

# User Manual for the NETGEAR Pre-N Wireless PC Card WGM511



## NETGEAR

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## **Technical Support**

Please refer to the support information card that shipped with your product. By registering your product at <http://www.netgear.com/register>, we can provide you with faster expert technical support and timely notices of product and software upgrades.

NETGEAR, INC. Support Information

Phone: 1-888-NETGEAR, for US & Canada only. For other countries, see your Support information card.

E-mail: [support@netgear.com](mailto:support@netgear.com)

Web site: <http://www.netgear.com>

## **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.

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December 2004

## **Certificate of the Manufacturer/Importer**

It is hereby certified that the Model WGM511 Wireless PC Card has been suppressed in accordance with the conditions set out in the BMPT- AmtsblVfg 243/1991 and Vfg 46/1992. The operation of some equipment (for example, test transmitters) in accordance with the regulations may, however, be subject to certain restrictions. Please refer to the notes in the operating instructions.

Federal Office for Telecommunications Approvals has been notified of the placing of this equipment on the market and has been granted the right to test the series for compliance with the regulations.

## **FCC Information to User**

This product does not contain any user serviceable components and is to be used with approved antennas only. Any product changes or modifications will invalidate all applicable regulatory certifications and approvals

## **FCC Guidelines for Human Exposure**

In order to comply with RF exposure limits established in the ANSI C95.1 standards, the user is advised to maintain a distance of at least 1 inch (2.5 cm) from the antenna of this device while it is in use.

## Declaration Of Conformity

We NETGEAR, Inc., 4500 Great America Parkway, Santa Clara, CA 95054, declare under our sole responsibility that the model WGM511 Cardbus Card Wireless Adapter complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

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

## Regulatory Compliance Information

This section includes user requirements for operating this product in accordance with National laws for usage of radio spectrum and operation of radio devices. Failure of the end-user to comply with the applicable requirements may result in unlawful operation and adverse action against the end-user by the applicable National regulatory authority.

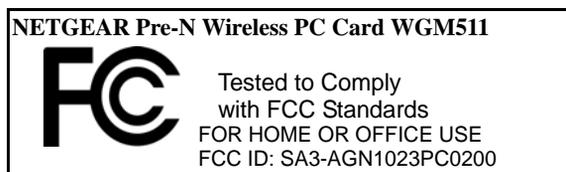
**NOTE:** This product's firmware limits operation to only the channels allowed in a particular Region or Country. Therefore, all options described in this user's guide may not be available in your version of the product.

## FCC Requirements for Operation in the United States

### Radio Frequency Interference Warnings & Instructions

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

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



Modifications made to the product, unless expressly approved by NETGEAR, Inc., could void the user's right to operate the equipment.

## Export Restrictions

This product or software contains encryption code which may not be exported or transferred from the US or Canada without an approved US Department of Commerce export license.



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# Chapter 1

## About This Manual

Congratulations on your purchase of the NETGEAR Pre-N Wireless PC Card WGM511. The WGM511 provides connection for multiple personal computers to the Internet through an external broadband access device (such as a cable modem or DSL modem).

### Audience

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This reference manual assumes that the reader has basic to intermediate computer and Internet skills. However, basic computer network, Internet, and firewall technology tutorial information is provided in the Appendices, on the NETGEAR Pre-N Wireless PC Card WGM511 Resource CD, and on the NETGEAR Web site.

### Scope

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This manual is written for the WGM511 Pre-N Wireless PC Card according to these specifications.:

**Table 1-1. Manual Specifications**

Product Version	NETGEAR Pre-N Wireless PC Card WGM511
Manual Publication Date	December 2004



**Note:** Product updates are available on the NETGEAR Web site at <http://www.netgear.com/support/main.asp>

## Typographical Conventions

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This guide uses the following typographical conventions:

**Table 1. Typographical conventions**

<i>italics</i>	Emphasis.
<b>bold</b>	User input.

## Special Message Formats

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This guide uses the following formats to highlight special messages:

	<b>Note:</b> This format is used to highlight information of importance or special interest.
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## How to Print this Manual

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

- **A Chapter.** Use the “PDF of This Chapter” link at the top right of any page.
  - Click “PDF of This Chapter” link at the top right of any page in the chapter you want to print. A new browser window opens showing the PDF version of the chapter you were viewing.
  - 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.
- **The Full Manual.** Use the PDF button in the toolbar at the top right of the browser window.
  - Click PDF button. A new browser window opens showing the PDF version of the chapter you were viewing.
  - 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

### About the NETGEAR Pre-N Wireless PC Card WGM511

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This chapter introduces the features, package contents, and a road map of typical applications for the NETGEAR Pre-N Wireless PC Card WGM511.

The WGM511 gives you ultimate mobility in your office or while you are traveling. It frees you from traditional Ethernet wiring and helps you create a wireless network for sharing your broadband Internet access in and around your home. It is designed for notebook computers running Microsoft® Windows®. It is 32-bit CardBus compatible and works in any available CardBus slot.

Its auto-sensing capability allows high packet transfer at up to 108 Mbps for maximum throughput or dynamic range shifting to lower speeds due to distance or operating limitations in an environment with a lot of electromagnetic interference.

The WGM511 provides reliable, standards-based 802.11b/g wireless connectivity that is protected with WEP security. It works with Windows 2000 and Windows XP operating systems. When used with a router such as the NETGEAR WGM124 router with Airgo's True MIMO technology, the WGM511 can provide 802.11g standards-based wireless networking at up to 108 Mbps.

### Key Features and Related NETGEAR Products

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The WGM511 Pre-N Wireless PC Card provides the following features:

- 802.11b and 802.11g standards-based wireless networking.
- Supports roaming between access points when configured in Infrastructure mode.
- Fast 108 Mbps speed for ultra high speed data transfer. Wireless nodes negotiate to operate in the optimal data transfer rate. In a noisy environment or when the distance between the wireless nodes is far, the wireless nodes automatically fall back to operate at lower transfer rates.

- High level of data encryption using the 128-bit Shared Key WEP data encryption method. A lower level of data encryption or no data encryption is available to simplify your network setup or to improve data transfer rate.
- 802.11g or 802.11b wireless networking.

## What's in the Box?

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The product package should contain the following items:

- NETGEAR Pre-N Wireless PC Card WGM511
- Installation Guide for the NETGEAR Pre-N Wireless PC Card WGM511
- *NETGEAR Pre-N Wireless PC Card WGM511 Resource CD*, including:
  - Driver and Configuration Utility Software
  - *User Manual for the NETGEAR Pre-N Wireless PC Card WGM511*
  - Animated Network Properties Configuration Tutorial
  - PC Networking Tutorial
- Warranty card
- Support information card

If any of the parts are incorrect, missing, or damaged, contact your NETGEAR dealer. Keep the carton, including the original packing materials, in case you need to return the product for repair.

## WGM511 LEDs and Interfaces

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The NETGEAR Pre-N Wireless PC Card WGM511 has two LEDs: Link and Act (Activity). The Activity LED lights up and blinks when the card is active. The Link LED lights when the card is connected to a wireless network

The NETGEAR Pre-N Wireless PC Card WGM511 has two interfaces:

- The PCMCIA Type II connector connects to any notebook PC with an available PCMCIA or CardBus slot.

- The wireless interface of the NETGEAR Pre-N Wireless PC Card WGM511 remains outside of the notebook PC chassis when the wireless PC card is inserted into a notebook. The LED indicates the wireless link condition and signal quality of the NETGEAR Pre-N Wireless PC Card WGM511 with another wireless node or the associated access point.

## A Road Map for “How to Get There From Here”

The introduction and adoption of any new technology can be a difficult process. Wireless technology has removed one of the barriers to networking—running wires. It allows more people to try networking while at the same time exposes them to the inherent complexity of networking. General networking concepts, setup, and maintenance can be difficult to understand. In addition, wireless technology adds issues, such as range, interference, signal quality, and security to the picture.

To help overcome potential barriers to successfully using wireless networks, the table below identifies how to accomplish such things as connecting to a wireless network, assuring appropriate security measures are taken, browsing the Internet through your wireless connection, exchanging files with other computers and using printers in the combined wireless and wired network.

**Table 2-1. A Road Map for How to Get There From Here ...**

If I Want To ... ?	What Do I Do?	What's Needed?	How Do I?
Connect to a wireless network.	<ol style="list-style-type: none"> <li>1. Identify the wireless network name (SSID) and, if used, the wireless security settings.</li> <li>2. Set up the WGM511 with the settings from step 1.</li> </ol>	<ol style="list-style-type: none"> <li>1. A wireless network</li> <li>2. A notebook PC within the operating range of the wireless network. For guidelines about the range of wireless networks, see <a href="#">“Observing Location and Range Guidelines”</a> on page 3-2.</li> </ol>	<p>To set up the WGM511, see <a href="#">Chapter 3, “Basic Setup”</a> and follow the instructions provided.</p> <p>To learn about wireless networking technology, see <a href="#">Appendix B, “Wireless Networking Basics”</a> for a general introduction.</p>

**Table 2-1. A Road Map for How to Get There From Here ...**

If I Want To ... ?	What Do I Do?	What's Needed?	How Do I?
<p>Protect my wireless connection from snooping, hacking, or information theft.</p>	<ol style="list-style-type: none"> <li>1. Assure that the wireless network has security features enabled.</li> <li>2. Configure your WGM511 with the security settings of the wireless network.</li> <li>3. Use Windows security features.</li> </ol>	<ol style="list-style-type: none"> <li>1. A wireless network with authentication and WEP encryption enabled.</li> <li>2. Wireless networking equipment that supports WEP encryption, such as the WGM511 and all NETGEAR wireless networking products.</li> </ol>	<p>To learn about wireless networking security, see <a href="#">"WEP Wireless Security"</a> on page B-3.</p> <p>To use WEP security features, see <a href="#">"Statistics Page"</a> on page 4-7 and configure your WGM511 accordingly.</p>
<p><b>Note:</b> Secure Internet sites such as banks and online merchants use encryption security built into browsers like Internet Explorer and Netscape. Any wireless networking security features you might implement are in addition to those already in place on secure Internet sites.</p>			
<p>Connect to the Internet over my wireless network.</p>	<ol style="list-style-type: none"> <li>1. Activate your wireless link and verify your network connection.</li> <li>2. Open an Internet browser such as Internet Explorer or Netscape Navigator.</li> </ol>	<ol style="list-style-type: none"> <li>1. An active Internet connection like those from cable or DSL service providers.</li> <li>2. A wireless network connected to the cable or DSL Internet service through a cable/DSL router as illustrated in <a href="#">"Connecting to an Access Point in Infrastructure Mode"</a> on page 4-2.</li> <li>3. TCP/IP Internet networking software installed and configured on your notebook PC according to the requirements of the Internet service provider.</li> <li>4. A browser like Internet Explorer or Netscape Navigator.</li> </ol>	<p>To configure your WGM511 in Infrastructure mode, see <a href="#">"Basic Installation Instructions"</a> on page 3-3, and locate the section for your version of Windows.</p> <p>For assistance with configuring the TCP/IP Internet software on a PC, see <a href="#">"Preparing Your Computers for TCP/IP Networking"</a> on page C-1 or refer to the PC Networking Tutorial on the <i>NETGEAR Pre-N Wireless PC Card WGM511 Resource CD</i> and the Help information provided in the Windows system you are using.</p>

**Table 2-1. A Road Map for How to Get There From Here ...**

If I Want To ... ?	What Do I Do?	What's Needed?	How Do I?
<p>Exchange files between a wirelessly connected notebook computer and other computers in a my combined wireless and wired network.</p>	<ol style="list-style-type: none"> <li>1. Use the Windows Network Neighborhood feature to browse for computers in the combined wireless and wired network.</li> <li>2. Browse the hard drive of the target computer in the network in order to locate the directory or files you want to work with.</li> <li>3. Use the Windows Explorer copy and paste functions to exchange files between the computers.</li> </ol>	<ol style="list-style-type: none"> <li>1. The notebook computer you are using to connect to the wireless network needs to be configured with the Windows Client and File and Print Sharing.</li> <li>2. The notebook computer you are using to connect to the wireless network needs to be configured with the same Windows Workgroup or Domain settings as the other Windows computers in the combined wireless and wired network.</li> <li>3. Any Windows networking security access rights such as login user name/ password that have been assigned in the Windows network or for sharing particular files must be provided when Windows prompts for such information.</li> <li>4. If so-called Windows "peer" Workgroup networking is being used, the drive, file system directory, or file need to be enabled for sharing.</li> </ol>	<p>For assistance with Windows networking software, see <a href="#">Appendix , "Preparing Your Computers for TCP/IP Networking"</a> for configuration scenarios or refer to the Help system included with your version of Windows.</p> <p>Windows Domain settings are usually managed by corporate computer support groups.</p> <p>Windows Workgroup settings are commonly managed by individuals who want to set up small networks in their homes, or small offices.</p> <p>For assistance with setting up Windows networking, refer to the PC Networking Tutorial on the <i>NETGEAR Pre-N Wireless PC Card WGM511 Resource CD</i> and the Help information provided in the Windows system you are using.</p>

**Table 2-1. A Road Map for How to Get There From Here ...**

If I Want To ... ?	What Do I Do?	What's Needed?	How Do I?
<p>Use printers in a combined wireless and wired network.</p>	<ol style="list-style-type: none"> <li>1. Use the Windows Printers and Fax features to locate available printers in the combined wireless and wired network.</li> <li>2. Use the Windows Add a Printer wizard to add access to a network printer from the notebook PC you are using to wirelessly connect to the network.</li> <li>3. From the File menu of an application such as Microsoft Word, use the Print Setup feature to direct your print output to the printer in the network.</li> </ol>	<ol style="list-style-type: none"> <li>1. The notebook computer you are using to connect to the wireless network needs to be configured with the Windows Client and File and Print Sharing.</li> <li>2. The notebook computer you are using to connect to the wireless network needs to be configured with the same Windows Workgroup or Domain settings as the other Windows computers in the combined wireless and wired network.</li> <li>3. Any Windows networking security access rights such as login user name/ password that have been assigned in the Windows network must be provided when Windows prompts for such information.</li> <li>4. If so-called Windows "peer" networking is being used, the printer needs to be enabled for sharing.</li> </ol>	<p>Windows Domain settings are usually managed by corporate computer support groups.</p> <p>Windows Workgroup settings are commonly managed by individuals who want to set up small networks in their homes, or small offices.</p> <p>For assistance with setting up Windows networking, refer to the PC Networking Tutorial on the <i>NETGEAR Pre-N Wireless PC Card WGM511 Resource CD</i> and the Help information provided in the Windows system you are using.</p> <p>For assistance with setting up printers in Windows, refer to the Help and Support information that comes with the version of the Windows operating systems you are using.</p>

# Chapter 3

## Basic Setup

This chapter describes how to install your NETGEAR Pre-N Wireless PC Card WGM511 and set up basic wireless connectivity on your Wireless Local Area Network (WLAN). Advanced wireless network configuration is covered in [Chapter 4, “NETGEAR Smart Wireless Wizard”](#) in this manual.



**Note:** Indoors, computers can easily connect to 802.11 wireless networks at distances of several hundred feet. Because walls do not always block wireless signals, others outside your immediate area could access your network. It is important to take appropriate steps to secure your network from unauthorized access. The NETGEAR Pre-N Wireless PC Card WGM511 provides highly effective security features, which are covered in [“Statistics Page” on page 4-7](#) in this manual. Deploy the security features appropriate to your needs.

## What You Need Before You Begin

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You need to verify that your computer meets the minimum system requirements and identify the wireless network configuration settings of the WLAN where you will connect before you can configure your wireless PC card and connect.

### Verifying System Requirements

Before installing the NETGEAR Pre-N Wireless PC Card WGM511, please make sure that these minimum requirements have been met:

- You must have a computer with a Pentium® 300 MHz or higher compatible processor with an available Cardbus slot.
- A CD drive.
- 5 Mbytes of free hard disk space.
- Windows XP Home, Windows XP Professional, or Windows 2000
- Some versions of Windows may ask for the original Windows operating system installation files to complete the installation of the WGM511 driver software.

## Observing Location and Range Guidelines

Computers can connect over wireless networks indoors at a range which varies significantly based on the physical location of the computer with the NETGEAR Pre-N Wireless PC Card WGM511. For best results, avoid potential sources of interference, such as:

- Large metal surfaces
- Microwaves
- 2.4 GHz Cordless phones

In general, wireless devices can communicate through walls. However, if the walls are constructed with concrete, or have metal, or metal mesh, the effective range will decrease if such materials are between the devices.

## Two Operating Modes

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The WGM511 Pre-N Wireless PC Card can operate in the following two modes:

- **Infrastructure Mode:** An 802.11 networking framework in which devices and computers communicate with each other by first going through an access point (AP). For example, this mode is used when computers in a house connect to an access point that is attached to a router that lets multiple computers share a single cable or DSL broadband Internet connection.
- **Ad Hoc Mode:** An 802.11 networking framework in which devices or computers communicate directly with each other, without the use of an AP. For example, Ad Hoc mode is used when two Windows computers are configured with file and print sharing enabled and you want to exchange files directly between them.

Both of these configuration options are available with the WGM511 Pre-N Wireless PC Card. Infrastructure configuration procedures for basic network connectivity are covered below. Advanced infrastructure configuration procedures and ad hoc configuration are covered in [Chapter 4, “NETGEAR Smart Wireless Wizard”](#) of this manual.

## WGM511 Default Wireless Configuration Settings

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If this is a new wireless network installation, use the factory default settings to set up the network and verify wireless connectivity. If this is an addition to an existing wireless network, you will need to identify the wireless configuration and security parameters already defined.

Your NETGEAR Pre-N Wireless PC Card WGM511 factory default basic settings are:

- Network Name Service Set Identification (SSID): **Any** (First available network)  
**Note:** In order for the WGM511 Pre-N Wireless PC Card to communicate with a wireless access point or wireless adapter, all devices must be configured with the same wireless network name (SSID).
- Network mode (Infrastructure or Ad Hoc): **Infrastructure**
- Data security WEP encryption: **Disabled**

The section below provides instructions for setting up the NETGEAR Pre-N Wireless PC Card WGM511 for basic wireless connectivity to an access point. The procedures below provide step-by-step installation instructions for Windows PCs. Use the procedure that corresponds to the version of Windows you are using.

## Basic Installation Instructions

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Basic instructions for Windows XP Users and for Windows 2000 users are included. Use the procedure below that corresponds to the version of Windows that you use.

### For Windows XP Users Installing a WGM511

#### **1** Install the WGM511 software.

**Note:** During installation the following Windows messages may appear:

- Windows Logo testing warning: Click **Continue Anyway**.
  - Update Drivers warning: Click **Yes** to proceed.
- a. Power on your computer, let the operating system boot up completely, and log in as needed.

- b. Insert the *Resource CD* for the WGM511 into your CD drive. The Resource CD main page loads.

**Note:** If the Resource CD main page does not automatically load, browse to the CD and double-click on **autorun.exe**.

- c. Click the **Install Driver & Utility** link.  
The NETGEAR Smart Wizard opens.
- d. Follow the Smart Wizard steps, and click **Finish** when done.



Resource CD main page

## 2

### Install the NETGEAR Pre-N Wireless PC Card WGM511.

- a. Hold the WGM511 with the NETGEAR logo facing up and insert it into a CardBus slot in your computer.

After a short delay the Found New Hardware Wizard displays.

- b. Select **Install the software automatically (Recommended)** and click **Next**.

You will be prompted to enable the NETGEAR Smart Wizard Wireless Assistant.

- c. Click **Yes** to accept this option.

If you choose **No**, you must read the Windows XP documentation to learn how to use the Windows XP wireless network configuration utility.

- d. Click **Finish** to complete the installation. You will see the WGM511 system tray icon on the lower right part of the Windows task bar.



Found New Hardware Wizard



## 3

**Configure your WGM511 and save the profile.**

- a. Determine the current settings for your wireless access point, including the case-sensitive SSID and WEP security settings, if used (64 or 128 bit, Passphrase (case-sensitive) or Key # with ASCII and hexadecimal key).
- b. Click the  icon in the Windows system tray.

The Smart Wizard Wireless Assistant opens to the Settings tab page.

- c. Change the Network Name SSID and security settings to match your wireless access point.

- **SSID:** To view available wireless networks, use the drop-down list or the Networks tab and choose the one you want.



Settings tab page

- **Security:** If your network includes WEP settings, click the Security tab page and configure the WGM511 accordingly. For help with these steps, click the Help button in the WGM511 Smart Wireless Wizard to view context-sensitive help information, or see [Chapter 5, “Wireless Security Configuration”](#).

- d. Click **Apply** to activate the connection.

**Tip:** Create work and home profiles. Then, activate whichever one you need for your current location.

## 4 Verify wireless connectivity to your network.

- Use the status bar at the bottom of the Smart Wizard Wireless Assistant page to verify your wireless network connection. Click the Help button to view the online help.



**Help button**

**Unlocked:** the wireless network does not use security

**Locked:** the wireless network uses security

**Note:** The status bar reports the speed of your connection. 108, 96, and 72 Mbps speeds are only possible when your wireless network has a Pre-N access point or router such as the NETGEAR WGM124 Pre-N Wireless Router

- Check the color of the WGM511 icon in the Windows system tray: green or yellow indicates a working connection; red indicates no connection.
- Check the WGM511 LEDs: The Activity LED lights up and blinks when the card is active. The Link LED lights when the card is connected to a wireless network. Both LEDs off means the WGM511 is not plugged in or does not have power. See [“Interpreting the LEDs on the WGM511” on page 3-10](#).
- Verify connectivity to the Internet by opening a browser or verify access to network resources such as files and printers.

**Note:** If you are unable to connect, see troubleshooting tips in [Chapter 6, “Troubleshooting”](#).

## For Windows 2000 Users Installing a WGM511

### 1 Install the WGM511 software.

**Note:** Windows 2000 may require you to be logged on with administrator rights.

- a. Power on your computer, let the operating system boot up completely, and log in as needed.
- b. Insert the *Resource CD* for the WGM511 into your CD drive. The Resource CD main page loads.

If the Resource CD main page does not automatically load, browse to the CD and double-click on **autorun.exe**.

- c. Click the **Install Driver & Utility** link to open the NETGEAR Smart Wizard.
- d. You will be prompted to choose the country you are located in. Select your location from the list.
- e. Follow the Smart Wizard steps.
- f. Click **Finish** when done.
- g. If prompted, restart your computer.

**Note:** If a Windows XP Certification warning appears, click **Continue Anyway** to proceed.

## 2

### Install the NETGEAR Pre-N Wireless PC Card WGM511.

- a. Hold the WGM511 with the NETGEAR logo facing up and insert it into a CardBus slot in your computer.

After a short delay the Found New Hardware Wizard displays.

**Note:** If Windows 2000 displays a Digital Signature Not Found warning, click Yes to continue.

- b. Select Install the software automatically (Recommended) and click **Next**.

You will be prompted to enable the NETGEAR Smart Wizard Wireless Assistant.

- c. Click Yes to accept this option.

If you choose No, you must read the Windows XP documentation to learn how to use the Windows XP wireless network configuration utility.

- d. Click **Finish** to complete the installation. You will see the WGM511 system tray icon on the lower right part of the Windows task bar.



Found New Hardware Wizard



3

**Configure your WGM511.**

- a. Determine the current settings for your wireless access point, including the case-sensitive SSID and WEP security settings, if used (64 or 128 bit, Passphrase (case-sensitive) or Key # with ASCII and hexadecimal key).
- b. Click the  icon in the Windows system tray.

The Smart Wizard Wireless Assistant opens to the Settings tab page.

- c. Change the Network Name SSID and security settings to match your wireless access point.

- **SSID:** To view available wireless networks, use the drop-down list or the Networks tab and choose the one you want.



Settings tab page

- **Security:** If your network includes WEP settings, click the Security tab page and configure the WGM511 accordingly. For help with these steps, click the Help button in the WGM511 Smart Wireless Wizard to view context-sensitive help information, or see [Chapter 5, “Wireless Security Configuration”](#).

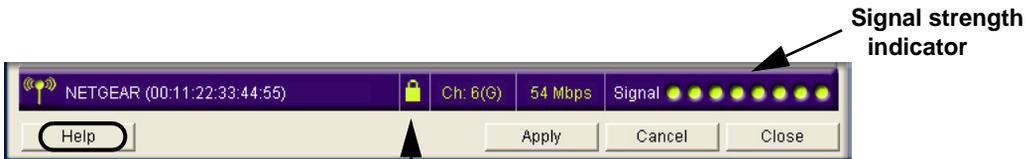
- d. Click **Apply** to activate the connection.

**Tip:** Create work and home profiles. Then, activate whichever one you need for your current location.

## 4

**Verify wireless connectivity to your network.**

- Use the status bar at the bottom of the Smart Wizard Wireless Assistant page to verify your wireless network connection. Click the Help button to view the online help.



**Help button**

**Unlocked:** the wireless network does not use security

**Locked:** the wireless network uses security

**Note:** The status bar reports the speed of your connection. 108, 96, and 72 Mbps speeds are only possible when your wireless network has a Pre-N access point or router such as the NETGEAR WGM124 Pre-N Wireless Router

- Check the color of the WGM511 icon in the Windows system tray: green or yellow indicates a working connection; red indicates no connection.
- Check the WGM511 LEDs: The Activity LED lights up and blinks when the card is active. The Link LED lights when the card is connected to a wireless network. Both LEDs off means the WGM511 is not plugged in or does not have power. See [“Interpreting the LEDs on the WGM511”](#) on page 3-10.
- Verify connectivity to the Internet by opening a browser or verify access to network resources such as files and printers.

**Note:** If you are unable to connect, see troubleshooting tips in [Chapter 6, “Troubleshooting”](#).

## WGM511 Wireless Connection Indicators

The NETGEAR Pre-N Wireless PC Card WGM511 provides the following indicators, which give you feedback on the status of your wireless connection:

- The two LEDs on the NETGEAR Pre-N Wireless PC Card WGM511 indicate the condition of wireless link.
- The color of the System Tray icon on the taskbar in the Microsoft Windows desktop indicates the status of the connection.

## Interpreting the LEDs on the WGM511

These LEDs are described in this table.

**Table 3-1. LED Descriptions**

Act LED (Activity)	Link LED	Meaning
Fast Blink	Off	The WGM511 card is active.
Fast Blink or On	On	WGM511 is active and associated or joined with network. The blink rate increases with activity on the network over the air or locally on the network.
Off	Off	WGM511 is not fully inserted into the CardBus slot, or no power is applied to the card.

## Interpreting System Tray Icon Colors

The System Tray (SysTray) resides on one end of the taskbar in the Microsoft Windows desktop.

**Table 3-2. System Tray Icon Descriptions**

Color	Condition	Description
Red 	The wireless PC Card has no connection to any other wireless node.	The wireless PC Card is not able to link to any other wireless node or the link is lost. Check your configuration or try moving to a location where the wireless signal quality is better.
Yellow 	The wireless PC Card has a connection with another wireless node.	The wireless link is weak. You may need to move to a better spot, such as closer to the wireless access point. Also, look for possible interference such as a 2.4 GHz cordless phone or large metal surface.
Green 	The wireless PC Card has a connection with another wireless node.	The wireless PC Card has established good communication with an access point and the signal quality is strong.

# Chapter 4

## NETGEAR Smart Wireless Wizard

This chapter describes how to configure your NETGEAR Pre-N Wireless PC Card WGM511 for wireless connectivity on your Wireless Local Area Network (WLAN) and use the data security encryption features.



**Note:** The instructions in this section refer to the NETGEAR WGM511 Smart Wireless Wizard. For Windows XP users to use the NETGEAR Smart Wireless Wizard, you must first disable the Windows XP configuration utility. Open the network connections from the system tray icon, click the Properties button, click the Wireless Networks tab and then clear the “Use Windows to configure my wireless network settings” check box.

### Understanding the Configuration Options

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The WGM511 Smart Wireless Wizard provides a complete and easy to use set of tools to:

- Configure wireless settings.
- Monitor wireless network connections.
- Save your settings in configuration profiles.

The section below introduces these capabilities of the Smart Wireless Wizard.

### Using Configuration Profiles

---

The WGM511 Smart Wireless Wizard uses profiles to store all the configuration settings for a particular wireless network. You can store multiple profiles and recall the one that matches the network you want to join.

For example, if you use your notebook PC to connect to a wireless network in an office and a wireless network in your home, you can create a profile for each wireless network. Then, you can easily load the profile that has all the configuration settings you need to join the network you are using at the time.

There are two types of wireless network connections you can configure:

- **Infrastructure mode** — uses the 802.11 infrastructure mode.
- **Ad Hoc mode** — uses the 802.11 ad hoc mode

For more information on 802.11 wireless network modes, see [“Wireless Networking Overview”](#) on page B-1 of this manual.

## Connecting to an Access Point in Infrastructure Mode

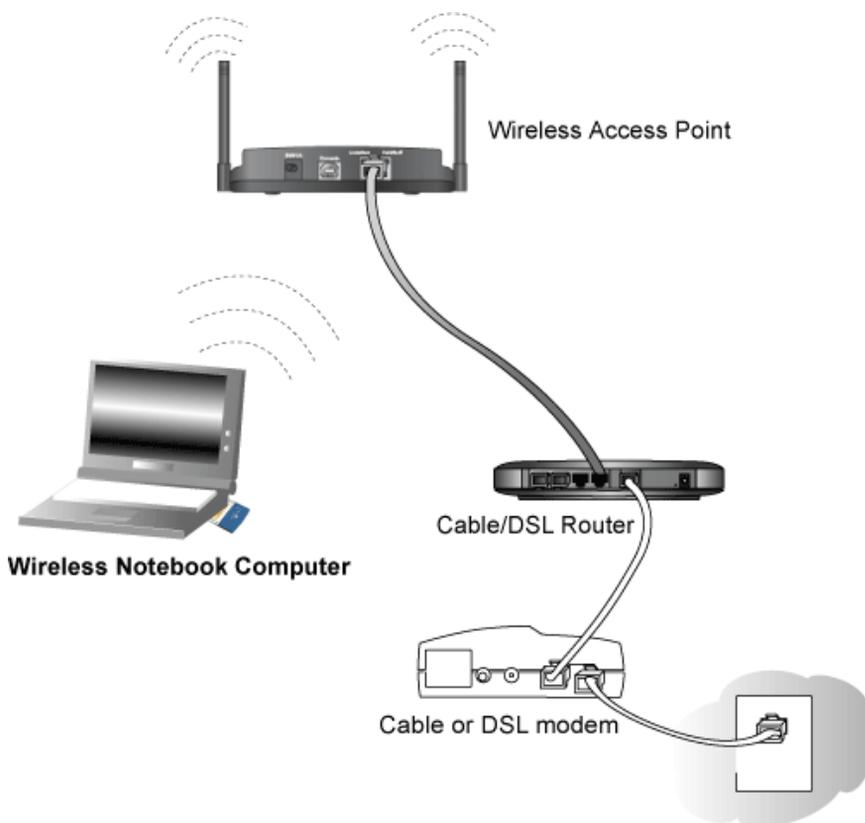


Figure 4-1: WGM511 Pre-N Wireless PC Card connecting to a wireless access point

This section provides instructions for configuring the NETGEAR Pre-N Wireless PC Card WGM511 to connect to a wireless access point.

## How to Configure an Infrastructure Mode Profile

Follow the instructions below to configure an infrastructure mode profile for connecting to an access point.

### 1. Run the WGM511 Smart Wizard Installation Assistant.

- a. Make sure the WGM511 software is installed and the WGM511 is fully inserted in an available CardBus slot in your PC.
- b. Click the WGM511 icon  in the Windows system tray to open the Smart Wizard Installation Assistant.

The Settings tab displays.

### 2. Configure the wireless network settings.

- a. In the Network Type section, be sure that Infrastructure is selected.
- b. Enter the SSID. This is also called the Wireless Network Name.



Settings tab page

**Note:** You will not get a wireless network connection unless the network SSID matches exactly what is configured in the access point.

**Tip:** You can click the Network tab to view a list of the available wireless networks and their SSIDs at the location where you are.

### 3. Save your settings in a Profile.

- a. Type a descriptive name for the Profile in the “Profiles” field.
- b. Click Save Profile. All the configuration settings are saved in this profile.
- c. Click **Apply**.
- d. Click Close to exit the Smart Wireless Wizard or Cancel to return to the previous settings

### 4. Verify wireless connectivity to your network.

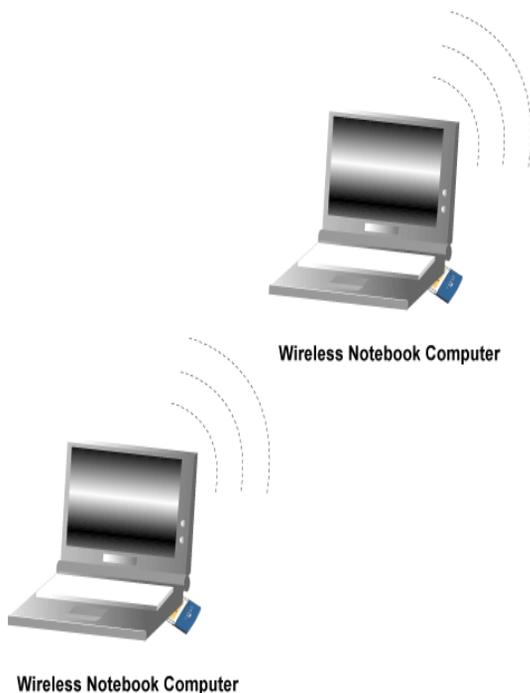
Verify connectivity by using a browser such as Netscape or Internet Explorer to connect to the Internet, or check for file and printer access on your network.

You can check the status bar in the Smart Wireless Wizard for the current connection status.

**Note:** If you cannot connect, see [“Troubleshooting Basic Tips”](#) on page 6-1. Also, for problems with accessing network resources, the Windows Client and File and Print Sharing software might not be installed and configured properly on your computers. Please refer to [“Preparing Your Computers for TCP/IP Networking”](#) on page C-1.

## Connecting to Another PC in Ad Hoc Mode

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**Figure 4-2: NETGEAR WGM511 Wireless PC Card in peer-to-peer mode**

The peer-to-peer setting of the WGM511 uses ad hoc mode. Ad hoc mode is an 802.11 networking framework in which devices or computers communicate directly with each other, without the use of an access point. For example, this mode is used when two Windows computers are configured with file and print sharing enabled and you want to exchange files directly between them.

## How to Configure an Ad Hoc Mode Profile

**Note:** Ad hoc mode will not work using DHCP settings. Ad hoc mode requires static IP addresses (such as 192.168.0.1). For instructions on setting up static IP addresses on a Windows PC, refer to the PC Networking Tutorial included on the *NETGEAR Pre-N Wireless PC Card WGM511 Resource CD*.

Follow the instructions below to configure an ad hoc mode profile.

### 1. Run the WGM511 Smart Wizard Installation Assistant.

- Make sure the WGM511 software is installed and the WGM511 is fully inserted in a CardBus slot in your PC.
- Click the WGM511 icon  in the Windows system tray to open the Smart Wizard Installation Assistant.
- Click the Settings tab to display the Settings page shown below.
- Select Ad Hoc for the Network Type.
- Enter the SSID for the ad hoc network.
- Click **Apply**.



Settings tab page

### 2. Save your settings in a Profile.

- Type a descriptive name in the “Profiles” field.
- Click Save Profile. All the configuration settings are saved in this profile.
- Click **Apply**.
- Click Close to exit the Smart Wireless Wizard.

### 3. Configure the PC network settings.

- Configure each PC with either a static IP address or with the IPX protocol.

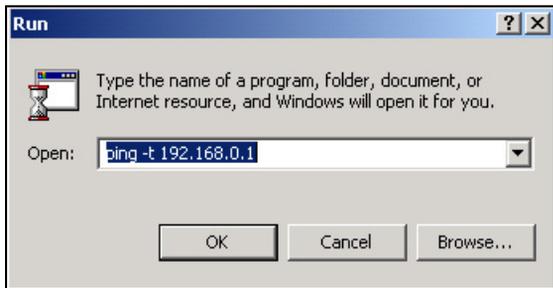
**Note:** For instructions on configuring static IP addresses, refer to the networking tutorial on your *Resource CD*.

- Restart the PCs.

### 4. Verify wireless connectivity between your peer devices.

Verify connectivity by using the Ping program:

- a. On the Windows taskbar click the Start button, and then click Run.



- b. Assuming the target PC is configured with 192.168.0.1 as its IP address, type `ping -t 192.168.0.1` and then click OK.
- c. This will cause a continuous ping to be sent to the device with the 192.168.0.1 static IP address. The ping response should change to “reply.”

```
Request timed out.  
Request timed out.  
Reply from 192.168.0.1: bytes=32 time=40ms TTL=127  
Reply from 192.168.0.1: bytes=32 time=41ms TTL=127  
Reply from 192.168.0.1: bytes=32 time=30ms TTL=127
```

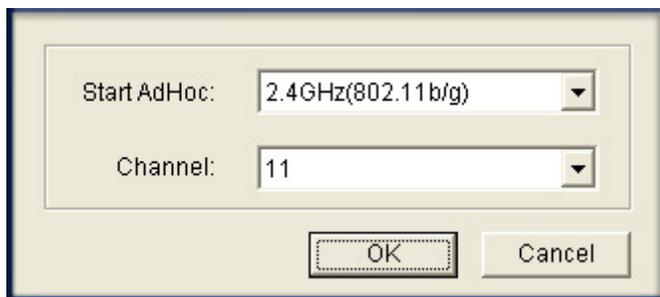
At this point the connection is established.

**Note:** If you cannot connect, see [“Troubleshooting Basic Tips”](#) on page 6-1. Also, for problems with accessing network resources, the Windows Client and File and Print Sharing software might not be installed and configured properly on your computers. Please refer to [“Preparing Your Computers for TCP/IP Networking”](#) on page C-1.

## How to Start a Computer-to-Computer (Ad Hoc) Network

1. Fill in the Network Name (SSID).
2. Select the Computer-to-computer (Ad Hoc) network type.

- Click Initiate Ad Hoc. The Ad Hoc Setting dialog box will appear, as shown below.



**Figure 4-3: Ad Hoc Setting dialog box**

- In the Start Ad Hoc field, choose the wireless standard (802.11b or 802.11g) for your ad hoc computer-to-computer network.
- In the Channel field, Automatic should work. If you notice interference problems with another nearby wireless device, select a channel that is not being used by any other wireless networks near your wireless adapter. Use the Networks tab page to identify the channels in use in your area.
- Click **OK**.

**Note:** The channel number differs depending on the country. The connection speed automatically defaults to the highest speed.

## Statistics Page

The Statistics page provides real time and historical trend information on the data traffic and performance of your wireless adapter.

To view the Statistics page, click the WGM511 icon  in the Windows system tray. The Settings page opens. Click the Statistics tab..

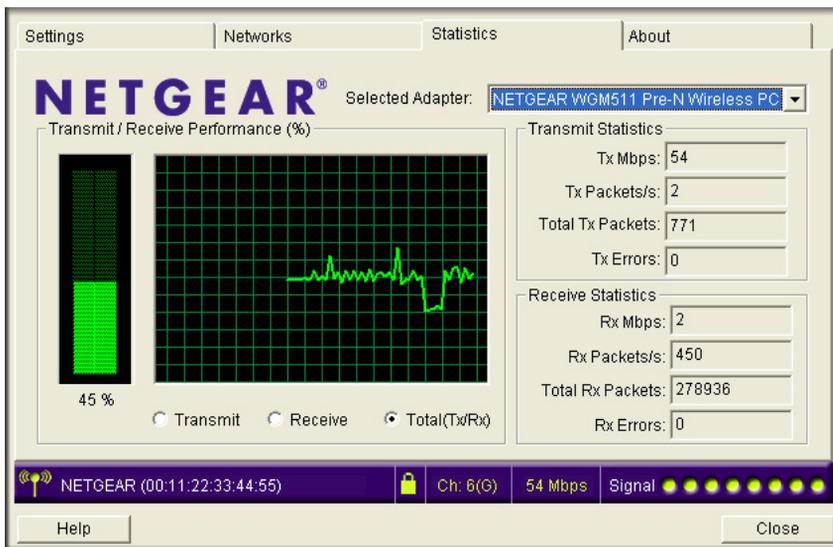


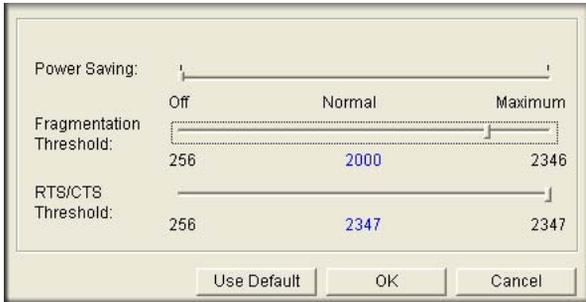
Figure 4-4: Statistics page

- **Transmit/Receive Performance (%):** A real time graph identifying the total, receive, and transmit utilization as a percentage the total possible.
- **Total Receive/Transmit Graph:** Identifies the trend of transmit/receive data communications over time.
- **Transmit Statistics:** Identifies transmit megabits per second (Mbps), transmit packets per second (Tx Packets/s), total transmitted packets, and transmit errors.
- **Receive Statistics:** Identifies receive megabits per second (Mbps), receive packets per second (Rx Packets/s), total received packets, and received errors.

## Advanced Settings Display

The Advanced settings should not require adjustment. Except for the power saving setting, changing any of the settings incorrectly on this page could cause your wireless connection to fail.

Click the WGM511 icon  in the Windows system tray to open the Smart Wizard Installation Assistant. The Settings page opens. Click the Advanced Settings button..



**Figure 4-5: Advanced Settings display**

- **Power Saving:** Select On if you are using a notebook computer running on battery power.
- **Fragmentation Threshold:** This is the maximum packet size used for fragmentation. Packets larger than the size programmed in this field will be fragmented. The Fragmentation Threshold value must be larger than the RTS/CTS Threshold value.
- **RTS/CTS Threshold:** RTS is request to send and CTS is clear to send; their purpose is to avoid collisions. RTS/CTS will be enabled if the data frame size is larger than the threshold value set here. The maximum frame size is 2346 octets, so if the threshold is 2346, RTS/CTS will be disabled.

**Note:** This setting is reserved for wireless testing and advanced configuration only. Do not change this setting unless you are sure you need to. The primary reason for implementing RTS/CTS is to minimize collisions between hidden stations. This occurs when users and access points are spread out and a high number of retransmissions occur on the wireless LAN.



# Chapter 5

## Wireless Security Configuration

This chapter describes how to configure the security features of your NETGEAR Pre-N Wireless PC Card WGM511.



**Note:** These instructions refer to the WGM511 configuration utility. The Windows XP wireless configuration utility must be deselected. Check if this is so by viewing the Properties of the Network Connections for the WGM511. Click the Wireless Networks tab and clear the “Use Windows to configure my wireless network settings” check box.

### Understanding the Security Options

---

For a full discussion of wireless security technologies, please see [“Wireless Networking Overview” on page B-1](#). The WGM511 configuration utility provides WEP (Wired Equivalent Privacy) security. WEP is an existing, widely implemented and supported, data encryption protocol for 802.11 wireless networks. All wireless nodes on the network are configured with a static 64-bit or 128-bit Shared Key for data encryption but authentication is optional.

**Note:** You can use WPA-PSK by using the Windows zero configuration. See [“Using the Wireless Zero Configuration Service for WPA-PSK Advanced Security” on page 5-5](#).

When you use the WGM511 configuration utility to configure these security options, you can save your settings in a profile. For example, you can have *work* and *home* profiles that make it easy to switch from one environment to the other. For more information on configuring profiles, see [“Understanding the Configuration Options” on page 4-1](#).

### Using WEP Security

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You can strengthen the security of your wireless connection by enabling Wired Equivalent Privacy (WEP) encryption of the wireless data communications. For more information on 802.11 wireless security, see [“Wireless Networking Overview” on page B-1](#).

In addition to the WGM511 wireless security features, configure appropriate LAN network security features such as requiring a user name and password to access shared resources in your network.

Fill in the worksheet and use the procedures below to configure the WEP encryption settings of your NETGEAR Pre-N Wireless PC Card WGM511.

## **Basic Requirements for WEP**

WEP requires these elements:

1. A wireless adapter with WEP enabled.
2. A wireless access point or another PC with WEP enabled.

Fill in the worksheet and use the procedures below to configure the WEP encryption settings of your WGM511.

## WEP Security Settings Worksheet

Print this form, fill in the configuration parameters and put it in a safe place for possible future reference. For an existing wireless network, the person who set up the network will be able to provide this information.

- Wireless Network Name (SSID)

The Service Set Identification (SSID) identifies the wireless local area network. For the access point and wireless nodes to communicate with each other, all must be configured with the same SSID.

**Note:** Some wireless access points will not broadcast their SSID as a security feature. In such a case, you will need to get the SSID from the wireless network administrator.

Wireless network name (SSID): \_\_\_\_\_

- WEP Security Encryption Key

The default WEP encryption key number is 1, and the default key size is 64 bits.

**Note:** The key number as well as the key value used by all wireless nodes must be the same. If yours is different, you will not be able to connect.

WEP Encryption Key Size, circle one: **64** or **128** bits

WEP Encryption Passphrase (case sensitive), if used: \_\_\_\_\_

A Passphrase is used to automatically generate the WEP hexadecimal numbers for the key. If the wireless network access point uses a Passphrase, you can also use that here. Otherwise, you will have to manually enter the hexadecimal numbers.

**Note:** Not all wireless networks support the Passphrase method of key generation. In such settings, instead of Passphrase, use the Enter Key Manually option.

WEP Hexadecimal Numbers (not case sensitive): \_\_\_\_\_

— 64-bit WEP: enter 10 hexadecimal digits (any combination of 0-9, a-f, or A-F) and 5 ASCII.

— 128-bit WEP: enter 26 hexadecimal digits (any combination of 0-9, a-f, or A-F) and 13 ASCII.

Use the procedures below to configure WEP security settings in the WGM511.

## How to Configure WEP Encryption Security

Follow the steps below to configure WEP Encryption Security.

### 1. Run the WGM511 Smart Wizard Installation Assistant.

- a. Make sure the WGM511 software is installed and the WGM511 is fully inserted in your PC.
- b. Click the WGM511 icon  on the Windows desktop or in the system tray.  
The Smart Wizard Installation Assistant opens to the Settings tab page.

### 2. Configure the Network Name (SSID) settings.

Enter the SSID. This is also called the Wireless Network Name.

**Tip:** Click the Networks tab to view a list of the available wireless networks and their SSIDs.

### 3. Configure the WEP settings.

- a. Select the WEP radio button.

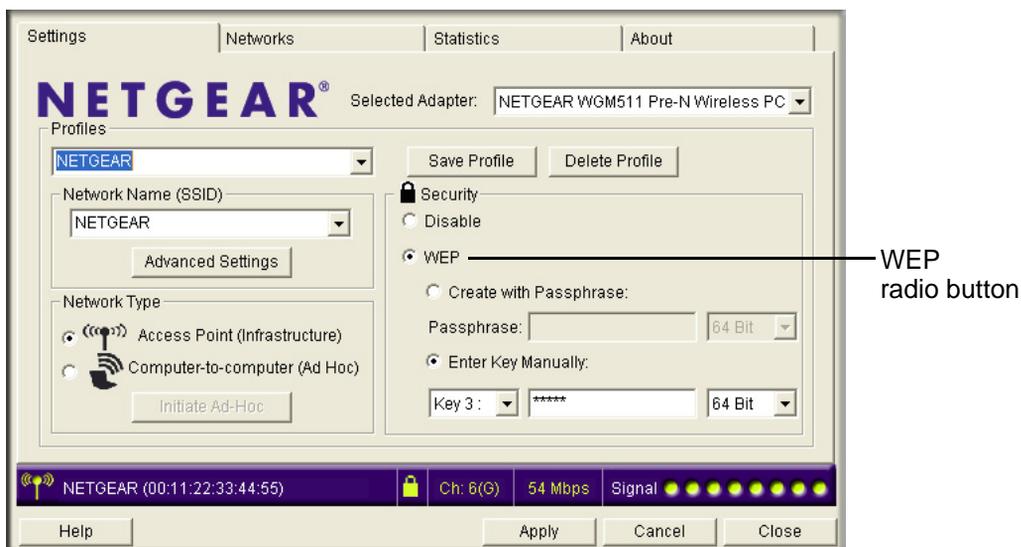


Figure 5-1: WEP settings screen

- b. Select how you will enter the Key and the key size. The choices are:
  - Create Key with Passphrase. The characters are case sensitive.

- Enter Key Manually

Select the encryption strength choices are:

- 64-bit WEP data encryption
- 128-bit WEP data encryption

**Note:** Larger encryption keys require more processing and may slow the communications response times, and consume more notebook PC battery power.

- a. Select the Key number: The Key setting must match what is set in wireless network.
- b. Click **Apply** for the changes to take effect. In the status area at the bottom of the screen, you will notice the security lock icon change from open and red to closed and yellow.

#### 4. Save your settings in a Profile.

- a. Type a descriptive name in the Profiles field.
- b. Click **Save Profile**. All the configuration settings are saved in this profile.
- c. Click **Apply** and click **Close** to exit the configuration utility.

## Using the Wireless Zero Configuration Service for WPA-PSK Advanced Security

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You can have very strong security on your wireless connection by enabling WPA-PSK. For more information on wireless security, see [“Wireless Networking Overview”](#) on page B-1.

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

For wireless clients that are running Windows XP Service Pack 1 (SP1) or Windows Server 2003 and that are using a wireless network adapter that supports the Wireless Zero Configuration service, you must obtain and install the Windows WPA Client. For wireless clients that are running Windows XP service pack 2 (SP2) and that are using a wireless network adapter that supports the Wireless Zero Configuration service, the Windows WPA Client is included in Windows XP SP2. Therefore, additional downloads are not needed. The Windows WPA Client updates the wireless network configuration dialog boxes to support new WPA options.

For additional information and to obtain the WPA client program, click the article number **826942** to view the article in the Microsoft Knowledge Base. Wireless update rollup package for Windows XP is available.

For wireless clients running Windows 2000 (or clients running Windows XP SP1 or Windows Server 2003 and using a wireless network adapter that does not support the Wireless Zero Configuration service), you must obtain and install a new WPA-compliant configuration tool from your wireless network adapter vendor.

## Enabling Wireless Security Features

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You can strengthen the security of your wireless connection by enabling Wired Equivalent Privacy (WEP) encryption of the wireless data communications. For more information on 802.11 wireless security, see [“WEP Wireless Security” on page B-3](#).

In addition to the WGM511 wireless security features, you should also configure appropriate LAN network security features such as requiring a user name and password to access the shared resources in your network.

The procedures below identify how to configure the WEP encryption settings of your NETGEAR Pre-N Wireless PC Card WGM511.

## Identifying the Wireless Network Name (SSID) and WEP Security Settings

Print this form, fill in the configuration parameters and put it in a safe place for possible future reference. For an existing wireless network, the person who set up the network will be able to provide this information.

- **Wireless Network Name (SSID):** The Service Set Identification (SSID) identifies the wireless local area network. Any (First available network) is the default WGM511 wireless network name (SSID). You may customize it using up to 32 alphanumeric characters. Write your customized wireless network name (SSID) on the line below.

**Note:** The SSID in the wireless access point is the SSID you configure in the wireless PC card. For the access point and wireless nodes to communicate with each other, all must be configured with the same SSID.

Wireless network name (SSID): \_\_\_\_\_

- **WEP Security Encryption key:** The default WEP encryption key number is 1, and the default key size is 64 bits.

**Note:** The key number as well as the key value used by all wireless nodes must be the same. If they are different, you will not be able to connect.

WEP Encryption Key Size, circle one: 64 or 128 bits

WEP Encryption Passphrase, if used: \_\_\_\_\_

A Passphrase is used to automatically generate the WEP ASCII characters and hexadecimal numbers for the key. If the wireless network access point uses a Passphrase, you can also use that here. Otherwise, you will have to manually enter the characters and hexadecimal numbers.

WEP ASCII characters and hexadecimal numbers: \_\_\_\_\_

The WEP ASCII characters and hexadecimal numbers are needed if a Passphrase is not used in the wireless network access point, but rather if the key is manually entered.

Use the procedures below to configure basic security settings in the WGM511.

## How to Configure WEP Encryption Security

Follow the steps below to configure WEP Encryption Security.

### 1. Run the WGM511 Smart Wizard Installation Assistant.

- a. Make sure the WGM511 software is installed and the WGM511 is fully inserted in an available CardBus slot in your PC.
- b. Click the WGM511 icon  in the Windows system tray.
- c. Click on the Settings tab to display the view shown above.

### 2. Configure the Security settings.

- a. Select the Use WEP Encryption check box.
- b. Enter the SSID. This is also called the Wireless Network Name.

**Note:** You will not get a wireless network connection unless the network SSID matches exactly what is configured in the access point.

**Tip:** You can click the Networks tab to view a list of the available wireless networks and their SSIDs at your location.

### 3. Save your settings in a Profile.

- a. Type a descriptive name in the “Profiles” field.
- b. Click Save Profile. All the configuration settings are saved in this profile.
- c. Click Apply.
- d. Click Close to exit the Smart Wizard.

**4. Select the WEP encryption strength you will use.**

The choices are:

- 64-bit WEP data encryption
- 128-bit WEP data encryption

**Note:** Larger encryption keys require more processing and may slow the communications response times.

**5. Select Create with Passphrase and enter the passphrase.**

The Smart Wizard will automatically generate the WEP keys.

**Note:** The characters are case sensitive. Be sure to use the same passphrase for all the wireless devices in the network.

If the passphrase method is not available in the other devices, you must manually enter the keys to match exactly what is in the access point and other 802.11b wireless devices.

- 6. The Default Key setting must match what is set in the access point and the other 802.11 wireless devices.**
- 7. Click **Apply** for the changes to take effect.**

# Chapter 6

## Troubleshooting

This chapter provides information about troubleshooting your NETGEAR Pre-N Wireless PC Card WGM511. After each problem description, instructions are given to help you diagnose and solve the problem.

Also, for problems with accessing network resources, the Windows software might not be installed and configured properly on your computers. Please refer to [Appendix C, “Preparing Your PCs for Network Access”](#).

### Troubleshooting Basic Tips

If you have problems connected to your wireless network, try the tips below.

**Table 6-1. Troubleshooting Tips**

Symptom	Cause	Solution
The PC Card LEDs are not lit.	The WGM511 is not inserted into the slot properly or the WGM511 software is not loaded.	Remove and reinsert the WGM511. Check the Windows device manager to see if the PC Card is recognized and enabled. Reload the WGM511 software, if necessary. Try to install the WGM511 in a different slot on your system if one is available.
The Act LED blinks and the WGM511 cannot connect to an access point.	The WGM511 is attempting to connect to an access point, but cannot connect.	The access point may not be powered on. Or, the access point and the PC card are not configured with the same wireless parameters. Check the SSID and WEP settings.
I can connect to an access point, but I cannot connect to other computers on the network or the Internet.	This could be a physical layer problem or a network configuration problem.	Check to make sure that the access point is physically connected to the Ethernet network. Make sure that the IP addresses and the Windows networking parameters are all configured correctly. Restart the cable or DSL modem, router, access point, and notebook PC.



**Note:** As of the date of publication of this manual, the Windows XP HotFix #Q815485 can prevent wireless adapters from connecting to the Internet and prevent wireless adapters from reloading a working configuration after a restart of the computer. To see if HotFix #Q815485 is installed, look in Add Remove Programs from the Windows Control Panel. If installed, remove it. Future updates to the Windows XP operating systems may correct this problem.

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## Frequently Asked Questions

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Use the information below to solve common problems you may encounter. Also, please refer to the knowledge base on the NETGEAR Web site at <http://www.netgear.com/support/main.asp>.

### **Why do I see no more than 54 Mbps on the Configuration Utility status line?**

The WGM511 can operate at 108 Mbps. You are probably connecting to a standard 802.11g network. If you connect to a WGM124 router with Airgo's True MIMO technology, then you will see network speeds up to 108 Mbps.

If you are connecting to an 802.11b network, the maximum 802.11b speed is 11 Mbps.

### **The WGM511 Smart Configuration Utility keeps asking me to save my settings**

This is because you have made changes to the settings and the utility is offering you the chance to save the changes. If you want to avoid these Profile setting prompts, simply click Apply before you close the utility program.

### **Ad hoc mode is not working correctly**

You need to click the Initiate Ad Hoc button on the Settings screen before you click Apply. Here is how you start an ad hoc network:

1. Fill in the Network Name (SSID).
2. Select the Computer-to-Computer (Ad Hoc) Network Type.
3. Click Initiate Ad Hoc.
4. Accept the default settings or make your changes and click OK.
5. Click **Apply**.

**Note:** Be sure all computers in your Ad Hoc network are configured with static IP addresses in the same subnet.

### **How to know if the WGM511 card has received a valid IP address**

The easiest way is find out if the WGM511 card has received a valid IP address from the Wireless Router/AP is to open up the WGM511 utility program and check the IP address in the About page.

### **How to use XP's own Wireless configuration utility**

The NETGEAR WGM511 software is designed so that the user will be asked to choose one of the utility programs during initial software installation. Be sure the WGM511 is connected to the PC and follow these instructions to change your selection.

1. Go to Control Panel and select Network Connections.
2. Right click on the connection and select Properties.
3. Click the Wireless Networks tab.
4. Select or clear the WGM511 "Use Windows to configure my wireless network settings" check box.

### **I cannot connect to the AP that I want from the Networks browser list**

The access point is available and there is good signal strength. There are a few possibilities:

- If the access point (AP) is WPA-PSK protected, you will need to have the correct WPA-PSK Passphrase. Otherwise, the WGM511 will still be connected to the previous access point and you will not be able to change to the WPA-PSK access point.
- If the access point is WEP protected (either 64 or 128 bit encryption), you will be prompted to enter the WEP encryption security information.

### **Why does the New Hardware Wizard appear after installation has completed?**

This happens if the PC Card device is connected to a different slot than the one used during installation. Return the PC Card device to the original PC Card slot.

### **How do the LEDs work?**

If both LEDs are off, then the card is not plugged in or no power is applied to the card. The ACT LED blinks fast when the card is active. When the ACT LED blinks or stays on, and the Link LED is on, the WGM511 is associated or joined with a network.

### **How can I get a PDF copy of the Manual?**

In the Manual HTML page, there is a PDF button image at the top right hand corner of the Web page. Click the PDF icon to bring up a PDF file of the entire manual. You can also Print, Email, or Bookmark pages using the corresponding icons next to the PDF icon.

### **How can I remove the WGM511 software and utility?**

1. Use the “Uninstall NETGEAR WGM511 Smart Wizard” in Start > All Programs > NETGEAR WGM511 Adapter.
2. Click the shortcut called “NETGEAR WGM511 Smart Wizard” on the desktop.
3. Choose “Remove” and click “Next” until finished.
4. The WGM511 uninstaller program is in the Windows Control Panel. To remove the WGM511 software, do the following: Use “Add or Remove Programs” in the Control Panel and remove the “NETGEAR WG51154Mbps Wireless PC Card” entry.

# Appendix A

## Technical Specifications

This appendix provides technical specifications for the NETGEAR Pre-N Wireless PC Card WGM511.

Antennae	3 Integrated internal diversity antennae
Radio Data Rate	1, 2, 5.5, 6, 9, 12, 18, 24, 36, 48, 54, 72, 96, and 108 Mbps (Auto Rate Sensing)
Frequency	2.4GHz to 2.5GHz CCK and OFDM Modulation)
Power Consumption	3.3V DC
Emissions	FCC
Bus interface	Cardbus
Provided drivers	Microsoft Windows 2000, XP
Dimensions	L: 123.12 mm W: 54 mm H: 10 mm
Weight	60 g
Status LED	Wireless Link
Operating Environment	Operating temperature: 0 to 55 degree C
Safety	US: UL1950
Encryption	40-bit (also called 64-bit) and 128-bit WEP data encryption
Warranty	Limited 1-year warranty



# Appendix B

## Wireless Networking Basics

### Wireless Networking Overview

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The WGM511 Pre-N Wireless PC Card conforms to the Institute of Electrical and Electronics Engineers (IEEE) 802.11g standard for wireless LANs (WLANs). On an 802.11 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 802.11g wireless link is 54 Mbps, but it will automatically back down from 54 Mbps when the radio signal is weak or when interference is detected.

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.

## Wireless Channels

IEEE 802.11g/b 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 are listed in [Table 6-2](#):

**Table 6-2. 802.11g 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
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

**Table 6-2. 802.11g Radio Frequency Channels**

Channel	Center Frequency	Frequency Spread
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.

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.

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## WEP Wireless Security

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 two types of authentication methods, Open System and Shared Key. With Open System authentication, a wireless computer can join any network and receive any messages that are not encrypted. With Shared Key authentication, only those computers that possess the correct authentication key can join the network. By default, IEEE 802.11 wireless devices operate in an Open System network. Recently, Wi-Fi, the Wireless Ethernet Compatibility Alliance (<http://www.wi-fi.net>) developed the Wi-Fi Protected Access (WPA), a new strongly enhanced Wi-Fi security. WPA will soon be incorporated into the IEEE 802.11 standard. WEP and WPA are discussed below.

### WEP 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 WGM511:

1. Turn on the wireless station.

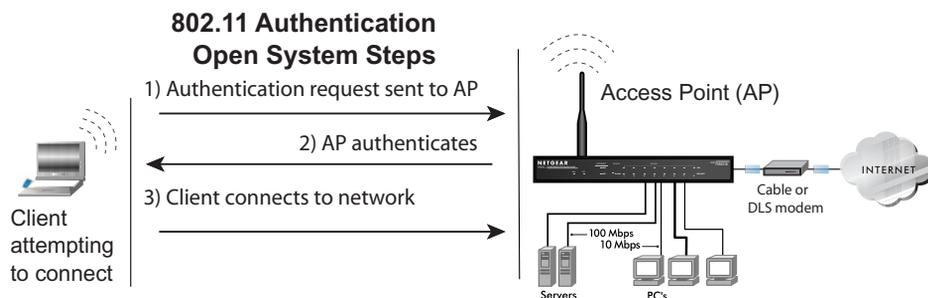
2. The station listens for messages from any access points that are in range.
3. The station finds a message from an access point that has a matching SSID.
4. The station sends an authentication request to the access point.
5. The access point authenticates the station.
6. The station sends an association 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 WEP 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.

## WEP Open System Authentication

This process is illustrated below.



**Figure 6-1: 802.11 open system authentication**

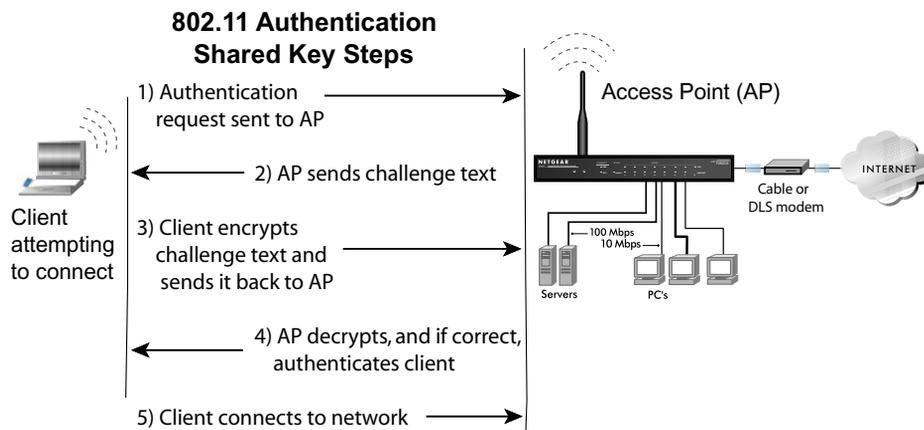
The following steps occur when two devices use Open System Authentication:

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

- The station associates with the access point and joins the network.

## WEP Shared Key Authentication

This process is illustrated below.



**Figure 6-2: 802.11 shared key authentication**

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

- The station sends an authentication request to the access point.
- The access point sends challenge text to the station.
- 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.
- 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.
- The station connects to the network.

If the decrypted text does not match the original challenge text (i.e., 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.

## Key Size and Configuration

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 40-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.

The 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 five 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, 802.11g 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.

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.

Whatever keys you enter for an access point, 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, etc.

**Note:** The access point 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 access point’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.

## How to Use WEP Parameters

Wired Equivalent Privacy (WEP) data encryption is used when the wireless devices are configured to operate in Shared Key authentication mode. There are two shared key methods implemented in most commercially available products, 64-bit and 128-bit WEP data encryption.

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 802.11g device decrypts the data using the same WEP Key. For authentication purposes, the 802.11g 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 802.11 device decrypts the data using the same WEP Key. For authentication purposes, the 802.11 network uses Shared Key Authentication.

**Note:** Some 802.11 access points also support **Use WEP for Authentication Only** (Shared Key Authentication without data encryption). However, the WGM511 does not offer this option.

## WPA Wireless Security

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Wi-Fi Protected Access (WPA) 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 802.11g (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 short comings 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 being defined in the IEEE.

WPA offers the following benefits:

- Enhanced data privacy
- Robust key management

- Data origin authentication
- Data integrity protection

Starting in August of 2003, all new Wi-Fi certified products had to support WPA and all existing Wi-Fi certified products had one year to comply with the new standard or lose their Wi-Fi certification. NETGEAR has implemented WPA on client and access point products. As of August 2004, all Wi-Fi certified products must support WPA.

## 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 don't 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 IEEE 802.11i?

WPA is forward compatible with the IEEE 802.11i security specification currently under development. WPA is a subset of the current 802.11i draft and uses certain pieces of the 802.11i draft that were ready to bring to market in 2003, such as 802.1x and TKIP. The main pieces of the 802.11i draft 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 are either not yet ready for market or will require hardware upgrades to implement.

## What are the Key Features of WPA Security?

The following security features are included in the WPA standard:

- WPA Authentication
- WPA Encryption Key Management
  - Temporal Key Integrity Protocol (TKIP)
  - Michael message integrity code (MIC)
  - AES Support
- Support for a Mixture of WPA and WEP Wireless Clients

These features are discussed below.

WPA 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 (e.g., user names and passwords) and authenticates wireless users before they gain access to the network.

The strength WPA 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 passphrase on both the stations and the access point. This removes 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'll talk more 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. The 802.1X port access control prevents full access to the network until authentication completes. The 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 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 four-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 plain text message to ensure messages are not being spoofed.

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

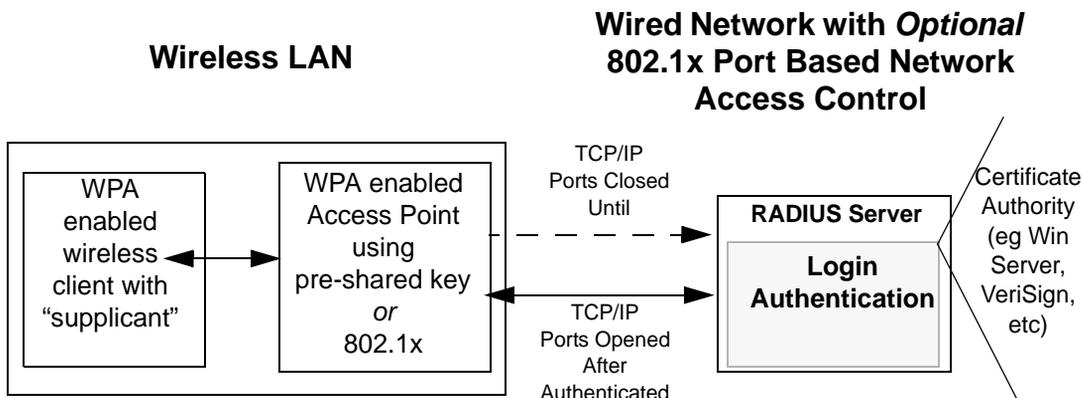


Figure 6-3: WPA Overview

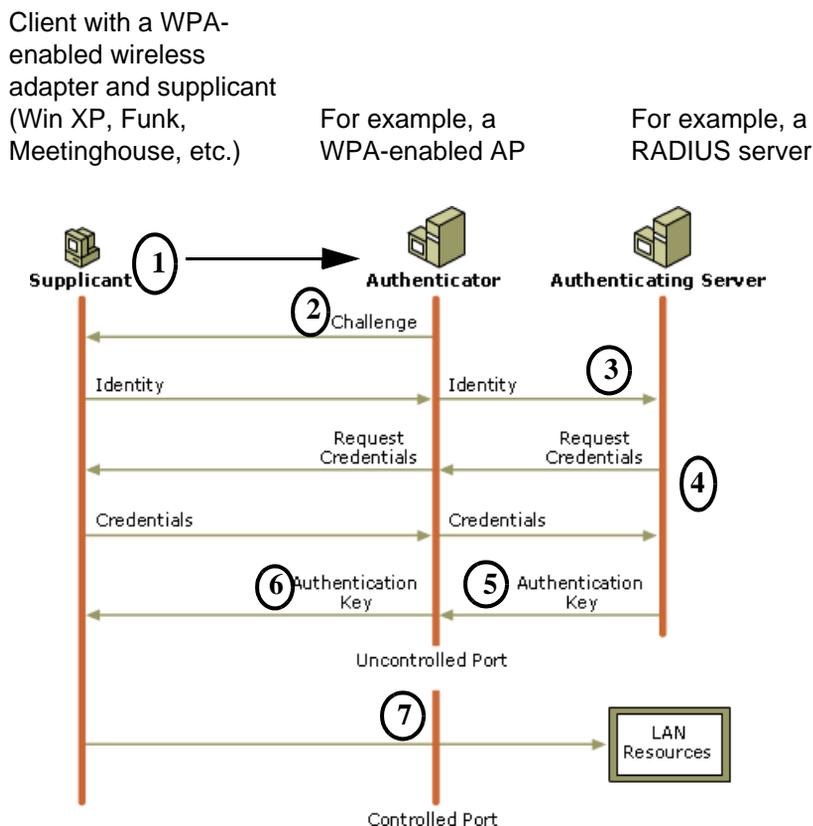
IEEE 802.1x offers an effective framework for authenticating and controlling user traffic to a protected network, as well as providing a vehicle for dynamically varying data encryption keys via EAP from a RADIUS server, for example. This framework enables using a central authentication server, which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

It's important to note that 802.1x doesn't 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 preshared 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 6-4: 802.1x Authentication Sequence**

The access point (AP) sends Beacon Frames with WPA information elements 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 (i.e., client device) attempting to connect with an authenticator (i.e., 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 (e.g., 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 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, 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 code* (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.** One of the encryption methods supported by WPA beside TKIP 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 was a pragmatic compromise that allows organizations to deploy better security while AES capable equipment is being designed, manufactured, and incrementally deployed.

## Is WPA Perfect?

WPA 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) check 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 includes 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 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

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 requires software changes to the following:

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

### Supporting a Mixture of WPA and WEP Wireless Clients

To support the gradual transition of WEP-based wireless networks to WPA, a wireless AP can support both WEP and WPA clients at the same time. During the association, the wireless AP determines which clients use WEP and which clients use WPA. The disadvantage to supporting a mixture of WEP and WPA 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 and non-WPA clients would offer network security that is no better than that obtained with a non-WPA 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 information element**  
To advertise their support of WPA, wireless APs send the beacon frame with a new 802.11 WPA information element that contains the wireless AP's security configuration (encryption algorithms and wireless security configuration information).
- **The WPA two-phase authentication**  
Open system, then 802.1x (EAP with RADIUS or preshared key).
- **TKIP**
- **Michael**
- **AES** (optional)

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

## Changes to Wireless Network Adapters

Wireless network adapters must have their firmware updated to support the following:

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

To upgrade your wireless network adapters to support WPA, obtain a WPA 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 firmware update in the wireless adapter driver. So, to update you Windows wireless client, all you have to do is obtain the new WPA-compatible driver and install the driver. The firmware is automatically updated when the wireless network adapter driver is loaded in Windows.

## Changes to Wireless Client Programs

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

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

# Appendix C

## Preparing Your PCs for Network Access

This appendix describes how to prepare your PCs to connect to the Internet through the NETGEAR Pre-N Wireless PC Card WGM511.

For adding file and print sharing to your network, please consult the Windows help information included with the version of Windows installed on each computer on your network.

### Preparing Your Computers for TCP/IP Networking

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Computers access the Internet using a protocol called TCP/IP (Transmission Control Protocol/Internet Protocol). Each computer on your network must have TCP/IP installed and selected as its networking protocol. If a Network Interface Card (NIC) is already installed in your PC, then TCP/IP is probably already installed as well.

Most operating systems include the software components you need for networking with TCP/IP. Windows 95 or later includes the software components for establishing a TCP/IP network.

In your TCP/IP network, each PC and the wireless access point must be assigned a unique IP addresses. Each PC must also have certain other TCP/IP configuration information such as a subnet mask (netmask), a domain name server (DNS) address, and a default gateway address. In most cases, you should install TCP/IP so that the PC obtains its specific network configuration information automatically from a DHCP server during startup.

### Configuring Windows 98 and Me for TCP/IP Networking

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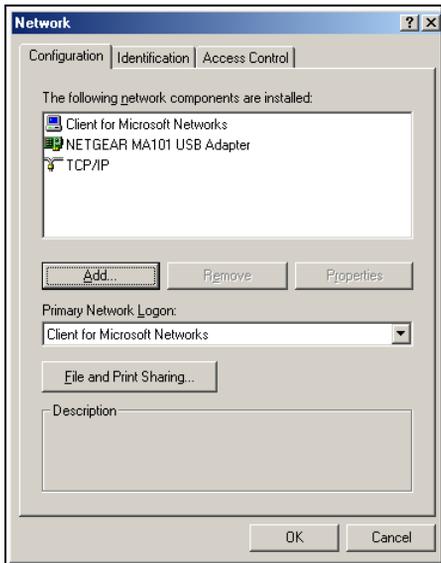
As part of the PC preparation process, you may need to install and configure TCP/IP on your PC. Before starting, locate your Windows CD; you may need to insert it during the TCP/IP installation process.

### Install or Verify Windows Networking Components

To install or verify the necessary components for IP networking:

1. On the Windows taskbar, click the Start button, point to Settings, and then click Control Panel.
2. Double-click the Network icon.

The Network window opens, which displays a list of installed components:



You must have an Ethernet adapter or an WGM511, the TCP/IP protocol, and the Client for Microsoft Networks.



**Note:** It is not necessary to remove any other network components shown in the Network window in order to install the adapter, TCP/IP, or Client for Microsoft Networks.

If you need to add TCP/IP:

- a. Click the Add button.
- b. Select Protocol, and then click Add.
- c. Select Microsoft.
- d. Select TCP/IP, and then click OK.

If you need to add the Client for Microsoft Networks:

- a. Click the Add button.
- b. Select Client, and then click Add.
- c. Select Microsoft.
- d. Select Client for Microsoft Networks, and then click OK.

If you need to add File and Print Sharing for Microsoft Networks:

- a. Click the Add button.
  - b. Select Client, and then click Add.
  - c. Select Microsoft.
  - d. Select File and Print Sharing for Microsoft Networks, and then click OK.
3. Restart your PC for the changes to take effect.

## Enabling DHCP to Automatically Configure TCP/IP Settings in Windows 98 and Me

After the TCP/IP protocol components are installed, each PC must be assigned specific information about itself and resources that are available on its network. The simplest way to configure this information is to allow the PC to obtain the information from a DHCP server in the network.

You will find there are many similarities in the procedures for different Windows systems when using DHCP to configure TCP/IP.

The following steps will walk you through the configuration process for each of these versions of Windows.

**1**

Locate your **Network Neighborhood** icon.

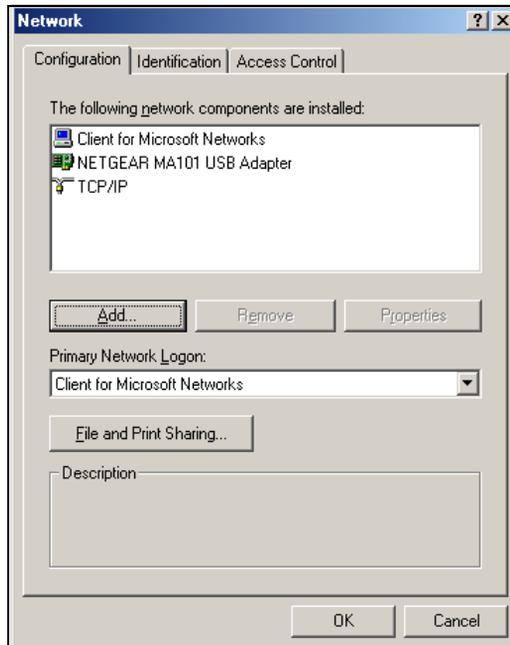
- If the Network Neighborhood icon is on the Windows desktop, position your mouse pointer over it and right-click your mouse button.
- If the icon is not on the desktop,
  - Click **Start** on the task bar located at the bottom left of the window.
  - Choose **Settings**, and then **Control Panel**.
  - Locate the **Network Neighborhood** icon and click on it. This will open the Network panel as shown below.

2

Verify the following settings as shown:

- Client for Microsoft Network exists
- Ethernet adapter is present
- TCP/IP is present
- **Primary Network Logon** is set to Windows logon

Click on the **Properties** button. The following TCP/IP Properties window will display.



3

By default, the **IP Address** tab is open on this window.

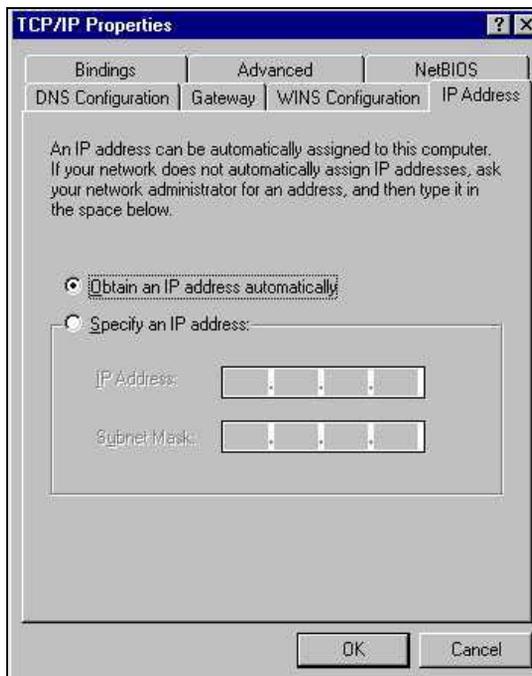
- Verify the following:

**Obtain an IP address automatically** is selected. If not selected, click in the radio button to the left of it to select it. This setting is required to enable the DHCP server to automatically assign an IP address.

- Click **OK** to continue.

Restart the PC.

Repeat these steps for each PC with this version of Windows on your network.



## Selecting Windows' Internet Access Method

1. On the Windows taskbar, click the Start button, point to Settings, and then click Control Panel.
2. Double-click the Internet Options icon.
3. Select "I want to set up my Internet connection manually" or "I want to connect through a Local Area Network" and click Next.
4. Select "I want to connect through a Local Area Network" and click Next.
5. Uncheck all boxes in the LAN Internet Configuration screen and click Next.
6. Proceed to the end of the Wizard.

## Verifying TCP/IP Properties

After your PC is configured and has rebooted, you can check the TCP/IP configuration using the utility *wipcfg.exe*:

1. On the Windows taskbar, click the Start button, and then click Run.

2. Type **winipcfg**, and then click OK.

The IP Configuration window opens, which lists (among other things), your IP address, subnet mask, and default gateway.

3. From the drop-down box, select your Ethernet adapter.

The window is updated to show your settings, which should match the values below if you are using the default TCP/IP settings that NETGEAR recommends for connecting through a router or gateway:

- The IP address is between 192.168.0.2 and 192.168.0.254
- The subnet mask is 255.255.255.0
- The default gateway is 192.168.0.1

## **Configuring Windows 2000 or XP for TCP/IP Networking**

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As part of the PC preparation process, you may need to install and configure TCP/IP on each networked PC. Before starting, locate your Windows CD; you may need to insert it during the TCP/IP installation process.

### **Install or Verify Windows Networking Components**

To install or verify the necessary components for IP networking:

1. On the Windows taskbar, click the Start button, point to Settings, and then click Control Panel.
2. Double-click the Network and Dialup Connections icon.
3. If an Ethernet adapter is present in your PC, you should see an entry for Local Area Connection. Double-click that entry.
4. Select Properties.
5. Verify that 'Client for Microsoft Networks' and 'Internet Protocol (TCP/IP)' are present. If not, select Install and add them.
6. Select 'Internet Protocol (TCP/IP)', click Properties, and verify that "Obtain an IP address automatically is selected.
7. Click OK and close all Network and Dialup Connections windows.
8. Then, restart your PC.

## DHCP Configuration of TCP/IP in Windows XP or 2000

You will find there are many similarities in the procedures for different Windows systems when using DHCP to configure TCP/IP.

The following steps will walk you through the configuration process for each of these versions of Windows.

### DHCP Configuration of TCP/IP in Windows XP

1

Locate your **Network Neighborhood** icon.

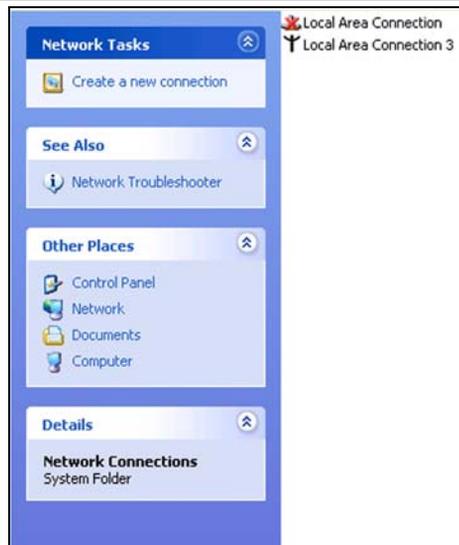
- Select **Control Panel** from the Windows XP Start Menu.
- Select the **Network Connections** icon on the Control Panel. This will take you to the next step.

2

Now the Network Connection window displays.

The Connections List that shows all the network connections set up on the PC, located to the right of the window.

- Right-click on the **Connection with the wireless icon** and choose **Status**.

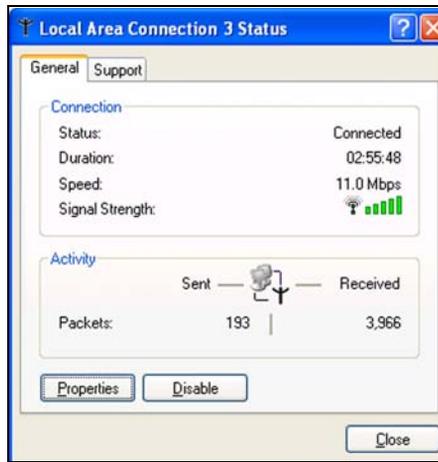


3

Now you should be at the Local Area Network Connection Status window. This box displays the connection status, duration, speed, and activity statistics.

Administrator logon access rights are needed to use this window.

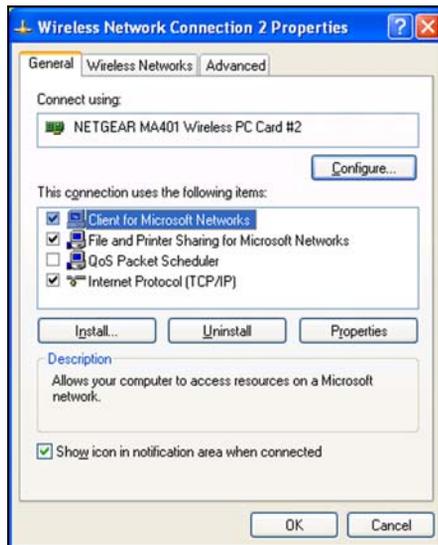
- Click the **Properties** button to view details about the connection.



4

The TCP/IP details are presented on the Support tab page.

- Select **Internet Protocol**, and click **Properties** to view the configuration information.



Verify that **Obtain an IP address**

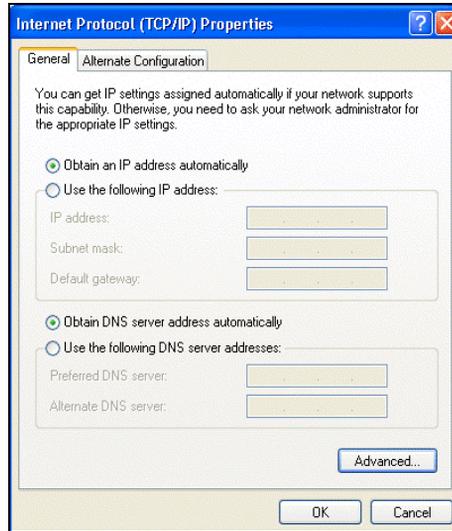
**5**

**automatically** radio button is selected and that the **Obtain DNS server address automatically** radio button is selected.

- Click the **OK** button.

This completes the DHCP configuration in Windows XP.

Repeat these steps for each PC with this version of Windows on your network.



## DHCP Configuration of TCP/IP in Windows 2000

After you install a network card, TCP/IP for Windows 2000 is configured and set to DHCP without your having to configure it. However, if there are problems, following the steps below to configure TCP/IP with DHCP for Windows 2000.

**1**

Click on the **My Network Places** icon on the Windows desktop. This will bring up a window called Network and Dial-up Connections.

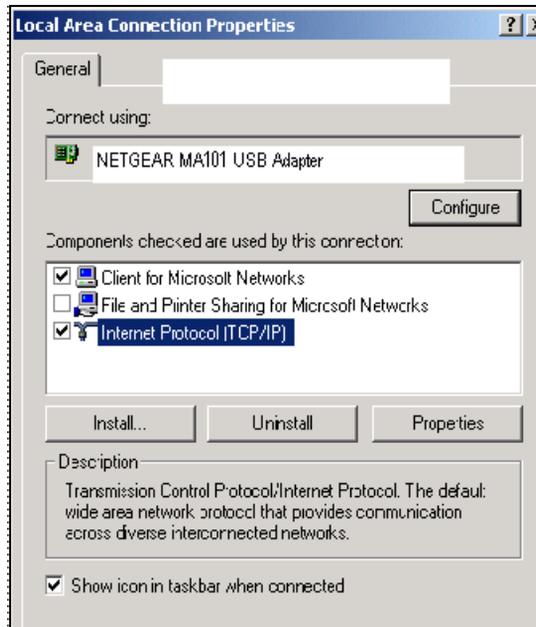
- Right click on **Local Area Connection** and select **Properties**.

2

The **Local Area Connection Properties** dialog box appears. Verify that you have the correct Ethernet card selected in the **Connect using:** box and that the following two items are displayed and selected in the box of “Components checked are used by this connection:”

- Client for Microsoft Networks and
- Internet Protocol (TCP/IP)

Click **OK**.



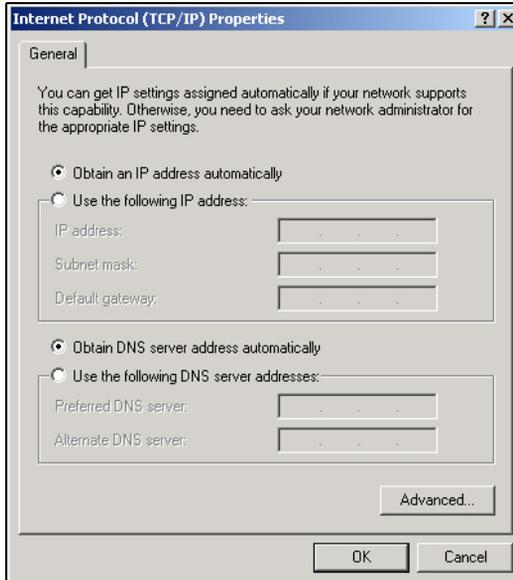
3

With Internet Protocol (TCP/IP) selected, click on **Properties** to open the Internet Protocol (TCP/IP) Properties dialogue box. Verify that

- **Obtain an IP address automatically** is selected.
- **Obtain DNS server address automatically** is selected.

Click **OK** to return to Local Area Connection Properties. Click **OK** again to complete the configuration process.

Restart the PC. Repeat these steps for each PC with this version of Windows on your network.



## Verifying TCP/IP Properties for Windows XP or 2000

To check your PC's TCP/IP configuration:

1. On the Windows taskbar, click the Start button, and then click Run.

The Run window opens.

2. Type `cmd` and then click OK.

A command window opens

3. Type `ipconfig /all`

Your IP Configuration information will be listed, and should match the values below if you are using the default TCP/IP settings that NETGEAR recommends for connecting through a router or gateway:

- The IP address is between 192.168.0.2 and 192.168.0.254
- The subnet mask is 255.255.255.0
- The default gateway is 192.168.0.1

4. Type `exit`



## List of Glossary Terms

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

### **10BASE-T**

IEEE 802.3 specification for 10 Mbps Ethernet over twisted pair wiring.

### **100BASE-Tx**

IEEE 802.3 specification for 100 Mbps Ethernet over twisted pair wiring.

### **802.11b**

IEEE specification for wireless networking at 11 Mbps using direct-sequence spread-spectrum (DSSS) technology and operating in the unlicensed radio spectrum at 2.5GHz.

### **802.11g**

A soon to be ratified IEEE specification for wireless networking at 54 Mbps using direct-sequence spread-spectrum (DSSS) technology and operating in the unlicensed radio spectrum at 2.5GHz. 802.11g is backwards compatible with 802.11b.

### **ADSL**

Short for asymmetric digital subscriber line, a technology that allows data to be sent over existing copper telephone lines at data rates of from 1.5 to 9 Mbps when receiving data (known as the downstream rate) and from 16 to 640 Kbps when sending data (known as the upstream rate).

ADSL requires a special ADSL modem. ADSL is growing in popularity as more areas around the world gain access.

### **DHCP**

An Ethernet protocol specifying how a centralized DHCP server can assign network configuration information to multiple DHCP clients. The assigned information includes IP addresses, DNS addresses, and gateway (router) addresses.

### **DNS**

Short for Domain Name System (or Service), an Internet service that translates domain names into IP addresses.

Because domain names are alphabetic, they're easier to remember. The Internet however, is really based on IP addresses. Every time you use a domain name, therefore, a DNS service must translate the name into the corresponding IP address. For example, the domain name `www.example.com` might translate to

198.105.232.4. The DNS system is, in fact, its own network. If one DNS server doesn't know how to translate a particular domain name, it asks another one, and so on, until the correct IP address is returned.

### **Domain Name**

A descriptive name for an address or group of addresses on the Internet. Domain names are of the form of a registered entity name plus one of a number of predefined top level suffixes such as .com, .edu, .uk, etc. For example, in the address mail.NETGEAR.com, mail is a server name and NETGEAR.com is the domain.

### **DSL**

Short for digital subscriber line, but is commonly used in reference to the asymmetric version of this technology (ADSL) that allows data to be sent over existing copper telephone lines at data rates of from 1.5 to 9 Mbps when receiving data (known as the downstream rate) and from 16 to 640 Kbps when sending data (known as the upstream rate).

ADSL requires a special ADSL modem. ADSL is growing in popularity as more areas around the world gain access.

### **Dynamic Host Configuration Protocol**

DHCP. An Ethernet protocol specifying how a centralized DHCP server can assign network configuration information to multiple DHCP clients. The assigned information includes IP addresses, DNS addresses, and gateway (router) addresses.

### **ESSID**

The Extended Service Set Identification (ESSID) is a thirty-two character (maximum) alphanumeric key identifying the wireless local area network.

### **Gateway**

A local device, usually a router, that connects hosts on a local network to other networks.

### **IETF**

Internet Engineering Task Force. Working groups of the IETF propose standard protocols and procedures for the Internet, which are published as RFCs (Request for Comment) at [www.ietf.org](http://www.ietf.org).

An open international community of network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet.

### **IP**

Internet Protocol is the main internetworking protocol used in the Internet. Used in conjunction with the Transfer Control Protocol (TCP) to form TCP/IP.

### **IP Address**

A four-byte number uniquely defining each host on the Internet, usually written in dotted-decimal notation with periods separating the bytes (for example, 134.177.244.57).

Ranges of addresses are assigned by Internic, an organization formed for this purpose.

**IPX**

Short for Internetwork Packet Exchange, a networking protocol used by the Novell NetWare operating systems.

Like UDP/IP, IPX is a datagram protocol used for connectionless communications. Higher-level protocols, such as SPX and NCP, are used for additional error recovery services.

**ISP**

Internet service provider.

**Internet Protocol**

The main internetworking protocol used in the Internet. Used in conjunction with the Transfer Control Protocol (TCP) to form TCP/IP.

**LAN**

A communications network serving users within a limited area, such as one floor of a building.

**local area network**

LAN. A communications network serving users within a limited area, such as one floor of a building. A LAN typically connects multiple personal computers and shared network devices such as storage and printers. Although many technologies exist to implement a LAN, Ethernet is the most common for connecting personal computers.

**MAC address**

The Media Access Control address is a unique 48-bit hardware address assigned to every network interface card. Usually written in the form 01:23:45:67:89:ab.

**Mbps**

Megabits per second.

**NetBIOS**

The Network Basic Input Output System is an application programming interface (API) for sharing services and information on local-area networks (LANs).

Provides for communication between stations of a network where each station is given a name. These names are alphanumeric names, up to 16 characters in length.

**Network Address Translation**

NAT. A technique by which several hosts share a single IP address for access to the Internet.

**NIC**

Network Interface Card. An adapter in a computer which provides connectivity to a network.

**packet**

A block of information sent over a network. A packet typically contains a source and destination network address, some protocol and length information, a block of data, and a checksum.

**router**

A device that forwards data between networks. An IP router forwards data based on IP source and destination addresses.

**Routing Information Protocol**

RIP. A protocol in which routers periodically exchange information with one another so that they can determine minimum distance paths between sources and destinations.

**SSID**

A Service Set Identification is a thirty-two character (maximum) alphanumeric key identifying a wireless local area network. For the wireless devices in a network to communicate with each other, all devices must be configured with the same SSID.

This is typically the configuration parameter for a wireless PC card. It corresponds to the ESSID in the wireless Access Point and to the wireless network name. *See also* Wireless Network Name and ESSID.

**Subnet Mask**

A mask used to determine what subnet an IP address belongs to. Subnetting enables a network administrator to further divide an IP address into two or more subnets.

**TCP/IP**

The main internetworking protocols used in the Internet. The Internet Protocol (IP) used in conjunction with the Transfer Control Protocol (TCP) form TCP/IP.

**WAN**

A long distance link used to extend or connect remotely located local area networks. The Internet is a large WAN.

**WEB Proxy Server**

A Web proxy server is a specialized HTTP server that allows clients access to the Internet from behind a firewall.

The proxy server listens for requests from clients within the firewall and forwards these requests to remote Internet servers outside the firewall. The proxy server reads responses from the external servers and then sends them to internal client clients.

**WEP**

Wired Equivalent Privacy is a data encryption protocol for 802.11b wireless networks.

All wireless nodes and access points on the network are configured with a 64-bit or 128-bit Shared Key for data encryption.

**wide area network**

WAN. A long distance link used to extend or connect remotely located local area networks. The Internet is a large WAN.

**Wi-Fi**

A trade name for the 802.11b wireless networking standard, given by the Wireless Ethernet Compatibility Alliance (WECA, see <http://www.wi-fi.net>), an industry standards group promoting interoperability among 802.11b devices.

**Windows Internet Naming Service**

WINS. Windows Internet Naming Service is a server process for resolving Windows-based computer names to IP addresses.

If a remote network contains a WINS server, your Windows PCs can gather information from that WINS server about its local hosts. This allows your PCs to browse that remote network using the Windows Network Neighborhood feature.

**WINS**

WINS. Windows Internet Naming Service is a server process for resolving Windows-based computer names to IP addresses.

**Wireless Network Name (SSID)**

Wireless Network Name (SSID) is the name assigned to a wireless network. This is the same as the SSID or ESSID configuration parameter.



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