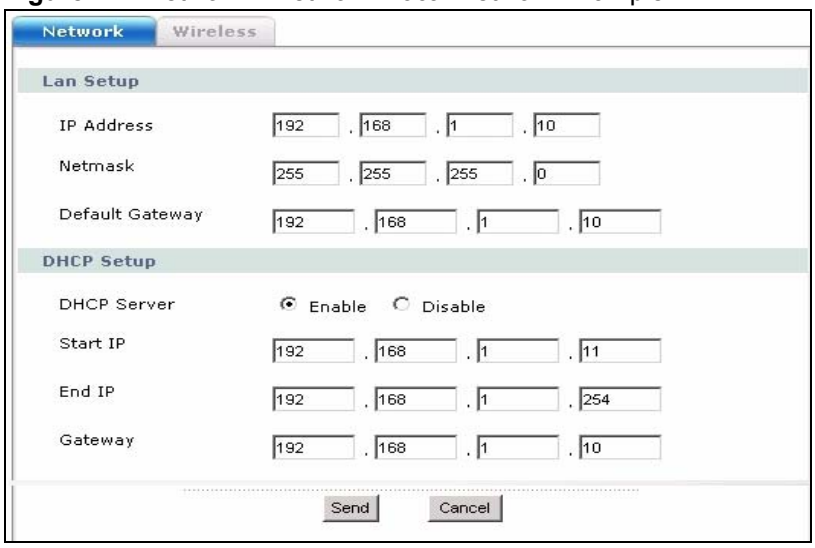
Table 9 Network > Wireless

LABEL	DESCRIPTION
Wireless Setup	
Mode	This is the wireless mode for the WPA-1000. It can be either **AP mode** (default) or **Infrastructure mode**. • Use **AP mode** (default) to connect wirelessly to the WPA-1000 directly. • Use **Infrastructure mode** to connect to the WPA-1000 via another AP.
ESSID	Set the WPA-1000's **ESSID**. This is the name of the network. The default is **ZyXEL**.
Channel	Set the WPA-1000's wireless connection channel. The default is **Auto**. **Auto**'s default channel is **1**. All devices on the WPA-1000's wireless network must be on the same channel.
WEP	Select an **WEP** security mode to encrypt data you send over the network. 128 bit is more secure than 64 but may have slower throughput.
Key	Type a WEP key here to use to encrypt your wireless communication. Write this down as meeting participants will have to use it when they try to reconnect wirelessly to the WPA-1000's network. In **Infrastructure mode** the key must be the same as the AP's WEP key. Ask your network administrator for more information.
Send	Click **Send** to apply your settings.
Cancel	Click **Cancel** to return to the previous settings.

5.1.4 AP Mode Example (Standalone)

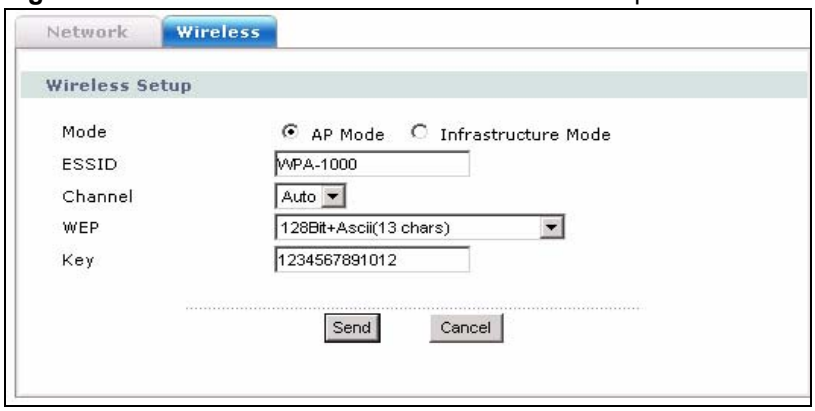
1. Go to **Network > Network** to set an IP address for your WPA-1000. The default is 192.168.1.10.
2. Enable the DHCP server. Set the WPA-1000's DHCP server to allocate an IP address for each user. These IP addresses need to be in the same subnet as the WPA-1000's IP address. In this example the DHCP server allocates IP addresses from 192.168.1.11 to 192.168.1.254.

Figure 14 Network > Network: Local Network Example



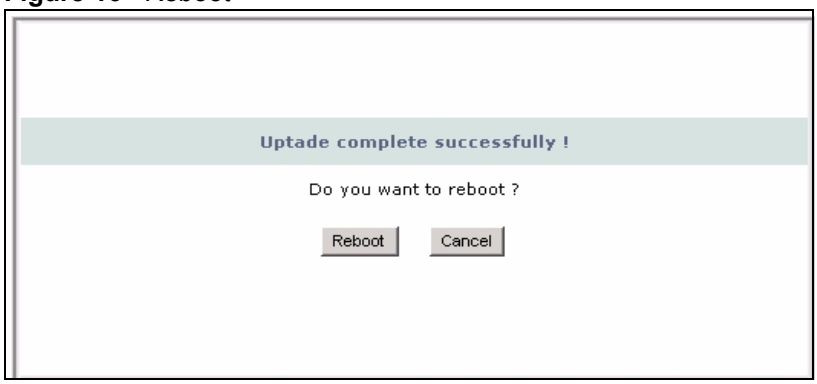
3. Go to **Network** > **Wireless** to configure your wireless settings.
4. Select **AP Mode** (default).
5. Set the **ESSID** that you want every user to see when they scan for available wireless devices. The default is **ZyXEL**. The **ESSID** is set to WPA-1000 in this example.
6. Type a **Key** in the screen and write down the **Key** for use when you and users connect to the WPA-1000's network.

Figure 15 Network > Wireless: Local Network Example .



7. Click **Send.**
8. Click **Reboot** to restart your WPA-1000.

Figure 16 Reboot



9 After the WPA-1000 restarts, connect to the WPA-1000's wireless network. Type the **key** when prompted.

10 Log in to the WPA-1000 utility with the new **Login Code** on the projector screen.

11 Press **Play** on your WPA-1000 utility to begin wireless projection.

5.1.5 AP Mode Example (With Internet Access)

See Figure 2 on page 22 for a diagram of this example.

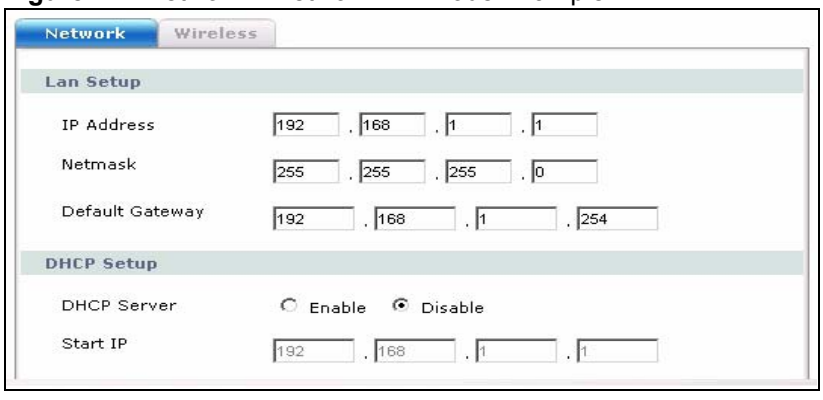
1 Connect the LAN port to a broadband modem for Internet access.

2 Go to **Network > Network** to set an IP address for your WPA-1000. Ask your network administrator if you are unsure of what this should be. In this example it is 192.168.1.1.

3 Set the **Default Gateway** IP Address to the IP address of your internet gateway device (192.168.1.254 in this case).

4 **Disable** the **DHCP Server** if your ISP assigns IP addresses to you.

Figure 17 Network > Network: AP Mode Example



5 Go to **Network > Wireless** and select **AP Mode**.

6 Connect your WPA-1000 and your gateway device with a crossover cable (from the same package as your device).

7 Click **Send** and **Reboot**.

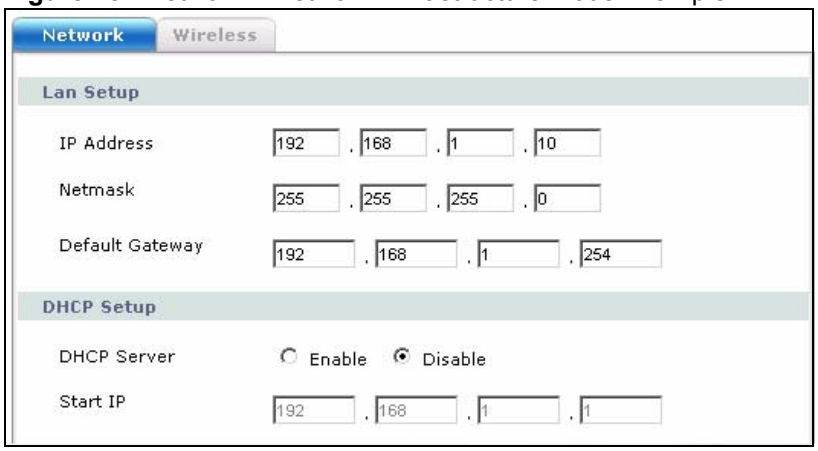
8 Meeting par tic pants may now connect to the WPA-1000 and display their presentations.

5.1.6 Infrastructure Mode Example

See Figure 3 on page 22 for a diagram of this example.

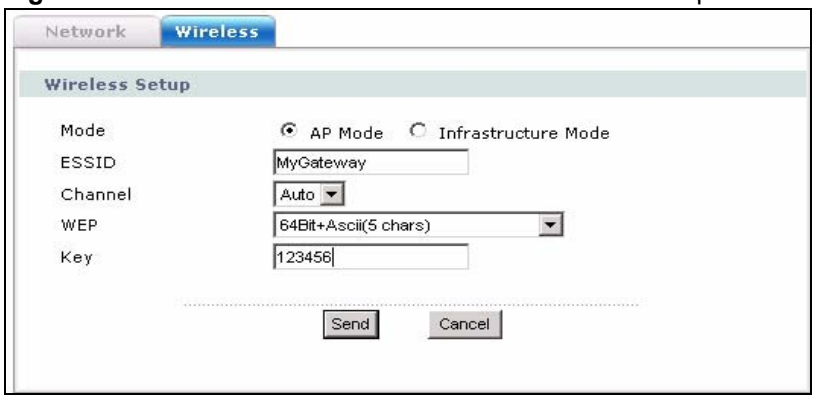
1. Go to **Network > Network** to set an IP address for your WPA-1000. Ask your network administrator if you are unsure of what this should be. In this example it is 192.168.1.1.
2. Set the **Default Gateway** IP Address to the same IP address as your internet gateway device (192.168.1.254 in this example).
3. **Disable** the **DHCP Server** if your ISP assigns IP addresses to you.

Figure 18 Network > Network: Infrastructure Mode Example



4. Go to **Network > Wireless** and select **Infrastructure Mode**.
5. Type the **ESSID** and **key** of the AP you want to connect to. Ask your network administrator for more information.

Figure 19 Network > Wireless: Infrastructure Mode Example



6. Click **Send** and **Reboot** to restart your device.
7. Reconnect to WPA-1000. Type the **key** when prompted.
8. Press **Play** on your projecting utility to begin wireless projection.

6

Troubleshooting

This chapter offers some suggestions to solve problems you might encounter. The potential problems are divided into the following categories.

6.1 Power, Hardware Connections, and LEDs

The WPA-1000 does not turn on. None of the LEDs turn on.

1. Make sure the WPA-1000 is turned on.
2. Make sure you are using the power cord included with the WPA-1000.
3. Make sure the power cord is connected to the WPA-1000 and plugged in to an appropriate power source. Make sure the power source is turned on.
4. Turn the WPA-1000 off and on.
5. If the problem continues, contact the vendor.

One of the LEDs does not behave as expected.

1. Make sure you understand the normal behavior of the LED. See Section 2.2 on page 25.
2. Check the hardware connections. See the Quick Start Guide and Section 2.1 on page 25.
3. Inspect your cables for damage. Contact the vendor to replace any damaged cables.
4. Turn the WPA-1000 off and on.
5. If the problem continues, contact the vendor.

My WPA-1000 cannot connect to a projector. The standby screen does not appear.

1. Check the projector is turned on and working properly.
2. Check your grey VGA cable is securely attached to the WPA-1000 and to the projector.
3. Turn the projector off and then on.

6.2 WPA-1000 Access and Login

I forgot the IP address for the WPA-1000.

1. The default IP address is **192.168.1.10**.
2. If you changed the IP address and have forgotten it, you might get the IP address of the WPA-1000 by looking up the IP address of the default gateway. To do this in most Windows computers, click **Start > Run**, enter **cmd**, and then enter **ipconfig**. The IP address of the **Default Gateway** might be the IP address of the WPA-1000 (it depends on the network), so enter this IP address in your Internet browser.
3. If this does not work, you have to reset the device to its factory defaults. See Section 6.6 on page 46.

I forgot the password.

1. The default password is **admin**.
2. If this does not work, you have to reset the device to its factory defaults. See Section 6.6 on page 46.

I cannot see or access the **Login** screen in the web configurator.

1. Make sure you are using the correct IP address.
   - The default IP address is 192.168.1.10.
   - If you changed the IP address (Section 6.1 on page 41), use the new IP address.
   - If you changed the IP address and have forgotten it, see the troubleshooting suggestions for I forgot the IP address for the WPA-1000.
2. Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 2.1 on page 25.

3 Make sure your Internet browser does not block pop-up windows and has JavaScripts and Java enabled. See Section Appendix C on page 65

4 Make sure your computer is in the same subnet as the WPA-1000. (If you know that there are routers between your computer and the WPA-1000, skip this step.)
   - If there is a DHCP server on your network, make sure your computer is using a dynamic IP address. See Appendix B on page 55. Your WPA-1000 is a DHCP server by default.
   - If there is no DHCP server on your network, make sure your computer's IP address is in the same subnet as the WPA-1000. See Appendix B on page 55.

5 Reset the device to its factory defaults, and try to access the WPA-1000 with the default IP address. See section Section 6.6 on page 46.

6 If the problem continues, contact the network administrator or vendor, or try one of the advanced suggestions.

I can see the **Login** screen, but I cannot log in to the WPA-1000.

1 Make sure you have entered the user name and password correctly. The default user name is **admin**, and the default password is **admin**. These fields are case-sensitive, so make sure [Caps Lock] is not on.

2 Turn the WPA-1000 off and on.

3 Disconnect and re-connect the power adaptor or cord to the WPA-1000.

4 If this does not work, you have to reset the device to its factory defaults. See section Section 6.6 on page 46.

I cannot make a LAN connection to the WPA-1000.

1 Check you have typed the correct IP address in the address bar of your Internet browser.

2 The IP address of your computer and the WPA-1000 must be in the same subnet.

3 Check if you are in **Infrastructure Mode**. Check the Network settings or ask your network administrator. In **Infrastructure Mode** the Ethernet port is automatically disabled.

4 If you are connecting to the WPA-1000 through an AP, check the AP is using WEP security with the same key. If the AP is using a different kind of security, the WPA-1000 cannot connect to it.

5 Check you are using the correct cable. The LAN port is not autocrossover so you have to use a crossover cable (included in the package) when connecting to a broadband modem or computer and a straight-through cable when connecting to a switch.

I cannot access the WPA-1000 wirelessly.

1. Make sure the wireless LAN is enabled on the WPA-1000
2. Make sure the wireless adapter on your computer is working properly.
3. Make sure the wireless adapter installed on your computer is IEEE 802.11 compatible and supports the same wireless standard as the WPA-1000.
4. Make sure your computer (with a wireless adapter installed) is within the transmission range of the WPA-1000.
5. Check that both the WPA-1000 and your wireless station are using the same wireless and wireless security settings.

The link quality and/or signal strength is poor all the time.

1. Move your computer closer to the AP or the peer computer(s) within the transmission range.
2. There may be too much radio interference (for example microwave or another AP using the same channel) around your wireless network. Lower the output power of the AP if your AP has this option and the WPA-1000 is in **Infrastructure Mode**.
3. Make sure there are not too many wireless stations connected to a wireless network.

6.3 Projection Problems

I cannot install the projection utility from my web browser.

1. Insert the support CD in the package into your CD-ROM.
2. Click "Setup", or you can find the setup.exe file in the directory of your CD-ROM and then double-click it.

Figure 20 Support CD

3. The installation wizard appears.

4 After the successful installation and reboot of your computer, double click the WPA-1000 shortcut () on your desktop.

The projection is unclear.

1 Click **Refresh** in the projection utility.
2 Check the resolution settings on your computer monitor. The projection is best viewed at 1024 * 768.

I cannot use the WPA-1000 utility to project my presentation.

1 Uninstall the WPA-1000 utility and reinstall it.
2 Check you have permission to join the network. For example, check you are not kicked out. See Chapter 3 on page 31 for more information.
3 Check your operating system. The WPA-1000 utility is only compatible with Windows XP Professional and Windows 2000.

6.4 Internet Access

I cannot access the Internet.

1 Check the hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 2.1 on page 25.
2 If you are trying to access the Internet wirelessly, make sure your wireless settings are the same as the settings in the AP through which you are trying to access the Internet.
3 Disconnect all the cables from your device, and reconnect them following the directions in the Quick Start Guide.
4 If the problem continues, contact your ISP.

I cannot access the Internet anymore. I had access to the Internet (with the WPA-1000), but my Internet connection is not available anymore.

1 Check the WPA-1000's hardware connections, and make sure the LEDs are behaving as expected. See the Quick Start Guide and Section 2.1 on page 25.
2 Restart the WPA-1000.

3 If the problem continues, contact your ISP.

? The Internet connection is slow or intermittent.

1 There might be a lot of traffic on the network. Try closing some programs that use the Internet, especially peer-to-peer applications.
2 Check the signal strength. If the signal strength is low, try moving the WPA-1000 closer to the AP if possible, and look around to see if there are any devices that might be interfering with the wireless network (for example, microwaves, other wireless networks, and so on).
3 Reboot the WPA-1000.
4 If the problem continues, contact the network administrator or vendor.

6.5 Reset the WPA-1000 to Its Factory Defaults

If you reset the WPA-1000, you lose all of the changes you have made. The WPA-1000 re-loads its default settings, and the admin password resets to **admin** and the IP address resets to 192.168.1.10. You have to make all of your changes again.

You will lose all of your changes when you push the **RESET** button.

To reset the WPA-1000,

1 Make sure the **STATUS LED** is on and not blinking.
2 Press and hold the **RESET** button for 30 seconds. Turn the device on and off. Release the **RESET** button when the **STATUS** LED begins to blink. The default settings have been restored.

When the WPA-1000 restarts automatically, wait for the WPA-1000 to finish restarting, and log in to the web configurator. The password is “admin”.

If the WPA-1000 does not restart automatically, disconnect and reconnect the WPA-1000’s power. Then, follow the directions above again.

PART III Appendices and Index

A

Product Specifications

The following tables summarize the WPA-1000's hardware and firmware features.

Table 10 Hardware Specifications

Dimensions (W x D x H)	190 x 130 x 33 mm
Device Weight	0.4kg
Power Specification	5 V DC 2A
Ethernet Ports	Auto-negotiating: 10 Mbps or 100 Mbps in either half-duplex or full-duplex mode. Use crossover Ethernet cables.
Ports	One 10/100 Ethernet LAN port with RJ-45 jack
Connector	One VGA (D-sub 15 pin)
Antenna	One external 2.95dBi antenna
Transmission Rate	Up to 20 frames per second
Frame size	320 x 240
Operation Temperature	5º C ~ 40º C
Storage Temperature	0º C ~ 65º C
Operation Humidity	20% ~ 80% RH
Storage Humidity	5% ~ 95% RH
Distance between the centers of the holes (for wall mounting) on the device's back.	137 mm
Recommended type of screws for wall-mounting	M4 Tap Screw, see Figure 22 on page 54.

Table 11 Firmware Specifications

FEATURE	DESCRIPTION
Default IP Address	192.168.1.10
Default Subnet Mask	255.255.255.0 (24 bits)
Default Password	admin
DHCP Pool	192.168.1.1 to 192.168.1.254
Device Management	Use the web configurator to easily configure the rich range of features on the WPA-1000.
Wireless Functionality	Allow the IEEE 802.11b and/or IEEE 802.11g wireless clients to connect to the WPA-1000 wirelessly. Enable wireless security (WEP) to protect your wireless network.

Table 11 Firmware Specifications

FEATURE	DESCRIPTION
Firmware Upgrade	Download new firmware (when available) from the ZyXEL web site and use the web configurator to put it on the WPA-1000. Note: Only upload firmware for your specific model!
DHCP (Dynamic Host Configuration Protocol)	Use this feature to have the WPA-1000 assign IP addresses, an IP default gateway and DNS servers to computers on your network.

The following list, which is not exhaustive, illustrates the standards supported in the WPA-1000.

Table 12 Standards Supported

STANDARD	DESCRIPTION
RFC 1112	IGMP v1
RFC 2236	Internet Group Management Protocol, Version 2.
IEEE 802.11	Also known by the brand Wi-Fi, denotes a set of Wireless LAN/WLAN standards developed by working group 11 of the IEEE LAN/MAN Standards Committee (IEEE 802).
IEEE 802.11b	Uses the 2.4 gigahertz (GHz) band
IEEE 802.11g	Uses the 2.4 gigahertz (GHz) band

Wall-mounting Instructions

Complete the following steps to hang your WPA-1000 on a wall.

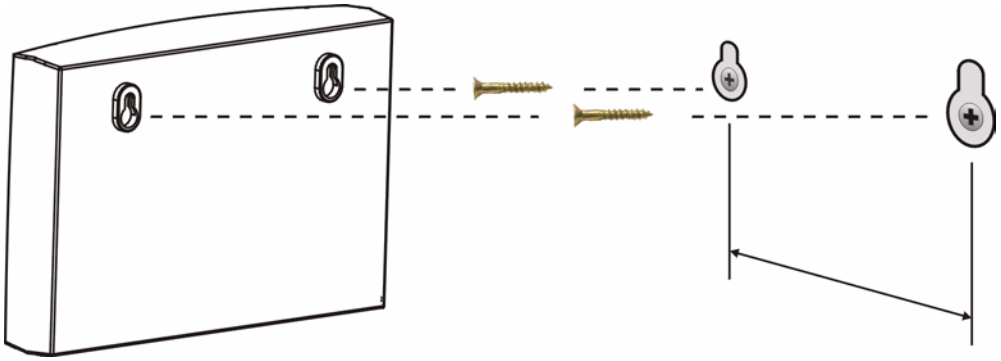
See Table 10 on page 51 for the size of screws to use and how far apart to place them.

1. Select a position free of obstructions on a sturdy wall.
2. Drill two holes for the screws.

Be careful to avoid damaging pipes or cables located inside the wall when drilling holes for the screws.

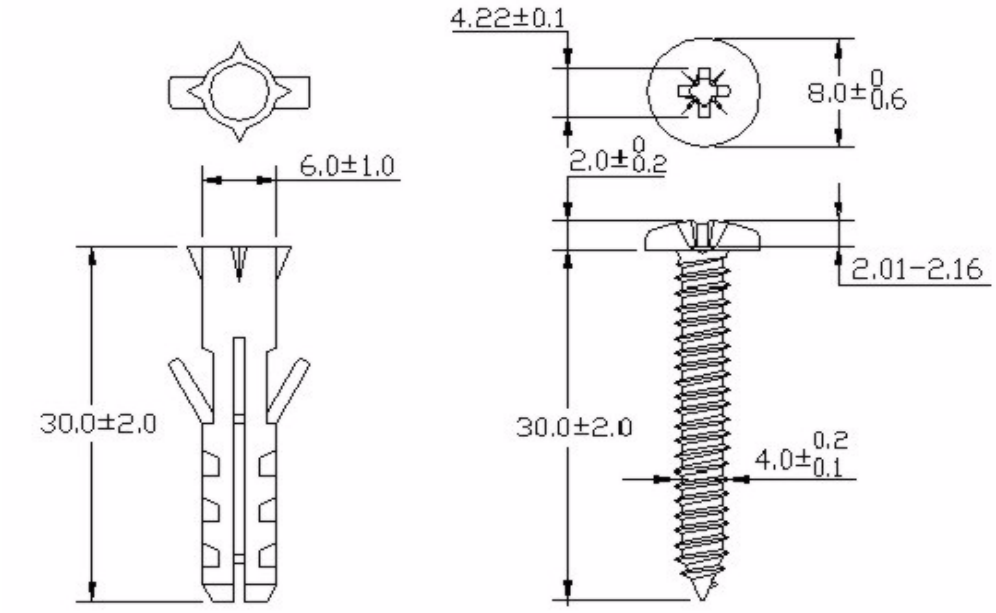
3. Do not insert the screws all the way into the wall. Leave a small gap of about 0.5 cm between the heads of the screws and the wall.
4. Make sure the screws are snugly fastened to the wall. They need to hold the weight of the WPA-1000 with the connection cables.
5. Align the holes on the back of the WPA-1000 with the screws on the wall. Hang the WPA-1000 on the screws.

Figure 21 Wall-mounting Example



The following are dimensions of an M4 tap screw and masonry plug used for wall mounting. All measurements are in millimeters (mm).

Figure 22 Masonry Plug and M4 Tap Screw



B

Setting up Your Computer's IP Address

All computers must have a 10M or 100M Ethernet adapter card and TCP/IP installed.

Windows 95/98/Me/NT/2000/XP, Macintosh OS 7 and later operating systems and all versions of UNIX/LINUX include the software components you need to install and use TCP/IP on your computer. Windows 3.1 requires the purchase of a third-party TCP/IP application package.

TCP/IP should already be installed on computers using Windows NT/2000/XP, Macintosh OS 7 and later operating systems.

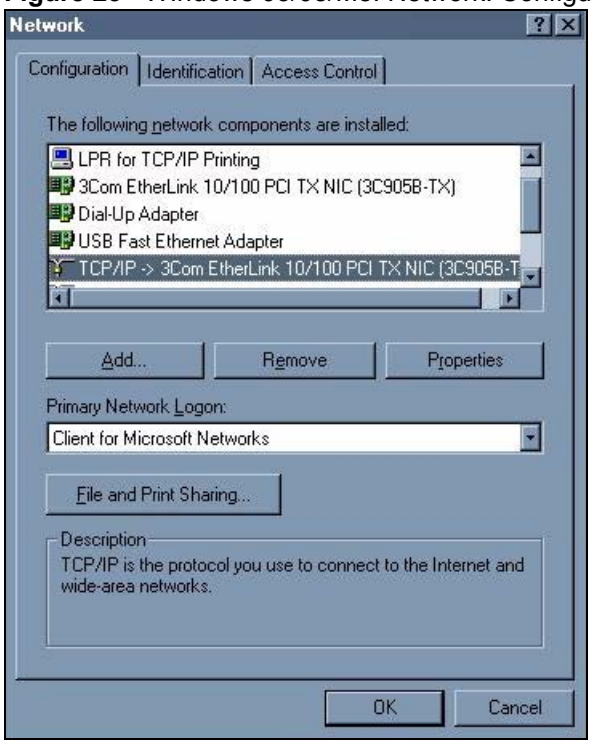
After the appropriate TCP/IP components are installed, configure the TCP/IP settings in order to "communicate" with your network.

If you manually assign IP information instead of using dynamic assignment, make sure that your computers have IP addresses that place them in the same subnet as the WPA-1000's LAN port.

Windows 95/98/Me

Click **Start**, **Settings**, **Control Panel** and double-click the **Network** icon to open the **Network** window.

Figure 23 WIndows 95/98/Me: Network: Configuration



Installing Components

The **Network** window **Configuration** tab displays a list of installed components. You need a network adapter, the TCP/IP protocol and Client for Microsoft Networks.

If you need the adapter:

1. In the **Network** window, click **Add**.
2. Select **Adapter** and then click **Add**.
3. Select the manufacturer and model of your network adapter and then click **OK**.

If you need TCP/IP:

1. In the **Network** window, click **Add**.
2. Select **Protocol** and then click **Add**.
3. Select **Microsoft** from the list of **manufacturers**.
4. Select **TCP/IP** from the list of network protocols and then click **OK**.

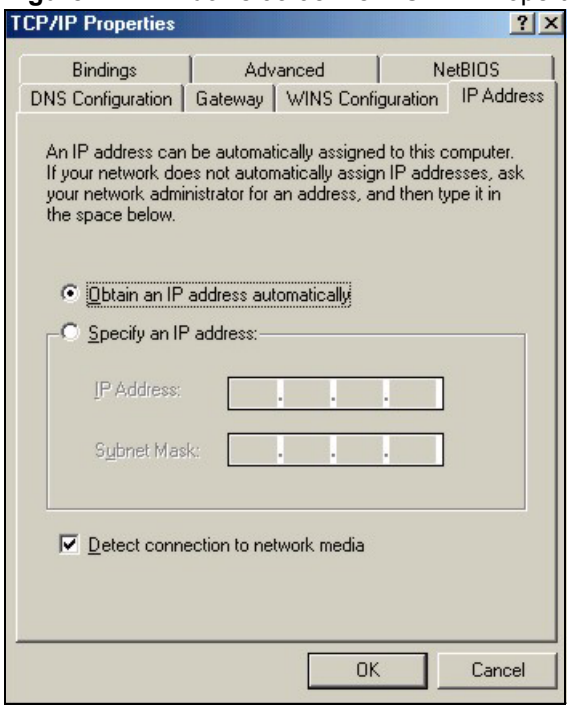
If you need Client for Microsoft Networks:

1. Click **Add**.
2. Select **Client** and then click **Add**.
3. Select **Microsoft** from the list of manufacturers.
4. Select **Client for Microsoft Networks** from the list of network clients and then click **OK**.
5. Restart your computer so the changes you made take effect.

Configuring

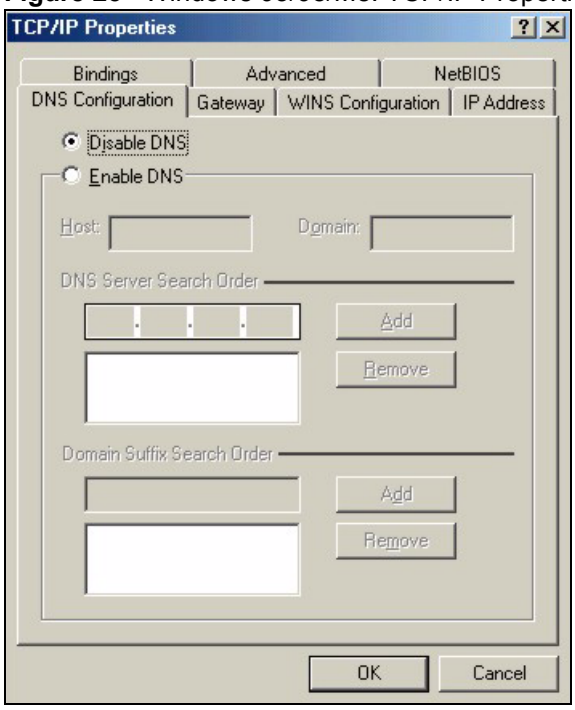
1. In the **Network** window **Configuration** tab, select your network adapter's TCP/IP entry and click **Properties**
2. Click the **IP Address** tab.
   - If your IP address is dynamic, select **Obtain an IP address automatically**.
   - If you have a static IP address, select **Specify an IP address** and type your information into the **IP Address** and **Subnet Mask** fields.

Figure 24 Windows 95/98/Me: TCP/IP Properties: IP Address



3. Click the **DNS** Configuration tab.
   - If you do not know your DNS information, select **Disable DNS**.
   - If you know your DNS information, select **Enable DNS** and type the information in the fields below (you may not need to fill them all in).

Figure 25 Windows 95/98/Me: TCP/IP Properties: DNS Configuration



4 Click the **Gateway** tab.
   - If you do not know your gateway's IP address, remove previously installed gateways.
   - If you have a gateway IP address, type it in the **New gateway field** and click **Add**.
5 Click **OK** to save and close the **TCP/IP Properties** window.
6 Click **OK** to close the **Network** window. Insert the Windows CD if prompted.
7 Turn on your WPA-1000 and restart your computer when prompted.

Verifying Settings

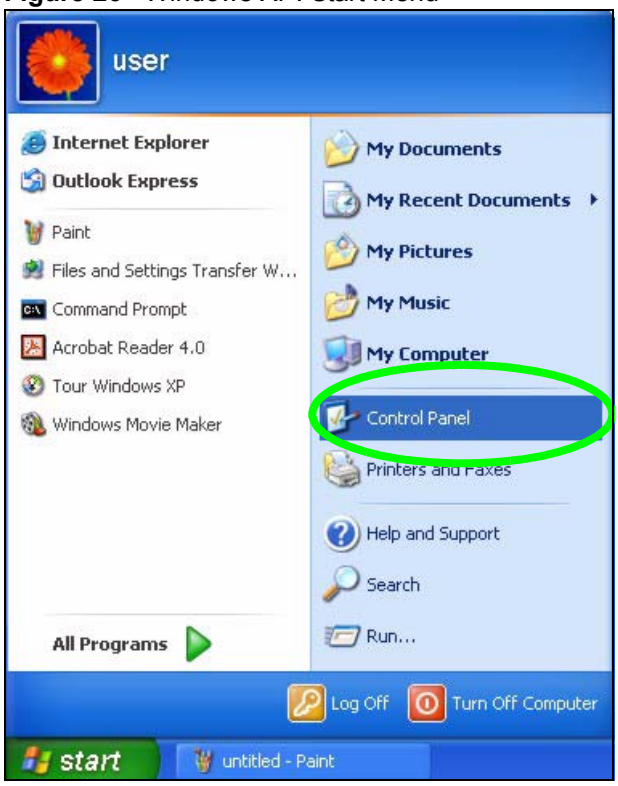
1 Click **Start** and then **Run**.
2 In the **Run** window, type "winipcfg" and then click **OK** to open the **IP Configuration** window.
3 Select your network adapter. You should see your computer's IP address, subnet mask and default gateway.

Windows 2000/NT/XP

The following example figures use the default Windows XP GUI theme.

1 Click **start** (**Start** in Windows 2000/NT), **Settings**, **Control Panel**.

Figure 26 Windows XP: Start Menu

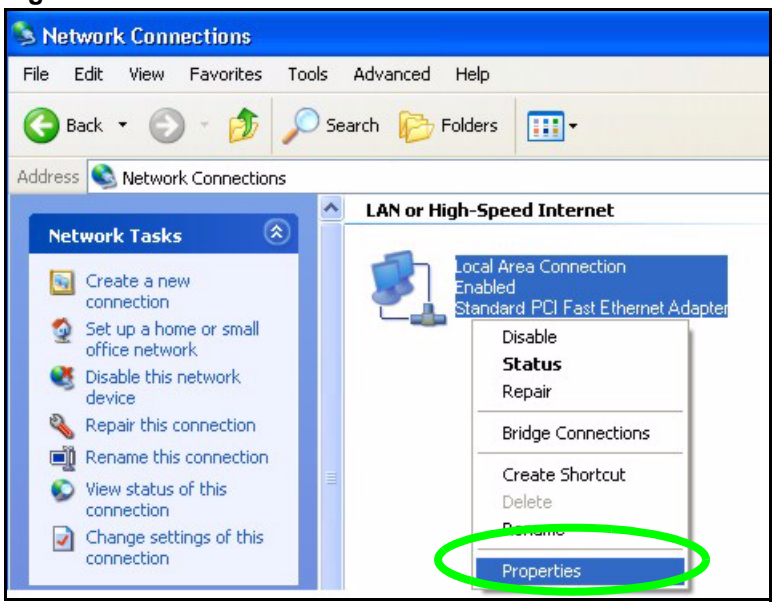


2 In the **Control Panel**, double-click **Network Connections** (**Network and Dial-up Connections** in Windows 2000/NT).

Figure 27 Windows XP: Control Panel

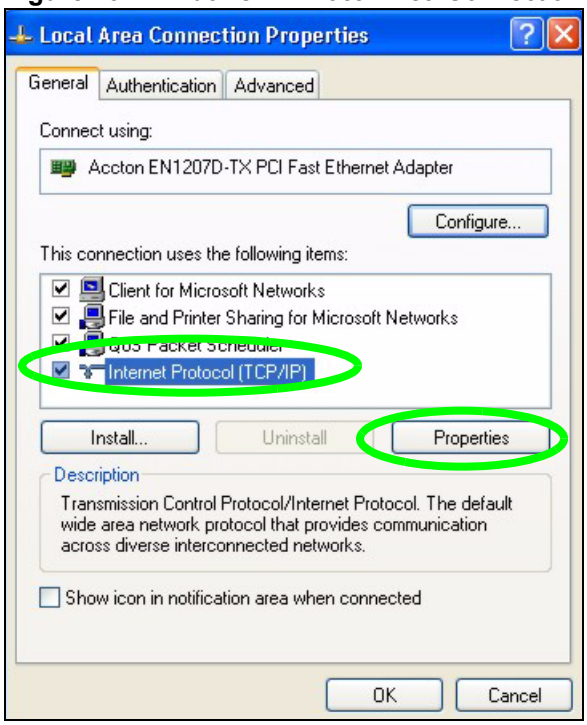
3 Right-click **Local Area Connection** and then click **Properties**.

Figure 28 Windows XP: Control Panel: Network Connections: Properties



4 Select **Internet Protocol (TCP/IP)** (under the **General** tab in Win XP) and then click **Properties**.

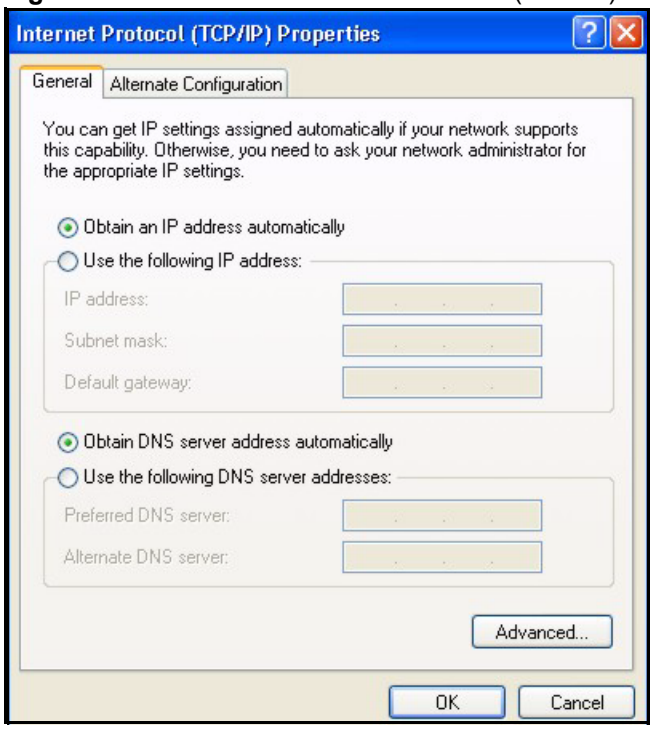
Figure 29 Windows XP: Local Area Connection Properties



5 The **Internet Protocol TCP/IP Properties** window opens (the **General tab** in Windows XP).

- If you have a dynamic IP address click **Obtain an IP address automatically**.
- If you have a static IP address click **Use the following IP Address** and fill in the **IP address**, **Subnet mask**, and **Default gateway** fields.
- Click **Advanced**.

Figure 30 Windows XP: Internet Protocol (TCP/IP) Properties

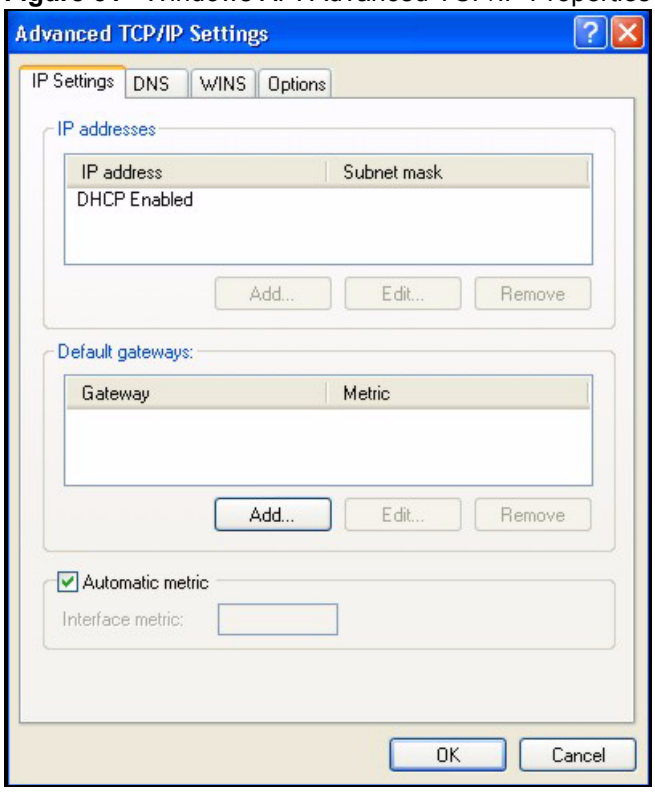


6 If you do not know your gateway's IP address, remove any previously installed gateways in the **IP Settings** tab and click **OK**.

Do one or more of the following if you want to configure additional IP addresses:

- In the **IP Settings** tab, in IP addresses, click **Add**.
- In **TCP/IP Address**, type an IP address in **IP address** and a subnet mask in **Subnet mask**, and then click **Add**.
- Repeat the above two steps for each IP address you want to add.
- Configure additional default gateways in the **IP Settings** tab by clicking **Add** in **Default gateways**.
- In **TCP/IP Gateway Address**, type the IP address of the default gateway in **Gateway**. To manually configure a default metric (the number of transmission hops), clear the **Automatic metric** check box and type a metric in **Metric**.
- Click **Add**.
- Repeat the previous three steps for each default gateway you want to add.
- Click **OK** when finished.

Figure 31 Windows XP: Advanced TCP/IP Properties

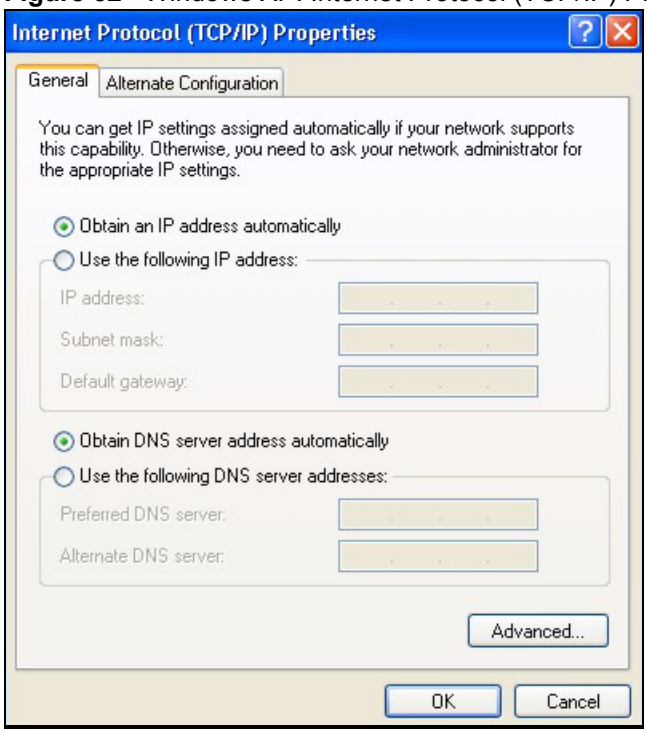


7 In the **Internet Protocol TCP/IP Properties** window (the **General** tab in Windows XP):

- Click **Obtain DNS server address automatically** if you do not know your DNS server IP address(es).
- If you know your DNS server IP address(es), click **Use the following DNS server addresses**, and type them in the **Preferred DNS server** and **Alternate DNS server** fields.

  If you have previously configured DNS servers, click **Advanced** and then the **DNS** tab to order them.

Figure 32 Windows XP: Internet Protocol (TCP/IP) Properties



8 Click **OK** to close the **Internet Protocol (TCP/IP) Properties** window.

9 Click **Close** (**OK** in Windows 2000/NT) to close the **Local Area Connection Properties** window.

10 Close the **Network Connections** window (**Network and Dial-up Connections** in Windows 2000/NT).

11 Turn on your WPA-1000 and restart your computer (if prompted).

Verifying Settings

1 Click **Start**, **All Programs**, **Accessories** and then **Command Prompt**.

2 In the **Command Prompt** window, type "ipconfig" and then press [ENTER]. You can also open **Network Connections**, right-click a network connection, click **Status** and then click the **Support** tab.

C

Pop-up Windows, JavaScripts and Java Permissions

In order to use the web configurator you need to allow:

- Web browser pop-up windows from your device.
- JavaScripts (enabled by default).
- Java permissions (enabled by default).

Internet Explorer 6 screens are used here. Screens for other Internet Explorer versions may vary.

Internet Explorer Pop-up Blockers

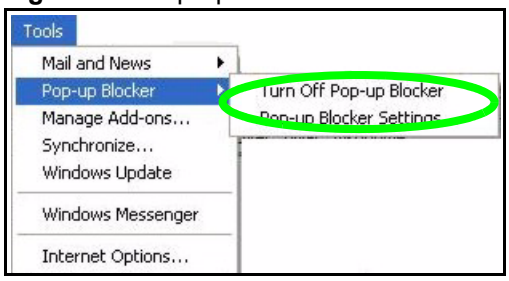
You may have to disable pop-up blocking to log into your device.

Either disable pop-up blocking (enabled by default in Windows XP SP (Service Pack) 2) or allow pop-up blocking and create an exception for your device's IP address.

Disable pop-up Blockers

1 In Internet Explorer, select **Tools**, **Pop-up Blocker** and then select **Turn Off Pop-up Blocker**.

Figure 33 Pop-up Blocker

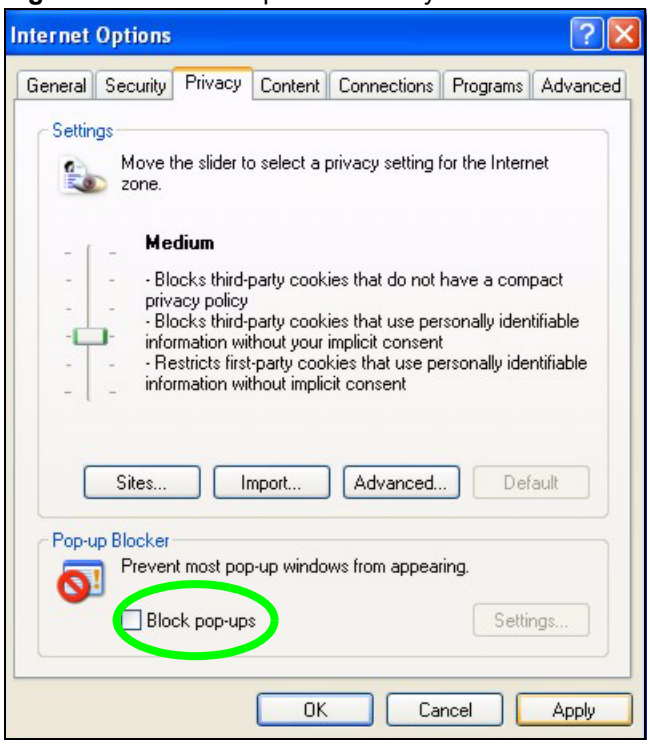


You can also check if pop-up blocking is disabled in the **Pop-up Blocker** section in the **Privacy** tab.

1 In Internet Explorer, select **Tools**, **Internet Options**, **Privacy**.

2 Clear the **Block pop-ups** check box in the **Pop-up Blocker** section of the screen. This disables any web pop-up blockers you may have enabled.

Figure 34 Internet Options: Privacy



3 Click **Apply** to save this setting.

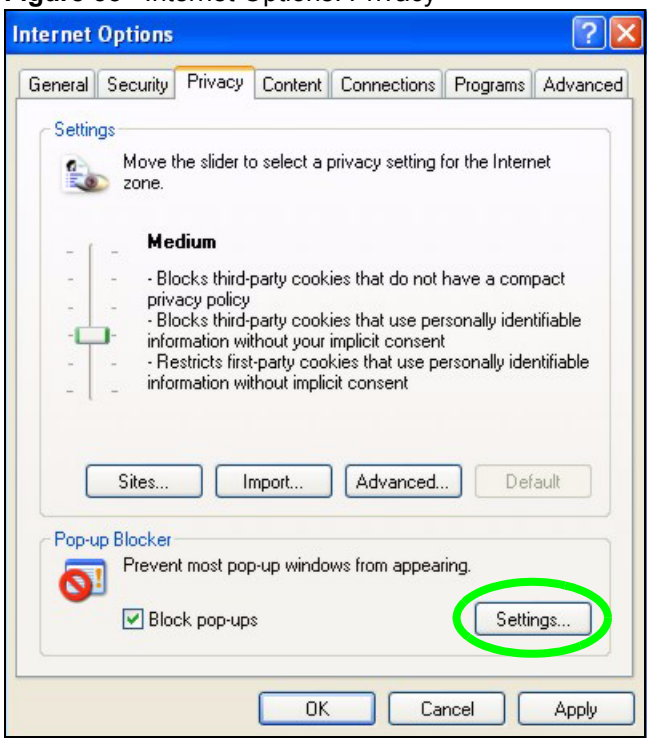
Enable pop-up Blockers with Exceptions

Alternatively, if you only want to allow pop-up windows from your device, see the following steps.

1 In Internet Explorer, select **Tools**, **Internet Options** and then the **Privacy** tab.

2 Select **Settings…**to open the **Pop-up Blocker Settings** screen.

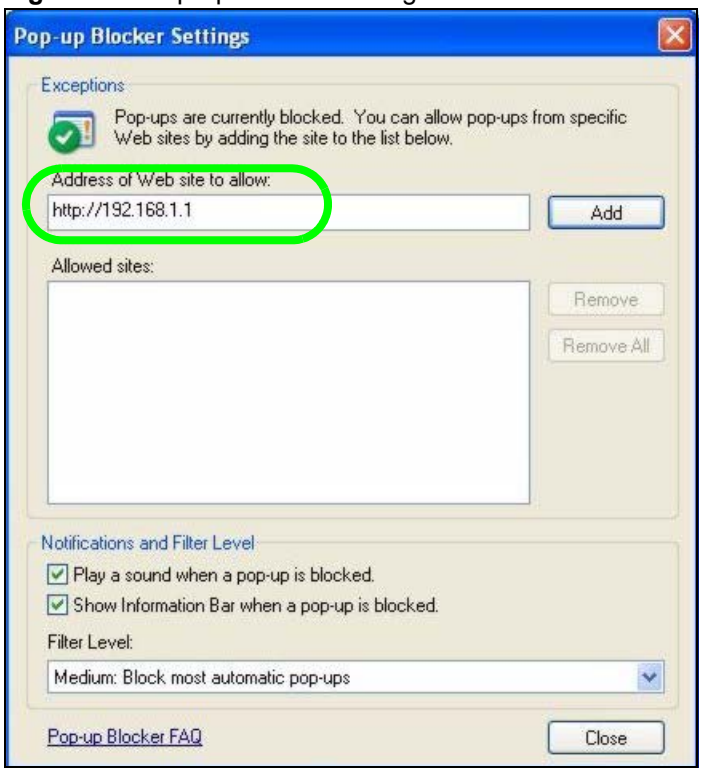
Figure 35 Internet Options: Privacy



3 Type the IP address of your device (the web page that you do not want to have blocked) with the prefix "http://". For example, http://192.168.167.1.

4 Click **Add** to move the IP address to the list of **Allowed sites**.

Figure 36 Pop-up Blocker Settings



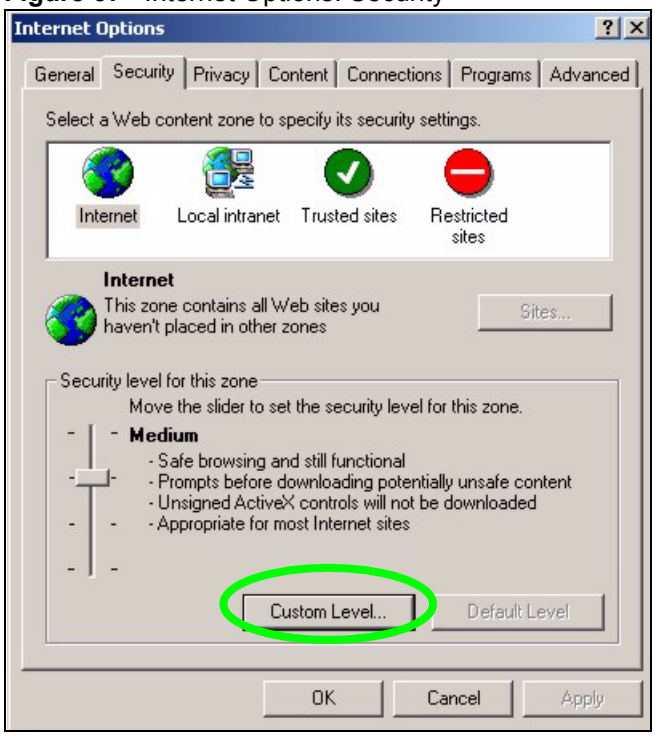
5 Click **Close** to return to the **Privacy** screen.
6 Click **Apply** to save this setting.

JavaScripts

If pages of the web configurator do not display properly in Internet Explorer, check that JavaScripts are allowed.

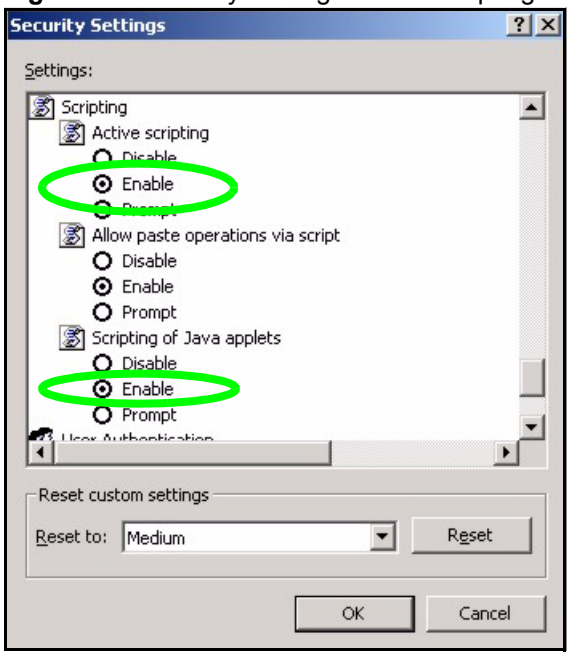
1 In Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.

Figure 37 Internet Options: Security



2 Click the **Custom Level...** button.
3 Scroll down to **Scripting**.
4 Under **Active scripting** make sure that **Enable** is selected (the default).
5 Under **Scripting of Java applets** make sure that **Enable** is selected (the default).
6 Click **OK** to close the window.

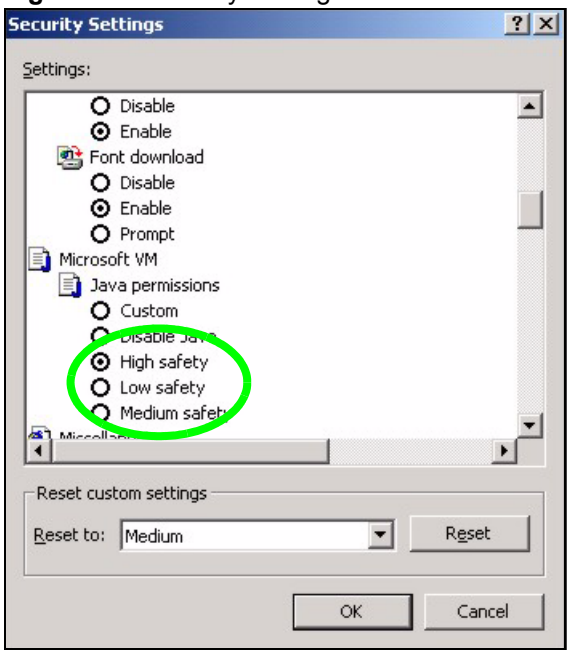
Figure 38 Security Settings - Java Scripting



Java Permissions

1. From Internet Explorer, click **Tools**, **Internet Options** and then the **Security** tab.
2. Click the **Custom Level...** button.
3. Scroll down to **Microsoft VM**.
4. Under **Java permissions** make sure that a safety level is selected.
5. Click **OK** to close the window.

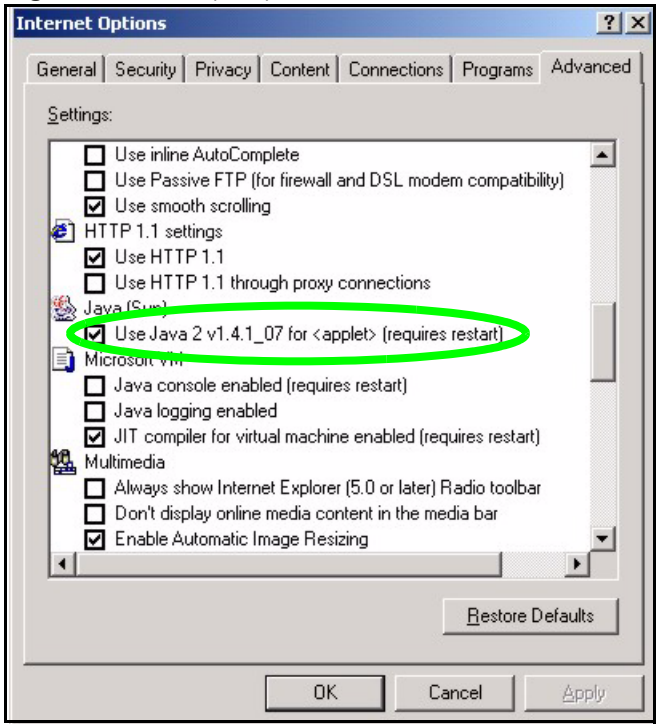
Figure 39 Security Settings - Java



JAVA (Sun)

1 From Internet Explorer, click **Tools**, **Internet Options** and then the **Advanced** tab.
2 Make sure that **Use Java 2 for <applet>** under **Java (Sun)** is selected.
3 Click **OK** to close the window.

Figure 40 Java (Sun)



D

IP Addresses and Subnetting

This appendix introduces IP addresses and subnet masks.

IP addresses identify individual devices on a network. Every networking device (including computers, servers, routers, printers, etc.) needs an IP address to communicate across the network. These networking devices are also known as hosts.

Subnet masks determine the maximum number of possible hosts on a network. You can also use subnet masks to divide one network into multiple sub-networks.

Introduction to IP Addresses

One part of the IP address is the network number, and the other part is the host ID. In the same way that houses on a street share a common street name, the hosts on a network share a common network number. Similarly, as each house has its own house number, each host on the network has its own unique identifying number - the host ID. Routers use the network number to send packets to the correct network, while the host ID determines to which host on the network the packets are delivered.

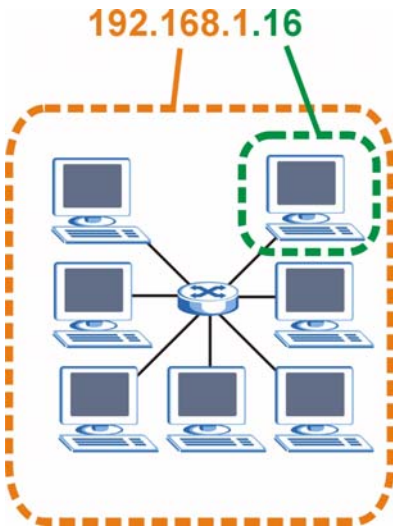
Structure

An IP address is made up of four parts, written in dotted decimal notation (for example, 192.168.1.1). Each of these four parts is known as an octet. An octet is an eight-digit binary number (for example 11000000, which is 192 in decimal notation).

Therefore, each octet has a possible range of 00000000 to 11111111 in binary, or 0 to 255 in decimal.

The following figure shows an example IP address in which the first three octets (192.168.1) are the network number, and the fourth octet (16) is the host ID.

Figure 41 Network Number and Host ID



How much of the IP address is the network number and how much is the host ID varies according to the subnet mask.

Subnet Masks

A subnet mask is used to determine which bits are part of the network number, and which bits are part of the host ID (using a logical AND operation). The term "subnet" is short for "sub-network".

A subnet mask has 32 bits. If a bit in the subnet mask is a "1" then the corresponding bit in the IP address is part of the network number. If a bit in the subnet mask is "0" then the corresponding bit in the IP address is part of the host ID.

The following example shows a subnet mask identifying the network number (in bold text) and host ID of an IP address (192.168.1.2 in decimal).

Table 13 IP Address Network Number and Host ID Example

	1ST OCTET: (192)	2ND OCTET: (168)	3RD OCTET: (1)	4TH OCTET (2)
IP Address (Binary)	11000000	10101000	00000001	00000010
Subnet Mask (Binary)	**11111111**	**11111111**	**11111111**	00000000
Network Number	**11000000**	**10101000**	**00000001**	
Host ID				00000010

By convention, subnet masks always consist of a continuous sequence of ones beginning from the leftmost bit of the mask, followed by a continuous sequence of zeros, for a total number of 32 bits.

Subnet masks can be referred to by the size of the network number part (the bits with a "1" value). For example, an "8-bit mask" means that the first 8 bits of the mask are ones and the remaining 24 bits are zeroes.

Subnet masks are expressed in dotted decimal notation just like IP addresses. The following examples show the binary and decimal notation for 8-bit, 16-bit, 24-bit and 29-bit subnet masks.

Table 14 Subnet Masks

	BINARY				DECIMAL
	1ST OCTET	2ND OCTET	3RD OCTET	4TH OCTET	
8-bit mask	11111111	00000000	00000000	00000000	255.0.0.0
16-bit mask	11111111	11111111	00000000	00000000	255.255.0.0
24-bit mask	11111111	11111111	11111111	00000000	255.255.255.0
29-bit mask	11111111	11111111	11111111	11111000	255.255.255.248

Network Size

The size of the network number determines the maximum number of possible hosts you can have on your network. The larger the number of network number bits, the smaller the number of remaining host ID bits.

An IP address with host IDs of all zeros is the IP address of the network (192.168.1.0 with a 24-bit subnet mask, for example). An IP address with host IDs of all ones is the broadcast address for that network (192.168.1.255 with a 24-bit subnet mask, for example).

As these two IP addresses cannot be used for individual hosts, calculate the maximum number of possible hosts in a network as follows:

Table 15 Maximum Host Numbers

SUBNET MASK		HOST ID SIZE		MAXIMUM NUMBER OF HOSTS
8 bits	255.0.0.0	24 bits	$2^{24} - 2$	16777214
16 bits	255.255.0.0	16 bits	$2^{16} - 2$	65534
24 bits	255.255.255.0	8 bits	$2^{8} - 2$	254
29 bits	255.255.255.248	3 bits	$2^{3} - 2$	6

Notation

Since the mask is always a continuous number of ones beginning from the left, followed by a continuous number of zeros for the remainder of the 32 bit mask, you can simply specify the number of ones instead of writing the value of each octet. This is usually specified by writing a "/" followed by the number of bits in the mask after the address.

For example, 192.1.1.0 /25 is equivalent to saying 192.1.1.0 with subnet mask 255.255.255.128.

The following table shows some possible subnet masks using both notations.

Table 16 Alternative Subnet Mask Notation

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.0	/24	0000 0000	0
255.255.255.128	/25	1000 0000	128

Table 16 Alternative Subnet Mask Notation (continued)

SUBNET MASK	ALTERNATIVE NOTATION	LAST OCTET (BINARY)	LAST OCTET (DECIMAL)
255.255.255.192	/26	1100 0000	192
255.255.255.224	/27	1110 0000	224
255.255.255.240	/28	1111 0000	240
255.255.255.248	/29	1111 1000	248
255.255.255.252	/30	1111 1100	252

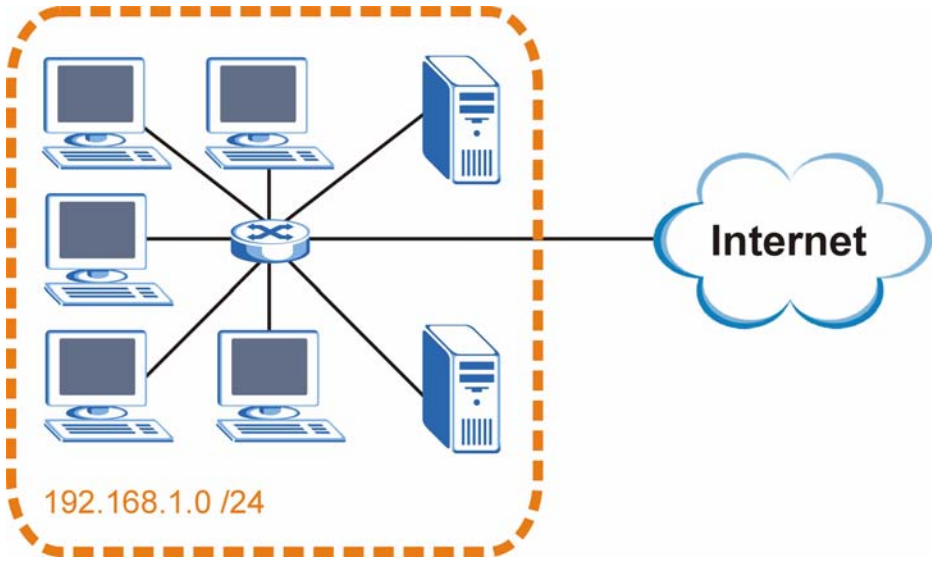
Subnetting

You can use subnetting to divide one network into multiple sub-networks. In the following example a network administrator creates two sub-networks to isolate a group of servers from the rest of the company network for security reasons.

In this example, the company network address is 192.168.1.0. The first three octets of the address (192.168.1) are the network number, and the remaining octet is the host ID, allowing a maximum of $2^8 - 2$ or 254 possible hosts.

The following figure shows the company network before subnetting.

Figure 42 Subnetting Example: Before Subnetting

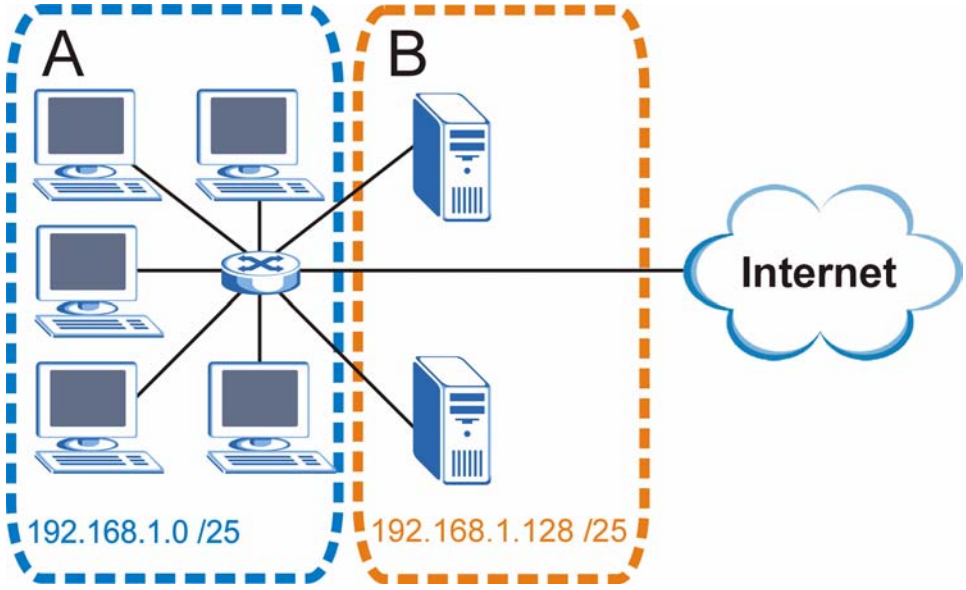


You can "borrow" one of the host ID bits to divide the network 192.168.1.0 into two separate sub-networks. The subnet mask is now 25 bits (255.255.255.128 or /25).

The "borrowed" host ID bit can have a value of either 0 or 1, allowing two subnets; 192.168.1.0 /25 and 192.168.1.128 /25.

The following figure shows the company network after subnetting. There are now two sub-networks, **A** and **B**.

Figure 43 Subnetting Example: After Subnetting



In a 25-bit subnet the host ID has 7 bits, so each sub-network has a maximum of $2^7 - 2$ or 126 possible hosts (a host ID of all zeroes is the subnet's address itself, all ones is the subnet's broadcast address).

192.168.1.0 with mask 255.255.255.128 is subnet **A** itself, and 192.168.1.127 with mask 255.255.255.128 is its broadcast address. Therefore, the lowest IP address that can be assigned to an actual host for subnet **A** is 192.168.1.1 and the highest is 192.168.1.126.

Similarly, the host ID range for subnet **B** is 192.168.1.129 to 192.168.1.254.

Example: Four Subnets

The previous example illustrated using a 25-bit subnet mask to divide a 24-bit address into two subnets. Similarly, to divide a 24-bit address into four subnets, you need to "borrow" two host ID bits to give four possible combinations (00, 01, 10 and 11). The subnet mask is 26 bits (11111111.11111111.11111111.**11**000000) or 255.255.255.192.

Each subnet contains 6 host ID bits, giving 2^6 - 2 or 62 hosts for each subnet (a host ID of all zeroes is the subnet itself, all ones is the subnet's broadcast address).

Table 17 Subnet 1

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address (Decimal)	192.168.1.	0
IP Address (Binary)	11000000.10101000.00000001.	**00**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.0	Lowest Host ID: 192.168.1.1	
Broadcast Address: 192.168.1.63	Highest Host ID: 192.168.1.62	

Table 18 Subnet 2

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	64
IP Address (Binary)	11000000.10101000.00000001.	**01**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.64	Lowest Host ID: 192.168.1.65	
Broadcast Address: 192.168.1.127	Highest Host ID: 192.168.1.126	

Table 19 Subnet 3

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	128
IP Address (Binary)	11000000.10101000.00000001.	**10**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.128	Lowest Host ID: 192.168.1.129	
Broadcast Address: 192.168.1.191	Highest Host ID: 192.168.1.190	

Table 20 Subnet 4

IP/SUBNET MASK	NETWORK NUMBER	LAST OCTET BIT VALUE
IP Address	192.168.1.	192
IP Address (Binary)	11000000.10101000.00000001.	**11**000000
Subnet Mask (Binary)	11111111.11111111.11111111.	**11**000000
Subnet Address: 192.168.1.192	Lowest Host ID: 192.168.1.193	
Broadcast Address: 192.168.1.255	Highest Host ID: 192.168.1.254	

Example: Eight Subnets

Similarly, use a 27-bit mask to create eight subnets (000, 001, 010, 011, 100, 101, 110 and 111).

The following table shows IP address last octet values for each subnet.

Table 21 Eight Subnets

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
1	0	1	30	31
2	32	33	62	63
3	64	65	94	95
4	96	97	126	127

Table 21 Eight Subnets (continued)

SUBNET	SUBNET ADDRESS	FIRST ADDRESS	LAST ADDRESS	BROADCAST ADDRESS
5	128	129	158	159
6	160	161	190	191
7	192	193	222	223
8	224	225	254	255

Subnet Planning

The following table is a summary for subnet planning on a network with a 24-bit network number.

Table 22 24-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.255.128 (/25)	2	126
2	255.255.255.192 (/26)	4	62
3	255.255.255.224 (/27)	8	30
4	255.255.255.240 (/28)	16	14
5	255.255.255.248 (/29)	32	6
6	255.255.255.252 (/30)	64	2
7	255.255.255.254 (/31)	128	1

The following table is a summary for subnet planning on a network with a 16-bit network number.

Table 23 16-bit Network Number Subnet Planning

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
1	255.255.128.0 (/17)	2	32766
2	255.255.192.0 (/18)	4	16382
3	255.255.224.0 (/19)	8	8190
4	255.255.240.0 (/20)	16	4094
5	255.255.248.0 (/21)	32	2046
6	255.255.252.0 (/22)	64	1022
7	255.255.254.0 (/23)	128	510
8	255.255.255.0 (/24)	256	254
9	255.255.255.128 (/25)	512	126
10	255.255.255.192 (/26)	1024	62
11	255.255.255.224 (/27)	2048	30
12	255.255.255.240 (/28)	4096	14
13	255.255.255.248 (/29)	8192	6

Table 23 16-bit Network Number Subnet Planning (continued)

NO. "BORROWED" HOST BITS	SUBNET MASK	NO. SUBNETS	NO. HOSTS PER SUBNET
14	255.255.255.252 (/30)	16384	2
15	255.255.255.254 (/31)	32768	1

Configuring IP Addresses

Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. You must also enable Network Address Translation (NAT) on the WPA-1000.

Once you have decided on the network number, pick an IP address for your WPA-1000 that is easy to remember (for instance, 192.168.1.1) but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your WPA-1000 will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the WPA-1000 unless you are instructed to do otherwise.

Private IP Addresses

Every machine on the Internet must have a unique address. If your networks are isolated from the Internet (running only between two branch offices, for example) you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks:

- 10.0.0.0 — 10.255.255.255
- 172.16.0.0 — 172.31.255.255
- 192.168.0.0 — 192.168.255.255

You can obtain your IP address from the IANA, from an ISP, or it can be assigned from a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, Address Allocation for Private Internets and RFC 1466, Guidelines for Management of IP Address Space.

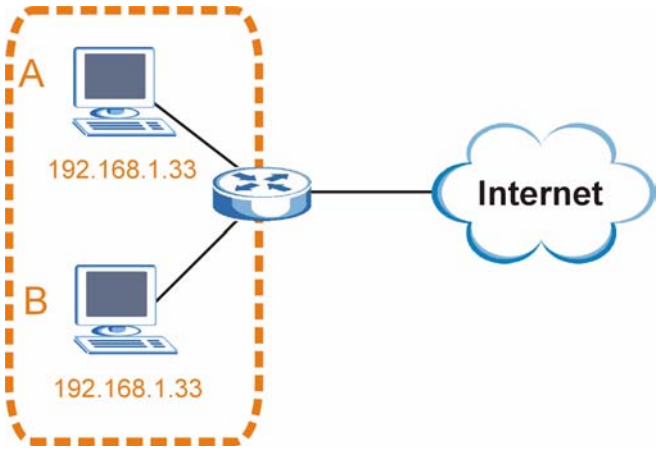
IP Address Conflicts

Each device on a network must have a unique IP address. Devices with duplicate IP addresses on the same network will not be able to access the Internet or other resources. The devices may also be unreachable through the network.

Conflicting Computer IP Addresses Example

More than one device can not use the same IP address. In the following example computer **A** has a static (or fixed) IP address that is the same as the IP address that a DHCP server assigns to computer **B** which is a DHCP client. Neither can access the Internet. This problem can be solved by assigning a different static IP address to computer **A** or setting computer **A** to obtain an IP address automatically.

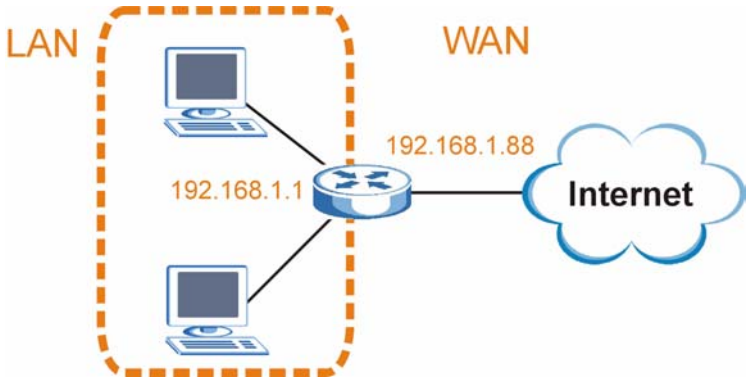
Figure 44 Conflicting Computer IP Addresses Example



Conflicting Router IP Addresses Example

Since a router connects different networks, it must have interfaces using different network numbers. For example, if a router is set between a LAN and the Internet (WAN), the router's LAN and WAN addresses must be on different subnets. In the following example, the LAN and WAN are on the same subnet. The LAN computers cannot access the Internet because the router cannot route between networks.

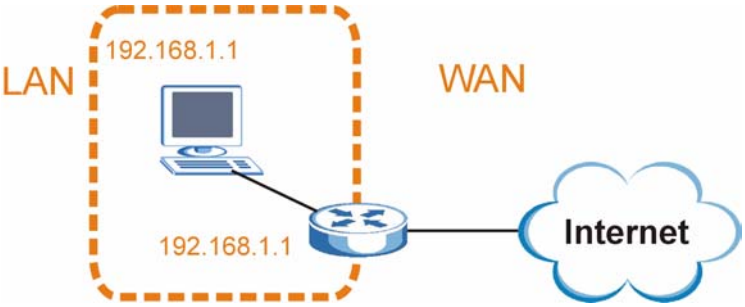
Figure 45 Conflicting Computer IP Addresses Example



Conflicting Computer and Router IP Addresses Example

More than one device can not use the same IP address. In the following example, the computer and the router's LAN port both use 192.168.1.1 as the IP address. The computer cannot access the Internet. This problem can be solved by assigning a different IP address to the computer or the router's LAN port.

Figure 46 Conflicting Computer and Router IP Addresses Example



E

Wireless LANs

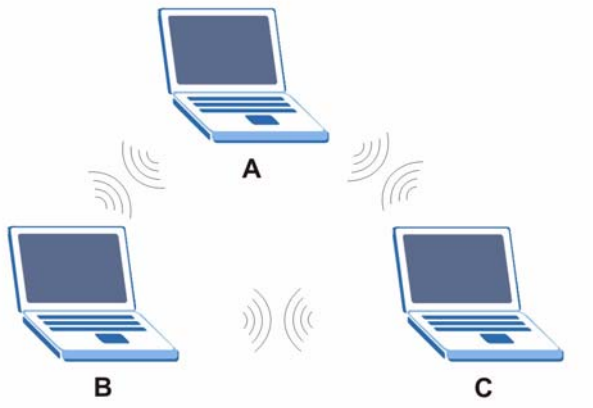
Wireless LAN Topologies

This section discusses ad-hoc and infrastructure wireless LAN topologies.

Ad-hoc Wireless LAN Configuration

The simplest WLAN configuration is an independent (Ad-hoc) WLAN that connects a set of computers with wireless adapters (A, B, C). Any time two or more wireless adapters are within range of each other, they can set up an independent network, which is commonly referred to as an ad-hoc network or Independent Basic Service Set (IBSS). The following diagram shows an example of notebook computers using wireless adapters to form an ad-hoc wireless LAN.

Figure 47 Peer-to-Peer Communication in an Ad-hoc Network

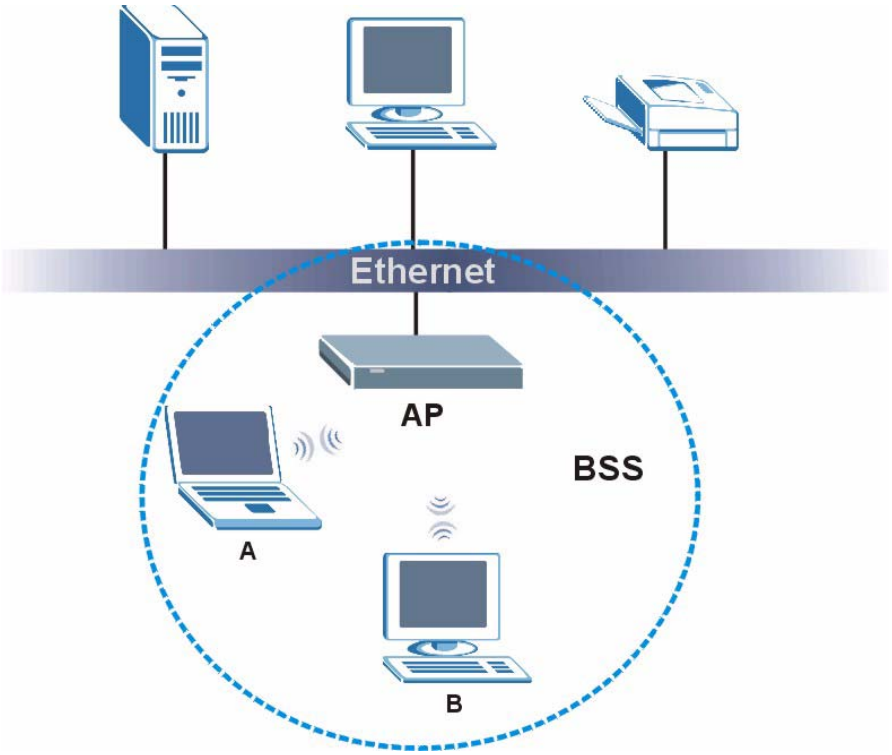


BSS

A Basic Service Set (BSS) exists when all communications between wireless clients or between a wireless client and a wired network client go through one access point (AP).

Intra-BSS traffic is traffic between wireless clients in the BSS. When Intra-BSS is enabled, wireless client **A** and **B** can access the wired network and communicate with each other. When Intra-BSS is disabled, wireless client **A** and **B** can still access the wired network but cannot communicate with each other.

Figure 48 Basic Service Set



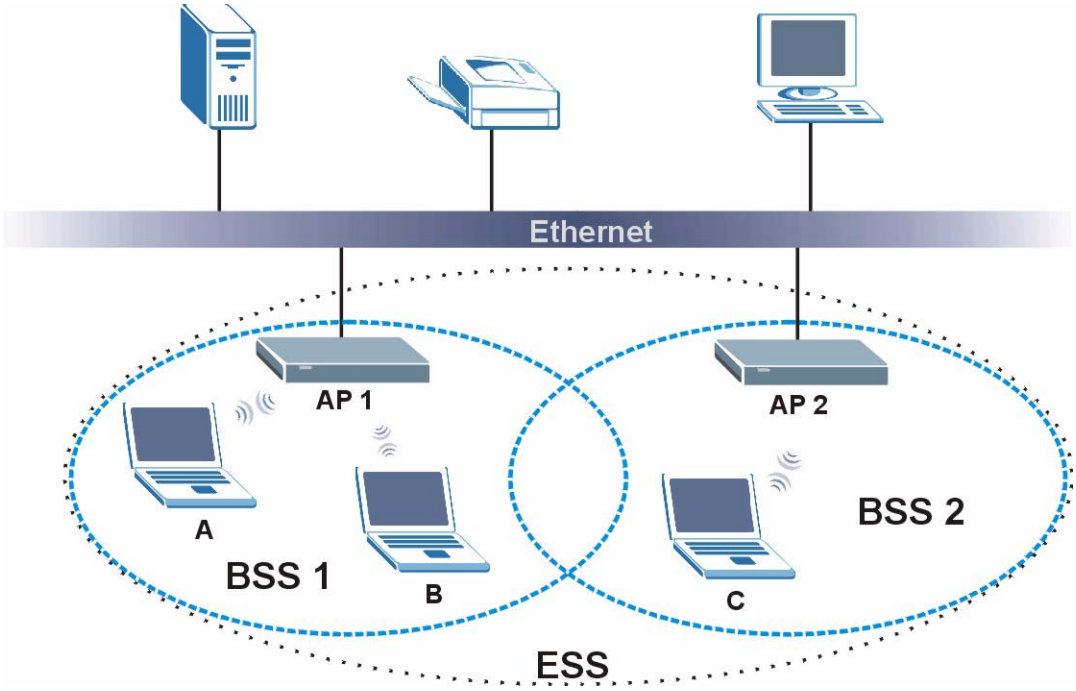
ESS

An Extended Service Set (ESS) consists of a series of overlapping BSSs, each containing an access point, with each access point connected together by a wired network. This wired connection between APs is called a Distribution System (DS).

This type of wireless LAN topology is called an Infrastructure WLAN. The Access Points not only provide communication with the wired network but also mediate wireless network traffic in the immediate neighborhood.

An ESSID (ESS IDentification) uniquely identifies each ESS. All access points and their associated wireless clients within the same ESS must have the same ESSID in order to communicate.

Figure 49 Infrastructure WLAN



Channel

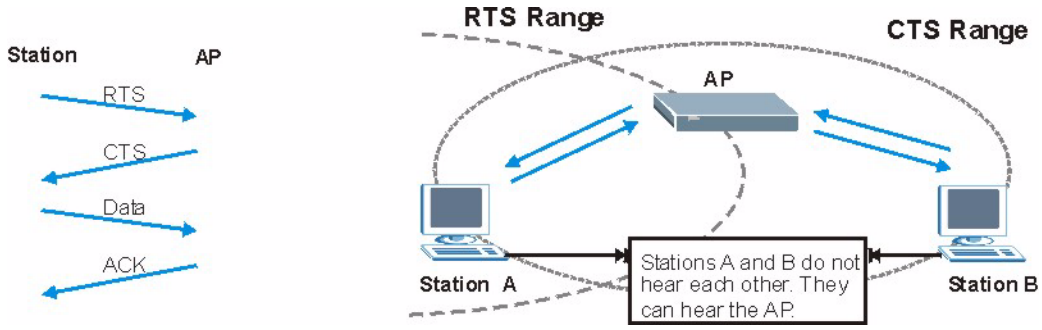
A channel is the radio frequency(ies) used by wireless devices to transmit and receive data. Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a channel different from an adjacent AP (access point) to reduce interference. Interference occurs when radio signals from different access points overlap causing interference and degrading performance.

Adjacent channels partially overlap however. To avoid interference due to overlap, your AP should be on a channel at least five channels away from a channel that an adjacent AP is using. For example, if your region has 11 channels and an adjacent AP is using channel 1, then you need to select a channel between 6 or 11.

RTS/CTS

A hidden node occurs when two stations are within range of the same access point, but are not within range of each other. The following figure illustrates a hidden node. Both stations (STA) are within range of the access point (AP) or wireless gateway, but out-of-range of each other, so they cannot "hear" each other, that is they do not know if the channel is currently being used. Therefore, they are considered hidden from each other.

Figure 50 RTS/CTS



When station **A** sends data to the AP, it might not know that the station **B** is already using the channel. If these two stations send data at the same time, collisions may occur when both sets of data arrive at the AP at the same time, resulting in a loss of messages for both stations.

RTS/CTS is designed to prevent collisions due to hidden nodes. An **RTS/CTS** defines the biggest size data frame you can send before an RTS (Request To Send)/CTS (Clear to Send) handshake is invoked.

When a data frame exceeds the **RTS/CTS** value you set (between 0 to 2432 bytes), the station that wants to transmit this frame must first send an RTS (Request To Send) message to the AP for permission to send it. The AP then responds with a CTS (Clear to Send) message to all other stations within its range to notify them to defer their transmission. It also reserves and confirms with the requesting station the time frame for the requested transmission.

Stations can send frames smaller than the specified **RTS/CTS** directly to the AP without the RTS (Request To Send)/CTS (Clear to Send) handshake.

You should only configure **RTS/CTS** if the possibility of hidden nodes exists on your network and the "cost" of resending large frames is more than the extra network overhead involved in the RTS (Request To Send)/CTS (Clear to Send) handshake.

If the **RTS/CTS** value is greater than the **Fragmentation Threshold** value (see next), then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Enabling the RTS Threshold causes redundant network overhead that could negatively affect the throughput performance instead of providing a remedy.

Fragmentation Threshold

A **Fragmentation Threshold** is the maximum data fragment size (between 256 and 2432 bytes) that can be sent in the wireless network before the AP will fragment the packet into smaller data frames.

A large **Fragmentation Threshold** is recommended for networks not prone to interference while you should set a smaller threshold for busy networks or networks that are prone to interference.

If the **Fragmentation Threshold** value is smaller than the **RTS/CTS** value (see previously) you set then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach **RTS/CTS** size.

Preamble Type

Preamble is used to signal that data is coming to the receiver. Short and long refer to the length of the synchronization field in a packet.

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

Use long preamble if you are unsure what preamble mode other wireless devices on the network support, and to provide more reliable communications in busy wireless networks.

Use short preamble if you are sure all wireless devices on the network support it, and to provide more efficient communications.

Use the dynamic setting to automatically use short preamble when all wireless devices on the network support it, otherwise the WPA-1000 uses long preamble.

The wireless devices MUST use the same preamble mode in order to communicate.

IEEE 802.11g Wireless LAN

IEEE 802.11g is fully compatible with the IEEE 802.11b standard. This means an IEEE 802.11b adapter can interface directly with an IEEE 802.11g access point (and vice versa) at 11 Mbps or lower depending on range. IEEE 802.11g has several intermediate rate steps between the maximum and minimum data rates. The IEEE 802.11g data rate and modulation are as follows:

Table 24 IEEE 802.11g

DATA RATE (MBPS)	MODULATION
1	DBPSK (Differential Binary Phase Shift Keyed)
2	DQPSK (Differential Quadrature Phase Shift Keying)
5.5 / 11	CCK (Complementary Code Keying)
6/9/12/18/24/36/48/54	OFDM (Orthogonal Frequency Division Multiplexing)

Wireless Security Overview

Wireless security is vital to your network to protect wireless communication between wireless clients, access points and the wired network.

Wireless security methods available on the WPA-1000 are data encryption, wireless client authentication, restricting access by device MAC address and hiding the WPA-1000 identity.

The following figure shows the relative effectiveness of these wireless security methods available on your WPA-1000.

Table 25 Wireless Security Levels

SECURITY LEVEL	SECURITY TYPE
Least Secure	Unique SSID (Default)
	Unique SSID with Hide SSID Enabled
	MAC Address Filtering
	WEP Encryption
	IEEE802.1x EAP with RADIUS Server Authentication
	Wi-Fi Protected Access (WPA)
Most Secure	WPA2

You must enable the same wireless security settings on the WPA-1000 and on all wireless clients that you want to associate with it.

IEEE 802.1x

In June 2001, the IEEE 802.1x standard was designed to extend the features of IEEE 802.11 to support extended authentication as well as providing additional accounting and control features. It is supported by Windows XP and a number of network devices. Some advantages of IEEE 802.1x are:

- User based identification that allows for roaming.
- Support for RADIUS (Remote Authentication Dial In User Service, RFC 2138, 2139) for centralized user profile and accounting management on a network RADIUS server.
- Support for EAP (Extensible Authentication Protocol, RFC 2486) that allows additional authentication methods to be deployed with no changes to the access point or the wireless clients.

RADIUS

RADIUS is based on a client-server model that supports authentication, authorization and accounting. The access point is the client and the server is the RADIUS server. The RADIUS server handles the following tasks:

- Authentication
  Determines the identity of the users.
- Authorization

Determines the network services available to authenticated users once they are connected to the network.

- Accounting

  Keeps track of the client's network activity.

RADIUS is a simple package exchange in which your AP acts as a message relay between the wireless client and the network RADIUS server.

Types of RADIUS Messages

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user authentication:

- Access-Request

  Sent by an access point requesting authentication.
- Access-Reject

  Sent by a RADIUS server rejecting access.
- Access-Accept

  Sent by a RADIUS server allowing access.
- Access-Challenge

  Sent by a RADIUS server requesting more information in order to allow access. The access point sends a proper response from the user and then sends another Access-Request message.

The following types of RADIUS messages are exchanged between the access point and the RADIUS server for user accounting:

- Accounting-Request

  Sent by the access point requesting accounting.
- Accounting-Response

  Sent by the RADIUS server to indicate that it has started or stopped accounting.

In order to ensure network security, the access point and the RADIUS server use a shared secret key, which is a password, they both know. The key is not sent over the network. In addition to the shared key, password information exchanged is also encrypted to protect the network from unauthorized access.

Types of EAP Authentication

This section discusses some popular authentication types: EAP-MD5, EAP-TLS, EAP-TTLS, PEAP and LEAP. Your wireless LAN device may not support all authentication types.

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. .

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.

EAP-MD5 (Message-Digest Algorithm 5)

MD5 authentication is the simplest one-way authentication method. The authentication server sends a challenge to the wireless client. The wireless client '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 clients 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 security configuration screen. You may still configure and store keys, but they will not be used while dynamic WEP is enabled.

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
Deployment Difficulty	Easy	Hard	Moderate	Moderate	Moderate
Client Identity Protection	No	No	Yes	Yes	No

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 or WPA2 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 clients. 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 clients 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.

Wireless Client WPA Supplicants

A wireless client supplicant is the software that runs on an operating system instructing the wireless client how to use WPA. At the time of writing, the most widely available supplicant is the WPA patch for Windows XP, Funk Software's Odyssey client.

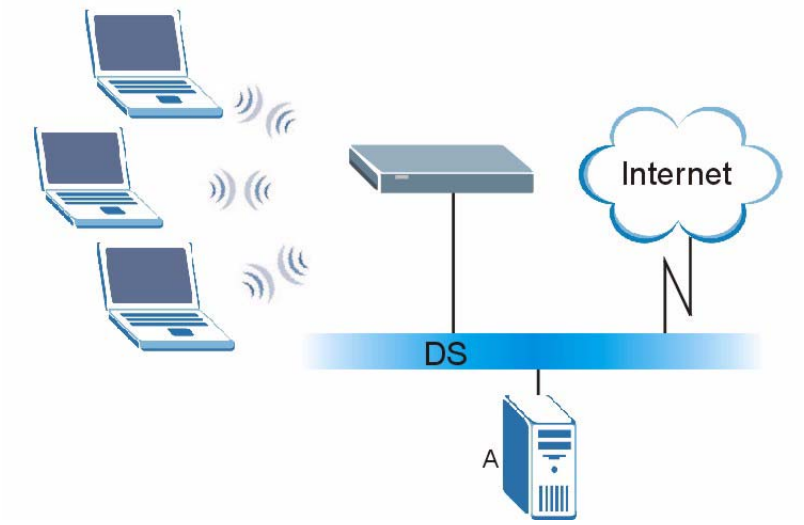
The Windows XP patch is a free download that adds WPA capability to Windows XP's built-in "Zero Configuration" wireless client. However, you must run Windows XP to use it.

WPA(2) with RADIUS Application Example

To set up WPA(2), 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. A 256-bit Pairwise Master Key (PMK) is derived from the authentication process by the RADIUS server and the client.
4. The RADIUS server distributes the PMK to the AP. The AP then sets up a key hierarchy and management system, using the PMK to dynamically generate unique data encryption keys. The keys are used to encrypt every data packet that is wirelessly communicated between the AP and the wireless clients.

Figure 51 WPA(2) with RADIUS Application Example



WPA(2)-PSK Application Example

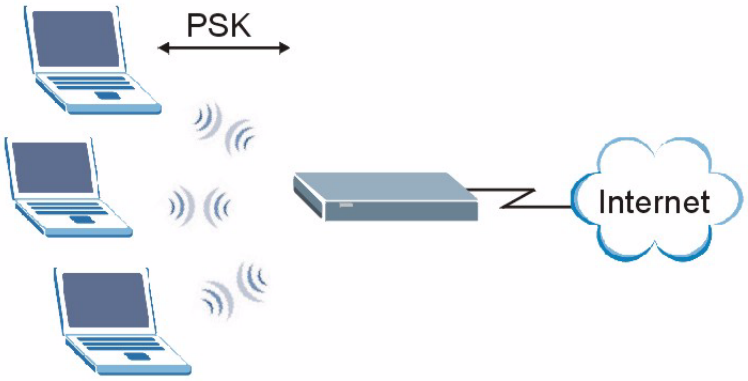
A WPA(2)-PSK application looks as follows.

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 wireless client's password and allows it to join the network only if the password matches.

3 The AP and wireless clients generate a common PMK (Pairwise Master Key). The key itself is not sent over the network, but is derived from the PSK and the SSID.

4 The AP and wireless clients use the TKIP or AES encryption process, the PMK and information exchanged in a handshake to create temporal encryption keys. They use these keys to encrypt data exchanged between them.

Figure 52 WPA(2)-PSK Authentication



Security Parameters Summary

Refer to this table to see what other security parameters you should configure for each authentication method or 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

Antenna Overview

An antenna couples RF signals onto air. A transmitter within a wireless device sends an RF signal to the antenna, which propagates the signal through the air. The antenna also operates in reverse by capturing RF signals from the air.

Positioning the antennas properly increases the range and coverage area of a wireless LAN.

Antenna Characteristics

Frequency

An antenna in the frequency of 2.4GHz (IEEE 802.11b and IEEE 802.11g) or 5GHz (IEEE 802.11a) is needed to communicate efficiently in a wireless LAN

Radiation Pattern

A radiation pattern is a diagram that allows you to visualize the shape of the antenna's coverage area.

Antenna Gain

Antenna gain, measured in dB (decibel), is the increase in coverage within the RF beam width. Higher antenna gain improves the range of the signal for better communications.

For an indoor site, each 1 dB increase in antenna gain results in a range increase of approximately 2.5%. For an unobstructed outdoor site, each 1dB increase in gain results in a range increase of approximately 5%. Actual results may vary depending on the network environment.

Antenna gain is sometimes specified in dBi, which is how much the antenna increases the signal power compared to using an isotropic antenna. An isotropic antenna is a theoretical perfect antenna that sends out radio signals equally well in all directions. dBi represents the true gain that the antenna provides.

Types of Antennas for WLAN

There are two types of antennas used for wireless LAN applications.

- Omni-directional antennas send the RF signal out in all directions on a horizontal plane. The coverage area is torus-shaped (like a donut) which makes these antennas ideal for a room environment. With a wide coverage area, it is possible to make circular overlapping coverage areas with multiple access points.
- Directional antennas concentrate the RF signal in a beam, like a flashlight does with the light from its bulb. The angle of the beam determines the width of the coverage pattern. Angles typically range from 20 degrees (very directional) to 120 degrees (less directional). Directional antennas are ideal for hallways and outdoor point-to-point applications.

Positioning Antennas

In general, antennas should be mounted as high as practically possible and free of obstructions. In point-to–point application, position both antennas at the same height and in a direct line of sight to each other to attain the best performance.

For omni-directional antennas mounted on a table, desk, and so on, point the antenna up. For omni-directional antennas mounted on a wall or ceiling, point the antenna down. For a single AP application, place omni-directional antennas as close to the center of the coverage area as possible.

For directional antennas, point the antenna in the direction of the desired coverage area.

F

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- This device must accept any interference received, including interference that may cause undesired operations.

This device 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 device 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 device does cause harmful interference to radio/television reception, which can be determined by turning the device off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

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- This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- IEEE 802.11b or 802.11g operation of this product in the U.S.A. is firmware-limited to channels 1 through 11.

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original:

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patch:

busybox-1.00+autoip.060915.patch

*uCLinux 2.4.22

original:

linux-2.4.22.tar.bz2

uClinux-2.4.22-uc0.diff.bz2

patch:

linux-2.4.22-patches.tar.bz2

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bin/Vera.ttf

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MRUA_src/rmupnp/upnp_stack/_MediaServerControlPointStack/MmsCp.h MRUA_src/rmupnp/upnp_stack/_MediaServerControlPointStack/MmsCp.c MRUA_src/rmupnp/upnp_stack/_Utility/MyString.c

MRUA_src/rmupnp/upnp_stack/_Utility/MyString.h

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibSSDPClient.c

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibParsers.c

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibWebClient.h

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/MSCP_ControlPoint.c

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibParsers.h

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibWebServer.c

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibWebServer.h

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibSSDPClient.h

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/UPnPControlPointStructs.h

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/BrowseOnly-Posix.upnpsg

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibAsyncServerSocket.h

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibWebClient.c

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibAsyncSocket.h

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibAsyncSocket.c

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/ILibAsyncServerSocket.c

MRUA_src/rmupnp/upnp_stack/_ControlPointCoreStack/MSCP_ControlPoint.h

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Mambolfb (Linux Frame Buffer Driver):

em86xxfb-2_6.c

vfb.c

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*

* Authors and maintainers:

* libpng versions 0.71, May 1995, through 0.88, January 1996: Guy Schalnat

* libpng versions 0.89c, June 1996, through 0.96, May 1997: Andreas Dilger

* libpng versions 0.97, January 1998, through 1.2.5 - October 3, 2002: Glenn

* See also "Contributing Authors", below.

*

* Note about libpng version numbers:

*

* Due to various miscommunications, unforeseen code incompatibilities

* and occasional factors outside the authors' control, version numbering

```
* on the library has not always been consistent and straightforward.
* The following table summarizes matters since version 0.89c, which was
* the first widely used release:
*
* source png.h png.h shared-lib
* version string int version
*
* 0.89c "1.0 beta 3" 0.89 89 1.0.89
* 0.90 "1.0 beta 4" 0.90 90 0.90 [should have been 2.0.90]
* 0.95 "1.0 beta 5" 0.95 95 0.95 [should have been 2.0.95]
* 0.96 "1.0 beta 6" 0.96 96 0.96 [should have been 2.0.96]
* 0.97b "1.00.97 beta 7" 1.00.97 97 1.0.1 [should have been 2.0.97]
* 0.97c 0.97 97 2.0.97
* 0.98 0.98 98 2.0.98
* 0.99 0.99 98 2.0.99
* 0.99a-m 0.99 99 2.0.99
* 1.00 1.00 100 2.1.0 [100 should be 10000]
* 1.0.0 (from here on, the 100 2.1.0 [100 should be 10000]
* 1.0.1 png.h string is 10001 2.1.0
* 1.0.1a-e identical to the 10002 from here on, the shared library
* 1.0.2 source version) 10002 is 2.V where V is the source code
* 1.0.2a-b 10003 version, except as noted.
* 1.0.3 10003
* 1.0.3a-d 10004
* 1.0.4 10004
* 1.0.4a-f 10005
* 1.0.5 (+ 2 patches) 10005
* 1.0.5a-d 10006
* 1.0.5e-r 10100 (not source compatible)
* 1.0.5s-v 10006 (not binary compatible)
* 1.0.6 (+ 3 patches) 10006 (still binary incompatible)
* 1.0.6d-f 10007 (still binary incompatible)
* 1.0.6g 10007
* 1.0.6h 10007 10.6h (testing xy.z so-numbering)
* 1.0.6i 10007 10.6i
* 1.0.6j 10007 2.1.0.6j (incompatible with 1.0.0)
```

* 1.0.7beta11-14 DLLNUM 10007 2.1.0.7beta11-14 (binary compatible)
* 1.0.7beta15-18 1 10007 2.1.0.7beta15-18 (binary compatible)
* 1.0.7rc1-2 1 10007 2.1.0.7rc1-2 (binary compatible)
* 1.0.7 1 10007 (still compatible)
* 1.0.8beta1-4 1 10008 2.1.0.8beta1-4
* 1.0.8rc1 1 10008 2.1.0.8rc1

* 1.0.8 1 10008 2.1.0.8
* 1.0.9beta1-6 1 10009 2.1.0.9beta1-6
* 1.0.9rc1 1 10009 2.1.0.9rc1
* 1.0.9beta7-10 1 10009 2.1.0.9beta7-10
* 1.0.9rc2 1 10009 2.1.0.9rc2
* 1.0.9 1 10009 2.1.0.9
* 1.0.10beta1 1 10010 2.1.0.10beta1
* 1.0.10rc1 1 10010 2.1.0.10rc1
* 1.0.10 1 10010 2.1.0.10
* 1.0.11beta1-3 1 10011 2.1.0.11beta1-3
* 1.0.11rc1 1 10011 2.1.0.11rc1
* 1.0.11 1 10011 2.1.0.11
* 1.0.12beta1-2 2 10012 2.1.0.12beta1-2
* 1.0.12rc1 2 10012 2.1.0.12rc1
* 1.0.12 2 10012 2.1.0.12
* 1.1.0a-f - 10100 2.1.1.0a-f (branch abandoned)
* 1.2.0beta1-2 2 10200 2.1.2.0beta1-2
* 1.2.0beta3-5 3 10200 3.1.2.0beta3-5
* 1.2.0rc1 3 10200 3.1.2.0rc1
* 1.2.0 3 10200 3.1.2.0
* 1.2.1beta1-4 3 10201 3.1.2.1beta1-4
* 1.2.1rc1-2 3 10201 3.1.2.1rc1-2
* 1.2.1 3 10201 3.1.2.1
* 1.2.2beta1-6 12 10202 12.so.0.1.2.2beta1-6
* 1.0.13beta1 10 10013 10.so.0.1.0.13beta1
* 1.0.13rc1 10 10013 10.so.0.1.0.13rc1
* 1.2.2rc1 12 10202 12.so.0.1.2.2rc1
* 1.0.13 10 10013 10.so.0.1.0.13
* 1.2.2 12 10202 12.so.0.1.2.2

```
* 1.2.3rc1-6 12 10203 12.so.0.1.2.3rc1-6
* 1.2.3 12 10203 12.so.0.1.2.3
* 1.2.4beta1-3 13 10204 12.so.0.1.2.4beta1-3
* 1.0.14rc1 13 10014 10.so.0.1.0.14rc1
* 1.2.4rc1 13 10204 12.so.0.1.2.4rc1
* 1.0.14 10 10014 10.so.0.1.0.14
* 1.2.4 13 10204 12.so.0.1.2.4
* 1.2.5beta1-2 13 10205 12.so.0.1.2.5beta1-2
* 1.0.15rc1-3 10 10015 10.so.0.1.0.15rc1-3
* 1.2.5rc1-3 13 10205 12.so.0.1.2.5rc1-3
* 1.0.15 10 10015 10.so.0.1.0.15
* 1.2.5 13 10205 12.so.0.1.2.5
*
* Henceforth the source version will match the shared-library major
* and minor numbers; the shared-library major version number will be
* used for changes in backward compatibility, as it is intended. The
* PNG_LIBPNG_VER macro, which is not used within libpng but is available
* for applications, is an unsigned integer of the form xyyzz corresponding
* to the source version x.y.z (leading zeros in y and z). Beta versions
* were given the previous public release number plus a letter, until
* version 1.0.6j; from then on they were given the upcoming public
* release number plus "betaNN" or "rcN".
*
* Binary incompatibility exists only when applications make direct access
* to the info_ptr or png_ptr members through png.h, and the compiled
* application is loaded with a different version of the library.
*
* DLLNUM will change each time there are forward or backward changes
* in binary compatibility (e.g., when a new feature is added).
*
* See libpng.txt or libpng.3 for more information. The PNG specification
* is available as RFC 2083 <ftp://ftp.uu.net/graphics/png/documents/>
* and as a W3C Recommendation <http://www.w3.org/TR/REC.png.html>
*/

/*
```

```
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/*

* A "png_get_copyright" function is available, for convenient use in "about" * boxes and the like:

*

* printf("%s",png_get_copyright(NULL));

*

* Also, the PNG logo (in PNG format, of course) is supplied in the

* files "pngbar.png" and "pngbar.jpg (88x31) and "pngnow.png" (98x31).

*/

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/*

* The contributing authors would like to thank all those who helped * with testing, bug fixes, and patience. This wouldn't have been * possible without all of you.

*

* Thanks to Frank J. T. Wojcik for helping with the documentation.

*/

/*

* Y2K compliance in libpng:

* =========================

*

* October 3, 2002

*

* Since the PNG Development group is an ad-hoc body, we can't make

* an official declaration.

*

```
* This is your unofficial assurance that libpng from version 0.71 and
* upward through 1.2.5 are Y2K compliant. It is my belief that earlier
* versions were also Y2K compliant.
*
* Libpng only has three year fields. One is a 2-byte unsigned integer
* that will hold years up to 65535. The other two hold the date in text
* format, and will hold years up to 9999.
*
* The integer is
* "png_uint_16 year" in png_time_struct.
*
* The strings are
* "png_charp time_buffer" in png_struct and
* "near_time_buffer", which is a local character string in png.c.
*
* There are seven time-related functions:
* png.c: png_convert_to_rfc_1123() in png.c
* (formerly png_convert_to_rfc_1152() in error)
* png_convert_from_struct_tm() in pngwrite.c, called in pngwrite.c
* png_convert_from_time_t() in pngwrite.c
* png_get_tIME() in pngget.c
* png_handle_tIME() in pngrutil.c, called in pngread.c
* png_set_tIME() in pngset.c
* png_write_tIME() in pngwutil.c, called in pngwrite.c
*
* All handle dates properly in a Y2K environment. The
* png_convert_from_time_t() function calls gmtime() to convert from system
* clock time, which returns (year - 1900), which we properly convert to
* the full 4-digit year. There is a possibility that applications using
* libpng are not passing 4-digit years into the png_convert_to_rfc_1123()
* function, or that they are incorrectly passing only a 2-digit year
* instead of "year - 1900" into the png_convert_from_struct_tm() function,
* but this is not under our control. The libpng documentation has always
* stated that it works with 4-digit years, and the APIs have been
* documented as such.
*
```

* The tIME chunk itself is also Y2K compliant. It uses a 2-byte unsigned

* integer to hold the year, and can hold years as large as 65535.

*

* zlib, upon which libpng depends, is also Y2K compliant. It contains

* no date-related code.

*

* Glenn Randers-Pehrson

* libpng maintainer

* PNG Development Group

*/

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www.sourceforge.net/projects/tinyxml Original file by Yves Berquin.

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ARMUTILS Package

Software included with the ARM utilities package (as inferred from the list of Makefiles):

binutils:
binutils-2.11.2
GPL
ftp://sources.redhat.com/pub/binutils/releases

busybox:
busybox-1.00-pre3 and busybox-1.00
GPL
http://www.busybox.net/downloads

ccache:
ccache-2.3
GPL
http://ccache.samba.org/ftp/ccache/

cdrtools:
cdrtools-2.00.3
GPL
http://www.fokus.gmd.de/research/cc/glone/employees/jo erg.schilling/private/cdrecord.html

elf2flt:
elf2flt-20020214 and elf2flt-20030314
GPL
http://www.uclinux.org/pub/uClinux/utilities/

gcc:
gcc-2.95.3
GPL
http://gcc.gnu.org

ext2root:
genext2fs-1.3
GPL
http://packages.debian.org/unstable/admin/genext2fs

genromfs:
genromfs-0.5.1
GPL
http://www.uclinux.org/pub/uClinux/utilities/

linux:
linux-2.4.22
GPL
http://www.kernel.org/pub/linux/kernel/v2.4

uClinux-2.4.22-uc0
GPL
http://www.uclinux.org/pub/uClinux/uClinux-2.4.x

microwin:
microwindows-src-snapshot-013004

MPL (Mozilla Public License) -OR- GPL ftp://ftp.microwindows.org/pub/microwindows
madwifi:
madwifi-cvs20040331
Dual license:
a) Custom license - source redistribution OK - see
- OR -
b) GPL
http://madwifi.org/pub/linux/snapshot/tars

mtd:
mtd-20040901
GPL

ftp://ftp.uk.linux.org/pub/people/dwmw2/mtd/cvs

ncurses:

ncurses-5.2

GPL

http://ftp.gnu.org/pub/gnu/ncurses

openssl:

openssl-0.9.7d

Dual license:

a) OpenSSL license

- AND -

b) SSLeay license

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http://www.openssl.org/source

prism54:

prism54-cvs20040318

GPL

http://prism54.org/pub/linux/snapshot/tars Firmware issue at http://www.prism54.org/firmware/

STLport:

STLport-4.5.3

Custom license - source redistribution OK - see

http://www.stlport.org/archive

tinylogin:

tinylogin-1.4

GPL -AND- Shadow utilities license (BSD-style) -PLUS- derived work from code licensed under the Eindhoven University of Technology license

http://tinylogin.busybox.net/downloads

uclibc:

uClibc-0.9.21 and uClibc-0.9.26

LGPL
http://www.uclibc.org/downloads

udhcp:
udhcp-0.9.8
GPL
http://udhcp.busybox.net/downloads/

wtools:
wireless_tools.26
GPL
http://pcmcia-cs.sourceforge.net/ftp/contrib/

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* README file for STLport 4.5 *

* *

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This directory contains STLport-4.5 release. What's inside :

README - this file

INSTALL - installation instructions

stlport - main STLport include directory

src - source and makefiles for iostreams implementation

lib - installation directory for STLport library (if you use STLport

iostreams only)

test/regression - regression test, using wrapper iostreams

test/eh - exception handling test using STLport iostreams

etc - miscellanous files (ChangeLog, TODO, scripts, etc.)

GETTING STLPORT

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Customer Support

Please have the following information ready when you contact customer support.

Required Information

- Product model and serial number.
- Warranty Information.
- Date that you received your device.
- Brief description of the problem and the steps you took to solve it.

Corporate Headquarters (Worldwide)

- Support E-mail: support@zyxel.com.tw
- Sales E-mail: sales@zyxel.com.tw
- Telephone: +886-3-578-3942
- Fax: +886-3-578-2439
- Web Site: www.zyxel.com, www.europe.zyxel.com
- FTP Site: ftp.zyxel.com, ftp.europe.zyxel.com
- Regular Mail: ZyXEL Communications Corp., 6 Innovation Road II, Science Park, Hsinchu 300, Taiwan

Costa Rica

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

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