Reference Manual for the NETGEAR ProSafe Wireless Access Point 802.11g WG302

NETGEAR

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202-10008-03
July 2005

Technical Support

Please register to obtain technical support. Please retain your proof of purchase and warranty information.

To register your product, get product support or obtain product information and product documentation, go to http://www.NETGEAR.com. If you do not have access to the World Wide Web, you may register your product by filling out the registration card and mailing it to NETGEAR customer service.

You will find technical support information at:
http://www.NETGEAR.com/ through the customer service area. If you want to contact technical support by telephone, see the support information card for the correct telephone number for your country.

Trademarks

Statement of Conditions

In the interest of improving internal design, operational function, and/or reliability, NETGEAR reserves the right to make changes to the products described in this document without notice. NETGEAR does not assume any liability that may occur due to the use or application of the product(s) or circuit layout(s) described herein.

Modifications made to the product, unless expressly approved by Netgear, could void the user's authority to operate the equipment. NETGEAR does not assume any liability that may occur due to such condition.

Federal Communications Commission (FCC) Compliance Notice: Radio Frequency Notice

NETGEAR ProSafe Wireless Access Point

Tested to Comply
with FCC Standards
FOR HOME OR OFFICE USE

FCC ID: PY3WG302

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

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

Placement and Range Guidelines

Indoors, computers can connect over 802.11 wireless networks at a maximum range of 500 feet (152.4 m) for 802.11b devices. However, the operating distance or range of your wireless connection can vary significantly, based on the physical placement of the wireless access point.

For best results, identify a location for your wireless access point according to these guidelines:

- Away from potential sources of interference, such as PCs, large metal surfaces, microwaves, and 2.4 GHz cordless phones.
- In an elevated location such as a high shelf that is near the center of the wireless coverage area for all mobile devices.

Failure to follow these guidelines can result in significant performance degradation or inability to wirelessly connect to the wireless access point.

To meet FCC and other national safety guidelines for RF exposure, the antennas for this device must be installed to ensure a minimum separation distance of 20cm (7.9 in.) from persons. Further, the antennas shall not be colocated with other transmitting structures.

FCC Statement

DECLARATION OF CONFORMITY

We Netgear,

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Santa Clara, CA 95054, USA

Tel: +1 408 907 8000

declare under our sole responsibility that the product(s)

WG302 *(Model Designation)*

802.11g ProSafe Wireless Access Point *(Product Name)*

complies with Part 15 of FCC Rules.

Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

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

RF Exposure Warning for North America, and Australia

Warning! To meet FCC and other national safety guidelines for RF exposure, the antennas for this device (see below) must be installed to ensure a minimum separation distance of 20cm (7.9 in.) from persons. Further, the antennas shall not be colocated with other antenna or radio transmitter.

Antenna Statement for North America and Australia

In addition to its own 2 antennas, the WG302 device has been approved for use with the following detachable antennas and antenna cables:

Approved Antennas	Antenna Gain and type	Approved Antenna Cable	Antenna Cable Length	Maximum Transmitted Power
NETGEAR ANT24D18	18 dBi, directional outdoor/indoor	NETGEAR ACC-10314-01 thru 05	1.5 m to 30 m	19 dBm + 18 dBi ant.
NETGEAR ANT2409	9 dBi, omnidirectional outdoor/indoor	NETGEAR ACC-10314-01 thru 05	1.5 m to 30 m	19 dBm + 9 dBi ant.
NETGEAR ANT24O5	5 dBi, ceiling/wall indoor	NETGEAR ACC-10314-01 thru 05	1.5 m to 30 m	19 dBm + 5 dBi ant.

*** WG302 maximum radiated power in North America and Australia: 20 dBm – cable loss + antenna gain**

Please go to *www.netgear.com/go/wg302_fcc* for an updated list of wireless accessories approved to be used with the WG302 in North America and Australia.

Industry Canada Compliance Statement

This Class B Digital apparatus meets all the requirements of the Canadian Interference Causing Equipment Regulations ICES 003.

Cet appareil numerique de classe B respecte les exigences du reglement du Canada sur le materiel brouilleur NMB-003.

The device is certified to the requirements of RSS-210 for 2.4 GHz spread spectrum devices. The use of this device in a system operating either partially or completely outdoors may require the user to obtain a license

for the system according to the Canadian regulations. For further information, contact your local Industry Canada office.

Product and Publication Details

Model Number:	WG302
Publication Date:	July 2005
Product Family:	wireless access point
Product Name:	NETGEAR ProSafe Wireless Access Point 802.11g WG302
Home or Business Product:	Business
Language:	English
Publication Part Number:	202-10008-03

Contents

Chapter 1
About This Manual

This chapter describes the intended audience, scope, conventions, and formats of this manual.

Audience, Scope, Conventions, and Formats

This reference manual assumes that the reader has basic to intermediate computer and Internet skills. However, basic computer network, Internet, firewall, and VPN technologies tutorial information is provided in the Appendices and on the Netgear website.

This guide uses the following typographical conventions:

Table 1-1. Typographical Conventions

italics	Emphasis, books, CDs, URL names
bold	User input
`fixed`	Screen text, file and server names, extensions, commands, IP addresses

This guide uses the following formats to highlight special messages:

Note: This format is used to highlight information of importance or special interest.

This manual is written for the WG302 Access Point according to these specifications:

Table 1-2. Manual Scope

Product Version	NETGEAR ProSafe Wireless Access Point 802.11g WG302
Manual Publication Date	July 2005

Note: Product updates are available on the NETGEAR, Inc. Web site at *http://kbserver.netgear.com/products/WG302.asp*.

How to Use This Manual

The HTML version of this manual includes the following:

- Buttons, > and <, for browsing forwards or backwards through the manual one page at a time
- A TOC button that displays the table of contents and an Index button. Double-click on a link in the table of contents or index to navigate directly to where the topic is described in the manual.
- A Knowledge Base button to access the full NETGEAR, Inc. online knowledge base for the product model.
- Links to PDF versions of the full manual and individual chapters.

How to Print this Manual

To print this manual you can choose one of the following several options, according to your needs.

- **Printing a Page in the HTML View**.

  Each page in the HTML version of the manual is dedicated to a major topic. Use the *Print* button on the browser toolbar to print the page contents.

- **Printing a Chapter**.

  Use the *PDF of This Chapter* link at the top left of any page.

  – Click the *PDF of This Chapter* link at the top right of any page in the chapter you want to print. The PDF version of the chapter you were viewing opens in a browser window.

    Note: Your computer must have the free Adobe Acrobat reader installed in order to view and print PDF files. The Acrobat reader is available on the Adobe Web site at *http://www.adobe.com*.

  – Click the print icon in the upper left of the window.

    Tip: If your printer supports printing two pages on a single sheet of paper, you can save paper and printer ink by selecting this feature.

- **Printing the Full Manual**.

  Use the *Complete PDF Manual* link at the top left of any page.

  – Click the *Complete PDF Manual* link at the top left of any page in the manual. The PDF version of the complete manual opens in a browser window.
  – Click the print icon in the upper left of the window.

    Tip: If your printer supports printing two pages on a single sheet of paper, you can save paper and printer ink by selecting this feature.

Chapter 2
Introduction

This chapter introduces the NETGEAR NETGEAR ProSafe Wireless Access Point 802.11g WG302. Minimal prerequisites for installation are presented in "System Requirements" on page 2-5.

About the NETGEAR ProSafe Wireless Access Point 802.11g WG302

The NETGEAR ProSafe Wireless Access Point 802.11g WG302 is the basic building block of a wireless LAN infrastructure. It provides connectivity between Ethernet wired networks and radio-equipped wireless notebook systems, desktop systems, print servers, and other devices.

The WG302 provides wireless connectivity to multiple wireless network devices within a fixed range or area of coverage, interacting with a wireless network interface card (NIC) via an antenna. Typically, an individual in-building access point provides a maximum connectivity area with about a 300 foot radius. The NETGEAR ProSafe Wireless Access Point 802.11g WG302 can support a small group of users in a range of several hundred feet. Most access points are rated between 30-70 users simultaneously.

The NETGEAR ProSafe Wireless Access Point 802.11g WG302 acts as a bridge between the wired LAN and wireless clients. Connecting multiple WG302 Access Points via a wired Ethernet backbone can further lengthen the wireless network coverage. As a mobile computing device moves out of the range of one access point, it moves into the range of another. As a result, wireless clients can freely roam from one Access Point to another and still maintain seamless connection to the network.

The auto-sensing capability of the NETGEAR ProSafe Wireless Access Point 802.11g WG302 allows packet transmission at up to 108 Mbps, or at reduced speeds to compensate for distance or electromagnetic interference.

Key Features

The WG302 Access Point is easy-to-use and provides solid wireless and networking support.

Supported Standards and Conventions

The following standards and conventions are supported:

- **Standards Compliant.** The Wireless Access Point complies with the IEEE 802.11g for Wireless LANs.
- **WEP support.** Support for WEP is included. 64-bit, 128-bit, and 152-bit keys are supported.
- **Full WPA and WPA2 support.** WPA and WPA2 enterprise class strong security with RADIUS and certificate authentication as well as dynamic encryption key generation. WPA-PSK and WPA2-PSK pre-shared key authentication without the overhead of RADIUS servers but with all of the strong security of WPA.
- **DHCP Client Support.** DHCP provides a dynamic IP address to PCs and other devices upon request. The WG302 can act as a client and obtain information from your DHPC server.
- **SNMP Support.** Support for Simple Network Management Protocol (SNMP) Management Information Base (MIB) management.

Key Features

The NETGEAR WG302 provides solid functionality, including these features:

- **AutoCell RF Management.** AutoCell provides advanced automated RF management that improves performance and enhances security.
- **Multiple Operating Modes**
  - **Wireless Access Point.** Operates as a standard 802.11g.
  - **Point-to-Point Bridge.** In this mode, the WG302 only communicates with another bridge-mode wireless station. You must enter the MAC address (physical address) of the other bridge-mode wireless station in the field provided. WEP should be used to protect this communication.
  - **Point-to-Multi-Point Bridge.** Select this only if this WG302 is the “Master” for a group of bridge-mode wireless stations. The other bridge-mode wireless stations must be set to Point-to-Point Bridge mode, using this WG302's MAC address. They then send all traffic to this “Master”, rather than communicate directly with each other. WEP should be used to protect this traffic.

  - **Wireless Repeater.** In this half-duplex mode, the WG302 only communicates with another repeater-mode wireless station. You must enter the MAC address of both adjacent repeater-mode wireless stations in the fields provided. WEP should be used to protect this communication.
- **Wireless Multimedia (WMM) support.** WMM is a subset of the 802.11e standard. WMM allows wireless traffic to have a range of priorities, depending on the kind of data. Time-dependent information such as video or audio will have a higher priority than normal traffic. For WMM to function correctly, wireless clients must also support WMM.
- **Rogue Access Point detection.** For enhanced security, you can scan the wireless network to detect rogue access points.
- **Hotspot settings.** You can allow all HTTP (TCP, port 80) requests to be captured and re-directed to the URL you specify.
- **Upgradeable Firmware.** Firmware is stored in a flash memory and can be upgraded easily, using only your Web browser, and can be upgraded remotely.
- **Access Control.** The Access Control MAC address filtering feature can ensure that only trusted wireless stations can use the WG302 to gain access to your LAN.
- **Simple Configuration.** If the default settings are unsuitable, they are easy to change.
- **Hidden Mode.** The SSID is not broadcast, assuring only clients configured with the correct SSID can connect.
- **Secure Telnet Command Line Interface.** The Telnet command line interface enables direct access over the serial port and easy scripting of configuration of multiple WG302 across an extensive network via the Ethernet interface. An SSH client is required.
- **Configuration Backup.** Configuration settings can be backed up to a file and restored.
- **Secure and Economical Operation.** Adjustable power output allows more secure or economical operation.
- **Power over Ethernet.** Power can be supplied to the WG302 over the Ethernet port from any 802.3af compliant mid-span or end-span source such as the NETGEAR FSM7326P Managed Power over Ethernet Layer 3 managed switch.
- **Autosensing Ethernet Connection with Auto Uplink lnterface.** Connects to 10/100 Mbps IEEE 802.3 Ethernet networks.
- **LED Indicators.** Power, test, LAN speed, LAN activity, and wireless activity are easily identified.

AutoCell—The Self-Organizing Wireless Network

AutoCell™, an embedded control system for 802.11 WLANs. AutoCell increases available bandwidth and reduces WLAN installation and operating costs significantly.

AutoCell is completely automatic: It is a continuous communication system that relies on a lightweight protocol to monitor changes on the wireless domain while keeping overhead very low. Among AutoCell's inherent advantages:

- Elimination of manual site surveys and channel maps
- Dynamic load balancing
- Plug-and-play-implementation
- Transparent fault recovery and failover

Since AutoCell is completely self-organizing, it holds human intervention to a minimum. That reduces the people costs associated with deployment, management, and maintenance—making 802.11 WLANs practical, efficient, and cost-effective.

802.11g Standards-based Wireless Networking

The NETGEAR ProSafe Wireless Access Point 802.11g WG302 provides a bridge between Ethernet wired LANs and 802.11g compatible wireless LAN networks. It provides connectivity between Ethernet wired networks and radio-equipped wireless notebook systems, desktop systems, print servers, and other devices. Additionally, the WG302 supports the following wireless features:

- Distributed coordinated function (CSMA/CA, Back off procedure, ACK procedure, retransmission of unacknowledged frames)
- RTS/CTS handshake
- Beacon generation
- Packet fragmentation and reassembly
- Short or long preamble
- Roaming among access points on the same subnet

Autosensing Ethernet Connections with Auto Uplink

The WG302 can connect to a standard Ethernet network. The LAN interface is autosensing and capable of full-duplex or half-duplex operation.

The wireless access point incorporates Auto Uplink™ technology. The Ethernet port will automatically sense whether the Ethernet cable plugged into the port should have a 'normal' connection such as to a computer or an 'uplink' connection such as to a switch or hub. That port will then configure itself to the correct configuration. This feature also eliminates any concerns about crossover cables, as Auto Uplink will accommodate either type of cable to make the right connection.

Compatible and Related NETGEAR Products

For a list of compatible products from other manufacturers, see the Wireless Ethernet Compatibility Alliance Web site (WECA, see *http://www.wi-fi.net*).

The following NETGEAR products work with the WG302 Access Point:

- WAG511 ProSafe 108 Mbps Dual Band PC Card
- WAG311 ProSafe 108 Mbps Dual Band PCI Card
- WG311T 802.11g 108 Mbps Wireless PCI Card
- WG511T 802.11g 108 Mbps Wireless CardBus Adapter
- WG511 802.11g 54 Mbps Wireless CardBus Adapter
- WG111 801.11g 54 Mbps Wireless Bridge

System Requirements

Before installing the WG302, make sure your system meets these requirements:

- A 10/100 Mbps Local Area Network device such as a hub or switch
- The Category 5 UTP straight through Ethernet cable with RJ-45 connector included in the package, or one like it
- A 100-240 V, 50-60 HZ AC power source
- A Web browser for configuration such as Microsoft Internet Explorer 6.0 or above, or Netscape Navigator 4.78 or above
- At least one computer with the TCP/IP protocol installed
- 802.11b or 802.11b-compliant devices, such as the NETGEAR WG511 Wireless Adapter

What's In the Box?

The product package should contain the following items:

- NETGEAR ProSafe Wireless Access Point 802.11g WG302
- Power adapter and cord (12 V dc, 1.2 A)
- Straight through Category 5 Ethernet cable
- WG302 802.11g ProSafe Wireless Access Point Installation Guide
- *Resource CD for the NETGEAR WG302 ProSafe 802.11g Wireless Access Point* which includes this manual.
- Support Registration card

Contact your reseller or customer support in your area if there are any missing or damaged parts. You can refer to the Support Information Card for the telephone number of customer support in your area. You should keep the Support Information card, along with the original packing materials, and use the packing materials to repack the WG302 if you need to return it for repair. To qualify for product updates and product warranty registrations, we encourage you to register on the NETGEAR Web site at: *http://www.NETGEAR.com*.

Hardware Description

The WG302 front and rear hardware functions are described below.

Figure 2-1: WG302 front panel

The following table explains the LED indicators:

LED	DESCRIPTION
PWR	Power Indicator
Off	No power.
On	Power is on.
TEST	Self Test Indicator
Blink	Indicates self test, loading software, or system fault (if continues). **Note:** This LED may blink for a minute before going off.
100	Ethernet LAN Speed Indicator
Off	Indicates 10 Mbps Ethernet link detected
Green On	100 Mbps Fast Ethernet link detected.
LINK/ACT LAN	Ethernet LAN Link Activity Indicator
Off	Indicates no Ethernet link detected.
Green On	100 Mbps Fast Ethernet link detected, no activity.
Green Blink	Indicates data traffic on the 100Mbps Ethernet LAN.
Amber 0n	10 Mbps Ethernet link detected, no activity.
Amber Blink	Indicates data traffic on the 10Mbps Ethernet LAN.
802.11g WLAN	Wireless LAN Link Activity Indicator
Off	Indicates no wireless link activity.
Green Blink	Wireless link activity.

Figure 2-2: WG302 rear panel

- **Left and Right Detachable Antenna**

  The WG302 provides two detachable antenna.

- **Restore to Factory Defaults Button**

  The restore to default button located between the Ethernet RJ-45 connector and the power socket restores the WG302 to the factory default settings.

- **Serial Console Port**

  Male DB-9 serial port for serial DTE connections.

- **RJ-45 Ethernet Port**

  Use the WG302 Ethernet RJ-45 port to connect to an Ethernet LAN through a device such as a hub, switch, router, or POE switch.

- **Power Socket**

  This socket connects to the WG302 12V 1.2A power adapter.

Chapter 3
Basic Installation and Configuration

This chapter describes how to set up your NETGEAR ProSafe Wireless Access Point 802.11g WG302 for wireless connectivity to your LAN. This basic configuration will enable computers with 802.11b or 802.11g wireless adapters to do such things as connect to the Internet, or access printers and files on your LAN.

Note: Indoors, computers can connect over 802.11g wireless networks at ranges of several hundred feet or more. This distance can allow for others outside your area to access your network. It is important to take appropriate steps to secure your network from unauthorized access. The WG302 Access Point provides highly effective security features which are covered in detail in "Understanding WEP/WPA Security Options" on page 3-15. Deploy the security features appropriate to your needs.

You need to prepare these three things before you can establish a connection through your wireless access point:

- A location for the WG302 that conforms to the Observing Placement and Range Guidelines below.
- The wireless access point connected to your LAN through a device such as a hub, switch, router, or Cable/DSL gateway.
- One or more computers with properly configured 802.11b or 802.11g wireless adapters.

Observing Placement and Range Guidelines

The operating distance or range of your wireless connection can vary significantly based on the physical placement of the wireless access point. The latency, data throughput performance, and notebook power consumption of wireless adapters also vary depending on your configuration choices.

Note: Failure to follow these guidelines can result in significant performance degradation or inability to wirelessly connect to the WG302. For complete performance specifications, see Appendix A, "Specifications".

For best results, place your wireless access point:

- Near the center of the area in which your PCs will operate.
- In an elevated location such as a high shelf where the wirelessly connected PCs have line-of-sight access (even if through walls).
- Away from sources of interference, such as PCs, microwaves, and 2.4 GHz cordless phones.
- Away from large metal surfaces.
- Putting the antenna in a vertical position provides best side-to-side coverage. Putting the antenna in a horizontal position provides best up-and-down coverage.
- If using multiple access points, it is better if adjacent access points use different radio frequency Channels to reduce interference. The recommended Channel spacing between adjacent access points is 5 Channels (for example, use Channels 1 and 6, or 6 and 11).

The time it takes to establish a wireless connection can vary depending on both your security settings and placement. WEP connections can take slightly longer to establish. Also, WEP encryption can consume more battery power on a notebook computer.

Cabling Requirements

The WG302 Access Point connects to your LAN via twisted-pair Category 5 Ethernet cable with RJ-45 connectors.

Default Factory Settings

When you first receive your WG302, the default factory settings will be set as shown below. You can restore these defaults with the Factory Default Restore switch on the rear panel — see "WG302 front panel" on page 2-6.

FEATURE	FACTORY DEFAULT SETTINGS
User Name (case sensitive)	**admin**
Password (case sensitive)	**password**
Operating Mode	**Access Point**
Access Point Name	**netgearxxxxxx where xxxxxx are the last six digits of the wireless access point's MAC address**
Built-in DHCP client Built-in DHCP server	**DHCP client disabled** **DHCP server disabled**
IP Configuration (if DHCP server is unavailable)	**IP Address: 192.168.0.228** **Subnet Mask: 255.255.255.0** **Gateway: 0.0.0.0**
Network Name (SSID)	**NETGEAR**
Broadcast Network Name (SSID)	**Enabled**
802.11g Radio Frequency Channel	**11**
AutoCell RF Management AutoCell Enhanced RF Security 'stealth' mode	**Enabled** **Disabled**
WEP/WPA	**Disabled**
Restricting connectivity based on MAC Access Control List	**Disabled**
Spanning Tree Protocol	**Enabled**
Time Zone	**GMT**
Time Zone Adjust for Daylight Saving TIme	**Disabled**
SNMP	**Enabled but Trap forwarding is disabled**
Secure Telnet	**Enabled**
SugerG Mode	**Disabled**
WMM Mode	**Disabled**

Understanding WG302 Wireless Security Options

Your wireless data transmissions can be received well beyond your walls by anyone with a compatible adapter. For this reason, use the security features of your wireless equipment. The WG302 Access Point provides highly effective security features which are covered in detail in this chapter. Deploy the security features appropriate to your needs.

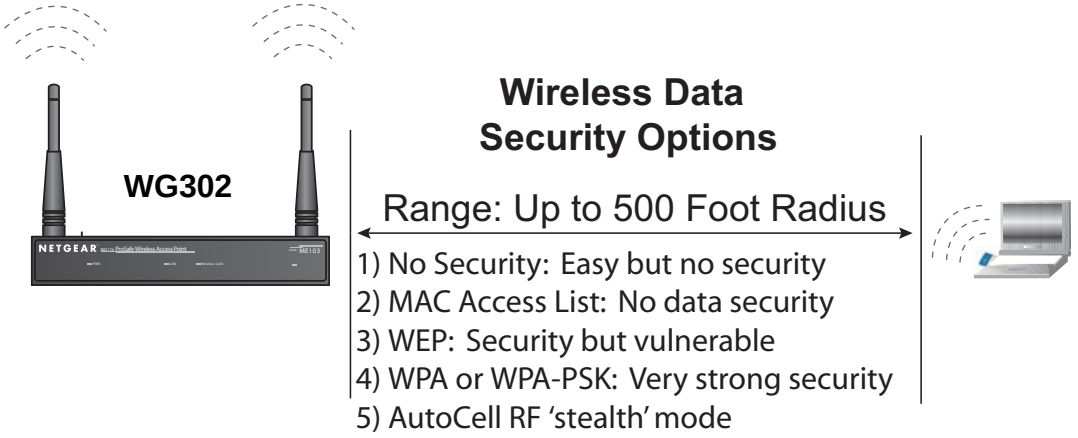


Figure 3-1: WG302 wireless data security options

There are several ways you can enhance the security of your wireless network:

- **Restrict Access Based on MAC address.** You can restrict access to only trusted PCs so that unknown PCs cannot wirelessly connect to the WG302. MAC address filtering adds an obstacle against unwanted access to your network, but the data broadcast over the wireless link is fully exposed.
- **Turn Off the Broadcast of the Wireless Network Name (SSID).** If you disable broadcast of the SSID, only devices that have the correct SSID can connect. This nullifies the wireless network 'discovery' feature of some products such as Windows XP, but the data is still fully exposed to a determined snoop using specialized test equipment like wireless sniffers.
- **Use WEP.** Wired Equivalent Privacy (WEP) data encryption provides data security. WEP Shared Key authentication and WEP data encryption will block all but the most determined eavesdropper.

- **Use WPA, WPA-PSK, WPA2, or WPA2-PSK.** Wi-Fi Protected Access (WPA and WPA2) data encryption provides data security. The very strong authentication along with dynamic per frame rekeying of WPA make it virtually impossible to compromise. Because this is a new standard, wireless device driver and software availability may be limited.
- **Use AutoCell Enhanced RF Security 'Stealth Mode.'** In addition to standard encryption and security mechanisms such as WEP and WPA, the WG302 AutoCell feature provides self-organizing micro cells for an additional level of privacy for enterprises. In this mode, AutoCell shrinks the size of coverage to the minimum to reach clients but also shrinks the size of the beacons that access points use to announce their presence. This mode makes an enterprise wireless LAN nearly invisible to users outside an office building. AutoCell clients such as the NETGEAR WAG511 are highly-recommended for Enhanced RF Security.

Installing the WG302 Access Point

Before installing the NETGEAR ProSafe Wireless Access Point 802.11g WG302, you should make sure that your Ethernet network is up and working. You will be connecting the access point to the Ethernet network so that computers with 802.11b or 802.11g wireless adapters will be able to communicate with computers on the Ethernet network. In order for this to work correctly, verify that you have met all of the system requirements, shown on page 2-5.

1 Set up the WG302 Access Point

Tip: Before mounting the WG302 in a high location, first set up and test the WG302 to verify wireless network connectivity.

a. Prepare a computer with an Ethernet adapter. If this computer is already part of your network, record its TCP/IP configuration settings.

b. Configure the computer with a static IP address of 192.168.0.210 and 255.255.255.0 for the Subnet Mask.

c. Connect an Ethernet cable from the WG302 to the computer.

d. Turn on your computer, connect the power adapter to the WG302 and verify the following:

   – The PWR power light goes on.

   – The LAN light of the wireless access point is lit when connected to a powered on computer.

2 CONFIGURE LAN AND WIRELESS ACCESS

a. Configure the WG302 Ethernet port for LAN access.

- Connect to the WG302 by opening your browser and entering *http://192.168.0.228* in the address field. A login window like the one shown below opens:

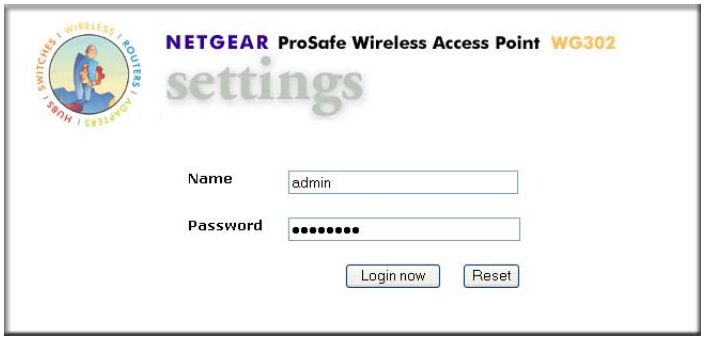


Figure 3-2: Login window

- When prompted, enter **admin** for the user name and **password** for the password, both in lower case letters.

- The Web browser will then display the WG302 settings page.

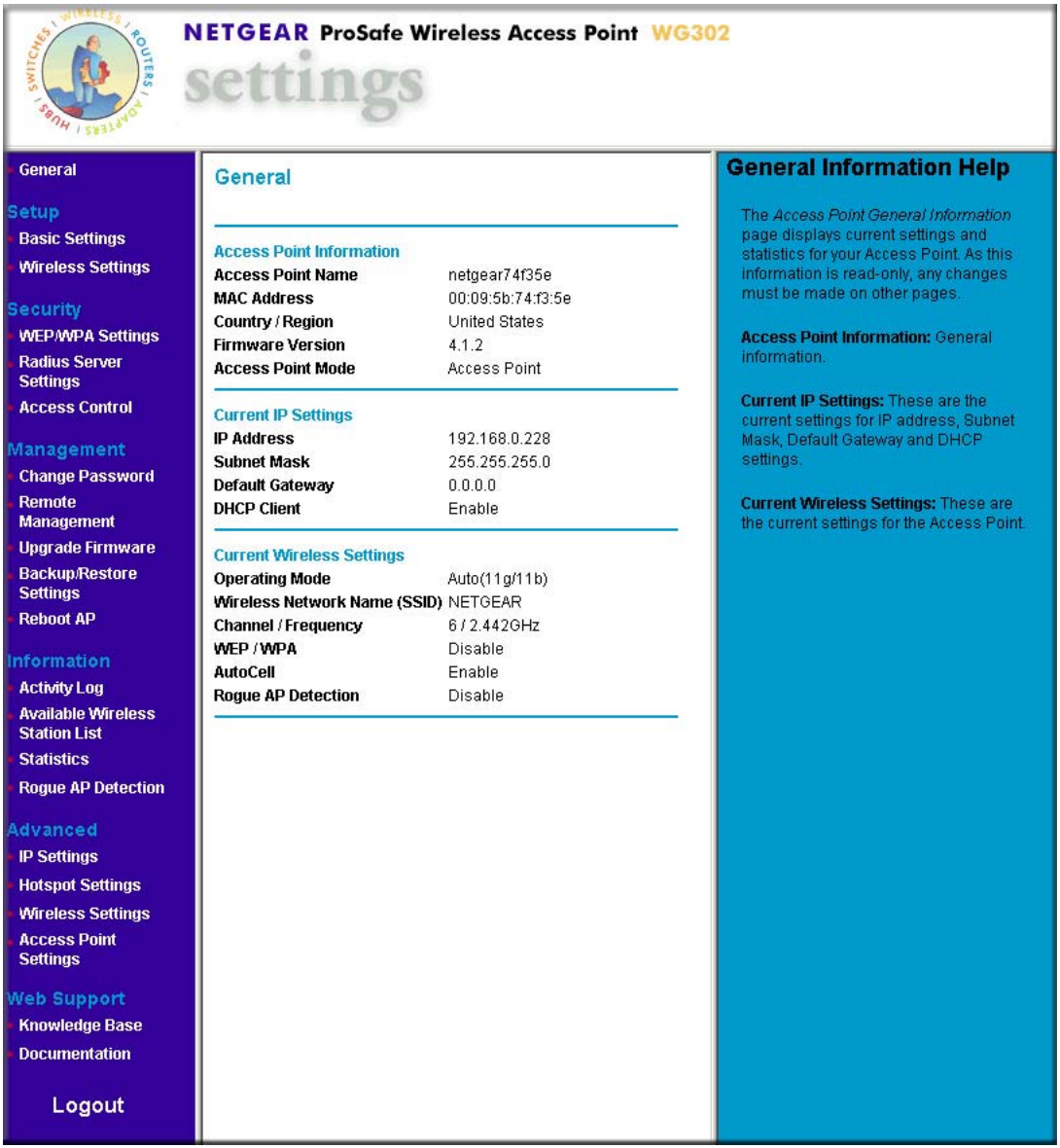


Figure 3-3: Login result: WG302 home page

– When the wireless access point is connected to the Internet, click the Knowledge Base or the Documentation link under the Web Support menu to view support information or the documentation for the wireless access point.

– If you do not click Logout, the wireless access point will wait 5 minutes after there is no activity before it automatically logs you out.

• Click the Basic Settings link to view the Basic Settings menu.

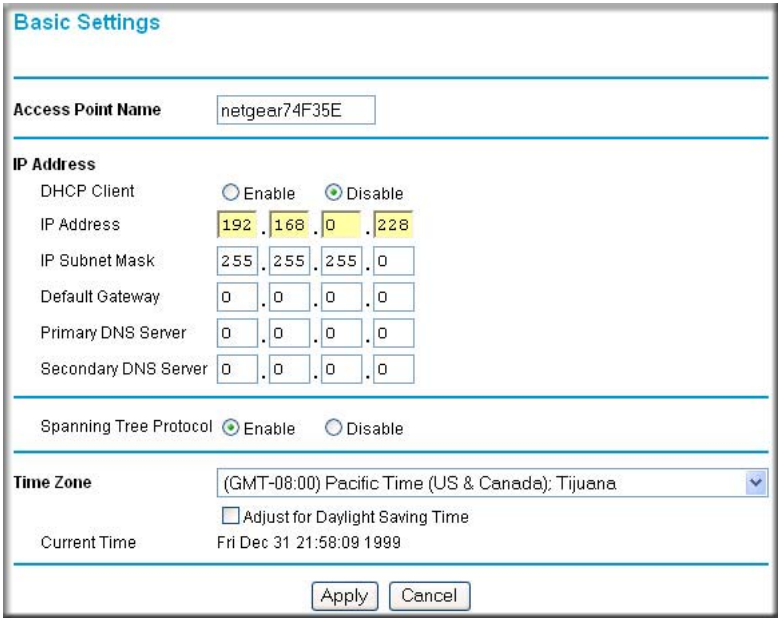


Figure 3-4: Basic Settings menu

• Configure the settings appropriate for your network.

b. Click the Wireless Settings link in the Setup section of the main menu to view the Wireless Settings menu.

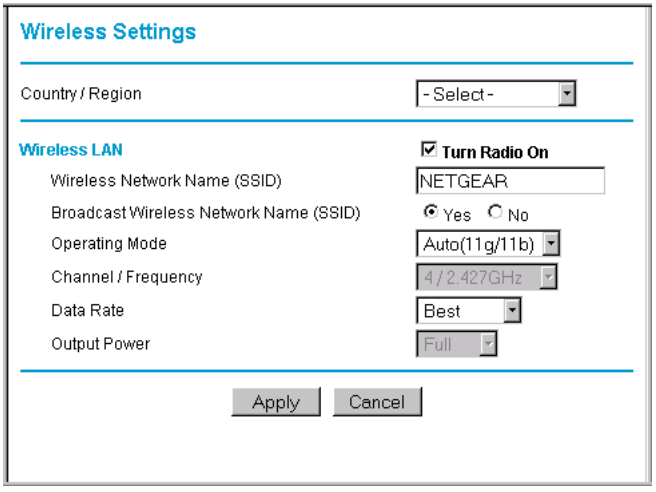


Figure 3-5: Basic Wireless Settings menu

c. Configure the wireless interface for wireless access. See the online help or the Understanding Basic Wireless Settings topic of this Reference Manual for full instructions.

Note: You must set the Regulatory Domain. It may not be legal to operate the wireless access point in a region other than one of those identified in this field.

Now that you have finished the setup steps, you are ready to deploy the WG302 in your network. If needed, you can now reconfigure the computer you used in step 1 back to its original TCP/IP settings.

3 Deploy the WG302 Access Point

a. Disconnect the WG302 and position it where you will deploy it. The best location is elevated, such as wall mounted or on the top of a cubicle, at the center of your wireless coverage area, and within line of sight of all the mobile devices.

b. Lift the antenna on either side so that they are vertical.

Note: Consult the antenna positioning and wireless mode configuration information in the Advanced Configuration chapter of the Reference Manual.

c. Connect an Ethernet cable from your WG302 Access Point to a LAN port on your router, switch, or hub.

Note: By default, WG302 is set to with the DHCP client disabled. If your network uses dynamic IP addresses, you will need to change this setting.

d. Connect the power adapter to the wireless access point and plug the power adapter in to a power outlet. The PWR, LAN, and Wireless LAN lights and should light up.

4 VERIFY WIRELESS CONNECTIVITY

Using a computer with an 802.11b or 802.11g wireless adapter with the correct wireless settings needed to connect to the WG302 (SSID, WEP/WPA, MAC ACL, etc.), verify connectivity by using a browser such as Netscape or Internet Explorer to browse the Internet, or check for file and printer access on your network.

Note: If you are unable to connect, see Chapter 6, "Troubleshooting."

How to Log In to the WG302 Using Its Default IP Address

1. 192.168.0.228 is the default IP address of your access point. The WG302 is set by default with the DHCP client disabled.

   Note: The computer you are using to connect to the WG302 should be configured with an IP address that starts with 192.168.0.x and a Subnet Mask of 255.255.255.0.
2. Open a Web browser such as Internet Explorer or Netscape Navigator.
3. Connect to the WG302 by entering its default address of *http://192.168.0.228* into your browser.
4. A login window like the one shown below opens:

Figure 3-6: Login window

Log in use the default user name of **admin** and default password of **password**.

Once you have entered your access point name, your Web browser should automatically find the WG302 Access Point and display the home page, as shown in "Login result: WG302 home page" on page 3-7.

Using the Basic IP Settings Options

The Basic IP Settings menu is under the Basic heading of the main menu. Use this menu to configure DHCP, static IP, and access point access point name settings.

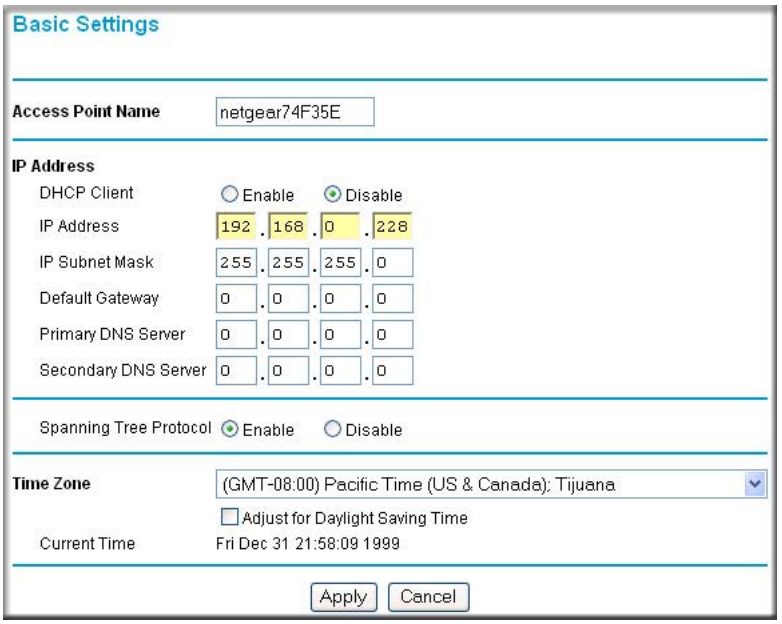


Figure 3-7: IP Settings menu

- **Access Point Name (NetBIOS)**

  Enter a new name for the wireless access point and click Apply to save your changes.

- **The IP Address**

  The wireless access point is shipped preconfigured with its DHCP client disabled and with the following private static IP addresses:

  – IP Address — 192.168.0.228

  – IP Subnet Mask — 255.255.255.0

  – Gateway — 0.0.0.0

  – Primary and Secondary DNS Servers — 0.0.0.0

  If your network has a requirement to use a different IP addressing scheme, you can make those changes in this menu. These settings are only required if the “Use this IP address” radio button is chosen. Remember to click Apply to save your changes.

- **Spanning Tree Protocol**

  Spanning Tree Protocol in enabled by default for the wireless access point. This provides network traffic optimization in settings with multiple WG302 Access Points.

- **Time Zone**

  Select the time zone location for your setting.

  Note: You must have an Internet connection to get the current time.

Understanding Basic Wireless Settings

To configure the wireless settings of your wireless access point, click the Wireless Settings link in the Basic section of the main menu of the browser interface. The Basic Wireless Settings menu will appear, as shown below.

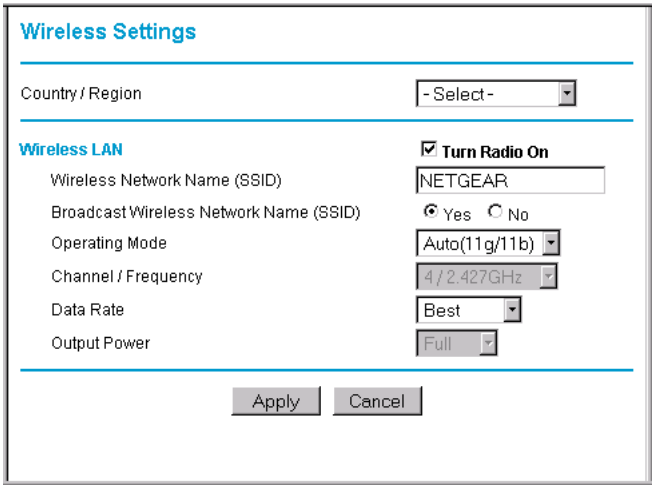


Figure 3-8: Basic Wireless Settings menu

The Basic Wireless Settings menu options are discussed below:

- **Country/Region.** This field identifies the region where the WG302 can be used. It may not be legal to operate the wireless features of the wireless access point in a region other than one of those identified in this field. There is no default country domain, and the channel is set to 11. Unless a country domain is selected, the channel cannot be changed.

- **Turn Radio On**. On by default, you can also turn off the radio to disable access through this device. This can be helpful for configuration, network tuning, or troubleshooting activities.
- **Wireless Network Name (SSID).** The SSID is also known as the wireless network name. Enter a value of up to 32 alphanumeric characters. In a setting where there is more than one wireless network, different wireless network names provide a means for separating the traffic. Any device you want to participate in a particular wireless network will need to use the SSID. The WG302 default SSID is: **NETGEAR**.
  - A group of Wireless Stations and a single access point, all using the same ID (SSID), form a Basic Service Set (BSS).
  - Using the same SSID is essential. Devices with different SSIDs are unable to communicate with each other. However, some access points allow connections from wireless stations which have their SSID set to “any” or whose SSID is blank (null).
  - A group of wireless stations and multiple access points, all using the same ID (ESSID), form an Extended Service Set (ESS).
  - Different access points within an ESS can use different channels. To reduce interference, it is recommended that adjacent access points *should* use different channels.
  - As wireless stations physically move through the area covered by an ESS, they will automatically change to the access point which has the least interference or best performance. This capability is called roaming.

    Note: The AutoCell feature enhances the roaming, interference, and channel selection of an extended wireless network.
- **Broadcast Wireless Network Name (SSID).** This field lets you turn off the SSID broadcast. If you turn off the SSID broadcast, only stations that know the SSID will connect. Disabling SSID broadcast somewhat hampers the wireless network ‘discovery’ feature of some products. The default is to enable SSID broadcast.

Note: Broadcast Wireless Network Name (SSID) is automatically turned off when you select the AutoCell Enhanced RF Security option in the advanced wireless settings page.

- **Operating Mode**. Select the desired wireless operating mode. The options are:
  - Auto (11g/b) – Both 802.11g and 802.11b wireless stations can be used. This is the default.
  - 11g Only - Only 802.11g wireless stations can be used. This is required for 108 Mbps data rate operation.

  - 11b Only - All 802.11b wireless stations can be used. 802.11g wireless stations can still be used if they can operate in 802.11b mode.

- **Channel.** This field identifies which operating frequency will be used. It should not be necessary to change the wireless channel unless you notice interference problems or setting up the WG302 near another access point. See "Wireless Channels" on page B-7 for more information on wireless channels.

Note: Channel selection is automatically adjusted by AutoCell when the Auto RF Management option is enabled. The default setting is for the AutoCell Auto RF Management option to be enabled.

  - Access points use a fixed channel. You can select the channel used. This allows you to choose a channel which provides the least interference and best performance. In the USA and Canada, 11 channels are available.

    Note: Channel 6 is required for 108 Mbps data rate.

  - If using multiple access points, it is better if adjacent access points use different channels to reduce interference. The recommended channel spacing between adjacent access points is 5 channels (for example, use channels 1 and 6, or 6 and 11).

  - In "Infrastructure" mode, wireless stations normally scan all channels, looking for an access point. If more than one access point can be used, the one with the strongest signal is used. This can only happen when the various access points are using the same SSID.

- **Data Rate**. Shows the available transmit data rate of the wireless network. 108 Mbps is only available when the operating mode is 802.11g only and the channel is 6. The default is Best.

- **Output Power**. Set the transmit signal strength of the access point. The options are full, half, quarter, eighth, and min. Decrease the transmit power if more than one AP is colocated using the same channel frequency. The default is Full.

Note: Output power is automatically adjusted by AutoCell when the Auto RF Management option is enabled. The default setting is for the AutoCell Auto RF Management option to be enabled.

Understanding WEP/WPA Security Options

The table below identifies the various WEP/WPA security options. A full explanation of these standards is available in Appendix B, "Wireless Networking Basics".

Figure 3-9: Wireless Security Settings

The WEP/WPA settings are explained as follows:

- **Network Authentication**: Specifies the Authentication type used. The default is Open System. Select the desired option:
  - **Open System**: If selected, you have the option of using WEP encryption, or no encryption.
  - **Shared Key**: If selected, you must use WEP; at least one shared key must be entered.
  - **Legacy 802.1x**: If selected, you must configure the Radius Server Settings Screen.
  - **WPA-PSK**: If selected, you must use TKIP encryption, and enter the WPA passphrase (Network key).
  - **WPA with Radius**: If selected, you must configure the Radius Server Settings Screen.
  - **WPA2-PSK**: WPA2 is a later version of WPA. Only select this if all clients support WPA2. If selected, you must use AES encryption, and enter the WPA passphrase (Network key).

  - **WPA-PSK and WPA2-PSK**: This selection allows clients to use either WPA (with TKIP) or WPA2 (with AES). If selected, encryption must be TKIP + AES. The WPA passphrase (Network key) must also be entered.
  - **WPA2 with Radius**: WPA2 is a later version of WPA. Only select this if all clients support WPA2. If selected, you must use AES encryption, and configure the Radius Server Settings Screen.
  - **WPA and WPA2 with Radius**: This selection allows clients to use either WPA (with TKIP) or WPA2 (with AES). If selected, encryption must be TKIP + AES, and you must also configure the Radius Server Settings Screen.

  Note: All options are available if using Access Point mode. In other modes (e.g. Repeater or Bridge) some options may be unavailable.

- **Data Encryption**: Select the desired option. The available options depend on the Network Authentication setting above (otherwise, the default is None). The supported options are:
  - **None**: No encryption is used.
  - **64 bits WEP**: Standard WEP encryption, using 40/64 bit encryption.
  - **128 bits WEP**: Standard WEP encryption, using 104/128 bit encryption.
  - **152 bits WEP**: Proprietary mode that will only work with other wireless devices that support this mode.
  - **TKIP**: This is the standard encryption method used with WPA.
  - **AES**: This is the standard encryption method for WPA2. Some clients may support AES with WPA, but this is not supported by this Access Point.
  - **TKIP + AES**: This setting allows both WPA and WPA2 to be supported. Broadcast packets use TKIP. For unicast (point-to-point) transmissions, WPA clients use TKIP, and WPA2 clients use AES.
- **Passphrase**: To use the passphrase to generate the WEP keys, enter a passphrase and click **Generate Keys**. You can also enter the keys directly. These keys must match the other wireless stations.
- **Key 1, Key 2, Key 3, Key 4**: If using WEP, select the key to be used as the default key. Data transmissions are always encrypted using the default key. The other keys can only be used to decrypt received data.
- **WPA Passphrase (Network Key)**: If using WPA-PSK, enter the passphrase here. All wireless stations must use the same passphrase (network key). The network key must be from 8 to 63 characters in length.
- **Wireless Client Security Separation**: If enabled, the associated wireless clients will not be able to communicate with each other. This feature is intended for hotspots and other public access situations. The default is Disabled.

Before You Change the SSID and WEP Settings

For a new wireless network, print this form and fill in the parameters. For an existing wireless network, get the settings from the person who set up or is responsible for the network. Be sure to set the Regulatory Domain correctly as the first step. Store this information in a safe place.

- **SSID*:*** The Service Set Identification (SSID) identifies the wireless local area network. NETGEAR is the default WG302 SSID. However, you may customize it by using up to 32 alphanumeric characters. Write your customized SSID on the line below.

  SSID: _____

  Note: The SSID in the wireless access point is the SSID you configure in the wireless adapter card. All wireless nodes in the same network must be configured with the same SSID:
- **Authentication**

  Circle one: Open System or Shared Key. Choose "Shared Key" for more security.

  Note: If you select shared key, the other devices in the network will not connect unless they are set to Shared Key and have the same keys in the same positions as those in the WG302.
- **WEP Encryption Keys**

  For all four 802.11b keys, choose the Key Size. Circle one: 64, 128, or 152 bits

  Key 1: _____

  Key 2: _____

  Key 3: _____

  Key 4: _____
- **WPA-PSK (Pre-Shared Key)**

  Record the WPA-PSK key:

  Key: _____

  WPA2-PSK (Pre-Shared Key)

  Record the WPA2-PSK key:

  Key: _____
- **WPA RADIUS Settings**

  For WPA, record the following settings for the primary and secondary RADIUS servers:

  Server Name/IP Address: Primary _____ Secondary _____

  Port: _____

  Shared Secret: _____
- **WPA2 RADIUS Settings**

  For WPA2, record the following settings for the primary and secondary RADIUS servers:

  Server Name/IP Address: Primary _____ Secondary _____

  Port: _____

  Shared Secret: _____

Use the procedures described in the following sections to configure the WG302.

How to Set Up and Test Basic Wireless Connectivity

Follow the instructions below to set up and test basic wireless connectivity. Once you have established basic wireless connectivity, you can enable security settings appropriate to your needs.

1. Log in to the WG302 using its default address of *http://192.168.0.228* or at whatever IP address the unit is currently configured. Use the default user name of **admin** and default password of **password**, or whatever password you set up.
2. Click the Wireless Settings link in the main menu of the WG302.
3. Choose a suitable descriptive name for the wireless network name (SSID). In the SSID box, enter a value of up to 32 alphanumeric characters. The default SSID is NETGEAR.

   Note: The SSID of any wireless access adapters must match the SSID you configure in the NETGEAR ProSafe Wireless Access Point 802.11g WG302. If they do not match, you will not get a wireless connection to the WG302.
4. Select the Country/Region in which the wireless interface will operate.
5. Set the Channel. It should not be necessary to change the wireless channel unless you notice interference problems or are near another wireless access point. Select a channel that is not being used by any other wireless networks within several hundred feet of your wireless access point. For more information on the wireless channel frequencies see "Wireless Channels" on page B-7.
6. For initial configuration and testing, leave the Wireless Card Access List set to "Everyone" and the Encryption Strength set to "Disabled."
7. Click Apply to save your changes.

Note: If you are configuring the WG302 from a wireless computer and you change the SSID, channel, or security settings, you will lose your wireless connection when you click Apply. You must then change the wireless settings of your computer to match the new settings.

8. Configure and test your PCs for wireless connectivity.

   Program the wireless adapter of your PCs to have the same SSID and channel that you configured in the WG302. Check that they have a wireless link and are able to obtain an IP address by DHCP from the WG302.

Once your PCs have basic wireless connectivity to the WG302, you can configure the advanced wireless security functions.

How to Restrict Wireless Access by MAC Address

To restrict access based on MAC addresses, follow these steps:

1. Log in to the WG302 using its default address of *http://192.168.0.228* or at whatever IP address the unit is currently configured. Use the default user name of **admin** and default password of **password**, or whatever LAN address and password you have set up.

> **Note:** When configuring the WG302 from a wireless computer whose MAC address is not in the access control list, if you select Turn Access Control On, you will lose your wireless connection when you click Apply. You must then access the wireless access point from a wired computer or from a wireless computer which is on the access control list to make any further changes.

2. From the Security menu, click the Access Control link to display the Access Control List menu shown below.

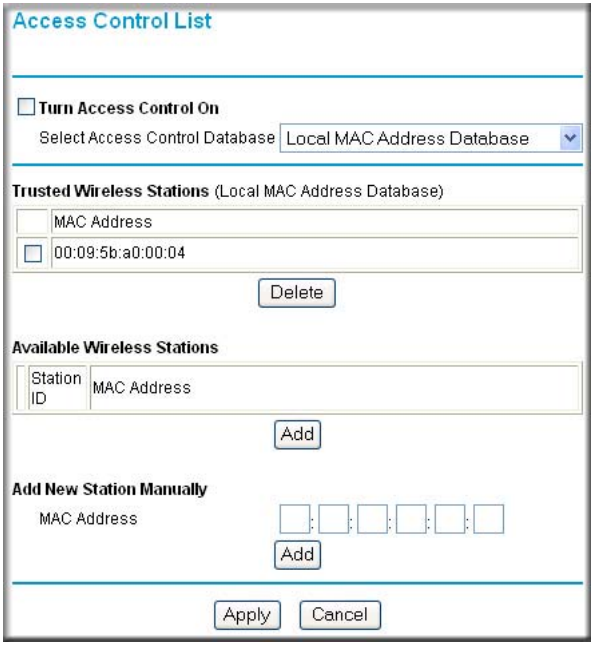


Figure 3-10: Access Control List menu

3. Select the Turn Access Control On check box.

4. Choose to use the local MAC address database stored on the access point, or use the RADIUS MAC address database stored on a RADIUS server. If you choose the RADIUS MAC Address Database, you must configure the RADIUS Server Settings first.
5. Then, either select from the list of available wireless cards the WG302 has found in your area, or enter the MAC address and device name for a device you plan to use. You can usually find the MAC address printed on the wireless adapter.
6. Click **Add** to add the wireless device to the access list. Repeat these steps for each additional device you want to add to the list.
7. Be sure to click **Apply** to save your wireless access control list settings.

Now, only devices on this list will be allowed to wirelessly connect to the WG302.

How to Configure WEP

To configure WEP data encryption, follow these steps:

1. Log in to the WG302 using its default address of *http://192.168.0.228* or at whatever IP address the unit is currently configured Use the default user name of **admin** and default password of **password**, or whatever LAN address and password you have set up.
2. Click the WEP/WPA Settings link in the main menu of the WG302.

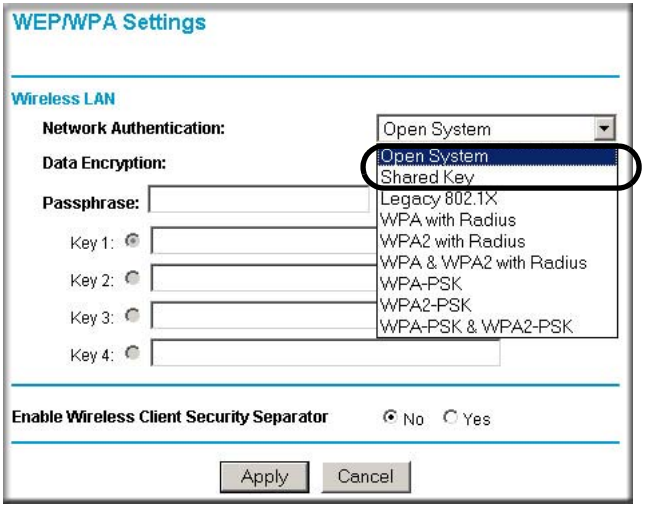


Figure 3-11: Wireless Settings menu

3. Choose Open System or Shared Key authentication.

4. Select encryption strength.
5. You can manually or automatically program the four data encryption keys. These values must be identical on all PCs and Access Points in your network.
   - Automatic - enter a word or group of printable characters in the Passphrase box and click the Generate button. The four key boxes will be automatically populated with key values.
   - Manual - enter ten hexadecimal digits (any combination of 0-9, a-f, or A-F)
     Select which of the four keys will be the default.

   See "Overview of WEP Parameters" on page B-5 for a full explanation of each of these options, as defined by the IEEE 802.11 wireless communication standard.
6. Click **Apply** to save your settings.

Note: If you use a wireless computer to configure WEP settings, you will be disconnected when you click Apply. Reconfigure your wireless adapter to match the new settings or access the wireless access point from a wired computer to make any further changes.

How to Configure WPA with Radius

Note: Not all wireless adapters support WPA. Furthermore, client software is required on the client. Windows XP and Windows 2000 with Service Pack 3 do include the client software that supports WPA. Nevertheless, the wireless adapter hardware and driver must also support WPA. Consult the product document for your wireless adapter and WPA client software for instructions on configuring WPA settings.

To configure WPA, follow these steps:

1. Log in at the default LAN address of *http://192.168.0.228* with the default user name of **admin** and default password of **password**, or using whatever LAN address and password you have set up.

2. Click **Radius Server Settings** in the Security menu.

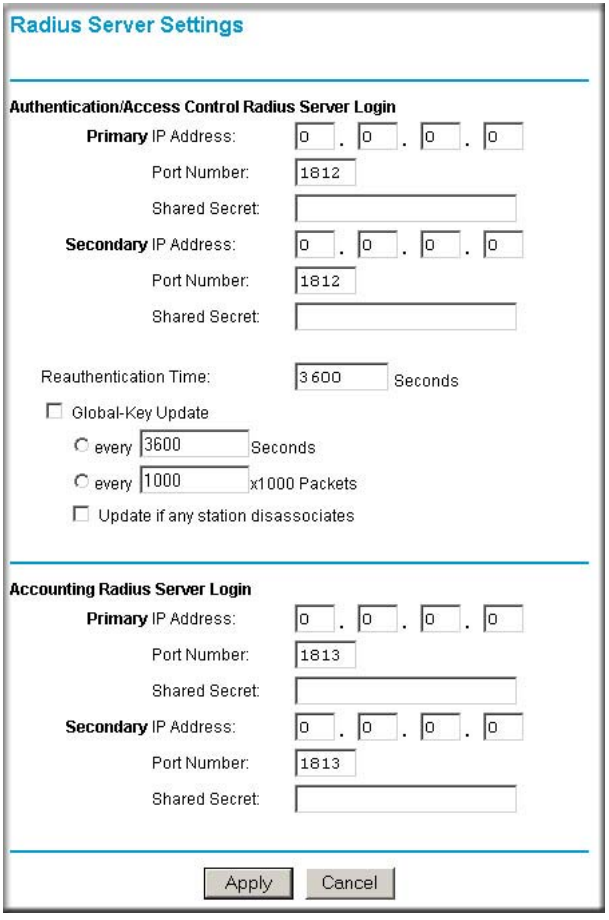


Figure 3-12: Radius Server Settings

3. Enter the Radius settings.

   - **Authentication/Access Control Radius Server Configuration**: This configuration is required for authentication using Radius. IP Address, Port No. and Shared Secret is required for communication with Radius Server. A Secondary Radius Server can be configured which is used on failure on Primary Radius Server
   - **IP Address**: The IP address of the Radius Server. The default is 0.0.0.0.
   - **Port Number**: Port number of the Radius Server. The default is 1812.

- **Shared Secret**: This is shared between the Wireless Access Point and the Radius Server while authenticating the supplicant.
- **Re-authentication Time**: The time interval in seconds after which the supplicant will be authenticated again with the Radius Server. The default is 3600 seconds.
- **Global-key Re-Key Time**: Check on this option to enable Re-keying of Global Key. The Global Key Re-Key can be done based on time interval in seconds or number of packets exchanged using the global key. The default is 3600 seconds.
- **Update if any station disassociates**: Check on this option to refresh global key when any stations disassociated with wireless Access Point.
- **Accounting Radius Server Configuration**: This configuration is required for accounting using Radius Server. IP Address, Port No. and Shared Secret is required for communication with Radius Server. A Secondary Radius Server can be configured which is used on failure on Primary Radius Server.
- **IP Address**: The IP address of the Radius Server. The default is 0.0.0.0.
- **Port Number**: Port number of the Radius Server. The default is 1813.
- **Shared Secret**: This is shared between the Wireless Access Point and the Radius Server while authenticating the supplicant.

4. Click **Apply** to save your settings.
5. Click **WEP/WPA Settings** in the Security menu.

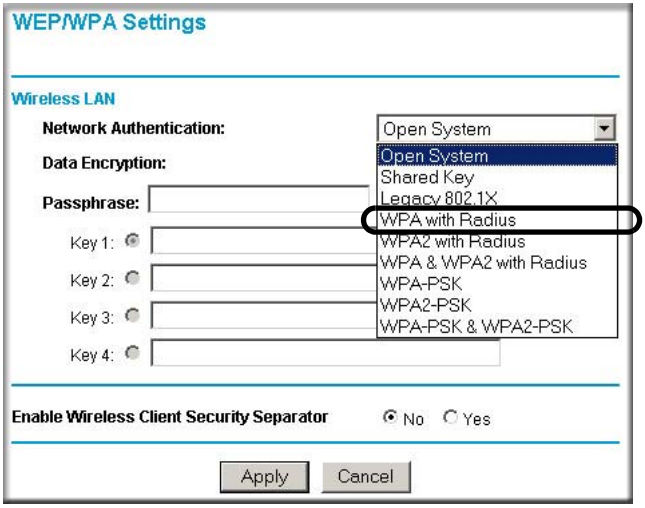


Figure 3-13: Wireless Settings menu

6. Choose **WPA with Radius** from the list.
7. Click **Apply** to save your settings.

How to Configure WPA-PSK

Note: Not all wireless adapters support WPA. Furthermore, client software is required on the client. Windows XP and Windows 2000 with Service Pack 3 do include the client software that supports WPA. Nevertheless, the wireless adapter hardware and driver must also support WPA. Consult the product document for your wireless adapter and WPA client software for instructions on configuring WPA settings.

To configure WPA-PSK, follow these steps:

1. Log in at the default LAN address of *http://192.168.0.228* with the default user name of **admin** and default password of **password**, or using whatever LAN address and password you have set up.
2. Click **WEP/WPA Settings** in the Security menu of the WG302.

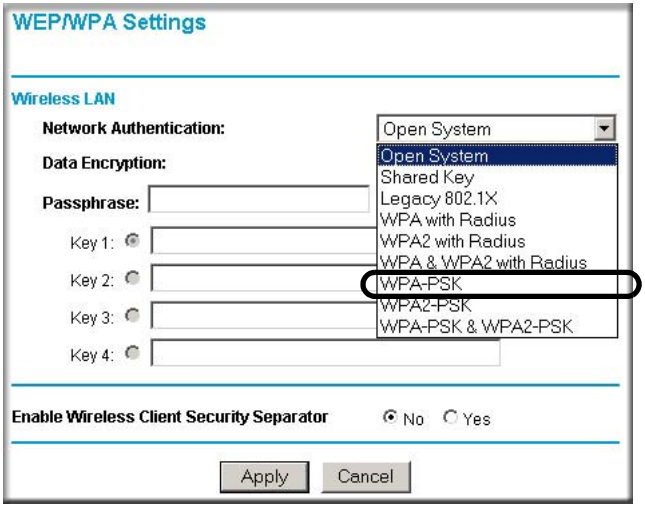


Figure 3-14: WEP/WPA Settings menu

3. Choose **WPA-PSK** from the list.
4. Enter the pre-shared key passphrase.
5. Click **Apply** to save your settings.

How to Configure WPA2 with Radius

Note: Not all wireless adapters support WPA2. Furthermore, client software is required on the client. Make sure your client card supports WPA2. Consult the product document for your wireless adapter and WPA2 client software for instructions on configuring WPA2 settings.

To configure WPA2, follow these steps:

1. Log in at the default LAN address of *http://192.168.0.229* with the default user name of **admin** and default password of **password**, or using whatever LAN address and password you have set up.
2. Click **Radius Server Settings** in the Security menu.

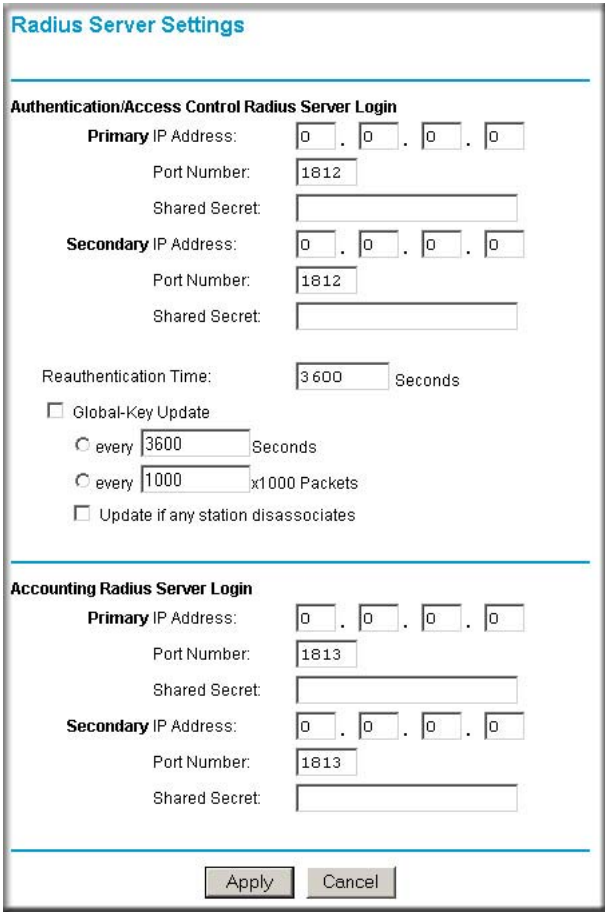


Figure 3-15: Radius Server Settings menu

3. Enter the Radius settings.

   - **Authentication/Access Control Radius Server Configuration**: This configuration is required for authentication using Radius. IP Address, Port No. and Shared Secret is required for communication with Radius Server. A Secondary Radius Server can be configured which is used on failure on Primary Radius Server
   - **IP Address**: The IP address of the Radius Server. The default is 0.0.0.0.
   - **Port Number**: Port number of the Radius Server. The default is 1812.
   - **Shared Secret**: This is shared between the Wireless Access Point and the Radius Server while authenticating the supplicant.
   - **Re-authentication Time**: The time interval in seconds after which the supplicant will be authenticated again with the Radius Server. The default is 3600 seconds.
   - **Global-key Re-Key Time**: Check on this option to enable Re-keying of Global Key. The Global Key Re-Key can be done based on time interval in seconds or number of packets exchanged using the global key. The default is 3600 seconds.
   - **Update if any station disassociates**: Check on this option to refresh global key when any stations disassociated with wireless Access Point.
   - **Accounting Radius Server Configuration**: This configuration is required for accounting using Radius Server. IP Address, Port No. and Shared Secret is required for communication with Radius Server. A Secondary Radius Server can be configured which is used on failure on Primary Radius Server.
   - **IP Address**: The IP address of the Radius Server. The default is 0.0.0.0.
   - **Port Number**: Port number of the Radius Server. The default is 1813.
   - **Shared Secret**: This is shared between the Wireless Access Point and the Radius Server while authenticating the supplicant.

4. Click **Apply** to save your settings.

5. Click **WEP/WPA Settings** in the Security menu.

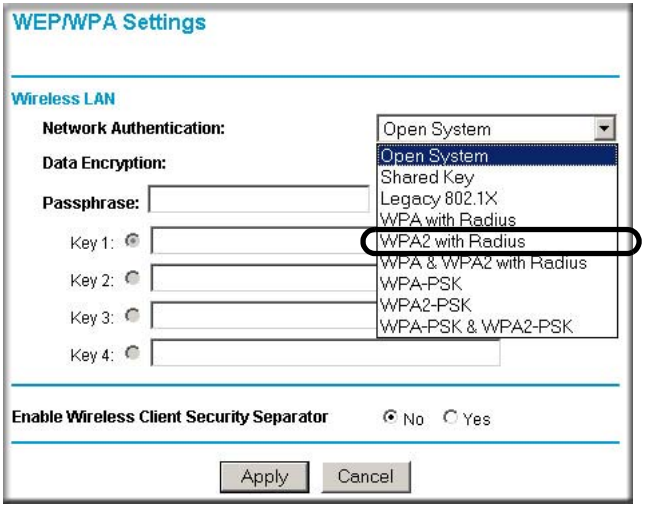


Figure 3-16: WEP/WPA Settings menu

6. Choose **WPA2 with Radius** from the list.
7. Click **Apply** to save your settings.

How to Configure WPA2-PSK

Note: Not all wireless adapters support WPA2. Furthermore, client software is required on the client. Make sure your client card supports WPA2. Consult the product document for your wireless adapter and WPA2 client software for instructions on configuring WPA2 settings.

To configure WPA2-PSK, follow these steps:

1. Log in at the default LAN address of *http://192.168.0.229* with the default user name of **admin** and default password of **password**, or using whatever LAN address and password you have set up.

2. Click **WEP/WPA Settings** in the Security menu of the WG302.

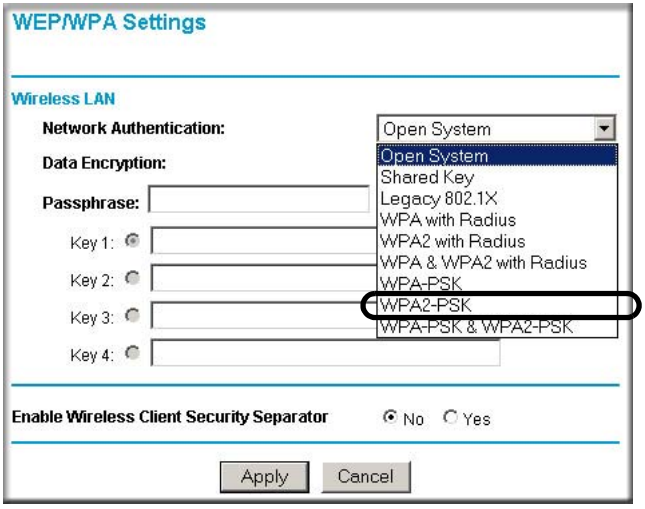


Figure 3-17: WEP/WPA Settings menu

3. Choose **WPA2-PSK** from the list.
4. Enter the pre-shared key passphrase.
5. Click **Apply** to save your settings.

How to Configure WPA and WPA2 with Radius

Note: Not all wireless adapters support WPA. Furthermore, client software is required on the client. Windows XP and Windows 2000 with Service Pack 3 do include the client software that supports WPA. Nevertheless, the wireless adapter hardware and driver must also support WPA. Consult the product document for your wireless adapter and WPA client software for instructions on configuring WPA settings.

Note: Not all wireless adapters support WPA2. Furthermore, client software is required on the client. Make sure your client card supports WPA2. Consult the product document for your wireless adapter and WPA2 client software for instructions on configuring WPA2 settings.

To configure WPA and WPA2, follow these steps:

1. Log in at the default LAN address of *http://192.168.0.229* with the default user name of **admin** and default password of **password**, or using whatever LAN address and password you have set up.
2. Click **Radius Server Settings** in the Security menu.

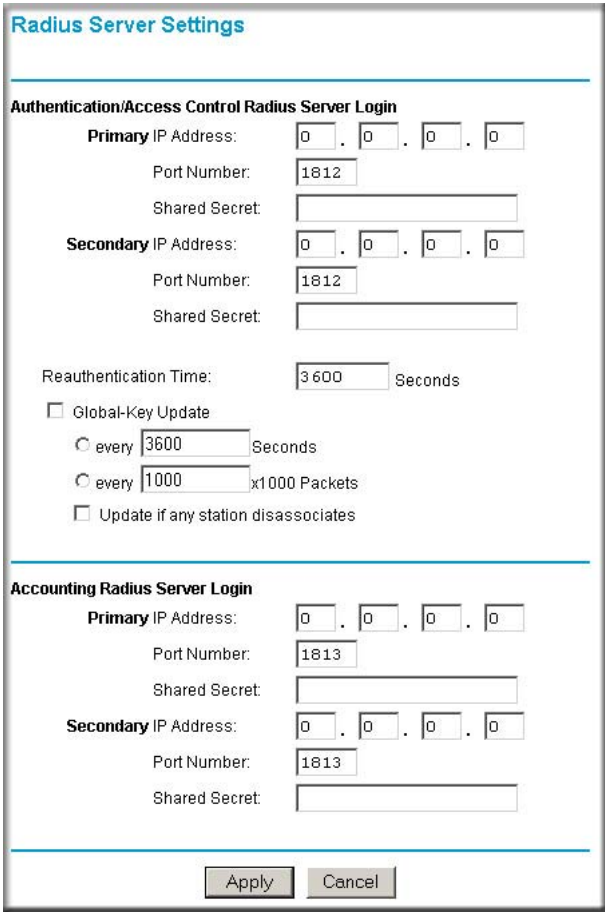


Figure 3-18: Radius Server Settings menu

3. Enter the Radius settings.

   - **Authentication/Access Control Radius Server Configuration**: This configuration is required for authentication using Radius. IP Address, Port No. and Shared Secret is required for communication with Radius Server. A Secondary Radius Server can be configured which is used on failure on Primary Radius Server
   - **IP Address**: The IP address of the Radius Server. The default is 0.0.0.0.
   - **Port Number**: Port number of the Radius Server. The default is 1812.
   - **Shared Secret**: This is shared between the Wireless Access Point and the Radius Server while authenticating the supplicant.
   - **Re-authentication Time**: The time interval in seconds after which the supplicant will be authenticated again with the Radius Server. The default is 3600 seconds.
   - **Global-key Re-Key Time**: Check on this option to enable Re-keying of Global Key. The Global Key Re-Key can be done based on time interval in seconds or number of packets exchanged using the global key. The default is 3600 seconds.
   - **Update if any station disassociates**: Check on this option to refresh global key when any stations disassociated with wireless Access Point.
   - **Accounting Radius Server Configuration**: This configuration is required for accounting using Radius Server. IP Address, Port No. and Shared Secret is required for communication with Radius Server. A Secondary Radius Server can be configured which is used on failure on Primary Radius Server.
   - **IP Address**: The IP address of the Radius Server. The default is 0.0.0.0.
   - **Port Number**: Port number of the Radius Server. The default is 1813.
   - **Shared Secret**: This is shared between the Wireless Access Point and the Radius Server while authenticating the supplicant.

4. Click **Apply** to save your settings.

5. Click **WEP/WPA Settings** in the Security menu.

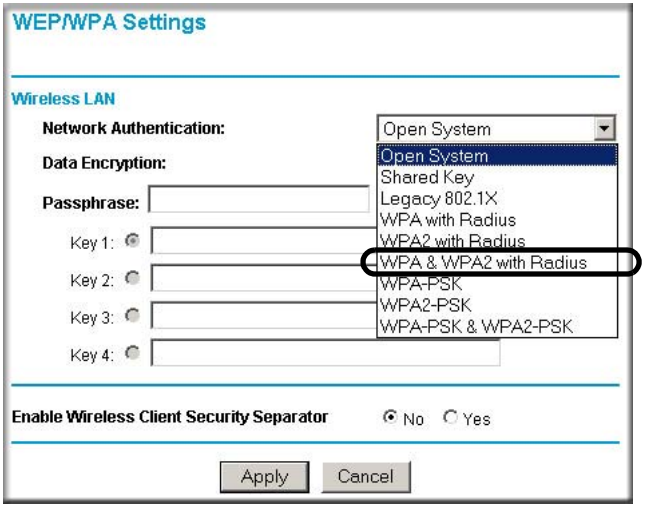


Figure 3-19: WEP/WPA Settings menu

6. Choose **WAP and WPA2 with Radius** from the list.
7. Click **Apply** to save your settings.

How to Configure WPA2-PSK and WPA2-PSK

Note: Not all wireless adapters support WPA. Furthermore, client software is required on the client. Windows XP and Windows 2000 with Service Pack 3 do include the client software that supports WPA. Nevertheless, the wireless adapter hardware and driver must also support WPA. Consult the product document for your wireless adapter and WPA client software for instructions on configuring WPA settings.

Note: Not all wireless adapters support WPA2. Furthermore, client software is required on the client. Make sure your client card supports WPA2. Consult the product document for your wireless adapter and WPA2 client software for instructions on configuring WPA2 settings.

To configure WPA-PSK and WPA2-PSK, follow these steps:

1. Log in at the default LAN address of *http://192.168.0.229* with the default user name of **admin** and default password of **password**, or using whatever LAN address and password you have set up.

2. Click **WEP/WPA Settings** in the Security menu of the WG302.

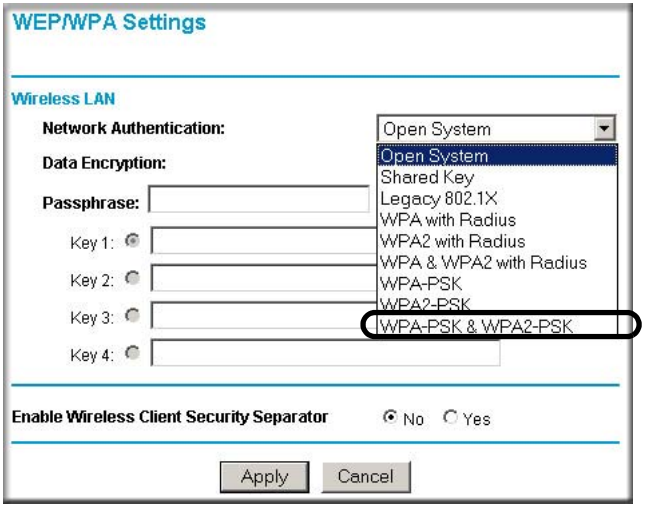


Figure 3-20: WEP/WPA Settings menu

3. Choose **WPA-PSK and WPA2-PSK** from the list.
4. Enter the pre-shared key passphrase.
5. Click **Apply** to save your settings.

Chapter 4
Management

This chapter describes how to use the management features of your NETGEAR ProSafe Wireless Access Point 802.11g WG302. These features can be found by clicking on the Maintenance heading in the Main Menu of the browser interface.

Remote Management

Access the Remote Management screen by clicking on Remote Management under Management on the main menu.

Figure 4-1: Remote Management screen

Enter the Remote Management information.

- **Remote Console**, **Secure Shell (SSH)**: If set to Enable, the Wireless Access Point will only allow remote access via Secure Shell and Secure Telnet. The default is Enable.
- **SNMP**: Enable SNMP to allow the SNMP network management software, such as HP OpenView, to manage the wireless access point via SNMPv1/v2 protocol.
- **Public Community Name**: The community string to allow the SNMP manager to read the wireless access point's MIB objects. The default is public.

- **Private Community Name**: The community string to allow the SNMP manager to read and write the wireless access point's MIB objects. The default is private.
- **IP address to Receive Traps**: The IP address of the SNMP manager to receive traps sent from the wireless access point. The default is 0.0.0.0.

Using the Secure Telnet Interface

The WG302 includes a secure Telnet command line interface (CLI). You can access the CLI from a secure Telnet client over the Ethernet port or over the serial console port.

Note: You must use a secure Telnet client such as Absolute Telnet. Also, when you configure the client, use the SSH1, 3DES option. If you use the Telnet client to connect over the Ethernet port, use the IP address of the WG302 as the host name.

How to Use the CLI via the Console Port

1. **Using the null-modem cable, connect a VT100/ANSI terminal or a workstation to the port labeled Console.**

   If you attached a PC, Apple Macintosh, or UNIX workstation, start a secure terminal-emulation program.

2. **Configure the terminal-emulation program to use the following settings:**

   - **Baud rate: 9,600 bps**
   - **Data bits: 8**
   - **Parity: none**
   - **Stop bit: 1**
   - **Flow control: none**

   These settings appear below the connector on the back panel.

3. **Press the return key, and the screen below should appear.**

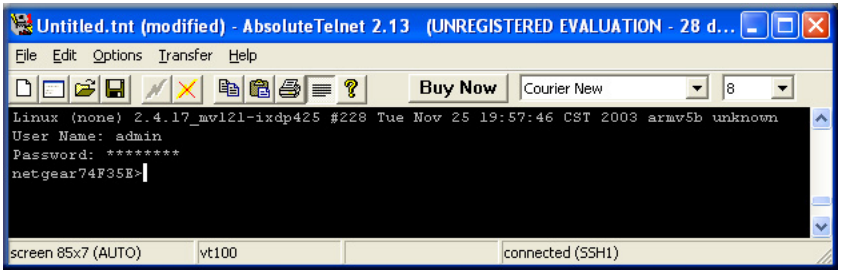


Figure 4-2: Secure Telnet Client

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

After successful login, the screen should show the (*Access Point Name*)> prompt. In this example, the prompt is *netgear74F35E*.

Enter help to display the CLI command help..

CLI Commands

The CLI commands are listed in Appendix C, “Command Line Reference.”

Using Syslog and Activity Log Information

The Information contains the activity log link you can use for setting up a syslog server and viewing activity log information. From the main menu of the browser interface, under the Information heading, click the Station List link to view the list, shown below:

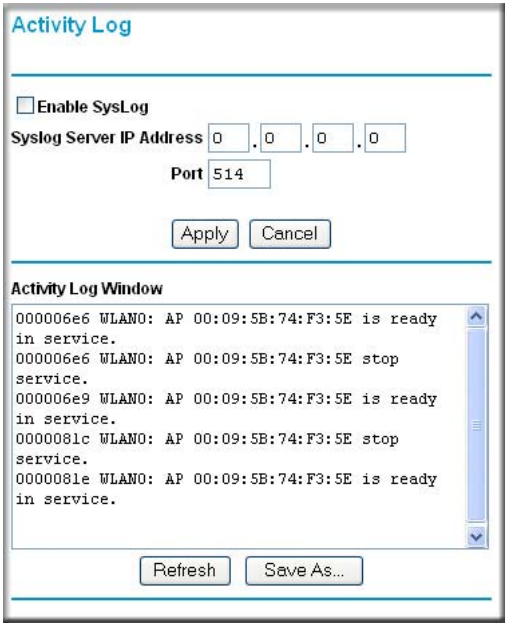


Figure 4-3: Syslog and Activity Log information

Enable the SysLog option if you have a SysLog server on your LAN. If enabled, you must enter the IP address of your SysLog server and the port number your SysLog server is configured to use.

- SysLog Server IP address: The access point will send all the SysLog to the specified IP address if SysLog option is enabled. Default: 0.0.0.0
- Port: The port number configured in the SysLog server on your LAN. Default: 514

The Activity Log Window displays the Access Point system activity.

You may click Refresh to update the display or Click Save As. To save the log contents into a file on your PC, click Save As and save the file to a disk drive.

Viewing General, Log, Station, and Statistical Information

The General information screen provides a summary of the current WG302 configuration settings. From the main Menu of the browser interface, click General to view the System Status screen, shown below.

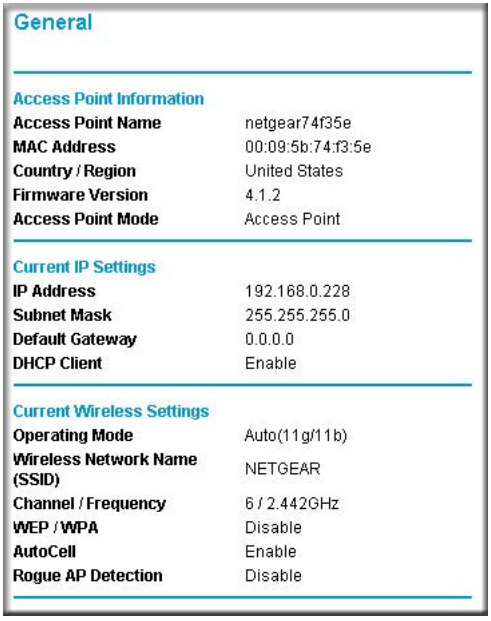


Figure 4-4: Wireless Access Point Status screen

This screen shows the following parameters:

Table 4-1. General Information Fields

Field	Description
Access Point Information	
Access Point Name (NetBIOS name)	The default name may be changed if desired.
MAC Address	Displays the Media Access Control address (MAC address) of the wireless access point's Ethernet port.
Country/Region	Displays the domain or region for which the wireless access point is licensed for use. It may not be legal to operate this wireless access point in a region other than one of those identified in this field.
Firmware Version	The version of the firmware currently installed.
Access Point Mode	Identifies the operating mode of the WG302: Access Point, Point-to-point bridge, Multi-point bridge or Repeater.
Current IP Settings	
IP Address	The IP address of the wireless access point.
Subnet Mask	The subnet mask for the wireless access point.
Default Gateway	The default gateway for the wireless access point communication.
DHCP Client	Enabled indicates that the current IP address was obtained from a DHCP server on your network. Disabled indicated a static IP configuration.
Current Wireless Settings	
Operating Mode	Identifies the 802.11 operating mode of the WG302.
Wireless Network Name (SSID)	Displays the wireless network name (SSID) being used by the wireless port of the wireless access point. The default is NETGEAR.
Channel/Frequency	Identifies the channel the wireless port is using. 11 is the default channel setting. See "Wireless Channels" on page B-7 for the frequencies used on each channel.
WEP/WPA	WEP/WPA setting.
AutoCell	AutoCell setting.
Rogue AP Detection	Rogue AP detection setting.

Statistics

The Information - Statistics screen provides various LAN and WLAN statistics.

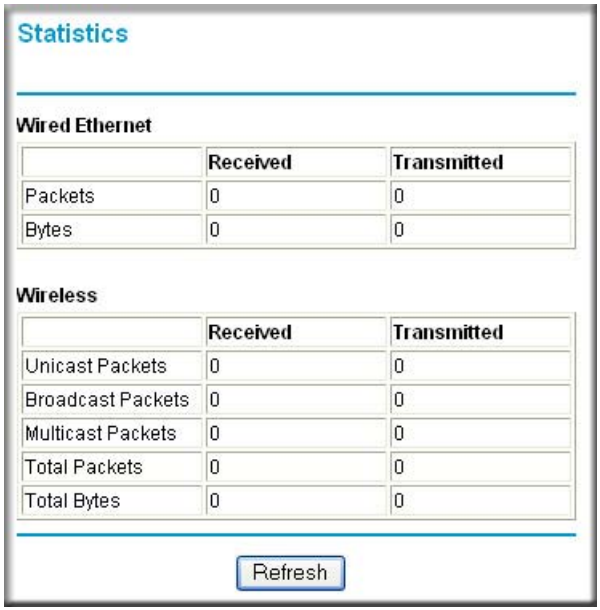


Figure 4-5: Wireless Access Point Status screen

Table 4-1. Statistics Fields

Field	Description
Wired Ethernet	**Received/Transmitted**
Packets	The number of packets sent since the WG302 was restarted.
Bytes	The number of bytes sent since the WG302 was restarted.
Wireless	**Received/Transmitted**
Unicast Packets	The Unicast packets sent since the WG302 was restarted.
Broadcast Packets	The Broadcast packets sent since the WG302 was restarted.
Multicast Packets	The Multicast packets sent since the WG302 was restarted.
Total Packets	The Wireless packets sent since the WG302 was restarted.
Total Bytes	The Wireless bytes sent since the WG302 was restarted.
Refresh button	Click the Refresh button to update the statistics on this screen.

Viewing a List of Available Wireless Stations

The Available Wireless Station List contains a table of all IP devices associated with the wireless access point in the wireless network defined by the Wireless Network Name (SSID). From the main menu of the browser interface, under the Information heading, click the Available Wireless Station List link to view the list, shown below.

For each device, the table shows the Station ID, MAC address, IP Address, and Status (whether the device is allowed to communicate with the wireless access point or not).

Note that if the wireless access point is rebooted, the table data is lost until the wireless access point rediscovers the devices. To force the wireless access point to look for associated devices, click the Refresh button.

Note: A wireless network can include multiple wireless access points, all using the same network name (SSID). This enables extending the reach of the wireless network and allows users to roam from one access point to another, providing seamless network connectivity. Under these circumstances, be aware that only the stations associated with this access point will be presented in the Available Station List.

Detecting a Rogue Access Point

For enhanced security, you can scan the wireless network to detect rogue access points. Detecting Rogue AP's involves scanning the wireless environment on all available channels looking for unidentified AP's. In particular, unidentified AP's that are using the SSID of a legitimate network can present a serious security threat.

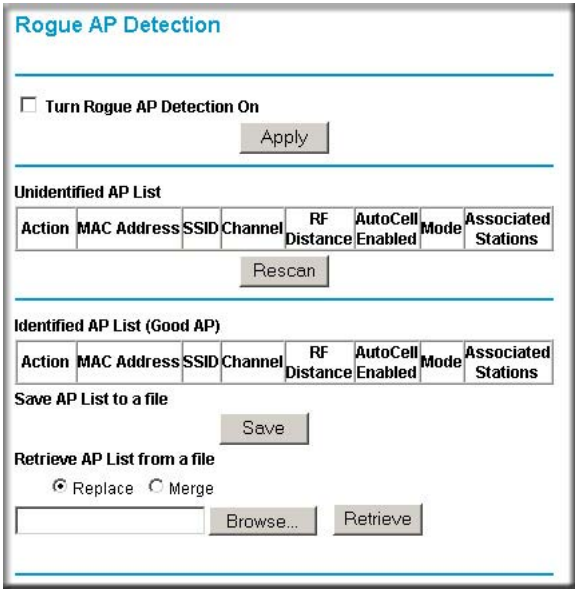


Figure 4-6: Rogue AP Detection menu

Once you turn on Rogue AP Detection in the WG302, the AutoCell Enabled AP continuously scans the wireless network and collects information about all APs heard on their channel. The information collected includes: SSID, MAC Address, Channel, and AutoCell Enabled.

The user can Grant authorization to an unidentified AP, Save the Authorized APs into a file, Import the previous Authorized APs from a file.

Note: The AP will disconnect all the wireless connections if Rogue AP Detection is turned ON.

Upgrading the Wireless Access Point Software

	**Note:** When uploading software to the WG302 Access Point, it is important not to interrupt the Web browser by closing the window, clicking a link, or loading a new page. If the browser is interrupted, the upload may fail, corrupt the software, and render the WG302 completely inoperable.

You cannot perform the firmware upgrade from a workstation connected to the WG302 via a wireless link. The firmware upgrade must be performed via a workstation connected to the WG302 via the Ethernet LAN interface.

The software of the WG302 Access Point is stored in FLASH memory, and can be upgraded as new software is released by NETGEAR. Upgrade files can be downloaded from Neater's Web site. If the upgrade file is compressed (.ZIP file), you must first extract the image (.RMG) file before sending it to the wireless access point. The upgrade file can be sent using your browser.

Note: The Web browser used to upload new firmware into the WG302 must support HTTP uploads, such as Microsoft Internet Explorer 6.0 or above, or Netscape Navigator 4.78 or above.

1. Download the new software file from NETGEAR, save it to your hard disk, and unzip it.
2. From the main menu Management section, click the Upgrade Firmware link to display the screen above.
3. In the Upgrade Firmware menu, click the Browse button and browse to the location of the image (.RMG) upgrade file.
4. Click Upload.

   When the upload completes, your wireless access point will automatically restart. The upgrade process typically takes about one minute.

In some cases, you may need to reconfigure the wireless access point after upgrading.

Configuration File Management

The WG302 Access Point settings are stored in the wireless access point in a configuration file. This file can be saved (backed up) to a user's computer, retrieved (restored) from the user's computer, or cleared to factory default settings.

From the main menu Management heading, click the Backup/Restore Settings link to bring up the menu shown below.

Figure 4-7: Settings Backup menu

The three options displayed are described in the following sections:

Saving and Retrieving the Configuration

The Backup/Restore Settings menu allows you to save or retrieve a file containing your wireless access point's configuration settings.

To save your settings, click the Save button. Your browser will extract the configuration file from the wireless access point and prompts you for a location on your computer to store the file. You can give the file a meaningful name at this time, such as `WG302.cfg`.

To restore your settings from a saved configuration file, enter the full path to the file on your computer or click the Browse button to locate the file. When you have located it, click the Retrieve button to upload the file. After completing the upload, the WG302 will reboot automatically.

Restoring the WG302 to the Factory Default Settings

It is sometimes desirable to restore the wireless access point to the factory default settings. This can be done by using the Restore function, which restores all factory settings. After a restore, the wireless access point's password will be **password**, the WG302's DHCP client is enabled, the default LAN IP address is 192.168.0.228, and the access point name is reset to the name printed on the label on the bottom of the unit.

Using the Reset Button to Restore Factory Default Settings

To restore the factory default configuration settings without knowing the login password or IP address, you must use the Default Reset button on the rear panel of the wireless access point (see "WG302 rear panel" on page 2-7). The reset button has two functions:

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

To clear all data and restore the factory default values:

1. Power Off the WG302
2. Hold the Reset Button down while you Power On the WG302 for 5 seconds.
3. Continue holding the Reset Button until the LEDs blink twice.
4. Release the Reset Button.

The factory default configuration has now been restored, and the WG302 is ready for use.

Changing the Administrator Password

The default password is **password**. Change this password to a more secure password. You cannot change the administrator login name.

From the main menu of the browser interface, under the Management heading, click Change Password to bring up the menu shown below.

Figure 4-8: Set Password menu

To change the password, first enter the old password, and then enter the new password twice. Click Apply to save your change.

Chapter 5
Advanced Configuration

This chapter describes how to configure the advanced features of your NETGEAR ProSafe Wireless Access Point 802.11g WG302:

- **IP Settings**: Use the AP as a DHCP server for wireless clients.
- **Wireless Settings**: Set up AutoCell and configure advanced wireless LAN parameters.
- **Access Point Settings**: Enable wireless bridging and repeating.

These features can be found under the Advanced heading in the main menu.

Understanding Advanced IP Settings for Wireless Clients

The default advanced IP wireless settings usually work well. If you want the AP to act as a DHCP server gateway for wireless clients, use this feature. The AP can accept both static and DHCP clients.

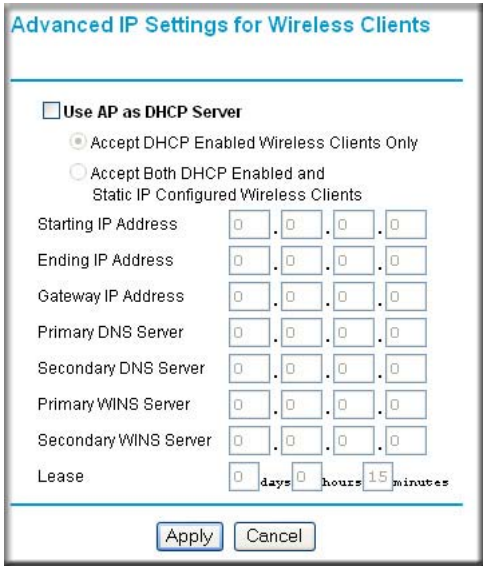


Figure 5-1: Advanced IP Settings for Wireless Clients screen

Understanding Advanced Wireless Settings

The advanced wireless settings menu enables configuration of the following:

- AutoCell RF management
- Wi-Fi multimedia (WMM) setup
- Hotspot settings
- Advanced wireless parameters

These options are discussed below.

AutoCell RF Management

AutoCell provides advanced RF wireless management features that improve performance and enhance security.

Table 5-1. What does AutoCell do?

Problem	AutoCell Settings
Erosion of privacy	Optional setting allows Wi-Fi network to be nearly undetectable by neighbors and hackers. **(Enhance RF Privacy -- Default: Disable)**
Diminishing performance from multiple APs installed in one area.	APs and clients load-balance traffic across under utilized APs. (**Auto RF Management -- Default: Enable)**.
Complexity of installation	Customers can put APs anywhere they want and in any density APs. (**Auto RF Management -- Default: Enable)**
Increasing interference	Clients and APs avoid interference from neighbors and other unexpected sources. (**Auto RF Management -- Default: Enable).**

AutoCell's self-organizing micro cells provide an additional level of privacy for enterprises. AutoCell clients are highly-recommended for Enhanced RF Security.

Configuration

Figure 5-2: Advanced Wireless Settings screen AutoCell Setup options

There are two AutoCell configuration setting choices:

- Enable/disable Auto RF Management: Enabled by default
- Enable/disable Enhanced RF Security (‘Stealth Mode’): Disabled by default

Auto RF Management

Note: Channel selection and power management is automatically adjusted by AutoCell when the Auto RF Management option is enabled.

In this mode, AutoCell APs and clients load-balance traffic across under utilized APs. This mode avoids interference from neighbors clients and APs and other unexpected sources.

Enhanced RF Security ‘Stealth Mode’

Note: Broadcast Wireless Network Name (SSID) is automatically turned off when you select the AutoCell Enhanced RF Security option.

In this mode, AutoCell shrinks the size of coverage to the minimum to reach clients but also shrinks the size of the beacons that access points use to announce their presence. This mode makes an enterprise wireless LAN nearly invisible to users outside an office building.

AutoCell AP/Client Interaction

AutoCell's self-organizing micro cells provide performance benefits and an additional level of privacy for enterprises.

- **Automatic Transmit Power Control.** An AutoCell-enabled client's RF transmit power level is automatically coordinated with an AutoCell-enabled AP. This creates client micro-cells and reduces co-channel interference with other clients and APs on the same frequency and improves overall throughput and performance. (Requires: AutoCell-enabled AP)
- **Automatic Load-Balancing.** An AutoCell-enabled client will seek out and associate to the lightest loaded AutoCell-enabled AP available. (Requires: AutoCell-enabled AP)
- **Rapid Roaming.** An AutoCell-enabled client will accurately and rapidly detect movement as distinguished from RF anomalies such as arbitrary and momentary changes in the surrounding RF domain. When it detects true movement, the client immediately seeks the best available AP at the highest data rate possible instead of waiting for the data rate to decline. (Does not Require AutoCell-enabled APs)

Additional AutoCell View Management Options

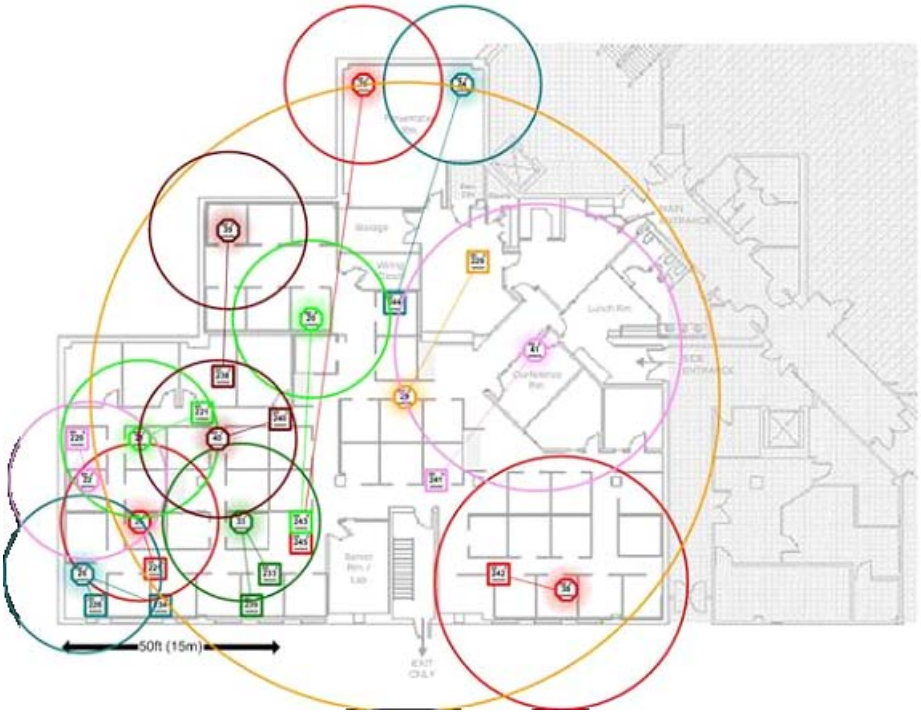


Figure 5-3: AutoCell View wireless network

AutoCell View is an available management tool that provides sophisticated views of your wireless network and enables managing the wireless communications easily from a simple console.

Wi-Fi Multimedia (WMM) Setup

WMM is a subset of the 802.11e standard. WMM allows wireless traffic to have a range of priorities, depending on the kind of data. Time-dependent information, such as video or audio, will have a higher priority than normal traffic. For WMM to function correctly, wireless clients must also support WMM.

WMM Support: Select Yes or No as required on the Advanced Wireless Settings menu. The default is No.

Configuring Wireless LAN Parameters

The default advanced wireless LAN parameter settings usually work well. If you want the AP to operate in Super-G mode, use this feature.

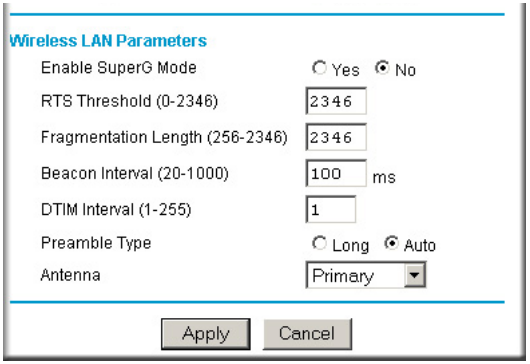


Figure 5-4: Advanced Wireless Settings screen

The table below describes the advanced wireless parameters.

Table 5-1. Advanced Wireless LAN Settings Fields

Field	Description
Enable SuperG Mode	Click Enable to enable SuperG Mode.
RTS Threshold	The packet size used to determine whether it should use the CSMA/CD (Carrier Sense Multiple Access with Collision Detection) or the CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) mechanism for packet transmission.
Fragmentation Length	This is the maximum packet size used for fragmentation. Packets larger than the size programmed in this field will be fragmented. The Fragment Threshold value must be larger than the RTS Threshold value.
Beacon Interval	Specifies the data beacon rate between 20 and 1004.
DTIM Interval	The Delivery Traffic Indication Message specifies the data beacon rate between 1 and 255.
Preamble Type	A long transmit preamble may provide a more reliable connection or slightly longer range. A short transmit preamble gives better performance. Long is the default
Antenna	Select the desired antenna for transmitting and receiving. Auto is the default.

Hotspot Settings

You can allow all HTTP (TCP, port 80) requests to be captured and re-directed to the URL you specify.

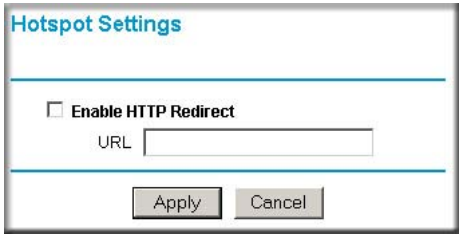


Figure 5-5: Hotspot Settings screen

Enable HTTP Redirect: Enable this if you want all HTTP (TCP, port 80) requests to be captured and re-directed to the URL you specify.

URL: Enter the URL of the Web Server you wish HTTP requests to be redirected to.

Enabling Wireless Bridging and Repeating

The NETGEAR ProSafe Wireless Access Point 802.11g WG302 lets you build large bridged wireless networks.

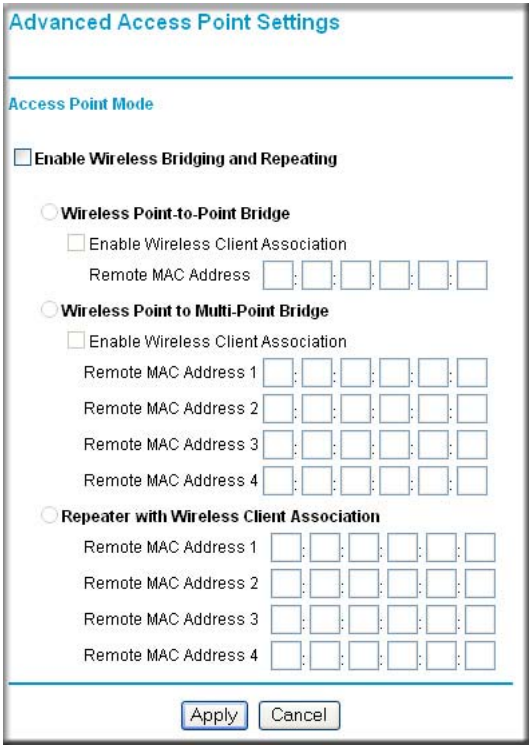


Figure 5-6: Advanced Wireless Settings Access Point Mode settings

Examples of wireless bridged configurations are:

- Client Access Point to Access Point, the default
- Point-to-Point Bridge
- Multi-Point Bridge
- Repeater with Wireless Client Association

These features are discussed below.

How to Configure a WG302 as a Point-to-Point Bridge

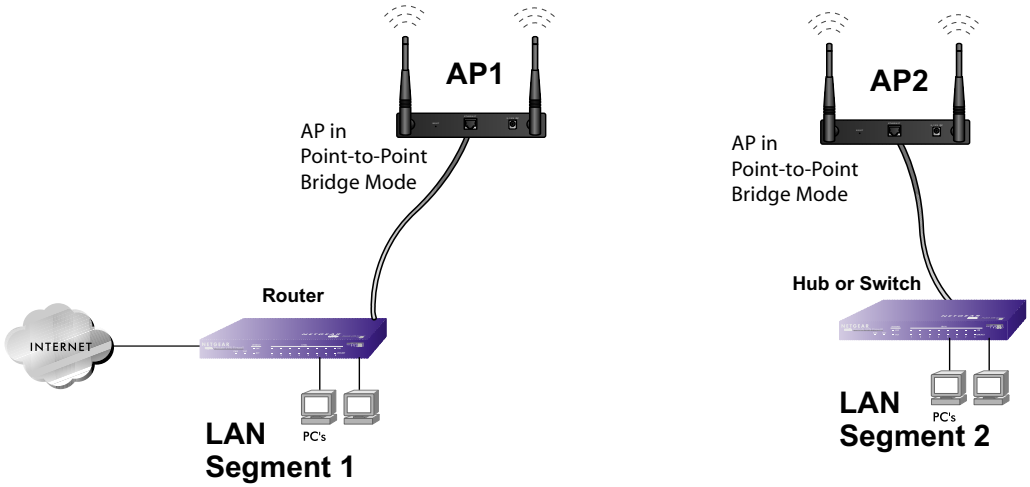


Figure 5-7: Point-to-Point Bridge

1. Configure the WG302 (AP1) on LAN Segment 1 in Point-to-Point Bridge mode.
2. Configure the WG302 (AP2) on LAN Segment 2 in Point-to-Point Bridge mode.
   AP1 must have AP2's MAC address in its Remote MAC Address field and AP2 must have AP1's MAC address in its Remote MAC Address field.
3. Configure and verify the following parameters for both access points:
   - Verify that the LAN network configuration of the WG302 Access Points both are configured to operate in the same LAN network address range as the LAN devices
   - Both use the same ESSID, Channel, authentication mode, if any, and security settings if security is in use.
4. Verify connectivity across the LAN 1 and LAN 2.
   - A computer on either LAN segment should be able to connect to the Internet or share files and printers of any other PCs or servers connected to LAN Segment 1 or LAN Segment 2.

How to Configure Multi-Point Wireless Bridging

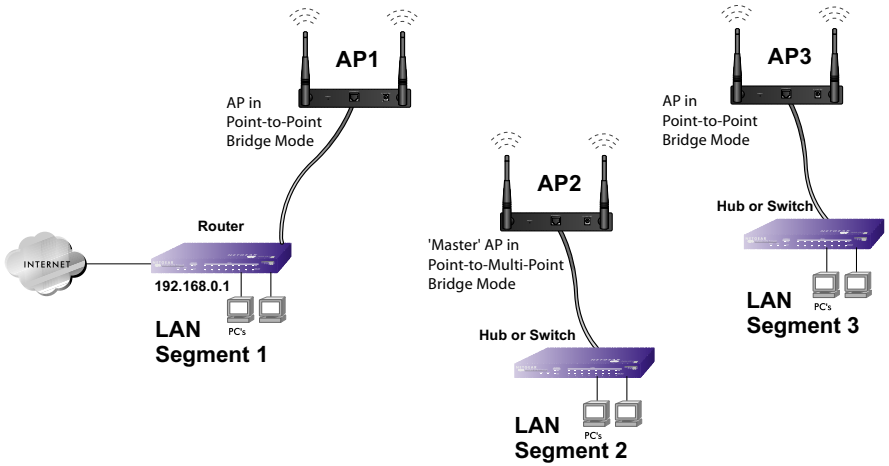


Figure 5-8: Multi-Point bridging

1. Configure the Operating Mode of the WG302 Access Points.
   - WG302 (AP1) on LAN Segment 1 in Point-to-Point Bridge mode with the Remote MAC Address of AP2.
   - Because it is in the central location, configure WG302 (AP2) on LAN Segment 2 in Point-to-Multi-Point Bridge mode. The MAC addresses of the adjacent APs are required in AP2.
   - Configure the WG302 (AP3) on LAN 3 in Point-to-Point Bridge mode with the Remote MAC Address of AP2.
2. Verify the following parameters for all access points:
   - Verify that the LAN network configuration the WG302 Access Points are configured to operate in the same LAN network address range as the LAN devices
   - Only one AP is configured in Point-to-Multi-Point Bridge mode, and all the others are in Point-to-Point Bridge mode.
   - All APs must be on the same LAN. That is, all the APs LAN IP address must be in the same network.
   - If using DHCP, all WG302 Access Points should be set to “Obtain an IP address automatically (DHCP Client)” in the IP Address Source portion of the Basic IP Settings menu.

- All WG302 Access Points use the same SSID, Channel, authentication mode, if any, and encryption in use.
- All Point-to-Point APs must have AP2's MAC address in its Remote AP MAC address field.

3. Verify connectivity across the LANs.
   - A computer on any LAN segment should be able to connect to the Internet or share files and printers with any other PCs or servers connected to any of the three LAN segments.
   - Wireless stations will not be able to connect to the WG302 Access Points in the illustration above. If you require wireless stations to access any lan segment, you can additional WG302 Access Points configured in Wireless Access Point mode to any LAN segment.

Note: You can extend this multi-point bridging by adding additional WG302s configured in Point-to-Point mode for each additional LAN segment. Furthermore, you can extend the range of the wireless network with NETGEAR wireless antenna accessories.

How to Configure Wireless Repeating

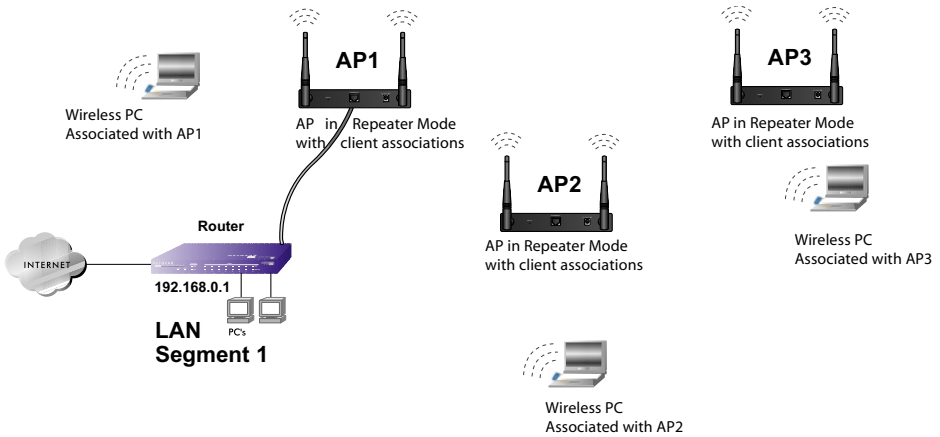


Figure 5-9: Multi-Point bridging

1. Configure the Operating Mode of the WG302 Access Points.
   - WG302 (AP1) on LAN Segment 1 in Repeater mode with the Remote MAC Address of AP2.
   - Configure WG302 (AP2) in Repeater mode with MAC addresses of AP1 and AP3.

   – Configure the WG302 (AP3) in Repeater mode with the Remote MAC Address of AP2.

2. Verify the following parameters for all access points:

   - Verify that the LAN network configuration the WG302 Access Points are configured to operate in the same LAN network address range as the LAN devices
   - All APs must be on the same LAN. That is, all the APs LAN IP address must be in the same network.
   - If using DHCP, all WG302 Access Points should be set to “Obtain an IP address automatically (DHCP Client)” in the IP Address Source portion of the Basic IP Settings menu.
   - All WG302 Access Points use the same SSID, Channel, authentication mode, if any, and encryption in use.

3. Verify connectivity across the LANs.

   - A computer on any LAN segment should be able to connect to the Internet or share files and printers with any other PCs or servers connected to any of the three WLAN segments.

Note: You can extend this repeating by adding up to 2 additional WG302s configured in repeater mode. However, since Repeater configurations communicate in half-duplex mode, the bandwidth decreases as you add Repeaters to the network. Also, you can extend the range of the wireless network with NETGEAR wireless antenna accessories.

Chapter 6
Troubleshooting

This chapter provides information about troubleshooting your NETGEAR ProSafe Wireless Access Point 802.11g WG302. After each problem description, instructions are given to help you diagnose and solve the problem. For the common problems listed, go to the section indicated.

- Is the WG302 on?
- Have I connected the wireless access point correctly?

  Go to "Installing the WG302 Access Point" on page 3-5.
- I cannot remember the wireless access point's configuration password.

  Go to "Changing the Administrator Password" on page 4-12.

Note: For up-to-date WG302 installation details and troubleshooting guidance visit *http://kbserver.netgear.com/products/WG302.asp*.

If you have trouble setting up your WG302, check the tips below.

No lights are lit on the access point.

It takes a few seconds for the power indicator to light up. Wait a minute and check the power light status on the access point.

If the access point has no power.

- Make sure the power cord is connected to the access point.
- Make sure the power adapter is connected to a functioning power outlet. If it is in a power strip, make sure the power strip is turned on. If it is plugged directly into the wall, verify that it is not a switched outlet.
- Make sure you are using the correct NETGEAR power adapter supplied with your access point.

The Wireless LAN activity light does not light up.

The access point's antennae are not working.

- If the Wireless LAN activity light stays off, disconnect the adapter from its power source and then plug it in again.
- Make sure the antennas are tightly connected to the WG302.
- Contact NETGEAR technical support if the Wireless LAN activity light remains off.

The LAN light is not lit.

There is a hardware connection problem.Check these items:

- Make sure the cable connectors are securely plugged in at the access point and the network device (hub, switch, or router). A switch, hub, or router must be installed between the access point and the Ethernet LAN or broadband modem.
- Make sure the connected device is turned on.
- Be sure the correct cable is used. Use a standard Category 5 Ethernet patch cable. If the network device has Auto Uplink™ (MDI/MDIX) ports, you can use either a crossover cable or a normal patch cable.

I cannot access the Internet or the LAN with a wireless capable computer.

There is a configuration problem. Check these items:

- You may not have restarted the computer with the wireless adapter to have TCP/IP changes take effect. Restart the computer.
- The computer with the wireless adapter may not have the correct TCP/IP settings to communicate with the network. Restart the computer and check that TCP/IP is set up properly for that network. The usual setting for Windows the Network Properties is set to "Obtain an IP address automatically."
- The access point's default values may not work with your network. Check the access point default configuration against the configuration of other devices in your network.

I cannot connect to the WG302 to configure it.

Check these items:

- The WG302 is properly installed, LAN connections are OK, and it is powered on. Check that the LAN port LED is green to verify that the Ethernet connection is OK.
- The default configuration of the WG302 is for a static IP address of 192.168.0.228 and a Mask of 255.255.255.0 with DHCP disabled. Make sure your network configuration settings are correct.
- If you are using the NetBIOS name of the WG302 to connect, ensure that your computer and the WG302 are on the same network segment or that there is a WINS server on your network.
- If your computer is set to “Obtain an IP Address automatically” (DHCP client), restart it.
- If your computer uses a Fixed (Static) IP address, ensure that it is using an IP Address in the range of the WG302. The WG302 default IP Address is 192.168.0.228 and the default Subnet Mask is 255.255.255.0. If you are not sure about these settings, follow the instructions for “Installing the WG302 Access Point” on page 3-5.

When I enter a URL or IP address I get a timeout error.

A number of things could be causing this. Try the following troubleshooting steps.

- Check whether other PCs work. If they do, ensure that your PCs TCP/IP settings are correct. If using a Fixed (Static) IP Address, check the Subnet Mask, Default Gateway, DNS, and IP Addresses.
- If the PCs are configured correctly, but still not working, ensure that the WG302 is connected and turned on. Connect to it and check its settings. If you cannot connect to it, check the LAN and power connections.
- If the WG302 is configured correctly, check your Internet connection (DSL/Cable modem etc.) to make sure that it is working correctly.
- Try again.

Using the Reset Button to Restore Factory Default Settings

The Reset button (see "WG302 rear panel" on page 2-7) has two functions:

- **Reboot.** When pressed and released quickly, the WG302 will reboot (restart).
- **Reset to Factory Defaults.** This button can also be used to clear ALL data and restore ALL settings to the factory default values.

To clear all data and restore the factory default values:

1. Power off the WG302 and power it back on.
2. Use something with a small point, such as a pen, to press the Reset button in and hold it in for at least 5 seconds.
3. Release the Reset button.

   The factory default configuration has now been restored, and the WG302 is ready for use.

Appendix A
Specifications

This appendix provides technical specifications for the NETGEAR ProSafe Wireless Access Point 802.11g WG302.

Specifications for the WG302

Parameter	NETGEAR ProSafe Wireless Access Point 802.11g WG302
802.11g Data Rates	1, 2, 5.5, 11, 12, 18, 24, 36, 38, 54, & 108 Mbps (Auto-rate capable)
802.11g Operating Frequencies	2.412 ~ 2.462 GHz (US) 2.412 ~ 2.484 GHz (Japan) 2.412 ~ 2.472 GHz (Europe ETSI) 2.457 ~ 2.462 GHz (Spain) 2.457 ~ 2.472 GHz (France)
802.11g Encryption	40-bits (also called 64-bits), 128- and 152-bits WEP data encryption
Network Management	Web-based configuration and status monitoring
Maximum Clients	Limited by the amount of wireless network traffic generated by each node; typically 15 to 20 nodes.
Status LEDs	Power/Ethernet LAN/Wireless LAN/Test
Power Adapter	12V DC, 1.2 A
Electromagnetic Compliance	FCC Part 15 Class B and Class E
Environmental Specifications	Operating temperature: 0 to 50° C Operating humidity: 5-95%, non-condensing

Appendix B
Wireless Networking Basics

This chapter provides an overview of Wireless networking.

Wireless Networking Overview

The WG302 Access Point conforms to the Institute of Electrical and Electronics Engineers (IEEE) 802.11b and 802.11g standards for wireless LANs (WLANs). On an 802.11b or g wireless link, data is encoded using direct-sequence spread-spectrum (DSSS) technology and is transmitted in the unlicensed radio spectrum at 2.5GHz. The maximum data rate for the 802.11b wireless link is 11 Mbps, but it will automatically back down from 11 Mbps to 5.5, 2, and 1 Mbps when the radio signal is weak or when interference is detected. The 802.11g auto rate sensing rates are 1, 2, 5.5, 6, 9, 12, 18, 24, 36, 48, and 54 Mbps.

The 802.11 standard is also called Wireless Ethernet or Wi-Fi by the Wireless Ethernet Compatibility Alliance (WECA, see *http://www.wi-fi.net*), an industry standard group promoting interoperability among 802.11 devices. The 802.11 standard offers two methods for configuring a wireless network - ad hoc and infrastructure.

Infrastructure Mode

With a wireless Access Point, you can operate the wireless LAN in the infrastructure mode. This mode provides wireless connectivity to multiple wireless network devices within a fixed range or area of coverage, interacting with wireless nodes via an antenna.

In the infrastructure mode, the wireless access point converts airwave data into wired Ethernet data, acting as a bridge between the wired LAN and wireless clients. Connecting multiple Access Points via a wired Ethernet backbone can further extend the wireless network coverage. As a mobile computing device moves out of the range of one access point, it moves into the range of another. As a result, wireless clients can freely roam from one Access Point domain to another and still maintain seamless network connection.

Ad Hoc Mode (Peer-to-Peer Workgroup)

In an ad hoc network, computers are brought together as needed; thus, there is no structure or fixed points to the network - each node can generally communicate with any other node. There is no Access Point involved in this configuration. This mode enables you to quickly set up a small wireless workgroup and allows workgroup members to exchange data or share printers as supported by Microsoft networking in the various Windows operating systems. Some vendors also refer to ad hoc networking as peer-to-peer group networking.

In this configuration, network packets are directly sent and received by the intended transmitting and receiving stations. As long as the stations are within range of one another, this is the easiest and least expensive way to set up a wireless network.

Network Name: Extended Service Set Identification (ESSID)

The Extended Service Set Identification (ESSID) is one of two types of Service Set Identification (SSID). In an ad hoc wireless network with no access points, the Basic Service Set Identification (BSSID) is used. In an infrastructure wireless network that includes an access point, the ESSID is used, but may still be referred to as SSID.

An SSID is a thirty-two character (maximum) alphanumeric key identifying the name of the wireless local area network. Some vendors refer to the SSID as network name. For the wireless devices in a network to communicate with each other, all devices must be configured with the same SSID.

The ESSID is usually broadcast in the air from an access point. The wireless station sometimes can be configured with the ESSID **ANY.** This means the wireless station will try to associate with whichever access point has the stronger radio frequency (RF) signal, providing that both the access point and wireless station use Open System authentication.

Authentication and WEP Data Encryption

The absence of a physical connection between nodes makes the wireless links vulnerable to eavesdropping and information theft. To provide a certain level of security, the IEEE 802.11 standard has defined these two types of authentication methods:

- **Open System**. With Open System authentication, a wireless computer can join any network and receive any messages that are not encrypted.

- **Shared Key**. With Shared Key authentication, only those PCs that possess the correct authentication key can join the network. By default, IEEE 802.11 wireless devices operate in an Open System network.

Wired Equivalent Privacy (WEP) data encryption is used when the wireless devices are configured to operate in Shared Key authentication mode.

802.11 Authentication

The 802.11 standard defines several services that govern how two 802.11 devices communicate. The following events must occur before an 802.11 Station can communicate with an Ethernet network through an access point, such as the one built in to the WG302:

1. Turn on the wireless station.
2. The station listens for messages from any access points that are in range.
3. The station finds a message from an access point that has a matching SSID.
4. The station sends an authentication request to the access point.
5. The access point authenticates the station.
6. The station sends an association request to the access point.
7. The access point associates with the station.
8. The station can now communicate with the Ethernet network through the access point.

An access point must authenticate a station before the station can associate with the access point or communicate with the network. The IEEE 802.11 standard defines two types of authentication: Open System and Shared Key.

- Open System Authentication allows any device to join the network, assuming that the device SSID matches the access point SSID. Alternatively, the device can use the “ANY” SSID option to associate with any available Access Point within range, regardless of its SSID.
- Shared Key Authentication requires that the station and the access point have the same WEP Key to authenticate. These two authentication procedures are described below.

Open System Authentication

The following steps occur when two devices use Open System Authentication:

1. The station sends an authentication request to the access point.

2. The access point authenticates the station.
3. The station associates with the access point and joins the network.

This process is illustrated below.

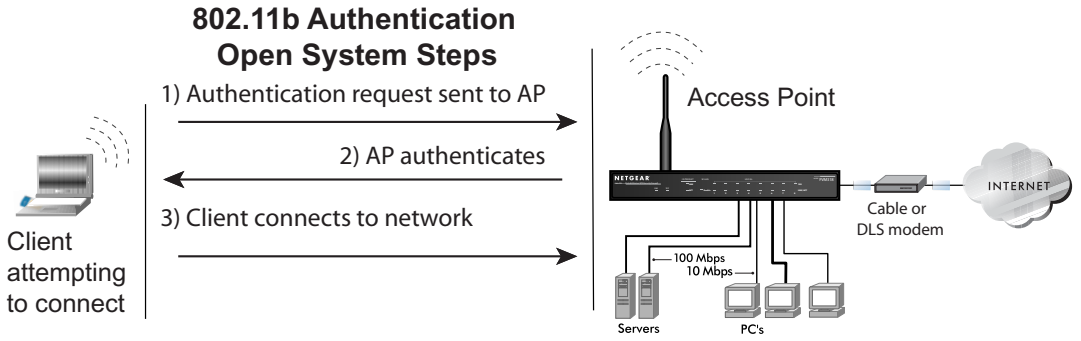


Figure B-1: Open system authentication

Shared Key Authentication

The following steps occur when two devices use Shared Key Authentication:

1. The station sends an authentication request to the access point.
2. The access point sends challenge text to the station.
3. The station uses its configured 64-bit or 128-bit default key to encrypt the challenge text, and sends the encrypted text to the access point.
4. The access point decrypts the encrypted text using its configured WEP Key that corresponds to the station's default key. The access point compares the decrypted text with the original challenge text. If the decrypted text matches the original challenge text, then the access point and the station share the same WEP Key and the access point authenticates the station.
5. The station connects to the network.

If the decrypted text does not match the original challenge text (the access point and station do not share the same WEP Key), then the access point will refuse to authenticate the station and the station will be unable to communicate with either the 802.11 network or Ethernet network.

This process is illustrated below.

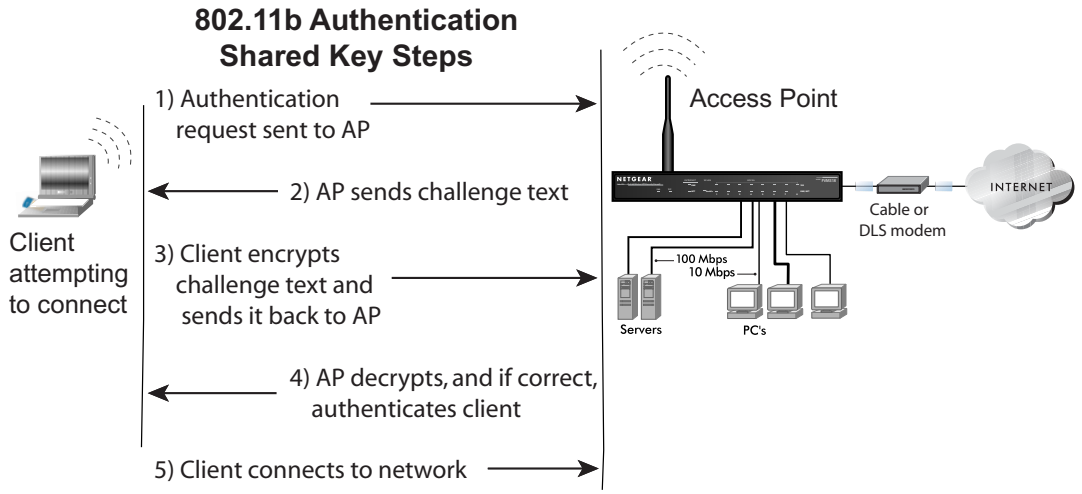


Figure B-2: Shared key authentication

Overview of WEP Parameters

Before enabling WEP on an 802.11 network, you must first consider what type of encryption you require and the key size you want to use. Typically, there are three WEP Encryption options available for 802.11 products:

1. **Do Not Use WEP:** The 802.11 network does not encrypt data. For authentication purposes, the network uses Open System Authentication.

2. **Use WEP for Encryption:** A transmitting 802.11 device encrypts the data portion of every packet it sends using a configured WEP Key. The receiving device decrypts the data using the same WEP Key. For authentication purposes, the network uses Open System Authentication.

3. **Use WEP for Authentication and Encryption:** A transmitting 802.11 device encrypts the data portion of every packet it sends using a configured WEP Key. The receiving device decrypts the data using the same WEP Key. For authentication purposes, the wireless network uses Shared Key Authentication.

Note: Some 802.11 access points also support **Use WEP for Authentication Only** (Shared Key Authentication without data encryption).

Key Size

The IEEE 802.11 standard supports two types of WEP encryption: 40-bit and 128-bit.

The 64-bit WEP data encryption method allows for a five-character (40-bit) input. Additionally, 24 factory-set bits are added to the forty-bit input to generate a 64-bit encryption key. The 24 factory-set bits are not user-configurable). This encryption key will be used to encrypt/decrypt all data transmitted via the wireless interface. Some vendors refer to the 64-bit WEP data encryption as 40-bit WEP data encryption since the user-configurable portion of the encryption key is 40 bits wide.

The 128-bit WEP data encryption method consists of 104 user-configurable bits. Similar to the forty-bit WEP data encryption method, the remaining 24 bits are factory set and not user configurable. Some vendors allow passphrases to be entered instead of the cryptic hexadecimal characters to ease encryption key entry.

128-bit encryption is stronger than 40-bit encryption, but 128-bit encryption may not be available outside of the United States due to U.S. export regulations.

When configured for 40-bit encryption, 802.11 products typically support up to four WEP Keys. Each 40-bit WEP Key is expressed as 5 sets of two hexadecimal digits (0-9 and A-F). For example, “12 34 56 78 90” is a 40-bit WEP Key.

When configured for 128-bit encryption, 802.11 products typically support four WEP Keys but some manufacturers support only one 128-bit key. The 128-bit WEP Key is expressed as 13 sets of two hexadecimal digits (0-9 and A-F). For example, “12 34 56 78 90 AB CD EF 12 34 56 78 90” is a 128-bit WEP Key.

Table B-1: Encryption Key Sizes

Encryption Key Size	# of Hexadecimal Digits	Example of Hexadecimal Key Content
64-bit (24+40)	10	4C72F08AE1
128-bit (24+104)	26	4C72F08AE19D57A3FF6B260037

Note: Typically, 802.11 access points can store up to four 128-bit WEP Keys but some 802.11 client adapters can only store one. Therefore, make sure that your 802.11 access and client adapters’ configurations match.

WEP Configuration Options

The WEP settings must match on all 802.11 devices that are within the same wireless network as identified by the SSID. In general, if your mobile clients will roam between access points, then all of the 802.11 access points and all of the 802.11 client adapters on the network must have the same WEP settings.

Note: Whatever keys you enter for an AP, you must also enter the same keys for the client adapter in the same order. In other words, WEP key 1 on the AP must match WEP key 1 on the client adapter, WEP key 2 on the AP must match WEP key 2 on the client adapter, and so on.

Note: The AP and the client adapters can have different default WEP Keys as long as the keys are in the same order. In other words, the AP can use WEP key 2 as its default key to transmit while a client adapter can use WEP key 3 as its default key to transmit. The two devices will communicate as long as the AP's WEP key 2 is the same as the client's WEP key 2 and the AP's WEP key 3 is the same as the client's WEP key 3.

Wireless Channels

The wireless frequencies used by 802.11b/g networks are discussed below.

IEEE 802.11b/g wireless nodes communicate with each other using radio frequency signals in the ISM (Industrial, Scientific, and Medical) band between 2.4 GHz and 2.5 GHz. Neighboring channels are 5 MHz apart. However, due to spread spectrum effect of the signals, a node sending signals using a particular channel will utilize frequency spectrum 12.5 MHz above and below the center channel frequency. As a result, two separate wireless networks using neighboring channels (for example, channel 1 and channel 2) in the same general vicinity will interfere with each other. Applying two channels that allow the maximum channel separation will decrease the amount of channel cross-talk, and provide a noticeable performance increase over networks with minimal channel separation.

The radio frequency channels used in 802.11b/g networks are listed in Table B-2:

Table B-2: 802.11b/g Radio Frequency Channels

Channel	Center Frequency	Frequency Spread
1	2412 MHz	2399.5 MHz - 2424.5 MHz
2	2417 MHz	2404.5 MHz - 2429.5 MHz
3	2422 MHz	2409.5 MHz - 2434.5 MHz

Table B-2: 802.11b/g Radio Frequency Channels

Channel	Center Frequency	Frequency Spread
4	2427 MHz	2414.5 MHz - 2439.5 MHz
5	2432 MHz	2419.5 MHz - 2444.5 MHz
6	2437 MHz	2424.5 MHz - 2449.5 MHz
7	2442 MHz	2429.5 MHz - 2454.5 MHz
8	2447 MHz	2434.5 MHz - 2459.5 MHz
9	2452 MHz	2439.5 MHz - 2464.5 MHz
10	2457 MHz	2444.5 MHz - 2469.5 MHz
11	2462 MHz	2449.5 MHz - 2474.5 MHz
12	2467 MHz	2454.5 MHz - 2479.5 MHz
13	2472 MHz	2459.5 MHz - 2484.5 MHz

Note: The available channels supported by the wireless products in various countries are different. For example, Channels 1 to 11 are supported in the U.S. and Canada, and Channels 1 to 13 are supported in Europe and Australia.

The preferred channel separation between the channels in neighboring wireless networks is 25 MHz (5 channels). This means that you can apply up to three different channels within your wireless network. There are only 11 usable wireless channels in the United States. It is recommended that you start using channel 1 and grow to use channel 6, and 11 when necessary, as these three channels do not overlap.

WPA and WPA2 Wireless Security

Wi-Fi Protected Access (WPA and WPA2) is a specification of standards-based, interoperable security enhancements that increase the level of data protection and access control for existing and future wireless LAN systems.

The IEEE introduced the WEP as an optional security measure to secure 802.11b (Wi-Fi) WLANs, but inherent weaknesses in the standard soon became obvious. In response to this situation, the Wi-Fi Alliance announced a new security architecture in October 2002 that remedies the shortcomings of WEP. This standard, formerly known as Safe Secure Network (SSN), is designed to work with existing 802.11 products and offers forward compatibility with 802.11i, the new wireless security architecture that has been defined by the IEEE.

WPA and WPA2 offer the following benefits:

- Enhanced data privacy
- Robust key management
- Data origin authentication
- Data integrity protection

The Wi-Fi Alliance is now performing interoperability certification testing on Wi-Fi Protected Access products. Starting August of 2003, all new Wi-Fi certified products have to support WPA. NETGEAR is implementing WPA and WPA2 on client and access point products. The 802.11i standard was ratified in 2004.

How Does WPA Compare to WEP?

WEP is a data encryption method and is not intended as a user authentication mechanism. WPA user authentication is implemented using 802.1x and the Extensible Authentication Protocol (EAP). Support for 802.1x authentication is required in WPA. In the 802.11 standard, 802.1x authentication was optional. For details on EAP specifically, refer to IETF's RFC 2284.

With 802.11 WEP, all access points and client wireless adapters on a particular wireless LAN must use the same encryption key. A major problem with the 802.11 standard is that the keys are cumbersome to change. If you do not update the WEP keys often, an unauthorized person with a sniffing tool can monitor your network for less than a day and decode the encrypted messages. Products based on the 802.11 standard alone offer system administrators no effective method to update the keys.

For 802.11, WEP encryption is optional. For WPA, encryption using Temporal Key Integrity Protocol (TKIP) is required. TKIP replaces WEP with a new encryption algorithm that is stronger than the WEP algorithm, but that uses the calculation facilities present on existing wireless devices to perform encryption operations. TKIP provides important data encryption enhancements including 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. Through these enhancements, TKIP addresses all of known WEP vulnerabilities.

How Does WPA Compare to WPA2 (IEEE 802.11i)?

WPA is forward compatible with the WPA2 security specification. WPA is a subset of WPA2 and used certain pieces of the early 802.11i draft, such as 802.1x and TKIP. The main pieces of WPA2 that are not included in WPA are secure IBSS (Ad-Hoc mode), secure fast handoff (for specialized 802.11 VoIP phones), as well as enhanced encryption protocols, such as AES-CCMP. These features were either not yet ready for market or required hardware upgrades to implement.

What are the Key Features of WPA and WPA2 Security?

The following security features are included in the WPA and WPA2 standard:

- WPA and WPA2 Authentication
- WPA and WPA2 Encryption Key Management
  - Temporal Key Integrity Protocol (TKIP)
  - Michael message integrity code (MIC)
  - AES support (WPA2, requires hardware support)
- Support for a mixture of WPA, WPA2, and WEP wireless clients to allow a migration strategy, but mixing WEP and WPA/WPA2 is discouraged

These features are discussed below.

WPA/WPA2 addresses most of the known WEP vulnerabilities and is primarily intended for wireless infrastructure networks as found in the enterprise. This infrastructure includes stations, access points, and authentication servers (typically RADIUS servers). The RADIUS server holds (or has access to) user credentials (for example, user names and passwords) and authenticates wireless users before they gain access to the network.

The strength of WPA/WPA2 comes from an integrated sequence of operations that encompass 802.1X/EAP authentication and sophisticated key management and encryption techniques. Its major operations include:

- Network security capability determination. This occurs at the 802.11 level and is communicated through WPA information elements in Beacon, Probe Response, and (Re) Association Requests. Information in these elements includes the authentication method (802.1X or Pre-shared key) and the preferred cipher suite (WEP, TKIP, or AES).

The primary information conveyed in the Beacon frames is the authentication method and the cipher suite. Possible authentication methods include 802.1X and Pre-shared key. Pre-shared key is an authentication method that uses a statically configured pass phrase on both the stations and the access point. This obviates the need for an authentication server, which in many home and small office environments will not be available nor desirable. Possible cipher suites include: WEP, TKIP, and AES (Advanced Encryption Standard). We talk more about TKIP and AES when addressing data privacy below.

- Authentication. EAP over 802.1X is used for authentication. Mutual authentication is gained by choosing an EAP type supporting this feature and is required by WPA. 802.1X port access control prevents full access to the network until authentication completes. 802.1X EAPOL-Key packets are used by WPA to distribute per-session keys to those stations successfully authenticated.

  The supplicant in the station uses the authentication and cipher suite information contained in the information elements to decide which authentication method and cipher suite to use. For example, if the access point is using the pre-shared key method then the supplicant need not authenticate using full-blown 802.1X. Rather, the supplicant must simply prove to the access point that it is in possession of the pre-shared key. If the supplicant detects that the service set does not contain a WPA information element then it knows it must use pre-WPA 802.1X authentication and key management in order to access the network.

- Key management. WPA/WPA2 features a robust key generation/management system that integrates the authentication and data privacy functions. Keys are generated after successful authentication and through a subsequent 4-way handshake between the station and Access Point (AP).

- Data Privacy (Encryption). Temporal Key Integrity Protocol (TKIP) is used to wrap WEP in sophisticated cryptographic and security techniques to overcome most of its weaknesses.

- Data integrity. TKIP includes a message integrity code (MIC) at the end of each plaintext message to ensure messages are not being spoofed.

WPA/WPA2 Authentication: Enterprise-level User Authentication via 802.1x/EAP and RADIUS

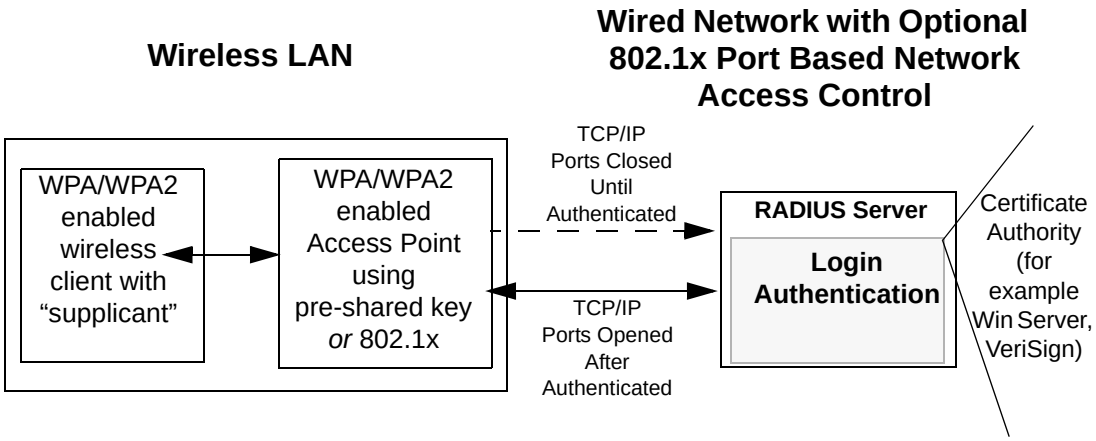


Figure B-3: WPA/WPA2 Overview

IEEE 802.1x offers an effective framework for authenticating and controlling user traffic to a protected network, as well as providing a vehicle for dynamically varying data encryption keys via EAP from a RADIUS server, for example. This framework enables using a central authentication server, which employs mutual authentication so that a rogue wireless user does not join the network.

It is important to note that 802.1x does not provide the actual authentication mechanisms. When using 802.1x, the EAP type, such as Transport Layer Security (EAP-TLS), or EAP Tunneled Transport Layer Security (EAP-TTLS), defines how the authentication takes place.

Note: For environments with a Remote Authentication Dial-In User Service (RADIUS) infrastructure, WPA supports Extensible Authentication Protocol (EAP). For environments without a RADIUS infrastructure, WPA supports the use of a pre-shared key.

Together, these technologies provide a framework for strong user authentication.

Windows XP implements 802.1x natively, and several NETGEAR switch and wireless access point products support 802.1x.

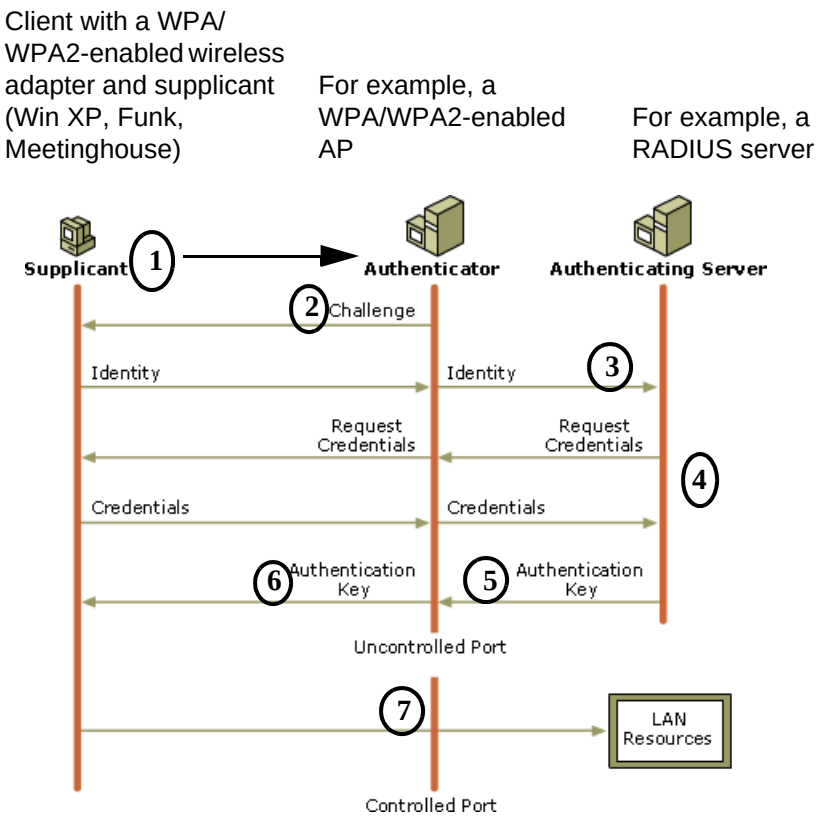


Figure B-4: 802.1x Authentication Sequence

The AP sends Beacon Frames with WPA/WPA2 information element to the stations in the service set. Information elements include the required authentication method (802.1x or Pre-shared key) and the preferred cipher suite (WEP, TKIP, or AES). Probe Responses (AP to station) and Association Requests (station to AP) also contain WPA information elements.

1. Initial 802.1x communications begin with an unauthenticated supplicant (client device) attempting to connect with an authenticator (802.11 access point). The client sends an EAP-start message. This begins a series of message exchanges to authenticate the client.
2. The access point replies with an EAP-request identity message.

3. The client sends an EAP-response packet containing the identity to the authentication server. The access point responds by enabling a port for passing only EAP packets from the client to an authentication server located on the wired side of the access point. The access point blocks all other traffic, such as HTTP, DHCP, and POP3 packets, until the access point can verify the client's identity using an authentication server (for example, RADIUS).
4. The authentication server uses a specific authentication algorithm to verify the client's identity. This could be through the use of digital certificates or some other EAP authentication type.
5. The authentication server will either send an accept or reject message to the access point.
6. The access point sends an EAP-success packet (or reject packet) to the client.
7. If the authentication server accepts the client, then the access point will transition the client's port to an authorized state and forward additional traffic.

The important part to know at this point is that the software supporting the specific EAP type resides on the authentication server and within the operating system or application “supplicant” software on the client devices. The access point acts as a “pass through” for 802.1x messages, which means that you can specify any EAP type without needing to upgrade an 802.1x-compliant access point. As a result, you can update the EAP authentication type to such devices as token cards (Smart Cards), Kerberos, one-time passwords, certificates, and public key authentication, or as newer types become available and your requirements for security change.

WPA/WPA2 Data Encryption Key Management

With 802.1x, the rekeying of unicast encryption keys is optional. Additionally, 802.11 and 802.1x provide no mechanism to change the global encryption key used for multicast and broadcast traffic. With WPA/WPA2, rekeying of both unicast and global encryption keys is required.

For the unicast encryption key, the Temporal Key Integrity Protocol (TKIP) changes the key for every frame, and the change is synchronized between the wireless client and the wireless access point (AP). For the global encryption key, WPA includes a facility (the Information Element) for the wireless AP to advertise the changed key to the connected wireless clients.

If configured to implement dynamic key exchange, the 802.1x authentication server can return session keys to the access point along with the accept message. The access point uses the session keys to build, sign and encrypt an EAP key message that is sent to the client immediately after sending the success message. The client can then use contents of the key message to define applicable encryption keys. In typical 802.1x implementations, the client can automatically change encryption keys as often as necessary to minimize the possibility of eavesdroppers having enough time to crack the key in current use.

Temporal Key Integrity Protocol (TKIP)

WPA uses TKIP to provide important data encryption enhancements including 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. TKIP also provides for the following:

- The verification of the security configuration after the encryption keys are determined.
- The synchronized changing of the unicast encryption key for each frame.
- The determination of a unique starting unicast encryption key for each preshared key authentication.

Michael

With 802.11 and WEP, data integrity is provided by a 32-bit *integrity check value* (ICV) that is appended to the 802.11 payload and encrypted with WEP. Although the ICV is encrypted, you can use cryptanalysis to change bits in the encrypted payload and update the encrypted ICV without being detected by the receiver.

With WPA, a method known as *Michael* specifies a new algorithm that calculates an 8-byte message integrity check (MIC) using the calculation facilities available on existing wireless devices. The MIC is placed between the data portion of the IEEE 802.11 frame and the 4-byte ICV. The MIC field is encrypted together with the frame data and the ICV.

Michael also provides replay protection. A new frame counter in the IEEE 802.11 frame is used to prevent replay attacks.

AES Support for WPA2

One of the encryption methods supported by WPA2 is the advanced encryption standard (AES), although AES support will not be required initially for Wi-Fi certification. This is viewed as the optimal choice for security conscience organizations, but the problem with AES is that it requires a fundamental redesign of the NIC's hardware in both the station and the access point. TKIP is a pragmatic compromise that allows organizations to deploy better security while AES capable equipment is being designed, manufactured, and incrementally deployed.

Is WPA/WPA2 Perfect?

WPA/WPA2 is not without its vulnerabilities. Specifically, it is susceptible to denial of service (DoS) attacks. If the access point receives two data packets that fail the message integrity code (MIC) within 60 seconds of each other, then the network is under an active attack, and as a result, the access point employs counter measures, which include disassociating each station using the access point. This prevents an attacker from gleaning information about the encryption key and alerts administrators, but it also causes users to lose network connectivity for 60 seconds. More than anything else, this may just prove that no single security tactic is completely invulnerable. WPA/WPA2 is a definite step forward in WLAN security over WEP and has to be thought of as a single part of an end-to-end network security strategy.

Product Support for WPA/WPA2

Starting in August, 2003, NETGEAR, Inc. wireless Wi-Fi certified products will support the WPA standard. NETGEAR, Inc. wireless products that had their Wi-Fi certification approved before August, 2003 will have one year to add WPA so as to maintain their Wi-Fi certification.

WPA/WPA2 requires software changes to the following:

- Wireless access points
- Wireless network adapters
- Wireless client programs

Supporting a Mixture of WPA, WPA2, and WEP Wireless Clients is Discouraged

To support the gradual transition of WEP-based wireless networks to WPA/WPA2, a wireless AP can support both WEP and WPA/WPA2 clients at the same time. During the association, the wireless AP determines which clients use WEP and which clients use WPA/WPA2. The disadvantage to supporting a mixture of WEP and WPA/WPA2 clients is that the global encryption key is not dynamic. This is because WEP-based clients cannot support it. All other benefits to the WPA clients, such as integrity, are maintained.

However, a mixed mode supporting WPA/WPA2 and non-WPA/WPA2 clients would offer network security that is no better than that obtained with a non-WPA/WPA2 network, and thus this mode of operation is discouraged.

Changes to Wireless Access Points

Wireless access points must have their firmware updated to support the following:

- **The new WPA/WPA2 information element**
  To advertise their support of WPA/WPA2, wireless APs send the beacon frame with a new 802.11 WPA/WPA2 information element that contains the wireless AP's security configuration (encryption algorithms and wireless security configuration information).
- **The WPA/WPA2 two-phase authentication**
  Open system, then 802.1x (EAP with RADIUS or preshared key).
- **TKIP**
- **Michael**
- **AES** (WPA2)

To upgrade your wireless access points to support WPA/WPA2, obtain a WPA/WPA2 firmware update from your wireless AP vendor and upload it to your wireless AP.

Changes to Wireless Network Adapters

Wireless networking software in the adapter, and possibly in the OS or client application, must be updated to support the following:

- **The new WPA/WPA2 information element**
  Wireless clients must be able to process the WPA/WPA2 information element and respond with a specific security configuration.
- **The WPA/WPA2 two-phase authentication**
  Open system, then 802.1x supplicant (EAP or preshared key).
- **TKIP**
- **Michael**
- **AES** (WPA2)

To upgrade your wireless network adapters to support WPA/WPA2, obtain a WPA/WPA2 update from your wireless network adapter vendor and update the wireless network adapter driver.

For Windows wireless clients, you must obtain an updated network adapter driver that supports WPA. For wireless network adapter drivers that are compatible with Windows XP (Service Pack 1) and Windows Server 2003, the updated network adapter driver must be able to pass the adapter's WPA capabilities and security configuration to the Wireless Zero Configuration service.

Microsoft has worked with many wireless vendors to embed the WPA driver update in the wireless adapter driver. So, to update your Microsoft Windows wireless client, all you have to do is obtain the new WPA/WPA2-compatible driver and install the driver.

Changes to Wireless Client Programs

Wireless client programs must be updated to permit the configuration of WPA/WPA2 authentication (and preshared key) and the new WPA/WPA2 encryption algorithms (TKIP and AES).

To obtain the Microsoft WPA client program, visit the Microsoft Web site.

Note: The Microsoft WPA2 client is still in beta.

Appendix C
Command Line Reference

The NETGEAR ProSafe Wireless Access Point 802.11g WG302 (AP) can be configured either through the command line interface (CLI), a Web browser, or an MIB browser. The CLI allows viewing and modification of the configuration from a terminal or PC through a telnet connection.

Command Sets

```
get set del keyword                  Description
--- --- --- ---------------------- -------------------------------
[X] [X]     time                   --time setting
[X]           |-now                --current system time
[X] [X]       |-zone               --time zone
[X] [X]       `-daylight saving    --daylight saving
[X] [X]     system                 --system setting
[X]           |-version            --system firmware version
[X] [X]       |-apname             --system name
[X]           |-macaddr            --system MAC address
[X] [X]       |-country            --country/region
[X] [X]       |-dhcpclient         --system dhcp client
[X] [X]       |-ipaddr             --system IP address
[X] [X]       |-netmask            --system network mask
[X] [X]       |-gateway            --system gateway
[X] [X]       |-dns                --system dns
[X] [X]       | |-primary          --primary system DNS server
[X] [X]       | `-secondary        --secondary system DNS server
[X] [X]       |-stp                --enable spanning tree protocol
[X]           `-ethstats           --ethernet statistics
[X] [X]     dhcp server            --DHCP server
[X] [X]       |-dhcpserver         --enable DHCP server
[X] [X]       |-anyip              --accept static IP (AnyIP function)
[X] [X]       |-ipstart            --starting IP address
[X] [X]       |-ipend              --ending IP address
[X] [X]       |-netmask            --network mask
[X] [X]       |-gateway            --gateway
```

```
get set del keyword                  Description
--- --- --- ---------------------- -------------------------------
[X] [X]       |-dns                 --
[X] [X]       | |-primary           --primary DNS server
[X] [X]       | `-secondary         --secondary DNS server
[X] [X]       |-wins                --
[X] [X]       | |-primary           --primary WINS server
[X] [X]       | `-secondary         --secondary WINS server
[X] [X]       `-lease               --lease time
[X] [X]     radius                  --radius setting
[X] [X]       |-auth                --authenication radius setting
[X] [X]       | |-primary           --primary
[X] [X]       | | |-ipaddr          --radius IP address
[X] [X]       | | |-port            --radius port number
[X] [X]       | | `-secret          --radius secret string
[X] [X]       | `-secondary         --secondary
[X] [X]       |   |-ipaddr          --radius IP address
[X] [X]       |   |-port            --radius port number
[X] [X]       |   `-secret          --radius secret string
[X] [X]       `-account             --account radius setting
[X] [X]         |-primary           --primary
[X] [X]         | |-ipaddr          --radius IP address
[X] [X]         | |-port            --radius port number
[X] [X]         | `-secret          --radius secret string
[X] [X]         `-secondary         --secondary
[X] [X]           |-ipaddr          --radius IP address
[X] [X]           |-port            --radius port number
[X] [X]           `-secret          --radius secret string
[X] [X]     ssh                     --enable remote SSH access
[X] [X]     snmp                    --SNMP setting
[X] [X]       |-server              --enable SNMP agent
[X] [X]       |-trap server         --SNMP TrapServer IP address
[X] [X]       |-read community      --SNMP ReadCommunity
[X] [X]       |-write community     --SNMP WriteCommunity
[X] [X]       `-description         --SNMP System Description
[X] [X]     log                     --syslog setting
[X] [X]       |-client              --enable syslog client
[X] [X]       |-ipaddr              --syslog server IP address
[X] [X]       `-port                --syslog server port number
[X] [X]     http redirection        --HTTP Redirection setting
[X] [X]       |-server              --enable HTTP redirection
[X] [X]       `-url                 --HTTP redirection URL
```

```
[get set del keyword                  Description
--- --- --- ---------------------- ------------------------------
X] [X] [X] wlan                    --wireless setting
[X]            |-version            --wireless driver version
[X] [X]        |-radio              --enable wireless radio
[X] [X]        |-wirelessmode       --wireless mode
[X] [X]        |-channel            --wireless channel (depends on
                                     country and wireless mode)
[X] [X]        |-rate               --wireless transmission date rate
[X] [X]        |-ssid               --wireless network name (1-32 chars)
[X] [X]        |-ssidsuppress       --wireless SSID broadcast suppress
[X] [X]        |-power              --wireless transmit power
[X] [X]        |-antenna            --wireless antenna selection
[X] [X]        |-fragmentationthreshold--wireless fragmentation
                                     threshold (even only)
[X] [X]        |-rtsthreshold       --wireless RTS/CTS threshold
[X] [X]        |-beaconinterval     --wireless beacon period in TU(1024
us)
[X] [X]        |-dtim               --wireless DTIM period in beacon
interval
[X] [X]        |-preamble           --wireless preamble (only effect on
                                     802.11b
               |                      rates)
[X] [X]        |-super              --enable wireless super-A/G mode
[X] [X]        |-wirelessisolate    --wireless isolate communication
                                     between clients
[X] [X]        |-operationmode      --wireless operation mode
[X] [X] [X]    |-remoteap           --wireless remote AP(s) (depends on
                                     operationmode)
[X] [X] [X]    | |-p2p(+ap)         --remote AP address for p2p mode
[X] [X] [X]    | |-p2mp(+ap)        --remote AP address for p2mp mode
[X] [X] [X]    | | |-1               --1st remote AP address for p2mp mode
[X] [X] [X]    | | |-2               --2nd remote AP address for p2mp mode
[X] [X] [X]    | | |-3               --3rd remote AP address for p2mp mode
[X] [X] [X]    | | `-4               --4th remote AP address for p2mp mode
[X] [X] [X]    | `-repeater         --remote AP address for repeater mode
[X] [X] [X]    |   |-1               --1st remote AP address for repeater
                                     mode
[X] [X] [X]    |   |-2               --2nd remote AP address for repeater
                                     mode
[X] [X] [X]    |   |-3               --3rd remote AP address for repeater
                                     mode
```

```
get set del keyword                  Description
--- --- --- ---------------------- -------------------------------
[X] [X] [X]   |   `-4               --4th remote AP address for repeater
                                     mode
[X] [X] [X]   |-acl                 --wireless access control
[X] [X]       | |-mode              --enable wireless access control
                                     (ACL)
[X] [X] [X]   | `-list              --
        [X]   |   |-all             --(delete only) all local ACL address
[X] [X] [X]   |   `-(null)          --edit local ACL address
[X] [X]       |-rogue ap detection --Rogue AP Detection
[X] [X] [X]   |-identified ap list --identified AP list
        [X]   | |-all               --empty identified AP list
[X] [X] [X]   | `-(null)            --edit identified AP list
[X]           |-association         --list of associated wireless clients
[X]           |-wlanstats           --wlan statistics
[X] [X]       |-authentication      --wireless authentication type
[X] [X]       |-encryption          --wireless data encryption
[X] [X] [X]   |-key                 --wireless wep key setting
[X] [X]       | |-type              --wireless wep key type
[X] [X]       | |-default           --wireless wep default key index
[X] [X] [X]   | |-passphrase        --wireless wep passphrase key
[X] [X] [X]   | |-1                 --wireless wep key 1
[X] [X] [X]   | |-2                 --wireless wep key 2
[X] [X] [X]   | |-3                 --wireless wep key 3
[X] [X] [X]   | `-4                 --wireless wep key 4
[X] [X] [X]   |-wpa                 --wireless WPA setting
[X] [X] [X]   | |-psk               --wireless pre-shared key (PSK) for
                                     WPA-PSK
[X] [X]       | |-reauthtime        --wireless WPA re-auth period (in
                                     seconds)
[X] [X]       | `-keyupdate         --enable wireless WPA global key
                                     update
[X] [X]       |   |-mode            --wireless WPA global key update
                                     condition
[X] [X]       |   `-interval        --wireless WPA global key update
                                     interval
[X] [X]       |     |-sec           --wireless WPA global key update
                                     interval (in seconds)
[X] [X]       |-autocell
[X] [X]       | |-mode              --autocell mode
[X] [X]       | `-super privacy     --avoid other wlan
[X] [X]       `-wmm                 --wmm settings
```

```
get set del keyword                  Description
--- --- --- ---------------------- --------------------------------
[X]     password                --system password
    [X]     reboot                  --reboot system
    [X]     exit                    --logout from CLI
    [X]     quit                    --quit CLI
```

Glossary

Use the list below to find definitions for technical terms used in this manual.

802.11 Standard

802.11, or IEEE 802.11, is a type of radio technology used for wireless local area networks (WLANs). It is a standard that has been developed by the IEEE (Institute of Electrical and Electronic Engineers), *http://standards.ieee.org*. The IEEE is an international organization that develops standards for hundreds of electronic and electrical technologies. The organization uses a series of numbers, like the Dewey Decimal system in libraries, to differentiate between the various technology families.

The 802 subgroup (of the IEEE) develops standards for local and wide area networks with the 802.11 section reviewing and creating standards for wireless local area networks.

Wi-Fi , 802.11, is composed of several standards operating in different radio frequencies: 802.11b is a standard for wireless LANs operating in the 2.4 GHz spectrum with a bandwidth of 11 Mbps; 802.11a is a different standard for wireless LANs, and pertains to systems operating in the 5 GHz frequency range with a bandwidth of 54 Mbps. Another standard, 802.11g, is for WLANS operating in the 2.4 GHz frequency but with a bandwidth of 54 Mbps.

802.11a Standard

An IEEE specification for wireless networking that operates in the 5 GHz frequency range (5.15 GHz to 5.85 GHz) with a maximum 54 Mbps data transfer rate. The 5 GHz frequency band is not as crowded as the 2.4 GHz frequency, because the 802.11a specification offers more radio channels than the 802.11b. These additional channels can help avoid radio and microwave interference.

802.11b Standard

International standard for wireless networking that operates in the 2.4 GHz frequency range (2.4 GHz to 2.4835 GHz) and provides a throughput of up to 11 Mbps. This is a very commonly used frequency. Microwave ovens, cordless phones, medical and scientific equipment, as well as Bluetooth devices, all work within the 2.4 GHz frequency band.

802.11d Standard

802.11d is an IEEE standard supplementary to the Media Access Control (MAC) layer in 802.11 to promote worldwide use of 802.11 WLANs. It will allow access points to communicate information on the permissible radio channels with acceptable power levels for client devices. The devices will automatically adjust based on geographic requirements.

The purpose of 11d is to add features and restrictions to allow WLANs to operate within the rules of these countries. Equipment manufacturers do not want to produce a wide variety of country-specific products and users that travel do not want a bag full of country-specific WLAN PC cards. The outcome will be country-specific firmware solutions.

802.11e Standard

802.11e is a proposed IEEE standard to define quality of service (QoS) mechanisms for wireless gear that gives support to bandwidth-sensitive applications such as voice and video.

802.11g Standard

Similar to 802.11b, this physical layer standard provides a throughput of up to 54 Mbps. It also operates in the 2.4 GHz frequency band but uses a different radio technology in order to boost overall bandwidth.

802.11i

This is the name of the IEEE Task Group dedicated to standardizing WLAN security. The 802.11i Security has a frame work based on RSN (Robust Security Mechanism). RSN consists of two parts: 1) The Data Privacy Mechanism and 2) Security Association Management.

The Data Privacy Mechanism supports two proposed schemes: TKIP and AES. TKIP (Temporal Key Integrity) is a short-term solution that defines software patches to WEP to provide a minimally adequate level of data privacy. AES or AES-OCB (Advanced Encryption Standard and Offset Codebook) is a robust data privacy scheme and is a longer-term solution.

Security Association Management is addressed by a) RSN Negotiation Procedures, b) IEEE 802.1x Authentication and c) IEEE 802.1x Key management.

The standards are being defined to naturally co-exist with pre-RSN networks that are currently deployed.

802.11n Standard

A recently formed (Oct 2003) IEEE official task group referred to as: 802.11n or "TGn" for the 100 Mbps wireless physical layer standard protocol. Current published ratification date is December 2005. As of February 2004, no draft specification has been written - It is expected to use both the 2.4 and 5GHz frequencies.

AES (Advanced Encryption Standard)

A symmetric 128-bit block data encryption technique developed by Belgian cryptographers Joan Daemen and Vincent Rijmen. The U.S government adopted the algorithm as its encryption technique in October 2000, replacing the DES encryption it used. AES works at multiple network layers simultaneously. The National Institute of Standards and Technology (NIST) of the U.S. Department of Commerce selected the algorithm, called Rijndael (pronounced Rhine Dahl or Rain Doll), out of a group of five algorithms under consideration, including one called MARS from a large research team at IBM. AES is expected to replace WEP as a WLAN encryption method in 2003.

Access Point (AP)

A wireless LAN transceiver or "base station" that can connect a wired LAN to one or many wireless devices. Access points can also bridge to each other.

There are various types of access points, also referred to as base stations, used in both wireless and wired networks. These include bridges, hubs, switches, routers and gateways. The differences between them are not always precise, because certain capabilities associated with one can also be added to another. For example, a router can do bridging, and a hub may also be a switch. But they are all involved in making sure data is transferred from one location to another.

A bridge connects devices that all use the same kind of protocol. A router can connect networks that use differing protocols. It also reads the addresses included in the packets and routes them to the appropriate computer station, working with any other routers in the network to choose the best path to send the packets on. A wireless hub or access point adds a few capabilities such as roaming and provides a network connection to a variety of clients, but it does not allocate bandwidth. A switch is a hub that has extra intelligence: It can read the address of a packet and send it to the appropriate computer station. A wireless gateway is an access point that provides additional capabilities such as NAT routing, DHCP, firewalls, security, etc.

Ad-Hoc mode

A client setting that provides independent peer-to-peer connectivity in a wireless LAN. An alternative set-up is one where PCs communicate with each other through an AP. See access point and Infrastructure mode.

Bandwidth

The amount of transmission capacity that is available on a network at any point in time. Available bandwidth depends on several variables such as the rate of data transmission speed between networked devices, network overhead, number of users, and the type of device used to connect PCs to a network. It is similar to a pipeline in that capacity is determined by size: the wider the pipe, the more water can flow through it; the more bandwidth a network provides, the more data can flow through it. Standard 802.11b provides a bandwidth of 11 Mbps; 802.11a and 802.11g provide a bandwidth of 54 Mbps.

Bits per second (bps)

A measure of data transmission speed over communication lines based on the number of bits that can be sent or received per second. Bits per second—bps—is often confused with bytes per second—Bps. While "bits" is a measure of transmission speed, "bytes" is a measure of storage capability. 8 bits make a byte, so if a wireless network is operating at a bandwidth of 11 megabits per second (11 Mbps or 11 Mbits/sec), it is sending data at 1.375 megabytes per second (1.375 Mbps).

Bluetooth Wireless Technology

A technology specification for linking portable computers, personal digital assistants (PDAs) and mobile phones for short-range transmission of voice and data across a global radio frequency band without the need

for cables or wires. Bluetooth is a frequency-hopping technology in the 2.4 GHz frequency spectrum, with a range of 30 feet and up to 11Mbps raw data throughput.

Bridge

A product that connects a local area network (LAN) to another local area network that uses the same protocol (for example, wireless, Ethernet or token ring). Wireless bridges are commonly used to link buildings in campuses.

Client or Client devices

Any computer connected to a network that requests services (files, print capability) from another member of the network. Clients are end users. Wi-Fi client devices include PC Cards that slide into laptop computers, mini-PCI modules embedded in laptop computers and mobile computing devices, as well as USB and PCI/ ISA bus Wi-Fi radios. Client devices usually communicate with hub devices like access points and gateways.

Collision avoidance

A network node characteristic for proactively detecting that it can transmit a signal without risking a collision, thereby ensuring a more reliable connection.

Crossover cable

A special cable used for networking two computers without the use of a hub. Crossover cables may also be required for connecting a cable or DSL modem to a wireless gateway or access point. Instead of the signals transferring in parallel paths from one set of plugs to another, the signals "crossover." If an eight-wire cable was being used, for instance, the signal would start on pin one at one end of the cable and end up on pin eight at the other end. They "cross-over" from one side to the other.

CSMA-CA (Carrier Sense Multiple Action)

CSMA/CA is the principle medium access method employed by IEEE 802.11 WLANs. It is a "listen before talk": method of minimizing (but not eliminating) collisions caused by simultaneous transmission by multiple radios. IEEE 802.11 states collision avoidance method rather than collision detection must be used, because the standard employs half duplex radios—radios capable of transmission or reception—but not both simultaneously.

Unlike conventional wired Ethernet nodes, a WLAN station cannot detect a collision while transmitting. If a collision occurs, the transmitting station will not receive an ACKnowledge packet from the intended receive station. For this reason, ACK packets have a higher priority than all other network traffic. After completion of a data transmission, the receive station will begin transmission of the ACK packet before any other node can begin transmitting a new data packet. All other stations must wait a longer pseudo randomized period of time before transmitting. If an ACK packet is not received, the transmitting station will wait for a subsequent opportunity to retry transmission

CSMA-CD (Carrier Sense Multiple Action/Collision Detection)

A method of managing traffic and reducing noise on an Ethernet network. A network device transmits data after detecting that a channel is available. However, if two devices transmit data simultaneously, the sending devices detect a collision and retransmit after a random time delay.

DHCP (Dynamic Host Configuration Protocol)

A utility that enables a server to dynamically assign IP addresses from a predefined list and limit their time of use so that they can be reassigned. Without DHCP, an IT Manager would have to manually enter in all the IP addresses of all the computers on the network. When DHCP is used, whenever a computer logs onto the network, it automatically gets an IP address assigned to it.

Diversity: antenna

A type of antenna system that uses two antennas to maximize reception and transmission quality and reduce interference

DNS (Domain Name System)

A program that translates URLs to IP addresses by accessing a database maintained on a collection of Internet servers. The program works behind the scenes to facilitate surfing the Web with alpha versus numeric addresses. A DNS server converts a name like mywebsite.com to a series of numbers like 107.22.55.26. Every website has its own specific IP address on the Internet.

Encryption Key

An alphanumeric (letters and/or numbers) series that enables data to be encrypted and then decrypted so it can be safely shared among members of a network. WEP uses an encryption key that automatically encrypts outgoing wireless data. On the receiving side, the same encryption key enables the computer to automatically decrypt the information so it can be read.

Enhanced Data Encryption through TKIP

To improve data encryption, Wi-Fi Protected Access utilizes its Temporal Key Integrity Protocol (TKIP). TKIP provides important data encryption enhancements including 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. Through these enhancements, TKIP addresses all WEP known vulnerabilities.

Enterprise-level User Authentication via 802.1x and EAP

WEP has almost no user authentication mechanism. To strengthen user authentication, Wi-Fi Protected Access implements 802.1x and the Extensible Authentication Protocol (EAP). Together, these implementations provide a framework for strong user authentication. This framework utilizes a central authentication server, such as RADIUS, to authenticate each user on the network before they join it, and also employs "mutual authentication" so that the wireless user doesn’t accidentally join a rogue network that might steal its network credentials.

ESSID (more commonly referred to as SSID – Short Set Identifier)

The identifying name of an 802.11 wireless network. When you specify your correct ESSID in your client setup you ensure that you connect to your wireless network rather than another network in range. (See SSID.) The ESSID can be called by different terms, such as Network Name, Preferred Network, SSID or Wireless LAN Service Area.

Ethernet

International standard networking technology for wired implementations. Basic 10BaseT networks offer a bandwidth of about 10 Mbps. Fast Ethernet (100 Mbps) and Gigabit Ethernet (1000 Mbps) are becoming popular.

Firewall

A system that secures a network and prevents access by unauthorized users. Firewalls can be software, hardware or a combination of both. Firewalls can prevent unrestricted access into a network, as well as restrict data from flowing out of a network.

Gateway

In the wireless world, a gateway is an access point with additional software capabilities such as providing NAT and DHCP. Gateways may also provide VPN support, roaming, firewalls, various levels of security, etc.

Hot Spot (also referred to as Public Access Location)

A place where you can access Wi-Fi service. This can be for free or for a fee. HotSpots can be inside a coffee shop, airport lounge, train station, convention center, hotel or any other public meeting area. Corporations and campuses are also implementing HotSpots to provide wireless Internet access to their visitors and guests. In some parts of the world, HotSpots are known as CoolSpots.

Hub

A multiport device used to connect PCs to a network via Ethernet cabling or via Wi-Fi. Wired hubs can have numerous ports and can transmit data at speeds ranging from 10 Mbps to multigigabyte speeds per second. A hub transmits packets it receives to all the connected ports. A small wired hub may only connect 4 computers; a large hub can connect 48 or more. Wireless hubs can connect hundreds.

HZ (‘hertz”)

The international unit for measuring frequency, equivalent to the older unit of cycles per second. One megahertz (MHz) is one million hertz. One gigahertz (GHz) is one billion hertz. The standard US electrical power frequency is 60 Hz, the AM broadcast radio frequency band is 535—1605 kHz, the FM broadcast radio frequency band is 88—108 MHz, and wireless 802.11b LANs operate at 2.4 GHz.

IEEE (Institute of Electrical and Electronics Engineers)

A membership organization (*www.ieee.org*) that includes engineers, scientists and students in electronics and allied fields. It has more than 300,000 members and is involved with setting standards for computers and communications.

IEEE 802.11

A set of specifications for LANs from The Institute of Electrical and Electronics Engineers (IEEE). Most wired networks conform to 802.3, the specification for CSMA/CD based Ethernet networks or 802.5, the specification for token ring networks. 802.11 defines the standard for wireless LANs encompassing three incompatible (non-interoperable) technologies: Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS) and Infrared. WECA's (Wireless Ethernet Compatibility Alliance – now Wi-Fi Alliance) focus is on 802.11b, an 11 Mbps high-rate DSSS standard for wireless networks.

Infrastructure mode

A client setting providing connectivity to an access point (AP). As compared to Ad-Hoc mode, whereby PCs communicate directly with each other, clients set in Infrastructure Mode all pass data through a central AP. The AP not only mediates wireless network traffic in the immediate neighborhood, but also provides communication with the wired network. See Ad-Hoc and AP.

IP (Internet Protocol) address

A 32-bit number that identifies each sender or receiver of information that is sent across the Internet. An IP address has two parts: an identifier of a particular network on the Internet and an identifier of the particular device (which can be a server or a workstation) within that network.

ISO Network Model

A network model developed by the International Standards Organization (ISO) that consists of seven different levels, or layers. By standardizing these layers, and the interfaces in between, different portions of a given protocol can be modified or changed as technologies advance or systems requirements are altered. The seven layers are:

- Physical
- Data Link
- Network
- Transport
- Session
- Presentation
- Application

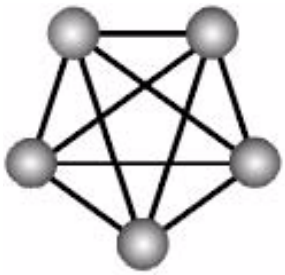
The IEEE 802.11 Standard encompasses the physical layer (PHY) and the lower portion of the data link layer. The lower portion of the data link layer is often referred to as the Medium Access Controller (MAC) sublayer.

MAC (Media Access Control)

Every wireless 802.11 device has its own specific MAC address hard-coded into it. This unique identifier can be used to provide security for wireless networks. When a network uses a MAC table, only the 802.11 radios that have had their MAC addresses added to that network's MAC table will be able to get onto the network.

Mesh Networks

Also called mesh topology, mesh is a network topology in which devices are connected with many redundant interconnections between network nodes. In a full mesh topology every node has a connection to every other node in the network. Mesh networks may be wired or wireless.



In a wireless mesh example, each of the spheres below represent a mesh router. Corporate servers and printers may be shared by attaching to each mesh router. For wireless access to the mesh, an access point must be attached to any one of the mesh routers.

Multiple Input Multiple Output (MIMO)

MIMO refers to radio links with multiple antennas at the transmitter and the receiver side to improve the performance of the wireless link.

NAT (Network Address Translation)

A network capability that enables a houseful of computers to dynamically share a single incoming IP address from a dial-up, cable or xDSL connection. NAT takes the single incoming IP address and creates new IP address for each client computer on the network.

Network name

Identifies the wireless network for all the shared components. During the installation process for most wireless networks, you need to enter the network name or SSID. Different network names are used when setting up your individual computer, wired network or workgroup.

NIC (Network Interface Card)

A type of PC adapter card that either works without wires (Wi-Fi) or attaches to a network cable to provide two-way communication between the computer and network devices such as a hub or switch. Most office wired NICs operate at 10 Mbps (Ethernet), 100 Mbps (Fast Ethernet) or 10/100 Mbps dual speed. High-speed Gigabit and 10 Gigabit NIC cards are also available. See PC Card.

PC card (also called PCMCIA)

A removable, credit-card-sized memory or I/O (input/output) device that fits into a Type 2 PCMCIA standard slot, PC Cards are used primarily in PCs, portable computers, PDAs and laptops. PC Card peripherals include Wi-Fi cards, memory cards, modems, NICs, hard drives, etc.

PCI adapter

A high-performance I/O computer bus used internally on most computers. Other bus types include ISA and AGP. PCIs and other computer buses enable the addition of internal cards that provide services and features not supported by the motherboard or other connectors.

Peer-to-peer network (also called Ad-Hoc in WLANs)

A wireless or wired computer network that has no server or central hub or router. All the networked PCs are equally able to act as a network server or client, and each client computer can talk to all the other wireless computers without having to go through an access point or hub. However, since there is no central base station to monitor traffic or provide Internet access, the various signals can collide with each other, reducing overall performance.

PHY

The lowest layer within the OSI Network Model. It deals primarily with transmission of the raw bit stream over the PHYsical transport medium. In the case of wireless LANs, the transport medium is free space. The PHY defines parameters such as data rates, modulation method, signaling parameters, transmitter/receiver synchronization, etc. Within an actual radio implementation, the PHY corresponds to the radio front end and baseband signal processing sections.

Plug and Play

A computer system feature that provides for automatic configuration of add-ons and peripheral devices such as wireless PC Cards, printers, scanners and multimedia devices.

Proxy server

Used in larger companies and organizations to improve network operations and security, a proxy server is able to prevent direct communication between two or more networks. The proxy server forwards allowable data requests to remote servers and/or responds to data requests directly from stored remote server data

Range

The distance away from your access point that your wireless network can reach. Most Wi-Fi systems will provide a range of a hundred feet or more. Depending on the environment and the type of antenna used, Wi-Fi signals can have a range of up to mile

Residential gateway

A wireless device that connects multiple PCs, peripherals and the Internet on a home network. Most Wi-Fi residential gateways provide DHCP and NAT as well.

RJ-45

Standard connectors used in Ethernet networks. Even though they look very similar to standard RJ-11 telephone connectors, RJ-45 connectors can have up to eight wires, whereas telephone connectors have only four.

Roaming

Moving seamlessly from one AP coverage area to another with your laptop or desktop with no loss in connectivity.

Rogue Access Point

"Rogue AP" is a term used to describe an unauthorized access point that is connected on the main home or corporate network or operating in a stand-alone mode (in a parking lot or in a neighbor's building). Rogue APs, by definition, are not under the management of network administrators and do not conform to network security policies and may present a severe security risk. Ideally, it is best to have some type of WLAN system that does not allow rogue access points to easily be added to an existing WLAN.

Router

A device that forwards data packets from one local area network (LAN) or wide area network (WAN) to another. Based on routing tables and routing protocols, routers can read the network address in each transmitted frame and make a decision on how to send it via the most efficient route based on traffic load, line costs, speed, bad connections, etc.

Satellite broadband

A wireless high-speed Internet connection provided by satellites. Some satellite broadband connections are two-way—up and down. Others are one-way, with the satellite providing a high-speed downlink and then using a dial-up telephone connection or other land-based system for the uplink to the Internet.

Server

A computer that provides its resources to other computers and devices on a network. These include print servers, Internet servers and data servers. A server can also be combined with a hub or router.

Site survey

The process whereby a wireless network installer inspects a location prior to putting in a wireless network. Site surveys are used to identify the radio- and client-use properties of a facility so that access points can be optimally placed.

SSID (also called ESSID)

A 32-character unique identifier attached to the header of packets sent over a WLAN that acts as a password when a mobile device tries to connect to the BSS. (Also called ESSID.) The SSID differentiates one WLAN from another, so all access points and all devices attempting to connect to a specific WLAN must use the same SSID.

A device will not be permitted to join the BSS unless it can provide the unique SSID. Because an SSID can be sniffed in plain text from a packet, it does not supply any security to the network. An SSID is also referred to as a Network Name because essentially it is a name that identifies a wireless network.

SSL (Secure Sockets Layer)

Commonly used encryption scheme used by many online retail and banking sites to protect the financial integrity of transactions. When an SSL session begins, the server sends its public key to the browser. The browser then sends a randomly generated secret key back to the server in order to have a secret key exchange for that session.

Subnetwork or Subnet

Found in larger networks, these smaller networks are used to simplify addressing between numerous computers. Subnets connect to the central network through a router, hub or gateway. Each individual wireless LAN will probably use the same subnet for all the local computers it talks to.

Switch

A type of hub that efficiently controls the way multiple devices use the same network so that each can operate at optimal performance. A switch acts as a networks traffic cop: rather than transmitting all the packets it receives to all ports as a hub does, a switch transmits packets to only the receiving port.

TCP (Transmission Control Protocol)

A protocol used along with the Internet Protocol (IP) to send data in the form of individual units (called packets) between computers over the Internet. While IP takes care of handling the actual delivery of the data, TCP takes care of keeping track of the packets that a message is divided into for efficient routing through the Internet.

For example, when a web page is downloaded from a web server, the TCP program layer in that server divides the file into packets, numbers the packets, and then forwards them individually to the IP program layer. Although each packet has the same destination IP address, it may get routed differently through the network. At the other end, TCP reassembles the individual packets and waits until they have all arrived to forward them as a single file.

TCP/IP

The underlying technology behind the Internet and communications between computers in a network. The first part, TCP, is the transport part, which matches the size of the messages on either end and guarantees that the correct message has been received. The IP part is the user's computer address on a network. Every computer in a TCP/IP network has its own IP address that is either dynamically assigned at startup or permanently assigned. All TCP/IP messages contain the address of the destination network as well as the address of the destination station. This enables TCP/IP messages to be transmitted to multiple networks (subnets) within an organization or worldwide.

TKIP

A security feature that is a WEP enhancement: Temporal Key Integrity Protocol and Message Integrity Check (MIC) is a modification of WEP to defend against known attacks (WEP+ four patches for key mixing, message integrity, rekeying, initialization vector protection)

USB (Universal Serial Bus)

A high-speed bidirectional serial connection between a PC and a peripheral that transmits data at the rate of 12 megabits per second. The new USB 2.0 specification provides a data rate of up to 480 Mbps, compared to standard USB at only 12 Mbps. 1394, FireWire and iLink all provide a bandwidth of up to 400 Mbps.

VoIP (Voice over IP)

Voice transmission using Internet Protocol to create digital packets distributed over the Internet. VoIP can be less expensive than voice transmission using standard analog packets over POTS (Plain Old Telephone Service).

VPN (Virtual Private Network)

A type of technology designed to increase the security of information transferred over the Internet. VPN can work with either wired or wireless networks, as well as with dial-up connections over POTS. VPN creates a private encrypted tunnel from the end user's computer, through the local wireless network, through the Internet, all the way to the corporate servers and database.

War Chalking

The act of making chalk marks on outdoor surfaces (walls, sidewalks, buildings, sign posts, trees) to indicate the existence of an open wireless network connection, usually offering an Internet connection so that others can benefit from the free wireless access. The open connections typically come from the access points of wireless networks located within buildings to serve enterprises. The chalk symbols indicate the type of access point that is available at that specific spot.

There are three basic designs that are currently used: a pair of back-to-back semicircles, which denotes an open node; a closed circle, which denotes a closed node; a closed circle with a “W” inside, which denotes a node equipped with WEP. Warchalkers also draw identifiers above the symbols to indicate the password that can be used to access the node, which can easily be obtained with sniffer software.

As a recent development, the debate over the legality of warchalking is still going on.

The practice stems from the U.S. Depression-era culture of wandering hobos who would make marks outside of homes to indicate to other wanderers whether the home was receptive to drifters or was inhospitable.

War Driving

War driving is the act of locating and possibly exploiting connections to wireless local area networks while driving around a city or elsewhere. To do war driving, you need a vehicle, a computer (which can be a laptop), a wireless Ethernet card set to work in promiscuous mode, and some kind of an antenna which can be mounted on top of or positioned inside the car. Because a wireless LAN may have a range that extends beyond an office building, an outside user may be able to intrude into the network, obtain a free Internet connection, and possibly gain access to company records and other resources.

Some people have made a sport out of war driving, in part to demonstrate the ease with which wireless LANs can be compromised. With an omnidirectional antenna and a geophysical positioning system (GPS), the war driver can systematically map the locations of 802.11b wireless access points.

WEP (Wired Equivalent Privacy)

Basic wireless security provided by Wi-Fi. In some instances, WEP may be all a home or small-business user needs to protect wireless data. WEP is available in 40-bit (also called 64-bit), or in 108-bit (also called 128-bit) encryption modes. As 108-bit encryption provides a longer algorithm that takes longer to decode, it can provide better security than basic 40-bit (64-bit) encryption.

Wi-Fi (Wireless Fidelity)

Another name for IEEE 802.11b. Products certified as Wi-Fi are interoperable with each other even if they are from different manufacturers. A user with a Wi-Fi product can use any brand of access point with any other brand of client hardware that is built to the Wi-Fi standard.

Wi-Fi Alliance (formerly WECA – Wireless Ethernet Compatibility Alliance)

The Wi-Fi Alliance is a nonprofit international association formed in 1999 to certify interoperability of wireless Local Area Network products based on IEEE 802.11 specification. Currently the Wi-Fi Alliance has 193 member companies from around the world, and 509 products have received Wi-Fi certification since certification began in March of 2000. The goal of the Wi-Fi Alliance's members is to enhance the user experience through product interoperability (*www.weca.net*).

Wi-Fi Protected Access (WPA)

WPA is a security technology for wireless networks that improves on the authentication and encryption features of WEP (Wired Equivalent Privacy). In fact, WPA was developed by the networking industry in response to the shortcomings of WEP.

One of the key technologies behind WPA is the Temporal Key Integrity Protocol (TKIP). TKIP addresses the encryption weaknesses of WEP. Another key component of WPA is built-in authentication that WEP

does not offer. With this feature, WPA provides roughly comparable security to VPN tunneling with WEP, with the benefit of easier administration and use. This is similar to 802.1x support and requires a RADIUS server in order to implement. The Wi-Fi Alliance will call this, 'WPA-Enterprise.'

One variation of WPA is called WPA Pre Shared Key or WPA-PSK for short - this provides an authentication alternative to an expensive RADIUS server. WPA-PSK is a simplified but still powerful form of WPA most suitable for home Wi-Fi networking. To use WPA-PSK, a person sets a static key or "passphrase" as with WEP. But, using TKIP, WPA-PSK automatically changes the keys at a preset time interval, making it much more difficult for hackers to find and exploit them. The Wi-Fi Alliance will call this, 'WPA-Personal.'

Wi-Fi Protected Access and IEEE 802.11i Comparison

Wi-Fi Protected Access will be forward-compatible with the IEEE 802.11i security specification currently under development by the IEEE. Wi-Fi Protected Access is a subset of the current 802.11i draft, taking certain pieces of the 802.11i draft that are ready to bring to market today, such as its implementation of 802.1x and TKIP. These features can also be enabled on most existing Wi-Fi CERTIFIED products as a software upgrade. The main pieces of the 802.11i draft that are not included in Wi-Fi Protected Access are secure IBSS, secure fast handoff, secure de-authentication and disassociation, as well as enhanced encryption protocols such as AES-CCMP. These features are either not yet ready for market or will require hardware upgrades to implement.

Wi-Fi Protected Access for the Enterprise

Wi-Fi Protected Access effectively addresses the WLAN security requirements for the enterprise and provides a strong encryption and authentication solution prior to the ratification of the IEEE 802.11i standard. In an enterprise with IT resources, Wi-Fi Protected Access should be used in conjunction with an authentication server such as RADIUS to provide centralized access control and management. With this implementation in place, the need for add-on solutions such as VPNs may be eliminated, at least for the express purpose of securing the wireless link in a network.

Wi-Fi Protected Access for Home/SOHO

In a home or Small Office/ Home Office (SOHO) environment, where there are no central authentication servers or EAP framework, Wi-Fi Protected Access runs in a special home mode. This mode, also called Pre-Shared Key (PSK), allows the use of manually-entered keys or passwords and is designed to be easy to set up for the home user. All the home user needs to do is enter a password (also called a master key) in their access point or home wireless gateway and each PC that is on the Wi-Fi wireless network. Wi-Fi Protected Access takes over automatically from that point. First, the password allows only devices with a matching password to join the network, which keeps out eavesdroppers and other unauthorized users. Second, the password automatically kicks off the TKIP encryption process, described above.

Wi-Fi Protected Access for Public Access

The intrinsic encryption and authentication schemes defined in Wi-Fi Protected Access may also prove useful for Wireless Internet Service Providers (WISPs) offering Wi-Fi public access in "hot spots" where

secure transmission and authentication is particularly important to users unknown to each other. The authentication capability defined in the specification enables a secure access control mechanism for the service providers and for mobile users not utilizing VPN connections.

Wi-Fi Protected Access in "Mixed Mode" Deployment

In a large network with many clients, a likely scenario is that access points will be upgraded before all the Wi-Fi clients. Some access points may operate in a "mixed mode", which supports both clients running Wi-Fi Protected Access and clients running original WEP security. While useful for transition, the net effect of supporting both types of client devices is that security will operate at the less secure level (WEP), common to all the devices. Therefore, organizations will benefit by accelerating the move to Wi-Fi Protected Access for all Wi-Fi clients and access points.

WiMAX

An IEEE 802.16 Task Group that provides a specification for fixed broadband wireless access systems employing a point-to-multipoint (PMP) architecture. Task Group 1 of IEEE 802.16 developed a point-to-multipoint broadband wireless access standard for systems in the frequency range 10-66 GHz. The standard covers both the Media Access Control (MAC) and the physical (PHY) layers. Ratification is expected in second half of 2004.

Wireless Multimedia (WMM)

WMM (Wireless Multimedia) is a subset of the 802.11e standard. WMM allows wireless traffic to have a range of priorities, depending on the kind of data. Time-dependent information, like video, audio, or voice will have a higher priority than normal traffic. For WMM to function correctly, wireless clients must also support WMM.

Wireless Networking

Wireless Networking refers to the infrastructure enabling the transmission of wireless signals. A network ties things together and enables resource sharing.

WLAN (Wireless LAN)

Also referred to as LAN. A type of local-area network that uses wireless or high-frequency radio waves rather than wires to communicate between nodes.