Instant Wireless® Series

Wireless Access Point Router with 4-Port Switch

Use this guide to install: **BEFW11S4**

User Guide

LINKSYS®

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• Reorient or relocate the receiving antenna
• Increase the separation between the equipment or devices
• Connect the equipment to an outlet other than the receiver's
• Consult a dealer or an experienced radio/TV technician for assistance

FCC Caution: Any changes or modifications nor expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

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This device and its antenna(s) must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users must be provided with specific operations for satisfying RF exposure compliance.

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ETS 301489-17, 301 489-1 General EMC requirements for Radio equipment.
EN 609 50 Safety
ETS 300-328-2 Technical requirements for Radio equipment.

Note: This equipment is intended to be used in all EU and EFTA countries. Outdoor use may be restricted to certain frequencies and/or may require a license for operation. For more details, contact Linksys Corporate Compliance.

Note: Combinations of power levels and antennas resulting in a radiated power level of above 100 mW are considered as not compliant with the above mentioned directive and are not allowed for use within the European community and countries that have adopted the European R&TTE directive 1999/5/EC and/or the CEPT recommendation Rec 70.03. For more details on legal combinations of power levels and antennas, contact Linksys Corporate Compliance.

- Linksys Group vakuuttaa täten että Instant Wireless Wireless Access Point Router with 4-Port Switch tyyppinen laite on direktiivin 1999/5/EY, direktiivin 89/336/EEC ja direktiivin 73/23/EEC oleellisten vaatimusten ja sitä koskevien näiden direktiivien muiden ehtojen mukainen.
- Linksys Group déclare que le routeur de point d'accès sans fil avec commutateur 4 ports est conforme aux conditions essentielles et aux dispositions relatives à la directive 1999/5/EC, la directive 89/336/EEC, et à la directive 73/23/EEC.
- Belgique B L'utilisation en extérieur est autorisé sur le canal 11 (2462 MHz), 12 (2467 MHz), et 13 (2472 MHz). Dans le cas d'une utilisation privée, à l'extérieur d'un bâtiment, au-dessus d'un espace public, aucun enregistrement n'est nécessaire pour une distance de moins de 300m. Pour une distance supérieure à 300m un enregistrement auprès de l'IBPT est requise. Pour une utilisation publique à l'extérieur de bâtiments, une licence de l'IBPT est requise. Pour les enregistrements et licences, veuillez contacter l'IBPT.
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- France F: Restricted frequency band: only channels 10, 11, 12, 13 (2457, 2462, 2467, and 2472 MHz respectively) may be used in France. License required for every indoor and outdoor installations. Please contact ART for procedure to follow.
- Deutschland D: Anmeldung im Outdoor-Bereich notwending, aber nicht genehmigungspflichtig. Bitte mit Händler die Vorgehensweise abstimmen.
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- Italia I: E' necessaria la concessione ministeriale anche per l'uso interno. Verificare con i rivenditori la procedura da seguire. L'uso per installazione in esterni non e' permessa.
- Italy I: License required for indoor use. Use with outdoor installations not allowed.
- the Netherlands NL License required for outdoor installations. Check with reseller for procedure to follow.
- Nederlands NL Licentie verplicht voor gebruik met buitenantennes. Neem contact op met verkoper voor juiste procedure.

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Chapter 1: Introduction

The Linksys Wireless Access Point Router with 4-Port Switch

Congratulations on your purchase of a Wireless Access Point Router with 4-Port Switch. The Wireless Access Point Router with 4-Port Switch provides the ideal solution for connecting your wireless network to a high-speed broadband Internet connection and a 10/100 Fast Ethernet backbone. Configurable as a DHCP server for your existing network, the Wireless Access Point Router with 4-Port Switch acts as the only externally recognized Internet gateway on your local area network (LAN) and serves as an Internet NAT firewall against unwanted outside intruders. The Wireless Access Point Router with 4-Port Switch can also be configured to filter internal users' access to the Internet.

A typical router relies on a hub or a switch to share its Internet connection, but the Linksys Wireless Access Point Router with 4-Port Switch channels this connection through the blazing, full duplex speed of its built-in EtherFast® 10/100 4-Port Switch. This cutting-edge combination of wireless router and switch technology eliminates the need to buy an additional hub or switch and extends the range of your wireless network. Now your entire wireless network can enjoy blazing broadband Internet connections supported by its robust switched backbone. With the dual-function speed and power of the Wireless Access Point Router with 4-Port Switch, your network will take off at speeds faster than you ever imagined possible.

Features

- Supports Universal Plug-and-Play for easy configuration
- Capable of up to 128-bit WEP Encryption
- Supports enhanced security using NAT firewall
- Access your network remotely over the Internet through Virtual Private Networking (VPN)
- Supports IPSec and PPTP Pass-Through
- Administer and upgrade the Router remotely over the Internet
- Configurable as a DHCP Server on your network
- Advanced security management functions for Port Filtering, MAC Address Filtering, and DMZ Hosting
- Includes one Ethernet Cable to Connect to a Cable or DSL modem

Minimum Requirements

- One Windows 98 SE, Millennium, 2000, or XP PC equipped with:
  - TCP/IP Protocol,
  - Internet Explorer 4.0 or Netscape Navigator 4.7 for web-based configuration,
  - a CD-ROM Drive, and
  - an Ethernet Adapter with a UTP CAT 5 Network Cable
- Cable or DSL Modem with Ethernet Connection and Internet Access

An Introduction to LANs and WANs

Simply put, a router is a network device that connects two networks together.

In this instance, the Router connects your Local Area Network (LAN), or the group of PCs in your home or office, to the Wide Area Network (WAN) that is the Internet. The Router processes and regulates the data that travels between these two networks.

Think of the Router as a network device with two sides. The first side is made up of your private Local Area Network (LAN) of PCs. The other, public side is the Internet, or the Wide Area Network (WAN), outside of your home or office.

The Router's firewall (NAT) protects your network of PCs so users on the public, Internet side cannot "see" your PCs. This is how your LAN, or network, remains private. The Router protects your network by inspecting the first packet coming in from the WAN port before delivery to the final destination on the LAN port. The Router inspects Internet port services like the web server, ftp server, or other Internet applications, and, if allowed, it will forward the packet to the appropriate PC on the LAN side.

IP Addresses

What's an IP Address?

IP stands for Internet Protocol. Every device on an IP-based network, including PCs, print servers, and routers, requires an IP address to identify its "location," or address, on the network. This applies to both the WAN and LAN connections.

There are two ways of assigning an IP address to your network devices.

Static IP Addresses

A static IP address is a fixed IP address that you assign manually to a PC or other device on the network. Since a static IP address remains valid until you disable it, static IP addressing insures that the device assigned it will have that same IP address until you change it. Static IP addresses are commonly used with network devices such as server PCs or print servers.

If you use the Router to share your cable or DSL Internet connection, contact your ISP to find out if they have assigned a static IP address to your account. If so, you will need that static IP address when configuring the Router. You can get the information from your ISP.

Note: Since the Router is a device that connects two networks, it needs two IP addresses—one for the LAN side, and one for the WAN side. In this User Guide, you'll see references to the "WAN IP address" and the "LAN IP address."

Since the Router has firewall security (NAT), only the Router's WAN IP address can be seen from the Internet.

However, even the WAN IP address can be blocked, so that the Router and network seem invisible to the Internet—This is shown in the Filters section in "Chapter 5: Using the Routers Web-Based Utility".

Dynamic IP Addresses

A dynamic IP address is automatically assigned to a device on the network, such as PCs and print servers. These IP addresses are called "dynamic" because they are only *temporarily* assigned to the PC or device. After a certain time period, they expire and may change. If a PC logs on to the network (or the Internet) and its dynamic IP address has expired, the DHCP server will assign it a new dynamic IP address.

For DSL users, many ISPs may require you to log on with a user name and password to gain access to the Internet. This is called "Point to Point Protocol over Ethernet" or PPPoE. PPPoE is similar to a dial-up connection but does not have a phone number to dial into, and PPPoE is a dedicated high-speed connection. PPPoE also will provide the Router with a dynamic IP address to establish a connection to the Internet.

DHCP (Dynamic Host Configuration Protocol) Servers

DHCP frees you from having to assign IP addresses manually every time a new user is added to your network. PCs and other network devices using dynamic IP addressing are assigned a new IP address by a DHCP server. The PC or network device obtaining an IP address is called the DHCP client. The Router's WAN port is, by default, set as a DHCP client.

DHCP servers can either be a designated PC on the network or another network device, such as the Router. By default, a DHCP server is enabled on your Router's LAN ports. If you already have a DHCP server running on your network, you *must* disable one of the two DHCP servers. If you run more than one DHCP server on your network, you will experience network errors, such as conflicting IP addresses. To disable the Router's DHCP function, see the DHCP section in Chapter 3: Configuring the Router.

Note: Even if you assign a static IP address to a PC, other PCs can still use DHCP's dynamic IP addressing, as long as the static IP is not within the DHCP range of the LAN IP Address.

If the Router's DHCP function fails to provide a dynamic IP address for any reason, please refer to Appendix A: Troubleshooting.

The Wireless Access Point Router's Ports

Figure 1-1

The Router's rear panel (as shown in Figure 1-1) is where all of its connections are made.

WAN The WAN (Wide Area Network) Port is where you will connect your cable or DSL modem with an Ethernet cable. *Your modem connection will not work from any other port.*

Ports 1-4 These four LAN (Local Area Network) ports are where you will connect networked devices, such as PCs, print servers, and any other Ethernet devices you want to put on your network. If Port 4 is being used, the Uplink Port will not work.

Uplink The Uplink Port is where you can expand your network by connecting to another switch or hub. Uplinking to another switch or a hub is done by simply running a cable from the Uplink Port to the other device. The Uplink Port is shared with Port 4. If the Uplink port is being used, Port 4 will not work.

Power The Power Port is where you will connect the included AC Power adapter.

Antenna Jacks The Antenna Jacks are where the included antennas are connected.

The Reset Button

Pressing the Reset Button and holding it in for a few seconds will clear all of the Router's data and restore the factory defaults. This should be done only if you are experiencing heavy routing problems, and only after you have exhausted all of the other troubleshooting options. By resetting the Router, you run the risk of creating conflicts between your PCs' actual IP Addresses and what the Router thinks their IP Addresses should be. You may be forced to reboot each network PC.

If the Router locks up, simply press the reset button or power it down for three to five seconds by removing the power cable from the Router's Power Port. Leaving the power off for too long could result in the loss of network connections.

The Wireless Access Point Router's LEDs

Figure 1-2

The LAN Indicators

WLAN Act *Green*. This LED indicates wireless activity.

WLAN Link *Green*. This LED indicates that the Router's wireless functions have been enabled through the Web-based utility.

Power *Green*. This LED indicates that the Router's power is on.

Link/Act *Green*. This LED serves two purposes. When this LED is lit continuously, this indicates that the Router is connected to a device through the corresponding port (1, 2, 3, or 4). A blinking LED indicates that the Router is actively sending or receiving data over that port. When the Uplink Port is in use, the LED for Port 4 will be lit continuously.

Full/Col — *Green*. This LED also serves two purposes. When this LED is lit continuously, the connection made through the corresponding port is running in Full Duplex mode. A blinking LED indicates that the connection is experiencing collisions. Infrequent collisions are normal. If this LED blinks too often, there may be a problem with your connection. Refer to the Troubleshooting Appendix if you think there is a problem.

100 — *Orange*. This LED indicates when a successful 100Mbps connection is made through the corresponding port.

The WAN Indicators

Link — *Green*. This LED indicates a connection between the Router and your broadband device or network.

Act — *Green*. This LED blinks when the Router is sending or receiving data over the broadband (WAN) port.

Diag — *Red*. This LED indicates the Router's self-diagnosis mode during boot-up and restart. It will turn off upon completing the diagnosis. If this LED stays on for an abnormally long period of time, refer to the Troubleshooting Appendix.

Chapter 2: Connecting the Router

Before You Start

Before plugging everything together, it's always a good idea to have everything you'll need to get the Router up and running. Depending upon how you configure the Router in Chapter 4: Configuring the Router, you may need some of the following values from your ISP:

When connecting through a Static IP connection, be sure to have 1) Your broadband-configured PC's fixed Internet IP Address, 2) Your broadband-configured PC's Computer Name and Workgroup Name, 3) Your Subnet Mask, 4) Your Default Gateway, and 5) Your Primary DNS IP address.

When connecting through a PPPoE connection, be sure to have 1) Your PPPoE User Name and 2) Your PPPoE Password.

The installation technician from your ISP should have left this information with you after installing your broadband connection. If not, you can call your ISP to request the data.

Once you have the above values, you can begin the Router's installation and setup.

Connecting Your Hardware Together and Booting Up

Once you are sure that you have the above values on hand, you can begin the Installation and Setup of the Router.

1. Power everything down, including your PCs, your cable or DSL modem and the Router.

2. Connect an Ethernet cable from one of your PC's Ethernet ports to one of the Router's LAN ports (as shown in Figure 2-1). Do the same with all the PCs you wish to connect to the Router. (LAN Port 4 will become inactive if you use the Uplink port.)

Figure 2-1

In addition to accessing the Router through an Ethernet connection, a wireless connection can be used to access the Router. See the "For Wireless Connections" section that follows these connection instructions.

3. Connect another Ethernet cable from your cable or DSL modem to the Router's **WAN** port (as shown in Figure 2-2).

Figure 2-2

4. Connect the Power Adapter (included) to the Router's Power port (as shown in Figure 2-3) and plug the other end into a power outlet.

   - The Power LED will illuminate green as soon as the power adapter is connected.
   - The Diag LED will illuminate red for a few seconds while the Router goes through its internal diagnostic test. The LED will turn off when the self-test is complete.

Figure 2-3

5. Power on the cable or DSL modem. Verify that the power is on by checking the **Link** LED in the WAN column on the front of the Router. The Link LED will be illuminated if the power is on and the modem is ready.

6. Press the Reset button on the back of the Router. Hold the button in for three seconds, or until the Diag LED illuminates red. This restores the Router's default settings.

7. Power on your PC.

The Router is now connected. Continue to the next chapter to configure your PCs.

For Wireless Connections: In addition to accessing the Router through an Ethernet connection, a wireless connection can be used to access the Router. After powering on the Router and connecting it to your modem, enter the Router's IP Address in the Address field of your wireless PC's web-browser as follows: **http://192.168.1.1** and press **Enter**.

Important: *The Wireless Access Point Router with 4-Port Switch is configured by default to work out of the box with all Linksys Wireless Adapters. If you have changed the defaults on your Linksys Wireless Adapters, or are using other wireless adapters, you must temporarily change your wireless adapter settings to: (SSID = linksys) in order to initially access the Router wirelessly. After you have accessed the Router with the default settings, you can change the router settings to coincide with your Network settings and reset your adapters.*

Important: *Some ISPs—most notably some cable providers—configure their networks so that you do not have to enter a full Internet address into your web browser or e-mail application to reach your home page or receive your e-mail. If your Internet home page address is something very simple, such as "www", rather than "www.linksys.com", or your e-mail server's address is something similar to "e-mail" or "pop3", rather than "pop.mail.linksys.com", you won't be able to properly configure the Router until you determine the actual Internet addresses of your Web and e-mail connections.*

*You **must** obtain this information prior to connecting the Router to your network. You can obtain this information by contacting your ISP.*

Chapter 3: Configuring the PCs

Overview

These instructions will help you configure each of your computers to communicate with the Router.

To do this, you will need to configure your PC's network settings to obtain an IP (or TCP/IP) address automatically. Computers use IP addresses to communicate with each other across a network or the Internet.

You will need to know which operating system your computer is running, such as Windows 95, 98, Millennium, 2000, or XP. You can find out by clicking the **Start** button and then selecting the **Settings** option. (If your Start menu doesn't have a Settings option, you're running Windows XP. You can select the Control Panel directly from the Start Menu.) Then, click **Control Panel** and double-click the **System** icon. Click the **Cancel** button when done.

Once you know which Windows operating system you are running, follow the directions in this step for your computer's operating system. If you PC is not configured with the TCP/IP protocol, you will need to do this for each computer you are connecting to the Router.

The next few pages tell you, step by step, how to configure your TCP/IP settings based on the type of Windows operating system you are using. Once you've configured your computers, continue to Chapter 4: Configuring the Router.

Configuring Windows 95, 98, and Millennium PCs

1. Click the **Start** button, click **Settings** and open the **Control Panel**. From there, double-click the **Network** icon to open the Network screen.

2. Select the Configuration tab and highlight the **TCP/IP line** for the applicable Ethernet adapter (as shown in Figure 3-1). If the word **TCP/IP** appears by itself, select that line. (Note: If there is no TCP/IP line listed, refer to your Ethernet adapter's documentation to install TCP/IP now.) Then, click the **Properties** button.

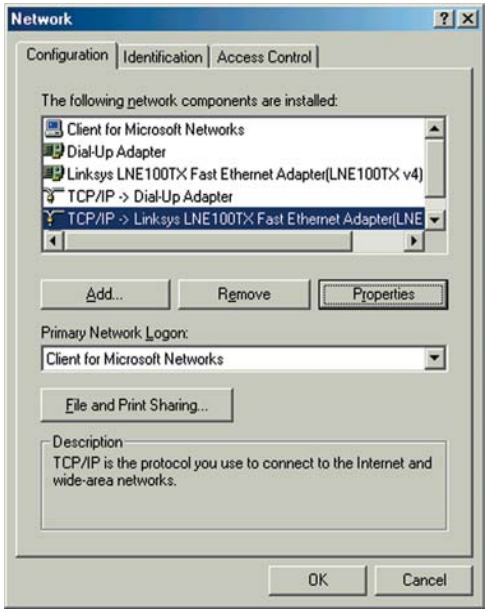

Figure 3-1

3. Click the **IP Address** tab and select **Obtain an IP address automatically** (as shown in figure 3-2).

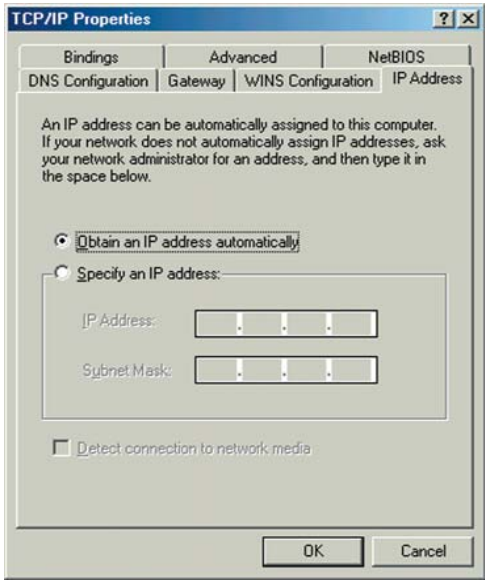

Figure 3-2

4. Click the **Gateway** tab and verify that the Installed Gateway field is blank. Click the **OK** button.

5. Click the **OK** button again. Windows may ask you for the original Windows installation disk or additional files. Supply them by pointing to the correct file location, e.g., D:\win98, D:\win9x, c:\windows\options\cabs, etc. (This assumes that "D" is the letter of your CD-ROM drive).

6. If Windows asks you to restart your PC, click the **Yes** button. If Windows does not ask you to restart, restart your computer anyway.

Repeat steps 1-6 for each PC on your network. When all of your PCs are configured, proceed to Chapter 4: Configuring the Router.

Configuring Windows 2000 PCs

1. Click the **Start** button, click **Settings** and open the **Control Panel**. From there, double-click the **Network and Dial-up Connections** icon. This will display the Network screen.

2. Select the **Local Area Connection** icon for the applicable Ethernet adapter (usually it is the first Local Area Connection listed).

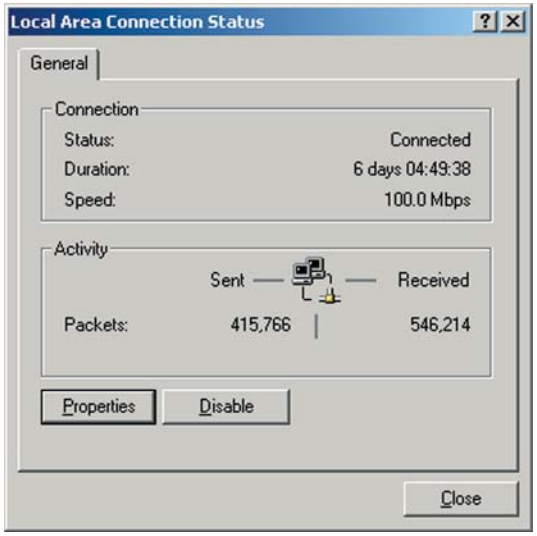

Figure 3-3

3. When the Local Area Connection Status screen appears, click the **Properties** button. (See Figure 3-3.)

4. Select **Internet Protocol (TCP/IP)** (as shown in Figure 3-4) and click the **Properties** button.

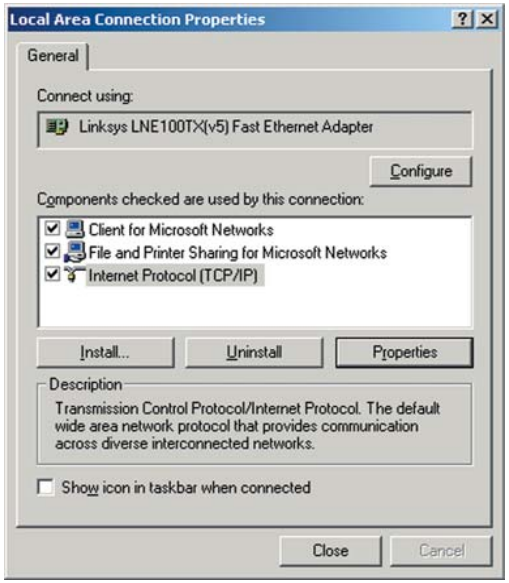

Figure 3-4

5. Select **Obtain an IP address automatically** and verify that **Obtain DNS server address automatically** is selected (as shown in Figure 3-5). Then, click the **OK** button and click the **OK** button on the subsequent screens to complete the PC's configuration.

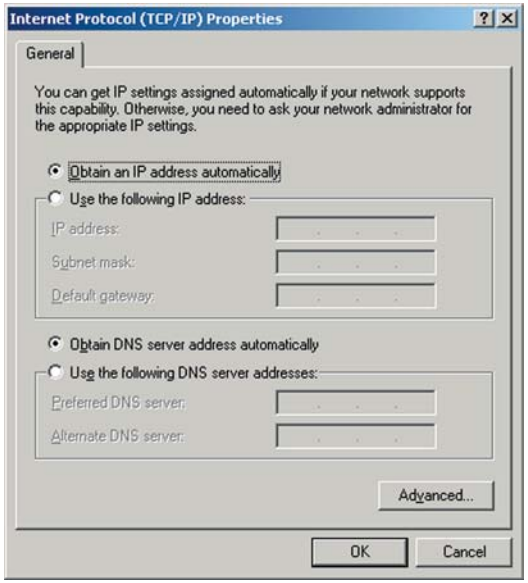

Figure 3-5

Repeat steps 1-5 for each PC on your network. When all of your PCs are configured, proceed to Chapter 4: Configuring the Router.

Configuring Windows XP PCs

The following instructions assume you are running Windows XP's default interface. If you are using the Classic interface (where the icons and menus look like previous Windows versions), please follow the instructions for Windows 2000.

1. Click the **Start** button, open the **Control Panel**. and click the **Network and Internet Connections** icon. Then, click the **Network Connections** icon to display the Network screen.

2. Select the **Local Area Connection** icon for the applicable Ethernet adapter (usually it is the first Local Area Connection listed).

Figure 3-6

3. When the Local Area Connection Status screen appears, click the **Properties** button. (See Figure 3-6.)

4. Select **Internet Protocol (TCP/IP)** (as shown in Figure 3-7) and click the **Properties** button.

Figure 3-7

5. Select **Obtain an IP address automatically** and verify that **Obtain DNS server address automatically** is selected (as shown in Figure 3-8). Then, click the **OK** button and click the **OK** button on the subsequent screens to complete the PC's configuration.

Figure 3-8

Repeat steps 1-5 for each PC on your network. When all of your PCs are configured, proceed to Chapter 4: Configuring the Router.

Chapter 4: Configuring the Router

Note: Linksys recommends using the Setup Wizard CD for first time installation of the Router and for setting up additional computers. For additional assistance, follow the steps in this chapter.

This chapter will show you how to configure the Router to function in your network and gain access to the Internet through your Internet Service Provider (ISP). Detailed description of the Router's Web-based Utility can be found in the Chapter 5: Using the Router's Web-Based Utility. Your ISP may require the use of a Host Name and Domain Name. Further, you will set the WAN Configuration Type on the Router's Setup tab from the information given by your ISP. *You will need this setup information from your ISP.* If you do not have this information, please contact your ISP before proceeding.

The instructions from your ISP tell you how to set up your PC for Internet access. Since you are now using the Router to share Internet access among several computers, you will use this setup information for Router configuration.

1. Open your web browser, and enter **192.168.1.1** into the web browser's Address field, as shown in Figure 4-1. Then, press the **Enter** key.

Figure 4-1

2. An Enter Network Password window, shown in Figure 4-2a, will appear. (Windows XP users will see a Connect to 192.168.1.1 window, shown in Figure 4-2b.) Leave the User Name field empty, and enter **admin** (the default password) in lowercase letters in the Password field. Then, click the **OK** button.

Figure 4-2a

Figure 4-2b

3. If required by your ISP, enter the Router's **Host Name** and **Domain Name** in the appropriate fields on the Setup tab. (This is usually required by cable ISPs.)

4. To configure the Router for your wireless network, verify that the Setup tab's Wireless fields (shown in Figure 4-3) are completed as follows:

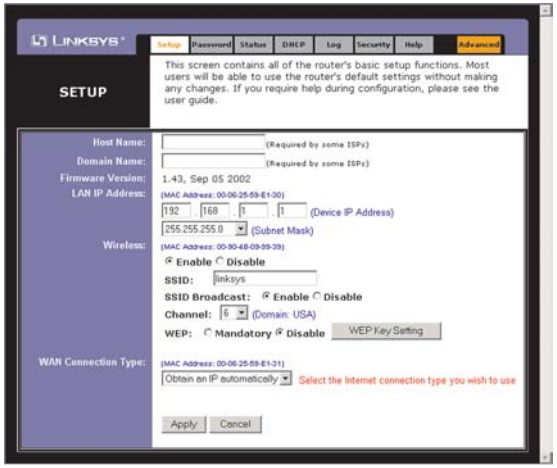

Figure 4-3

Enable/Disable: Selecting the **Enable** radio button will enable the Router's wireless feature. Wireless functions will not be available unless enabled.

SSID: The SSID is a unique name for your wireless network. It is case sensitive and must not exceed 32 characters. The default SSID is "linksys " but you should change this to a personal wireless network name. All wireless points in your network must use the same SSID.

SSID Broadcast - Allows the SSID to be broadcast on your network. You may want to enable this function while configuring the Router, but make sure that you disable it when you are finished. With this enabled, someone could easily obtain the SSID information with site survey software and gain unauthorized access to your network. Click **Enable** to broadcast. Click **Disable** to increase network security and prevent the SSID from being seen on networked PCs**.**

Channel: Select the appropriate channel for your network from the list provided. All wireless points in your network must use the same channel in order to function properly.

Do not *change the WEP setting from the default, "Disabled", without first referring to the Wireless Security sections of the User Guide or Setup Wizard CD-ROM for advanced features and settings.*

5. The Router supports five connection types: DHCP (obtain an IP automatically), PPPoE, Static IP Address, RAS, and PPTP. These types are selected from the drop-down menu beside **WAN Connection Type**. The Setup tab and available features will differ depending on what kind of connection type you select, the instructions for which are included here:

Obtain an IP Automatically

If your ISP says that you are connecting through a dynamic IP address (or DHCP), perform these steps:

a. Select **Obtain an IP automatically** as the WAN Connection Type (as previously shown in Figure 4-3).

b. Click the **Apply** button to save the settings.

Static IP

If your ISP says that you are connecting through a static (or fixed) IP address, perform these steps (as shown in Figure 4-4):

a. Select **Static IP** as the WAN Connection Type.

b. In the fields beside "Specify WAN IP Address", enter the **IP Address**.

c. Enter the **Subnet Mask**.

d. Enter the **Default Gateway Address**.

e. Enter the **DNS** in the 1, 2, and/or 3 fields. You must enter at least one DNS address.

f. Click the **Apply** button to save the settings.

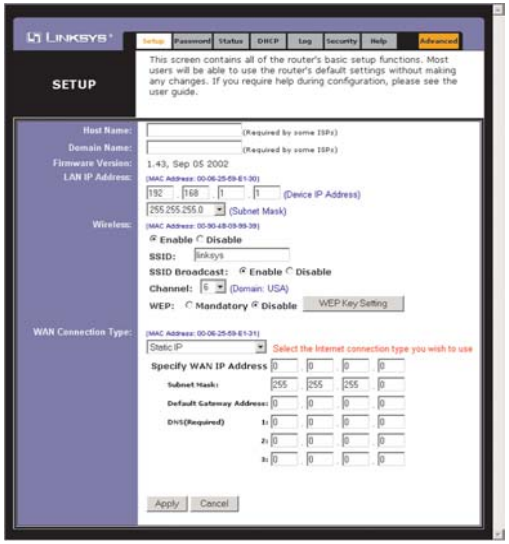

Figure 4-4

PPPoE

If your DSL provider says that you are connecting through PPPoE or if you normally enter a user name and password to access the Internet, perform these steps (shown in Figure 4-5):

a. Select **PPPoE** as the WAN Connection Type.

b. Enter the **User Name**.

c. Enter the **Password**.

d. Click the **Apply** button to save the settings.

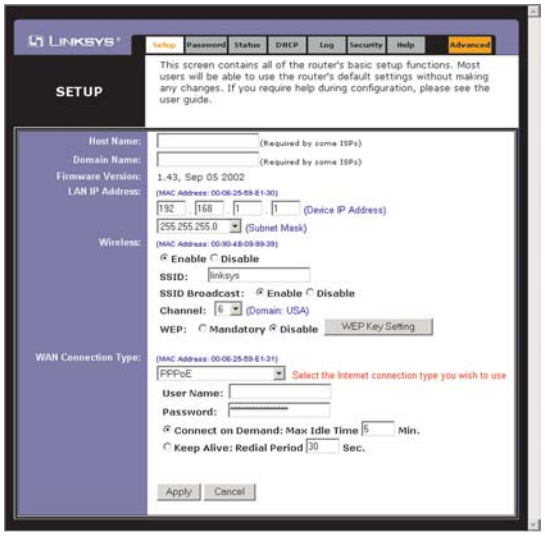

Figure 4-5

RAS (for SingTel Users)

RAS is a service used in Singapore only. If you are using a RAS connection (as shown in Figure 4-6), check with your ISP for the necessary setup information.

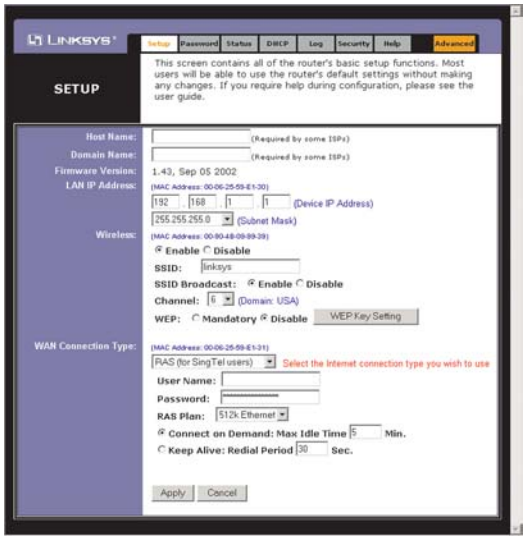

Figure 4-6

PPTP

PPTP is a service used in Europe only. If you are using a PPTP connection (as shown in Figure 4-7), check with your ISP for the necessary setup information.

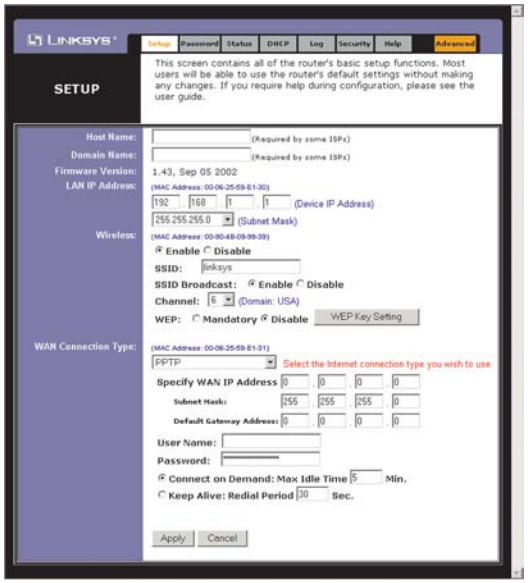

Figure 4-7

6. If you haven't already done so, click the **Apply** button to save the settings.

7. Reset the power on your cable or DSL modem and restart your computers. They will now obtain the Router's new settings.

   Note: You only need to configure the Router from one computer. If you need advanced setting information, please refer to the Linksys support website at *support.linksys.com* or the User Guide on the Setup Wizard CD-ROM.

   Congratulations! You've successfully configured the Router. You can test the setup by opening your web browser from any computer and entering *www.linksys.com/registration* (as shown in Figure 4-8).

Figure 4-8

If you are unable to reach our website, you may want to review what you did in this section or refer to the Troubleshooting Appendix.

Chapter 5: Using the Router's Web-Based Utility

For your convenience, an administrative utility has been programmed into the Router. This chapter will explain all of the functions in this utility. All router-based administrative tasks are performed through this web utility. The web utility can be accessed by any PC on the network by typing "http://192.168.1.1" in the PC's web browser address window, as shown in Figure 5-1.

Figure 5-1

Upon entering the address into the web browser, a password request page will pop up, as shown in Figure 5-2a. (Windows XP users will see a "Connect to 192.168.1.1" window, shown in Figure 5-2b.)

Figure 5-2a

Figure 5-2b

Leave the User Name field empty, and enter **admin** (the default password) in lowercase letters in the Password field. Then, click the **OK** button.

In this chapter, you will find brief descriptions of each of the utility's tabs and its more important functions. More detailed explanations and instructions can be found by clicking each page's **Help** button or on Linksys's website at *www.linksys.com*. To clear any values you've entered on any page, click the **Cancel** button. To apply any settings you've altered on any page, click the **Apply** button.

The utility's tabs: Setup, Password, Status, DHCP, Log, Security and Help are used for Basic Setup of the Router. When the Advanced Tab is clicked, further options will be displayed for Filters, Forwarding, Dynamic Routing, Static Routing DMZ Host, MAC Address Cloning, and Wireless configuration.

Setup

The Setup tab is the first tab you will see when you access the Utility. If you have already installed and set up the Router, you have already seen this tab and have already properly configured all of the values.

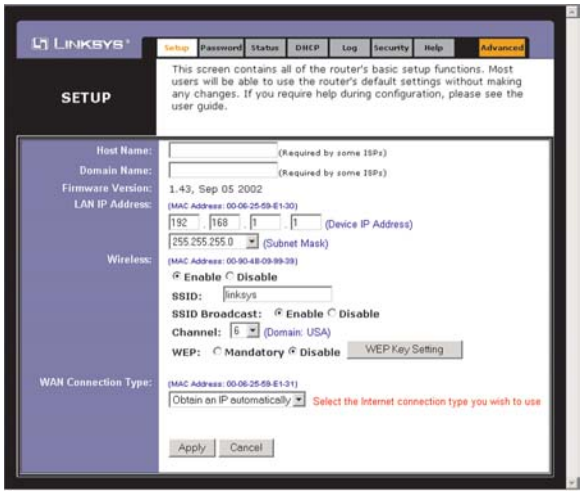

Figure 5-3

- **Host Name** This entry is necessary for some ISPs and can be provided by them.

- **Domain Name** This entry is necessary for some ISPs and can be provided by them.

- **Firmware Version** This displays the firmware version the Router is currently using. As future versions of the Router's firmware become available, they can be downloaded from the Linksys website at *www.linksys.com*.

Note: *Due to differences in web browsers, some screen shots may differ.*

- **LAN IP Address and Subnet Mask** This is the Router's IP Address and Subnet Mask as seen on the internal LAN. The default value is 192.168.1.1 for IP Address and 255.255.255.0 for Subnet Mask.

- **Wireless (Enable/Disable).** In order to utilize the Router's wireless functions, select **Enable**. If you do not wish to utilize any wireless functions, make sure **Disable** is selected. *(**Note:** No other wireless functions will be available unless you enable this setting.)*

- **SSID**: The SSID is a unique name for your wireless network. It is case sensitive and must not exceed 32 characters. The default SSID is "linksys " but you should change this to a personal wireless network name. All wireless points in your network must use the same SSID. Verify that you are using the correct SSID and click the **Apply** button to set it.

- **SSID Broadcast** - Allows the SSID to be broadcast on your network. You may want to enable this function while configuring the Router, but make sure that you disable it when you are finished. With this enabled, someone could easily obtain the SSID information with site survey software and gain unauthorized access to your network. Click **Enable** to broadcast. Click **Disable** to increase network security and prevent the SSID from being seen on networked PCs**.**

- **Channel** Select the appropriate channel from the list provided to correspond with your network settings, between 1 and 11. (Higher channels can only be used outside of the United States and Canada.) All points in your wireless network must use the same channel in order to function correctly. Verify that the correct channel is selected and click the **Apply** button to set it.

- **WEP (Mandatory/Disable).** In order to utilize WEP encryption, select **Enable**. If you do not wish to utilize WEP encryption, make sure **Disable** is selected.

- **WEP Key Setting** When WEP Encryption is Enabled, press this button to modify the WEP Key Settings.

  For further details on configuring Wireless Security, using WEP, refer to Appendix C: Configuring Wireless Security.

- **WAN Connection Type** The Router supports five connection types: DHCP (obtain an IP automatically), PPPoE, Static IP Address, RAS, and PPTP. These types are selected from the drop-down menu beside **WAN Connection Type**. The Setup tab and available features will differ depending on what kind of connection type you select. Each option is described on the following pages.

  Obtain an IP Automatically

  If your ISP says that you are connecting through a dynamic IP address (or DHCP), select this option from the drop-down menu (as shown in Figure 5-3). Now, the Router will accept the dynamic IP addresses assigned by your ISP when connecting to the Internet.

Static IP

If your ISP says that you are connecting through a static (or fixed) IP address, select this option from the drop-down menu (as shown in Figure 5-4). The Router will utilize that static IP Address when the following information is entered into the appropriate field:

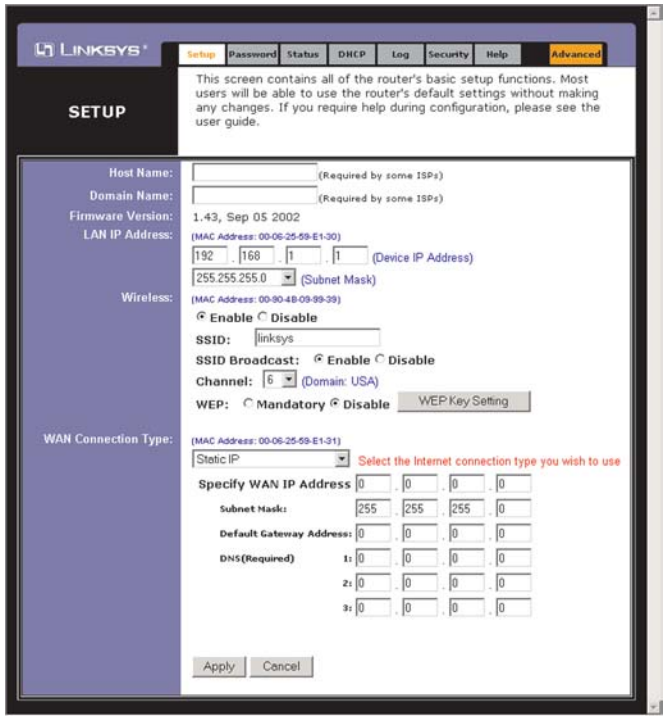

Figure 5-4

- **WAN IP Address and Subnet Mask** This is the Router's IP Address and Subnet Mask as seen by external users on the Internet (including your ISP).

- **Default Gateway Address** Your ISP will provide you with the Gateway IP Address.

- **DNS (Domain Name Server) IP Address** Your ISP will provide you with at least one DNS IP Address.

PPPoE

Some DSL-based ISPs use PPPoE (Point-to-Point Protocol over Ethernet) to establish communications with an end-user. If you are using a DSL line, check with your ISP to see if they use PPPoE. If they do use PPPoE, select this from the drop-down menu (as shown in Figure 5-5).

Figure 5-5

If you do enable PPPoE, remember to remove any existing PPPoE applications already on any of your PCs.

- **User Name and Password** Enter the User Name and Password you use when logging onto your ISP connection.

- **Connect on Demand and Max Idle Time** You can configure the Router to disconnect your ISP connection after a specified period of time (Max Idle Time). If you have been disconnected due to inactivity, Connect on Demand enables the Router to automatically re-establish your connection as soon as you attempt to access the Internet again. If you wish to activate Connect on Demand, click the radio button. If you want your Internet connection to remain on at all times, enter **0** in the Max Idle Time field. Otherwise, enter the number of minutes you want to have elapsed before your Internet access disconnects.

- **Keep Alive Option and Redial Period** This option keeps you connected to your ISP indefinitely, even when your connection sits idle. To use this option, click the radio button next to **Keep Alive**. The default Redial Period is 30 seconds.

RAS (for SingTel Users)
RAS is a service used in Singapore only. If you are using a RAS connection (as shown in Figure 4-6), check with your ISP for the necessary setup information.

PPTP
PPTP is a service used in Europe only. If you are using a PPTP connection (as shown in Figure 4-7), check with your ISP for the necessary setup information.

You can confirm that the above settings are correct by successfully connecting to the Internet.

To clear any values you've entered on any page, click the **Cancel** button. To apply any settings you've altered on any page, click the **Apply** button.

Password

From the Password tab, shown in Figure 5-7, you can change the Router's Password, enable Universal Plug and Play (UPnP) Services for systems such as Windows XP PCs, and restore the Router's factory default settings.

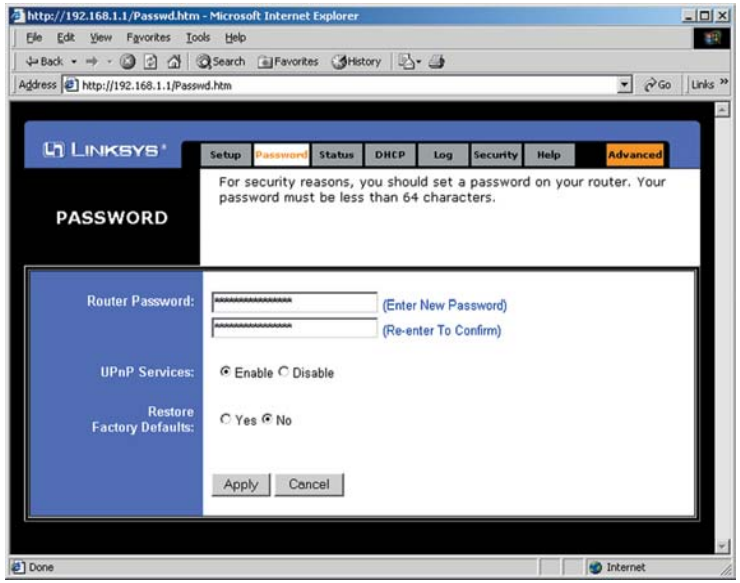

Figure 5-7

- **Router Password** For greater security, you should set a password for the Router. If you don't set the password, all users on your network will be able to access the Router using the default password **admin**. We recommend that you change your password often.

- **UPnP Services** Universal Plug and Play (UPnP) allows systems, such as Windows XP PCs to automatically configure the Router for various Internet applications, such as gaming and videoconferencing. Click the radio button next to **Enable** to enable UPnP Services, or **Disable** to disable UPnP Services.

- **Restore Factory Defaults** If you select the Restore Factory Default option and click the **Apply** button, you will clear all of the Router's settings and restore the default settings.

Do not restore the factory defaults unless you are having difficulties with the Router and have exhausted all other troubleshooting measures. Once the Router is reset, you will have to re-enter all of your configuration data.

To clear any values you've entered on any page, click the **Cancel** button. To apply any settings you've altered on any page, click the **Apply** button.

Status

The Status tab, shown in Figure 5-8, displays the Router's current status; it reflects the data and selections you've entered using the Setup tab and provides options for DHCP users.

Note: The information provided on the Status tab may vary depending on the Router's settings.

All of the information provided on the Status tab is read-only and can be changed using the Setup tab.

- **Host Name** This field shows the name of the Router. This entry is necessary for some ISPs.

- **Firmware Version** This field shows the installed version and date of the firmware. Version dates are slightly more accurate than version numbers.

- **Login** This indicates if you are using a dial-up style connection like PPPoE, RAS, or PPTP. For PPPoE, RAS, or PPTP only, there is a **Connect** button to click if you are disconnected and want to re-establish a connection.

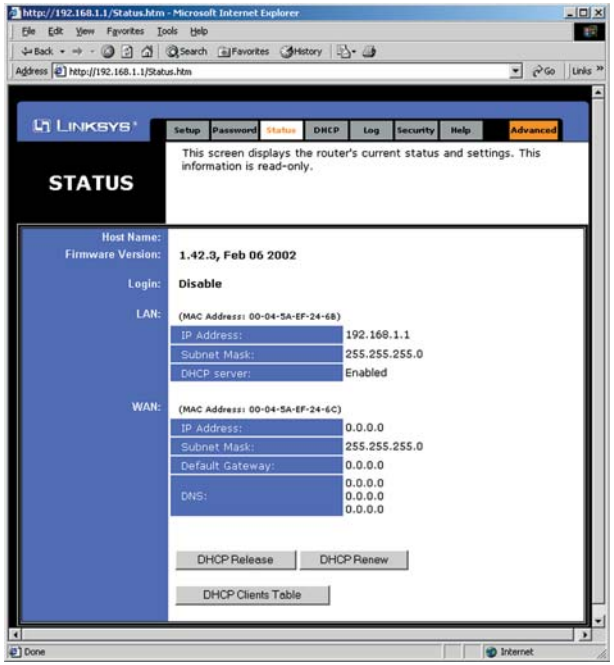

Figure 5-8

- **LAN** These fields display the current IP Address and Subnet Mask of the Router, as seen by users on your local area network. The DHCP Server field shows the status of the Router's DHCP server function, which is either enabled or disabled.

- **WAN** These fields display the WAN IP Address, WAN Subnet Mask, and WAN Default Gateway IP Address of the Router, as seen by external users on the Internet. The DNS (Domain Name System) IP Address fields show the IP address(es) of the DNS currently used by the Router. Multiple DNS IP settings are common. In most cases, the first available DNS entry is used.

- **DHCP Release** Click the **DHCP Release** button to delete the current IP address of the device connected to the Router's WAN port.

- **DHCP Renew** Click the **DHCP Renew** button to replace the current IP address—of the device connected to the Router's WAN port—with a new IP address.

- **DHCP Clients Table** This table lists the PCs that were given IP addresses by the Router.

DHCP

A DHCP (Dynamic Host Configuration Protocol) Server automatically assigns IP addresses to each computer on its network. Unless you already have one, you should set the Router up as a DHCP server. This is done on the DHCP tab, shown in Figure 5-9.

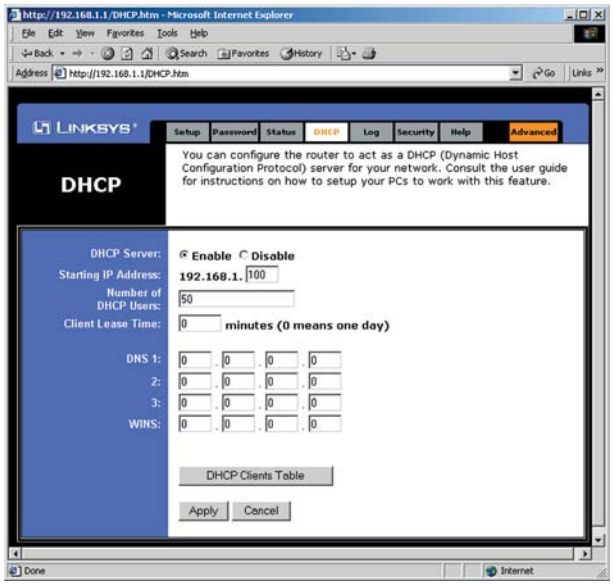

Figure 5-9

- **DHCP Server** Click the **Enable** option to enable the Router's DHCP server function If you already have a DHCP server on your network, set the Router's DHCP option to **Disable**.

- **Starting IP Address** Enter a numerical value for the DHCP server to start with when issuing IP addresses.

- **Number of DHCP users** Enter the maximum number of PCs that will require IP addresses assigned by the Router. No more than 253 computers can be used. In order to determine the DHCP IP Address range, add the starting IP address (e.g., 100) to the number of DHCP users. By default, as shown in Figure 5-9, if you add 50 users, the range or IP Addresses will be 192.168.1.100 to 192.168.1.149.

- **Client Lease Time** The Client Lease Time is the amount of time a network user will be allowed connection to the Router with their current dynamic IP address. Enter the amount of time, in minutes, that the user will be "leased" this dynamic IP address.

- **DNS** The Domain Name System (DNS) is how the Internet translates domain or website names into Internet addresses or URLs. Your ISP will provide you with at least one DNS Server IP Address. If you wish to use another, type that **IP Address** in one of these fields. You can type up to three DNS Server IP Addresses here. The Router will use these for quicker access to functioning DNS servers.

- **WINS** The Windows Internet Naming Service (WINS) manages each PC's interaction with the Internet. If you use a WINS server, enter that **server's IP Address** here. Otherwise, left this blank.

- **DHCP Clients Table** When this button is clicked, a table similar to that shown in Figure 5-10 appears, displaying a list of PCs assigned IP addresses by the Router. Click the **Refresh** button to display the most current information. If you wish to delete a client's IP address, select that client by clicking the box to the right and click the **Delete** button.

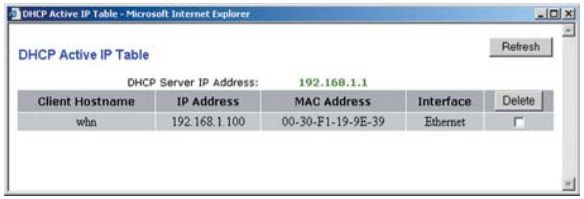

Figure 5-10

To clear any values you've entered on any page, click the **Cancel** button. To apply any settings you've altered on any page, click the **Apply** button.

Log

The Log tab, shown in Figure 5-11, provides you with a log of all incoming and outgoing URLs or IP addresses for your Internet connection.

To access activity logs, select the **Enable** option next to "Access Log". This function can be disabled by clicking the **Disable** radio button.

With logging Enabled, you can choose to view temporary logs or have a permanent record, using the Logviewer software. Temporary logs can be accessed from the Log tab by clicking either the **Incoming Access Log** or **Outgoing Access Log** buttons. The Incoming Access Log gives you a log of all the incoming Internet traffic while the Outgoing Access Log lists all the URLs and IP addresses of Internet sites that users on your network have accessed.

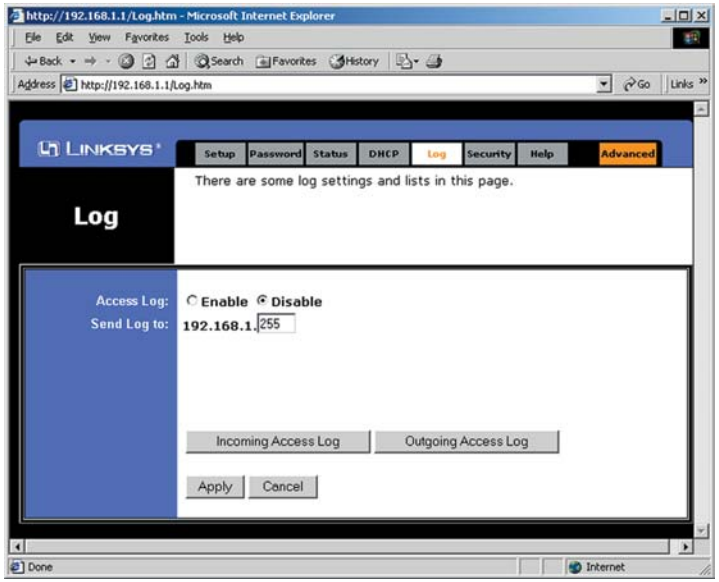

Figure 5-11

For a permanent record of these logs, Logviewer software must be used. This software is downloadable from the Linksys website at *www.linksys.com*. The Logviewer saves all incoming and outgoing activity as a permanent file on your PC's hard drive. Next to "Send Log to", enter the fixed IP address of the PC running the Logviewer software. The Router will now send updated logs to that PC.

To clear any values you've entered on any page, click the **Cancel** button. To apply any settings you've altered on any page, click the **Apply** button.

Security

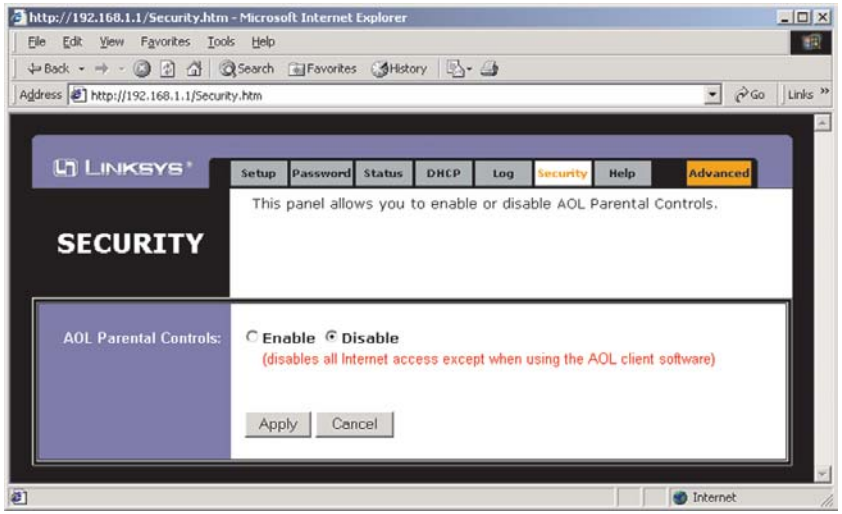

Figure 5-12

The Security tab, as shown in Figure 5-12, enables configuration of the Router to provide parental controls.

AOL Parental Controls

Click on the radio button next to **Enable** to use AOL's "Parental Controls" feature. Enabling this will disable all options under the Advanced tab except MAC Address cloning, and will disable all Internet access, except when using AOL client software. Click the radio button next to **Disable** if you don't want to use this feature.

Note: AOL Parental Controls are available to AOL customers in the United States only.

If at any time you enable the AOL Parental Controls feature in the Router, you must run the Setup Wizard CD and select Setup Additional Computer(s) to install the AOL 7.0 software on your computers.

To apply the settings that you change on a page, click the **Apply** button. To cancel any values you've entered on a page, click the **Cancel** button.

Help

The Help tab, as shown in Figure 5-13, contains links to all of the Utility's internal support documentation, a link to Linksys's website, and the application that upgrades the Router's firmware. To utility these links, you must have an active Internet connection.

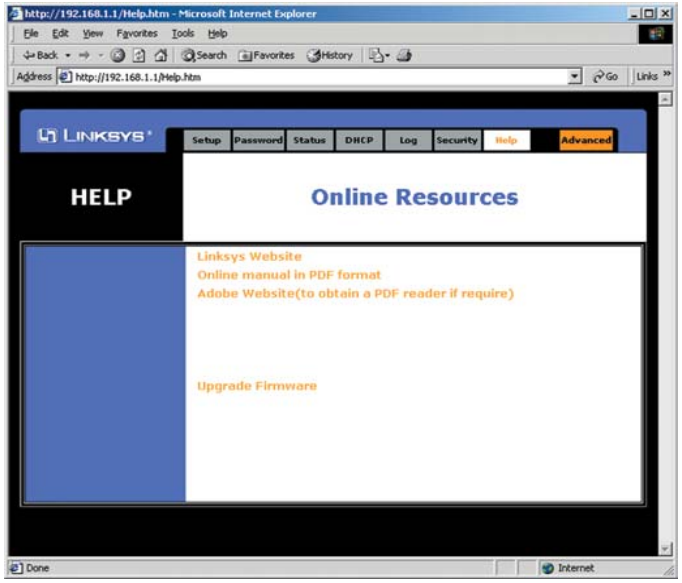

Figure 5-13

Click the **Linksys Website** link to connect to the Linksys homepage for Knowledgebase help files and information about other Linksys products.

For an **Online Manual in PDF format**, click that text link. The manual will appear in Adobe PDF format. If you do not have the Adobe PDF Reader installed on your computer, click the **Adobe Website** link to download this software.

Firmware can be upgraded by clicking the **Upgrade Firmware** link. Do not upgrade your firmware unless you are experiencing problems with the Access Point.

To upgrade the Router's firmware:

1. Access the **Help** tab and click **Upgrade Firmware**. A new page, shown in Figure 5-14, will appear.

Important: In order to upgrade the Router's firmware, you **must** use Internet Explorer 5.0 or higher, or Netscape Navigator 4.7 or higher. Upgrading the firmware may cause the Router to be reset to the factory defaults. Make a record of all settings before attempting the upgrade.

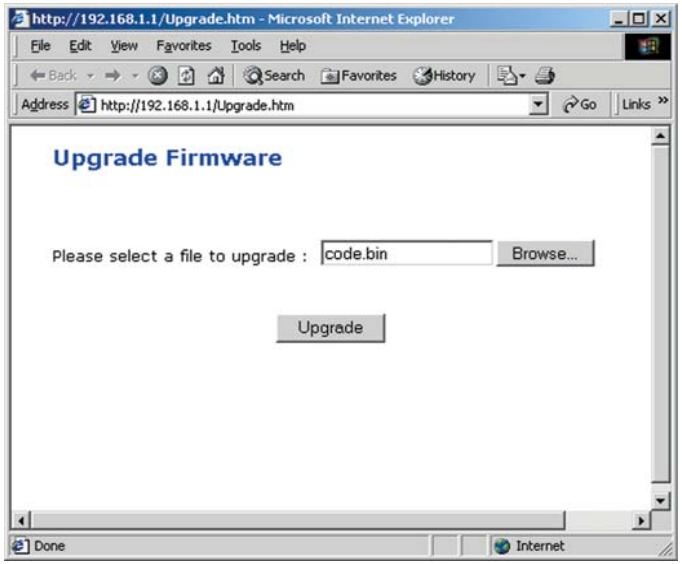

Figure 5-14

2. Click the **Browse** button and find the firmware upgrade file that you downloaded from the Linksys website. Double-click the **upgrade file**. This will place the file into the "File Path:" field.

3. When the correct file is in the "File Path:" field, click the **Upgrade** button and follow the instructions there. This will complete your firmware upgrade.

Important: Do not interrupt the firmware upgrade process in any way or power down the Router while the upgrade is in progress as this could damage the Router.

Advanced Tab: Filters

Important: Filtering is an Advanced Function. No changes should be made to this tab without a thorough understanding of networking concepts.

Filters block specific internal users from accessing the Internet. From the Filters tab, as shown in Figure 5-15, you can set up a filter through an IP address or a network port number.

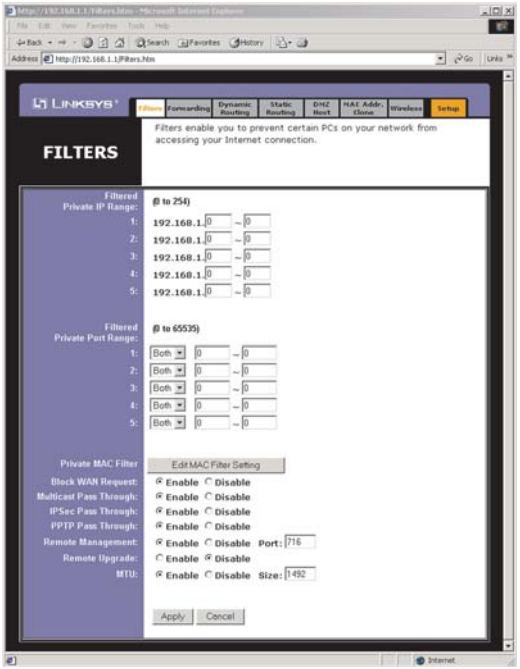

Figure 5-15

- **Setting Up Filters**

  To set up a filter using IP addresses, enter the range of IP addresses you wish to filter in the IP address fields. Users who have filtered IP addresses will not be able to access the Internet at all. If you only want to filter one IP address instead of a range of IP addresses, enter the same value into both fields. For instance, if you wish to filter the PC with the IP address of 192.168.1.5, enter **5** into both fields on one line: 192.168.1.**5** ~ 192.168.1.**5**. Click the **Apply** button when you're done.

To filter users by network port number, enter a network port number or a range of network ports. Enter the port numbers you want to filter in the port numbers fields. Users connected to the Router will no longer be able to access any port number listed there.

- **Editing MAC Filter Setting**

  This feature filters the Ethernet adapter's specific MAC address from going out to the Internet.

  To check your Ethernet adapter's MAC address, run **winipcfg** or **ipconfig** in the command prompt, depending on which Windows operating system you are using. To set the MAC filter, click the **Edit MAC Filter Setting** button. When a second window appears, select the range in the drop-down menu, and in a MAC number field, enter the 12-digit MAC address you want to filter. Click the **Apply** button before closing the window. For information on obtaining a MAC address, go to Appendix D: Finding the MAC Address and IP Address for Your Ethernet Adapter.

- **Blocking WAN Requests**

  By enabling the Block WAN Request feature, you can prevent your network from being "pinged," or detected, by other Internet users. The Block WAN Request feature also reinforces your network security by hiding your network ports. Both functions of the Block WAN Request feature make it more difficult for outside users to work their way into your network.

  Click the **Apply** button to save your changes.

- **Using Multicast Pass Through**

  This feature allows for multiple transmissions to specific recipients at the same time. Select **Enable** to support the feature, or **Disable** to keep the Router from multicasting.

- **Using Multicast Pass Through**

  This feature allows for multiple transmissions to specific recipients at the same time. Select **Enable** to support the feature, or **Disable** to keep the Router from multicasting.

- **Using IPSec Pass Through**

  This feature lets you use IPSec Pass Through. To use this feature, click the **Enable** button next to **IPSec Pass Through**, and then the **Apply** button.

  IPSec Pass Through is enabled by default. To disable IPSec Pass Through, click on **Disable** and then the **Apply** button.

- **Using PPTP Pass Through**

  Point-to-Point Tunneling Protocol is the method used to enable VPN sessions. To enable this feature, click the **Enable** button next to **PPTP Pass Through**, and click the **Apply** button.

  PPTP Pass Through is enabled by default. To disable this feature, click on **Disable** next to **PPTP Pass Through**, and then the **Apply** button.

- **Using Remote Management**

  This feature allows you to manage the Router from a remote location, via the Internet. To enable this feature, click on **Enable,** and enter the port number you want to use when accessing the Router remotely. Click the **Apply** button. Remote Management must be activated before you can manage the Router from a remote location.

  To disable Remote Management, click on **Disable**, and click the **Apply** button. If you wish to use this feature on the browser, enter **http:\\<WAN IP Address>: port.** (Enter your specific WAN IP Address in place of <WAN IP Address>, and enter the port number in place of the word port.)

- **Using Remote Upgrade**

  This feature allows you to upgrade the Router's firmware from a remote location. To enable Remote Upgrade, click on **Enable**, and then click the **Apply** button. Remote Management must be activated before you can manage the Router from a remote location.

Important: Upgrading may cause the Router to be reset to the factory defaults. Make a record of all settings before attempting the upgrade.

- **Using MTU (Maximum Transmission Unit)**

  This feature specifies the largest packet size permitted for network transmission. Select **Enable** and enter the value desired. It is recommended that you leave this value in the 1200 to 1500 range. For most DSL users, it is recommended to use the value **1492**. By default, MTU is set at **1500** when disabled.

Advanced Tab: Port Range Forwarding

Important: Port Range Forwarding is an Advanced Function. No changes should be made to this tab without a thorough understanding of networking concepts.

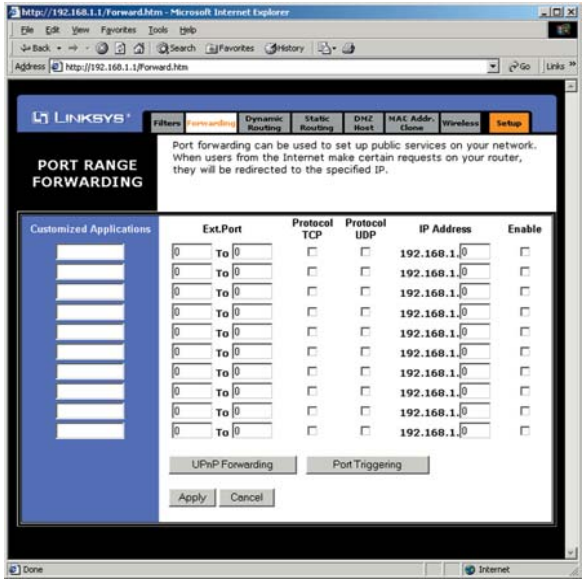

Figure 5-16

Port Range Forwarding from this tab, as shown in Figure 5-16, sets up public services on your network, such as web servers, ftp servers, e-mail servers, or other specialized Internet applications. (Specialized Internet applications are any applications that use Internet access to perform functions such as videoconferencing or online gaming. Some Internet applications may not require any forwarding.) When users send this type of request to your network via the Internet, the Router will forward those requests to the appropriate PC. Before using Forwarding, the DHCP function on the PC whose port is being forwarded must be disabled and have a new static IP address assigned because its IP address may change when using the DHCP function.

If you need to forward all ports to one PC, see the "DMZ" section.

To add a server using Port Range Forwarding:

1. Enter the **name** of the application in the appropriate Customized Applications field.

2. Next to the name of the application, enter the **number** or **range** of the external port(s) used by the server or Internet application in the Ext. Port column. Check with the Internet application software documentation for more information.

3. On the same line, select the protocol **TCP** or **UDP**, or select both protocols.

4. Enter the **IP address** of the server that you want the Internet users to be able to access. To find the IP address, go to Appendix D: Finding the MAC Address and IP Address for Your Ethernet Adapter.

5. Check the **Enable** box to enable the services you have defined. Port Range Forwarding will not function if the **Enable** button is left unchecked. This is disabled (unchecked) by default.

6. Configure as many entries as needed—the Router supports up to 10 ranges of ports. Click the **Apply** button when you are done.

UPnP Forwarding

Clicking the UPnP Forwarding button on the Port Range Forwarding tab will display the UPnP Forwarding tab. The UPnP Forwarding tab, shown in Figure 5-17, displays preset application settings as well as options for customization of port services for other applications.

This table is similar to the Port Forwarding table, but the items on this table will automatically synchronize with other UPnP devices and operating systems, such as Windows XP.

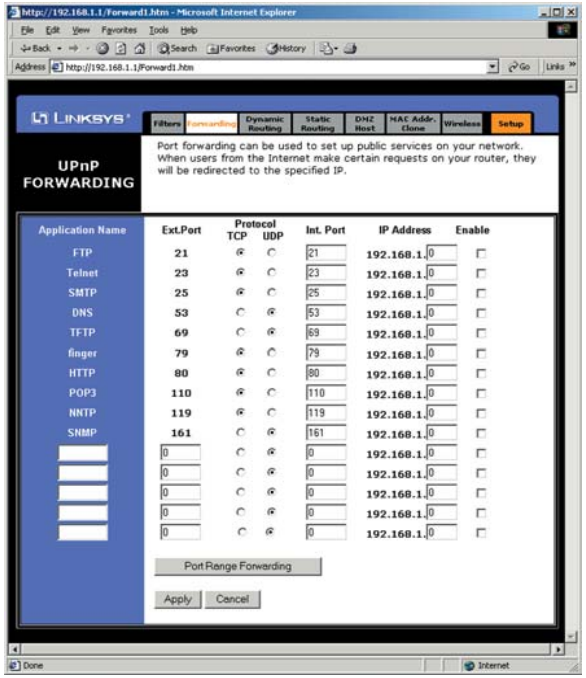

Figure 5-17

The Preset Applications are among the most widely used Internet applications that may require forwarding. They include the following:

- **FTP** (File Transfer Protocol) A protocol used to transfer files over a TCP/IP network (Internet, UNIX, etc.). For example, after developing the HTML pages for a website on a local machine, they are typically uploaded to the web server using FTP. FTP includes functions to log onto the network, list directories, and copy files. It can also convert between the ASCII and EBCDIC character codes. FTP operations can be performed by typing commands at a command prompt or via an FTP utility running under a graphical interface such as Windows. FTP transfers can also be initiated from within a web browser by entering the URL preceded by ftp://.

- **Telnet** A terminal emulation protocol commonly used on Internet and TCP/IP-based networks. It allows a user at a terminal or computer to log onto a remote device and run a program.

- **SMTP** (Simple Mail Transfer Protocol) The standard e-mail protocol on the Internet. It is a TCP/IP protocol that defines the message format and the message transfer agent (MTA), which stores and forwards the mail.

- **DNS** (Domain Name System) The way that Internet domain names are located and translated into IP addresses. A domain name is a meaningful and easy-to-remember "handle" for an Internet address.

- **TFTP** (Trivial File Transfer Protocol) A version of the TCP/IP FTP protocol that has no directory or password capability.

- **Finger** A UNIX command widely used on the Internet to find out information about a particular user, such as a telephone number, whether the user is currently logged on, and the last time the user was logged on. The person being "fingered" must have placed his or her profile on the system in order for the information to be available. Fingering requires entering the full user@domain address.

- **HTTP** (HyperText Transport Protocol) The communications protocol used to connect to servers on the World Wide Web. Its primary function is to establish a connection with a web server and transmit HTML pages to the client web browser.

- **POP3** (Post Office Protocol 3) A standard mail server commonly used on the Internet. It provides a message store that holds incoming e-mail until users log on and download it. POP3 is a simple system with little selectivity. All pending messages and attachments are downloaded at the same time. POP3 uses the SMTP messaging protocol.

- **NNTP** (Network News Transfer Protocol) The protocol used to connect to Usenet groups on the Internet. Usenet newsreaders support the NNTP protocol.

- **SNMP** (Simple Network Management Protocol) A widely used network monitoring and control protocol. Data is passed from SNMP agents, which are hardware and/or software processes reporting activity in each network device (hub, router, etc.) to the workstation console used to oversee the network. The agents return information contained in a MIB (Management Information Base), which is a data structure that defines what is obtainable from the device and what can be controlled (turned off, on, etc.).

You must check the **Enable** box to enable the applications you have defined.

To add a server using UPnP Forwarding:

1. Enter the **name** of the application in the appropriate Application Name field.

2. Next to the name of the application, enter the **number** of the external port used by the server in the Ext. Port column. Check with the Internet application software documentation for more information.

3. On the same line, select the protocol **UDP** or **TCP**.

4. Enter the **number** of the internal port used by the server in the Int. Port column. Check with the Internet application software documentation for more information.

5. Enter the IP address of the server that you want the Internet users to be able to access. To find the IP address, go to Appendix D: Finding the MAC Address and IP Address for Your Ethernet Adapter.

6. Check the **Enable** box to enable the services you have defined. UPnP Forwarding will not function if the **Enable** button is left unchecked. This is disabled (unchecked) by default.

Port Triggering

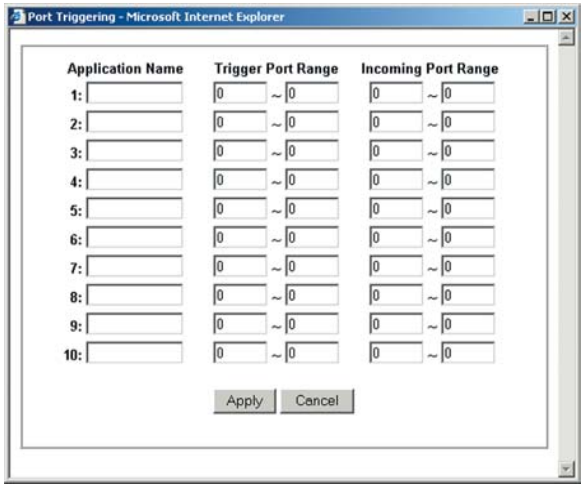

Figure 5-18

From the Port Range Forwarding tab, shown in Figure 5-18, click the **Port Triggering** button to allow the Router to watch outgoing data for specific port numbers. The IP address of the computer that sends the matching data is remembered by the Router, so that when the requested data returns through the Router, the data is pulled back to the proper computer by way of IP address and port mapping rules.

1. Enter the **Application Name** of the trigger.

2. Enter the **Trigger Port Range** used by the application. Check with the Internet application for the port number needed.

3. Enter the **Incoming Port Range** used by the application. Check with the Internet application for the port number needed.

4. Click the **Apply** button.

Advanced Tab: Dynamic Routing

Important: Dynamic Routing is an Advanced Function. No changes should be made to this tab without a thorough understanding of networking concepts.

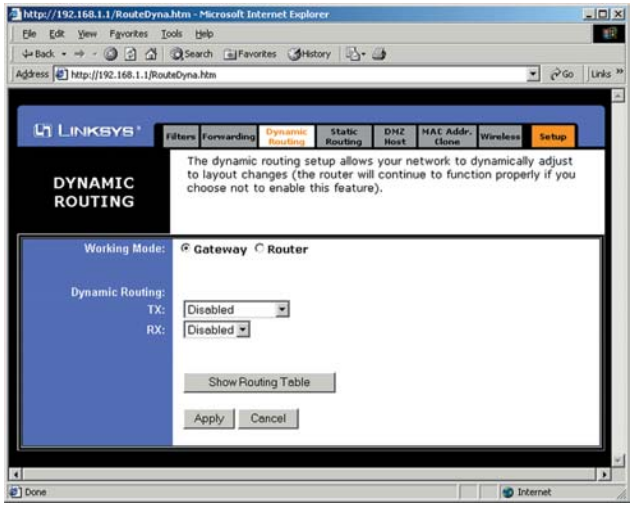

Figure 5-19

From the Dynamic Routing tab, shown in Figure 5-19, you can automatically adjust to physical changes in the network's layout. The Router, using the RIP protocol, determines the network packets' route based on the fewest number of hops between the source and the destination. The RIP protocol regularly broadcasts routing information to other routers on the network. To set up Dynamic Routing:

1. Choose the correct Working Mode. **Gateway Mode** should be used if the Router is hosting your network's connection to the Internet. **Router Mode** should be selected if the Router exists on a network with other routers.

2. In the **TX** field, choose the **protocol** by which you transmit data on the network.

3. In the **RX** field, choose the protocol by which the Router receives network data.

4. Click the **Apply** button to save your changes.

To view the Routing Table, which shows the network layout, click the **Show Routing Table** button.

To clear any values you've entered on any page, click the **Cancel** button. To apply any settings you've altered on any page, click the **Apply** button.

Advanced Tab: Static Routing

Important: Static Routing is an Advanced Function. No changes should be made to this tab without a thorough understanding of networking concepts.

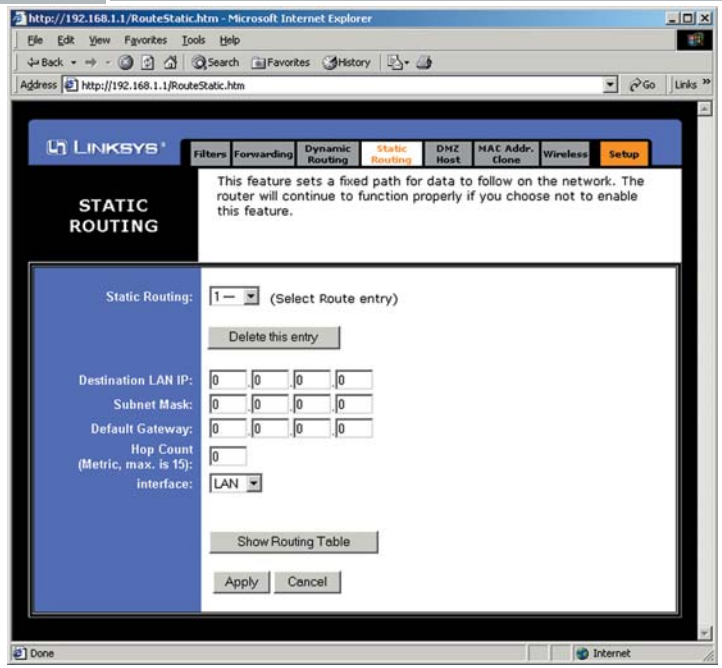

Figure 5-20

If the Router is connected to more than one network, it may be necessary to set up a static route between them. This is set on the Static Routing tab, as shown in Figure 5-20. A static route is a pre-determined pathway that network information must travel to reach a specific host or network. Click the **Show Routing Table** button to view the current static routing configuration.

To create a static route entry:

1. Select **Static Route Entry** from the drop-down list. The Router supports up to 20 static route entries.

2. Enter the following data to create a new static route:

   Destination LAN IP. The Destination LAN IP is the address of the remote network or host to which you want to assign a static route. Enter the IP address of the host for which you wish to create a static route here. If you are building a route to an entire network, be sure that the host portion of the IP address is set to zero. For example, the Router's standard IP address is 192.168.1.1. Based on this address, the address of the network to which the Router is connected is 192.168.1. You would enter the IP address 192.168.1.0 if you wanted to route to the entire network, rather than just to the Router.

   Subnet Mask. The Subnet Mask indicates which portion of an IP address is the network portion and which portion is the host portion. If, for instance, you use a Subnet Mask of 255.255.255.0 with the example shown above for Destination LAN IP, then this would indicate that the first three numbers of an network IP address identifies this particular network, while the last number in the network address (from 1 to 254) would identify the specific host.

   Gateway IP. This IP address should be the IP address of the gateway device that allows for contact between the Router and the remote network or host.

   Hop Count. This value gives the number of **nodes** that a data packet passes through before reaching its destination. A node is any device on the network, such as switches, PCs, etc.

   Interface. This interface tells you whether your network is on the internal LAN or the WAN, or the external Internet. If you're connecting to a subnetwork, select LAN. If you're connecting to another network through the Internet, select WAN.

To delete a Static Routing entry, select an **entry**, and click the **Delete this entry** button.

To clear any values you've entered on any page, click the **Cancel** button. To apply any settings you've altered on any page, click the **Apply** button.

Advanced Tab: DMZ Host

Important: DMZ Hosting is an Advanced Function. No changes should be made to this tab without a thorough understanding of networking concepts.

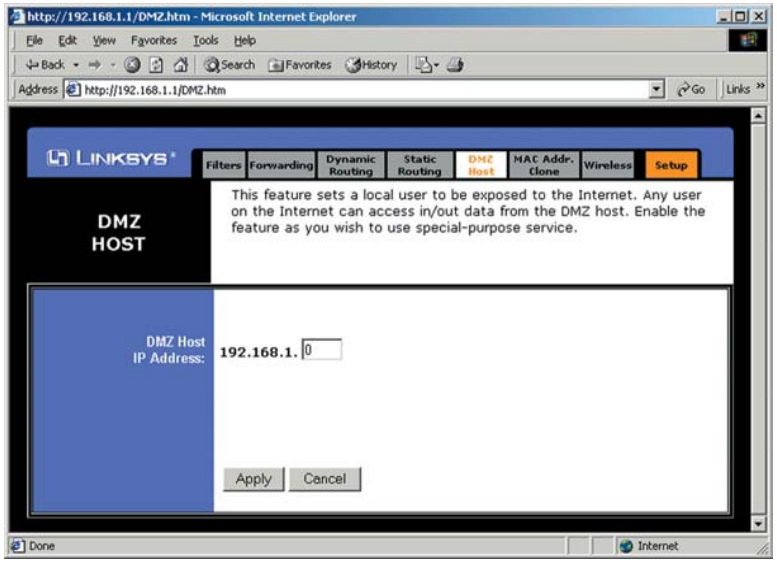

Figure 5-21

The DMZ Hosting feature, accessed from the DMZ Host tab as shown in Figure 5-21, allows one local user to be exposed to the Internet for use of a special-purpose service such as Internet gaming and videoconferencing.

Whereas Port Range Forwarding can only forward a maximum of ten port ranges, DMZ hosting forwards all the ports at the same time to one PC.

Before using this feature, the DHCP function on the PC whose port is being exposed must be disabled and have a new static IP address assigned because its IP address may change when using the DMZ function.

To expose one PC, enter the computer's IP address. To get the IP address of a computer, refer to Appendix D: Finding the MAC Address and IP Address for Your Ethernet Adapter.

Deactivate DMZ by entering a zero in the field.

When finished, click the **Apply** button to save the settings. Otherwise, click the **Cancel** button to undo changes made on this screen.

Advanced Tab: MAC Address Cloning

Important: MAC Address Cloning is an Advanced Function. No changes should be made to this tab without a thorough understanding of networking concepts.

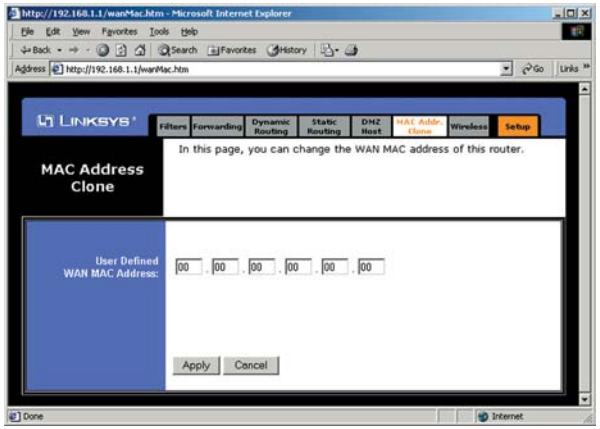

Figure 5-22

From the MAC Address Cloning tab, shown in Figure 5-22, you can assign the Router a MAC address, which is a 12-digit code assigned to a unique piece of hardware for identification, like a social security number. Some ISPs require that you register the MAC address of your network card/adapter, which was connected to your cable or DSL modem during installation. Therefore, in order to connect the Router to your cable or DSL modem in place of the PC (network card or adapter), you must change the Router MAC to duplicate (or clone) your network card/adapter MAC. You can find your adapter's MAC address by doing the following:

- If you are running Windows 95, 98 or Millennium:

  Go to **Start**, **Run**, type in **command**, and press **Enter**. At the DOS prompt, type **winipcfg**.

- If you are running Windows NT 4.0 or 2000:

  Go to **Start**, **Run**, type in **command**, and press **Enter**. At the DOS prompt, type **ipconfig /all**.

The Physical Address with 12 digits is your adapter's MAC address. Enter those 12 digits into the MAC Address fields, and click **Apply**. This "clones" your network adapter's MAC address onto the Router, and prevents you from having to call your ISP to change the registered MAC address to the adapter's MAC address.

Advanced Tab: Wireless

Important: Wireless is an Advanced Function. No changes should be made to this tab without a thorough understanding of networking concepts.

Before making any changes to the Wireless tab, shown in Figure 5-23, please check the wireless settings for all your wireless PCs, as these changes will alter the Router's effectiveness. In most cases, these settings do not need to be changed.

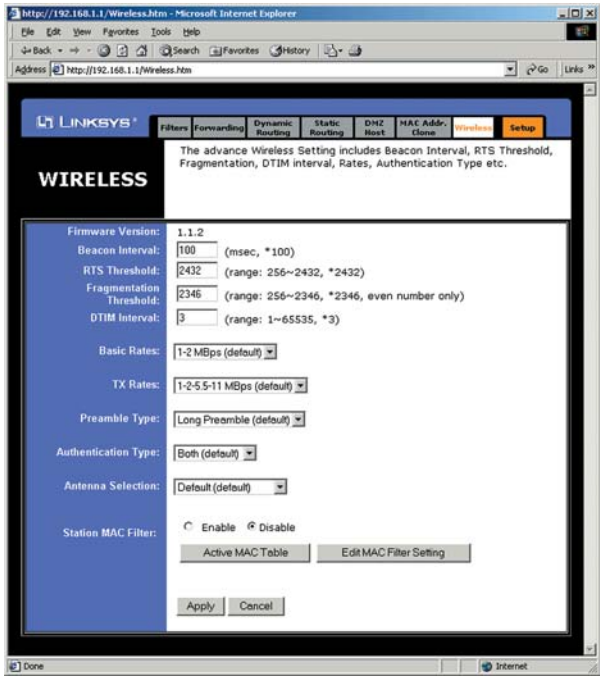

Figure 5-23

- **Firmware Version.** This indicates the Router's firmware version.

- **Beacon Interval.** This value indicates the frequency interval of the beacon. A beacon is a packet broadcast by the Router to keep the network synchronized. A beacon includes the wireless LAN service area, the IP address, the Broadcast destination addresses, a time stamp, Delivery Traffic Indicator Maps, and the Traffic Indicator Message (TIM).

- **RTS Threshold.** This value should remain at its default setting of 2,346. Should you encounter inconsistent data flow, only minor modifications are recommended.

- **Fragmentation Threshold.** This value indicates how much of the Router's resources are devoted to recovering packet errors. The value should remain at its default setting of 2,346. If you have decreased this value and experience high packet error rates, you can increase it again, but it will likely decrease overall network performance. Only minor modifications of this value are recommended.

- **DTIM Interval.** This value indicates the interval of the Delivery Traffic Indication Message (DTIM). A DTIM field is a countdown field informing clients of the next window for listening to broadcast and multicast messages. When the Router has buffered broadcast or multicast messages for associated clients, it sends the next DTIM with a DTIM Interval value. Clients for the Router hear the beacons and awaken to receive the broadcast and multicast messages.

- **Basic Rates.** The basic transfer rates should be set depending on the speed of your wireless network. You must select **1-2 (Mbps)** if you have older 802.11 compliant equipment on your network, such as wireless adapters that support only 1 or 2 Mbps. Selecting 1-2 (Mbps), however, does **not** limit the basic transfer rates of faster adapters.

- **TX Rates.** Select all the supported rates at which an access point will communicate with a client.

- **Preamble Type.** The preamble defines the length of the CRC block for communication between the Router and the roaming Network Card. (High network traffic areas should use the shorter preamble type.) Select the appropriate preamble type and click the **Apply** button to set it.

- **Authentication Type.** You may choose between **Open System**, **Shared Key**, and **Both**. The Authentication Type default is set to **Open System**, in which the sender and the recipient do NOT share a secret key. Each party generates its own key-pair and asks the receiver to accept the randomly-generated key. Once accepted, this key is used for a short time only. Then a new key is generated and agreed upon. **Shared Key** is when both the sender and the recipient share a secret key.

- **Antenna Selection.** This selection is for choosing which antenna transmits data. By default, the Diversity Antenna selection, used to increase reception, is chosen.

- **Station MAC Filter.** This option will allow you to prevent wireless users on your network from accessing the Router's functions.

  Clicking the **Active MAC Table** button will display the MAC Addresses of all users on your wireless network. Addresses in green show access to the Router, while addresses in red do not have access.

  To filter users, click the **Edit MAC Filter Setting** button. The window shown in Figure 5-24 will appear.

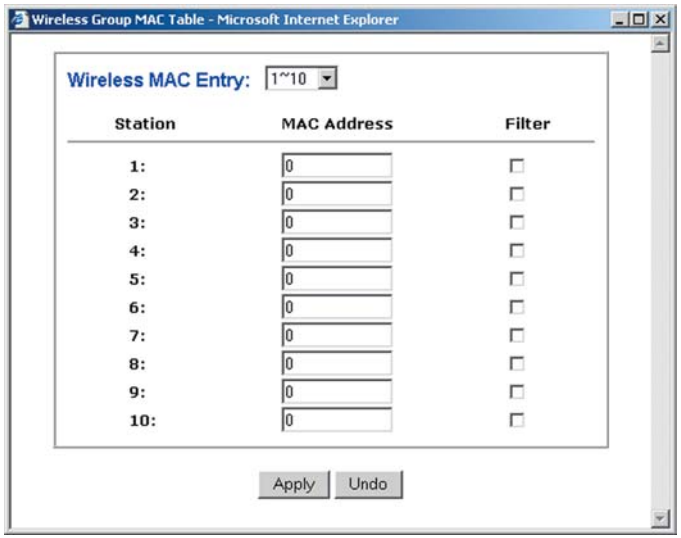

Figure 5-23

  Click the **Wireless MAC Entry** drop-down menu to select a range of entries for your network. From within this range, select the entry for which you'd like to manage access. Verify that the appropriate **MAC Address** is entered into the MAC Address field. Click the **Filter** checkbox beside that MAC Address. Now, this user will be prevented from accessing the Router. All other users will have access. To allow only that user and deny access to all others, leave **Filter** unchecked.

  Click the **Apply** button to set these changes or **Undo** if you do not wish these changes to go into effect.

When finished with the Wireless Tab, click the **Apply** button to save the settings. Otherwise, click the **Cancel** button to undo changes made on this screen.

Appendix A: Troubleshooting

Common Problems and Solutions

This appendix consists of two parts: "Common Problems and Solutions" and "Frequently Asked Questions." Provided are possible solutions to problems regarding the installation and operation of the Router. If your situation is described here, the problem should be solved by applying the corresponding solution. If you can't find an answer here, check the Linksys website at *www.linksys.com*.

1. I need to set a static IP address on a PC.

The Router, by default, assigns an IP address range of 192.168.1.100 to 192.168.1.150 using the DHCP server on the Router. To set a static IP address, you can only use the ranges 192.168.1.2 to 192.168.1.99 and 192.168.1.151 to 192.168.1.254. Each PC or network device that uses TCP/IP must have a unique address to identify itself in a network. If the IP address is not unique to a network, Windows will generate an IP conflict error message. You can assign a static IP address to a PC by performing the following steps:

For Windows 95, 98, and Me:

A. Click **Start**, **Settings**, and **Control Panel**. Double-click **Network**.
B. In *The following network components are installed* box, select the **TCP/IP->** associated with your Ethernet adapter. If you only have one Ethernet adapter installed, you will only see one TCP/IP line with no association to an Ethernet adapter. Highlight it and click the **Properties** button.
C. In the *TCP/IP properties* window, select the **IP address** tab, and select **Specify an IP address**. Enter a unique **IP address** that is not used by any other computer on the network connected to the Router. You can only use an IP address in the ranges 192.168.1.2 to 192.168.1.99 and 192.168.1.151 to 192.168.1.254. Make sure that each IP address is unique for each PC or network device.
D. Click the **Gateway** tab, and in the *New Gateway* prompt, enter **192.168.1.1**, which is the default IP address of the Router. Click the **Add** button to accept the entry.
E. Click the **DNS** tab, and make sure the **DNS Enabled** option is selected. Enter the **Host** and **Domain** names (e.g., John for Host and home for Domain). Enter the **DNS entry** provided by your ISP. If your ISP has not provided the DNS IP address, contact your ISP to get that information or go to its website for the information.
F. Click the **OK** button in the *TCP/IP properties* window, and click **Close** or the **OK** button for the Network window.
G. Restart the computer when asked.

For Windows 2000:

A. Click **Start**, **Settings**, and **Control Panel**. Double-click **Network and Dial-Up Connections**.
B. Right-click the **Local Area Connection** that is associated with the Ethernet adapter you are using, and select the **Properties** option.
C. In the *Components checked are used by this connection* box, highlight **Internet Protocol (TCP/IP)**, and click the **Properties** button. Select **Use the following IP address** option.
D. Enter a unique **IP address** that is not used by any other computer on the network connected to the Router. You can only use an IP address in the ranges 192.168.1.2 to 192.168.1.99 and 192.168.1.151 to 192.168.1.254.
E. Enter the Subnet Mask, **255.255.255.0**.
F. Enter the Default Gateway, **192.168.1.1** (Router's default IP address).
G. Toward the bottom of the window, select **Use the following DNS server addresses**, and enter the **Preferred DNS server** and **Alternative DNS server** (provided by your ISP). Contact your ISP or go on its website to find the information.
H. Click the **OK** button in the *Internet Protocol (TCP/IP) Properties* window, and click the **OK** button in the *Local Area Connection Properties* window.
I. Restart the computer if asked.

For Windows NT 4.0:

A. Click **Start**, **Settings**, and **Control Panel**. Double-click the **Network** icon.
B. Click the **Protocol** tab, and double-click **TCP/IP Protocol**.
C. When the window appears, make sure you have selected the correct **Adapter** for your Ethernet adapter.
D. Select **Specify an IP address**, and enter a unique **IP address** that is not used by any other computer on the network connected to the Router. You can only use an IP address in the ranges 192.168.1.2 to 192.168.1.99 and 192.168.1.151 to 192.168.1.254.
E. Enter the Subnet Mask, **255.255.255.0**.
F. Enter the Default Gateway, **192.168.1.1** (Router's default IP address).
G. Click the **DNS** tab, and enter the **Host** and **Domain** names (e.g., John for Host and home for Domain). Under DNS Service Search Order, click the **Add** button. Enter the **DNS IP address** in the DNS Server field, and click the **Add** button. Repeat this action for all DNS IP addresses given by your ISP.
H. Click the **OK** button in the *TCP/IP Protocol Properties* window, and click the **Close** button in the *Network* window.
I. Restart the computer if asked.

For Windows XP:

The following instructions assume you are running Windows XP with the default interface. If you are using the Classic interface (where the icons and menus look like previous Windows versions), please follow the instructions for Windows 2000.

A. Click **Start** and **Control Panel**.
B. Click the **Network and Internet Connections** icon and then the **Network Connections** icon.
C. Right-click the **Local Area Connection** that is associated with the Ethernet adapter you are using, and select the **Properties** option.
D. In the *This connection uses the following items* box, highlight **Internet Protocol (TCP/IP)**. Click the **Properties** button.
E. Enter a unique **IP address** that is not used by any other computer on the network connected to the Router. You can only use an IP address in the ranges 192.168.1.2 to 192.168.1.99 and 192.168.1.151 to 192.168.1.254.
F. Enter the Subnet Mask, **255.255.255.0**.
G. Enter the Default Gateway, **192.168.1.1** (Router's default IP address).
H. Toward the bottom of the window, select **Use the following DNS server addresses**, and enter the **Preferred DNS server** and **Alternative DNS server** (provided by your ISP). Contact your ISP or go on its website to find the information.
I. Click the **OK** button in the *Internet Protocol (TCP/IP) Properties* window. Click the **OK** button in the *Local Area Connection Properties* window.

2. I want to test my Internet connection.

A. Check your TCP/IP settings.

For Windows 95, 98, and Me:
Refer to your Ethernet adapter's documentation for details. Make sure **Obtain IP address automatically** is selected in the settings.

For Windows 2000:
- Click **Start**, **Settings**, and **Control Panel**. Double-click **Network and Dial-Up Connections**.
- Right-click the **Local Area Connection** that is associated with the Ethernet adapter you are using, and select the **Properties** option.
- In the *Components checked are used by this connection* box, highlight **Internet Protocol (TCP/IP)**, and click the **Properties** button. Make sure that **Obtain an IP address automatically** and **Obtain DNS server address automatically** are selected.

- Click the **OK** button in the *Internet Protocol (TCP/IP) Properties* window, and click the **OK** button in the Local Area Connection Properties window.
- Restart the computer if asked.

For Windows XP:
The following instructions assume you are running Windows XP with the default interface. If you are using the Classic interface (where the icons and menus look like previous Windows versions), please follow the instructions for Windows 2000.

- Click **Start** and **Control Panel**.
- Click the **Network and Internet Connections** icon and then the **Network Connections** icon.• Right-click the **Local Area Connection** that is associated with the Ethernet adapter you are using, and select the **Properties** option.
- In the *This connection uses the following items* box, highlight **Internet Protocol (TCP/IP)**, and click the **Properties** button. Make sure that **Obtain an IP address automatically** and **Obtain DNS server address automatically** are selected.
- Click the **OK** button in the *Internet Protocol (TCP/IP) Properties* window, and click the **OK** button in the *Local Area Connection Properties* window.
- Restart the computer if asked.

For Windows NT 4.0:
- Click **Start**, **Settings**, and **Control Panel**. Double-click the **Network** icon.
- Click the **Protocol** tab, and double-click on **TCP/IP Protocol**.
- When the window appears, make sure you have selected the correct **Adapter** for your Ethernet adapter and set it for **Obtain an IP address from a DHCP server**.
- Click the **OK** button in the *TCP/IP Protocol Properties* window, and click the **Close** button in the *Network* window.
- Restart the computer if asked.

B. Open a command prompt.
- For **Windows 95, 98,** and **Me**, please click **Start** and **Run**. In the Open field, type in **command**. Press the **Enter** key or click the **OK** button.
- For **Windows NT, 2000,** and **XP**, please click **Start** and **Run**. In the Open field, type **cmd**. Press the **Enter** key or click the **OK** button.

C. In the command prompt, type **ping 192.168.1.1** and press the **Enter** key.
- If you get a reply, the computer is communicating with the Router.
- If you do NOT get a reply, please check the cable, and make sure **Obtain an IP address automatically** is selected in the TCP/IP settings for your Ethernet adapter.

D. In the command prompt, type **ping** *followed by your WAN IP address* and press the **Enter** key. The WAN IP Address can be found in the web interface of the Router. For example, if your WAN IP address is 1.2.3.4, you would enter **ping 1.2.3.4** and press the **Enter** key.
- If you get a reply, the computer is connected to the Router.
- If you do NOT get a reply, try the ping command from a different computer to verify that your original computer is not the cause of the problem.

E. In the command prompt, type **ping www.yahoo.com** and press the **Enter** key.
- If you get a reply, the computer is connected to the Internet. If you cannot open a webpage, try the ping command from a different computer to verify that your original computer is not the cause of the problem.
- If you do NOT get a reply, there may be a problem with the connection. Try the ping command from a different computer to verify that your original computer is not the cause of the problem.

3. I am not getting an IP address on the WAN with my Internet connection.

A. Refer to "Problem #2, I want to test my Internet connection" to verify that you have connectivity.
B. If you need to register the MAC address of your Ethernet adapter with your ISP, please see "Appendix F: Finding the MAC address and IP Address for Your Ethernet Adapter." If you need to clone the MAC address of your Ethernet adapter onto the Router, see the MAC Address Clone section of "Chapter 5: Using the Router's Web-based Utility" for details.
C. Make sure you are using the right WAN settings. Contact your ISP to see if your WAN connection type is DHCP, Static IP Address, or PPPoE (commonly used by DSL consumers). Please refer to the Setup section of "Chapter 5: Using the Router's Web-based Utility" for details on WAN settings.
D. Make sure you have the right cable. Check to see if the WAN column has a solidly lit Link LED.
E. Make sure the cable connecting from your cable or DSL modem is connected to the Router's WAN port. Verify that the Status page of the Router's web interface shows a valid IP address from your ISP.

F. Turn off the computer, Router, and cable/DSL modem. Wait 30 seconds, and then turn on the Router, cable/DSL modem, and computer. Check the Status tab of the Router's web-based utility to see if you get an IP address.

4. I am not able to access the Router's web interface Setup page.

A. Refer to "Problem #2, I want to test my Internet connection" to verify that your computer is properly connected to the Router.
B. Refer to "Appendix D: Finding the MAC Address and IP address for Your Ethernet Adapter" to verify that your computer has an IP Address, Subnet Mask, Gateway, and DNS.
C. Set a static IP address on your system; refer to "Problem #1: I need to set a static IP address."
D. Refer to "Problem #10: I need to remove the proxy settings or the dial-up pop-up window (for PPPoE users)."

5. I can't get my Virtual Private Network (VPN) working through the Router.

Access the Router's web interface by going to **http://192.168.1.1** or the **IP address** of the Router, and go to the **Advanced => Filter** tab. Make sure you have IPsec pass-through and/or PPTP pass-through enabled.

VPNs that use IPSec with the ESP (Encapsulation Security Payload known as protocol 50) authentication will work fine. At least one IPSec session will work through the Router; however, simultaneous IPSec sessions *may* be possible, depending on the specifics of your VPNs.

VPNs that use IPSec and AH (Authentication Header known as protocol 51) are incompatible with the Router. AH has limitations due to occasional incompatibility with the NAT standard.

Change the IP address for the Router to another subnet to avoid a conflict between the VPN IP address and your local IP address. For example, if your VPN server assigns an IP address 192.168.1.X (X is a number from 1 to 254) and your local LAN IP address is 192.168.1.X (X is the same number used in the VPN IP address), the Router will have difficulties routing information to the right location. If you change the Router's IP address to 192.168.2.1, that should solve the problem. Change the Router's IP address through the Setup tab of the web interface. If you assigned a static IP address to any computer or network device on the network, you need to change its IP address accordingly to 192.168.2.Y (Y being any number from 1 to 254). Note that each IP address must be unique within the network.

Your VPN may require port 500/UDP packets to be passed to the computer that is connecting to the IPSec server. Refer to "Problem #7, I need to set up online game hosting or use other Internet applications" for details.

Check the Linksys website for more information at *www.linksys.com*.

6. I need to set up a server behind my Router.

To use a server like a web, ftp, or mail server, you need to know the respective port numbers they are using. For example, port 80 (HTTP) is used for web; port 21 (FTP) is used for FTP, and port 25 (SMTP outgoing) and port 110 (POP3 incoming) are used for the mail server. You can get more information by viewing the documentation provided with the server you installed. Follow these steps to set up port forwarding through the Router's web-based utility. We will be setting up web, ftp, and mail servers.

A. Access the Router's web-based utility by going to **http://192.168.1.1** or the **IP address** of the Router. Go to the **Advanced => Forwarding** tab.
B. Enter any **name** you want to use for the Customized Application.
C. Enter the **Ext. Port range** of the service you are using. For example, if you have a web server, you would enter the range 80 to 80.
D. Check the **protocol** you will be using, TCP and/or UDP.
E. Enter the **IP address** of the PC or network device that you want the port server to go to. For example, if the web server's Ethernet adapter IP address is 192.168.1.100, you would enter 100 in the field provided. Check "Appendix D: Finding the MAC Address and IP Address for Your Ethernet Adapter" for details on getting an IP address.
F. Check the **Enable** option for the port services you want to use. Consider the example below:

Customized Application	Ext. Port	TCP	UDP	IP Address	Enable
Web server	80 to 80	X	X	192.168.1.100	X
FTP server	21 to 21	X		192.168.1.101	X
SMTP (outgoing)	25 to 25	X	X	192.168.1.102	X
POP3 (incoming)	110 to 110	X	X	192.168.1.102	X

When you have completed the configuration, click the **Apply** button.

7. I need to set up online game hosting or use other Internet applications.

If you want to play online games or use Internet applications, most will work without doing any port forwarding or DMZ hosting. There may be cases when you want to host an online game or Internet application. This would require you to set up the Router to deliver incoming packets or data to a specific computer. This also applies to the Internet applications you are using. The best way to get the information on what port services to use is to go to the website of the online game or application you want to use. Follow these steps to set up online game hosting or use a certain Internet application:

A. Access the Router's web interface by going to **http://192.168.1.1** or the **IP address** of the Router. Go to the **Advanced => Forwarding** tab.
B. Enter any **name** you want to use for the Customized Application.
C. Enter the **Ext. Port range** of the service you are using. For example, if you want to host Unreal Tournament (UT), you would enter the range 7777 to 27900.
D. Check the **protocol** you will be using, TCP and/or UDP.
E. Enter the **IP address** of the PC or network device that you want the port server to go to. For example, if the web server's Ethernet adapter IP address is 192.168.1.100, you would enter 100 in the field provided. Check "Appendix D: Finding the MAC Address and IP Address for Your Ethernet Adapter" for details on getting an IP address.
F. Check the **Enable** option for the port services you want to use. Consider the example below:

Customized Application	Ext. Port	TCP	UDP	IP Address	Enable
UT	7777 to 27900	X	X	192.168.1.100	X
Halflife	27015 to 27015	X	X	192.168.1.105	X
PC Anywhere	5631 to 5631		X	192.168.1.102	X
VPN IPSEC	500 to 500		X	192.168.1.100	X

When you have completed the configuration, click the **Apply** button.

8. I can't get the Internet game, server, or application to work.

If you are having difficulties getting any Internet game, server, or application to function properly, consider exposing one PC to the Internet using DeMilitarized Zone (DMZ) hosting. This option is available when an application requires too many ports or when you are not sure which port services to use. Make sure you disable all the forwarding entries if you want to successfully use DMZ hosting, since forwarding has priority over DMZ hosting. (In other words, data that enters the Router will be checked first by the forwarding settings. If the port number that the data enters from does not have port forwarding, then the Router will send the data to whichever PC or network device you set for DMZ hosting.) Follow these steps to set DMZ hosting:

A. Access the Router's web-based utility by going to **http://192.168.1.1** or the **IP address** of the Router. Go to the **Advanced => Forwarding** tab.
B. Disable or remove the entries you have entered for forwarding. Keep this information in case you want to use it at a later time.
C. Click the **DMZ Host** tab.
D. Enter the Ethernet adapter's **IP address** of the computer you want exposed to the Internet. This will bypass the NAT firewall for that computer. Please refer to "Appendix D: Finding the MAC Address and IP Address for Your Ethernet Adapter" for details on getting an IP address.

Once completed with the configuration, click the **Apply** button.

9. I forgot my password, or the password prompt always appears when saving settings to the Router.

Reset the Router to factory default by pressing the **Reset** button for 30 seconds and then releasing it. If you are still getting prompted for a password when saving settings, then perform the following steps:

A. Access the Router's web interface by going to **http://192.168.1.1** or the **IP address** of the Router. Enter the default password **admin**, and click the **Password** tab.
B. Enter a **different password** in the Router Password field, and enter the same password in the second field to confirm the password.
C. Click the **Apply** button.

10. I am a PPPoE user, and I need to remove the proxy settings or the dial-up pop-up window.

If you have proxy settings, you need to disable these on your computer. Because the Router is the gateway for the Internet connection, the computer does not need any proxy settings to gain access. Please follow these directions to verify that you do not have any proxy settings and that the browser you use is set to connect directly to the LAN.

For Microsoft Internet Explorer 5.0 or higher:

A. Click **Start**, **Settings**, and **Control Panel**. Double-click **Internet Options**.
B. Click the **Connections** tab.
C. Click the **LAN settings** button and remove anything that is checked.
D. Click the **OK** button to go back to the previous screen.
E. Click the option **Never dial a connection**. This will remove any dial-up pop-ups for PPPoE users.

For Netscape 4.7 or higher:

A. Start **Netscape Navigator**, and click **Edit**, **Preferences**, **Advanced**, and **Proxies**.
B. Make sure you have **Direct connection to the Internet** selected on this screen.
C. Close all the windows to finish.

11. To start over, I need to set the Router to factory default.

Hold the **Reset** button for up to 30 seconds and then release it. This will return the password, forwarding, and other settings on the Router to the factory default settings. In other words, the Router will revert to its original factory configuration.

12. I need to upgrade the firmware.

In order to upgrade the firmware with the latest features, you need to go to the Linksys website and download the latest firmware at *www.linksys.com*. Follow these steps:

A. Go to the Linksys website at **http://www.linksys.com** and download the latest firmware.
B. To upgrade the firmware, follow the steps in the Help section found in "Chapter 5: Using the Router's Web-based Utility."

13. The firmware upgrade failed, and/or the Diag LED is flashing.

The upgrade could have failed for a number of reasons. Follow these steps to upgrade the firmware and/or make the Diag LED stop flashing:

A. If the firmware upgrade failed, use the **TFTP** program (it was downloaded along with the firmware). Open the pdf that was downloaded along with the firmware and TFTP program, and follow the pdf's instructions.
B. Set a **static IP address** on the PC; refer to "Problem #1, I need to set a static IP address." Use the following IP address settings for the computer you are using:

    IP Address: 192.168.1.50
    Subnet Mask: 255.255.255.0
    Gateway: 192.168.1.1

C. Perform the upgrade using the TFTP program or the Router's web-based utility through its Help tab.

14. My DSL service's PPPoE is always disconnecting.

PPPoE is not actually a dedicated or always-on connection. The DSL ISP can disconnect the service after a period of inactivity, just like a normal phone dial-up connection to the Internet. There is a setup option to "keep alive" the connection. This may not always work, so you may need to re-establish connection periodically.

A. To connect to the Router, go to the web browser, and enter **http://192.168.1.1** or the **IP address** of the Router.
B. Enter the **password**, if asked. (The default password is **admin**.)
C. In the Setup tab, select the option **Keep Alive**, and set the **Redial Period** option at **20** (seconds).
D. Click the **Apply** button.
E. Click the **Status** tab, and click the **Connect** button.
F. You may see the login status display as **Connecting**. Press the **F5** key to refresh the screen, until you see the login status display as **Connected**.
G. Click the **Apply** button to continue.

If the connection is lost again, follow steps E to G to re-establish connection.

15. I can't access my email, web, or VPN, or I am getting corrupted data from the Internet.

The Maximum Transmission Unit (MTU) setting may need to be adjusted. By default, the MTU is set at 1500. For most DSL users, it is strongly recommended to use MTU 1492. If you are having some difficulties, perform the following steps:

A. To connect to the Router, go to the web browser, and enter **http://192.168.1.1** or the **IP address** of the Router.
B. Enter the password, if asked. (The default password is **admin**.)
C. Click the **Advanced => Filter** tab.
D. Look for the MTU option, and select **Enable**. In the Size field, enter **1492**.
E. Click the **Apply** button to continue.

If your difficulties continue, change the **Size** to different values. Try this list of values, one value at a time, in this order, until your problem is solved:

1462
1400
1362
1300

16. I need to use port triggering.

Port triggering looks at the outgoing port services used and will trigger the Router to open a specific port, depending on which port an Internet application uses. Follow these steps:

A. To connect to the Router, go to the web browser, and enter **http://192.168.1.1** or the **IP address** of the Router.
B. Enter the password, if asked. (The default password is **admin**.)
C. Click the **Advanced => Forwarding** tab, and click the **Port Trigger** button.
D. Enter any **name** you want to use for the Application Name.
E. Enter the **Triggered Port Range**. Check with your Internet application provider for more information on which outgoing port services it is using.
F. Enter the **Incoming Port Range**. Check with your Internet Application provider for more information on which incoming port services are required by the Internet application.

17. The Diag LED stays lit continuously.

- The Diag LED lights up when the device is first powered up. Meantime, the system will boot up itself and check for proper operation. After finishing the checking procedure, the LED turns off to show that the system is working fine. If the LED remains lit after this time, the device is not working properly. Try to flash the firmware by assigning a static IP address to the computer, and then upgrade the firmware. Try using the following settings, IP Address: 192.168.1.50 and Subnet Mask: 255.255.255.0.

18. When I enter a URL or IP address, I get a time-out error or am prompted to retry.

- Check if other PCs work. If they do, ensure that your workstation's IP settings are correct (IP Address, Subnet Mask, Default Gateway, and DNS). Restart the computer that is having a problem.
- If the PCs are configured correctly, but still not working, check the Router. Ensure that it is connected and ON. Connect to it and check its settings. (If you cannot connect to it, check the LAN and power connections.)
- If the Router is configured correctly, check your Internet connection (DSL/cable modem, etc.) to see if it is working correctly. You can remove the Router to verify a direct connection.
- Manually configure the TCP/IP with a DNS address provided by your ISP.
- Make sure that your browser is set to connect directly and that any dial-up is disabled. For Internet Explorer, click **Tools**, **Internet Options**, and then the **Connection** tab. Make sure that Internet Explorer is set to **Never dial a connection**. For Netscape Navigator, click **Edit**, **Preferences**, **Advanced**, and **Proxy**. Make sure that Netscape Navigator is set to **Direct connection to the Internet**.

19. The Full/Col LED keeps flickering continuously.

- Check the Category 5 Ethernet cable and its RJ-45 connectors.
- There may be interference with other network devices. Try removing other PCs or network devices to see if the problem persists. Eliminate each network device one at a time to determine the cause.

Frequently Asked Questions

I'm an AOL member and I need more information. Additional information can be found at AOL Keyword: Linksys Setup.

What is the maximum number of IP addresses that the Router will support? The Router will support up to 253 IP addresses.

Is IPSec Pass-Through supported by the Router? Yes, it is a built-in feature that the Router automatically enables.

Where is the Router installed on the network? In a typical environment, the Router is installed between the cable/DSL modem and the LAN. Plug the Router into the cable/DSL modem's Ethernet port.

Does the Router support IPX or AppleTalk? No. TCP/IP is the only protocol standard for the Internet and has become the global standard for communications. IPX, a NetWare communications protocol used only to route messages from one node to another, and AppleTalk, a communications protocol used on Apple and Macintosh networks, can be used for LAN to LAN connections, but those protocols cannot connect from WAN to LAN.

Does the WAN connection of the Router support 100 Mbps Ethernet? Because of the speed limitations of broadband Internet connections, the Router's current hardware design supports 10 Mbps Ethernet on its WAN port. It does, of course, support 100 Mbps over the auto-sensing Fast Ethernet 10/100 switch on the LAN side of the Router.

What is Network Address Translation and what is it used for? Network Address Translation (NAT) translates multiple IP addresses on the private LAN to one public address that is sent out to the Internet. This adds a level of security since the address of a PC connected to the private LAN is never transmitted on the Internet. Furthermore, NAT allows the Router to be used with low cost Internet accounts, such as DSL or cable modems, when only one TCP/IP address is provided by the ISP. The user may have many private addresses behind this single address provided by the ISP.

Does the Router support any operating system other than Windows 95, Windows 98, Windows 2000, Windows NT, or Windows XP? Yes, but Linksys does not, at this time, provide technical support for setup, configuration or troubleshooting of any non-Windows operating systems.

Does the Router support ICQ send file? Yes, with the following fix: click **ICQ menu -> preference -> connections tab->**, and check **I am behind a firewall or proxy**. Then set the firewall time-out to **80** seconds in the firewall setting. The Internet user can then send a file to a user behind the Router.

I set up an Unreal Tournament Server, but others on the LAN cannot join. What do I need to do? If you have a dedicated Unreal Tournament server running, you need to create a static IP for each of the LAN computers and forward ports 7777, 7778, 7779, 7780, 7781, and 27900 to the IP address of the server. You can also use a port forwarding range of 7777 ~ 27900. If you want to use the UT Server Admin, forward another port (8080 usually works well but is used for remote admin. You may have to disable this.), and then in the [UWeb.WebServer] section of the server.ini file, set the ListenPort to 8080 (to match the mapped port above) and ServerName to the IP assigned to the Router from your ISP.

Can multiple gamers on the LAN get on one game server and play simultaneously with just one public IP address? It depends on which network game or what kind of game server you are using. For example, Unreal Tournament supports multi-login with one public IP.

How do I get *Half-Life: Team Fortress* to work with the Router? The default client port for Half-Life is 27005. The computers on your LAN need to have "+clientport 2700x" added to the HL shortcut command line; the x would be 6, 7, 8, and on up. This lets multiple computers connect to the same server. *One problem:* Version 1.0.1.6 won't let multiple computers with the same CD key connect at the same time, even if on the same LAN (not a problem with 1.0.1.3). As far as hosting games, the HL server does not need to be in the DMZ. Just forward port 27015 to the local IP address of the server computer.

How can I block corrupted FTP downloads? If you are experiencing corrupted files when you download a file with your FTP client, try using another FTP program.

The web page hangs; downloads are corrupt, or nothing but junk characters are being displayed on the screen. What do I need to do? Force your Ethernet adapter to 10Mbps or half duplex mode, and turn off the "Auto-negotiate" feature of your Ethernet adapter as a temporary measure. (Please look at the Network Control Panel in your Ethernet adapter's Advanced Properties tab.) Make sure that your proxy setting is disabled in the browser. Check our website at *www.linksys.com* for more information.

If all else fails in the installation, what can I do? Reset the Router by holding down the reset button until the Diag LED fully turns on and off. Reset your cable or DSL modem by powering the unit off and then on. Obtain and flash the latest firmware release that is readily available on the Linksys website, *www.linksys.com*.

How will I be notified of new Router firmware upgrades? All Linksys firmware upgrades are posted on the Linksys website at *www.linksys.com*, where they can be downloaded for free. The Router's firmware can be upgraded with TFTP programs. If the Router's Internet connection is working well, there is no need to download a newer firmware version, unless that version contains new features that you would like to use. Downloading a more current version of Router firmware will not enhance the quality or speed of your Internet connection, and may disrupt your current connection stability.

Will the Router function in a Macintosh environment? Yes, but the Router's setup pages are accessible only through Internet Explorer 4.0 or Netscape Navigator 4.0 or higher for Macintosh.

I am not able to get the web configuration screen for the Router. What can I do? You may have to remove the proxy settings on your Internet browser, e.g., Netscape Navigator or Internet Explorer. Or remove the dial-up settings on your browser. Check with your browser documentation, and make sure that your browser is set to connect directly and that any dial-up is disabled. Make sure that your browser is set to connect directly and that any dial-up is disabled. For Internet Explorer, click **Tools**, **Internet Options**, and then the **Connection** tab. Make sure that Internet Explorer is set to **Never dial a connection**. For Netscape Navigator, click **Edit**, **Preferences**, **Advanced**, and **Proxy**. Make sure that Netscape Navigator is set to **Direct connection to the Internet**.

What is DMZ Hosting? Demilitarized Zone (DMZ) allows one IP address (computer) to be exposed to the Internet. Some applications require multiple TCP/IP ports to be open. It is recommended that you set your computer with a static IP if you want to use DMZ Hosting. To get the LAN IP address, see "Appendix D: Finding the MAC Address and IP Address for Your Ethernet Adapter."

If DMZ Hosting is used, does the exposed user share the public IP with the Router? No.

Does the Router pass PPTP packets or actively route PPTP sessions? The Router allows PPTP packets to pass through.

Is the Router cross-platform compatible? Any platform that supports Ethernet and TCP/IP is compatible with the Router.

How many ports can be simultaneously forwarded? Theoretically, the Router can establish 520 sessions at the same time, but you can only forward 10 ranges of ports.

Does the Router replace a modem? Is there a cable or DSL modem in the Router? No, this version of the Router must work in conjunction with a cable or DSL modem.

Which modems are compatible with the Router? The Router is compatible with virtually any cable or DSL modem that supports Ethernet.

What are the advanced features of the Router? The Router's advanced features include IP Filtering, Port Range Forwarding, Dynamic Routing, Static Routing, DMZ hosting, and MAC Address Cloning.

What is the maximum number of VPN sessions allowed by the Router? The maximum number depends on many factors. At least one IPSec session will work through the Router; however, simultaneous IPSec sessions *may* be possible, depending on the specifics of your VPNs.

How big is the memory buffer on the Router? 1MB buffer and 512KB flash.

How can I check whether I have static or DHCP IP Addresses? Consult your ISP to obtain this information.

How do I get mIRC to work with the Router? Under the Port Range Forwarding tab, set port forwarding to 113 for the PC on which you are using mIRC.

Can the Router act as my DHCP Server? Yes. The Router has DHCP Server software built-in.

Can I run an application from a remote computer over the wireless network? This will depend on whether or not the application is designed to be used over a network. Consult the application's documentation to determine if it supports operation over a network.

What is the IEEE 802.11b standard? The IEEE 802.11b Wireless LAN standards subcommittee formulates the standard for the industry. The objective is to enable wireless LAN hardware from different manufacturers to communicate.

What IEEE 802.11 features are supported? The product supports the following IEEE 802.11 functions:

- CSMA/CA plus Acknowledge protocol
- Multi-Channel Roaming
- Automatic Rate Selection
- RTS/CTS feature
- Fragmentation
- Power Management

What is BSS ID? A specific Ad-hoc LAN is called a Basic Service Set (BSS). Computers in a BSS must be configured with the same BSS ID.

What is SSID? An Infrastructure configuration could also support roaming capability for mobile workers. More than one BSS can be configured as an Extended Service Set (ESS). Users within an ESS could roam freely between BSSs while maintaining a continuous connection to the wireless network stations and Access Points.

What is ISM band? The FCC and their counterparts outside of the U.S. have set aside bandwidth for unlicensed use in the ISM (Industrial, Scientific and Medical) band. This presents a truly revolutionary opportunity to place convenient high speed wireless capabilities in the hands of users around the globe.

What is Spread Spectrum? Spread Spectrum technology is a wideband radio frequency technique developed by the military for use in reliable, secure, mission-critical communications systems. It is designed to trade off bandwidth efficiency for reliability, integrity, and security. In other words, more bandwidth is consumed than in the case of narrowband transmission, but the trade-off produces a signal that is, in effect, louder and thus easier to detect, provided that the receiver knows the parameters of the spread-spectrum signal being broadcast. If a receiver is not tuned to the right frequency, a spread-spectrum signal looks like background noise. There are two main alternatives, Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum (FHSS).

What is DSSS? What is FHSS? And what are their differences? Frequency Hopping Spread Spectrum (FHSS) uses a narrowband carrier that changes frequency in a pattern that is known to both transmitter and receiver. Properly synchronized, the net effect is to maintain a single logical channel. To an unintended receiver, FHSS appears to be short-duration impulse noise. Direct Sequence Spread Spectrum (DSSS) generates a redundant bit pattern for each

bit to be transmitted. This bit pattern is called a chip (or chipping code). The longer the chip, the greater the probability that the original data can be recovered. Even if one or more bits in the chip are damaged during transmission, statistical techniques embedded in the radio can recover the original data without the need for retransmission. To an unintended receiver, DSSS appears as low power wideband noise and is rejected (ignored) by most narrowband receivers.

Would the information be intercepted while transmitting on air? WLAN features two-fold protection in security. On the hardware side, as with Direct Sequence Spread Spectrum technology, it has the inherent security feature of scrambling. On the software side, the WLAN series offers the encryption function (WEP) to enhance security and access control. Users can set it up depending upon their needs.

What is WEP? WEP is Wired Equivalent Privacy, a data privacy mechanism based on a 40/64 bit shared key algorithm, as described in the IEEE 802.11 standard.

What is a MAC Address? The Media Access Control (MAC) address is a unique number assigned by the manufacturer to any Ethernet networking device, such as a network adapter, that allows the network to identify it at the hardware level. For all practical purposes, this number is usually permanent. Unlike IP addresses, which can change every time a computer logs on to the network, the MAC address of a device stays the same, making it a valuable identifier for the network.

If your questions are not addressed here, refer to the Linksys website, *www.linksys.com*.

Appendix B: How to Ping Your ISP's E-mail and Web Addresses

Virtually all Internet addresses are configured with words or characters (i.e., www.linksys.com, www.yahoo.com, etc.) In actuality, however, these Internet addresses are assigned to IP addresses, which are the true addresses on the Internet. For example, www.linksys.com is actually 216.23.162.142. Entering that into your web browser will bring up at the Linksys home page every time.

IP and web addresses, however, can sometimes be long and hard to remember. Because of this, certain ISPs will shorten their server addresses to single words or codes on their users' web browser or e-mail configurations. If your ISP's e-mail and web server addresses are configured with single words ("www," "e-mail," "home," "pop3," etc.) rather than whole Internet Addresses or IP Addresses, the Router may have problems sending or receiving mail and accessing the Internet. This happens because the Router has not been configured by your ISP to accept their abbreviated server addresses.

The solution is to determine the true web addresses behind your ISP's code words. You can determine the IP and web addresses of your ISP's servers by "pinging" them.

Note: If you don't have your ISP's web and e-mail IP addresses, you must either get them from your ISP or follow these steps prior to connecting the Router to your network.

Step One: Pinging an IP Address

The first step to determining your ISP's web and e-mail server address is to ping its IP address.

1. **Power on the computer and the cable or DSL modem**, and restore the network configuration set by your ISP if you have since changed it.

2. **Click Start**, then **Run,** and type "command." This will bring up the DOS window.

3. **At the DOS command prompt**, type "ping mail" (assuming that the location for which you're trying to find an IP address is configured as "mail"). Press **Enter**. Information such as the following data, taken from a ping of Microsoft Network's e-mail server, will be displayed.

```
C:\>ping mail

Pinging mail [24.53.32.4] with 32 bytes of data:

Reply from 24.53.32.4: bytes=32 time<10ms TTL=128
Reply from 24.53.32.4: bytes=32 time<10ms TTL=128
Reply from 24.53.32.4: bytes=32 time<10ms TTL=128
Reply from 24.53.32.4: bytes=32 time<10ms TTL=128

Ping statistics for 24.53.32.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
  loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum =  0ms, Average =  0ms
```

4. **Write down the IP address returned by the ping command**. (In the example above: 24.53.32.4.) This IP address is the actual IP address of the server "mail," or any other word or value you have pinged.

Step Two: Pinging for a Web Address

While the IP address returned above would work as your e-mail server address, it may not be permanent. IP addresses change all the time. Web addresses, however, usually don't. Because of this, you're likely to have fewer problems by configuring your system with web addresses rather than IP addresses. Follow the instructions below to find the web address assigned to the IP address you just pinged.

1. **At the DOS command prompt**, type "ping -a 24.53.32.4," where 24.53.32.4 is the IP address you just pinged. Information such as the following data will be displayed.

```
C:\>ping -a 24.53.32.4

Pinging mail.msnv3.occa.home.com [24.53.32.4] with
   32 bytes of data:

Reply from 24.53.32.4: bytes=32 time<10ms TTL=127
Reply from 24.53.32.4: bytes=32 time<10ms TTL=127
Reply from 24.53.32.4: bytes=32 time<10ms TTL=127
Reply from 24.53.32.4: bytes=32 time<10ms TTL=127

Ping statistics for 24.53.32.4:
    Packets: Sent = 4, Received = 4, Lost = 0 (0%
   loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum =  0ms, Average =  0ms
```

2. **Write down the web address returned by the ping command** (in the example above: mail.msnv3.occa.home.com.). This web address is the web address assigned to the IP address you just pinged. While the IP address of "mail" could conceivably change, it is likely that this web address will not.

3. **Replace your ISP's abbreviated server address** with this extended web address in the corresponding Internet application (web browser, e-mail application, etc.).

Once you have replaced the brief server address with the true server address, the Router should have no problem accessing the Internet through that Internet application.

Appendix C: Configuring Wireless Security

Note: WEP encryption is an additional data security measure and not essential for router operation.

An acronym for Wired Equivalent Privacy, WEP is an encryption method used to protect your wireless data communications. WEP uses a combination of 64-bit or 128-bit keys to provide access control to your network and encryption security for every data transmission. To decode a data transmission, each point in a network must use an identical 64-bit or 128-bit key. Higher encryption levels mean higher levels of security, but due to the complexity of the encryption, they may mean decreased network performance.

You may also have heard the term "40-bit" used in conjunction with WEP encryption. This is simply another term for 64-bit WEP encryption. This level of WEP encryption has been called 40-bit because it uses a 40-bit secret key along with a 24-bit Initialization Vector (40 + 24 = 64). Wireless vendors may use either name. Linksys uses the term "64-bit" when referring to this level of encryption.

Make sure your wireless network is functioning before attempting to configure WEP encryption.

A 128-bit WEP encrypted wireless network will NOT communicate with a 64-bit WEP encrypted wireless network. Therefore, make sure that all of your wireless devices are using the same encryption level. All wireless devices complying with the 802.11b standard will support 64-bit WEP.

In addition to enabling WEP, Linksys also recommends the following security implementations:
• Changing the SSID from the default "linksys"
• Changing the WEP key regularly

Note: In order for WEP Encryption to be enabled, wireless functions must first be enabled. Select **Enable** under the Wireless section before proceeding.

The following steps will show you how to utilize WEP encryption

1. From the Web-based Utility's Setup tab, select **Mandatory** under the WEP section.

2. Press the **WEP Key Setting** button to set the WEP Encryption type and level.

3. The screen displayed in Figure C-1 may appear, verifying that you are enabling WEP Encryption. Press the **OK** button to continue.

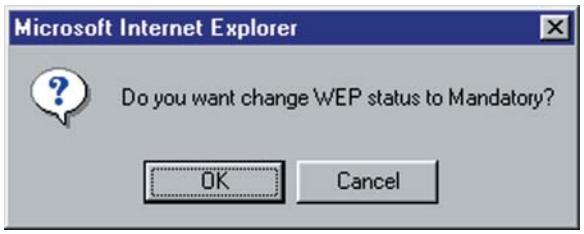

Figure C-1

4. This will display the screen shown in Figure C-2. From this screen, you will choose your WEP Encryption settings.

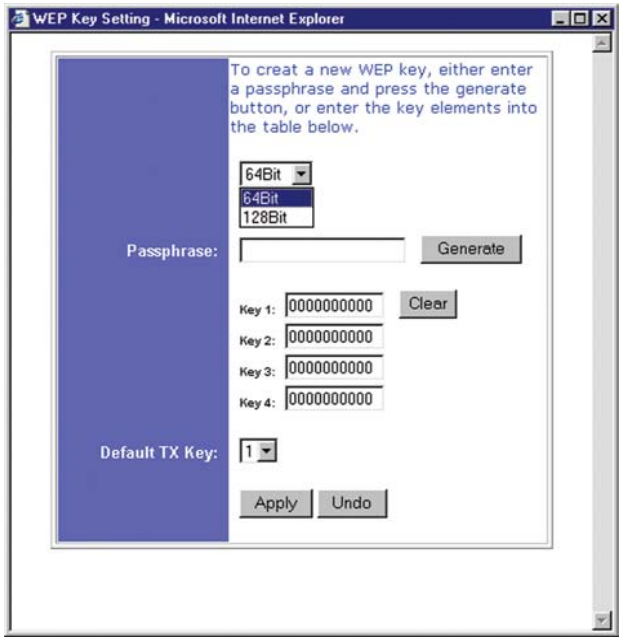

Figure C-2

- **WEP (64Bit or 128B)** Select the level of encryption from the drop-down box. 128-bit WEP encryption is unique to Linksys and may conflict with other vendors' WEP encryption.

Note: In order to utilize WEP encryption, all points in your wireless network must have WEP enabled and be set to the same Key Setting.

The WEP Encryption key is generated in one of two ways:

1. You may create an encryption key by using a **Passphrase.**

   a. Enter a Passphrase, a user-defined password, into the **Passphrase** field. The Passphrase can be a maximum of 31 letters, symbols, and numbers. No spaces can be used.

   b. Click the **Generate** button to create a key. The key will be 10 digits if you chose 64-bit encryption, or 26 digits if you chose 128-bit encryption. This key will be used to encrypt and decrypt the data being sent between the Router and your network's wireless PCs.

   The Key field may not display all digits. Using the mouse, click anywhere within the Key field. Move the cursor to the right to view the rest of the Key. Make sure your write down the entire Key EXACTLY the way it is displayed.

2. You may enter the encryption key manually.

Make a note of the Passphrase or Manual Key. You will need it for the other wireless devices on the network, as the same WEP encryption key must be entered in all wireless devices on the network.

Once you have chosen your key encryption method and entered either the Passphrase or manual key, click the **Apply** button, and the encryption portion of the setup is complete.

Note: In Windows XP, a 128-bit Key generated by the Router will be called a "104 bits (26 digits)" key, and a 64-bit Key generated by the Router will be called a "40 bits (10 digits)" key.

Configuring Wireless Security in Windows XP

As Windows XP does not allow for the use of the Linksys Passphrase feature with the wireless PC adapters, you will need to manually enter the key generated in the previous section.

The following steps will help you enable WEP and enter the encryption key manually for your wireless PC cards, in order to enable your Windows XP system to communicate with the Router wirelessly.

These steps assume that your CD-ROM drive is letter D and that you are running Windows XP in the default mode.

Be sure you have the WEP Key generated by the Router.

1. As shown in Figure C-3, click the **Start** button and go to the **Control Panel**.

Figure C-3

2. In the "Control Panel" window, click the **Network and Internet Connections** icon, shown in Figure C-4.

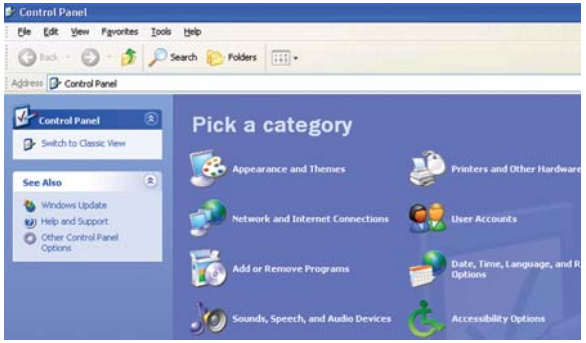

Figure C-4

3. Click the **Network Connections** icon, shown in Figure C-5.

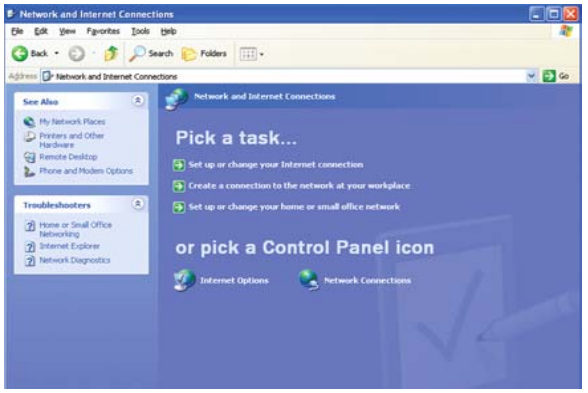

Figure C-5

4. The "Network Connections" window will appear, as shown in Figure C-6. Under LAN or High-Speed Internet you will see all Network cards that are installed and operating in your computer. Double-click the **Wireless Network Connection** icon associated with your wireless adapter.

   If the "Wireless Network Connection Status" window appears, continue to the next step

If a "Connect to Wireless Network" window appears, in the Available Networks section, click the desired wireless network, specified by the Router's SSID. Then, double-click the **Wireless Network Connection** icon.

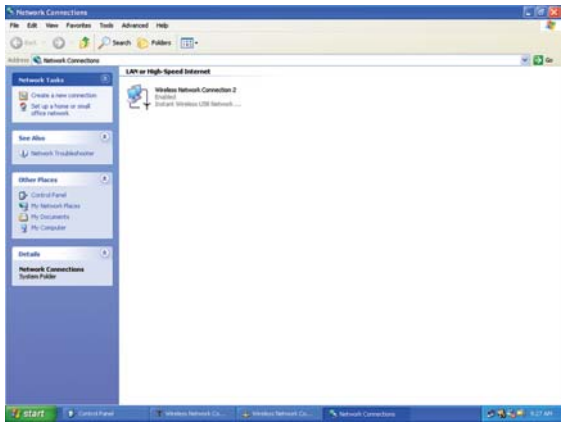

Figure C-6

5. When the "Wireless Network Connection Status" window appears, as in Figure C-7, click the **Properties** button.

Figure C-7

6. When the "Wireless Network Connection Properties" window appears, as in Figure C-8, click the **Wireless Networks** Tab.

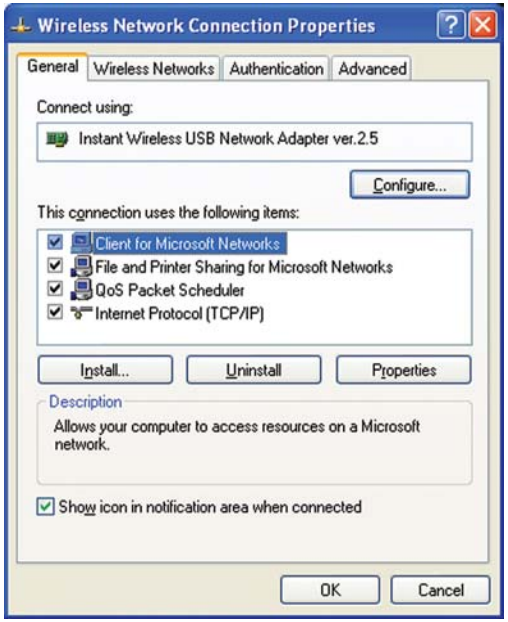

Figure C-8

7. If the appropriate wireless network, specified by the Router's SSID, is displayed in the "Preferred networks" section, as shown in Figure C-9, double-click it and continue to the next step.

   Otherwise, click on the appropriate wireless network, specified by the Router's SSID, in the "Available networks" section. Then, click the **Configure** button

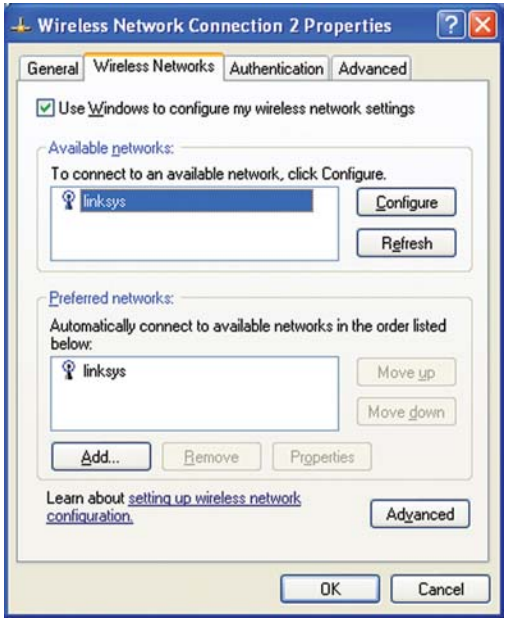

Figure C-9

8. The “Wireless Network Properties” window (shown in Figure C-10) will appear.

   Click the check box for the **Data encryption (WEP enabled)** option.

   Remove the check from the **Network Authentication (Shared mode)** and **The key is provided for me automatically** fields.

   In the "Network key" field, enter the exact Key (all 10 or 26 digits, depending on the level of encryption) generated by the Router.

   Verify that the “Key format” field displays “Hexadecimal digits” and that the “Key length” field displays either “40 bits (10 digits)” or “104 bits (26 digits)”. If this is not displayed, you have entered the key incorrectly.

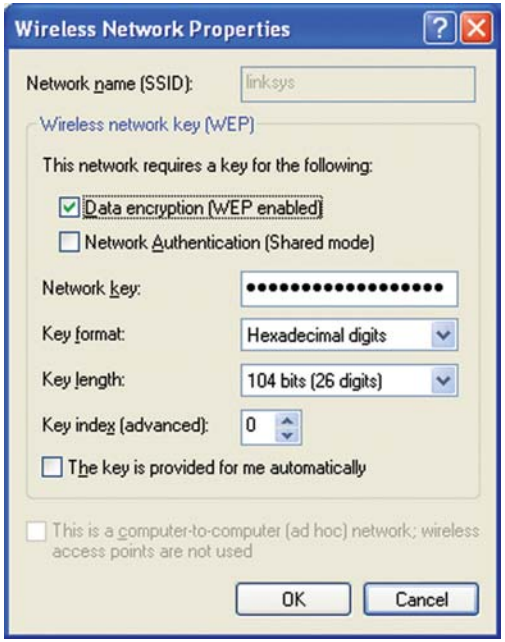

Figure C-10

   Click the **OK** button to save the settings. Click on **OK** buttons until you get back to the “Wireless Network Connection Status” window. Close any open windows to get back to the Windows XP desktop.

Close any applications and reboot your PC. After reboot, WEP configuration is complete and you should be able to connect wirelessly to the Router.

Appendix D: Finding the MAC Address and IP Address for Your Ethernet Adapter

This section describes how to find the MAC address for your Ethernet adapter to do either MAC Filtering or MAC Address Cloning for the Router and ISP. You can also find the IP address of your computer’s Ethernet adapter. The IP address is used for filtering, forwarding, and DMZ. Follow these steps to find the MAC address or IP address for your adapter in Windows 95, 98, ME, NT, 2000, and XP.

For Windows 95, 98, and ME:

1. Click on **Start** and **Run**. In the Open field, enter **winipcfg**, as shown in Figure D-1. Then press the **Enter** key or the **OK** button.

Figure D-1

2. When the IP Configuration window appears, as shown in Figure D-2, select the Ethernet adapter you are using to connect to the Router via a CAT 5 Ethernet cable.

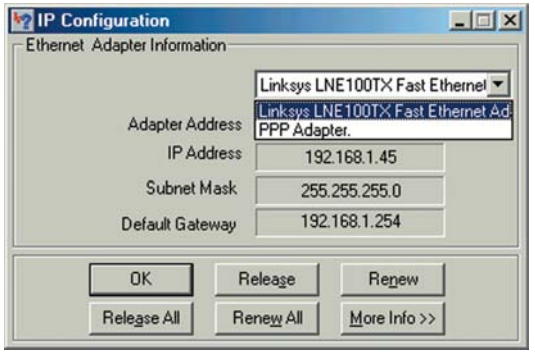

Figure D-2

3. Write down the Adapter Address as shown on your computer screen (see Figure D-3). This is the MAC address for your Ethernet adapter and will be shown as a series of numbers and letters.

   The MAC address/Adapter Address is what you will use for MAC Address Cloning or MAC Filtering.

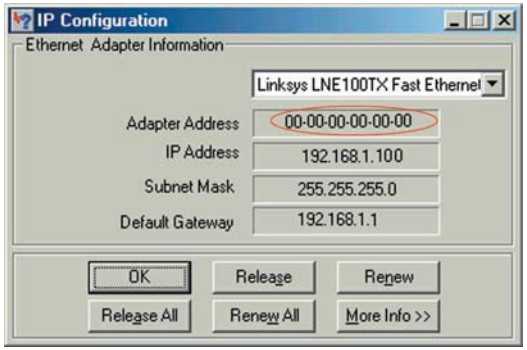

Figure D-3

The example in Figure F-3 shows the IP address of your Ethernet adapter as 192.168.1.100. Your computer may show something different.

Note: The MAC address is also called the Adapter Address.

For Windows NT, 2000, and XP:

The following steps show an alternative way of obtaining the MAC address and IP address for your Ethernet adapter.

1. Click on **Start** and **Run**. In the Open field, enter **cmd**, as shown in Figure D-4. Press the **Enter** key or click the **OK** button.

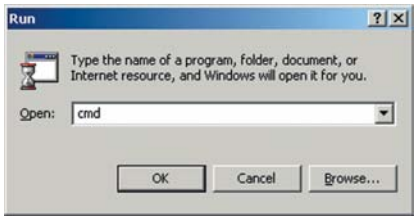

Figure D-4

2. In the command prompt, enter **ipconfig /all**. Then press the **Enter** key.

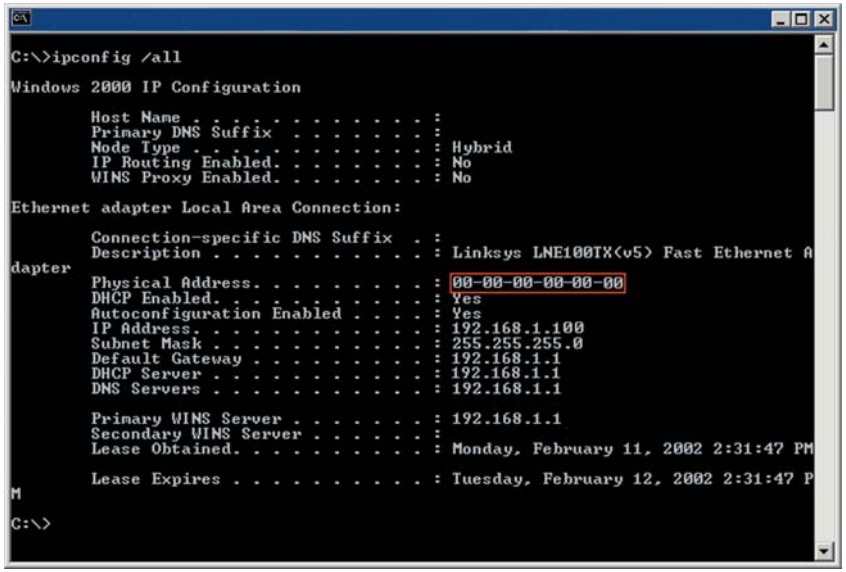

Figure D-5

3. Write down the Physical Address as shown on your computer screen; it is the MAC address for your Ethernet adapter. This will appear as a series of letters and numbers.

   The MAC address/Physical Address is what you will use for MAC Address Cloning or MAC Filtering.

Note: The MAC address is also called the Physical Address.

The example in Figure D-5 shows the IP address of your Ethernet adapter as 192.168.1.100. Your computer may show something different.

When entering the information using the Router's web-based utility, you will type the **12-digit MAC address** in this format, XXXXXXXXXXXX ***without the hyphens*** for MAC Filtering. See Figure D-6.

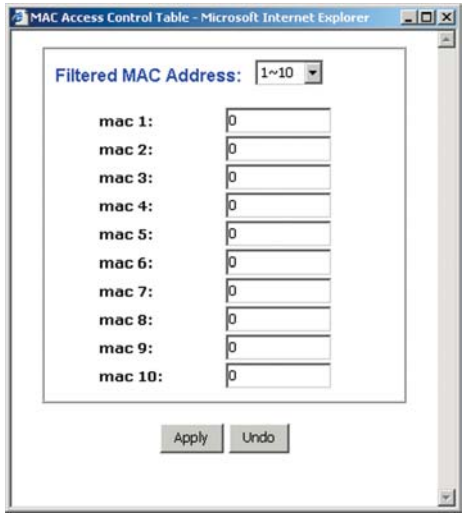

Figure D-6

When entering information for MAC Address Cloning, type the **12-digit MAC address** (see Figure D-7).

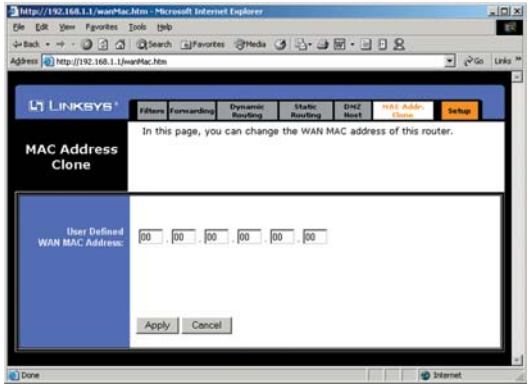

Figure D-7

Appendix E: Setting Up AOL® Broadband Cable & DSL

This document provides instructions for setting up the Router using firmware version 1.43 or above to work with AOL Broadband via a Cable or DSL connection. This Router's AOL Parental Controls feature is available for AOL customers in the US only. Please follow the instructions in the appropriate section below to configure for AOL Broadband for the type of broadband connection you have.

Note: You must install AOL 7.0 or above to all computers using AOL Services. Those with earlier versions of AOL can find details at AOL Keyword: Linksys Setup.

Note: Some of the screens in this section may look slightly different than what appears on your screen.

AOL Broadband via Cable

1. Open your web browser. Enter **http://192.168.1.1** in the web browser's Address field, as shown in Figure E-1, and press the **Enter** key.

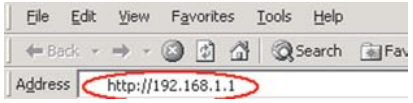

Figure E-1

2. A password request page, shown in Figure E-2 will appear. (Windows XP users will see a Connect to 192.168.1.1 window slightly different from that shown). Leave the User Name field blank, and enter **admin** in the Password field. Then click the **OK** button.

Figure E-2

3. From the *Setup* screen that appears, shown in Figure E-3, select **Obtain an IP automatically** from the WAN Connection Type drop-down menu. Then, click the **Security** tab.

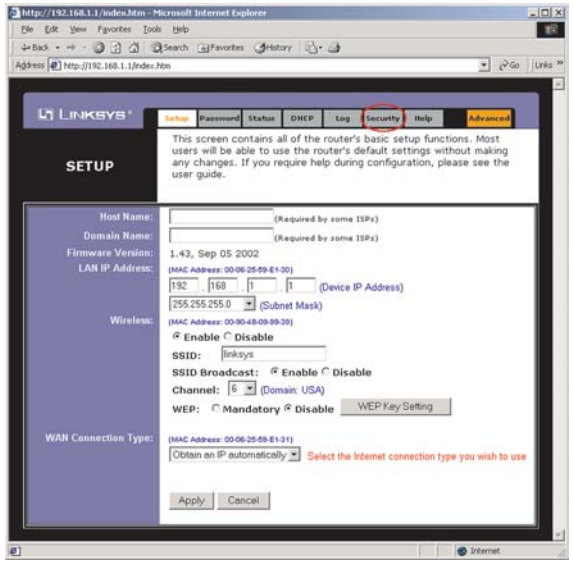

Figure E-3

4. Select **Enable** for AOL Parental Controls from the *Security* tab, shown in Figure E-4, and click the **Apply** button. Click the **OK** button on the screen that appears. Enabling this will disable all options under the Advanced tab except MAC Address cloning.

Then, click the **OK** button to save these settings. Click the **X** button on the top right side of the window to close it.

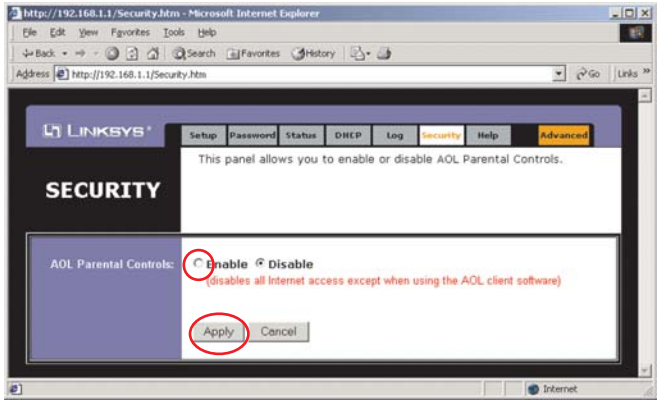

Figure E-4

Note: AOL Parental Controls are available to AOL customers in the Unites States Only.

AOL Broadband via DSL

1. Open your web browser. Enter **http://192.168.1.1** in the web browser's Address field, as shown in Figure E-5, and press the **Enter** key.

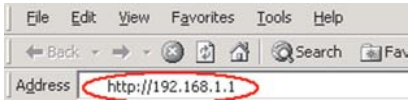

Figure E-5

2. A password request page, shown in Figure E-6 will appear. (Windows XP users will see a Connect to 192.168.1.1 window slightly different from that shown). Leave the User Name field blank, and enter **admin** in the Password field. Then click the **OK** button.

Figure E-6

3. From the *Setup* screen that appears, shown in Figure E-7, select **PPPoE** from the WAN Connection Type drop-down menu. Enter **america online** for the User Name. In the password field, multiple asterisks will appear. Keep these settings and click the **Apply** button to save them. Click the **X** button on the top right side of the window to close it.

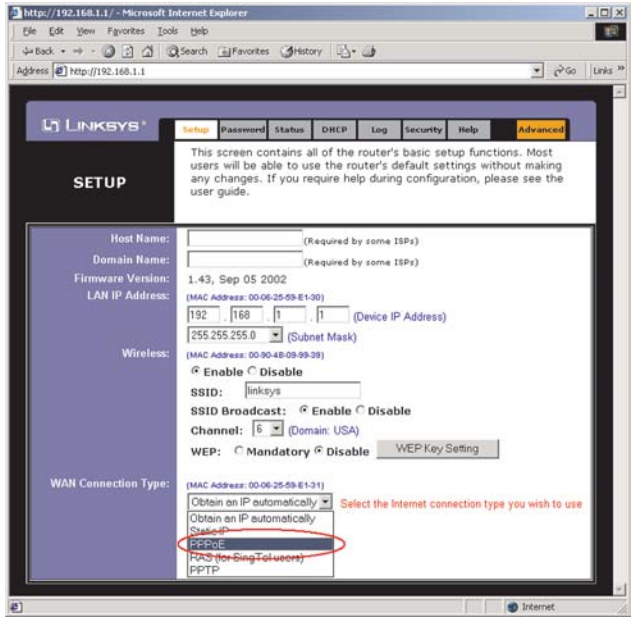

Figure E-7

Appendix F: Glossary

10BaseT - An Ethernet standard that uses twisted wire pairs.

100BaseTX - IEEE physical layer specification for 100 Mbps over two pairs of Category 5 wire.

Adapter - Printed circuit board that plugs into a PC to add to capabilities or connectivity to a PC. In a networked environment, a network interface card is the typical adapter that allows the PC or server to connect to the intranet and/or Internet.

Ad-hoc Network - An ad-hoc network is a group of computers, each with a wireless adapter, connected as an independent 802.11 wireless LAN. Ad-hoc wireless computers operate on a peer-to-peer basis, communicating directly with each other without the use of an access point. Ad-hoc mode is also referred to as an Independent Basic Service Set (IBSS) or as peer-to-peer mode.

AppleTalk - An Apple Computer networking system that support Apple's proprietary local talk.

Auto-negotiate - To automatically determine the correct settings. The term is often used with communications and networking. For example, Ethernet 10/100 cards, hubs and switches can determine the highest speed of the node they are connected to and adjust their transmission rate accordingly.

Backbone - The part of a network that connects most of the systems and networks together and handles the most data.

Bandwidth - The transmission capacity of a given facility, in terms of how much data the facility can transmit in a fixed amount of time; expressed in bits per second (bps).

Beacon Interval - A beacon is a packet broadcast by the Access Point to keep the network synchronized. A beacon includes the wireless LAN service area, the AP address, the Broadcast destination addresses, a time stamp, Delivery Traffic Indicator Maps, and the Traffic Indicator Message (TIM).

Bit - A binary digit. The value - 0 or 1-used in the binary numbering system. Also, the smallest form of data.

Boot - To cause the computer to start executing instructions. Personal computers contain built-in instructions in a ROM chip that are automatically executed on startup. These instructions search for the operating system, load it and pass control to it.

Broadband - A data-transmission scheme in which multiple signals share the bandwidth of a medium. This allows the transmission of voice, data and video signals over a single medium. Cable television uses broadband techniques to deliver dozens of channels over one cable.

Browser - A browser is an application program that provides a way to look at and interact with all the information on the World Wide Web or PC. The word "browser" seems to have originated prior to the Web as a generic term for user interfaces that let you browse text files online.

BSS (**B**asic **S**ervice **S**et) - An infrastructure network connecting wireless devices to a wired network using a single access point.

Buffer - A buffer is a shared or assigned memory area used by hardware devices or program processes that operate at different speeds or with different sets of priorities. The buffer allows each device or process to operate without being held up by the other. In order for a buffer to be effective, the size of the buffer and the algorithms for moving data into and out of the buffer need to be considered by the buffer designer. Like a cache, a buffer is a "midpoint holding place" but exists not so much to accelerate the speed of an activity as to support the coordination of separate activities.

Cable Modem - A device that connects a computer to the cable television network, which in turn connects to the Internet. Once connected, cable modem users have a continuous connection to the Internet. Cable modems feature asymmetric transfer rates: around 36 Mbps downstream (from the Internet to the computer), and from 200 Kbps to 2 Mbps upstream (from the computer to the Internet).

CAT 5 - ANSI/EIA (American National Standards Institute/Electronic Industries Association) Standard 568 is one of several standards that specify "categories" (the singular is commonly referred to as "CAT") of twisted pair

cabling systems (wires, junctions, and connectors) in terms of the data rates that they can sustain. CAT 5 cable has a maximum throughput of 100 Mbps and is usually utilized for 100BaseTX networks.

CAT 5e - The additional cabling performance parameters of return loss and far-end crosstalk (FEXT) specified for 1000BASE-T and not specified for 10BASE-T and 100BASE-TX are related to differences in the signaling implementation. 10BASE-T and 100BASE-TX signaling is unidirectional-signals are transmitted in one direction on a single wire pair. In contrast, Gigabit Ethernet is bi-directional-signals are transmitted simultaneously in both directions on the same wire pair; that is, both the transmit and receive pair occupy the same wire pair.

CSMA/CA (**C**arrier **S**ense **M**ultiple **A**ccess/**C**ollision **A**voidance) - In local area networking, this is the CSMA technique that combines slotted time-division multiplexing with carrier sense multiple access/collision detection (CSMA/CD) to avoid having collisions occur a second time. This works best if the time allocated is short compared to packet length and if the number of situations is small.

Data Packet - One frame in a packet-switched message. Most data communications is based on dividing the transmitted message into packets. For example, an Ethernet packet can be from 64 to 1518 bytes in length.

Default Gateway - The routing device used to forward all traffic that is not addressed to a station within the local subnet.

DHCP (**D**ynamic **H**ost **C**onfiguration **P**rotocol) - A protocol that lets network administrators manage centrally and automate the assignment of Internet Protocol (IP) addresses in an organization's network. Using the Internet's set of protocol (TCP/IP), each machine that can connect to the Internet needs a unique IP address. When an organization sets up its computer users with a connection to the Internet, an IP address must be assigned to each machine. Without DHCP, the IP address must be entered manually at each computer and, if computers move to another location in another part of the network, a new IP address must be entered. DHCP lets a network administrator supervise and distribute IP addresses from a central point and automatically sends a new IP address when a computer is plugged into a different place in the network.

DHCP uses the concept of a "lease" or amount of time that a given IP address will be valid for a computer. The lease time can vary depending on how long a user is likely to require the Internet connection at a particular location. It's especially useful in education and other environments where users change frequently. Using very short leases, DHCP can dynamically reconfigure networks in which there are more computers than there are available IP addresses.

DHCP supports static addresses for computers containing Web servers that need a permanent IP address.

DMZ (**Dem**ilitarized **Z**one) - Allows one IP address (or computer) to be exposed to the Internet. Some applications require multiple TCP/IP ports to be open. It is recommended that you set your computer with a static IP address if you want to use DMZ Hosting.

DNS - The domain name system (DNS) is the way that Internet domain name are located and translated into Internet Protocol (IP) addresses. A domain name is a meaningful and easy-to-remember "handle" for an Internet address.

Domain - A subnetwork comprised of a group of clients and servers under the control of one security database. Dividing LANs into domains improves performance and security.

Download - To receive a file transmitted over a network. In a communications session, download means receive, upload means transmit.

DSL (**D**igital **S**ubscriber **L**ine) - A technology that dramatically increases the digital capacity of ordinary telephone lines into the home or office and, by employing unused bandwidth, still allows for normal phone usage. DSL provides "always-on" operation, eliminating the need to dial in to the service.

DSSS (**D**irect-**S**equence **S**pread **S**pectrum) - DSSS generates a redundant bit pattern for all data transmitted. This bit pattern is called a chip (or chipping code). Even if one or more bits in the chip are damaged during transmission, statistical techniques embedded in the receiver can recover the original data without the need for retransmission. To an unintended receiver, DSSS appears as low power wideband noise and is rejected (ignored) by most narrowband receivers. However, to an intended receiver (i.e. another wireless LAN endpoint), the DSSS signal is recognized as the only valid signal, and interference is inherently rejected (ignored).

DTIM (**D**elivery **T**raffic **I**ndication **M**essage) - A DTIM field is a countdown field informing clients of the next window for listening to broadcast and multicast messages. When the AP has buffered broadcast or multicast messages for

associated clients, it sends the next DTIM with a DTIM Interval value. AP Clients hear the beacons and awaken to receive the broadcast and multicast messages.

Dynamic IP Address - An IP address that is automatically assigned to a client station in a TCP/IP network, typically by a DHCP server. Network devices that serve multiple users, such as servers and printers, are usually assigned static IP addresses.

Dynamic Routing - The ability for a router to forward data via a different route based on the current conditions of the communications circuits. For example, it can adjust for overloaded traffic or failing lines and is much more flexible than static routing, which uses a fixed forwarding path.

Encryption - A security method that applies a specific algorithm to data in order to alter the data's appearance and prevent other devices from reading the information.

ESS (**E**xtended **S**ervice **S**et) - A set of more than two or more BSSs (multiple access points) forming a single network.

Ethernet - IEEE standard network protocol that specifies how data is placed on and retrieved from a common transmission medium. Has a transfer rate of 10 Mbps. Forms the underlying transport vehicle used by several upper-level protocols, including TCP/IP and XNS.

Fast Ethernet - A 100 Mbps technology based on the 10Base-T Ethernet CSMA/CD network access method.

FHSS (**F**requency **H**opping **S**pread **S**pectrum) - FHSS continuously changes (hops) the carrier frequency of a conventional carrier several times per second according to a pseudo-random set of channels. Because a fixed frequency is not used, and only the transmitter and receiver know the hop patterns, interception of FHSS is extremely difficult.

Finger - A UNIX command widely used on the Internet to find out information about a particular user, such as telephone number, whether currently logged on or the last time logged on. The person being "fingered" must have placed his or her profile on the system. Fingering requires entering the full user@domain address.

Firewall - A firewall is a set of related programs, located at a network gateway server, that protects the resources of a network from users from other networks. (The term also implies the security policy that is used with the programs.) An enterprise with an intranet that allows its workers access to the wider Internet installs a firewall to prevent outsiders from accessing its own private data resources and for controlling what outside resources to which its own users have access.

Basically, a firewall, working closely with a router, examines each network packet to determine whether to forward it toward its destination.

Firmware - Code that is written onto read-only memory (ROM) or programmable read-only memory (PROM). Once firmware has been written onto the ROM or PROM, it is retained even when the device is turned off.

Fragmentation - Breaking a packet into smaller units when transmitting over a network medium that cannot support the original size of the packet.

FTP (**F**ile **T**ransfer **P**rotocol) - A protocol used to transfer files over a TCP/IP network (Internet, UNIX, etc.). For example, after developing the HTML pages for a Web site on a local machine, they are typically uploaded to the Web server using FTP.

FTP includes functions to log onto the network, list directories and copy files. It can also convert between the ASCII and EBCDIC character codes. FTP operations can be performed by typing commands at a command prompt or via an FTP utility running under a graphical interface such as Windows. FTP transfers can also be initiated from within a Web browser by entering the URL preceded with ftp://.

Unlike e-mail programs in which graphics and program files have to be "attached," FTP is designed to handle binary files directly and does not add the overhead of encoding and decoding the data.

Full Duplex - The ability of a device or line to transmit data simultaneously in both directions.

Gateway - A device that interconnects networks with different, incompatible communications protocols.

Half Duplex - Data transmission that can occur in two directions over a single line, but only one direction at a time.

Hardware - Hardware is the physical aspect of computers, telecommunications, and other information technology devices. The term arose as a way to distinguish the "box" and the electronic circuitry and components of a computer from the program you put in it to make it do things. The program came to be known as the software.

Hop - The link between two network nodes.

HTTP (**H**yper**T**ext **T**ransport **P**rotocol) - The communications protocol used to connect to servers on the World Wide Web. Its primary function is to establish a connection with a Web server and transmit HTML pages to the client browser.

Hub - The device that serves as the central location for attaching wires from workstations. Can be passive, where there is no amplification of the signals; or active, where the hubs are used like repeaters to provide an extension of the cable that connects to a workstation.

ICQ - A conferencing program for the Internet that provides interactive chat, e-mail and file transfer and can alert you when someone on your predefined list has also come online.

IEEE (The **I**nstitute of **E**lectrical and **E**lectronics **E**ngineers) - The IEEE describes itself as "the world's largest technical professional society, promoting the development and application of electrotechnology and allied sciences for the benefit of humanity, the advancement of the profession, and the well-being of our members."

The IEEE fosters the development of standards that often become national and international standards. The organization publishes a number of journals, has many local chapters, and several large societies in special areas, such as the IEEE Computer Society.

Infrastructure Network - An infrastructure network is a group of computers or other devices, each with a wireless adapter, connected as an 802.11 wireless LAN. In infrastructure mode, the wireless devices communicate with each other and to a wired network by first going through an access point. An infrastructure wireless network connected to a wired network is referred to as a Basic Service Set (BSS). A set of two or more BSS in a single network is referred to as an Extended Service Set (ESS). Infrastructure mode is useful at a corporation scale, or when it is necessary to connect the wired and wireless networks.

IP Address - In the most widely installed level of the Internet Protocol (Internet Protocol) today, an IP address is a 32-binary digit number that identifies each sender or receiver of information that is sent in packet across the Internet. When you request an HTML page or send e-mail, the Internet Protocol part of TCP/IP includes your IP address in the message (actually, in each of the packets if more than one is required) and sends it to the IP address that is obtained by looking up the domain name in the Uniform Resource Locator you requested or in the e-mail address you're sending a note to. At the other end, the recipient can see the IP address of the Web page requestor or the e-mail sender and can respond by sending another message using the IP address it received.

IPCONFIG - A Windows NT or 2000 utility that provides for querying, defining and managing IP addresses within a network. A commonly used utility for configuring networks with static IP addresses.

IPSec (**I**nternet **P**rotocol **Sec**urity) - A suite of protocols used to implement secure exchange of packets at the IP layer. IPSec supports two basic modes: Transport and Tunnel. Transport encrypts the payload of each packet, leaving the header untouched, while Tunnel mode encrypts both the header and the payload and is therefore more secure. IPSec must be supported on both transmitter and receiver and must share a public key. Tunnel mode is widely deployed in VPNs (Virtual Private Networks).

IPX (**I**nternetwork **P**acket E**X**change) - A NetWare communications protocol used to route messages from one node to another. IPX packets include network addresses and can be routed from one network to another.

ISM band - The FCC and their counterparts outside of the U.S. have set aside bandwidth for unlicensed use in the ISM (Industrial, Scientific and Medical) band. Spectrum in the vicinity of 2.4 GHz, in particular, is being made available worldwide. This presents a truly revolutionary opportunity to place convenient high-speed wireless capabilities in the hands of users around the globe.

ISP - An ISP (Internet service provider) is a company that provides individuals and companies access to the Internet and other related services such as Web site building and virtual hosting.

LAN - A local area network (LAN) is a group of computers and associated devices that share a common communications line and typically share the resources of a single processor or server within a small geographic area (for example, within an office building).

MAC (**M**edia **A**ccess **C**ontrol) **Address** - A unique number assigned by the manufacturer to any Ethernet networking device, such as a network adapter, that allows the network to identify it at the hardware level.

Mbps (**M**ega**B**its **P**er **S**econd) - One million bits per second; unit of measurement for data transmission.

MIB (**M**anagement **I**nformation **B**ase) - A set of database objects. This set contains information about a specific device for utilizing SNMP.

mIRC - mIRC runs under Windows and provides a graphical interface for logging onto IRC servers and listing, joining and leaving channels.

Multicasting - Sending data to a group of nodes instead of a single destination.

NAT (**N**etwork **A**ddress **T**ranslation) - The translation of an Internet Protocol address (IP address) used within one network to a different IP address known within another network. One network is designated the inside network and the other is the outside.

Network - A system that transmits any combination of voice, video and/or data between users.

NNTP (**N**etwork **N**ews **T**ransfer **P**rotocol) - The protocol used to connect to Usenet groups on the Internet. Usenet newsreaders support the NNTP protocol.

Node - A network junction or connection point, typically a computer or work station.

Packet - A unit of data routed between an origin and a destination in a network.

Passphrase - Used much like a password, a passphrase simplifies the WEP encryption process by automatically generating the WEP encryption keys for Linksys products.

PC Card - A credit-card sized removable module that contains memory, I/O, or a hard disk.

Ping (**P**acket **IN**ternet **G**roper) - An Internet utility used to determine whether a particular IP address is online. It is used to test and debug a network by sending out a packet and waiting for a response.

Plug-and-Play - The ability of a computer system to configure expansion boards and other devices automatically without requiring the user to turn off the system during installation.

Port - A pathway into and out of the computer or a network device such as a switch or router. For example, the serial and parallel ports on a personal computer are external sockets for plugging in communications lines, modems and printers.

PPPoE (**P**oint to **P**oint **P**rotocol **o**ver **E**thernet) - PPPoE is a method for the encapsulation of PPP packets over Ethernet frames from the user to the ISP over the Internet. One reason PPPoE is preferred by ISPs is because it provides authentication (username and password) in addition to data transport. A PPPoE session can be initiated by either a client application residing on a PC, or by client firmware residing on a modem or router.

PPTP (**P**oint-to-**P**oint **T**unneling **P**rotocol) - A protocol (set of communication rules) that allows corporations to extend their own corporate network through private "tunnels" over the public Internet. Effectively, a corporation uses a wide-area network as a single large local area network. A company no longer needs to lease its own lines for wide-area communication but can securely use the public networks. This kind of interconnection is known as a virtual private network.

RIP (**R**outing **I**nformation **P**rotocol) - A simple routing protocol that is part of the TCP/IP protocol suite. It determines a route based on the smallest hop count between source and destination. RIP is a distance vector protocol that routinely broadcasts routing information to its neighboring routers.

RJ-45 (**R**egistered **J**ack-**45**) - A connector similar to a telephone connector that holds up to eight wires, used for connecting Ethernet devices.

Roaming - In an infrastructure mode wireless network, this refers to the ability to move out of one access point's range and into another and transparently reassociate and reauthenticate to the new access point. This reassociation and reauthentication should occur without user intervention and ideally without interruption to network connectivity. A typical scenario would be a location with multiple access points, where users can physically relocate from one area to another and easily maintain connectivity.

Router - Protocol-dependent device that connects subnetworks together. Routers are useful in breaking down a very large network into smaller subnetworks; they introduce longer delays and typically have much lower throughput rates than bridges.

RTS (**R**equest **T**o **S**end) - An RS-232 signal sent from the transmitting station to the receiving station requesting permission to transmit.

Server - Any computer whose function in a network is to provide user access to files, printing, communications, and other services.

SMTP (**S**imple **M**ail **T**ransfer **P**rotocol) - The standard e-mail protocol on the Internet. It is a TCP/IP protocol that defines the message format and the message transfer agent (MTA), which stores and forwards the mail.

SNMP (**S**imple **N**etwork **M**anagement **P**rotocol) - A widely used network monitoring and control protocol. Data is passed from SNMP agents, which are hardware and/or software processes reporting activity in each network device (hub, router, bridge, etc.) to the workstation console used to oversee the network. The agents return information contained in a MIB (Management Information Base), which is a data structure that defines what is obtainable from the device and what can be controlled (turned off, on, etc.).

Software - Instructions for the computer. A series of instructions that performs a particular task is called a "program." The two major categories of software are "system software" and "application software." System software is made up of control programs such as the operating system and database management system (DBMS). Application software is any program that processes data for the user.

A common misconception is that software is data. It is not. Software tells the hardware how to process the data.

Spread Spectrum - Spread Spectrum technology is a wideband radio frequency technique developed by the military for use in reliable, secure, mission-critical communications systems. It is designed to trade off bandwidth efficiency for reliability, integrity, and security. In other words, more bandwidth is consumed than in the case of narrowband transmission, but the trade off produces a signal that is, in effect, louder and thus easier to detect, provided that the receiver knows the parameters of the spread-spectrum signal being broadcast.

If a receiver is not tuned to the right frequency, a spread-spectrum signal looks like background noise. There are two main alternatives, Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum (FHSS).

SPI (**S**tateful **P**acket **I**nspection) - A firewall technology that monitors the state of the transaction so that it can verify that the destination of an inbound packet matches the source of a previous outbound request. It examines not just the headers of the packet, but also the contents, to determine more about the packet than just its source and destination information. It is called "stateful" because verifies that the stated destination computer has previously requested the current communication. In this way, it verifies that all communications are initiated by the recipient computer and are taking place only with sources that are known and trusted from previous interactions. In addition to being a more rigorous inspection, stateful packet inspection closes off ports until connection to the specific port is requested. This allows an added layer of protection from the threat of port scanning.

SSID (**S**ervice **S**et IDentifier) - A unique name shared among all points in a wireless network. The SSID must be identical for each point in the wireless network and is case-sensitive.

Static IP Address - A permanent IP address that is assigned to a node in an IP or a TCP/IP network.

Static Routing - Forwarding data in a network via a fixed path. Static routing cannot adjust to changing line conditions as can dynamic routing.

Subnet Mask - The method used for splitting IP networks into a series of subgroups, or subnets. The mask is a binary pattern that is matched up with the IP address to turn part of the host ID address field into a field for subnets.

Switch - 1. A data switch connects computing devices to host computers, allowing a large number of devices to share a limited number of ports. 2. A device for making, breaking, or changing the connections in an electrical circuit.

TCP (**T**ransmission **C**ontrol **P**rotocol) - A method (protocol) used along with the IP (Internet Protocol) to send data in the form of message units (datagram) between network devices over a LAN or WAN. While IP takes care of handling the actual delivery of the data (routing), TCP takes care of keeping track of the individual units of data (called packets) that a message is divided into for effi-

cient delivery over the network. TCP is known as a "connection oriented" protocol due to requiring the receiver of a packet to return an acknowledgment of receipt to the sender of the packet resulting in transmission control.

TCP/IP (**T**ransmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol) - The basic communication language or set of protocols for communications over a network (developed specifically for the Internet). TCP/IP defines a suite or group of protocols and not only TCP and IP.

Telnet - A terminal emulation protocol commonly used on the Internet and TCP/IP-based networks. It allows a user at a terminal or computer to log onto a remote device and run a program.

TFTP (**T**rivial **F**ile **T**ransfer **P**rotocol) - A version of the TCP/IP FTP protocol that has no directory or password capability.

Throughput - The amount of data moved successfully from one place to another in a given time period.

TX Rate - Transmission Rate.

UDP (**U**ser **D**atagram **P**rotocol) - A method (protocol) used along with the IP (Internet Protocol) to send data in the form of message units (datagram) between network devices over a LAN or WAN. While IP takes care of handling the actual delivery of the data (routing), UDP takes care of keeping track of the individual units of data (called packets) that a message is divided into for efficient delivery over the network. UDP is known as a "connection-less" protocol due to NOT requiring the receiver of a packet to return an acknowledgment of receipt to the sender of the packet (as opposed to TCP).

Upgrade - To replace existing software or firmware with a newer version.

Upload - To transmit a file over a network. In a communications session, upload means transmit, download means receive.

URL (**U**niform **R**esource **L**ocator) - The address that defines the route to a file on the Web or any other Internet facility. URLs are typed into the browser to access Web pages, and URLs are embedded within the pages themselves to provide the hypertext links to other pages.

UTP - Unshielded twisted pair is the most common kind of copper telephone wiring. Twisted pair is the ordinary copper wire that connects home and many business computers to the telephone company. To reduce crosstalk or electromagnetic induction between pairs of wires, two insulated copper wires are twisted around each other. Each signal on twisted pair requires both wires. Since some telephone sets or desktop locations require multiple connections, twisted pair is sometimes installed in two or more pairs, all within a single cable.

VPN (**V**irtual **P**rivate **N**etwork) - A technique that allows two or more LANs to be extended over public communication channels by creating private communication subchannels (tunnels). Effectively, these LANs can use a WAN as a single large "virtually private" LAN. This removes the need to use leased lines for WAN communications through secure use of a publicly available WAN (such as the Internet). Examples of VPN technology are: PPTP (Point to Point Tunneling Protocol), L2TP (Layer 2 Tunneling Protocol), and IPSec (Internet Protocol Security).

WAN (**W**ide **A**rea **N**etwork)- A communications network that covers a relatively large geographic area, consisting of two or more LANs. Broadband communication over the WAN is often through public networks such as the telephone (DSL) or cable systems, or through leased lines or satellites. In its most basic definition, the Internet could be considered a WAN.

WEP (**W**ired **E**quivalent **P**rivacy) - A data privacy mechanism based on a 64-bit or 128-bit shared key algorithm, as described in the IEEE 802.11 standard.

WINIPCFG - Configuration utility based on the Win32 API for querying, defining and managing IP addresses within a network. A commonly used utility for configuring networks with static IP addresses.

Appendix G: Specifications

Standards		IEEE 802.3 (10BaseT), IEEE 802.3u (100BaseTX), IEEE 802.11b (Wireless)
Protocol		CSMA/CD
Ports		
WAN:		One 10Base-T RJ-45 Port for cable or DSL Modem
LAN:		Four 10/100 RJ-45 Switched Ports, One Shared Uplink Port
Speed (Mbps)	WAN:	10 (Half Duplex)
	LAN:	10/100 (Half Duplex) 20/200 (Full Duplex)
Cabling Type		UTP Category 5 or better
Button		Reset
TX Power		19 dbm
Throughput (average)		4.2 Mbps
Receiver Sensitivity (Typical)		1Mbps 0-5 BER @ -89dbm 5.5Mbps 10-5 BER @ -83dbm 11Mbps 10-5 BER @ -79dbm
Topology		Star (Ethernet)
LED Indicators		Power, WLAN Activity, WLAN Link
WAN		Link/Activity, Diag for WAN
LAN		Full Duplex/Collision, Link/Activity 100
Connectors		2 Antenna Connectors

Environmental

Dimensions	7.31" x 6.16" x 2.44" (186mm x 154mm x 62mm)
Unit Weight	18 oz. (0.51 kg.)
Power Input	External, 5V DC, 2.5A
Certifications	FCC Class B, CE Mark
Operating Temperature	0ºC to 40ºC (32ºF to 104ºF)
Storage Temperature	-20ºC to 70ºC (-4ºF to 158ºF)
Operating Humidity	10% to 85%, Non-Condensing
Storage Humidity	5% to 90%, Non-Condensing

Appendix H: Warranty Information

BE SURE TO HAVE YOUR PROOF OF PURCHASE AND A BARCODE FROM THE PRODUCT'S PACKAGING ON HAND WHEN CALLING. RETURN REQUESTS CANNOT BE PROCESSED WITHOUT PROOF OF PURCHASE.

IN NO EVENT SHALL LINKSYS'S LIABILITY EXCEED THE PRICE PAID FOR THE PRODUCT FROM DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF THE PRODUCT, ITS ACCOMPANYING SOFTWARE, OR ITS DOCUMENTATION. LINKSYS DOES NOT OFFER REFUNDS FOR ANY PRODUCT.

LINKSYS OFFERS CROSS SHIPMENTS, A FASTER PROCESS FOR PROCESSING AND RECEIVING YOUR REPLACEMENT. LINKSYS PAYS FOR UPS GROUND ONLY. ALL CUSTOMERS LOCATED OUTSIDE OF THE UNITED STATES OF AMERICA AND CANADA SHALL BE HELD RESPONSIBLE FOR SHIPPING AND HANDLING CHARGES. PLEASE CALL LINKSYS FOR MORE DETAILS.

Appendix I: Contact Information

For help with the installation or operation of the Wireless Access Point Router with 4-Port Switch, contact Linksys Technical Support at one of the phone numbers or Internet addresses below.

Sales Information	800-546-5797 (1-800-LINKSYS)
Technical Support	800-326-7114
RMA (Return Merchandise Authorization) Issues	www.linksys.com (or call 949-271-5461)
Fax	949-265-6655
E-mail	support@linksys.com
Web site	http://www.linksys.com
FTP site	ftp://ftp.linksys.com

http://www.linksys.com

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