ParkerVision

PRELIMINARY

Horizons Model 1500WR Wireless 4-Port Router User's Guide

Powered by ParkerVision™ D2D™ Wireless Technology

REVISION: 1
VERSION: 030104A
DATE: March 2004

www.direct2data.com

May include one or more of the following patents: US6421534, US6049706, US6266518, US6061555, US6061551,US6353735, US6091940, US6370371 Additional Patents Pending.
Designed and manufactured in the USA.

FCC INTERFERENCE STATEMENT
FCC ID: JFE-D2D00003

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

This device may not cause harmful interference.

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

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not used in accordance with the instructions, may cause harmful interference to radio communications.

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

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and the receiver.

Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

INFORMATION TO USER: THE USER'S MANUAL OR INSTRUCTION MANUAL FOR AN INTENTIONAL OR UNINTENTIONAL RADIATOR SHALL CAUTION THE USER THAT CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

"FCC RF exposure requirements: When in operation, the device should be located such that it is more than 20 cm. away from people and their person. This transmitter is restricted for use with the specific antenna(s) tested in the application for Certification. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter."

LIMITED WARRANTY

PLEASE READ THIS MANUFACTURER'S GUARANTEE CAREFULLY TO UNDERSTAND YOUR RIGHTS AND OBLIGATIONS.

MANUFACTURER'S GUARANTEE AND LIMITATION OF LIABILITY

Note: The following guarantee is not restricted to any territory and does not affect any statutory rights that you may have. The term "Hardware Device" means the enclosed Direct2Data™ Technologies Hardware Device. This Manufacturer's Guarantee does not cover your data, or any separate software, whether or not packaged or included with the Hardware Device.

Direct2Data Technologies GUARANTEE. Direct2Data Technologies guarantees (this "Guarantee") that on the day you receive the Hardware Device and for the next (1) year thereafter (a) the Hardware Device will be substantially free from defects in materials and workmanship, and (b) any support services provided by Direct2Data Technologies will be substantially as described in applicable written materials provided to you by Direct2Data Technologies, and Direct2Data Technologies support engineers will use reasonable efforts, care and skill to solve any problem issues. In the event that the Hardware Device fails to comply with this Guarantee, Direct2Data Technologies shall either, at Direct2Data Technologies' option, (a) repair or replace the Hardware Device or (b) return the price you paid for the Hardware Device (if any), provided that you return the Hardware Device to Direct2Data Technologies with a copy of your receipt of purchase. You may exercise this remedy without charge, except that you are responsible for any expenses you may incur. This Guarantee is void if failure of the Hardware Device results from any accident, abuse or misapplication. Any replacement Hardware Device shall be guaranteed for the remainder of the original Guarantee period or thirty (30) days, whichever is longer. Direct2Data Technologies shall not be liable for any loss or damage that you could have reasonably avoided, for example, by backing up your software and files regularly,

In addition, you may receive a full refund of your purchase price within the first 30 days following the purchase of the Hardware Device for any reason provided that you return the Hardware Device to the Manufacturer in its original condition, accompanied by the receipt of purchase.

EXCLUSION OF ALL OTHER TERMS. YOU AGREE THAT THIS GUARANTEE IS YOUR SOLE GUARANTEE IN RELATION TO THE HARDWARE DEVICE AND ANY SUPPORT SERVICES. DIRECT2DATA TECHNOLOGIES AND ITS SUPPLIERS MAKE NO OTHER GUARANTEES OR WARRANTIES WITH RESPECT TO THE HARDWARE DEVICE, THE SUPPORT SERVICES AND ANY PRODUCT MANUAL(S) OR OTHER WRITTEN MATERIALS THAT ACCOMPANY THE HARDWARE DEVICE. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW AND SUBJECT TO THIS GUARANTEE, DIRECT2DATA TECHNOLOGIES AND ITS SUPPLIERS DISCLAIM ALL WARRANTIES, CONDITIONS AND OTHER TERMS, EITHER EXPRESS OR IMPLIED (WHETHER BY STATUTE, COMMON LAW, COLLATERALLY OR OTHERWISE), INCLUDING BUT NOT LIMITED TO ANY (IF ANY) IMPLIED WARRANTIES OR CONDITIONS OF MERCHANTABILITY, SATISFACTORY QUALITY AND FITNESS FOR PARTICULAR PURPOSE, LACK OF VIRUSES, LACK OF NEGLIGENCE, LACK OF WORKMANLIKE EFFORT, TITLE, AUTHORITY, OR NONINFRINGEMENT WITH RESPECT TO THE HARDWARE DEVICE, THE SUPPORT SERVICES AND THE PRODUCT MANUAL(S) OR OTHER WRITTEN MATERIALS THAT ACCOMPANY THE HARDWARE DEVICE.

Continued Next Page

ANY IMPLIED WARRANTIES THAT ARE NOT DEEMED EXCLUDED ARE LIMITED TO THE ORIGINAL GUARANTEE PERIOD OR TO THE SHORTEST PERIOD PERMITTED BY APPLICABLE LAW, WHICHEVER IS GREATER. LIMITATION OF LIABILITY. TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW AND EXCEPT AS PROVIDED IN THIS GUARANTEE, DIRECT2DATA TECHNOLOGIES AND ITS SUPPLIERS SHALL NOT BE LIABLE FOR ANY DAMAGES WHATSOEVER (INCLUDING WITHOUT LIMITATION, SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES, DAMAGES FOR LOSS OF BUSINESS PROFITS, BUSINESS INTERRUPTION, LOSS OF BUSINESS INFORMATION OR OTHER PECUNIARY LOSS, FOR PERSONAL INJURY OR FOR FAILURE TO MEET ANY DUTY INCLUDING GOOD FAITH OR REASONABLE CARE, OR FOR NEGLIGENCE) ARISING OUT OF THE USE OR INABILITY TO USE THE HARDWARE DEVICE, EVEN IF DIRECT2DATA TECHNOLOGIES HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN ANY CASE DIRECT2DATA TECHNOLOGIES'S ENTIRE LIABILITY UNDER ANY PROVISION OF THIS AGREEMENT SHALL BE LIMITED TO THE AMOUNT ACTUALLY PAID BY YOU FOR THE HARDWARE DEVICE. THESE LIMITATIONS DO NOT APPLY TO ANY LIABILITIES THAT CANNOT BE EXCLUDED OR LIMITED BY APPLICABLE LAWS. THE FOREGOING LIMITATIONS, EXCLUSIONS AND DISCLAIMERS SHALL APPLY TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, EVEN IF ANY REMEDY FAILS ITS ESSENTIAL PURPOSE.

REGISTRATION. You need not return the registration card for this Guarantee to be effective.

BENEFICIARY. To the extent allowed by applicable law, this Guarantee is only made to you, the first user of the Hardware Device, and there are no third party beneficiaries of this Guarantee. It is not intended for and does not apply to anyone else (except as required by law).

GOVERNING LAW. If you acquired the Hardware Device in the United States of America, the laws of the State of Florida, U.S.A., apply to this agreement.

QUESTIONS. Should you have any questions concerning this agreement, or if you desire to contact Direct2Data Technologies for any reason, please use the address information enclosed in this Hardware Device to contact Direct2Data Technologies, or visit Direct2Data Technologies on the World Wide Web at http://www.Direct2Data.com/.

PACKAGE CONTENTS
- D2D™ Wireless 1500WR Wireless Router
- AC Power Adapter
- Manual and Driver on CD ROM
- Latest software always on-line at www.direct2data.com

SYSTEM REQUIREMENTS
- Microsoft™ Windows XP or 2000
- Minimum 300MHz processor or better
- Minimum 128 Mb Ram

ParkerVision Horizons 1500WR Wireless Router works with any 802.11b/802.11g-compatible Wireless LAN network, communicating with other computers using either a wireless 802.11b/802.11g interface, or with hard-wired PC laptop/desktops with an available LAN Port, 300 MHz or better processor & 128 Mb of RAM, running Microsoft™ Windows 2000 or XP.

This product is available for purchase in the U.S. only.

CUSTOMER SUPPORT

You can access customer support 24 hours a day online at www.direct2data.com. This is the quickest way to access:
- Troubleshooting Guides
- Manuals
- Answers to Frequently Asked Questions
- Updated Drivers

You can also request help by sending an email to support@direct2data.com or calling customer support directly at 1-800-231-1759.

Table of Contents

INTRODUCTION

All ParkerVision Horizons products are designed and manufactured by Direct2Data Technologies. Products are fully compliant with IEEE 802.11b standards and are optimized to provide maximum possible speed and bandwidth through your Internet connection for fastest uploads and downloads.

The distance capabilities of your wireless network equipment directly affect your signal quality. Distance capabilities are usually stated in terms of outdoor, open field reach. However, this reach is greatly diminished indoors by walls, doors, construction techniques and appliances that may block the radio signal. A wireless network adapter that tests outdoors at 200 feet could, in an indoor environment, provide 20 feet in one direction and as little as 5 or 10 feet in another direction. Factors such as building materials, floor plans and furnishings can greatly impact the signal range, quality and rate of data transmission. The extent to which your signal is affected varies greatly depending on your environment.

Wireless network products powered by D2D technology will provide better performance than other products because they can achieve open field distances of up to one mile, (when a D2D enabled adapter is used in conjunction with a D2D enabled base station). The D2D adapter alone provides 3 to 7 times the distance of other leading brands. This is sufficient to reach all rooms in most homes or small offices.

Part I

Getting Started

The following chapters are structured as a step-by-step guide to help you connect, install and setup your ParkerVision Horizons 1500WR Wireless Router.

Chapter 1

Getting to Know Your ParkerVision Horizons 1500WR Wireless Router

This chapter introduces the main features of the ParkerVision Horizons 1500WR Wireless Router

1.1 Introduction

The ParkerVision Horizons 1500WR Wireless Router provides wireless connectivity. As an Internet gateway, your 1500WR Wireless Router can share an Internet connection (through a cable or xDSL modem) with multiple computers using SUA/NAT and DHCP. The 1500WR Wireless Router offers highly secured wireless connectivity to your wired network with IEEE 802. lx, WEP data encryption and MAC address filtering.

The 1500WR Wireless Router is easy to install and configure. The embedded web-based configurator and SNMP network management enables remote configuration and management of your 1500WR Wireless Router.

1.2 Features of the ParkerVision Horizons PC 1500WR Wireless Router

The following are the essential features of the ParkerVision Horizons 1500WR Wireless Router .

4-Port Switch

A combination of switch and router makes your 1500WR Wireless Router a cost-effective and viable network solution. You can connect up to four computers to the LAN ports on you 1500WR Wireless Router without the cost of a hub.

10/100M Auto-negotiating Ethernet/Fast Ethernet Interface

This auto-negotiating feature allows the 1500WR Wireless Router to detect the speed of incoming transmissions and adjust appropriately without manual intervention. It allows data transfer of either 10 Mbps or 100 Mbps in either half-duplex or full-duplex mode depending on your Ethernet network.
10/100M Auto-crossover Ethernet/Fast Ethernet Interface.

The LAN interface automatically adjusts to either a crossover or straight-through Ethernet cable. 10/100 Mbps Ethernet WAN.

The 10/100 Mbps Ethernet WAN port attaches to the Internet via broadband modem or router.

Reset Button

The 1500WR Wireless Router reset button is built into the side panel. Use this button to restore the factory default password to 1234; IP address to 192.168.1.1, subnet mask to 255.255.255.0 and DHCP sever enabled with a pool of 32 IP addresses starting at 192.168.1.33.

Brute-Force Password Guessing Protection

The 1500WR Wireless Router has a special protection mechanism to discourage brute-force password guessing attacks on the 1500WR Wireless Router's management interfaces. You can specify a wait-time that must expire before entering a fourth password after three incorrect passwords have been entered. Please see the appendix for details about this feature.

1500WR Wireless Router LED

The blue 1500WR Wireless Router LED (also known as the Breathing LED) is on when the 1500WR Wireless Router is on and blinks (or breaths) when data is being transmitted to/from its wireless stations. You may use the web configurator to turn this LED off even when the 1500WR Wireless Router is on and data is being transmitted/received.

802.11b Wireless LAN Standard

1500WR Wireless Router products containing the letter “B” in the model name, such as 1500WR Wireless Router B-2000, 1500WR Wireless Router B-2000 v.2, comply with the 802.1 lb wireless standard.

The 802.1 lb data rate and corresponding modulation techniques are as follows. The modulation technique defines how bits are encoded onto radio waves.

Output Power Management

Power Management is the ability to set the level of output power.

There may be interference or difficulty with channel assignment when there is a high density of APs within a coverage area. In this case you can lower the output power of each Wireless Router, thus enabling you to place Wireless Routers closer together.

Limit the number of Client Connections

You may set a maximum number of wireless stations that may connect to the 1500WR Wireless Router. This may be necessary if for example, there is difficulty with channel assignment due to a high density of APs within a coverage area.

SSL Passthrough

SSL (Secure Sockets Layer) uses a public key to encrypt data that’s transmitted over an SSL connection. Both Netscape Navigator and Internet Explorer support SSL, and many web sites use the protocol to obtain confidential user information, such as credit card numbers. By convention, URLs that require an SSL connection start with “https” instead of “http”. The 1500WR Wireless Router allows SSL connections to take place through the 1500WR Wireless Router.

Firewall

The 1500WR Wireless Router employs a stateful inspection firewall with DoS (Denial of Service) protection. By default, when the firewall is activated, all incoming traffic from the WAN to the LAN is blocked unless it is initiated from the LAN. The 1500WR Wireless Router firewall supports TCP/UDP inspection, DoS detection and prevention, real time alerts, reports and logs.

IEEE 802.1 x Network Security

The 1500WR Wireless Router supports the IEEE 802. lx standard to enhance user authentication. Use the built-in user profile database to authenticate up to 32 users using MD5 encryption. Use an EAP-compatible RADIUS (RFC2138,2139 - Remote Authentication Dial In User Service) server to authenticate a limitless number of users using EAP (Extensible Authentication Protocol). EAP is an authentication protocol that supports multiple types of authentication.

Wireless LAN MAC Address Filtering

Your 1500WR Wireless Router checks the MAC address of the wireless station against a list of allowed or denied MAC addresses.

Universal Plug and Play (UPnP)

Using the standard TCP/IP protocol, the 1500WR Wireless Router and other UPnP-enabled devices can dynamically join a network, obtain an IP address and convey its capabilities to other devices on the network.

Dynamic DNS Support

With Dynamic DNS support, you can have a static hostname alias for a dynamic IP address, allowing the host to be more easily accessible from various locations on the Internet. You must register for this service.

PPPoE Support (RFC2516)

PPPoE (Point-to-Point Protocol over Ethernet) emulates a dial-up connection. It allows your ISP to use their existing network configuration with newer broadband technologies such as ADSL. The PPPoE driver on the 1500WR Wireless Router is transparent to the computers on the LAN, which see only Ethernet and are not aware of PPPoE thus saving you from having to manage PPPoE clients on individual computers.

PPTP Encapsulation

Point-to-Point Tunneling Protocol (PPTP) is a network protocol that enables secure transfer of data from a remote client to a private server, creating a Virtual Private Network (VPN) using a TCP/IP-based network. PPTP supports on-demand, multi-protocol and virtual private networking over public networks, such as the Internet. Use PPTP to connect to a broadband modem to achieve access to high-speed data networks via a familiar “dial-up networking” user interface.

Network Address Translation (NAT)

NAT (Network Address Translation - NAT, RFC 1631) allows the translations of multiple IP addresses used within one network to different IP addresses known within another network.

NAT for Single-IP-address Internet Access

The 1500WR Wireless Router’s SUA (Single User Account) feature allows multiple-user Internet access for the cost of a single IP account. NAT supports popular Internet applications such as MS traceroute, CuSeeMe, IRC, RealPlayer, VDOLive, Quake, and PPTP. No configuration is needed to support these applications.

DHCP (Dynamic Host Configuration Protocol)

DHCP (Dynamic Host Configuration Protocol) allows the individual clients (computers) to obtain the TCP/IP configuration at start-up from a centralized DHCP server. The 1500WR Wireless Router has built-in DHCP server capability enabled by default. It can assign IP addresses, an IP default gateway and DNS servers to DHCP clients. The 1500WR Wireless Router also acts as a surrogate DHCP server (DHCP Relay) where it relays IP address assignment from the actual real DHCP server to the clients.

Multicast

Traditionally, IP packets are transmitted in two ways - unicast or broadcast. Multicast is a third way to deliver IP packets to a group of hosts. IGMP (Internet Group Management Protocol) is the protocol used to support multicast groups. The latest version is version 2 (see RFC 2236). The 1500WR Wireless Router supports versions 1 and 2.

IP Alias

IP Alias allows you to partition a physical network into logical networks over the same Ethernet interface. The 1500WR Wireless Router supports three logical LAN interfaces via its single physical Ethernet LAN interface with the 1500WR Wireless Router itself as the gateway for each LAN network.

IP Policy Routing

IP Policy Routing provides a mechanism to override the default routing behavior and alter packet forwarding based on the policies defined by the network administrator.

SNMP

SNMP (Simple Network Management Protocol) is a protocol used for exchanging management information between network devices. SNMP is a member of the TCP/IP protocol suite. Your

1500WR Wireless Router supports SNMP agent functionality, which allows a manger station to manage and monitor the **SNMP - Continued**

1500WR Wireless Router through the network. The 1500WR Wireless Router supports SNMP version one (SNMPvl) and version two c (SNMPv2c).

Full Network Management

The embedded web configurator is an all-platform web-based utility that allows you to easily access the 1500WR Wireless Router's management settings. Most functions of the 1500WR Wireless Router are also software configurable via the SMT(System Management Terminal) interface. The SMT is a menu-driven interface that you can access from a terminal emulator through the console port or over a telnet connection.

- Logging and Tracing
- Built-in message logging and packet tracing.
- Unix syslog facility support.
- Diagnostics Capabilities

The 1500WR Wireless Router can perform self-diagnostic tests. These tests check the integrity of the following circuitry:

- FLASH memory
- DRAM
- LAN port
- Wireless port

Embedded FTP and TFTP Servers

The 1500WR Wireless Router's embedded FTP and TFTP servers enable fast firmware upgrades as well as configuration file backups and restoration.

Wireless Association List

With the Wireless Association List, you can see the list of the wireless stations that are currently using the 1500WR Wireless Router to access your wired network.

Wireless LAN Channel Usage

The Wireless Channel Usage displays whether the radio channels are used by other wireless devices within the transmission range of the 1500WR Wireless Router. This allows you to select the channel with minimum interference for your 1500WR Wireless Router.

1.3 Application for the 1500WR Wireless Router

Here is an application example of what you can do with your 1500WR Wireless Router.

1.3.1 Internet Access Application

Add a wireless LAN to your existing network without expensive network cables. Wireless stations can move freely anywhere in the coverage area and use resources on the wired network.

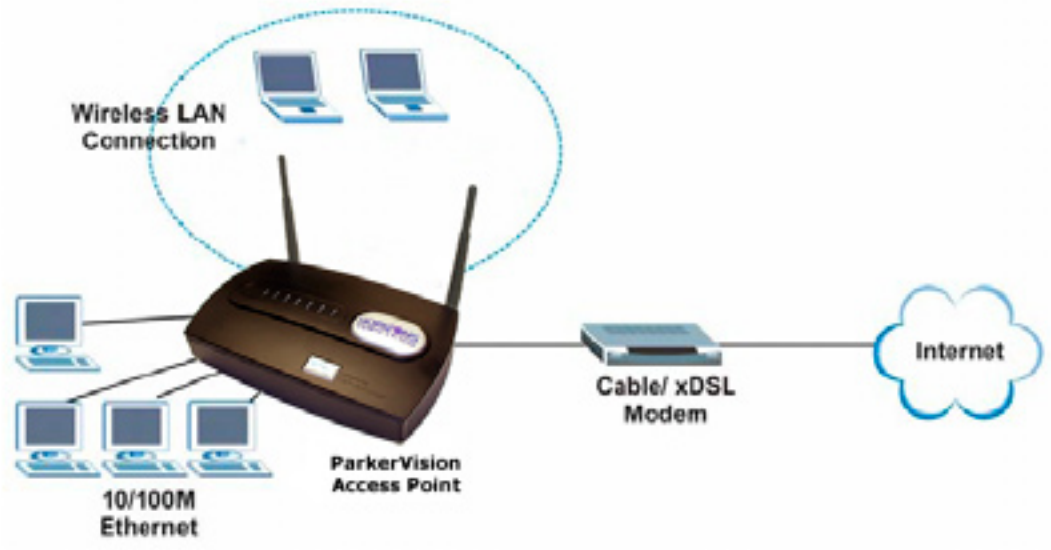


Figure 1-1 Internet Access Application Example

1.4 Installing Your 1500WR Wireless Router

This section will show you how to physically hook up your 1500WR Wireless Router.

1.4.1 Installation Options

The 1500WR is a powerful, feature-rich wireless router that can be used in a variety of installation schemes.

The following sections will detail the most common installation schemes. More advanced setups are explained in detail in later chapters of this manual.

1.4.2 Box Contents

The box your 1500WR came in should contain the following items:

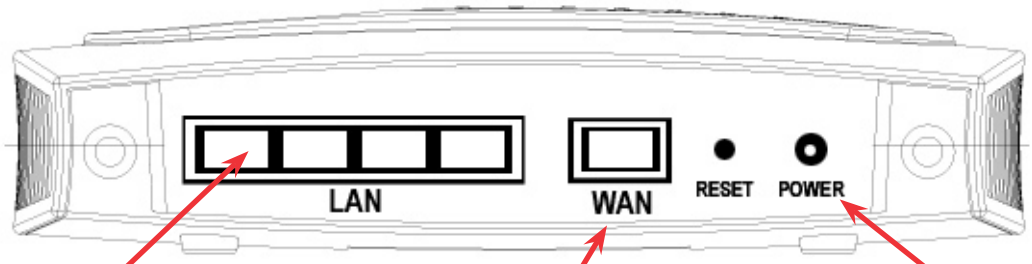
- 1500WR Wireless Router Unit
- Two Antennas
- One AC Power Adapter
- Printed Quick Start Guide
- CD ROM containing the electronic version of this manual

1.4.3 What You Will Need to Install and Setup the 1500WR

It is possible to setup the 1500WR using an existing Wi-Fi connected computer or laptop. However, for security reasons it is advised that you perform the initial setup using a computer that is connected to the 1500WR with a common CAT-5 Ethernet Cable, as shown below.

1.4.3 Connecting the 1500WR to Your Computer for Initial Configuration

The rear panel of the 1500WR contains several ports, as described below:



Plug your computer's Ethernet cable into Port 1. The remaining ports can to be used with other computers in a hard-wired router fashion

Plug your cable or DSL modem's Ethernet Cable into this port

Plug the AC Adapter into this port.

For initial setup, you should have:

- The power adpater plugged into the 1500WR as shown, and this adapter plugged into a surge-protected electrical outlet
- Your Cable or DSL modem's Ethernet cable plugged into the Internet In port as shown above
- An Ethernet cable plugged into the router port 1 as shown above, and the other end of this cable plugged into your computer's Ethernet port

Now Proceed to the Next Page to Begin Setting Up Your 1500WR

Chapter 2

Introducing the Web Configuration Utility

This chapter describes how to access the 1500WR Wireless Router web Web Configuration Utility and provides an overview of its screens.

2.1 Web Web Configuration Utility Overview

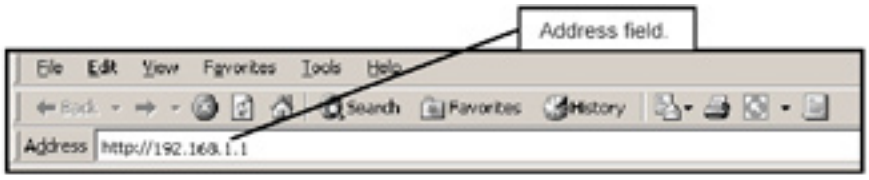
The web Web Configuration Utility makes it easy to configure and manage the 1500WR Wireless Router. The screens you see in the web Web Configuration Utility may vary somewhat from the ones shown in this document due to differences between individual 1500WR Wireless Router models or firmware versions.

2.2 Accessing the 1500WR Wireless Router Web Web Configuration Utility

Step 1. Make sure your 1500WR Wireless Router hardware is properly connected (refer to the Chapter 1 of this manual).

Step 2. Prepare your computer to connect to the 1500WR Wireless Router (refer to the Setting Up Your Computer's IP Address appendix).

Step 3. Launch your web browser. Step 4. Type "http://192.168.1.1" as the URL Address field.

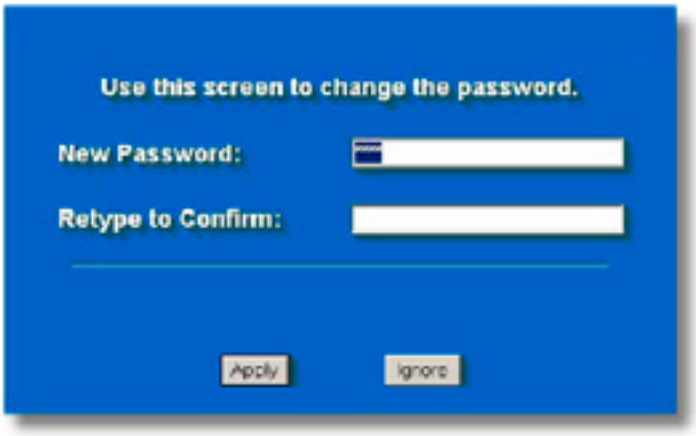


Step 5. Type "1234" (default) as the password and click Login. In some versions, the default password appears automatically - if this is the case, click Login.

Step 6. You should see a screen asking you to change your password (highly recommended) as shown next. Type a new password (and retype it to confirm) and click Apply or click Ignore to allow access without password change.

Note - If the default password of "1234" is not accepted, refer to the next page of this manual and go through the reset procedure to set all parameters back to factory defaults.

Then try the above steps again.



2.2 Accessing the 1500WR Wireless Router Web Web Configuration Utility - Continued

Step 7. You should now see the MAIN MENU screen.

The 1500WR Wireless Router automatically times out after five minutes of inactivity. Simply log back into the 1500WR Wireless Router if this happens to you.

2.3 Resetting the 1500WR Wireless Router

If you forget your password or cannot access the 1500WR Wireless Router, you will need to reload the factory-default configuration file or use the RESET button on the side panel of the 1500WR Wireless Router. Uploading this configuration file replaces the current configuration file with the factory-default configuration file. This means that you will lose all configurations that you had previously and the speed of the console port will be reset to the default of 9600bps with 8 data bit, no parity, one stop bit and flow control set to none. The password will be reset to “1234”, also.

2.3.1 Procedure to Use the Reset Button

Make sure the SYS LED is on (not blinking) before you begin this procedure.

Step 1. Press the RESET button for more than five seconds, and then release it. If the SYS LED begins to blink, the defaults have been restored and the 1500WR Wireless Router restarts. Otherwise, go to step 2.

Step 2. Turn the 1500WR Wireless Router off.

Step 3. While pressing the RESET button, turn the 1500WR Wireless Router on.

Step 4. Continue to hold the RESET button. The SYS LED will begin to blink and flicker very quickly after about 10 or 15 seconds. This indicates that the defaults have been restored and the 1500WR Wireless Router is now restarting.

Step 5. Release the RESET button and wait for the 1500WR Wireless Router to finish restarting.

2.3.2 Uploading a Configuration File via Console Port

This method is only applicable to 1500WR Wireless Router models with a console port
.

Step 1. Download the default configuration file from the 1500WR Wireless Router FTP site, unzip it and save it in a folder.

Step 2. Turn off the 1500WR Wireless Router, begin a terminal emulation software session and turn on the 1500WR Wireless Router again.

When you see the message “Press any key to enter Debug Mode within 3 seconds”, press any key to enter debug mode.

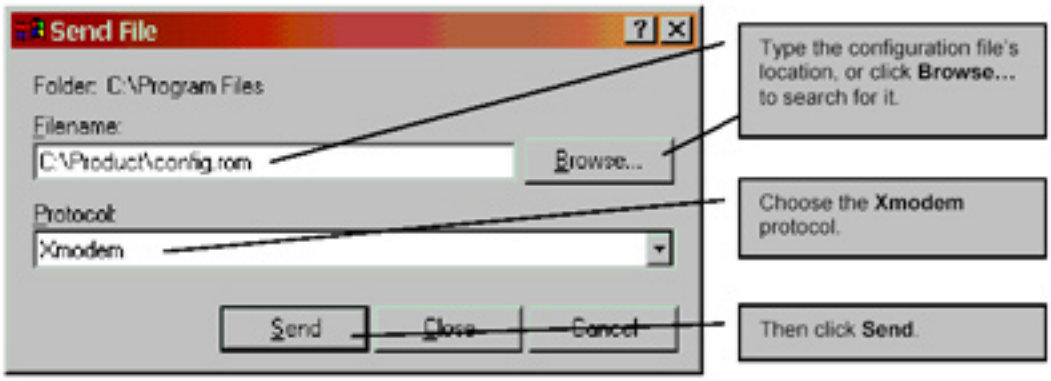
Step 3. Enter “y” at the prompt below to go into debug mode. Step 4. Enter “atlc” after “Enter Debug Mode” message.

Step 5. Wait for “Starting XMODEM upload” message before activating Xmodem upload on your terminal. This is an example Xmodem configuration upload using HyperTerminal.

Continued on next page

2.3.2 Uploading a Configuration File via Console Port - Continued

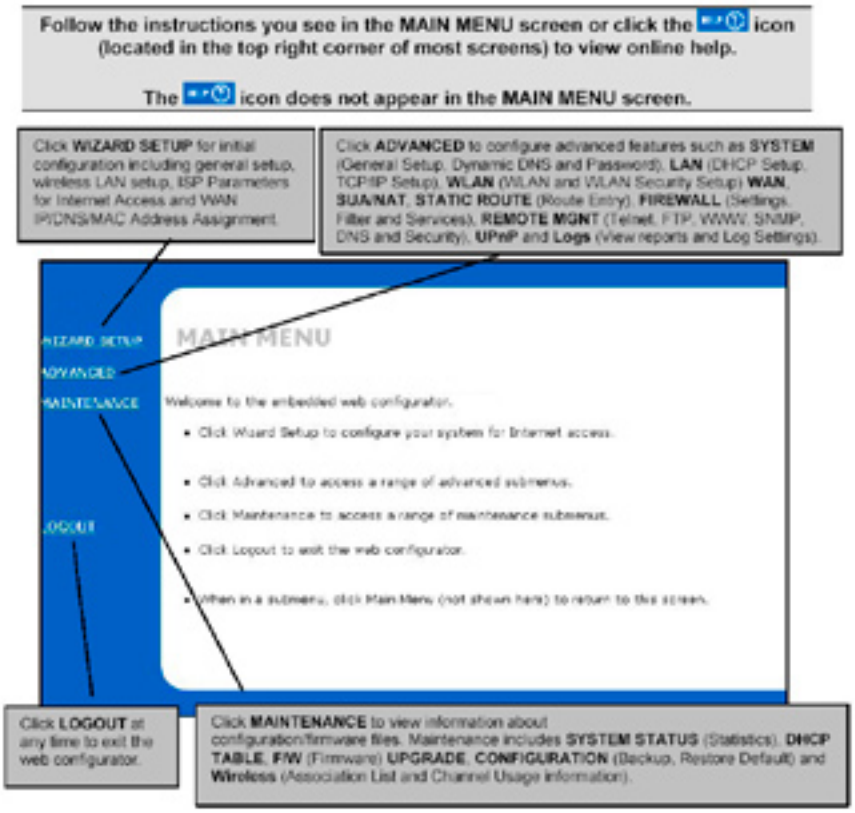
Step 6. Click Transfer, then Send File to display the following screen.



Step 7. After successful firmware upload, enter “atgo” to restart the 1500WR Wireless Router.

2.4 Navigating the 1500WR Wireless Router Web Web Configuration Utility

The following summarizes how to navigate the web Web Configuration Utility from the MAIN MENU screen. Follow the instructions you see in the MAIN MENU screen or click the IBs] icon (located in the top right corner of most screens) to view online help.



Chapter 3

Wizard Setup

This chapter provides information on the Wizard Setup screens in the web Web Configuration Utility.

3.1 Wizard Setup Overview

The web Web Configuration Utility's setup wizard helps you configure your 1500WR Wireless Router for Internet access and set up wireless LAN.

3.1.1 Channel

The range of radio frequencies used by IEEE 802.1 lb wireless devices is called a "channel". Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a different channel than an adjacent AP (Wireless Router) to reduce interference. Interference occurs when radio signals from different Wireless Routers overlap causing interference and degrading performance.

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

The 1500WR Wireless Router's "Scan" function is especially designed to automatically scan for a channel with the least interference.

3.1.2 ESS ID

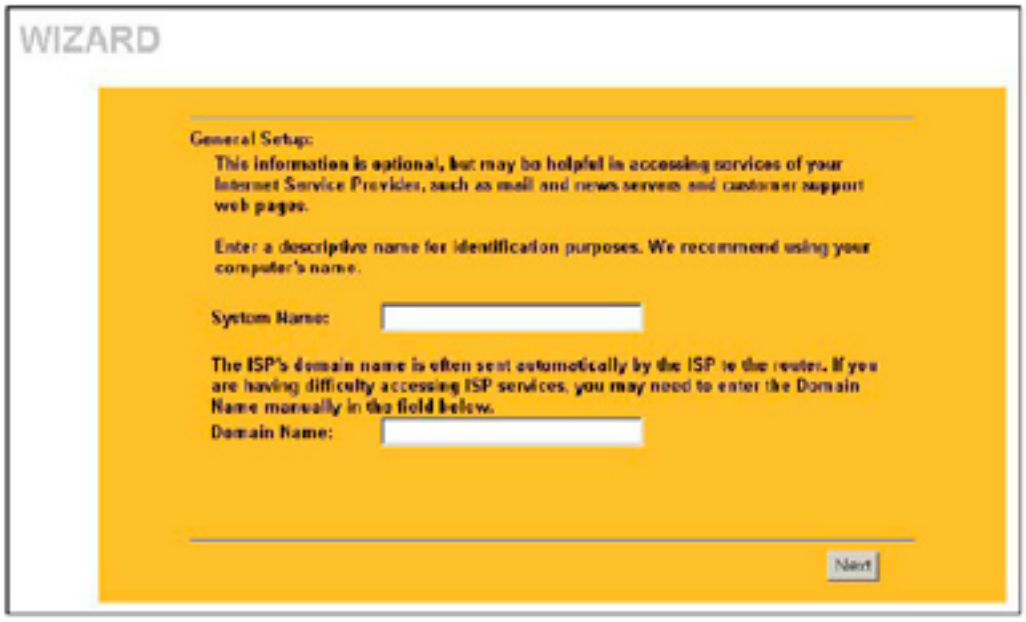
An Extended Service Set (ESS) is a group of Wireless Routers or wireless gateways connected to a wired LAN on the same subnet. An ESS ID uniquely identifies each set. All Wireless Routers or wireless gateways and their associated wireless stations in the same set must have the same ESSID.

3.1.3 WEP Encryption

WEP (Wired Equivalent Privacy) encrypts data frames before transmitting over the wireless network. WEP encryption scrambles the data transmitted between the wireless stations and the Wireless Routers to keep network communications private. It encrypts unicast and multicast communications in a network. Both the wireless stations and the Wireless Routers must use the same WEP key for data encryption and decryption.

3.2 Wizard Setup: General Setup

General Setup contains administrative and system-related information.



The following table describes the labels in this screen.

LABEL	DESCRIPTION
System Name	It is recommended you type your computer's "Computer name", some ISPs check this name you should enter your computer's "Computer Name". > In Windows 2000, click **Start, Settings, Control Panel** and then double-click **System.** Click the **Network Identification** tab and then the **Properties** button. Note the entry for the **Computer name** field and enter it as the **System Name.** > In Windows XP, click **Start, My Computer, View system information** and then click the **Computer Name** tab. Note the entry in the **Full computer name** field and enter it as the 1500WR Wireless Router **System Name.** This name can be up to 30 alphanumeric characters long. Spaces are not allowed, but dashes"-" and underscores"_" are accepted.
Domain Name	The **Domain Name** entry is what is propagated to the DHCP clients on the LAN. Type the domain name (if you know it) here. If you leave this field blank, the ISP may assign a domain name via DHCP. The domain name entered by you is given priority over the ISP assigned domain name.
Next	Click **Next** to proceed to the next screen.

3.3 Wizard Setup: Wireless LAN Setup

Set up your wireless LAN using the second wizard screen.

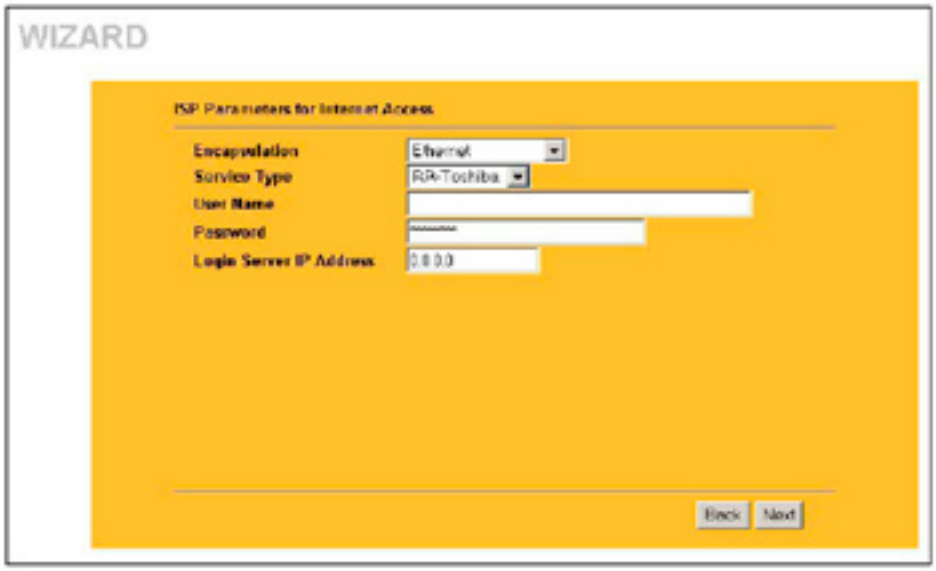
LABEL	DESCRIPTION
ESSID	Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN. If you change this field on the 1500WR Wireless Router, make sure all wireless stations use the same ESSID in order to access the network.
Choose Channel ID	To manually set the 1500WR Wireless Router to use a channel, select a channel from the drop-down list box. Open the **Channel Usage Table** screen to make sure the channel is not already used by another AP or independent peer-to-peer wireless network. To have the 1500WR Wireless Router automatically select a channel, click **Scan** instead.
Scan	Click this button to have the 1500WR Wireless Router automatically scan for and select a channel with the least interference.
WEP Encryption	Select **Disable** allows all wireless computers to communicate with the Wireless Routers without any data encryption. Select **64-bit WEP** or **128-bit WEP** to allow data encryption.
ASCII	Select this option in order to enter ASCII characters as the WEP keys.
HEX	Select this option to enter hexadecimal characters as the WEP keys. The preceding “Ox” is entered automatically. Leave this in front of your key.
Key 1 to Key 4	used to encrypt data. Both the 1500WR Wireless Router and the wireless stations must use the same WEP key for data transmission. If you chose **64-bit WEP,** then enter any 5 ASCII characters or 10 hexadecimal characters (“0-9”, “A-F”). If you chose **128-bit WEP,** then enter 13 ASCII characters or 26 hexadecimal characters (“0-9”, “A-F”). You must configure all four keys, but only one key can be activated at any one time. The default key is key 1.
Next	Click **Next** to continue.
Back	Click **Back** to return to the previous screen.

Refer to the chapter on wireless LAN for more information.

3.4 Wizard Setup: ISP Parameters

The 1500WR Wireless Router offers three choices of encapsulation. They are Ethernet, PPTP or PPPoE. The screen varies depending upon the type chosen.

3.4.1 Ethernet



The following table describes the labels in this screen.

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Encapsulation	You must choose the **Ethernet** option when the WAN port is used as a regular Ethernet. Otherwise, choose **PPPoE** or **PPTP** for a dial-up connection.
Service Type	Select from **Standard, RR-Toshiba** (RoadRunner Toshiba authentication method), **RR-Manager** (Roadrunner Manager authentication method), **RR-Telstra** or **Telia Login.** Choose a Roadrunner service type if your ISP is Time Warner's Roadrunner; otherwise choose **Standard.** The **User Name, Password** and **Login Server IP Address** fields are not applicable **(N/A)** for the **Standard** service type.

Continued next page

3.4.1 Wizard Setup - Ethernet - Continued

LABEL	DESCRIPTION
User Name	Type the username given to you by your ISP.
Password	Type the password associated with the username above.
Login Server IP Address	The 1500WR Wireless Router will find the Roadrunner Server IP if this field is left blank. If it does not, then you must enter the authentication server IP address.
Login Server (Telia Login only)	Type the domain name of the Telia login server, for example “logini .telia.com”. This field is not available on all models.
Relogin Every(min) (Telia Login only)	The Telia server logs the 1500WR Wireless Router out if the 1500WR Wireless Router does not log in periodically. Type the number of minutes from 1 to 59 (30 recommended) for the 1500WR Wireless Router to wait between logins. This field is not available on all models.
Next	Click **Next** to proceed to the next page.
Back	Click Back to go back to the previous page.

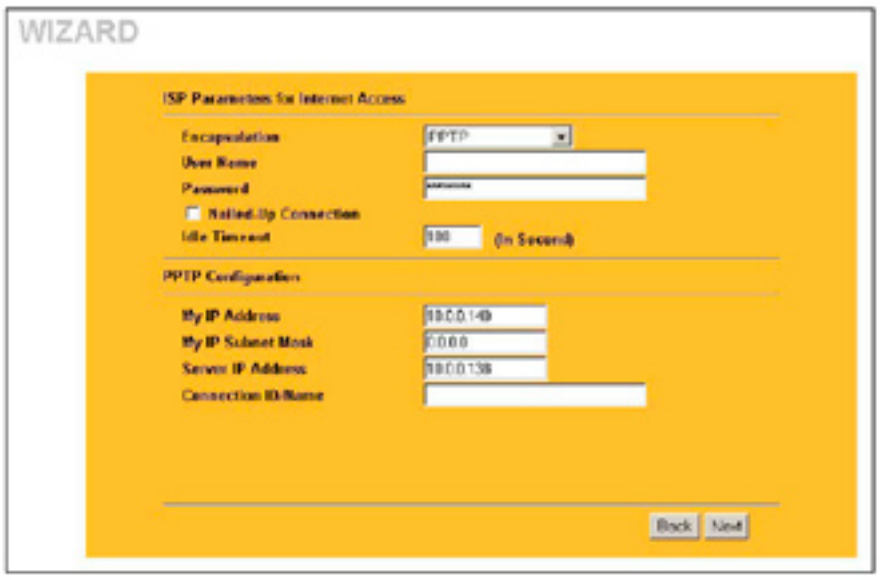
3.4.2 PPTP Encapsulation

Point-to-Point Tunneling Protocol (PPTP) is a network protocol that enables transfers of data from a remote client to a private server, creating a Virtual Private Network (VPN) using TCP/IP-based networks.

PPTP supports on-demand, multi-protocol, and virtual private networking over public networks, such as the Internet.

Refer to the appendix for more information on PPTP.

The 1500WR Wireless Router supports one PPTP server connection at any given time.



3.4.2 PPTP Encapsulation - Continued

The following table describes the labels in the screen on the previous page.

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Encapsulation	Select **PPTP** from the drop-down list box.
User Name	Type the user name given to you by your ISP. Most home user will need to use their name with their domain designation, such as user@bellsouth.net
Password	Type the password associated with the User Name above.
Nailed Up Connection	Select **Nailed Up Connection** if you do not want the connection to time out.
Idle Timeout	Type the time in seconds that elapses before the 1500WR Wireless Router automatically disconnects from the PPTP server.
PPTP Configuration	
My IP Address	Type the (static) IP address assigned to you by your ISP.
My IP Subnet Mask	Type the subnet mask assigned to you by your ISP (if given).
Server IP Address	Type the IP address of the PPTP server.
Connection ID/Name	If your ISP has provided a connection ID name, enter it in this field exactly as provided.
Next	Click **Next** to continue.
Back	Click **Back** to return to the previous screen.

3.4.3 PPPoE Encapsulation

Point-to-Point Protocol over Ethernet (PPPoE) functions as a dial-up connection. PPPoE is an IETF (Internet Engineering Task Force) draft standard specifying how a host personal computer interacts with a broadband modem (for example xDSL, cable, wireless, etc.) to achieve access to high-speed data networks. It preserves the existing Microsoft Dial-Up Networking experience and requires no new learning or procedures.

For the service provider, PPPoE offers an access and authentication method that works with existing access control systems (for instance, RADIUS). For the user, PPPoE provides a login and authentication method that the existing Microsoft Dial-Up Networking software can activate, and therefore requires no new learning or procedures for Windows users.

One of the benefits of PPPoE is the ability to let end users access one of multiple network services, a function known as dynamic service selection. This enables the service provider to easily create and offer new IP services for specific users.

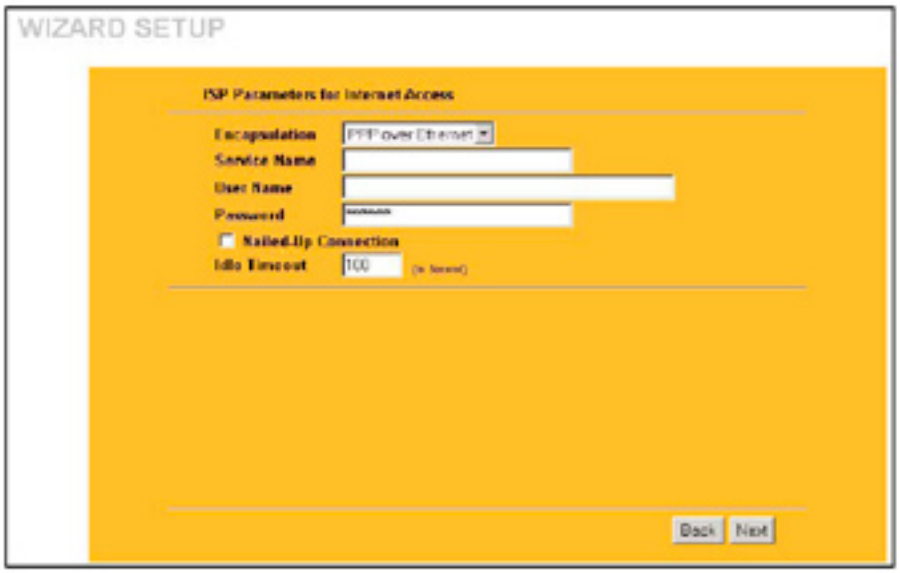
Operationally, PPPoE saves significant effort for both the subscriber and the ISP/carrier, as it requires no specific configuration of the broadband modem at the subscriber's site.

By implementing PPPoE directly on the 1500WR Wireless Router (rather than individual computers), the computers on the LAN do not need PPPoE software installed, since the 1500WR Wireless Router does that part of the task. Furthermore, with NAT, all of the LAN's computers will have Internet access.

Refer to the appendix for more information on PPPoE, and to the next page for setup details.

3.4.3 PPPoE Encapsulation - Continued

PPoE Wizard Setup Screen



The following table describes the labels in this screen.

LABEL	DESCRIPTION
ISP Parameter for Internet Access	
Encapsulation	Choose an encapsulation method from the pull-down list box. PPPoE forms a dial-up connection.
Service Name	Type the name of your service provider.
User Name	Type the user name given to you by your ISP.
Password	Type the password associated with the user name above.
Nailed Up Connection	Select **Nailed Up Connection** if you do not want the connection to time out.
Idle Timeout	Type the time in seconds that elapses before the 1500WR Wireless Router automatically disconnects from the PPPoE server.
Next	Click **Next** to continue.
Back	Click **Back** to return to the previous screen.

3.5 Wizard Setup: WAN and DNS

The fourth wizard screen allows you to configure WAN IP address assignment, DNS server address assignment and the WAN MAC address.

3.5.1 WAN IP Address Assignment

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

10.0.0.0	-	10.255.255.255
172.16.0.0	-	172.31.255.255
192.168.0.0	-	192.168.255.255

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

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

3.5.2 IP Address and Subnet Mask

Similar to the way houses on a street share a common street name, so too do computers on a LAN share one common network number. Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0 and you must enable the Network Address Translation (NAT) feature of the 1500WR Wireless Router. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. Let's say you select 192.168.1.0 as the network number; which covers 254 individual addresses, from 192.168.1.1 to 192.168.1.254 (zero and 255 are reserved). In other words, the first three numbers specify the network number while the last number identifies an individual computer on that network.

Once you have decided on the network number, pick an IP address that is easy to remember, for instance, 192.168.1.1, for your 1500WR Wireless Router, but make sure that no other device on your network is using that IP address.

The subnet mask specifies the network number portion of an IP address. Your 1500WR Wireless Router will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the 1500WR Wireless Router unless you are instructed to do otherwise.

3.5.3 DNS Server Address Assignment

Use DNS (Domain Name System) to map a domain name to its corresponding IP address and vice versa. For instance, the IP address of a web site with an URL of www.anycompany.com could be 192.168.3.1. The DNS server is extremely important because without it, you must know the IP address of a computer before you can access it.

There are two ways that an ISP disseminates the DNS server addresses.

1. The ISP tells you the DNS server addresses, usually in the form of an information sheet, when you sign up. If your ISP gives you DNS server addresses, enter them in the DNS Server fields in DHCP Setup.

2. Leave the DNS Server fields in DHCP Setup blank (for example 0.0.0.0). The 1500WR Access Point acts as a DNS proxy when this field is blank.

3.5.4 WAN MAC Address

Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02.

You can configure the WAN port's MAC address by either using the factory default or cloning the MAC address from a workstation on your LAN. Once it is successfully configured, the address will be copied to the "rom" file (ZyNOS configuration file). It will not change unless you change the setting or upload a different "rom" file.

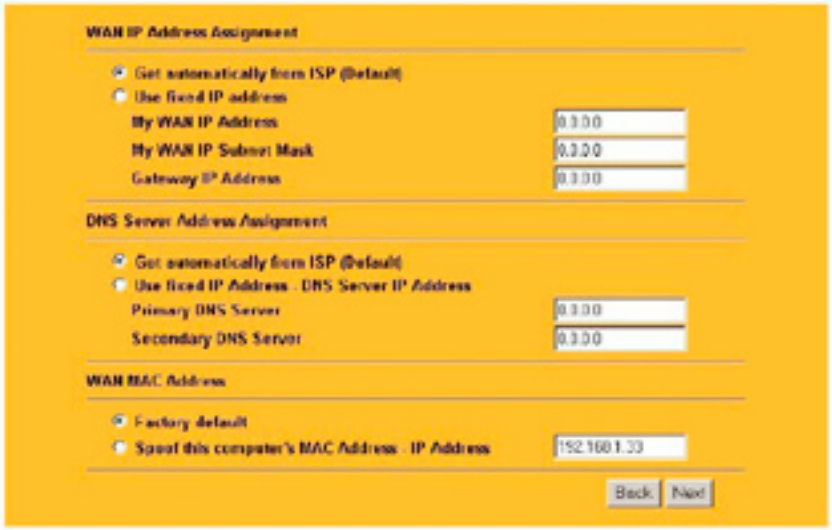
ParkerVision recommends you clone the MAC address from a workstation on your LAN even if your ISP does not require MAC address authentication.

Your 1500WR Wireless Router WAN port is always set at half-duplex mode as most cable/DSL modems only support half-duplex mode. Make sure your modem is in half-duplex mode. Your 1500WR Wireless Router supports full duplex mode on the LAN side.

Example of Network Properties for LAN Servers with Fixed IP Addresses:

Choose an IP address	192.168.1.2-192.168.1.32; 192.168.1.65-192.168.1.254.
Subnet mask	255.255.255.0
Gateway (or default route)	192.168.1.1(1500WR Wireless RouterLANIP)

3.5.4 WAN MAC Address - Continued



The following table describes the labels in the screen above.

LABEL	DESCRIPTION
WAN IP Address Assignment	
Get automatically from ISP	Select this option If your ISP did not assign you a fixed IP address. This is the default selection.
Use fixed IP address	Select this option If the ISP assigned a fixed IP address.
My WAN IP Address	Enter your WAN IP address in this field if you selected **Use Fixed IP Address.**
My WAN IP Subnet Mask	Enter the IP subnet mask in this field if you selected **Use Fixed IP Address.** This field is not available when you select PPPoE encapsulation in the previous wizard screen.
Gateway IP Address	Enter the gateway IP address in this field if you selected **Use Fixed IP Address.** This field is not available when you select PPPoE encapsulation in the previous wizard screen.
DNS Server Address Assignment	
Get automatically from ISP	Select this option if your ISP does not give you DNS server addresses. This option is selected by default.
Use fixed IP address -DNS Server IP Address	Select this option If your ISP provides you a DNS server address.
Primary/Secondary DNS Server	If you selected the **Use fixed IP address - Primary/Secondary DNS Server** option, enter the provided DNS addresses in these fields.
WAN MAC Address: The MAC address field allows you to configure the WAN port's MAC address by either using the factory default or cloning the MAC address from a workstation on your LAN.	
Factory Default	Select this option to use the factory assigned default MAC address.
Spoof this Computer's MAC address - IP Address	Select this option and enter the IP address of the computer on the LAN whose MAC address you are cloning. Once it is successfully configured, the MAC address will be copied to the rom file (ZyNOS configuration file). It will not change unless you change the setting or upload a different rom file. It is advisable to clone the MAC address from a computer on your LAN even if your ISP does not presently require MAC address authentication.
Back	Click **Back** to return to the previous screen.
Next	Click **Next** to continue.

3.6 Basic Setup Complete

Click **Finish** to complete and save the wizard setup.

If you are currently using a wireless (LAN) adapter to access this Horizons Router/Wireless Router and you made changes to the ESSID, then you will need to make the same changed to your wireless (LAN) adapter after you click the Finish button.

Part II

System, LAN, and Wireless

This part discusses the System, LAN, and Wireless Setup Screens

Chapter 4

System Screens

This chapter provides information on the System screens.

4.1 System Overview

This section provides information on general system setup.

4.2 Configuring General Setup

Click **ADVANCED** and then **SYSTEM** to open the **General** screen.

The table on the next page describes the labels in the above screen.

4.2 Configuring General Setup - Continued

LABEL	DESCRIPTION
System Name	Type a descriptive name for identification purposes. Some ISPs check this name, so it is recommended you enter your computer's "Computer name" This name can be up to 30 alphanumeric characters long. Spaces are not allowed, but dashes"-" and underscores"_" are accepted.
Domain Name	Type the domain name (if you know it) here. If you leave this field blank, the ISP may assign a domain name via DHCP. The domain name entered by you is given priority over the ISP assigned domain name.
Administrator Inactivity Timer	Type how many minutes a management session (either via the web web configuration utility or SMT) can be left idle before the session times out. The default is 5 minutes. After it times out you have to log in with your password again. Very long idle timeouts may have security risks. A value of "0" means a management session never times out, no matter how long it has been left idle (not recommended).
System DNS Servers	
First DNS Server Second DNS Server Third DNS Server	Select **From ISP** if your ISP dynamically assigns DNS server information (and the Horizons's WAN IP address). The field to the right displays the (read-only) DNS server IP address that the ISP assigns. Select **User-Defined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **User-Defined,** but leave the IP address set to 0.0.0.0, **User-Defined** changes to **None** after you click **Apply.** If you set a second choice to **User-Defined,** and enter the same IP address, the second **User-Defined** changes to **None** after you click **Apply.** Select **None** if you do not want to configure DNS servers. If you do not configure a DNS server, you must know the IP address of a machine in order to access it.
Apply	Click **Apply** to save your changes back to the Horizons.
Reset	Click **Reset** to reload the previous configuration for this screen.

4.3 Dynamic DNS

Dynamic DNS allows you to update your current dynamic IP address with one or many dynamic DNS services so that anyone can contact you (in NetMeeting, CU-SeeMe, etc.). You can also access your FTP server or web site on your own computer using a DNS-like address (for instance myhost.dhs.org, where myhost is a name of your choice) that will never change instead of using an IP address that changes each time you reconnect. Your friends or relatives will always be able to call you even if they don't know your IP address.

First of all, you need to have registered a dynamic DNS account with www.dyndns.org. This is for people with a dynamic IP from their ISP or DHCP server that would still like to have a DNS name. The dynamic DNS service provider will give you a password or key.

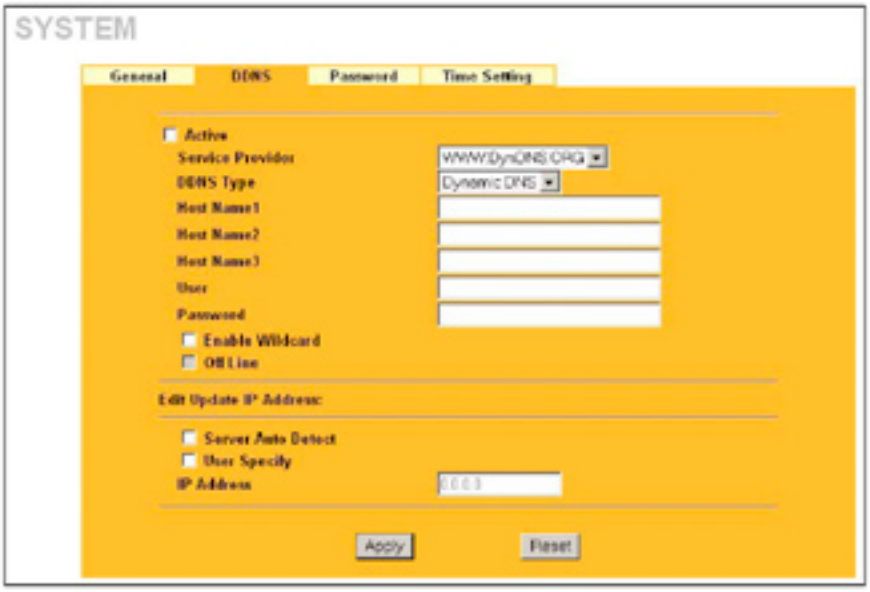
4.3.1 DYNDNS Wildcard

Enabling the wildcard feature for your host causes *.yourhost.dyndns.org to be aliased to the same IP address as yourhost.dyndns.org. This feature is useful if you want to be able to use, for example, www.yourhost.dyndns.org and still reach your hostname.

If you have a private WAN IP address, then you cannot use Dynamic DNS.

4.4 Configuring Dynamic DNS

To change your Horizons's **DDNS**, click **ADVANCED**, **SYSTEM** and then the **DDNS** tab. The screen appears as shown.



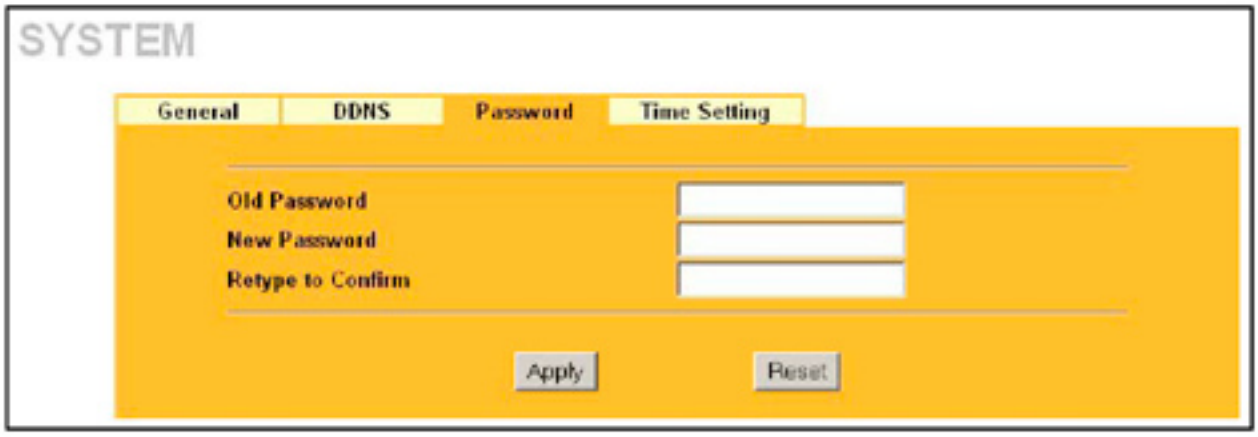
The following table describes the labels in this screen.

LABEL	DESCRIPTION
Active	Select this check box to activate DDNS.
Service Provider	Select the name of your DDNS service provider.
DDNS Type	Select the type of service that you are registered for from your DDNS service provider. Options are **Dynamic DNS, Static DNS** or **Custom DNS.**
Host Names 1-3	Enter your host names in the three fields provided. You can specify up to two host names in each field separated by a comma (",").
User	Type your user name.
Password	Type the password assigned to you.
Enable Wildcard	Your Horizons supports DYNDNS wildcard. Select the check box to enable.
Off Line	This option is available when **CustomDNS** is selected in the **DDNS Type** field. Check with your dynamic DNS service provider to have traffic redirected to a URL (that you can specify) while you are off line.
Edit Update IP Address:	
Server Auto Detect	Select this option to update the IP address of the host name(s) automatically by the DDNS server. It is recommended that you select this option.
User Specify	Select this option to update the IP address of the host name(s) to the IP address specified below. Use this option if you have a static IP address.
IP Address	Enter the IP address if you select the **User Specify** option.
Apply	Click **Apply** to save your changes back to the Horizons.
Reset	Click **Reset** to reload the previous configuration for this screen.

4.5 Configuring Password

To change your router's password (recommended), click **ADVANCED**, **SYSTEM** and then the **Password** tab. The screen appears as shown. This screen allows you to change the router's password.

If you forget your password (or the Horizons Wireless Routers IP address), you will need to reset the router or upload the default configuration file via console port. See the Resetting the Wireless Router section for details.

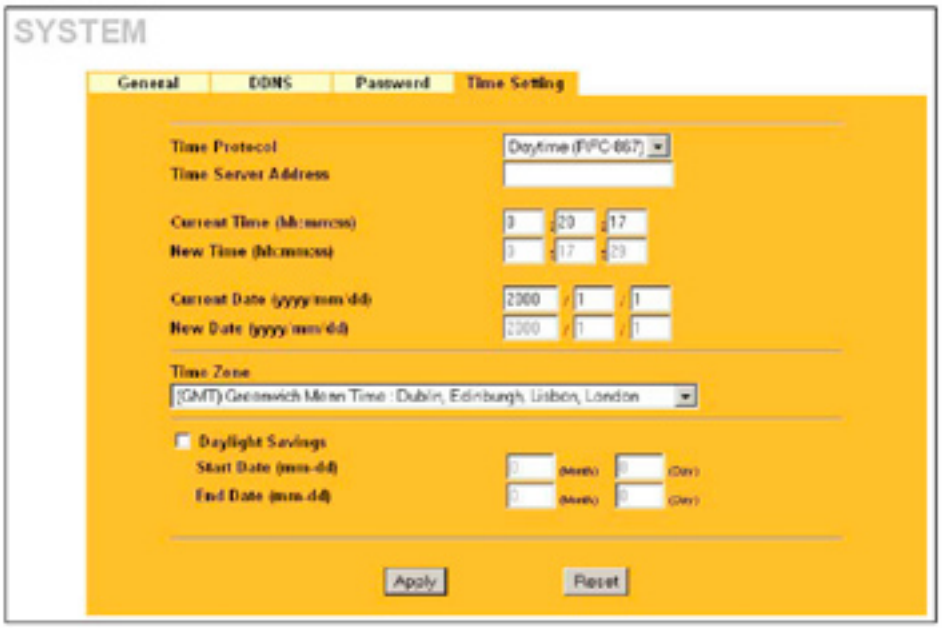


The following table describes the labels in this screen.

LABEL	DESCRIPTION
Old Password	Type in your existing system password (1234 is the default password).
New Password	Type your new system password (up to 31 characters). Note that as you type a password, the screen displays an asterisk (*) for each character you type.
Retype to Confirm	Retype your new system password for confirmation.
Apply	Click **Apply** to save your changes back to the Horizons Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

4.6 Configuring Time Setting

To change your Horizons Router's time and date, click **ADVANCED**, **SYSTEM** and then the **Time Setting** tab. The screen appears as shown. Use this screen to configure the router time based on your local time zone.



The following table describes the labels in this screen.

LABEL	DESCRIPTION
Time Protocol	Select the time service protocol that your time server sends when you turn on the router. Not all time servers support all protocols, so you may have to check with your ISP/network administrator or use trial and error to find a protocol that works. The main difference between them is the format. **Daytime (RFC 867)** format is day/month/year/time zone of the server. **Time (RFC 868)** format displays a 4-byte integer giving the total number of seconds since 1970/1/1 at 0:0:0. The default, **NTP (RFC 1305),** is similar to Time (RFC 868). Select **None** to enter the time and date manually.
Time Server Address	Enter the IP address or the URL of your time server. Check with your ISP/network administrator if you are unsure of this information (the default is tick.stdtime.gov.tw).
Current Time (hh:mm:ss)	This field displays the time of your Horizons Router. Each time you reload this page, the Horizons Router synchronizes the time with the time server.
New Time (hh:mm:ss)	This field displays the last updated time from the time server. When you select **None** in the **Time Protocol** field, enter the new time in this field and then click **Apply.**
Current Date (yyyy/mm/dd)	This field displays the date of your Horizons Router. Each time you reload this page, the Horizons Router synchronizes the time with the time server.
New Date (yyyy/mm/dd)	This field displays the last updated date from the time server. When you select **None** in the **Time Protocol** field, enter the new date in this field and then click **Apply.**
Time Zone	Choose the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).
Daylight Savings	Select this option if you use daylight savings time. Daylight saving is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening.
Start Date (mm-dd)	Enter the month and day that your daylight-savings time starts on if you selected **Daylight Savings.**
End Date (mm-dd)	Enter the month and day that your daylight-savings time ends on if you selected **Daylight Savings.**
Apply	Click **Apply** to save your changes back to the Horizons Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

Chapter 5

LAN Screens

This chapter describes how to configure LAN settings.

5.1 LAN Overview

Local Area Network (LAN) is a shared communication system to which many computers are attached. The LAN screens can help you configure a LAN DHCP server, manage IP addresses, and partition your physical network into logical networks.
Please see the Wizard Setup chapter for the background information about Primary and Secondary DNS Server and IP Address and Subnet Mask.

5.2 LANs and WANs

A LAN is a computer network limited to the immediate area, usually the same building or floor of a building. A WAN (Wide Area Network), on the other hand, is an outside connection to another network or the Internet.

5.2.1 LANs, WANs and the 1500WR Wireless Router

The actual physical connection determines whether the 1500WR Wireless Router ports are LAN or WAN ports. There are two separate IP networks, one inside, the LAN network; the other outside: the WAN network as shown next:

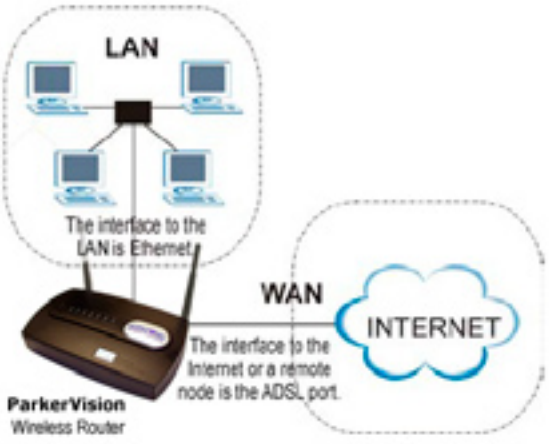


Figure 5-1 LAN & WAN IPs

5.3 DHCP Setup

DHCP (Dynamic Host Configuration Protocol, RFC 2131 and RFC 2132) allows individual clients to obtain TCP/IP configuration at start-up from a server. You can configure the 1500WR Wireless Router as a DHCP server or disable it. When configured as a server, the 1500WR Wireless Router provides the TCP/IP configuration for the clients. If set to **None**, DHCP service will be disabled and you must have another DHCP server on your LAN, or else the computer must be manually configured.

5.4 Factory LAN Defaults

The LAN parameters of the 1500WR Wireless Router are preset in the factory with the following values:

- IP address of 192.168.1.1 with subnet mask of 255.255.255.0 (24 bits)
- DHCP server enabled with 32 client IP addresses starting from 192.168.1.33.

IP Pool Setup

The 1500WR Wireless Router is pre-configured with a pool of 32 IP addresses starting from 192.168.1.33 to 192.168.1.64. This configuration leaves 31 IP addresses (excluding the 1500WR Wireless Router itself) in the lower range for other server computers, for instance, servers for mail, FTP, TFTP, web, etc., that you may have.

These parameters should work for the majority of installations. If your ISP gives you explicit DNS server address(es), read the embedded web Web Configuration Utility help regarding what fields need to be configured.

5.5 RIP Setup

RIP (Routing Information Protocol, RFC 1058 and RFC 1389) allows a router to exchange routing information with other routers. **RIP Direction** controls the sending and receiving of RIP packets. When set to:

1. **Both** - the 1500WR Wireless Router will broadcast its routing table periodically and incorporate the RIP information that it receives.

2. **In Only** - the 1500WR Wireless Router will not send any RIP packets but will accept all RIP packets received.

3. **Out Only** - the 1500WR Wireless Router will send out RIP packets but will not accept any RIP packets received.

4. **None** - the 1500WR Wireless Router will not send any RIP packets and will ignore any RIP packets received.

RIP Version controls the format and the broadcasting method of the RIP packets that the 1500WR Wireless Router sends (it recognizes both formats when receiving). **RIP-1** is universally supported; but **RIP-2** carries more information. RIP-1 is probably adequate for most networks, unless you have an unusual network topology.

Both **RIP-2B** and **RIP-2M** send routing data in **RIP-2** format; the difference being that RIP-2B uses subnet broadcasting while RIP-2M uses multicasting. Multicasting can reduce the load on non-router machines since they generally do not listen to the RIP multicast address and so will not receive the RIP packets. However, if one router uses multicasting, then all routers on your network must use multicasting, also.

By default, RIP Direction is set to **Both** and RIP Version to **RIP-1**.

5.6 Multicast

Traditionally, IP packets are transmitted in one of either two ways - **Unicast (1 sender -1 recipient)** or **Broadcast (1 sender - everybody on the network)**. Multicast delivers IP packets to a group of hosts on the network - not everybody and not just 1.

IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. **IGMP version 2 (RFC 2236)** is an improvement over version 1 (RFC 1112) but IGMP version 1 is still in wide use. If you would like to read more detailed information about interoperability between IGMP version 2 and version 1, please see sections 4 and 5 of RFC 2236.

The class D IP address is used to identify host groups and can be in the range 224.0.0.0 to 239.255.255.255. The address 224.0.0.0 is not assigned to any group and is used by IP multicast computers. The address 224.0.0.1 is used for query messages and is assigned to the permanent group of all IP hosts (including gateways).

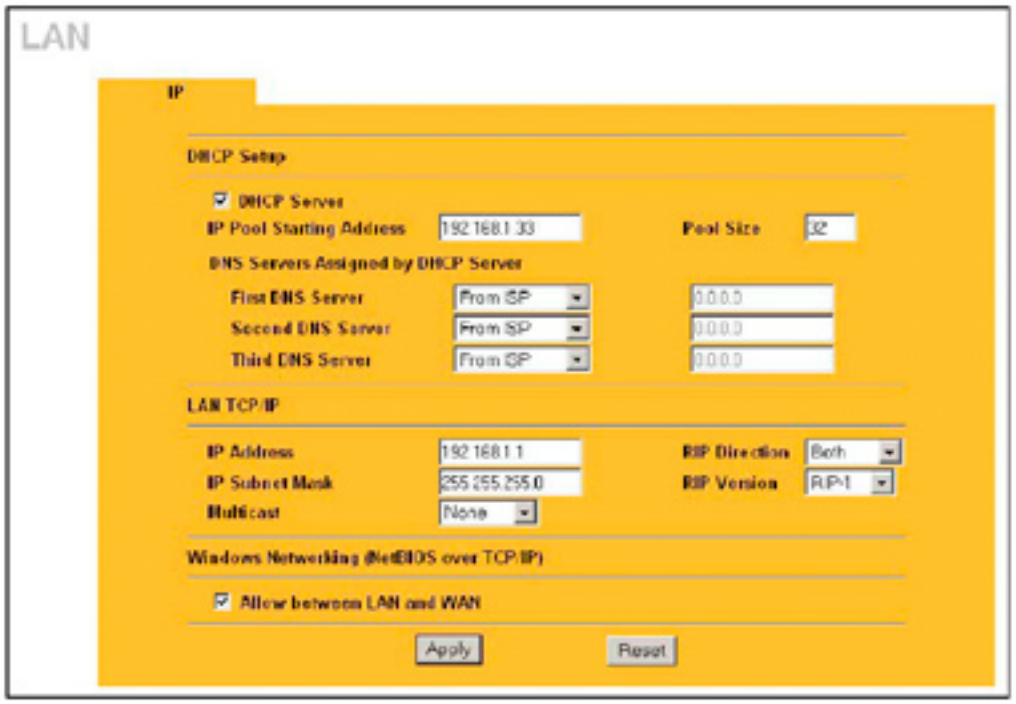
All hosts must join the 224.0.0.1 group in order to participate in IGMP. The address 224.0.0.2 is assigned to the multicast routers group.

The 1500WR Wireless Router supports both IGMP version 1 (IGMP-vl) and IGMP version 2 (IGMP-v2).

At start up, the 1500WR Wireless Router queries all directly connected networks to gather group membership. After that, the 1500WR Wireless Router periodically updates this information. IP multicasting can be enabled/disabled on the 1500WR Wireless Router LAN and/or WAN interfaces in the web Web Configuration Utility (LAN; WAN). Select **None** to disable IP multicasting on these interfaces.

5.7 Configuring the LAN IP Screens

Click **ADVANCED** and then **LAN** to open the **IP Screen**.



This screen's options are described on the next page.

5.7 Configuring the LAN IP Screens - Continued

The following table describes the options of the LAN Screen, from the previous page.

LABEL	DESCRIPTION
DHCP Setup (refer to your User's Guide for background information)	
DHCP Server	Select this option to allow your 1500WR Wireless Router to assign IP addresses, an IP default gateway and DNS servers to Windows 95, Windows NT and other systems that support the DHCP client. When DHCP is used, the following items need to be set:
IP Pool Starting Address	This field specifies the first of the contiguous addresses in the IP address pool.
Pool Size	This field specifies the size or count of the IP address pool.
DNS Servers Assigned by DHCP Server	
First DNS Server Second DNS Server Third DNS Server	Select **From ISP** if your ISP dynamically assigns DNS server information (and the 1500WR Wireless Router's WAN IP address). The field to the right displays the (read-only) DNS server IP address that the ISP assigns. Select User-Defined if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **User-Defined,** but leave the IP address set to 0.0.0.0, User-Defined changes to **None** after you click **Apply.** If you set a second choice to User-Defined, and enter the same IP address, the second User-Defined changes to **None** after you click **Apply.** Select **DNS Relay** to have the 1500WR Wireless Router act as a DNS proxy. The 1500WR Wireless Router's LAN IP address displays in the field to the right (read-only). The 1500WR Wireless Router tells the DHCP clients on the LAN that the 1500WR Wireless Router itself is the DNS server. When a computer on the LAN sends a DNS query to the 1500WR Wireless Router, the 1500WR Wireless Router forwards the query to the 1500WR Wireless Router's system DNS server (configured in the **SYSTEM General** screen) and relays the response back to the computer. You can only select **DNS Relay** for one of the three servers; if you select **DNS Relay** for a second or third DNS server, that choice changes to **None** after you click **Apply.** Select **None** if you do not want to configure DNS servers. If you do not configure a DNS server, you must know the IP address of a machine in order to access it.
LAN TCP/IP	
IP Address	Type the IP address of your 1500WR Wireless Router in dotted decimal notation, for example, 192.168.1.1 (factory default).
IP Subnet Mask	Type the subnet mask assigned to you by your ISP (if given).
RIP Direction	Select the RIP direction from **None, Both, In Only** and **Out Only.**
RIP Version	Select the RIP version from **RIP-1, RIP-2B** and **RIP-2M.**
Multicast	IGMP (Internet Group Multicast Protocol) is a session-layer protocol used to establish membership in a multicast group. The 1500WR Wireless Router supports both IGMP version 1 **(IGMP-v-l)** and **IGMP-v2.** Select **None** to disable it.
Windows Networking (NetBIOS over TCP/IP)	
Allow between LAN and WAN	Select this option to forward NetBIOS packets between the LAN port and the WAN port.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

Chapter 6

Wireless Configuration

This chapter discusses how to configure the Wireless screens on the 1500WR Wireless Router.

6.1 Wireless LAN Overview

This section introduces the wireless LAN(WLAN) and some basic scenarios.

6.1.1 IBSS

An **Independent Basic Service Set (IBSS)**, also called an **Ad-hoc network**, is the simplest WLAN configuration. An IBSS is defined as two or more computers with wireless adapters within range of each other that from an independent (wireless) network without the need of an Wireless Router (AP).

IBSS (Ad-hoc) Wireless LAN

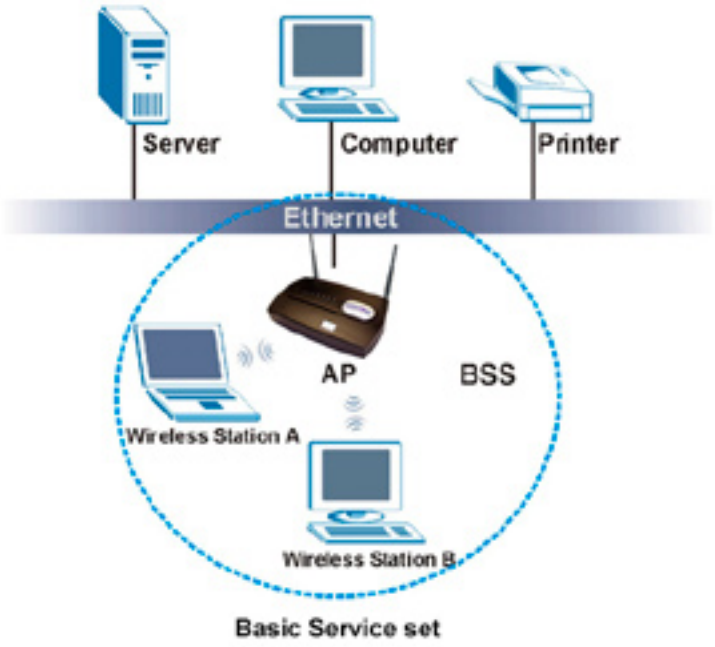
6.1.2 BSS

A **Basic Service Set (BSS)** exists when all communications between wireless stations or between a wireless station and a wired network client go through one Wireless Router (AP).

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

The illustration on the next page describes a BSS setup.

6.1.2 BSS - Continued



Basic Service set

6.1.3 ESS

An **Extended Service Set (ESS)** consists of a series of overlapping BSSs, each containing an Wireless Router, with each Wireless Router connected together by a wired network.

This wired connection between APs is called a **Distribution System (DS)**. An **ESSID (ESS IDentification)** uniquely identifies each ESS. All Wireless Routers and their associated wireless stations within the same ESS must have the same ESSID in order to communicate.

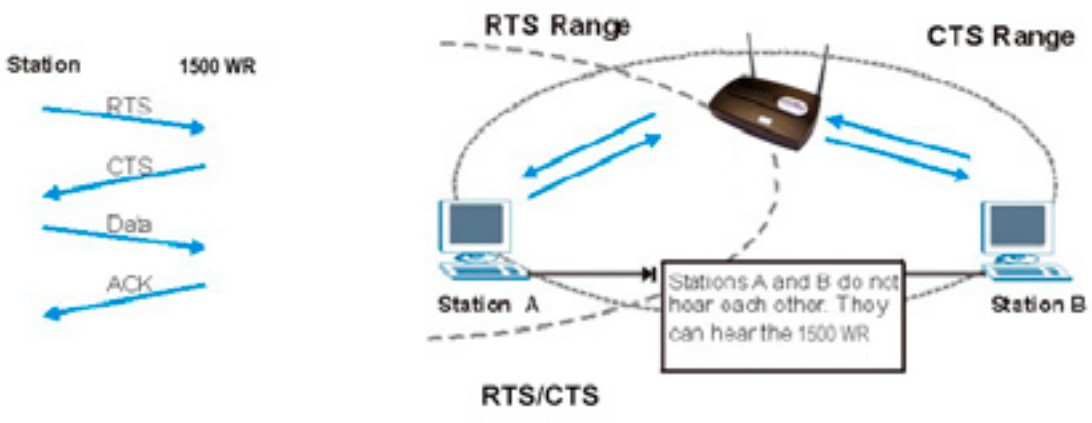
Extended Service Set

6.2 Wireless LAN Basics

Refer also to the INSERT CHAPTER # for more background information on Wireless LAN features, such as channels.

6.2.1 RTS/CTS

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



When station A sends data to the 1500WR Wireless Router, it might not know that station B is already using the channel. If these two stations send data at the same time, collisions may occur when both sets of data arrive at the AP at the same time, resulting in a loss of messages for both stations. RTS/CTS is designed to prevent collisions due to hidden nodes. An RTS/CTS defines the biggest size data frame you can send before an RTS (Request To Send)/CTS (Clear to Send) handshake is invoked.

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

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

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

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

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

6.2.2 Fragmentation Threshold

A **Fragmentation Threshold** is the maximum data fragment size (between 256 and 2432 bytes) that can be sent in the wireless network before the 1500WR Wireless Router will fragment the packet into smaller data frames.

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

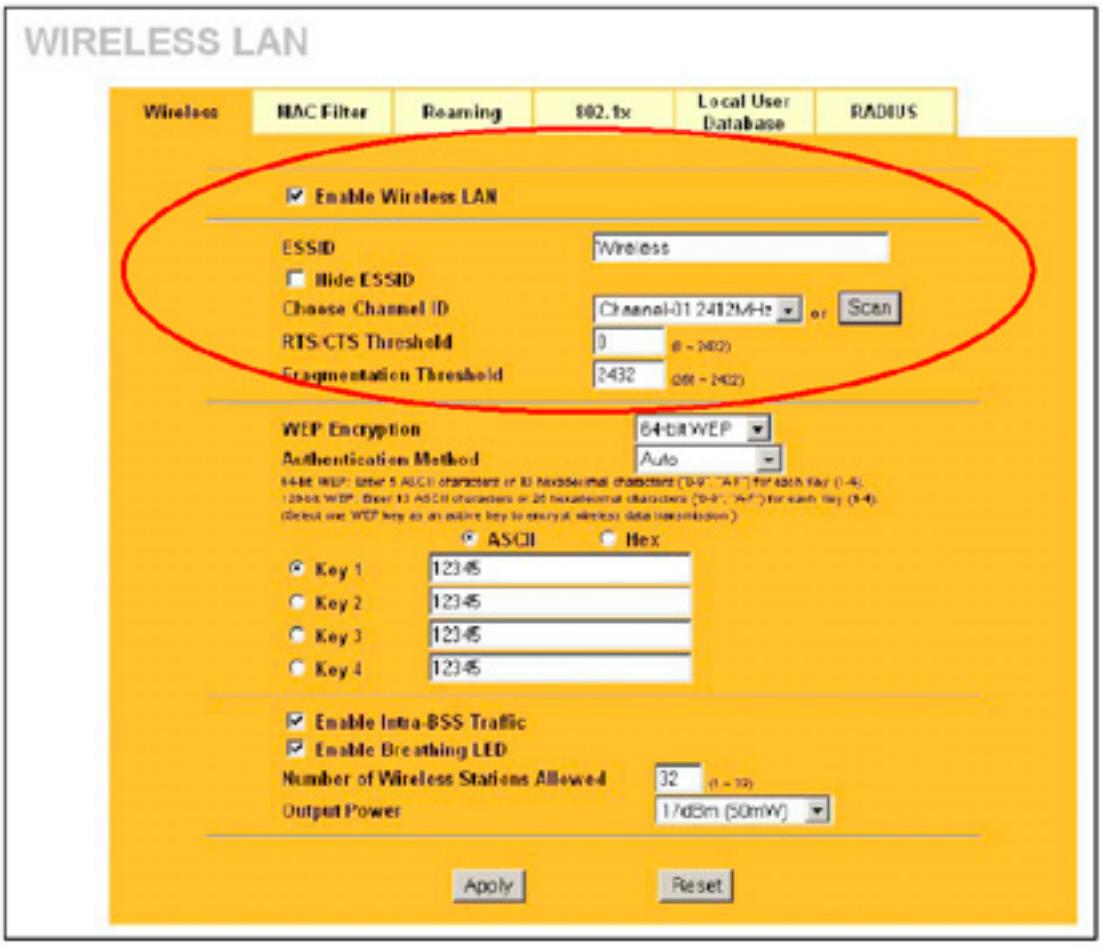
If the Fragmentation Threshold value is smaller than the RTS/CTS value (see previously) you set, then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach RTS/CTS size.

6.3 Configuring Wireless

If you are configuring the 1500WR Wireless Router from a computer connected to the wireless LAN and you change the 1500WR Wireless Router's ESSID or WEP settings, you will lose your wireless connection when you press Apply to confirm.

You must then change the wireless settings of your computer to match the 1500WR Wireless Router's new settings.

Click **ADVANCED** and then **WIRELESS** to open the Wireless screen.



The table on the next page describes the options in this screen.

6.3 Configuring Wireless - Continued

The following table describes the options on the screen shown on the previous page.

LABEL	DESCRIPTION
Enable Wireless LAN	Click the check box to activate wireless LAN.
ESSID	(Extended Service Set IDentity) The ESSID identifies the Service Set with which a wireless station is associated. Wireless stations associating to the Wireless Router (AP) must have the same ESSID. Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN.
	If you are configuring the 1500WR Wireless Router from a computer connected to the wireless LAN and you change the 1500WR Wireless Router's ESSID or WEP settings, you will lose your wireless connection when you press Apply to confirm. You must then change the wireless settings of your computer to match the 1500WR Wireless Router's new settings.
Hide ESSID	Select this check box to hide the ESSID in the outgoing beacon frame so a station cannot obtain the ESSID through passive scanning using a site survey tool.
Choose Channel ID	Set the operating frequency/channel depending on your particular region. To manually set the 1500WR Wireless Router to use a channel, select a channel from the drop-down list box. Click **MAINTENANCE, WIRELESS** and then the **Channel Usage** tab to open the **Channel Usage** screen to make sure the channel is not already used by another AP or independent peer-to-peer wireless network. To have the 1500WR Wireless Router automatically select a channel, click **Scan** instead. Refer to the *Wizard Setup* chapter for more information on channels.
Scan	Click this button to have the 1500WR Wireless Router automatically scan for and select a channel with the least interference.
RTS/CTS Threshold	Enter a value between 0 and 2432. The default is **2432.**
Fragmentation Threshold	Enter a value between 256 and 2432. The default is **2432.** It is the maximum data fragment size that can be sent.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

See the *Wireless Security* INSERT CHAPTER # chapter for information on the other labels in this screen.

Chapter 7

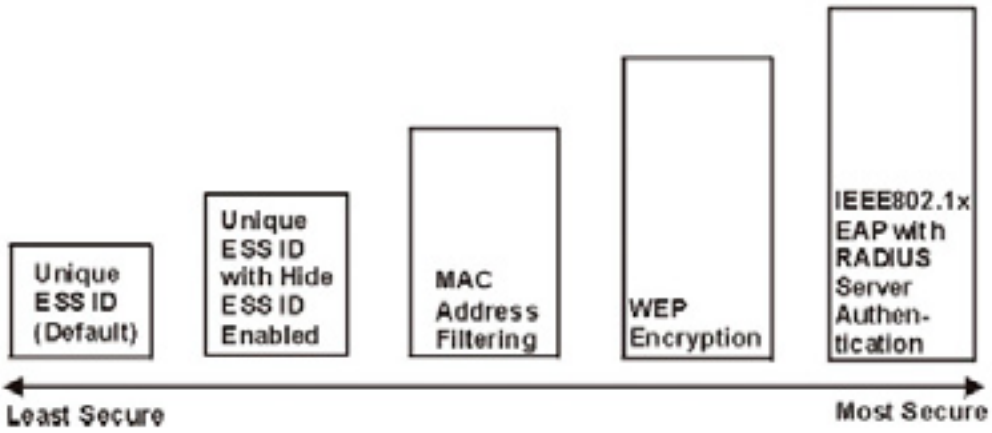
Wireless Security

This Chapter describes how to use the MAC Filter, 802. lx, Local User Database and RADIUS to configure wireless security on your 1500WR Wireless Router.

7.1 Wireless Security Overview

Wireless security is vital to your network to protect wireless communication between wireless stations, Wireless Routers and the wired network.

The figure below shows the possible wireless security levels on your 1500WR Wireless Router. The highest security level relies on EAP (Extensible Authentication Protocol) for authentication and utilizes dynamic WEP key exchange. It requires interaction with a RADIUS (Remote Authentication Dial-In User Service) server either on the WAN or your LAN to provide authentication service for wireless stations.



Wireless Security Levels

IMPORTANT - If you do not enable any wireless security on your 1500WR Wireless Router, your network is accessible to any wireless networking device that is within range.

7.2 WEP Overview

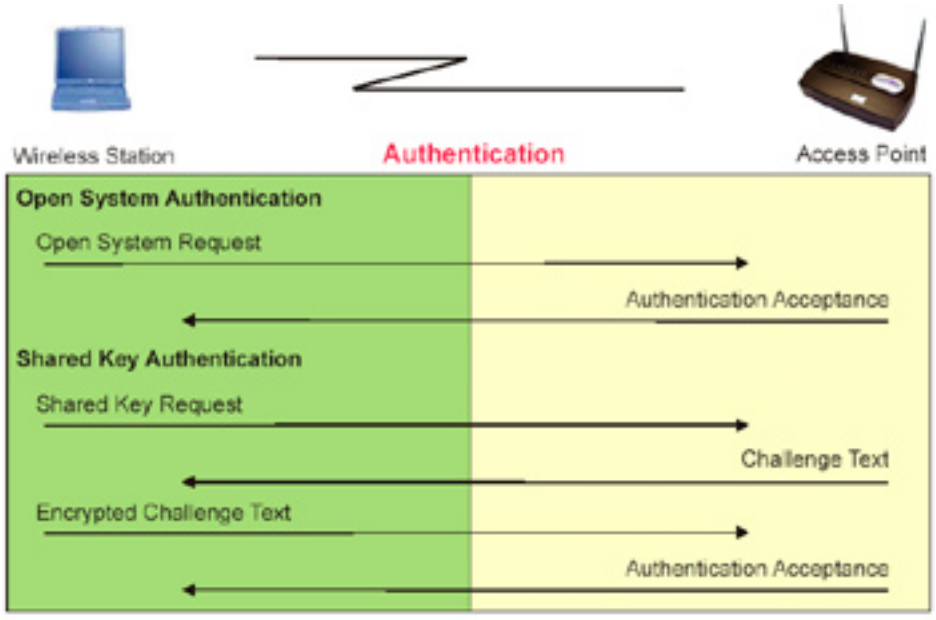
WEP (Wired Equivalent Privacy) as specified in the IEEE 802.11 standard provides methods for both data encryption and wireless station authentication.

7.2.1 Data Encryption

WEP provides a mechanism for encrypting data using encryption keys. Both the AP and the wireless stations must use the same WEP key to encrypt and decrypt data. Your 1500WR Wireless Router allows you to configure up to four 64-bit or 128-bit WEP keys, but only one key can be enabled at any one time.

7.2.2 Authentication

Three different methods can be used to authenticate wireless stations to the network: **Open System**, **Shared Key**, and **Auto**. The following figure illustrates the steps involved.



WEP Authentication Steps

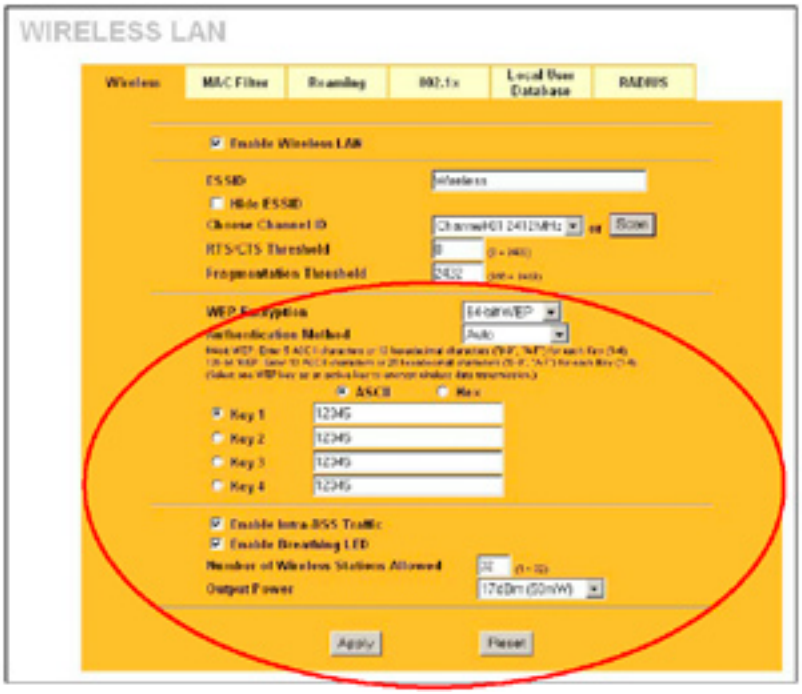
Open system authentication involves an unencrypted two-message procedure. A wireless station sends an open system authentication request to the AP, which will then automatically accept and connect the wireless station to the network. In effect, open system is not authentication at all as any station can gain access to the network.

Shared key authentication involves a four-message procedure. A wireless station sends a shared key authentication request to the AP, which will then reply with a challenge text message. The wireless station must then use the AP's default WEP key to encrypt the challenge text and return it to the AP, which attempts to decrypt the message using the AP's default WEP key. If the decrypted message matches the challenge text, the wireless station is authenticated.

When your 1500WR Wireless Router's authentication method is set to open system, it will only accept open system authentication requests. The same is true for shared key authentication. However, when it is set to **auto authentication**, the 1500WR Wireless Router will accept either type of authentication request and the 1500WR Wireless Router will fall back to use open authentication if the shared key does not match.

7.3 Configuring WEP Encryption

In order to configure and enable WEP encryption; click **ADVANCED** and then **WIRELESS** to display the Wireless screen.



The following table describes the wireless LAN security labels in this screen.

LABEL	DESCRIPTION
WEP Encryption	Select **Disable** to allow wireless stations to communicate with the Wireless Routers without any data encryption. Select **64-bit WEP** or **128-bit WEP** to enable data encryption.
Authentication Method	This field is activated when you select **64-bit WEP** or **128-bit WEP** in the **WEP Encryption** field. Select **Auto, Open System** or **Shared Key** from the drop-down list box.
ASCII	Select this option in order to enter ASCII characters as the WEP keys.
Hex	Select this option in order to enter hexadecimal characters as the WEP keys. The preceding “Ox”, that identifies a hexadecimal key, is entered automatically.
Key 1 to Key 4	The WEP keys are used to encrypt data. Both the 1500WR Wireless Router and the wireless stations must use the same WEP key for data transmission. If you chose **64-bit WEP,** then enter any 5 ASCII characters or 10 hexadecimal characters (“0-9”, “A-F”). If you chose **128-bit WEP,** then enter 13 ASCII characters or 26 hexadecimal characters (“0-9”, “A-F”). You must configure all four keys, but only one key can be activated at any one time. The default key is key 1.

Continued on next page.

7.3 Configuring WEP Encryption - Continued

Table continued from preceeding page.

LABEL	DESCRIPTION
Enable Intra-BSS Traffic	Intra-BSS traffic is traffic between wireless stations in the BSS. Select this check box to enable Intra-BSS Traffic.
Enable Breathing LED	Select this check box to enable the Breathing LED, also known as the 1500WR Wireless Router LED. The blue 1500WR Wireless Router LED is on when the 1500WR Wireless Router is on and blinks (or breaths) when data is being transmitted to/from its wireless stations. Clear the check box to turn this LED off even when the 1500WR Wireless Router is on and data is being transmitted/received.
Number of Wireless Stations Allowed	Use this field to set a maximum number of wireless stations that may connect to the 1500WR Wireless Router. Enter the number (from 1 to 32) of wireless stations allowed.
Output Power	Set the output power of the 1500WR Wireless Router in this field. If there is a high density of APs within an area, decrease the output power of the 1500WR Wireless Router to reduce interference with other APs. The options are **11dBm (50mW), 13dBm (32mW), 15dBm (20mW)** or **17dBm (12.6mW).**
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset to** reload the previous configuration for this screen.

7.4 MAC Filter

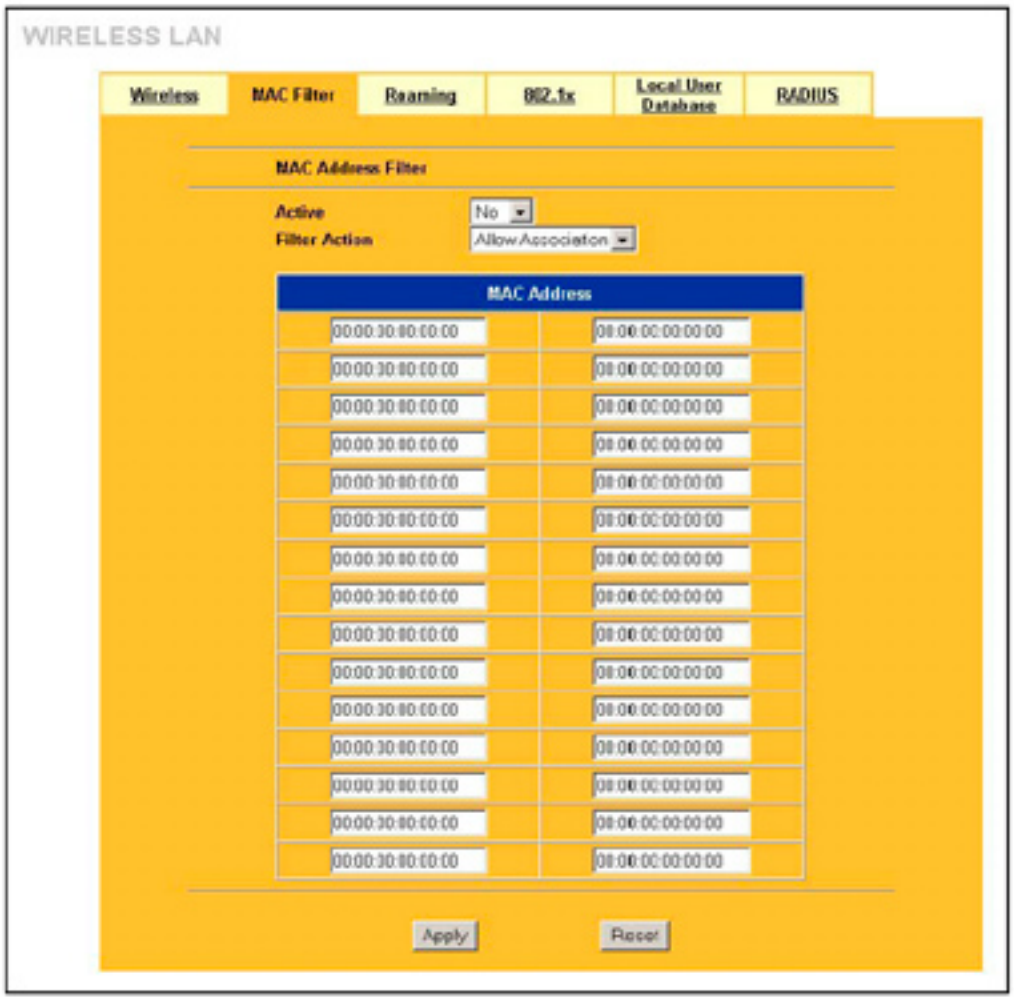
The MAC filter screen allows you to configure the 1500WR Wireless Router to give exclusive access to up to 32 devices (Allow Association) or exclude up to 32 devices from accessing the 1500WR Wireless Router (Deny Association). Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02. You need to know the MAC address of the devices to configure this screen.

To change your 1500WR Wireless Router's MAC filter settings, click **ADVANCED**, **WIRELESS** and then the **MAC Filter** tab.

The screen appears as shown on the next page.

7.4 MAC Filter - Continued

MAC Filter Configuration Screen:



The following table describes the labels in this menu.

LABEL	DESCRIPTION
Active	Select **Yes** from the drop down list box to enable MAC address filtering.
Filter Action	Define the filter action for the list of MAC addresses in the **MAC Address** table. Select **Deny Association** to block access to the 1500WR Wireless Router, MAC addresses not listed will be allowed to access the 1500WR Wireless Router Select **Allow Association** to permit access to the 1500WR Wireless Router, MAC addresses not listed will be denied access to the 1500WR Wireless Router.
MAC Address	Enter the MAC addresses (in XX:XX:XX:XX:XX:XX format) of the wireless station that are allowed or denied access to the 1500WR Wireless Router in these address fields.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

7.5 802.1 x Overview

The IEEE 802. lx standard outlines enhanced security methods for both the authentication of wireless stations and encryption key management. Authentication can be done using the local user database internal to the 1500WR Wireless Router (authenticate up to 32 users) or an external RADIUS server for an unlimited number of users.

7.6 Introduction to RADIUS

RADIUS is based on a client-sever model that supports authentication and accounting, where Wireless Router is the client and the server is the RADIUS server. The RADIUS server handles the following tasks among others:

- **Authentication** - Determines the identity of the users.
- **Accounting** - Keeps track of the client's network activity.

RADIUS user is a simple package exchange in which your 1500WR Wireless Router acts as a message relay between the wireless station and the network RADIUS server.

Types of RADIUS Messages

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

- **Access-Request** - Sent by an Wireless Router requesting authentication.
- **Access-Reject** - Sent by a RADIUS server rejecting access.
- **Access-Accept** - Sent by a RADIUS server allowing access.
- **Access-Challenge** - Sent by a RADIUS server requesting more information in order to allow access. The Wireless Router sends a proper response from the user and then sends another Access-Request message.

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

- **Accounting-Request** - Sent by the Wireless Router requesting accounting.
- **Accounting-Response** - Sent by the RADIUS server to indicate that it has started or stopped accounting.

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

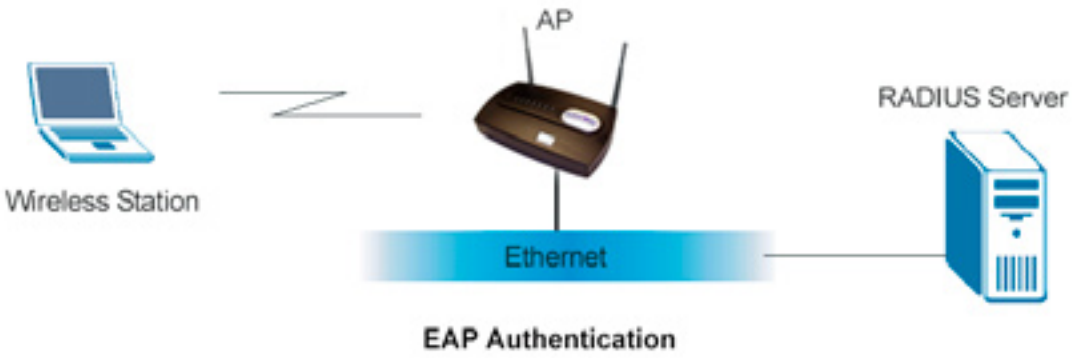
7.6.1 EAP Authentication Overview

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, the Wireless Router helps a wireless station and a RADIUS server perform authentication.

The type of authentication you use depends on the RADIUS server or the AP. The 1500WR Wireless Router supports EAP-TLS, EAP-TTLS and DEAP with RADIUS. Refer to the Types of EAP Authentication appendix for descriptions on the four common types.

Your 1500WR Wireless Router supports EAP-MD5 (Message-Digest Algorithm 5) with the local user database and RADIUS. The following figure shows an overview of authentication when you specify a RADIUS server on your Wireless Router.

7.6.1 EAP Authentication Overview - Continued



EAP Authentication

The details below provide a general description of how IEEE 802. lx EAP authentication works. For an example list of EAP-MD5 authentication steps, see the IEEE 802.lx appendix.

- The wireless station sends a “start” message to the 1500WR Wireless Router.
- The 1500WR Wireless Router sends a “request identity” message to the wireless station for identity information.
- The wireless station replies with identity information, including username and password.
- The RADIUS server checks the user information against its user profile database and determines whether or not to authenticate the wireless station.

7.7 Dynamic WEP Key Exchange

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

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

To use Dynamic WEP, enable and configure the RADIUS server (see section 7.11) and enable Dynamic WEP Key Exchange in the 802.lx screen. Ensure that the wireless station’s EAP type is configured to one of the following:

- **EAP-TLS**
- **EAP-TTLS**
- **PEAP**

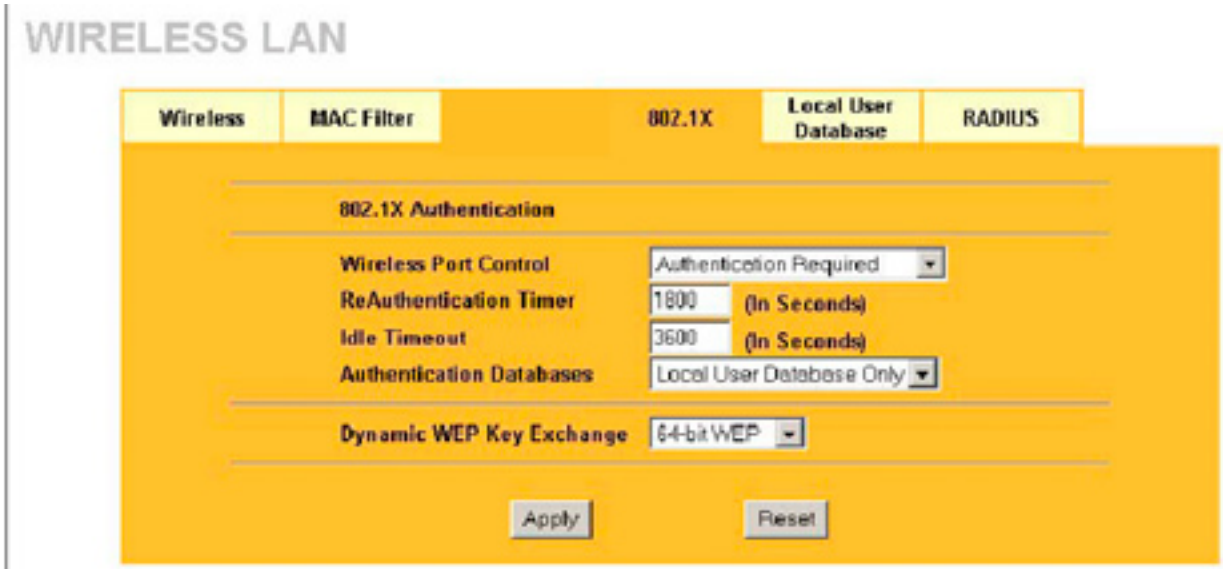
EAP-MD5 cannot be used with Dynamic WEP Key Exchange.

7.8 Introduction to Local User Database

By storing user profiles locally on the 1500WR Wireless Router, your 1500WR Wireless Router is able to authenticate wireless users without interacting with a network RADIUS server. However, there is a limit on the number of users you may authenticate in this way.

7.9 Configuring 802.1 x

To change your 1500WR Wireless Router's authentication settings, click **ADVANCED, WIRELESS** and then the **802.1x tab**. The screen appears as shown below.



The following table describes the settings on this screen.

LABEL	DESCRIPTION
Wireless Port Control	To control wireless stations access to the wired network, select a control method from the drop-down list box. Choose from **No Authentication Required, Authentication Required** and **No Access Allowed.** **No Authentication Required** allows all wireless stations access to the wired network without entering usernames and passwords. This is the default setting. **Authentication Required** means that all wireless stations have to enter usernames and passwords before access to the wired network is allowed. **No Access Allowed** blocks all wireless stations access to the wired network.
ReAuthentication Timer (in seconds)	Specify how often wireless stations have to reenter usernames and passwords in order to stay connected. This field is activated only when you select **Authentication Required** in the **Wireless Port Control** field. Enter a time interval between 10 and 9999 seconds. The default time interval is **1800** seconds (30 minutes). **If wireless station authentication is done using a RADIUS server, the reauthentication timer on the RADIUS server has priority.**
Idle Timeout	The 1500WR Wireless Router automatically disconnects a wireless station from the wired network after a period of inactivity. The wireless station needs to enter the username and password again before access to the wired network is allowed. This field is activated only when you select **Authentication Required** in the **Wireless Port Control** field. The default time interval is **3600** seconds (or 1 hour).

Table continued on next page.

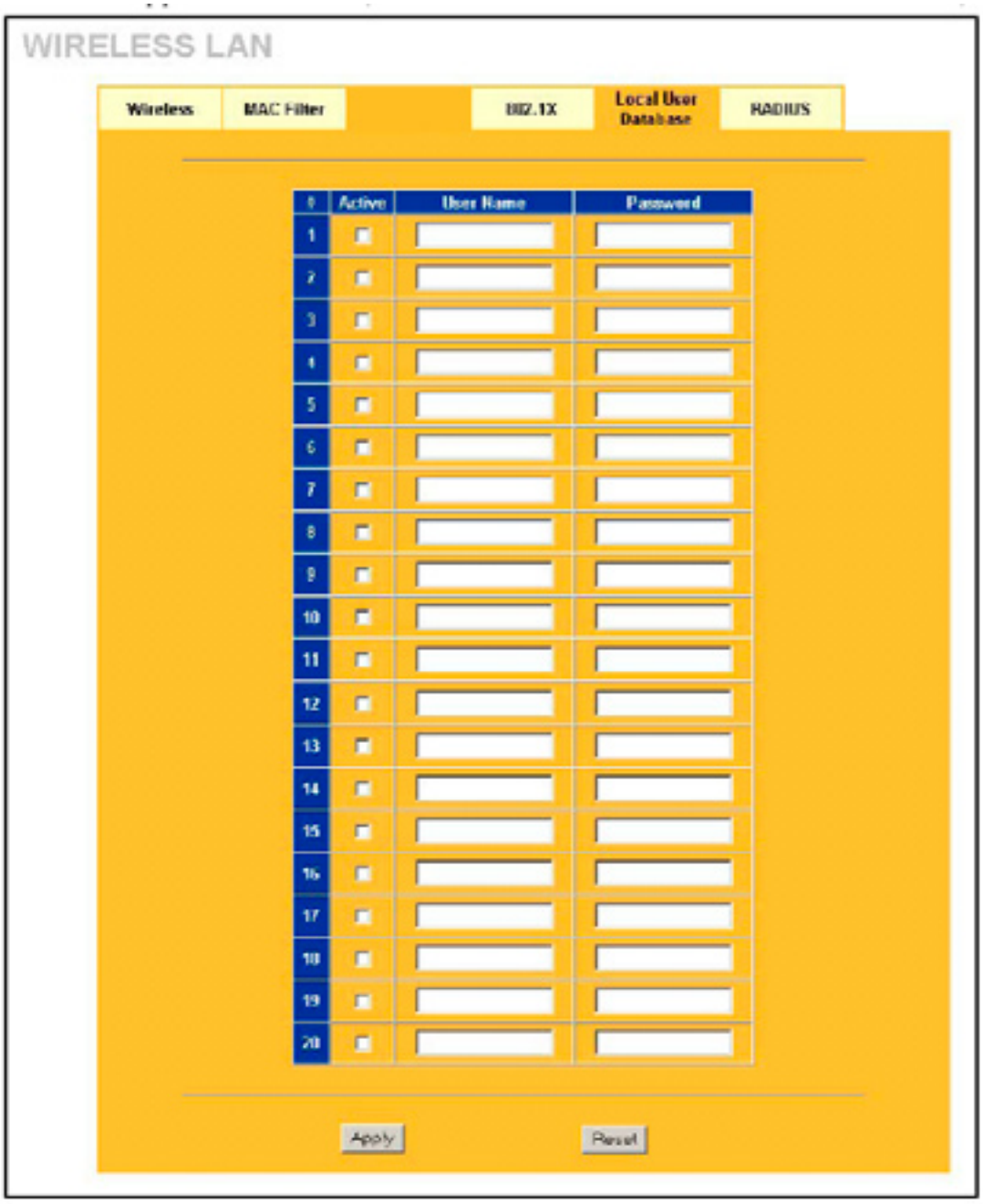
7.9 Configuring 802.1 x - Continued

LABEL	DESCRIPTION
Authentication Databases	This field is activated only when you select **Authentication Required** in the **Wireless Port Control** field. The authentication database contains wireless station login information. The local user database is the built-in database on the 1500WR Wireless Router. The RADIUS is an external server. Use this drop-down list box to select which database the 1500WR Wireless Router should use (first) to authenticate a wireless station. Before you specify the priority, make sure you have set up the corresponding database correctly first. Select **Local User Database Only** to have the 1500WR Wireless Router just check the built-in user database on the 1500WR Wireless Router for a wireless station's username and password. Select **RADIUS Only** to have the 1500WR Wireless Router just check the user database on the specified RADIUS server for a wireless station's username and password. Select **Local first, then RADIUS** to have the 1500WR Wireless Router first check the user database on the 1500WR Wireless Router for a wireless station's username and password. If the user name is not found, the 1500WR Wireless Router then checks the user database on the specified RADIUS server. Select **RADIUS first, then Local** to have the 1500WR Wireless Router first check the user database on the specified RADIUS server for a wireless station's username and password. If the 1500WR Wireless Router cannot reach the RADIUS server, the 1500WR Wireless Router then checks the local user database on the 1500WR Wireless Router. When the user name is not found or password does not match in the RADIUS server, the 1500WR Wireless Router will not check the local user database and the authentication fails.
Dynamic WEP Key Exchange	This field is activated only when you select **Authentication Required** in the **Wireless Port Control** field. Also set the **Authentication Databases** field to **RADIUS Only.** Local user database may not be used. Select **Disable** to allow wireless stations to communicate with the Wireless Routers without using dynamic WEP key exchange. Select **64-bit WEP** or **128-bit WEP** to enable data encryption. Up to 32 stations can access the 1500WR Wireless Router when you configure dynamic WEP key exchange.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

Once you enable user authentication, you need to specify an external RADIUS server or create local user accounts on the 1500WR Wireless Router for authentication.

7.10 Configuring Local User Database

To change your 1500WR Wireless Router's local user database, click **ADVANCED, WIRELESS** and then the **Local User Database tab**. The screen appears as shown (some of the screen's blank rows are not shown).



The descriptions for the settings in this screen are described on the next page.

7.10 Configuring Local User Database - Continued

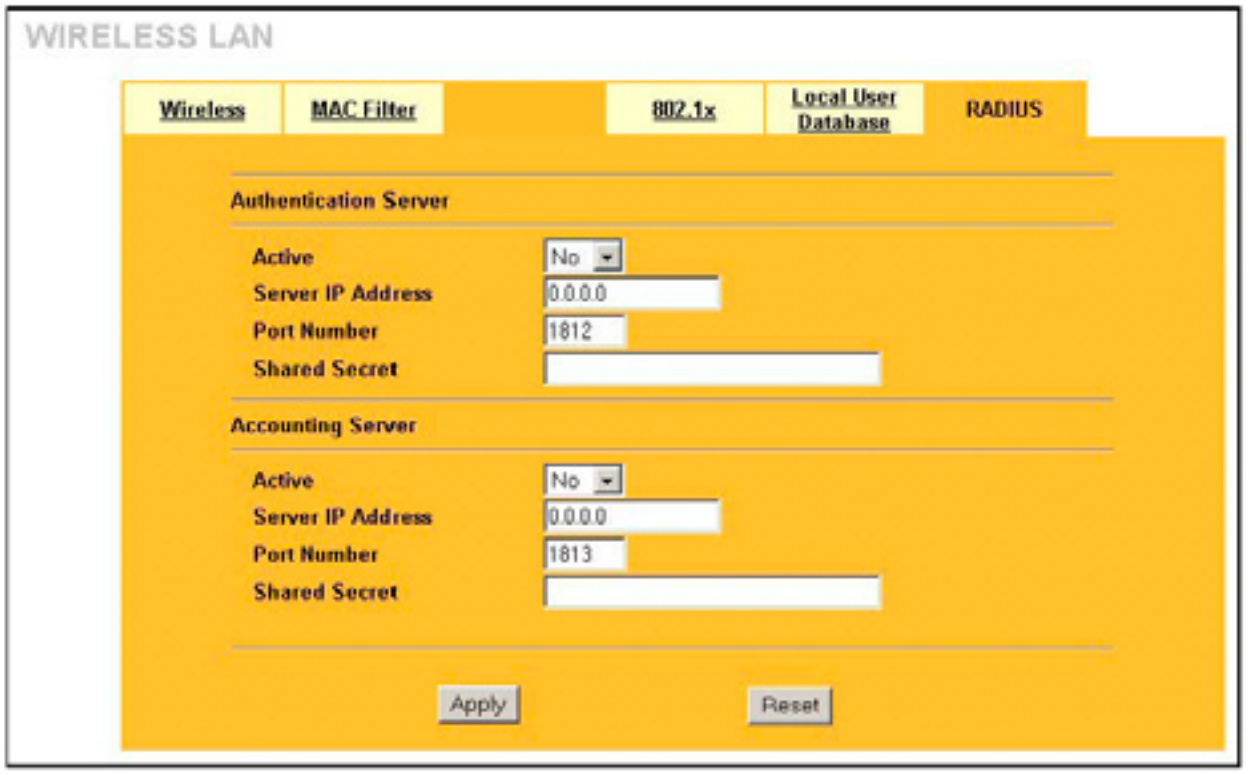
The following table describes the labels in the screen shown on the preceeding page.

LABEL	DESCRIPTION
Active	Select this option to activate the user profile.
User Name	Enter the username (up to 31 characters) for this user profile.
Password	Type a password (up to 31 characters) for this user profile. Note that as you type a password, the screen displays a (*) for each character you type.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

7.11 Configuring RADIUS

Use **RADIUS** if you want to authenticate wireless users using an external server.

To specify a RADIUS server, click **ADVANCED, WIRELESS** and then the **RADIUS tab**. The screen appears as shown below.



The descriptions for the labels in the screen above are shown on the next page.

7.11 Configuring RADIUS - Continued

The following table describes the labels in this screen on the preceeding page.

LABEL	DESCRIPTION
Authentication Server	
Active	Select **Yes** from the drop down list box to enable user authentication through an external authentication server.
Server IP Address	Enter the IP address of the external authentication server in dotted decimal notation.
Port Number	Enter the port number of the external authentication server. The default port number is **1812.** You need not change this value unless your network administrator instructs you to do so with additional information.
Shared Secret	Enter a password (up to 31 alphanumeric characters) as the key to be shared between the external authentication server and the 1500WR Wireless Router. The key must be the same on the external authentication server and your 1500WR Wireless Router. The key is not sent over the network.
Accounting Server	
Active	Select **Yes** from the drop down list box to enable user accounting through an external authentication server.
Server IP Address	Enter the IP address of the external accounting server in dotted decimal notation.
Port Number	Enter the port number of the external accounting server. The default port number is **1813.** You need not change this value unless your network administrator instructs you to do so with additional information.
Shared Secret	Enter a password (up to 31 alphanumeric characters) as the key to be shared between the external accounting server and the 1500WR Wireless Router. The key must be the same on the external accounting server and your 1500WR Wireless Router. The key is not sent over the network.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

Part III

WAN's - Wide Area Networks

This part discusses Wide Area Network (WAN) Setup Screens

Chapter 8

WAN Configuration Screens

This chapter describes how to configure the 1500WR Wireless Router WAN screens.

8.1 WAN Overview

A WAN (Wide Area Network) is an outside connection to another network or the Internet.

See the Wizard Setup chapter for more background information on most fields in the WAN screens.

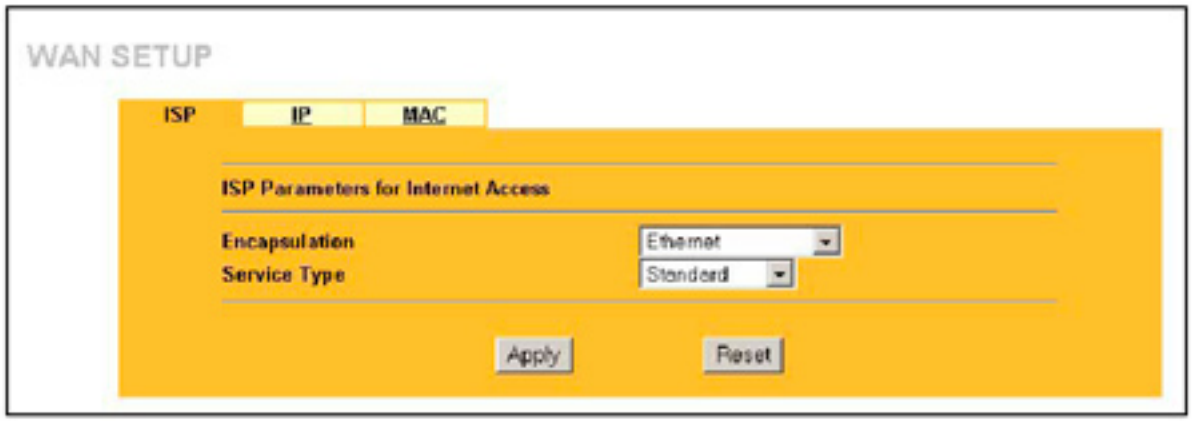
Background information on WAN fields not included in the Wizard is described here.

8.2 Configuring WAN ISP

To change your 1500WR Wireless Router's WAN ISP settings, click ADVANCED, WAN and then the ISP tab. The screen differs by the encapsulation.

8.2.1 Ethernet Encapsulation

The screen shown next is for Ethernet encapsulation.



The descriptions for the labels in the screen above are shown on the next page.

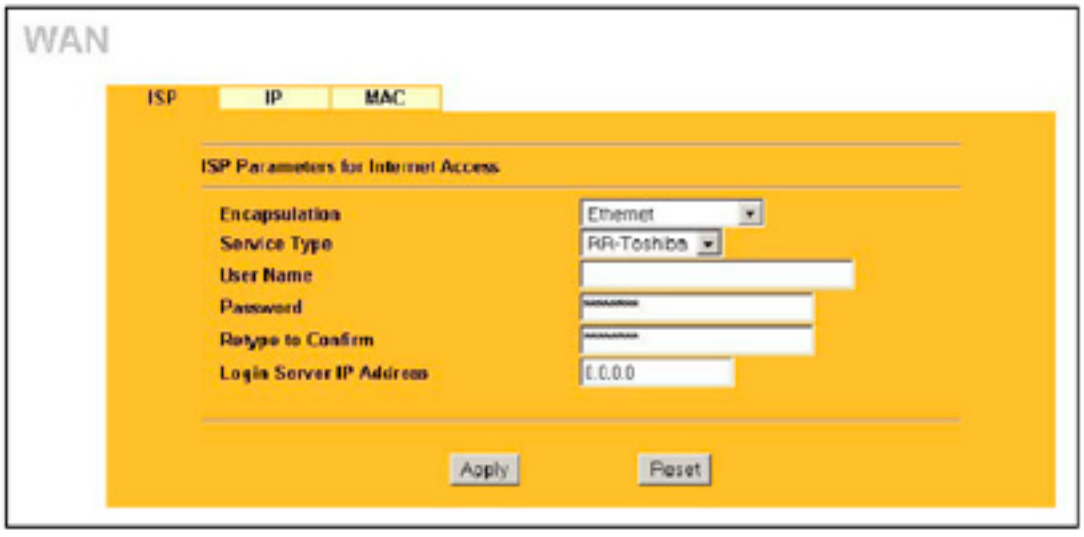
8.2.1 Ethernet Encapsulation - Continued

The following table descirbes the labels on the screen on the preceeding page.

Ethernet Encapsulation	
LABEL	**DESCRIPTION**
Encapsulation	You must choose the Ethernet option when the WAN port is used as a regular Ethernet.
Service Type	Select from **Standard, RR-Toshiba** (RoadRunner Toshiba authentication method), **RR-Manager** (Roadrunner Manager authentication method), **RR-Telstra** or **Telia Login.** Choose a Roadrunner service type if your ISP is Time Warner's Roadrunner; otherwise choose **Standard.**
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

Service Type

The screen varies according to the service type you select. You need a username and password if your ISP is Time Warner's Roadrunner.



The descriptions for the labels in the screen above are shown on the next page.

8.2.1 Ethernet Encapsulation Service Type - Continued

The following table descirbes the labels on the screen on the preceeding page.

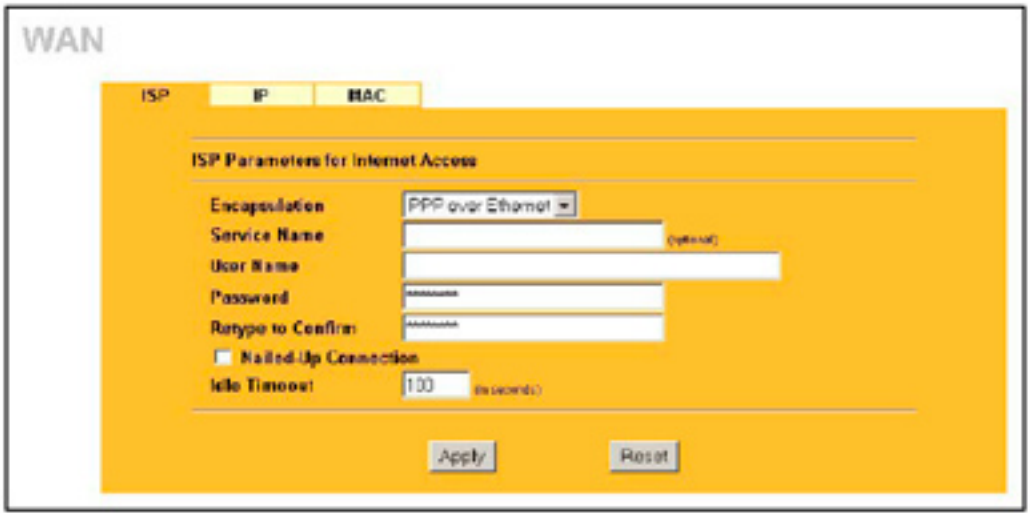
LABEL	DESCRIPTION
Encapsulation	You must choose the Ethernet option when the WAN port is used as a regular Ethernet.
Service Type	Select from **Standard, RR-Toshiba** (RoadRunner Toshiba authentication method), **RR-Manager** (Roadrunner Manager authentication method) **RR-Telstra** or **Telia Login.** Choose a Roadrunner service type if your ISP is Time Warner's Roadrunner; otherwise choose **Standard.**
User Name	Enter the username given to you by your ISP.
Password	Enter the password associated with the login name above.
Retype to Confirm	Type your password again here to ensure that what you entered in the **Password** field above was what you intended.
Login Server IP Address	The 1500WR Wireless Router will find the Roadrunner Server IP address if this field is left blank. If it does not, then you must enter the authentication server IP address.
Login Server (Telia Login only)	Type the domain name of the Telia login server, for example "logini .telia.com". This field is not available on all models.
Relogin Every(min) (Telia Login only)	The Telia server logs the 1500WR Wireless Router out if the 1500WR Wireless Router does not log in periodically. Type the number of minutes from 1 to 59 (30 recommended) for the 1500WR Wireless Router to wait between logins. This field is not available on all models.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

8.2.2 PPPoE Encapsulation

PPPoE (Point-to-Point Protocol over Ethernet) is an IETF Draft standard (RFC 2516) specifying how a personal computer (PC) interacts with a broadband modem (DSL, cable, wireless, etc.) connection. The PPP over Ethernet option is for a dial-up connection using PPPoE.

The screen shown on the next page is for **PPP over Ethernet** encapsulation.

8.2.2 PPPoE Encapsulation - Continued



The following table describes the labels in this screen.

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Encapsulation	The **PPP over Ethernet** choice is for a dial-up connection using PPPoE. The 1500WR Wireless Router supports PPPoE (Point-to-Point Protocol over Ethernet).
Service Name	Type the PPPoE service name provided to you. PPPoE uses a service name to identify and reach the PPPoE server.
User Name	Type the username given to you by your ISP.
Password	Type the password associated with the user name above.
Retype to Confirm	Type your password again here to ensure that what you entered in the **Password** field above was what you intended.
Nailed Up Connection	Select **Nailed Up Connection** if you do not want the connection to time out.
Idle Timeout	Specify the time in seconds that elapses before the 1500WR Wireless Router automatically disconnects from the PPPoE server.

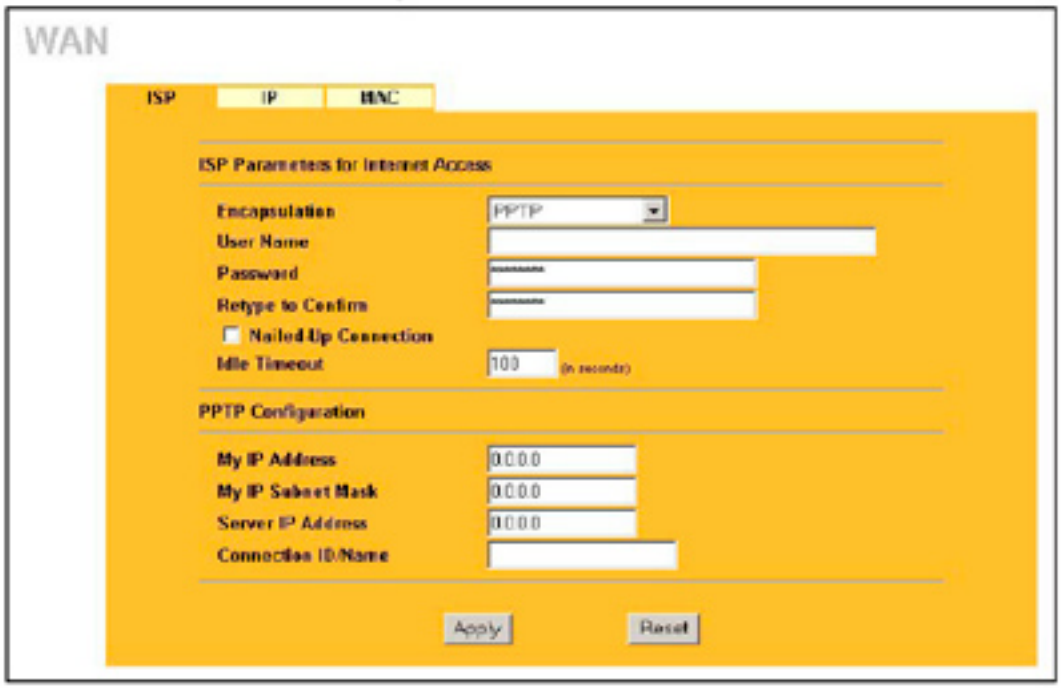
Apply	**Click Apply to save your changes back to the 1500WR Wireless Router.**
Reset	**Click Reset to begin configuring this screen afresh.**

8.2.3 PPTP Encapsulation

Point-to-Point Tunneling Protocol (PPTP) is a network protocol that enables secure transfer of data from a remote client to a private server, creating a Virtual Private Network (VPN) using TCP/IP-based networks.

PPTP supports on-demand, multi-protocol and virtual private networking over public networks, such as the Internet.

The screen shown below is for PPTP encapsulation.



The descriptions for the labels in the screen above are shown on the next page.

8.2.3 PPTP Encapsulation - Continued

The following table descirbes the labels on the screen on the preceeding page.

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Encapsulation	PPTP supports on-demand, multi-protocol, and virtual private networking over public networks, such as the Internet. The 1500WR Wireless Router supports only one PPTP server connection at any given time. To configure a PPTP client, you must configure the My Login and Password fields for a PPP connection and the PPTP parameters for a PPTP connection.
User Name	Type the user name given to you by your ISP.
Password	Type the password associated with the user name above.
Retype to Confirm	Type your password again here to ensure that what you entered in the **Password** field above was what you intended.
Nailed-up Connection	Select **Nailed Up Connection** if you do not want the connection to time out.
Idle Timeout	Specify the time in seconds that elapses before the 1500WR Wireless Router automatically disconnects from the PPTP server.
PPTP Configuration	
My IP Address	Type the (static) IP address assigned to you by your ISP.
My IP Subnet Mask	Type the subnet mask assigned to you by your ISP (if given).
Server IP Address	Type the IP address of the PPTP server.
Connection ID/Name	Type your identification name for the PPTP server.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

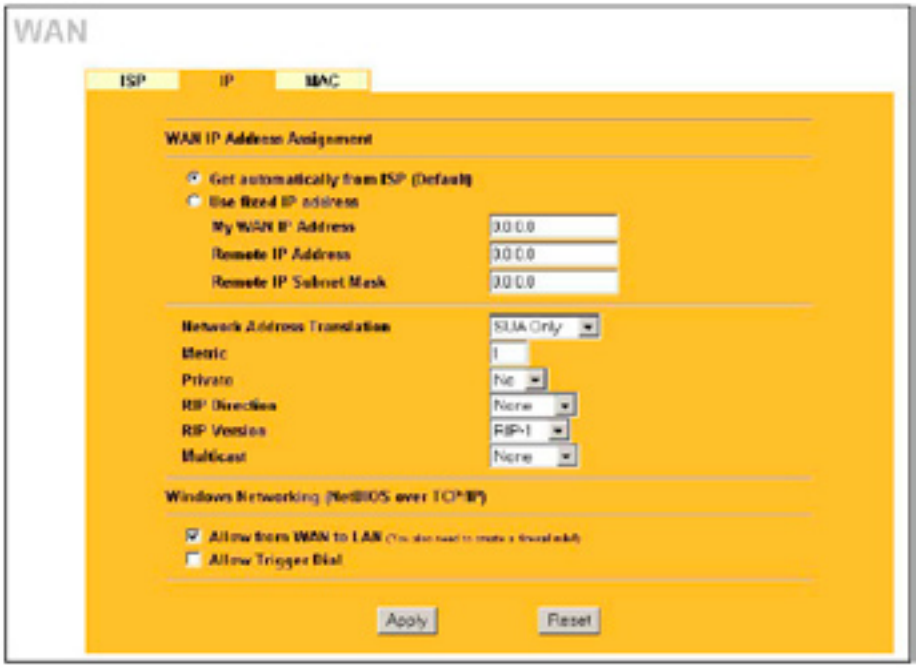
8.3 TCP/IP Priority (Metric)

The metric represents the “cost of transmission”. A router determines the best route for transmission by choosing a path with the lowest “cost”. RIP routing uses hop count as the measurement of cost, with a minimum of “ 1” for directly connected networks. The number must be between “ 1” and “ 15”; a number greater than “15” means the link is down. The smaller the number, the lower the “cost”.

The metric sets the priority for the 1500WR Wireless Router’s routes to the Internet, if any two of the default routes have the same metric.

8.4 Configuring WAN IP

To change your 1500WR Wireless Router's WAN IP settings, click **ADVANCED, WAN** and then the **IP** tab.



The table on the following page describes the labels in this screen.

LABEL	DESCRIPTION
WAN IP Address Assignment	
Get automatically from ISP option	Select this selection if your ISP did not assign you a fixed IP address. This is the default

8.4 Configuring WAN IP - Continued

The following table descirbes the labels on the screen on the preceeding page.

LABEL	DESCRIPTION
WAN IP Address Assignment	
Get automatically from ISP option	Select this selection if your ISP did not assign you a fixed IP address. This is the default
Use fixed IP address	Select this option If the ISP assigned a fixed IP address.
My WAN IP Address	Enter the 1500WR Wireless Router WAN IP address in this field if you selected **Use Fixed IP Address.**
My WAN IP Subnet Mask (Ethernet encapsulation)	Enter the 1500WR Wireless Router WAN IP subnet mask (if your ISP gave you one) in this field if you selected **Use Fixed IP Address.**
Remote IP Address (or Gateway IP Address)	Type the IP address of the remote network or gateway. The gateway is an immediate neighbor of your 1500WR Wireless Router that will forward the packet to the destination. On the LAN, the gateway must be a router on the same segment as your 1500WR Wireless Router; over the WAN, the gateway must be the IP address of one of the remote nodes.
Remote IP Subnet Mask (PPPoE and PPTP encapsulation)	When using a LAN to LAN application, type the IP subnet mask of the destination network. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255, in the subnet mask field, to force the network number to be identical to the host ID.
Network Address Translation	Network Address Translation (NAT) allows the translation of an Internet protocol address used within one network to a different IP address known within another network. **SUA** (Single User Account) is a subset of NAT that supports two types of mapping: **Many-to-One** and **Server.** When you select this option the 1500WR Wireless Router will use Address Mapping Set 255 in the SMT. Choose **SUA Only** if you have just one public WAN IP address for your 1500WR Wireless Router. Choose **Full Feature** if you have multiple public WAN IP addresses for your 1500WR Wireless Router. For more information about NAT refer to the MAT chapter in this *User's Guide*.
Metric (PPPoE and PPTP only)	Type a number that approximates the cost for this link. Metric represents the "cost" of transmission for routing purposes. IP routing uses hop count as the measurement of cost, with a minimum of 1 for directly connected networks. The number need not be precise, but it must be between 1 and 15. In practice, 2 or 3 is usually a good number.
Private (PPPoE and PPTP only)	This parameter determines if the 1500WR Wireless Router will include the route to this remote node in its RIP broadcasts. If select **Yes,** this route is kept private and not included in RIP broadcast. If select **No,** the route to this remote node will be propagated to other hosts through RIP broadcasts.

Continued Next Page

8.4 Configuring WAN IP - Continued

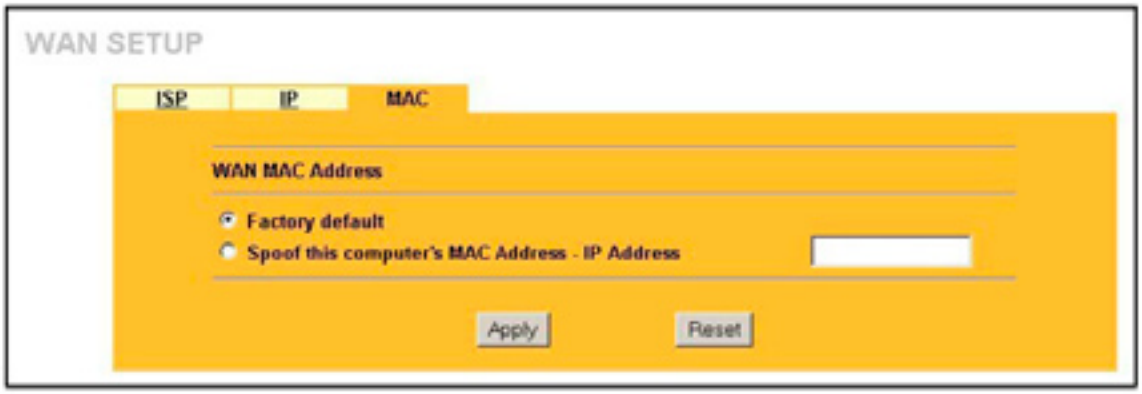
The following table descirbes the labels on the screen on the preceeding pages.

LABEL	DESCRIPTION
RIP Direction	RIP (Routing Information Protocol) allows a router to exchange routing information with other routers. The **RIP Direction** field controls the sending and receiving of RIP packets. Choose **Both, None, In Only** or **Out Only.** When set to **Both** or **Out Only,** the 1500WR Wireless Router will broadcast its routing table periodically. When set to **Both** or **In Only,** the 1500WR Wireless Router will incorporate RIP information that it receives. When set to **None,** the 1500WR Wireless Router will not send any RIP packets and will ignore any RIP packets received. By default, **RIP Direction** is set to **Both.**
RIP Version	The **RIP Version** field controls the format and the broadcasting method of the RIP packets that the 1500WR Wireless Router sends (it recognizes both formats when receiving). Choose **RIP-1, RIP-2B** or **RIP-2M.** **RIP-1** is universally supported; but **RIP-2** carries more information. RIP-1 is probably adequate for most networks, unless you have an unusual network topology. Both **RIP-2B** and **RIP-2M** sends the routing data in RIP-2 format; the difference being that RIP-2B uses subnet broadcasting while RIP-2M uses multicasting. Multicasting can reduce the load on non-router machines since they generally do not listen to the RIP multicast address and so will not receive the RIP packets. However, if one router uses multicasting, then all routers on your network must use multicasting, also. By default, the **RIP Version** field is set to **RIP-1**.
Multicast	Choose **None** (default), **IGMP-V1** or **IGMP-V2.** IGMP (Internet Group Multicast Protocol) is a session-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. IGMP version 2 (RFC 2236) is an improvement over version 1 (RFC 1112) but IGMP version 1 is still in wide use. If you would like to read more detailed information about interoperability between IGMP version 2 and version 1, please see sections 4 and 5 of RFC 2236.
Windows Networking (NetBIOS over TCP/IP): NetBIOS (Network Basic Input/Output System) are TCP or UDP broadcast packets that enable a computer to connect to and communicate with a LAN. For some dial-up services such as PPPoE or PPTP, NetBIOS packets cause unwanted calls.	
Allow From WAN to LAN	Select this option to forward NetBIOS packets from the WAN port to the LAN port.
Allow Trigger Dial	Select this option to allow NetBIOS packets to initiate calls.

Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

8.5 Configuring WAN MAC

To change your 1500WR Wireless Router's WAN MAC settings, click **ADVANCED, WAN** and then the **MAC** tab. The screen appears as shown.



The MAC address screen allows users to configure the WAN port's MAC address by either using the factory default or cloning the MAC address from a computer on your LAN.

Choose **Factory Default** to select the factory assigned default MAC address.

Part IV

SUA (Single User Account)/ NAT (Network Address Translation) and STATIC ROUTE

This part covers the information about SUA/NAT and Static Route setup.

Chapter 9

Single User Account (SUA) / Network Address Translation (NAT)

This chapter discusses how to configure SUA/NAT on the 1500WR Wireless Router.

9.1 NAT Overview

NAT (Network Address Translation - NAT, RFC 1631) is the translation of the IP address of a host in a packet. For example, the source address of an outgoing packet, used within one network is changed to a different IP address known within another network.

9.1.1 NAT Definitions

Inside/outside denotes where a host is located relative to the 1500WR Wireless Router For example, the computers of your subscribers are the inside hosts, while the web servers on the Internet are the outside hosts.

Global/local denotes the IP address of a host in a packet as the packet traverses a router. For example, the local address refers to the IP address of a host when the packet is in the local network, while the global address refers to the IP address of the host when the same packet is traveling in the WAN side.

Note that inside/outside refers to the location of a host, while global/local refers to the IP address of a host used in a packet. Thus, an inside local address (ILA) is the IP address of an inside host in a packet when the packet is still in the local network, while an inside global address (IGA) is the IP address of the same inside host when the packet is on the WAN side.

The following table summarizes this information.

TERM	DESCRIPTION
Inside	This refers to the host on the LAN.
Outside	This refers to the host on the WAN.
Local	This refers to the packet address (source or destination) as the packet travels on the LAN.
Global	This refers to the packet address (source or destination) as the packet travels on the WAN.

NAT never changes the IP address (either local or global) of an outside host.

9.1 NAT Overview - Continued

9.1.2 What NAT Does

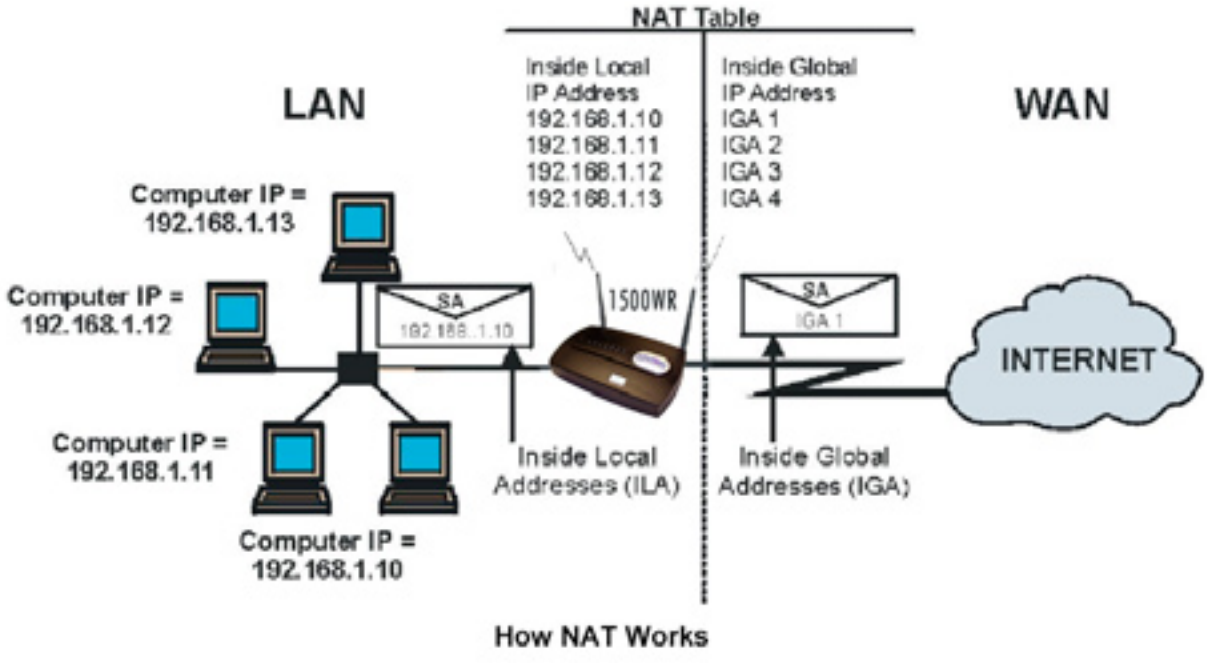
In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address) back to the inside local address before forwarding it to the original inside host. Note that the IP address (either local or global) of an outside host is never changed.

The global IP addresses for the inside hosts can be either static or dynamically assigned by the ISP. In addition, you can designate servers (for example a web server and a telnet server) on your local network and make them accessible to the outside world. Although you can make designated servers on the LAN accessible to the outside world, it is strongly recommended that you attach those servers to the DMZ port instead. If you do not define any servers (for Many-to-One and Many-to-Many Overload mapping), NAT offers the additional benefit of firewall protection. With no servers defined, your 1500WR Wireless Router filters out all incoming inquiries, thus preventing intruders from probing your network. For more information on IP address translation, refer to RFC 1631, The IP Network Address Translator (NAT).

9.1.3 How NAT Works

Each packet has two addresses - a source address and a destination address. For outgoing packets, the ILA (Inside Local Address) is the source address on the LAN, and the IGA (Inside Global Address) is the source address on the WAN. For incoming packets, the ILA is the destination address on the LAN, and the IGA is the destination address on the WAN. NAT maps private (local) IP addresses to globally unique ones required for communication with hosts on other networks. It replaces the original IP source address (and TCP or UDP source port numbers for Many-to-One and Many-to-Many Overload NAT mapping) in each packet and then forwards it to the Internet. The 1500WR Wireless Router keeps track of the original addresses and port numbers so incoming reply packets can have their original values restored.

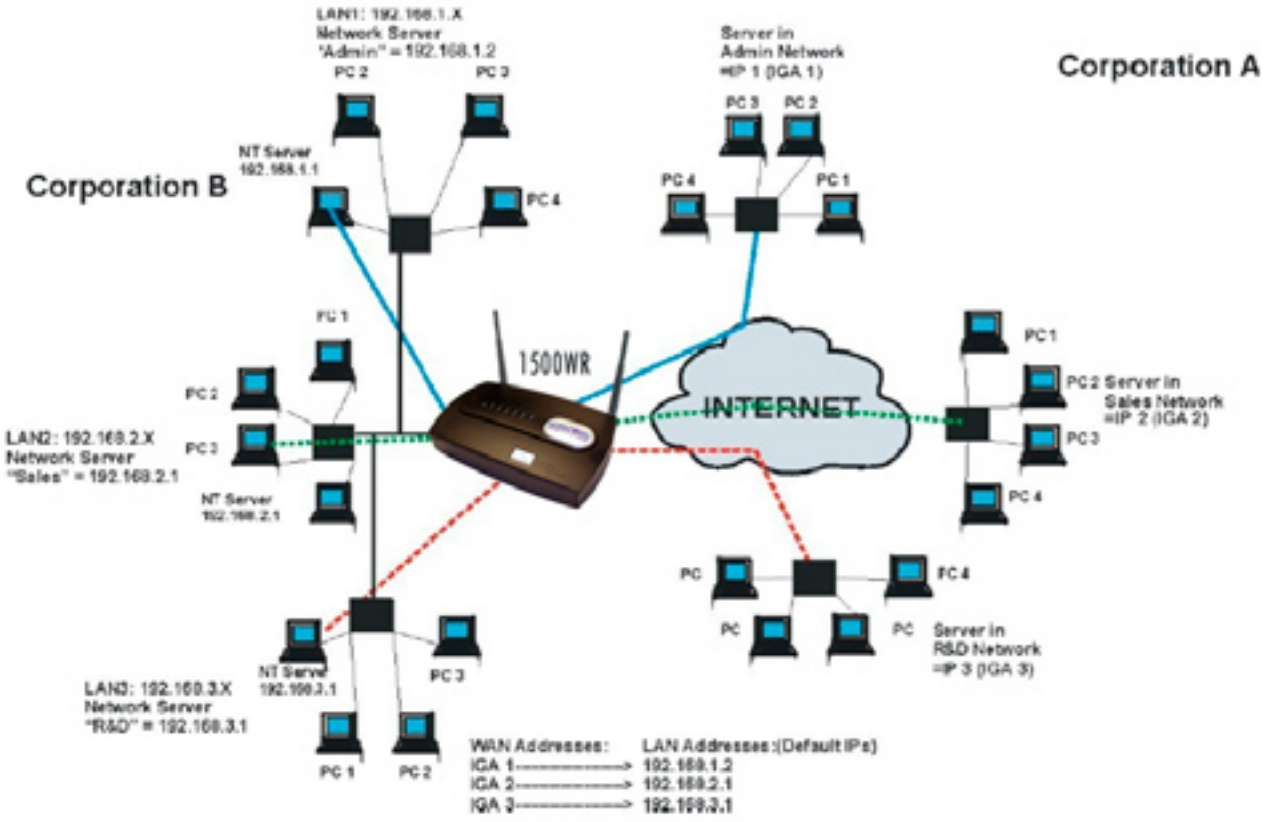
The following figure illustrates this.



9.1 NAT Overview - Continued

9.1.4 NAT Application

The following figure illustrates a possible NAT application, where three inside LANs (logical LANs using IP Alias) behind the 1500WR Wireless Router can communicate with three distinct WAN networks. More examples follow at the end of this chapter.



Application with IP Alias

9.1 NAT Overview - Continued

9.1.5 NAT Mapping Types

NAT supports five types of IP/port mapping. They are:

> **One to One:** In One-to-One mode, the 1500WR Wireless Router maps one local IP address to one global IP address.

> **Many to One:** In Many-to-One mode, the 1500WR Wireless Router maps multiple local IP addresses to one global IP address. This is equivalent to SUA (i.e., PAT, port address translation), ParkerVision's Single User Account feature (the SUA Only option).

> **Many to Many Overload:** In Many-to-Many Overload mode, the 1500WR Wireless Router maps the multiple local IP addresses to shared global IP addresses.

> **Many One to One:** In Many-One-to-One mode, the 1500WR Wireless Router maps each local IP address to a unique global IP address.

> **Server:** This type allows you to specify inside servers of different services behind the NAT to be accessible to the outside world.

Port numbers do not change for One-to-One and Many-One-to-One NAT mapping types.

The following table summarizes these types.

TYPE	IP MAPPING	SMT ABBREVIATION
One-to-One	ILA1 < > IGA1	1-1
Many-to-One (SUA/PAT)	ILA1 < > IGA1 ILA2 < > IGA1	M-1
Many-to-Many Overload	ILA1 < > IGA1 ILA2 < > IGA2 ILA3 < > IGA1 ILA4 < > IGA2	M-MOv
Many-One-to-One	ILA1 < > IGA1 ILA2< > IGA2 ILA3< > IGA3	M-1-1
Server	Server 1 IP< > IGA1 Server 2 IP< > IGA1 Server 3 IP< > IGA1	Server

9.1 NAT Overview - Continued

9.1.6 SUA (Single User Account) Versus NAT

SUA (Single User Account) is a ParkerVision implementation of a subset of NAT that supports two types of mapping, Many-to-One and Server. The 1500WR Wireless Router also supports Full Feature NAT to map multiple global IP addresses to multiple private LAN IP addresses of clients or servers using mapping types. Select either SUA Only or Full Feature in WAN IP.

9.2 SUA Server

An SUA server set is a list of inside (behind NAT on the LAN) servers, for example, web or FTP, that you can make visible to the outside world even though SUA makes your whole inside network appear as a single computer to the outside world.

You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 80 and FTP on port 21. In some cases, such as for unknown services or where one server can support more than one service (for example both FTP and web service), it might be better to specify a range of port numbers. You can allocate a server IP address that corresponds to a port or a range of ports.

Many residential broadband ISP accounts do not allow you to run any server processes (such as a Web or FTP server) from your location. Your ISP may periodically check for servers and may suspend your account if it discovers any active services at your location. If you are unsure, refer to your ISP.

Default Server IP Address

In addition to the servers for specified services, NAT supports a default server IP address. A default server receives packets from ports that are not specified in this screen.

If you do not assign a Default Server IP Address, then all packets received for ports not specified in this screen will be discarded.

9.2.1 Port Forwarding: Services and Port Numbers

In addition to the servers for specified services, NAT supports a default server. A service request that does not have a server explicitly designated for it is forwarded to the default server. If the default server is not defined, the service request is simply discarded.

Many residential broadband ISP accounts do not allow you to run any server processes (such as a Web or FTP server) from your location. Your ISP may periodically check for servers and may suspend your account if it discovers any active services at your location. If you are unsure, refer to your ISP.

The most often used port numbers are shown in the table on the following page.

9.2.1 Port Forwarding: Services and Port Numbers - Continued

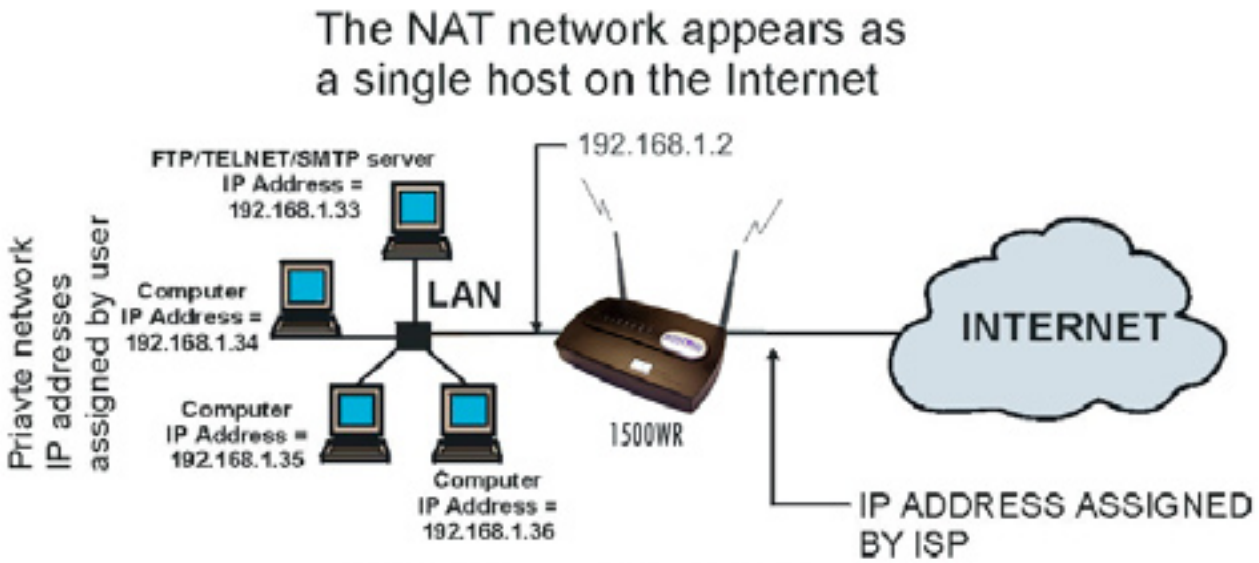
Services and Port Numbers

SERVICES	PORT NUMBER
ECHO	**7**
FTP (File Transfer Protocol)	**21**
SMTP (Simple Mail Transfer Protocol)	**25**
DNS (Domain Name System)	**53**
Finger	**79**
HTTP (Hyper Text Transfer protocol or WWW, Web)	**80**
P0P3 (Post Office Protocol)	110
NNTP (Network News Transport Protocol)	119
SNMP (Simple Network Management Protocol)	161
SNMP trap	162
PPTP (Point-to-Point Tunneling Protocol)	1723

9.2.2 Configuring Servers Behind SUA (Example)

Let's say you want to assign ports 22-25 to one server, port 80 to another and assign a default server IP address of 192.168.1.35 as shown in the figure below.

The NAT network appears as a single host on the Internet

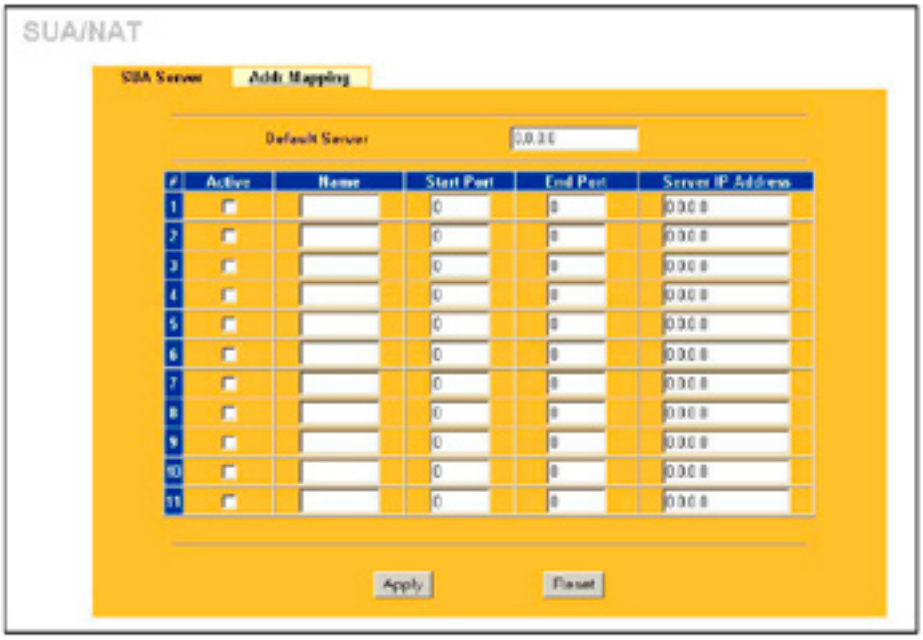


Multiple Servers Behind NAT Example

9.3 Configuring SUA Server

If you do not assign a Default Server IP address, then all packets received for ports not specified in this screen will be discarded.

Click **ADVANCED** and then **SU A/NAT** to open the SUA Server screen. Refer to the table in the previous section for port numbers commonly used for particular services.



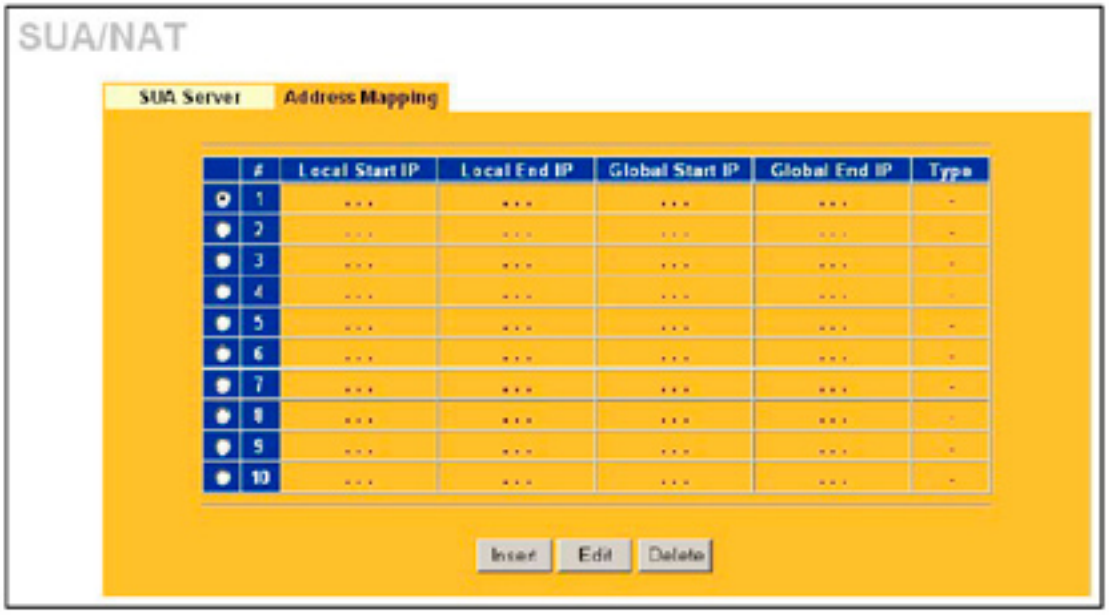
The table below describes the settings in this screen.

LABEL	DESCRIPTION
Default Server	In addition to the servers for specified services, NAT supports a default server. A default server receives packets from ports that are not specified in this screen. If you do not assign a default server IP address, then all packets received for ports not specified in this screen will be discarded.
#	This field displays the number of an individual SUA server entry.
Active	Select this check box to enable the SUA server entry. Clear this checkbox to disallow forwarding of these ports to an inside server without having to delete the entry.
Name	Enter a name to identify this port-forwarding rule.
Start Port End Port	Enter a port number here. To forward only one port, enter the port number in the **Start Port** field and then type it again in the **End Port** field. To specify a range of ports, enter the start port number in the **Start Port** field and the last port to be forwarded in the **End Port** field.
Server IP Address	Enter the inside IP address of the server here.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

9.4 Configuring Address Mapping

Ordering your rules is important because the 1500WR Wireless Router applies the rules in the order that you specify. When a rule matches the current packet, the 1500WR Wireless Router takes the corresponding action and the remaining rules are ignored. If there are any empty rules before your new configured rule, your configured rule will be pushed up by that number of empty rules. For example, if you have already configured rules 1 to 6 in your current set and now you configure rule number 9. In the set summary screen, the new rule will be rule 7, not 9. Now if you delete rule 4, rules 5 to 7 will be pushed up by 1 rule, so old rules 5,6 and 7 become new rules 4, 5 and 6.

To change your 1500WR Wireless Router's address mapping settings, click **ADVANCED, SUA/NAT** and then the **Address Mapping tab**. The screen appears as shown.



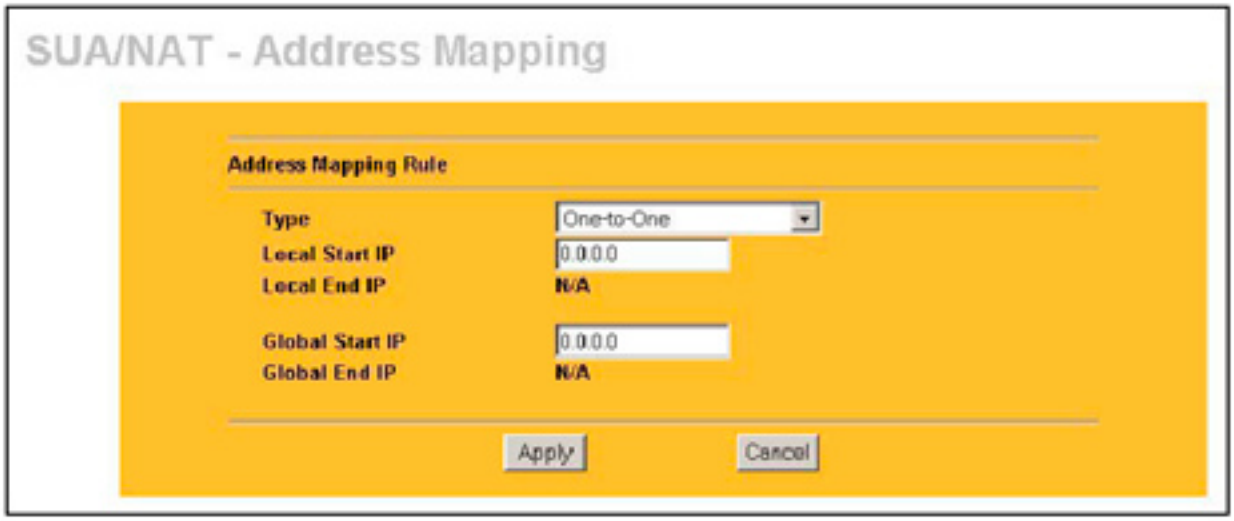
The table below describes the setting in the above screen.

LABEL	DESCRIPTION
#	This field displays the index number of the address mapping rule.
Local Start IP	This refers to the Inside Local Address (ILA), that is the starting local IP address. Local IP addresses are N/A for **Server** port mapping.
Local End IP	This is the end local IP address. If the rule is for all local IP addresses, then this field displays 0.0.0.0 and 255.255.255.255 as the **Local End IP** address. This field is **N/A** for **One-to-One** and **Server** mapping types.
Global Start IP	This refers to the global IP address. 0.0.0.0 is for a dynamic IP address from your ISP with **Many-to-One** and **Server** mapping types.
Global End IP	This is the ending Inside Global Address (IGA), that is the starting global IP address. This field is **N/A** for **One-to-One, Many-to-One** and **Server** mapping types.
Type	Choose the port mapping type from the drop down list.

Insert	Click **Insert** to insert a new mapping rule before an existing one.
Edit	Click **Edit to go to** the **Address Mapping Rule** screen.
Delete	Click **Delete** to delete an address mapping rule.

9.4.1 Configuring Address Mapping Rule

To edit an address mapping rule, click the **Edit** button to display the screen shown next.



The following table describes the labels in this screen.

LABEL	DESCRIPTION
Type	Choose the port mapping type from the drop down list.
Local Start IP	This is the starting local IP address (ILA). Local IP addresses are N/A for **Server** port mapping.
Local End IP	This is the end local IP address (ILA). If your rule is for all local IP addresses, then enter 0.0.0.0 as the **Local Start IP** address and 255.255.255.255 as the **Local End IP** address. This field is **N/A** for **One-to-One** and **Server** mapping types.
Global Start IP	This is the starting global IP address (IGA). Enter 0.0.0.0 here if you have a dynamic IP address from your ISP.
Global End IP	This is the ending global IP address (IGA). This field is **N/A** for **One-to-One, Many-to-One** and **Server** mapping types.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Cancel	Click **Cancel** to exit this screen without saving.

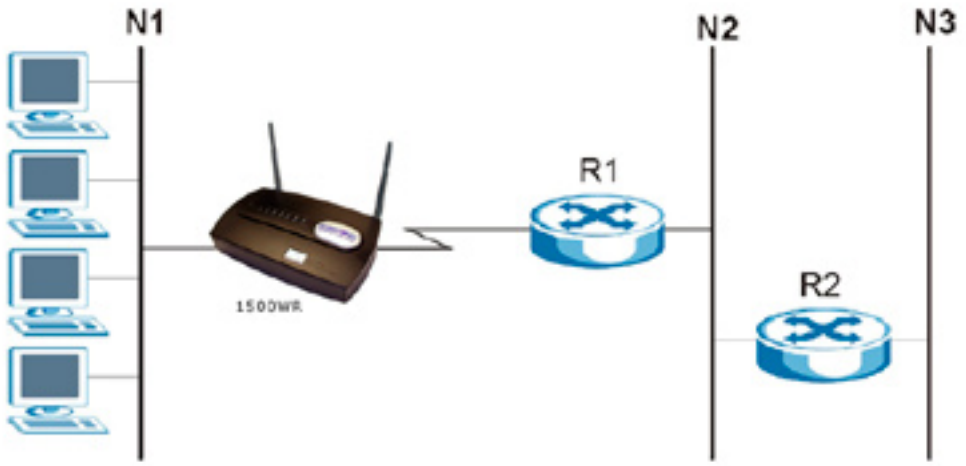
Chapter 10

Static Route

This chapter shows you how to configure static routes for your 1500WR Wireless Router.

10.1 Static Route Overview

Each remote node specifies only the network to which the gateway is directly connected, and the 1500WR Wireless Router has no knowledge of the networks beyond. For instance, the 1500WR Wireless Router knows about network N2 in the following figure through remote node Router 1. However, the 1500WR Wireless Router is unable to route a packet to network N3 because it doesn't know that there is a route through the same remote node Router 1 (via gateway Router 2). The static routes are for you to tell the 1500WR Wireless Router about the networks beyond the remote nodes.



Example of Static Routing Topology

10.2 Configuring IP Static Route

Click **ADVANCED** and then **STATIC ROUTE** to open the screen shown next.

10.2 Configuring IP Static Route

Click **ADVANCED** and then **STATIC ROUTE** to open the screen shown next.

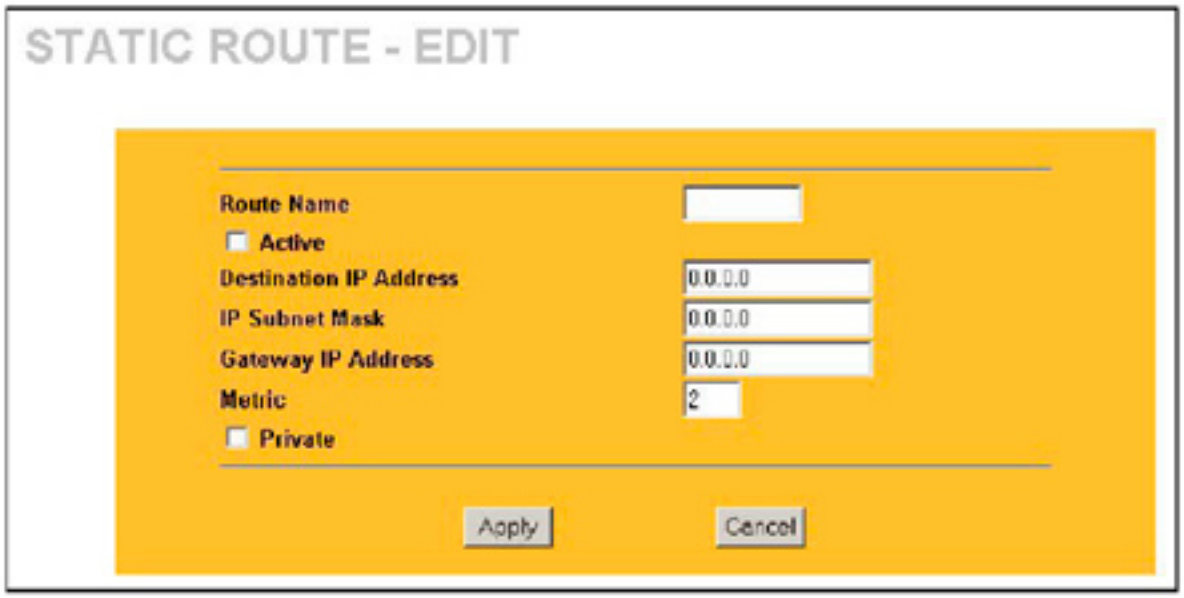
The following table describes the labels in this screen.

IP Static Route Summary

LABEL	DESCRIPTION
#	This field displays an individual static route index number.
Name	This field displays the name that describes or identifies this route.
Active	This field shows whether this static route is active (Yes) or not (No).
Destination	This parameter specifies the IP network address of the final destination. Routing is always based on network number.
Gateway	This field displays the IP address of the gateway. The gateway is an immediate neighbor of your 1500WR Wireless Router that will forward the packet to the destination. On the LAN, the gateway must be a router on the same segment as your 1500WR Wireless Router; over the WAN, the gateway must be the IP address of one of the remote nodes.
Edit	To set up a static route on the 1500WR Wireless Router, click the radio button next to the static route index number you want to configure, then click **Edit** to **go** to the **Static Route -Edit** screen.
Delete	To remove a static route on the 1500WR Wireless Router, click the radio button next to the static route index number you want to remove, then click **Delete.**

10.2.1 Configuring Route Entry

Select a static route index number and click **Edit**. The screen shown next appears. Fill in the required information for each static route.



The following table describes the labels in this screen.

Edit IP Static Route

LABEL	DESCRIPTION
Route Name	Enter a descriptive name for this route. This is for identification purposes only.
Active	Select this check box to activate this static route.
Destination IP Address	Type the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID.
IP Subnet Mask	Type the IP subnet mask here.
Gateway IP Address	Type the IP address of the gateway. The gateway is an immediate neighbor of your 1500WR Wireless Router that will forward the packet to the destination. On the LAN, the gateway must be a router on the same segment as your 1500WR Wireless Router; over the WAN, the gateway must be the IP address of one of the remote nodes.
Metric	Type a number that approximates the cost for this link. Metric represents the “cost” of transmission for routing purposes. IP routing uses hop count as the measurement of cost, with a minimum of 1 for directly connected networks. The number need not be precise, but it must be between 1 and 15. In practice, 2 or 3 is usually a good number.
Private	This parameter determines if the 1500WR Wireless Router will include the route to this remote node in its RIP broadcasts. If this check box is selected, this route is kept private and not included in RIP broadcast. If it is not selected, the route to this remote node will be propagated to other hosts through RIP broadcasts.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Cancel	Click **Cancel** to exit this screen without saving.

Part V

Firewall and Remote Management

This part introduces firewalls in general and the 1500WR Wireless Router firewall.

It also explains custom ports and gives example firewall rules and information on Remote Management.

Chapter 11

Introduction to Firewalls

This chapter gives some background information on firewalls and introduces the 1500WR Wireless Router firewall.

11.1 Firewall Overview

Originally, the term Firewall referred to a construction technique designed to prevent the spread of fire from one room to another. The networking term “firewall” is a system or group of systems that enforces an access-control policy between two networks. It may also be defined as a mechanism used to protect a trusted network from an untrusted network. Of course, firewalls cannot solve every security problem. A firewall is one of the mechanisms used to establish a network security perimeter in support of a network security policy. It should never be the only mechanism or method employed. For a firewall to guard effectively, you must design and deploy it appropriately. This requires integrating the firewall into a broad information-security policy. In addition, specific policies must be implemented within the firewall itself.

11.2 Types of Firewalls

There are three main types of firewalls:

1. Packet Filtering Firewalls
2. Application-level Firewalls
3. Stateful Inspection Firewalls

11.2.1 Packet Filtering Firewalls

Packet filtering firewalls restrict access based on the source/destination computer network address of a packet and the type of application.

11.2.2 Application-level Firewalls

Application-level firewalls restrict access by serving as proxies for external servers. Since they use programs written for specific Internet services, such as HTTP, FTP and telnet, they can evaluate network packets for valid application-specific data. Application-level gateways have a number of general advantages over the default mode of permitting application traffic directly to internal hosts:

i. Information hiding prevents the names of internal systems from being made known via DNS to outside systems, since the application gateway is the only host whose name must be made known to outside systems.

ii. Robust authentication and logging pre-authenticates application traffic before it reaches internal hosts and causes it to be logged more effectively than if it were logged with standard host logging. Filtering rules at the packet filtering router can be less complex than they would be if the router needed to filter application traffic and direct it to a number of specific systems. The router need only allow application traffic destined for the application gateway and reject the rest.

11.2.3 Stateful Inspection Firewalls

Stateful inspection firewalls restrict access by screening data packets against defined access rules. They make access control decisions based on IP address and protocol. They also “inspect” the session data to assure the integrity of the connection and to adapt to dynamic protocols. These firewalls generally provide the best speed and transparency; however, they may lack the granular application level access control or caching that some proxies support. See section 11.5 for more information on Stateful Inspection.

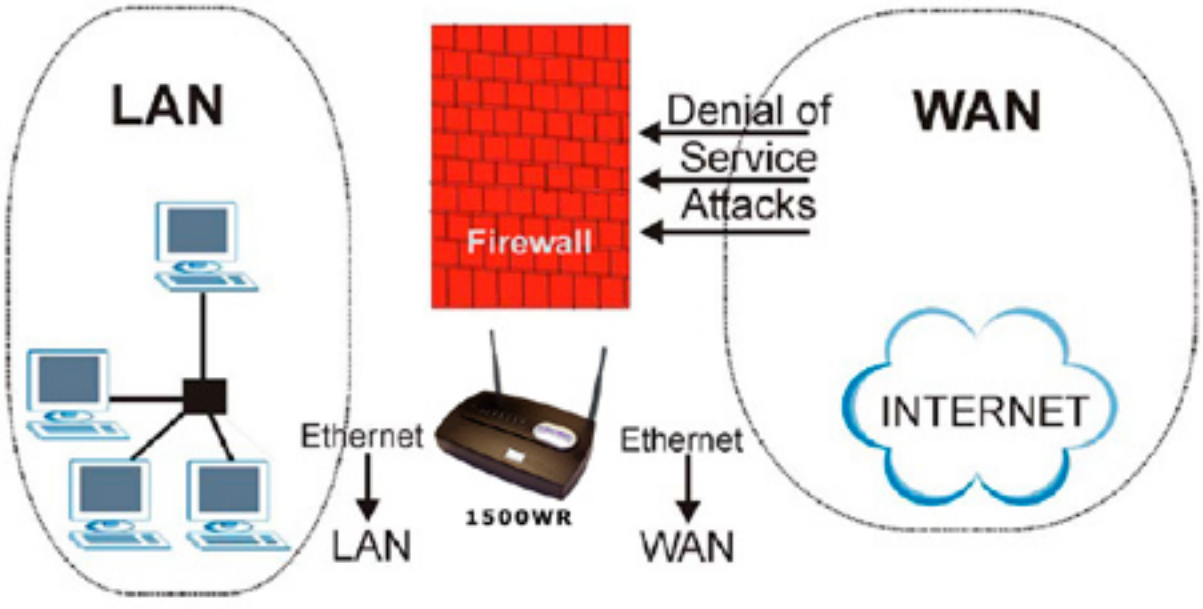
Firewalls, of one type or another, have become an integral part of standard security solutions for enterprises.

11.3 Introduction to ParkerVision’s Firewall

The 1500WR Wireless Router firewall is a stateful inspection firewall and is designed to protect against Denial of Service attacks when activated (in SMT menu 21.2 or in the web Web Configuration Utility). The 1500WR Wireless Router’s purpose is to allow a private Local Area Network (LAN) to be securely connected to the Internet. The 1500WR Wireless Router can be used to prevent theft, destruction and modification of data, as well as log events, which may be important to the security of your network. The 1500WR Wireless Router also has packet-filtering capabilities.

11.4 Denial of Service

Denials of Service (DoS) attacks are aimed at devices and networks with a connection to the Internet. Their goal is not to steal information, but to disable a device or network so users no longer have access to network resources. The 1500WR Wireless Router is pre-configured to automatically detect and thwart all known DoS attacks.



Firewall Application

11.4.1 Basics

Computers share information over the Internet using a common language called TCP/IP. TCP/IP, in turn, is a set of application protocols that perform specific functions. An “extension number”, called the “TCP port” or “UDP port” identifies these protocols, such as HTTP (Web), FTP (File Transfer Protocol), POP3 (E-mail), etc. For example, Web traffic by default uses TCP port 80.

When computers communicate on the Internet, they are using the client/server model, where the server “listens” on a specific TCP/UDP port for information requests from remote client computers on the network. For example, a Web server typically listens on port 80. Please note that while a computer may be intended for use over a single port, such as Web on port 80, other ports are also active. If the person configuring or managing the computer is not careful, a hacker could attack it over an unprotected port.

Some of the most common IP ports are:

Common IP Ports

21	FTP	53	DNS
23	Telnet	80	HTTP
25	SMTP	110	POP3

11.4.2 Types of DoS Attacks

There are four types of DoS attacks:

1. Those that exploit bugs in a TCP/IP implementation.
2. Those that exploit weaknesses in the TCP/IP specification.
3. Brute-force attacks that flood a network with useless data.
4. IP Spoofing.

1. “Ping of Death” and “Teardrop” attacks exploit bugs in the TCP/IP implementations of various computer and host systems.

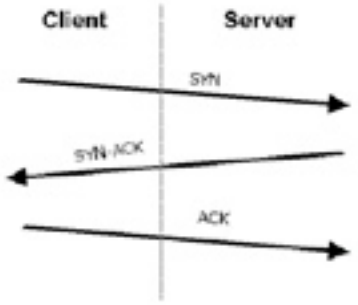
   1-a Ping of Death uses a “ping” utility to create an IP packet that exceeds the maximum 65,536 bytes of data allowed by the IP specification. The oversize packet is then sent to an unsuspecting system. Systems may crash, hang or reboot.

   1-b Teardrop attack exploits weaknesses in the reassembly of IP packet fragments. As data is transmitted through a network, IP packets are often broken up into smaller chunks. Each fragment looks like the original IP packet except that it contains an offset field that says, for instance, “This fragment is carrying bytes 200 through 400 of the original (non fragmented) IP packet.” The Teardrop program creates a series of IP fragments with overlapping offset fields. When these fragments are reassembled at the destination, some systems will crash, hang, or reboot.

2. Weaknesses in the TCP/IP specification leave it open to “SYN Flood” and “LAND” attacks. These attacks are executed during the handshake that initiates a communication session between two applications.

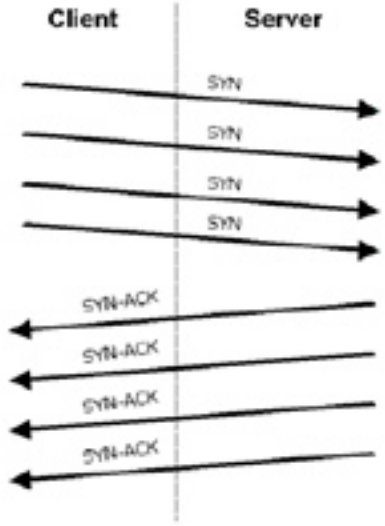
11.4.2 Types of DoS Attacks - Continued

Under normal circumstances, the application that initiates a session sends a SYN (synchronize) packet to the receiving server. The receiver sends back an ACK (acknowledgment) packet and its own SYN, and then the initiator responds with an ACK (acknowledgment). After this handshake, a connection is established.



Three-Way Handshake

2. a) A **SYN Attack** floods a targeted system with a series of SYN packets. Each packet causes the targeted system to issue a SYN-ACK response. While the targeted system waits for the ACK that follows the SYN-ACK, it queues up all outstanding SYN-ACK responses on what is known as a backlog queue. SYN-ACKs are moved off the queue only when an ACK comes back or when an internal timer (which is set at relatively long intervals) terminates the three-way handshake. Once the queue is full, the system will ignore all incoming SYN requests, making the system unavailable for legitimate users.



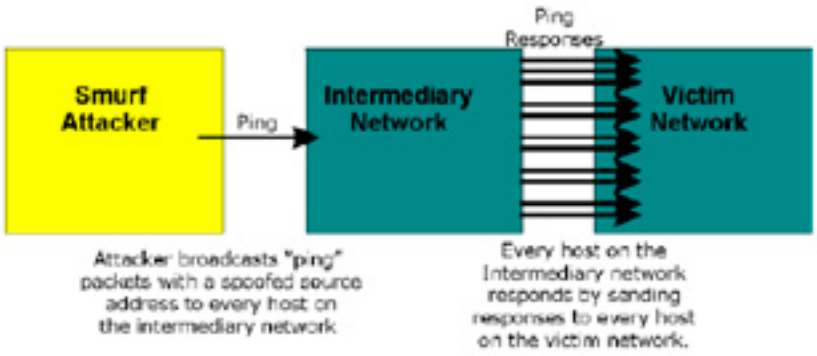
SYN Flood

2. b) In a **LAND Attack**, hackers flood SYN packets into the network with a spoofed source IP address of the targeted system. This makes it appear as if the host computer sent the packets to itself, making the system unavailable while the target system tries to respond to itself.

3. A **brute-force attack**, such as a **"Smurf' attack**, targets a feature in the IP specification known as directed or subnet broadcasting, to quickly flood the target network with useless data. A Smurf hacker floods a router with Internet Control Message Protocol (ICMP) echo request packets (pings). Since the destination IP address of each packet is the broadcast address of the network, the router will broadcast the ICMP echo request packet to all hosts on the network.

If there are numerous hosts, this will create a large amount of ICMP echo request and response traffic. If a hacker chooses to spoof the source IP address of the ICMP echo request packet, the resulting ICMP traffic will not only clog up the "intermediary" network, but will also congest the network of the spoofed source IP address, known as the "victim" network.

This flood of broadcast traffic consumes all available bandwidth, making communications impossible.



Smurf Attack

11.4.2 Types of DoS Attacks - Continued

ICMP Vulnerability

ICMP is an error-reporting protocol that works in concert with IP. The following ICMP types trigger an alert:

ICMP Commands That Trigger Alerts

5	REDIRECT
13	TIMESTAMP_REQUEST
14	TIMESTAMP_REPLY
17	ADDRESS_MASK_REQUEST
18	ADDRESS_MASK_REPLY

Illegal Commands (NetBIOS and SMTP)

The only legal NetBIOS commands are the following - all others are illegal.

Legal NetBIOS Commands

MESSAGE:
REQUEST:
POSITIVE:
NEGATIVE:
RETARGET:
KEEPALIVE:

All SMTP commands are illegal except for those displayed in the following table.

Legal SMTP Commands

AUTH	DATA	EHLO	ETRN	EXPN	HELO	HELP	MAIL	NOOP
QUIT	RCPT	RSET	SAML	SEND	SOML	TURN	VRFY	

Traceroute

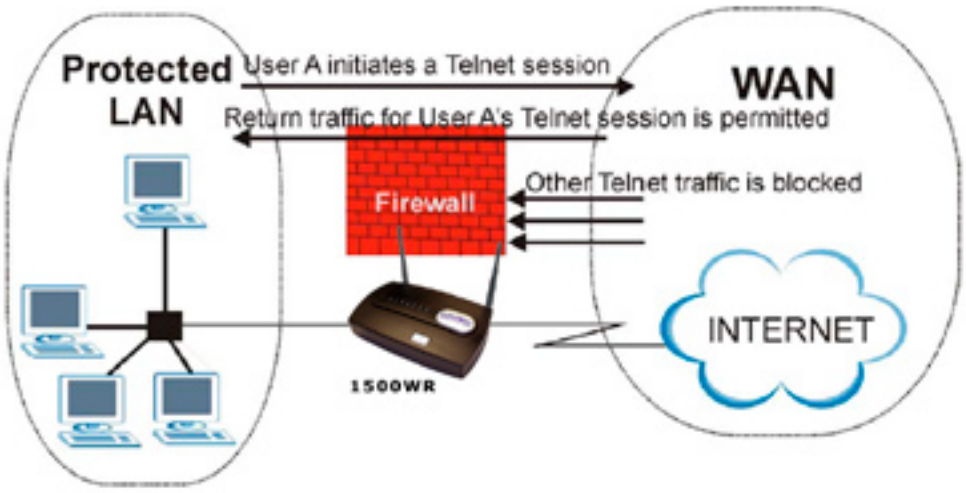
Traceroute is a utility used to determine the path a packet takes between two endpoints. Sometimes when a packet filter firewall is configured incorrectly an attacker can traceroute the firewall gaining knowledge of the network topology inside the firewall.

4. Often, many DoS attacks also employ a technique known as **"IP Spoofing"** as part of their attack. IP Spoofing may be used to break into systems, to hide the hacker's identity, or to magnify the effect of the DoS attack. IP Spoofing is a technique used to gain unauthorized access to computers by tricking a router or firewall into thinking that the communications are coming from within the trusted network. To engage in IP spoofing, a hacker must modify the packet headers so that it appears that the packets originate from a trusted host and should be allowed through the router or firewall. The 1500WR Wireless Router blocks all IP Spoofing attempts.

11.5 Stateful Inspection

Stateful inspection means the 1500WR Wireless Router records packet information, such as port number and source/destination addresses and then allows or denies the response depending on your firewall rules.

The default rules allow LAN-to-WAN traffic and deny traffic initiated from WAN-to-LAN.



Stateful Inspection

The previous figure shows the 1500WR Wireless Router's default firewall rules in action as well as demonstrates how stateful inspection works. User A can initiate a Telnet session from within the LAN and responses to this request are allowed. However other Telnet traffic initiated from the WAN is blocked.

Chapter 12

Firewall Screens

This chapter shows you how to configure your 1500WR Wireless Router firewall.

12.1 Access Methods

The web Web Configuration Utility is, by far, the most comprehensive firewall configuration tool your 1500WR Wireless Router has to offer. For this reason, it is recommended that you configure your firewall using the web Web Configuration Utility. SMT screens allow you to activate the firewall.

12.2 Firewall Policies Overview

Firewall rules are grouped based on the direction of travel of packets to which they apply:

- LAN to LAN/1500WR Wireless Router
- WAN to LAN
- LAN to WAN
- WAN to WAN/1500WR Wireless Router

By default, the 1500WR Wireless Router's stateful packet inspection allows packets traveling in the following directions:

- LAN to LAN/1500WR Wireless Router

This allows computers on the LAN to manage the 1500WR Wireless Router and communicate between networks or subnets connected to the LAN interface.

- LAN to WAN

By default, the 1500WR Wireless Router's stateful packet inspection blocks packets traveling in the following directions:

- WAN to LAN
- WAN to WAN/1500WR Wireless Router

This prevents computers on the WAN from using the 1500WR Wireless Router as a gateway to communicate with other computers on the WAN and/or managing the 1500WR Wireless Router.

You may define additional rules and sets or modify existing ones but please exercise extreme caution in doing so.

12.2 Firewall Policies Overview - Continued

If you configure firewall rules without a good understanding of how they work, you might inadvertently introduce security risks to the firewall and to the protected network. Make sure you test your rules after you configure them.

For example, you may create rules to:

- Block certain types of traffic, such as IRC (Internet Relay Chat), from the LAN to the Internet.
- Allow certain types of traffic, such as Lotus Notes database synchronization, from specific hosts on the Internet to specific hosts on the LAN.
- Allow everyone except your competitors to access a Web server.
- Restrict use of certain protocols, such as Telnet, to authorized users on the LAN.

These custom rules work by comparing the Source IP address, Destination IP address and IP protocol type of network traffic to rules set by the administrator. Your customized rules take precedence and override the 1500WR Wireless Router's default rules.

12.3 Rule Logic Overview

Study these points carefully before configuring rules.

12.3.1 Rule Checklist

1. State the intent of the rule. For example, "This restricts all IRC access from the LAN to the Internet." Or, "This allows a remote Lotus Notes server to synchronize over the Internet to an inside Notes server."
2. Is the intent of the rule to forward or block traffic?
3. What direction of traffic does the rule apply to (refer to 12.2)1
4. What IP services will be affected?
5. What computers on the Internet will be affected? The more specific, the better. For example, if traffic is being allowed from the Internet to the LAN, it is better to allow only certain machines on the Internet to access the LAN.

12.3.2 Security Ramifications

Once the logic of the rule has been defined, it is critical to consider the security ramifications created by the rule:

1. Does this rule stop LAN users from accessing critical resources on the Internet? For example, if IRC is blocked, are there users that require this service?

2. Is it possible to modify the rule to be more specific? For example, if IRC is blocked for all users, will a rule that blocks just certain users be more effective?

3. Does a rule that allows Internet users access to resources on the LAN create a security vulnerability? For example, if FTP ports (TCP 20,21) are allowed from the Internet to the LAN, Internet users may be able to connect to computers with running FTP servers.

4. Does this rule conflict with any existing rules?

Once these questions have been answered, adding rules is simply a matter of plugging the information into the correct fields in the web Web Configuration Utility screensSource Address

12.3.3 Key Fields For Configuring Rules Action

Should the action be to Block or Forward?

"Block" means the firewall silently discards the packet.

Service

Select the service from the Service scrolling list box. If the service is not listed, it is necessary to first define it. See section 12.5.3 for more information on predefined services.

Source Address

What is the connection's source address; is it on the LAN or WAN? Is it a single IP, a range of Ips or a subnet?

Destination Address

What is the connection's destination address; is it on the LAN or WAN? Is it a single IP, a range of Ips or a subnet?

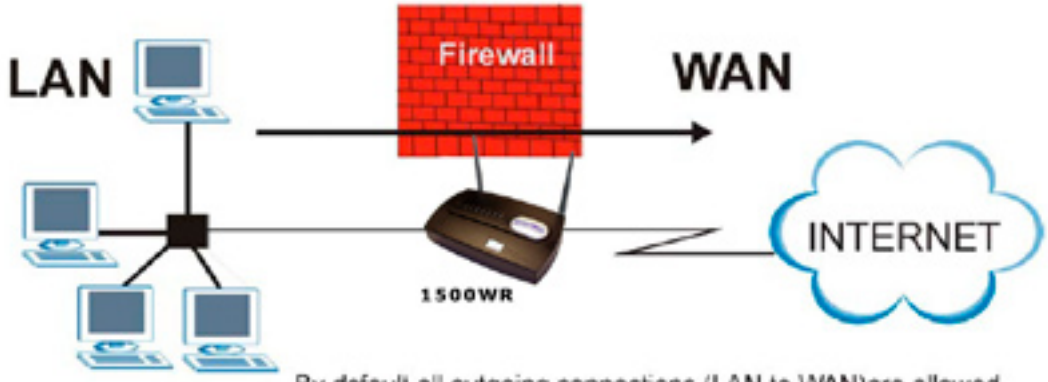
12.4 Connection Direction Examples

This section describes examples for firewall rules for connections going from LAN to WAN and from WAN to LAN.

LAN to LAN/1500WR Wireless Router and WAN to WAN/1500WR Wireless Router rules apply to packets coming in on the associated interface (LAN or WAN respectively). LAN to LAN/1500WR Wireless Router means policies for LAN-to-1500WR Wireless Router (the policies for managing the 1500WR Wireless Router through the LAN interface) and policies for LAN-to-LAN (the policies that control routing between two subnets on the LAN).

12.4.1 LAN to WAN Rules

The default rule for LAN to WAN traffic is that all users on the LAN are allowed non-restricted access to the WAN. When you configure a LAN to WAN rule, you in essence want to limit some or all users from accessing certain services on the WAN. See the following figure.

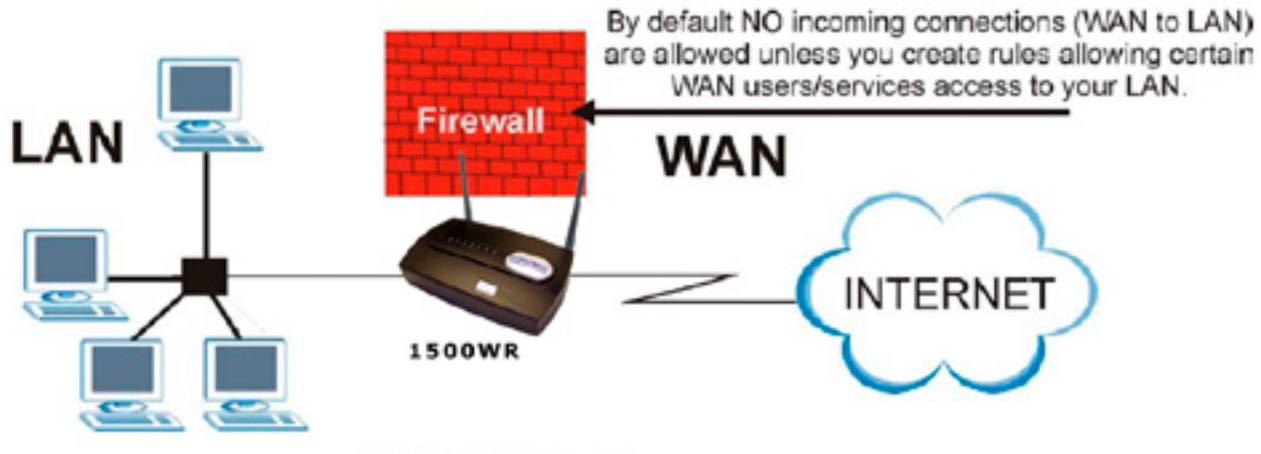


LAN to WAN Traffic

12.4.2 WAN to LAN Rules

The default rule for WAN to LAN traffic blocks all incoming connections (WAN to LAN). If you wish to allow certain WAN users to have access to your LAN, you will need to create custom rules to allow it.

See the following figure.



WAN to LAN Traffic

12.5 Enabling Firewall

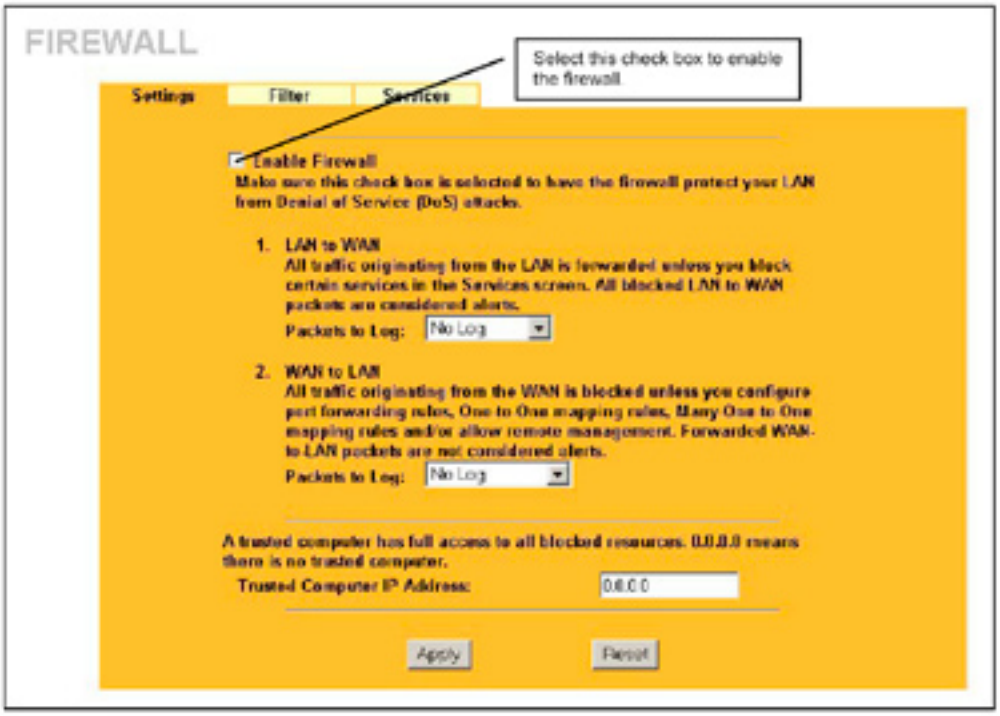
The ordering of your rules is very important as rules are applied in turn.

The default rules allow LAN-to-WAN traffic and deny traffic initiated from WAN-to-LAN. You may block traffic initiated from the LAN by configuring blocked services in the Services screen. You may allow traffic initiated from the WAN by configuring port-forwarding rules, one-to-one/many one-to-one mapping rules and/or allow remote management.

The firewall is automatically enabled when you configure blocked services. When you configure a remote management menu to allow access to the 1500WR Wireless Router, a firewall rule (WAN-to-WAN) is automatically created.

Click **ADVANCED** and **FIREWALL** to open the Settings screen. Enable (or activate) the firewall by selecting the Enable Firewall check box as seen in the screen on the following page.

12.5 Enabling Firewall - Continued



The following table describes the labels in this screen.

Firewall Settings

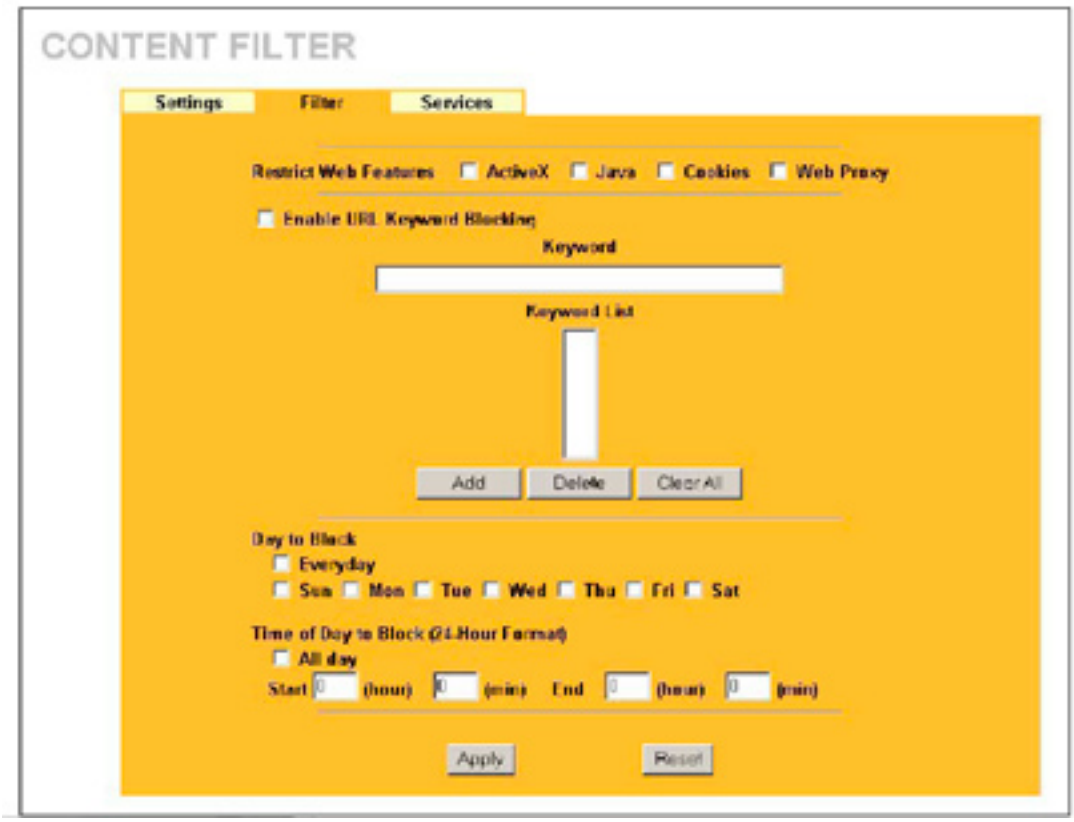
LABEL	DESCRIPTION
Enable Firewall	Select this check box to activate the firewall. The 1500WR Wireless Router performs access control and protects against Denial of Service (DoS) attacks when the firewall is activated.
LAN to WAN	To log packets related to firewall rules, make sure that **Access Control** under **Log** is selected in the **Logs, Log Settings** screen.
Packets to Log	Choose what **LAN to WAN** packets to log. Choose from: • **No Log** • **Log Blocked** (blocked LAN to WAN services appear in the **Blocked Services** textbox in the **Services** screen (with **Enable Services Blocking** selected)) • **Log All** (log all **LAN to WAN** packets)
WAN to LAN	To log packets related to firewall rules, make sure that **Access Control** under **Log** is selected in the **Logs, Log Settings** screen.
Packets to Log	Choose what **WAN to LAN** and WAN to WAN/Prestige packets to log. Choose from: • **No Log** • **Log Forwarded** • **Log All** (log all **WAN to LAN** packets).
Allow one specific computer full access to all blocked resources.	
Trusted Computer IP Address	You can allow a specific computer to access all Internet resources without restriction. Enter the IP address of the trusted computer in this field.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

12.5.1 Configuring Content Filtering

Content filtering allows you to block web sites by URL keywords that you specify, for example, you can block access to all web sites with the word “bad” in the URL by specifying “bad’ as a keyword.

You can also block access to web proxies and pages containing Active X components, Java applets and cookies. Finally you can schedule when the 1500WR Wireless Router performs content filtering by day and time.

Click **ADVANCED**, **FIREWALL** and then the **Filter tab** to open the Filter screen.



The settings in the screen above are described on the next page.

12.5.1 Configuring Content Filtering - Continued

The following table describes the labels in the screen on the preceeding page.

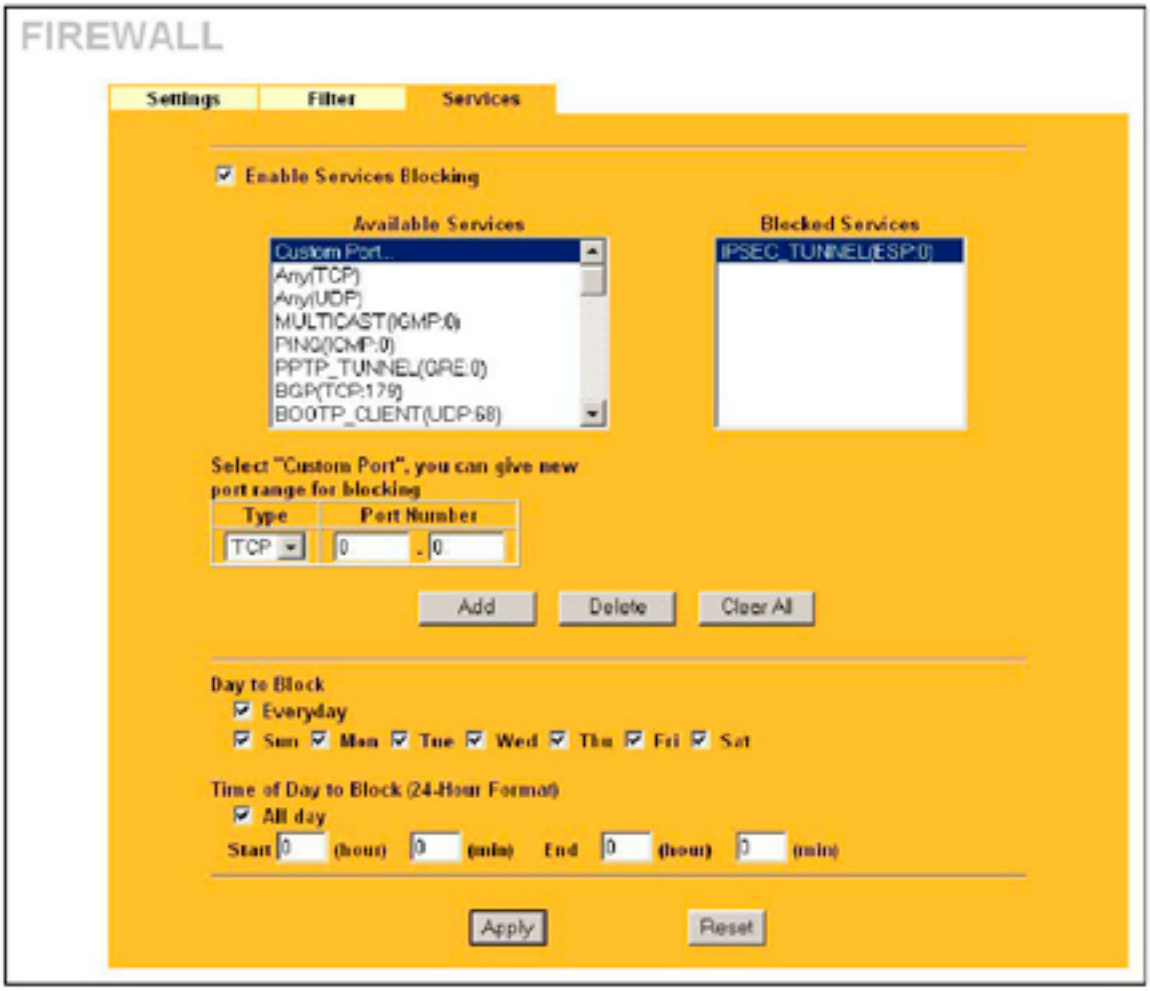
Firewall Filter

LABEL	DESCRIPTION
Restrict Web Features	Select the categories of web features that you want to restrict.
ActiveX	ActiveX is a tool for building dynamic and active Web pages and distributed object applications. When you visit an ActiveX Web site, ActiveX controls are downloaded to your browser, where they remain in case you visit the site again.
Java	Java is a programming language and development environment for building downloadable Web components or Internet and intranet business applications of all kinds.
Cookies	Web servers that track usage and provide service based on ID use cookies.
Web Proxy	This is a server that acts as an intermediary between a user and the Internet to provide security, administrative control, and caching service. When a proxy server is located on the WAN it is possible for LAN users to circumvent content filtering by pointing to this proxy server.
Enable URL Keyword Blocking	Select this check box to block the URL containing the keywords in the keyword list
Keyword	Type a keyword in this field. You may use any character (up to 64 characters). Wildcards are not allowed.
Keyword List	This is a list of keywords that will be inaccessible to computers on your LAN once you enable URL keyword blocking.
Add	Type a keyword in the **Keyword** field and click then **Add** to add a keyword to the **Keyword List.**
Delete	Select a keyword from the **Keyword List** and then click **Delete** to remove this keyword from the list.
Clear All	Click **Clear All** to empty the **Keyword List.**
Day to Block	Select everyday or the day(s) of the week to activate blocking.
Time of Day to Block (24-Hour Format)	Select **All Day** or enter the start and end times in the hour-minute format to activate blocking.
Apply	Click **Apply** to save your customized settings.
Reset	Click **Reset** to reload the previous configuration for this screen.

12.5.2 Configuring Firewall Services

Click **ADVANCED**, **FIREWALL** and then the **Services tab** to open the Services screen. Use this screen to enable service blocking, enter/delete/modify the services you want to block and the date/time you want to block them.

12.5.2 Configuring Firewall Services - Continued



The following table describes the labels in this screen.

Creating/Editing A Firewall Rule

LABEL	DESCRIPTION
Enable Services Blocking	Select the check box to activate service blocking.
Available Services	This is a list of pre-defined services (ports) you may prohibit your LAN computers from using. Select the port you want to block using the drop-down list and click **Add** to add the port to the **Blocked Service** field. Please see *Table 12-4* for more information on services available
Blocked Services	This is a list of services (ports) that will be inaccessible to computers on your LAN once you enable service blocking. Choose the IP port **(TCP, UDP orTCP/UDP)** that defines your customized port from the drop down list box.
Custom Port	A custom port is a service that is not available in the pre-defined **Available Services** list and you must define using the next two fields. For a comprehensive list of port numbers and services, visit the IANA (Internet Assigned Number Authority) web site.

Table continued on next page.

12.5.2 Configuring Firewall Services - Continued

Creating/Editing A Firewall Rule - Continued

LABEL	DESCRIPTION
Type	Services are either **TCP** and/or **UDP.** Select from either **TCP** or **UDP.**
Port Number	Enter the port number range that defines the service. For example, suppose you want to define the Gnutella service. Select TCP type and enter a port range from 6345-6349.
Add	Select a service from the **Available Services** drop-down list and then click **Add** to add a service to the Blocked Service.
Delete	Select a service from the **Blocked Services List** and then click **Delete** to remove this service from the list.
Clear All	Click **Clear All** to empty the **Blocked Service.**
Day to Block	Select everyday or the day(s) of the week to activate blocking.
Time of Day to Block (24-Hour Format)	Select the time of day you want service blocking to take effect. Configure blocking to take effect all day by selecting the **All Day** check box. You can also configure specific times that by entering the start time in the **Start (hr)** and **Start (min)** fields and the end time in the **End** (hr) and **End (min)** fields. Enter times in 24-hour format, for example, “3:00pm” should be entered as “15:00”.
Apply	Click **Apply** to save your customized settings.
Reset	Click **Reset** to reload the previous configuration for this screen.

12.5.3 Predefined Services

The Available Services list box in the Services screen (SEE PAGE XXX) displays all predefined services that the 1500WR Wireless Router already supports. Next to the name of the service, two fields appear in brackets.

The first field indicates the IP protocol type (TCP, UDP, or ICMP). The second field indicates the IP port number that defines the service. (Note that there may be more than one IP protocol type.

For example, look at the default configuration labeled “(DNS)”. (UDP/TCP:53) means UDP port 53 and TCP port 53. Up to 128 entries are supported.

Custom services may also be configured using the Custom Ports function discussed later.

See the next page for a list of predefined services.

12.5.3 Predefined Services - Continued

Predefined Services

SERVICE	DESCRIPTION
BGP(TCP:179)	Border Gateway Protocol.
BOOTP_CLIENT(UDP:68)	DHCP Client.
BOOTP_SERVER(UDP:67)	DHCP Server.
CU-SEEME (TCP/UDP: 7648, 24032)	A popular videoconferencing solution from White Pines Software.
DNS(UDP/TCP:53)	Domain Name Server, a service that matches web names (e.g. www.ParkerVision.com) to IP numbers.
FINGER(TCP:79)	Finger is a UNIX or Internet related command that can be used to find out if a user is logged on.
FTP(TCP:20.21)	File Transfer Program, a program to enable fast transfer of files, including large files that may not be possible by e-mail.
HTTP(TCP:80)	Hyper Text Transfer Protocol - a client/server protocol for the world wide web.
ICQ(UDP:4000)	This is a popular Internet chat program.
IPSEC_TUNNEL(ESP:O)	The IPSEC ESP (Encapsulation Security Protocol) tunneling protocol uses this service.
IRC(TCP/UDP:6667)	This is another popular Internet chat program.
MULTICAST(IGMP:O)	Internet Group Multicast Protocol is used when sending packets to a specific group of hosts.
NEWS(TCP:144)	A protocol for news groups.
NFS(UDP:2049)	Network File System - NFS is a client/server distributed file service that provides transparent file sharing for network environments.
NNTP(TCP:119)	Network News Transport Protocol is the delivery mechanism for the USENET newsgroup service.
PING(ICMP:O)	Packet INternet Groper is a protocol that sends out ICMP echo requests to test whether or not a remote host is reachable.
PPTP(TCP:1723)	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the control channel.
PPTP_TUNNEL(GRE:O)	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the data channel.
RCMD(TCP:512)	Remote Command Service.
REAL_AUDIO(TCP:7070)	A streaming audio service that enables real time sound over the web.
REXEC(TCP:514)	Remote Execution Daemon.
RLOGIN(TCP:513)	Remote Login.
RTELNET(TCP:107)	Remote Telnet.
RTSP(TCP/UDP:554)	The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
SFTP(TCP:115)	Simple File Transfer Protocol.
SMTP(TCP:25)	Simple Mail Transfer Protocol is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another.

12.5.3 Predefined Services - Continued

Predefined Services

SERVICE	DESCRIPTION
SNMP(TCP/UDP:161)	Simple Network Management Program.
SNMP-TRAPS(TCP/UDP:162)	Traps for use with the SNMP (RFC:1215).
SQL-NET(TCP:1521)	Structured Query Language is an interface to access data on many different types of database systems, including mainframes, midrange systems, UNIX systems and network servers.
SSH(TCP/UDP:22)	Secure Shell Remote Login Program.
STRM WORKS(UDP:1558)	Stream Works Protocol.
TELNET(TCP:23)	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems.
TFTP(UDP:69)	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
VDOLIVE(TCP:7000)	Another videoconferencing solution.

Chapter 13

Remote Management

This chapter provides information on the Remote Management screens.

13.1 Remote Management Overview

Remote management allows you to determine which services/protocols can access which 1500WR Wireless Router interface (if any) from which computers. You can customize the service port, access interface and the secured client IP address to enhance security and flexibility.

When you configure remote management to allow management from the WAN, you still need to configure a firewall rule to allow access. See the firewall chapters for details on configuring firewall rules.

You may manage your 1500WR Wireless Router from a remote location via:

- Internet (WAN only)
- LAN only,
- ALL (LAN and WAN)
- Neither (Disable).

When you Choose WAN only or ALL (LAN & WAN), you still need to configure a firewall rule to allow access.

To disable remote management of a service, select Disable in the corresponding Server Access field.

13.1.1 Remote Management Limitations

Remote management over LAN or WAN will not work when:

1. A filter in SMT menu 3.1 (LAN) or in menu 11.5 (WAN) is applied to block a Telnet, FTP or Web service.
2. You have disabled that service in one of the remote management screens.
3. The IP address in the Secured Client IP field does not match the client IP address. If it does not match, the 1500WR Wireless Router will disconnect the session immediately.
4. There is an SMT console session running.
5. There is already another remote management session of the same type (web, FTP or Telnet) running. You may only have one remote management session of the same type running at one time.
6. There is a web remote management session running with a Telnet session. A Telnet session will be disconnected if you begin a web session; it will not begin if there already is a web session.

13.1.2 Remote Management and NAT

When NAT is enabled:

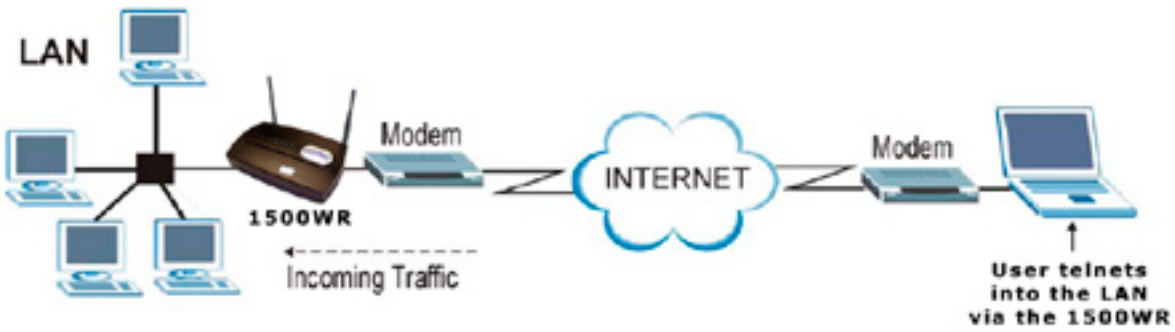
- Use the 1500WR Wireless Router's WAN IP address when configuring from the WAN. y Use the 1500WR Wireless Router's LAN IP address when configuring from the LAN.

13.1.3 System Timeout

There is a system timeout of five minutes (three hundred seconds) for either the console port or telnet/ web/FTP connections. Your 1500WR Wireless Router automatically logs you out if you do nothing in this timeout period, except when it is continuously updating the status in menu 24.1 or when sys stdio has been changed on the command line.

13.2 Telnet

You can telnet into the 1500WR Wireless Router to perform remote management.

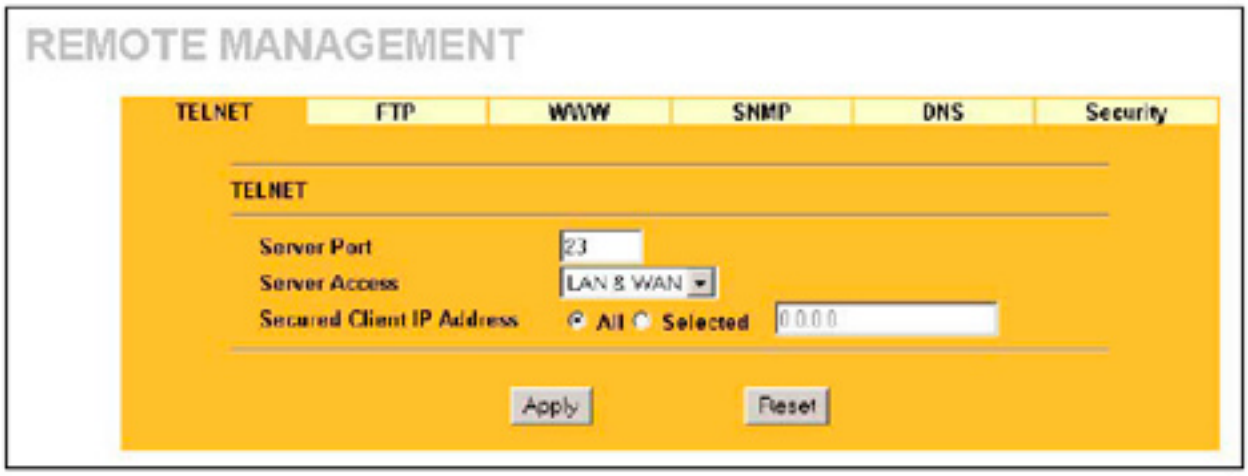


Telnet Configuration on a TCP/IP Network

13.3 Configuring TELNET

Click **ADVANCED** and then **REMOTE MANAGEMENT** to open the **TELNET** screen, shown on the next page.

13.3 Configuring TELNET - Continued



The following table describes the labels in this screen.

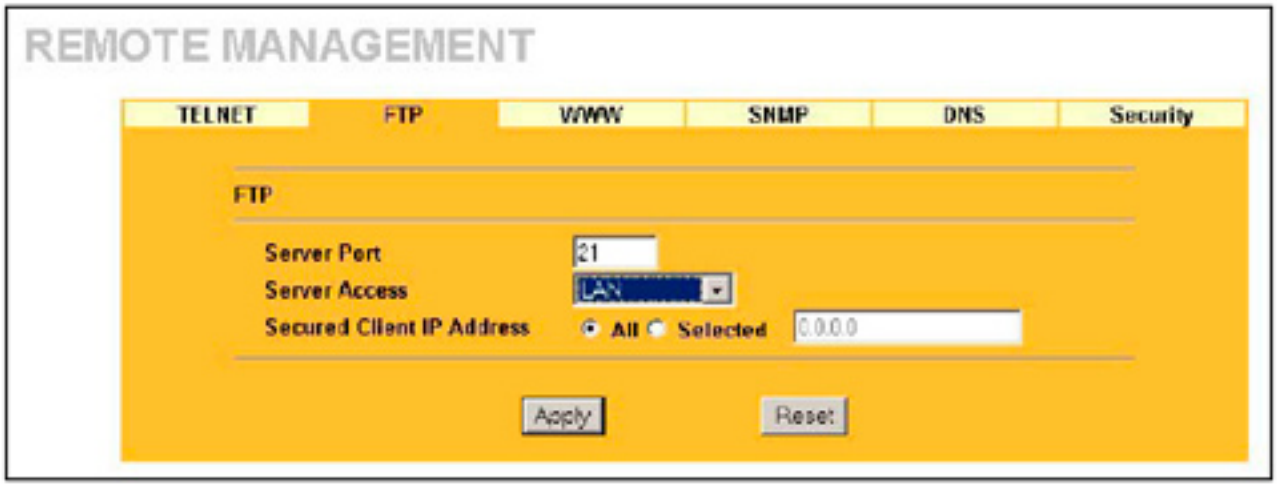
Telnet

LABEL	DESCRIPTION
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Server Access	Select the interface(s) through which a computer may access the 1500WR Wireless Router using this service.
Secured Client IP Address	A secured client is a “trusted” computer that is allowed to communicate with the 1500WR Wireless Router using this service. Select **All** to allow any computer to access the 1500WR Wireless Router using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the 1500WR Wireless Router using this service.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

13.4 Configuring FTP

You can upload and download the 1500WR Wireless Router's firmware and configuration files using FTP, please see the chapter on firmware and configuration file maintenance for details. To use this feature, your computer must have an FTP client.

To change your 1500WR Wireless Router's FTP settings, click **ADVANCED**, **REMOTE MANAGEMENT** and then the **FTP** tab. The screen appears as shown.



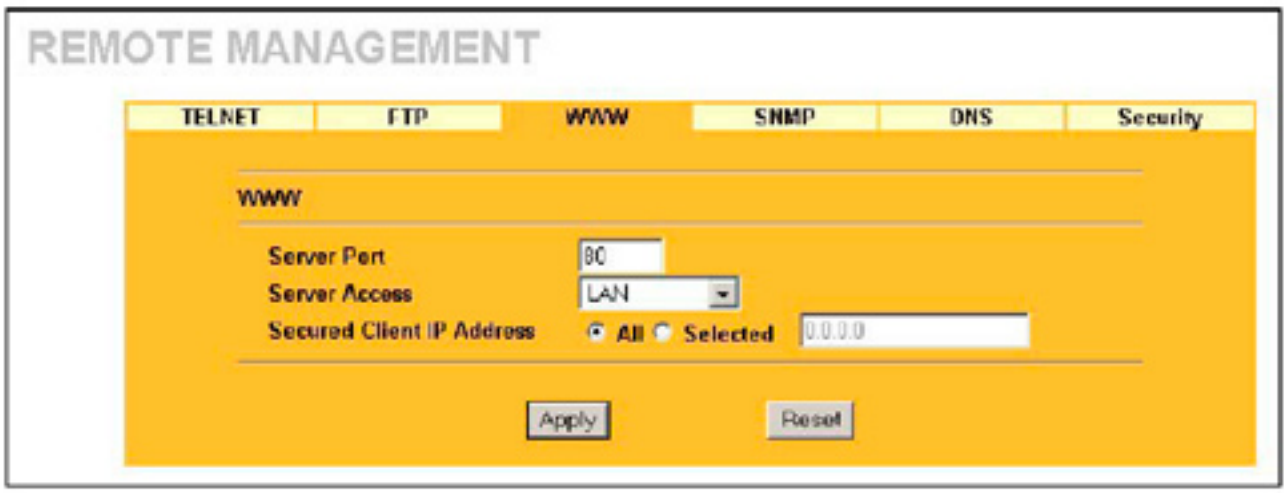
The following table describes the labels in this screen.

FTP

LABEL	DESCRIPTION
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Server Access	Select the interface(s) through which a computer may access the 1500WR Wireless Router using this service.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to communicate with the 1500WR Wireless Router using this service. Select **All** to allow any computer to access the 1500WR Wireless Router using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the 1500WR Wireless Router using this service.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

13.5 Configuring WWW

To change your 1500WR Wireless Router's World Wide Web settings, click **ADVANCED**, **REMOTE MANAGEMENT** and then the **WWW** tab. The screen appears as shown.



The following table describes the labels in this screen.

WWW

LABEL	DESCRIPTION
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Server Access	Select the interface(s) through which a computer may access the 1500WR Wireless Router using this service.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to communicate with the 1500WR Wireless Router using this service. Select **All** to allow any computer to access the 1500WR Wireless Router using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the 1500WR Wireless Router using this service.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

13.6 Configuring SNMP

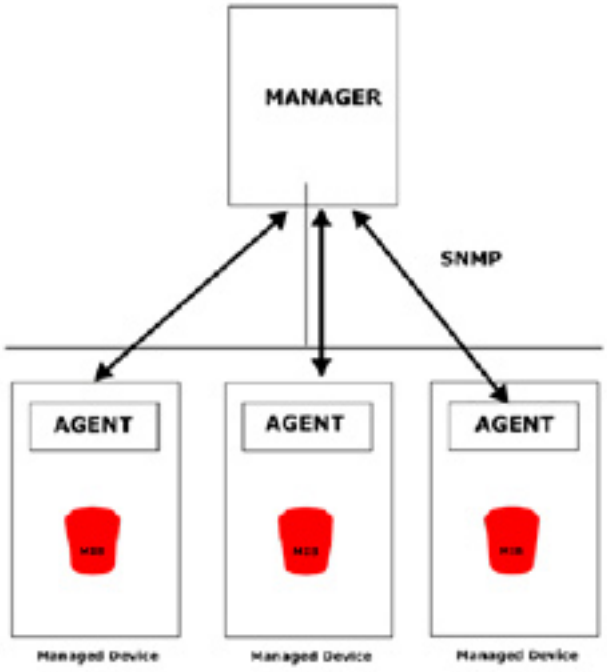
Simple Network Management Protocol is a protocol used for exchanging management information between network devices. SNMP is a member of the TCP/IP protocol suite. Your 1500WR Wireless Router supports SNMP agent functionality, which allows a manager station to manage and monitor the 1500WR Wireless Router through the network. The 1500WR Wireless Router supports SNMP version one (SNMPvl) and version two c (SNMPv2c).

The next figure illustrates an SNMP management operation. SNMP is only available if TCP/IP is configured.

An SNMP managed network consists of two main types of component: agents and a manager.

An agent is a management software module that resides in a managed device (the 1500WR Wireless Router). An agent translates the local management information from the managed device into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a device. Examples of variables include the number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects.



SNMP Management Model

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

- Get - Allows the manager to retrieve an object variable from the agent.
- GetNext - Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPvl, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
- Set - Allows the manager to set values for object variables within an agent.
- Trap - Used by the agent to inform the manager of some events.

13.6.1 Supported MIBs

The 1500WR Wireless Router supports MIB II that is defined in RFC-1213 and RFC-1215. The focus of the MIBs is to let administrators collect statistical data and monitor status and performance.

13.6.2 SNMP Traps

The 1500WR Wireless Router will send traps to the SNMP manager when any one of the following events occurs:

SNMP Traps

TRAP*	TRAP NAME	DESCRIPTION
1	coldStart *(defined in RFC-1215)*	A trap is sent after booting (power on).
2	warmStart *(defined in RFC-1215)*	A trap is sent after booting (software reboot).
3	NnkUp *(defined in RFC-1215)*	A trap is sent when the port is up.
4	authenticationFailure *(defined in RFC-1215)*	A trap is sent to the manager when receiving any SNMP get or set requirements with wrong community (password).
6	NnkDown *(defined in RFC-1215)*	A trap is sent when the port is down.

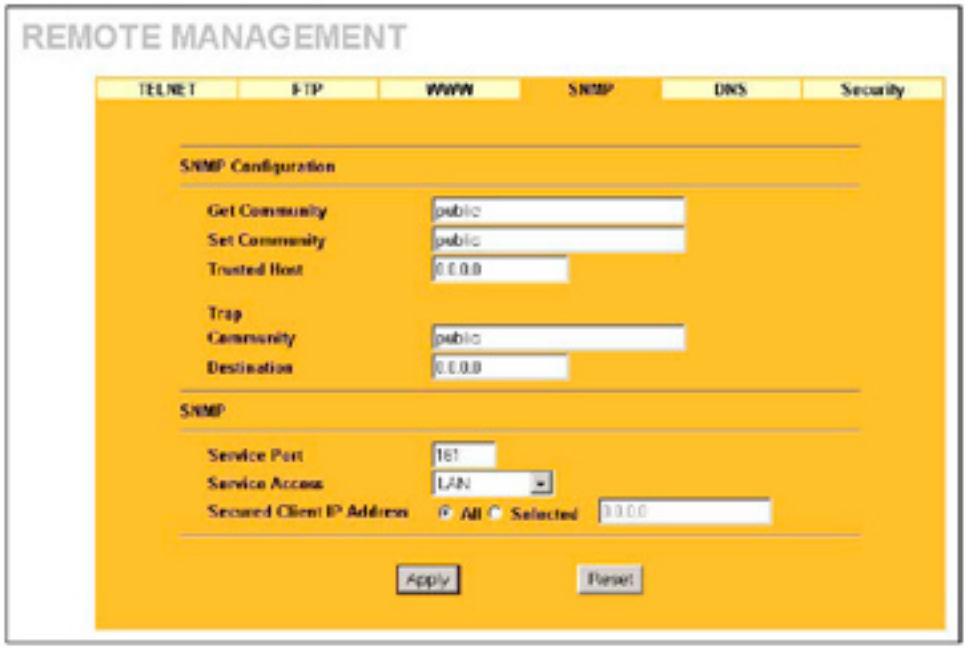
The following table maps the physical port and encapsulation to the interface type.

Ports and Interface Types

PHYSICAL PORT/ENCAP	INTERFACE TYPE
LAN port(s)	enetO
Wireless port	eneti
PPPoE encap	pppoe
1483 encap	mpoa
Ethernet encap	enet-encap
PPPoA	PPP

13.6.3 REMOTE MANAGEMENT: SNMP

To change your 1500WR Wireless Router's SNMP settings, click **ADVANCED**, **REMOTE MANAGEMENT** and then the **SNMP tab**. The screen appears as shown.



The following table describes the labels in this screen.

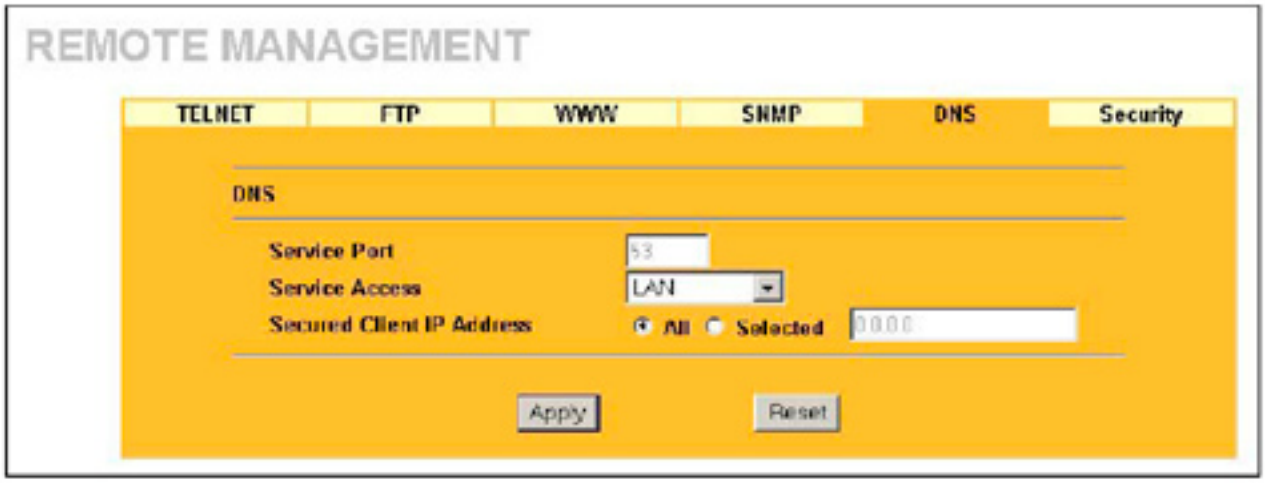
SNMP

LABEL	DESCRIPTION			
SNMP Configuration				
Get Community	Enter the **Get Community,** which is the password for the requests from the management station. incoming Get and GetNext			
Set Community	Enter the **Set community,** which is the password for incoming Set requests from the management station.			
Trusted Host	If you enter a trusted host, your 1500WR Wireless Router will only respond to SNMP messages from this address. A blank (default) field means your 1500WR Wireless Router will respond to all SNMP messages it receives, regardless of source.			
Trap				
Community	Type the trap community, which is the password sent with each trap to the SNMP manager.			
Destination	Type the IP address of the station to send your SNMP traps to.			
SNMP				
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.			
Server Access	Select the interface(s) through which a computer may access the 1500WR Wireless Router using this service.			

13.7 Configuring DNS

Use DNS (Domain Name System) to map a domain name to its corresponding IP address and vice versa, for example, the IP address ofwww.ParkerVision.com is 204.217.0.2. Refer to the Internet Access chapter for more information.

To change your 1500WR Wireless Router's DNS settings, click **ADVANCED**, **REMOTE MANAGEMENT** and then the **DNS tab**. The screen appears as shown.



The following table describes the labels in this screen.

DNS

LABEL	DESCRIPTION
Server Port	The DNS service port number is 53 and cannot be changed here.
Server Access	Select the interface(s) through which a computer may send DNS queries to the 1500WR Wireless Router.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to send DNS queries to the 1500WR Wireless Router. Select **All** to allow any computer to send DNS queries to the 1500WR Wireless Router. Choose **Selected** to just allow the computer with the IP address that you specify to send DNS queries to the 1500WR Wireless Router.
Apply	Click **Apply** to save your changes back to the 1500WR Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.