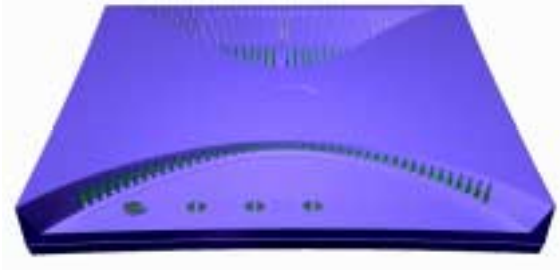
NETOPIA™ 4752
SDSL INTEGRATED ACCESS DEVICE

Administration Guide



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Part Number

For additional copies of this electronic manual, order Netopia part number 6161089-00-01.

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Part I: Getting Started

Chapter 1

Introduction

Overview

The Netopia 4752 Voice/Data Integrated Access Devices (IADs) make it possible for small businesses to take advantage of the advanced communications technologies previously limited to larger organizations. By integrating multiple voice connections and high-speed Internet access on one DSL line, businesses can squeeze the most out of their communications budget.

The Netopia 4752 SDSL Integrated Access Device combines a complete telephone system with a business-class data router to deliver a customized package of business communications services over DSL. The Netopia 4752 supports the broad array of phone features offered through your service provider and uses your existing analog telephone equipment. The Netopia 4752 includes Netopia's sophisticated data routing engine optimized for small and medium size business needs. These business-class features include IP routing, firewall, NAT, MultiNAT, DHCP and both PPTP and IPSec VPN functionality.

This section covers the following topics:

Features and Capabilities

Office telephone systems are commonly one of two types, PBX (Private Branch Exchange) or Centrex (Central Office Exchange). Technically, Centrex is a subset of PBX.

PBX users share a certain number of outside lines for making telephone calls external to the PBX. Most medium-sized and larger companies use a PBX because it's much less expensive than connecting an external telephone line to every telephone in the organization. In addition, it's easier to call someone within a PBX because the number you need to dial is typically just 3 or 4 digits.

Centrex is a newer variation on the PBX. It is a PBX with all switching occurring at a local telephone office instead of at the company's premises. Typically, the telephone company owns and manages all the communications equipment necessary to implement the PBX and then sells various services to the company.

Small- to medium-sized businesses need two kinds of services: Internet presence and voice telephony. But they don't need the additional burden of maintaining switching equipment or administering IP and voice services for their offices. An Integrated Access Device (IAD) that offers high-speed Symmetric (same speed upload and download) DSL for IP connectivity and a PBX that somebody else (the phone company) administers is the simple solution.

At the phone company's central office, where all the big switch gear is, there are two kinds of switches for the two kinds of services, voice and data. The voice switch is called a Voice Gateway and the data switch is called a Digital Subscriber Line Access Multiplexer (DSLAM) or access concentrator. Both the voice and data signals are concentrated at the DSLAM and forwarded either to a data router or to the Voice Gateway. Both kinds of switches are manufactured by a variety of companies. The IAD must be capable of communicating with a wide array of possible combinations of Voice Gateways and DSLAMs.

An IAD combines the voice telephony features of a telephone PBX system with the data routing features of an IP data router. The device uses a single outside line connection to carry all voice and data transmissions. If the device uses a DSL interface, it can carry all of these services over a single existing copper telephone line by using the different frequency ranges available on the copper wire for voice and data traffic.

The Netopia 4752 SDSL Integrated Access Device is that device: a Centrex-based PBX system combined with an SDSL internet router.

The Netopia 4752 SDSL Integrated Access Device provides the following features:

Support for ordinary analog phone equipment. Works with the same FXS analog phone sets and key systems that small businesses use today. No expensive handsets to order, no new interface to learn.

Centrex support. Advanced telephone features enabled by your service provider's telephone switch such as call forwarding or conferencing operate exactly as they did before.

Netopia data routing engine. Provides the same advanced, business-class data routing features used by leading DSL service providers around the world. Includes advanced data functionality such as firewall, VPN client and server (including PPTP and IPSec), DHCP automated address assignment, and Network Address Translation (NAT and MultiNAT).

Physical features include:

- SDSL WAN Interface interoperable with major ATM- and Frame Relay-based DSL equipment.
- A 10/100 Ethernet LAN Port.
- Eight analog telephone ports (local extensions).
- One DB-9 serial console port.
- Front panel status lights.
- Setup and configuration management via console menu.

How to Use This Guide

This guide is designed to be your source for information about your Netopia 4752 SDSL Integrated Access Device. It is intended to be viewed on-line, using the powerful features of the Adobe Acrobat Reader. The information display has been deliberately designed to present the maximum information in the minimum space on your screen. You can keep this document open while you perform any of the procedures described, and find useful information about the procedure you are performing.

If you prefer to work from hard copy rather than on-line documentation, you can also print out all of the manual, or individual sections. The pages are formatted to print on 8 1/2 by 11 inch paper. We recommend that you print on three-hole punched paper, so you can put the pages in a binder for future reference. For your convenience, a printed copy can be purchased from Netopia. Order part number TEP708/Doc.

This guide is organized into chapters describing the Netopia 4752's advanced features. You may want to read each chapter's introductory section to familiarize yourself with the various features available.

Use the guide's table of contents and index to locate informational topics.

Chapter 2

Setting Up Internet Services

This chapter describes how to obtain and set up Internet services.

This section covers the following topics:

Note: Some companies act as their own ISP. For example, some organizations have branch offices that can use the Netopia 4752 to access the Internet via the main office in a point-to-point scenario. If you install the Netopia 4752 in this type of environment, refer to the following sections for specific information you must receive from the network administrator to configure the Netopia 4752 properly.

Finding an Internet Service Provider

The Netopia 4752 SDSL Integrated Access Device provides its high speed symmetric (two-way) digital connection to the Internet through a Local Exchange Carrier (LEC) – a type of mini phone company. The CLEC uses a compatible type of switching equipment known as a Digital Subscriber Line Access Multiplexer (DSLAM). The DSLAM that you connect to with your Netopia Router must be capable of handling these symmetric connections. The Netopia 4752 is certified for use with DSLAMs manufactured by Nokia , Lucent, Paradyne, Nortel networks, and Copper Mountain.

If you have purchased your Netopia Router through a Netopia ISP partner, you can be sure that an account that supports SDSL connections will be available.

If your area has more than one ISP, the following considerations will help you decide which ISP is best suited for your requirements.

In determining which Internet service provider (ISP) to establish your account with, make sure that your ISP supports connections via a CLEC that also supports voice services.

Use an ISP that provides Internet access through a Symmetric Digital Subscriber Line (SDSL) and that supports the Netopia 4752 SDSL Integrated Access Device. If you would like to use an ISP that you already have a relationship with but that is not familiar with the Netopia 4752, call us at 1-800-NETOPIA. Our representative can call your ISP and introduce them to the product. If necessary, we will provide them with the technical background they need to support the product.

Unique requirements

Make sure the ISP can meet any unique requirements you may have, such as:

- Dynamic or static IP addressing
- Class C IP address

- Custom domain name
- Multiple e-mail addresses
- Web site hosting

Pricing and support

Compare pricing, service, and technical support service among various ISPs.

Endorsements

Consider recommendations from colleagues and reviews in publications. Netopia lists Netopia Certified ISPs on our Web site at **http://www.netopia.com**.

Deciding on an ISP Account

Your ISP may offer various Internet access account plans. Typically, these plans vary by usage charges and the number of host IP addresses supplied. Evaluate your networking needs and discuss them with your ISP before deciding on a plan for your network.

Setting up a Netopia 4752 account

Check whether your ISP has the Netopia 4752 on its list of supported products that have been tested with a particular configuration. If the ISP does not have the Netopia 4752 on such a list, describe the Netopia 4752 in as much detail as needed, so your ISP account can be optimized. As appropriate, refer your ISP to Netopia's Web site www.netopia.com for more information.

Obtaining an IP address

Typically, each network computer that requires Internet access requires its own unique IP address. If some or all network computers require simultaneous Internet access, obtain a block of IP host addresses large enough for each computer to have its own address, plus one for the Netopia 4752.

Consider expected growth in your network when deciding on the number of addresses to obtain. Alternatively, you can use the Network Address Translation feature of SmartIP.

SmartIP

The Netopia 4752 SDSL Integrated Access Device supports Multiple Network Address Translation (MultiNAT).

Network Address Translation provides Internet access to the network connected to the Netopia 4752 using only a single IP address. These routers translate between the internal or local area network (LAN) addresses and a single external IP address, and route accordingly. MultiNAT is a means of mapping one or more IP addresses and/or IP service ports into different values. This *mapping* serves two functions:

- It allows the addresses of many computers on a LAN to be represented to the public Internet by only one or a few addresses, saving you money.
- It can be used as a security feature by obscuring the true addresses of important machines from potential hackers on the Internet.

For more information on Network Address Translation, see Chapter 11, "Multiple Network Address Translation."

Obtaining Information from the ISP

After your account is set up, the ISP should send you the IP parameter information that will help you configure the Netopia 4752.

Local LAN IP address information to obtain

Your ISP will need to provide you with the following information:

- The default gateway IP address (same as remote IP address in most cases)
- Local WAN IP address and subnet mask
- Primary and secondary domain name server (DNS) IP addresses
- Domain name (usually the same as the ISP's domain name unless you have registered for your own individual domain name)

Note: The default gateway, WAN address and mask, DNS, and domain name are all obtainable via WAN DHCP, if your ISP supports it.

With Network Address Translation

If you are using MultiNAT, you should obtain the following:

- If you are connecting to a remote site using Network Address Translation on your router, your provider will not define the IP address information on your local LAN. You can define this information based on an IP configuration that may already be in place for the existing network. Alternatively, you can use the default IP address range used by the router.

Without Network Address Translation

If you are not using Network Address Translation, you will need to obtain all of the local LAN IP address information from your ISP.

If you are not using SmartIP (NAT), you should obtain:

- The number of Ethernet IP host addresses available with your account and the first usable IP host address in the address block
- The Ethernet IP address for your Netopia 4752
- The Ethernet IP subnet mask address for your Netopia 4752

Chapter 3

Making the Physical Connections

This section tells you how to make the physical connections to your Netopia 4752 SDSL Integrated Access Device. This section covers the following topics:

Find a Location

Note: Before connecting your Netopia 4752, be sure to read the important safety information contained in Appendix F, "Technical Specifications and Safety Information."

When choosing a location for the Netopia Router, consider:

- Available space and ease of installation
- Physical layout of the building and how to best use the physical space available for connecting your Netopia Router to the LAN
- Available wiring and jacks
- Distance from the point of installation to the next device (length of cable or wall wiring)
- Ease of access to the front of the unit for configuration and monitoring
- Ease of access to the back of the unit for checking and changing cables
- Cable length and network size limitations when expanding networks

For small networks, install the Netopia 4752 near one of the LANs. For large networks, you can install the Netopia 4752 in a wiring closet or a central network administration site.

What You Need

Locate all items that you need for the installation.

Included in your package are:

- The Netopia 4752 SDSL Integrated Access Device
- A power adapter and cord with a mini-DIN8 connector
- One 6 ft. RJ45 10/100 Ethernet cable
- One 6 ft. RJ45 SDSL WAN (or Line) cable
- A DB-9 to DB-9 console cable
- Printed Installation guide
- The Netopia CD containing Adobe Acrobat Reader for Windows and Macintosh, ZTerm terminal emulator software (for Classic MacOS and MacOSX) and NCSA Telnet for Macintosh, and documentation

You will need:

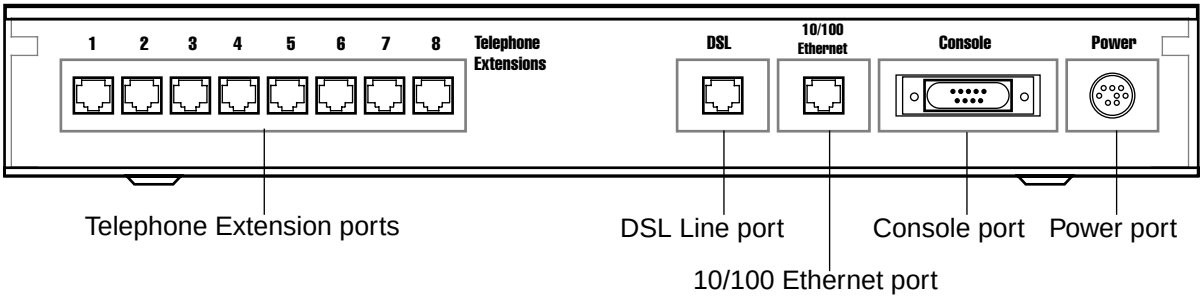
- A Windows 95 or 98–based PC or a Macintosh computer with Ethernet connectivity for configuring the Netopia 4752. This may be built-in Ethernet or an add-on card, with TCP/IP installed and configured. See "Sharing the Connection" on page 4-1.
- An SDSL wall outlet wired for a connection to a Local Exchange Carrier (LEC) who supports Symmetric Digital Subscriber Line connections.

Identify the Connectors and Attach the Cables

Identify the connectors on the back panel and attach the necessary Netopia cables.

The figure below displays the back of the Netopia 4752 SDSL Integrated Access Device.

Netopia 4752 back panel



The following table describes all the Netopia 4752 SDSL Integrated Access Device back panel ports.

Port	Description
Telephone extension ports	Eight RJ-11 telephone jacks for connecting your phone extensions.
DSL port	An RJ-45 10Base-T-style jack labeled DSL for your DSL connection.
Ethernet port	An RJ-45 10/100Base-T Ethernet jack. You will use this to configure the Netopia 4752. For a new installation, use the Ethernet connection. Alternatively, you can use the console connection to run console-based management using a direct serial connection. You can either connect your computer directly the Ethernet port using a crossover cable, or connect both your computer and the Netopia 4752 to an existing Ethernet hub on your LAN.
Console port	A DB-9 console port for a direct serial connection to the console screens. You can use this if you are an experienced user. See “Connecting a Console Cable to Your Device” on page 6-3.
Power port	A mini-DIN8 power adapter cable connection.

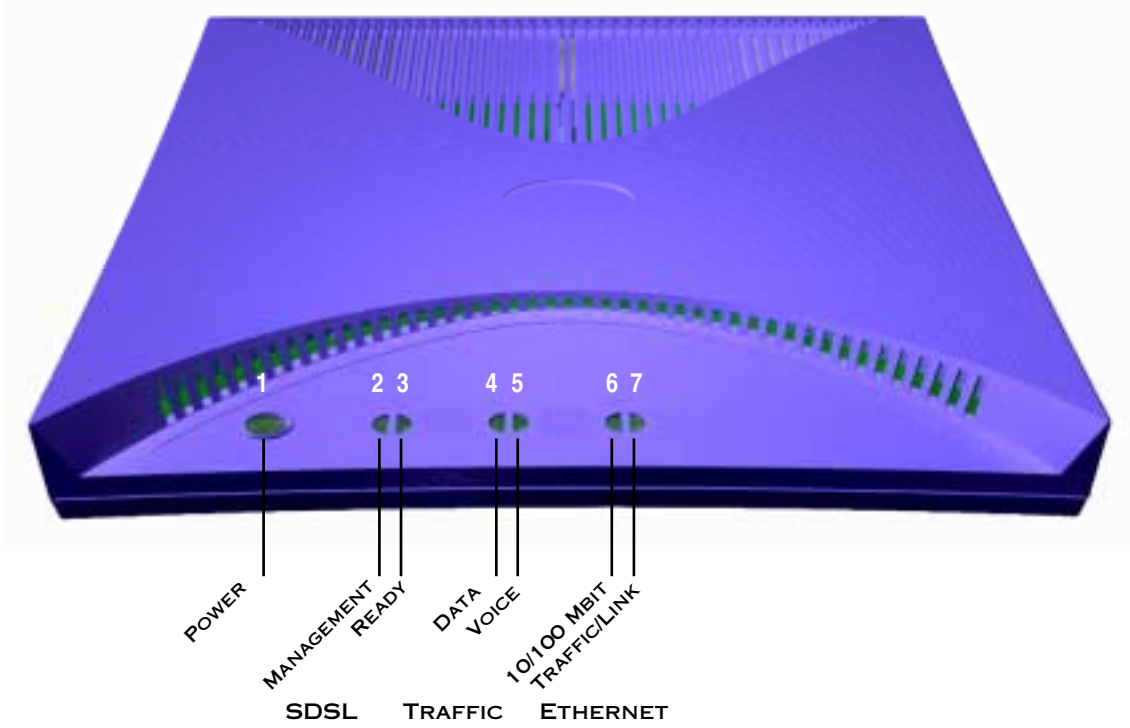
1. Connect the mini-DIN8 connector from the power adapter to the power port, and plug the other end into an electrical outlet.
2. Connect one end of the RJ-45 cable to the DSL port, and the other end to your DSL wall outlet.
3. Connect the Ethernet cable to the Ethernet port on the unit and the other end to your Ethernet hub.

   You should now have: the power adapter plugged in; the Ethernet cable connected between the router and your Ethernet hub; and the DSL cable connected between the router and the DSL wall outlet.

Netopia 4752 Status Lights

The figure below represents the Netopia 4752 status light (LED) panel.

Netopia 4752 LED front panel



The following table summarizes the meaning of the various LED states and colors:

When this happens...	the LEDs...
The power is off (button is not pressed in)	1 is **dark**.
The power is on (button pressed in)	1 is **green**.
The power-on self-test fails	1 is **red**.
The WAN interface is training	3 flashes **red**; then flashes **green**.
The WAN interface is operational	3 is **green**.
Data is transmitted or received	4 flashes **yellow**.
No traffic is being transmitted or received	4 is **dark**.
Voice is operational	5 is **green**.
Voice traffic is transmitted or received	5 is **yellow**.
The Ethernet interface is connected at 10Base-T speed	6 is **dark**.
The Ethernet interface is connected at 100Base-T speed	6 is **green**.
The Ethernet hub has no link	7 is **dark**.
The Ethernet hub has link	7 is **green**.

Chapter 4

Sharing the Connection

Once you have set up your physical local area network, you will need to configure the TCP/IP stack on each client workstation connected to your Netopia 4752. This chapter describes how to configure TCP/IP for both Windows-based and Macintosh computers.

This chapter explains the following topics:

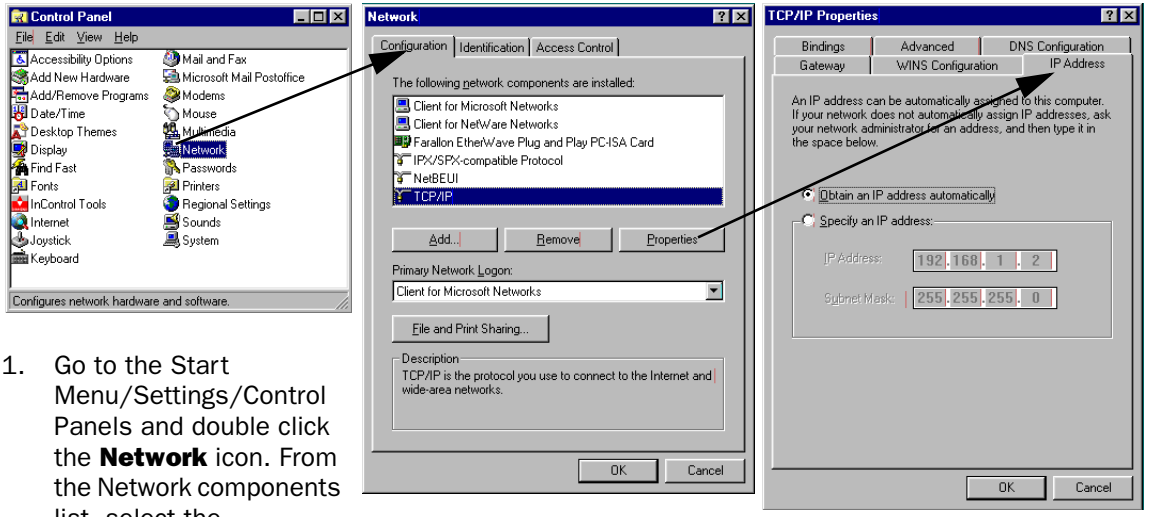
Configuring TCP/IP on Windows-based Computers

Configuring TCP/IP on a Windows computer requires the following:

- An Ethernet card (also known as a network adapter)
- The TCP/IP protocol must be “bound” to the adapter or card

Dynamic configuration (recommended)

To configure your PC for dynamic addressing do the following:



1. Go to the Start Menu/Settings/Control Panels and double click the **Network** icon. From the Network components list, select the **Configuration** tab.
2. Select **TCP/IP–>Your Network Card**. Then select **Properties**. In the TCP/IP Properties screen, select the **IP Address** tab. Click “**Obtain an IP Address automatically**”.
3. Click on the **DNS Configuration** tab. Click **Disable DNS**. DNS will be assigned by the router with DHCP.
4. Click **OK** in this window and the next window. When prompted, reboot the computer.

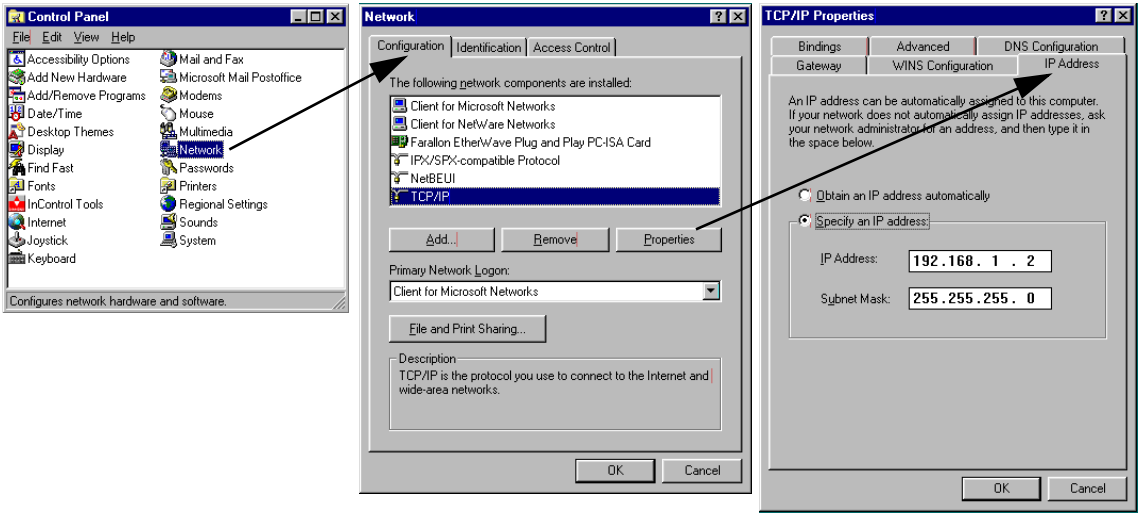
Note: You can also use these instructions to configure other computers on your network to accept IP addresses served by the Netopia 4752.

Static configuration (optional)

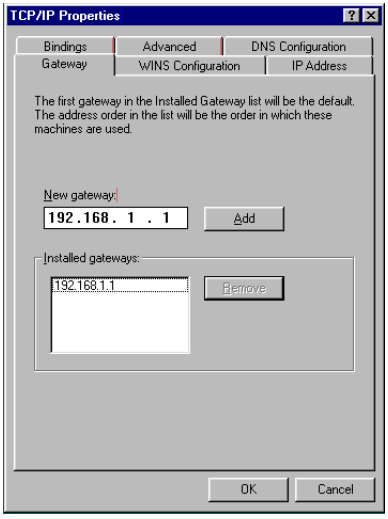
If you are manually configuring for a fixed or static IP address, perform the following:

1. Go to Start Menu/Settings/Control Panels and double click the **Network** icon. From the Network components list, select the **Configuration** tab.
2. Select **TCP/IP–>Your Network Card**. Then select **Properties**. In the TCP/IP Properties screen, select the **IP Address** tab. Click "**Specify an IP Address**."

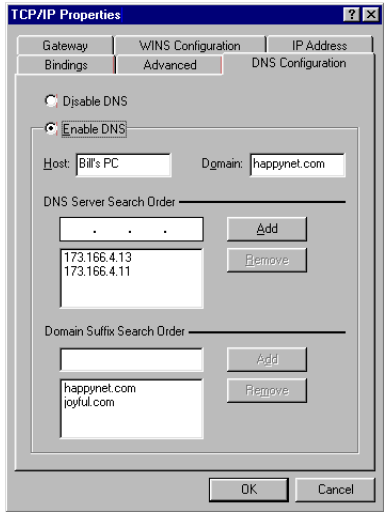
   Enter the following:
   IP Address: 192.168.1.2
   Subnet Mask: 255.255.255.0, or for 12-user models 255.255.255.240
   This address is an example of one that can be used to configure the router. Your ISP or network administrator may ask you to use a different IP address and subnet mask.



3. Click on the **Gateway** tab (shown below). Under "New gateway," enter **192.168.1.1**. Click **Add**. This is the Netopia 4752's pre-assigned IP address.



Click on the **DNS Configuration** tab. Click **Enable DNS**. Enter the following information:



Host: Type the name you want to give to this computer.

Domain: Type your domain name. If you don't have a domain name, type your ISP's domain name; for example, netopia.com.

DNS Server Search Order: Type the primary DNS IP address given to you by your ISP. Click **Add**. Repeat this process for the secondary DNS.

Domain Suffix Search Order: Enter the same domain name you entered above.

4. Click **OK** in this window and the next window. When prompted, reboot the computer.

Note: You can also use these instructions to configure other computers on your network with manual or static IP addresses. Be sure each computer on your network has its own IP address.

Configuring TCP/IP on Macintosh Computers

The following is a quick guide to configuring TCP/IP for MacOS computers. Configuring TCP/IP in a Macintosh computer requires the following:

- You must have either Open Transport or Classic Networking (MacTCP) installed.

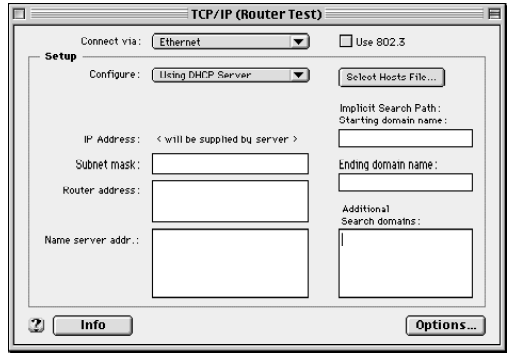
  Note: If you want to use the Dynamic Host Configuration Protocol (DHCP) server built into your Netopia 4752 to assign IP addresses to your Macintoshes, you must be running Open Transport, standard in MacOS 8 and optional in earlier system versions. You can have your Netopia 4752 dynamically assign IP addresses using MacTCP; however, to do so requires that the optional AppleTalk kit be installed which can only be done after the router is configured.

- You must have built-in Ethernet or a third-party Ethernet card and its associated drivers installed in your Macintosh.

Dynamic configuration (recommended)

The Dynamic Host Configuration Protocol (DHCP), which enables dynamic addressing, is enabled by default in the router. To configure your Macintosh computer for dynamic addressing do the following:

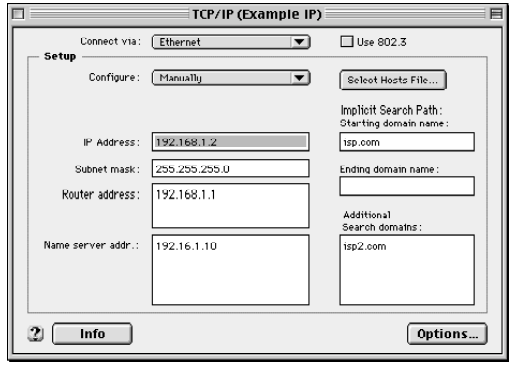
1. Go to the Apple menu. Select **Control Panels** and then **TCP/IP**.
2. With the TCP/IP window open, go to the Edit menu and select **User Mode**. Choose **Basic** and click **OK**.
3. In the TCP/IP window, select "**Connect via: Ethernet**" and "**Configure: Using DHCP Server**."



Note: You can also use these instructions to configure other computers on your network to accept IP addresses served by the Netopia 4752.

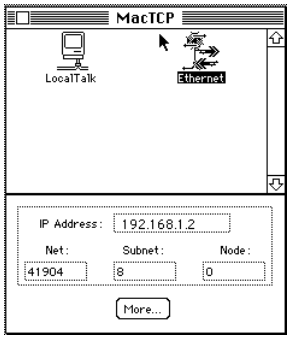
Static configuration (optional)

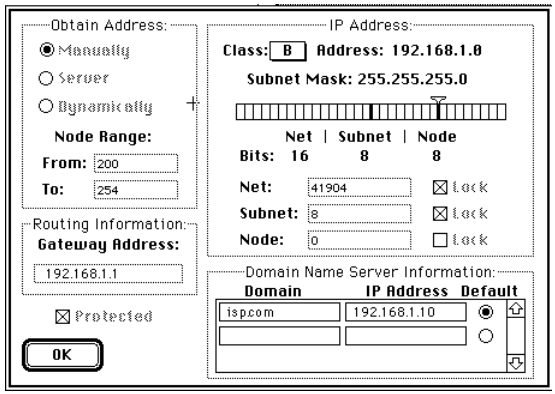
If you are manually configuring for a fixed or static IP address, perform the following:



1. Go to the Apple menu. Select **Control Panels** and then **TCP/IP** or **MacTCP**.
2. With the TCP/IP window open, go to the Edit menu and select **User Mode**. Choose **Advanced** and click **OK**.

   Or, in the MacTCP window, select **Ethernet** and click the **More** button.





3. In the TCP/IP window or in the MacTCP/More window, select or type information into the fields as shown in the following table.

Option:	Select/Type:
Connect via:	Ethernet
Configure:	Manually
IP Address:	192.168.1.2
Subnet mask:	255.255.255.0, or for 12-user models 255.255.255.240
Router or Gateway address:	192.168.1.1
Name server address:	Enter the primary and secondary name server addresses given to you by your ISP
Implicit Search Path: Starting domain name:	Enter your domain name; if you do not have a domain name, enter the domain name of your ISP

4. Close the TCP/IP or MacTCP control panel and save the settings.
5. If you are using MacTCP, you must restart the computer. If you are using Open Transport, you do not need to restart.

Note: You can also use these instructions to configure other computers on your network with manual or static IP addresses. Be sure each computer on your network has its own IP address.

More information about configuring your Macintosh computer for TCP/IP connectivity through a Netopia 4752 can be found in Technote NIR_026, “Open Transport and Netopia Routers,” located on the Netopia Web site.

Chapter 5

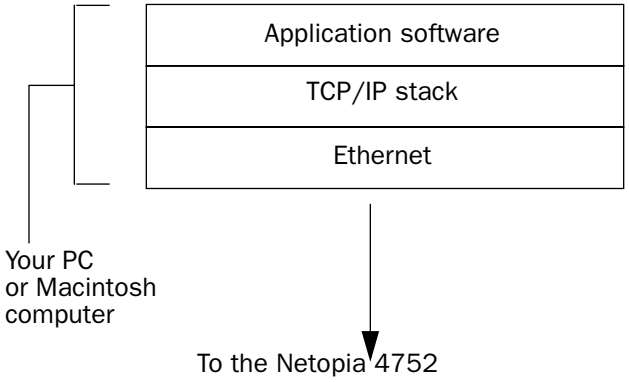
Connecting to Your Local Network

This chapter describes how to physically connect the Netopia 4752 to your local area network (LAN). Before you proceed, make sure the Netopia 4752 is properly configured. You can customize the device's configuration for your particular LAN requirements using console-based management (see "Console-Based Management" on page 6-1).

This section covers the following topics:

Readying Computers on Your Local Network

PC and Macintosh computers must have certain components installed before they can communicate through the Netopia 4752. The following illustration shows the minimal requirements for a typical PC or Macintosh computer.



Application software: This is the software you use to send e-mail, browse the World Wide Web, read newsgroups, etc. These applications may require some configuration. Examples include the Eudora e-mail client and the Web browsers Microsoft Internet Explorer and Netscape Navigator.

TCP/IP stack: This is the software that lets your PC or Macintosh computer communicate using Internet protocols. TCP/IP stacks must be configured with some of the same information you used to configure the Netopia 4752. There are a number of TCP/IP stacks available for PC computers. Windows 95 includes a built-in TCP/IP stack. See "Configuring TCP/IP on Windows-based Computers" on page 4-2. Macintosh computers use either MacTCP or Open Transport. See "Configuring TCP/IP on Macintosh Computers" on page 4-5.

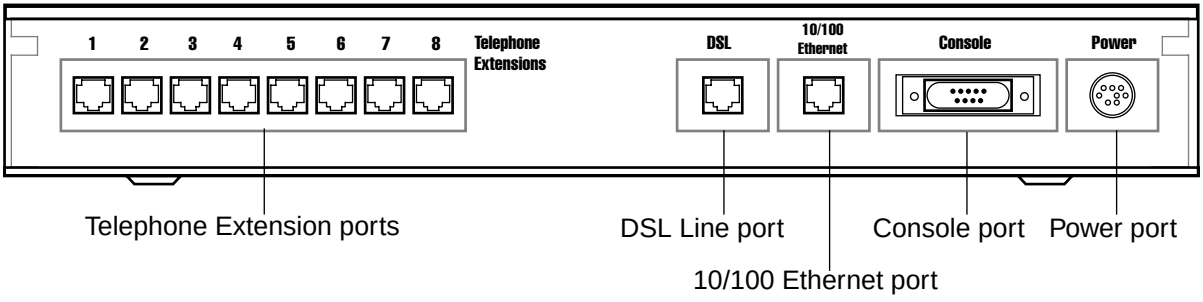
Ethernet: Ethernet hardware and software drivers enable your PC or Macintosh computer to communicate on the LAN.

Once the Netopia 4752 is properly configured and connected to your LAN, PC and Macintosh computers that have their required components in place will be able to connect to the Internet or other remote IP networks.

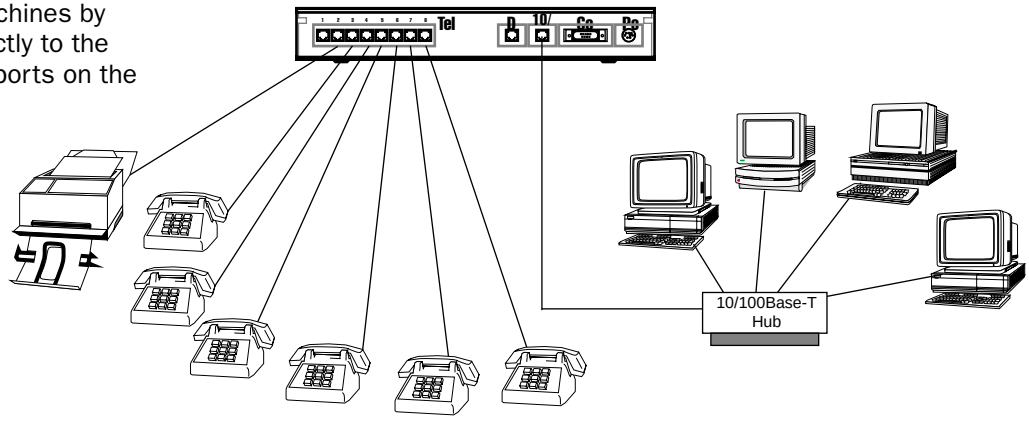
Connecting to an IP and Telephone Network

The Netopia 4752 supports Ethernet connections through its Ethernet port. You can connect a standard 10 or 100Base-T Ethernet network to the Netopia 4752 using its Ethernet port.

Netopia 4752 back panel



Add computers by connecting them to an Ethernet hub and connecting the hub to the Ethernet port on the Netopia 4752. Add telephones or fax machines by connecting them directly to the telephone extension ports on the Netopia 4752.



Note: The Ringer Equivalence Number (REN) is used to determine how many devices can be connected to your telephone line. In most areas, the sum of the REN's of all devices on any one line should not exceed two (2.0). If too many devices are attached, they many not ring properly. The REN for telephone devices is usually listed on the product label or stamped or moulded into the body of the device.

Chapter 6

Console-Based Management

Console-based management is a menu-driven interface for the capabilities built into the Netopia 4752. Console-based management provides access to a wide variety of features that the router supports. You can customize these features for your individual setup. This chapter describes how to access the console-based management screens.

This section covers the following topics:

Console-based management screens contain eight entry points to the Netopia 4752 configuration and monitoring features. The entry points are displayed in the Main Menu shown below:

```
                        Netopia 4752 v5.1

                    Easy Setup...
                    WAN Configuration...
                    System Configuration...
                    Voice Configuration...
                    Utilities & Diagnostics...
                    Statistics & Logs...
                    Quick Menus...
                    Quick View...


Return/Enter goes to Easy Setup -- minimal configuration.
You always start from this main screen.
```

- The **Easy Setup** menus display and permit changing the values contained in the default connection profile. You can use Easy Setup to initially configure the router directly through a console session.

  Easy Setup menus contain up to five descendant screens for viewing or altering these values. The number of screens depends on whether you have optional features installed.

- The **WAN Configuration** menu displays and permits changing your connection profile(s) and default profile, creating or deleting additional connection profiles, and configuring or reconfiguring the manner in which you

may be using the router to connect to more than one service provider or remote site.

- The **System Configuration** menus display and permit changing:
  - Internet protocol setup. See "IP Setup" on page 10-1.
  - Filter sets (firewalls). See "Security" on page 13-1.
  - IP address serving. See "IP Address Serving" on page 10-10.
  - Date and time. See "Date and time" on page 9-19.
  - Console configuration. See "Connecting a Console Cable to Your Device" on page 6-3.
  - SNMP (Simple Network Management Protocol). See "SNMP" on page 14-13.
  - Security. See "Security" on page 13-1.
  - Upgrade feature set. See "Upgrade feature set" on page 9-21.
- The **Voice Configuration** menus provide the tools for configuring the voice telephone features available in the Netopia 4752. See Chapter 8, "Voice Configuration."
- The **Utilities & Diagnostics** menus provide a selection of seven tools for monitoring and diagnosing the router's behavior, as well as for updating the firmware and rebooting the system. See "Utilities and Diagnostics" on page 15-1 for detailed information.
- The **Statistics & Logs** menus display nine sets of tables and device logs that show information about your router, your network, and their history. See "Statistics & Logs" on page 14-4 for detailed information.
- The **Quick Menus** screen is a shortcut entry point to 22 of the most commonly used configuration menus that are accessed through the other menu entry points.
- The **Quick View** menu displays at a glance current real-time operating information about your router. See "Quick View Status Overview" on page 14-1 for detailed information.

Connecting through a Telnet Session

Features of the Netopia 4752 can be configured through the console screens.

Before you can access the console screens through Telnet, you must have:

- A network connection locally to the router or IP access to the router.

  Note: Alternatively, you can have a direct serial console cable connection using the provided console cable for your platform (PC or Macintosh) and the Console port on the back of the router. For more information on attaching the console cable, see "Connecting a Console Cable to Your Device" on page 6-3.
- Telnet software installed on the computer you will use to configure the router

Configuring Telnet software

If you are configuring your router using a Telnet session, your computer must be running a Telnet software program.

- If you connect a PC with Microsoft Windows, you can use a Windows Telnet application or simply run Telnet

from the Start menu.

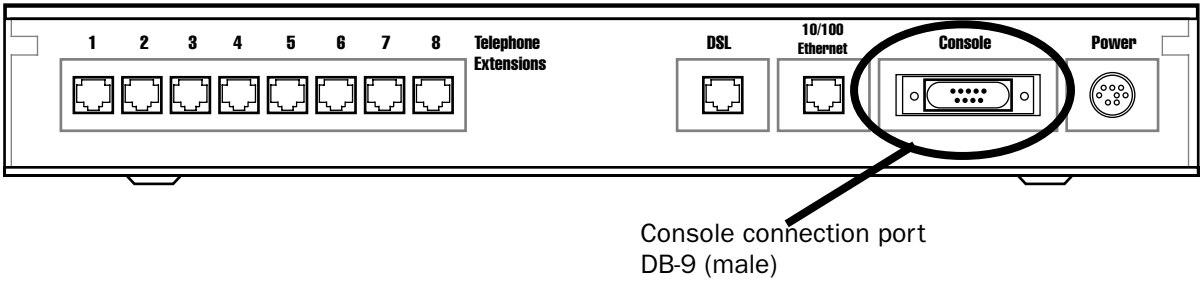
- If you connect a Macintosh computer, you can use the NCSA Telnet program supplied on the Netopia 4752 CD. You install NCSA Telnet by simply dragging the application from the CD to your hard disk.

Connecting a Console Cable to Your Device

You can perform all of the system configuration activities for your Netopia 4752 through a local serial console connection using terminal emulation software, such as HyperTerminal provided with Windows 95, 98, 2000, or NT on the PC, or ZTerm, included on the Netopia CD, for Macintosh computers.

The Netopia 4752 back panel has a connector labeled “Console” for attaching the Router to either a PC or Macintosh computer via the serial port on the computer. (On a Macintosh computer, the serial port is called the Modem port or Printer port.) This connection lets you use the computer to configure and monitor the Netopia 4752 via the console screens.

Netopia 4752 back panel



To connect the Netopia 4752 to your computer for serial console communication, use a console cable appropriate to your platform:

- A DB-9 connector end attaches to a PC.
- A mini-DIN8 or a USB connector end attaches to a Macintosh computer depending on your computer’s serial bus type. Since Macintosh computers have different serial bus connectors, you will need a mini-DIN8- or USB-to-DB-9 adapter. These are available from a variety of third-party manufacturers.
- A DB-9 end of the Console cable attaches to the Netopia 4752’s Console port.
- If you connect a PC with Microsoft Windows 95, 98, 2000 or NT, you can use the HyperTerminal application bundled with the operating system.
- If you connect a Macintosh computer, you can use the ZTerm terminal emulation program on the supplied Netopia 4752 CD.

Launch your terminal emulation software and configure the communications software for the values shown in the table below. These are the default communication parameters that the Netopia 4752 uses.

Parameter	Suggested Value
Terminal type	**PC**: ANSI-BBS **Mac**: ANSI, VT-100, or VT-200
Data bits	8
Parity	None
Stop bits	1
Speed	9600 bits per second (can be set for up to 57600)
Flow Control	None
Note: The router firmware contains an autobaud detection feature. If you are at any screen on the serial console, you can change your baud rate and press Return (HyperTerminal for the PC requires a disconnect). The new baud rate is displayed at the bottom of the screen.	

Navigating through the Console Screens

Use your keyboard to navigate the Netopia 4752's configuration screens, enter and edit information, and make choices. The following table lists the keys to use to navigate through the console screens.

To...	Use These Keys...
Move through selectable items in a screen or pop-up menu	Up, Down, Left, and Right Arrow
Set a change to a selected item or open a pop-up menu of options for a selected item like entering an upgrade key	Return or Enter
Change a toggle value (Yes/No, On/Off)	Tab
Restore an entry or toggle value to its previous value	Esc
Move one item up	Up arrow or Control + K
Move one item down	Down arrow or Control + O
Display a dump of the device event log	Control + E
Display a dump of the WAN event log	Control + F
Refresh the screen	Control + L

Chapter 7

Easy Setup

This chapter describes how to use the Easy Setup console screens on your Netopia 4752 SDSL Integrated Access Device. After completing the Easy Setup console screens, your device will be ready to connect to the Internet or another remote site.

Easy Setup Console Screens

Using five Easy Setup console screens, you can:

- Modify a connection profile for your device for the connection to your ISP or remote location
- Set up the voice connection to your remote voice provider
- Set up IP addresses and IP address serving
- Password–protect configuration access to your Netopia 4752 SDSL Integrated Access Device

Accessing the Easy Setup console screens

To access the console screens, Telnet to the Netopia 4752 over your Ethernet network or physically connect with a serial console cable and access it with a terminal emulation program. See "Connecting through a Telnet Session" on page 6-2 or "Connecting a Console Cable to Your Device" on page 6-3.

Note: Before continuing, make sure you have the information that your telephone service provider, ISP, or network administrator has given you for configuring the Netopia 4752.

The Netopia Router's first console screen, Main Menu, appears in the terminal emulation window of the attached PC or Macintosh computer when:

- The Netopia 4752 is turned on
- The computer is connected to the Netopia 4752
- Telnet or the terminal emulation software is running and configured correctly

A screen similar to the following Main Menu appears:

```
                        Netopia 4752 v5.1


                    Easy Setup...
                    WAN Configuration...
                    System Configuration...
                    Voice Configuration...
                    Utilities & Diagnostics...
                    Statistics & Logs...
                    Quick Menus...
                    Quick View...

Return/Enter goes to Easy Setup -- minimal configuration.
```

If you do not see the Main Menu, verify that:

- If you are using a serial connection, that your serial port speed is the same as the Netopia 4752's default 9600 baud, for first use.
- The computer used to view the console screen has its serial port connected to the Netopia 4752's Console port or an Ethernet connection to one of its Ethernet ports. See "Connecting a Console Cable to Your Device" on page 6-3 or "Connecting through a Telnet Session" on page 6-2.
- Telnet or the terminal emulation software is configured for the recommended values.
- If you are connecting via the Console port, your computer's serial port is not being used by another device, such as an internal modem, or an application. Turn off all other programs (other than your terminal emulation program) that may be interfering with your access to the port.
- You have entered the correct password, if necessary. Your Netopia 4752's console access may be password protected from a previous configuration. See your system administrator to obtain the password.

  See Appendix A, "Troubleshooting," for more suggestions.

Quick Easy Setup Connection Path

This section may be all you need to do to configure your Netopia 4752 SDSL Integrated Access Device to connect to the Internet.

Your service provider must supply you with several parameter values for you to enter in the device. The service provider will provide values for the parameters shown below:

Parameter:	Default value:	Your value:
SDSL Line Configuration Screen		
Operation Mode	Generic (default) Lucent Nokia EOC Fast Nokia Fixed Paradyne Nortel UE IMAS or HDLC (Copper Mountain)	
Data Rate (for any Operation Mode other than Nokia EOC Fast or HDLC (Copper Mountain))	144, 160, 192, 208, 272, 384, 400, 416, 528, 768, 784, 1040, 1152, 1168, 1536, 1552, 1568, or 2320	
Data Link Encapsulation	PPP, Frame Relay, or RFC1483	
PPP Mode	VC Multiplexed (default) or LLC SNAP	
RFC1483 Mode	Bridged 1483 (default) or Routed 1483	
PPP over Frame Relay Enabled	Off (default) or On	
PPP over Ethernet (PPPoE) (for Bridged 1483 only)	Off (default) or On	
Data Circuit VPI Data Circuit VPI	0-255 0-65535	
Voice Easy Setup Screen		
Voice Gateway	CopperCom, JetStream, TollBridge, TDSoft or Zhone	
Voice VPI Voice VCI (for any Voice Gateway other than TollBridge)	0-255 0-65535	

Parameter:	Default value:	Your value:
Easy Setup Profile Screen		
Address Translation Enabled	Yes (default) or No	
IP Addressing	Unnumbered (default) or Numbered	
Local WAN IP Address Local WAN IP Mask	n/a	
Remote IP Address Remote IP Mask	n/a	
PPP Authentication	None (default), PAP or CHAP	
User Name (or Host Name)	n/a	
Password (or Secret)	n/a	
IP Easy Setup Screen		
Ethernet IP Address Ethernet Subnet Mask	192.168.1.1 (default) 255.255.255.0	
Domain Name	n/a	
Primary Domain Name Server	n/a	
Secondary Domain Name Server	n/a	
Default IP Gateway	n/a	
Easy Setup Security Configuration Screen		
Write Access Name	n/a	
Write Access Password	n/a	

(If you want to record these values, you can print these pages and use the spaces above.)

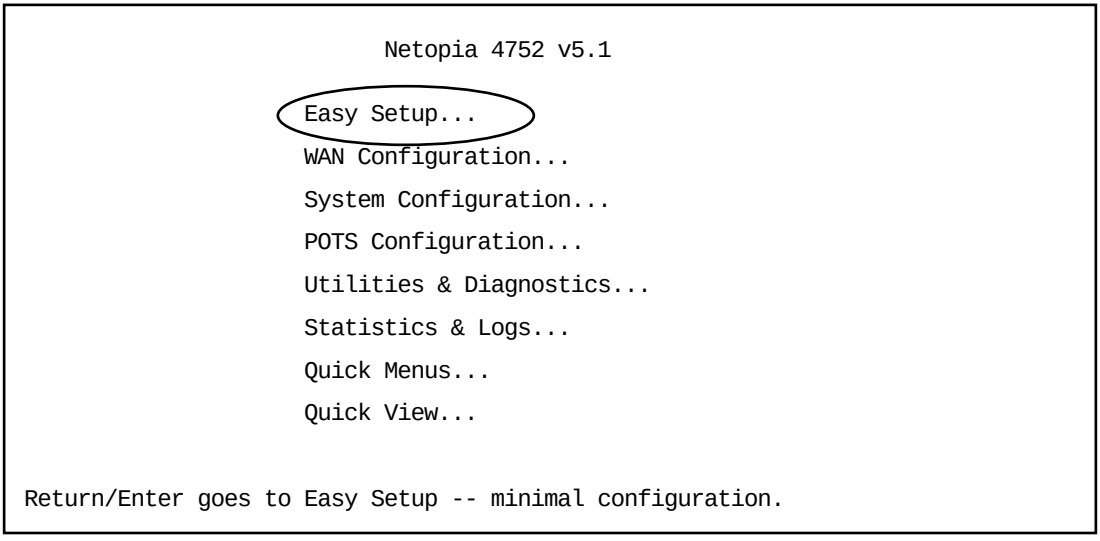
If your ISP assigns your Router a Static IP address, do the following:

1. Open a Telnet session to 192.168.1.1 to bring up the Main Menu.

   If you don't know how to do this, see “Connecting through a Telnet Session” on page 6-2.

   Alternatively, you can connect the console cable and open a direct serial console connection, using a terminal emulator program. See “Connecting a Console Cable to Your Device” on page 6-3.

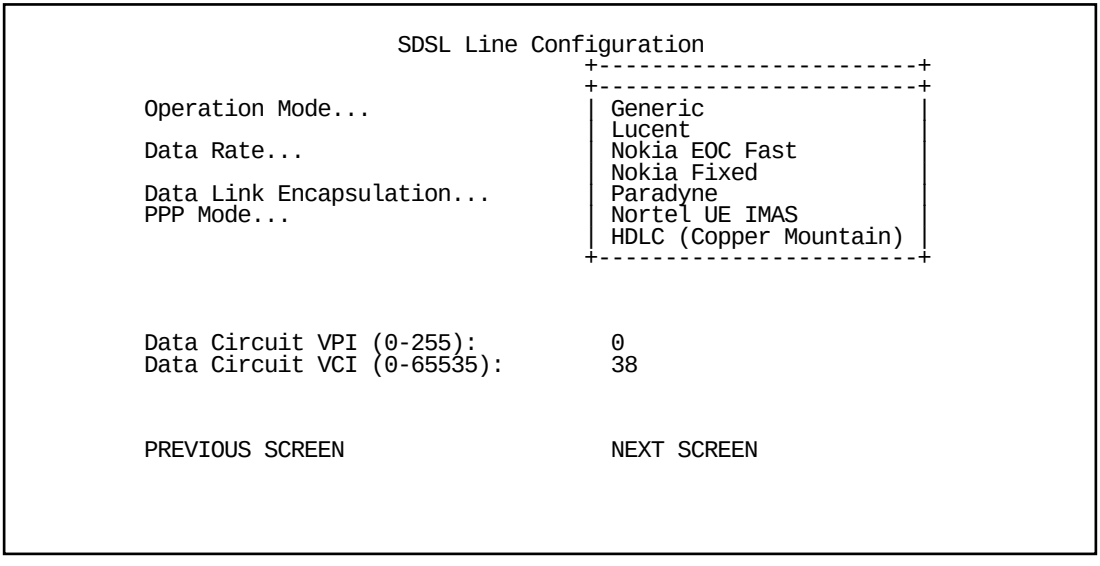
The Main Menu appears.



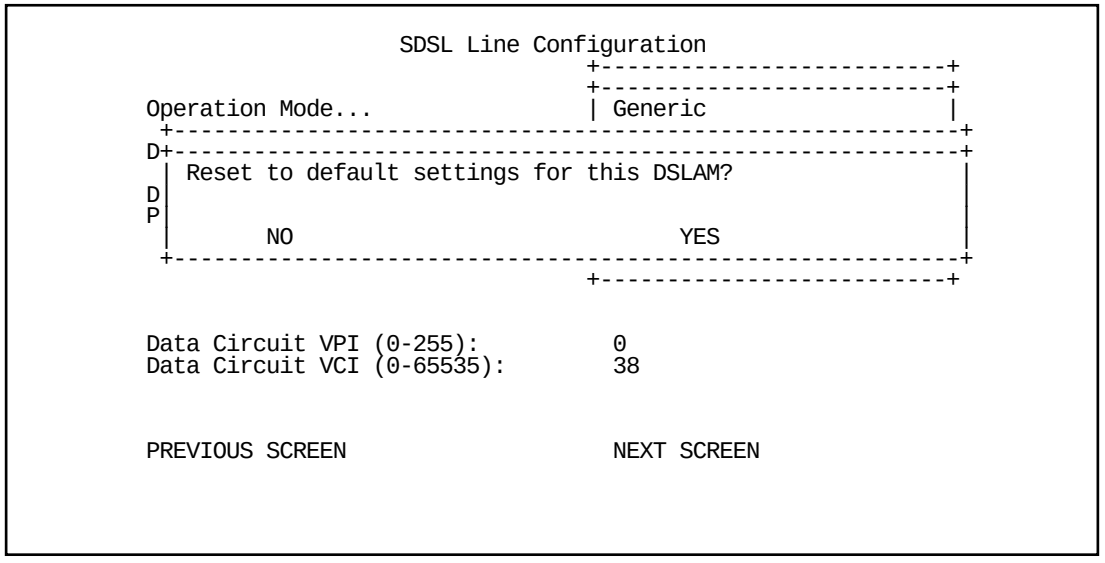
2. Select the first item on the Main Menu list, **Easy Setup**. Press Return to bring up the SDSL Line Configuration menu screen.

SDSL Line Configuration

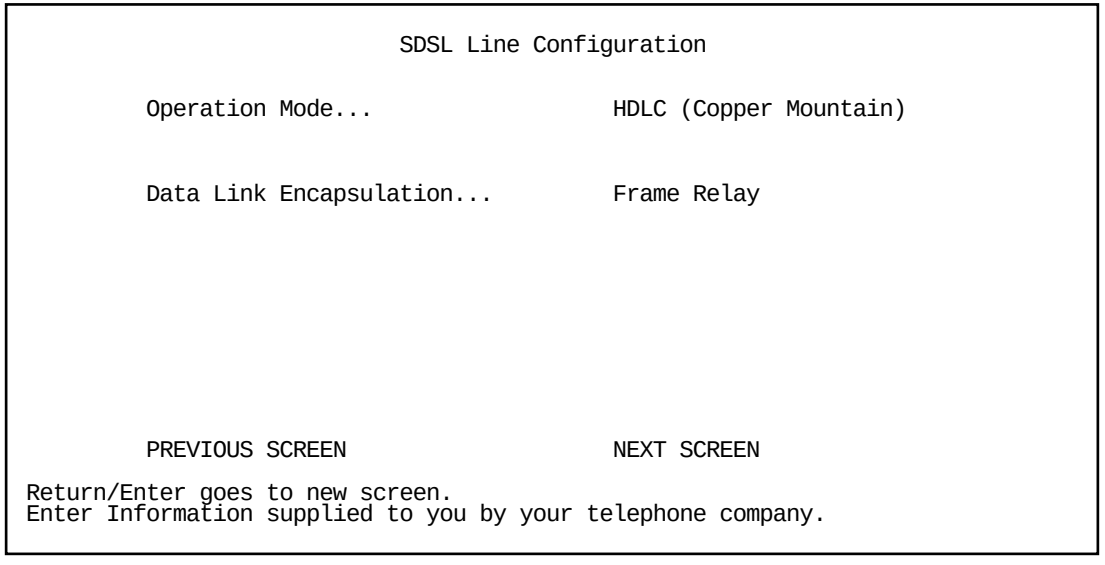
1. Select **Operation Mode** and from the pop-up menu choose the type of DSLAM to which you will be connecting.



The Operation Mode selection will reset a number of default values that pertain to that particular DSLAM. If the changes are such that the defaults completely change the configuration, you will see an alert message asking you to confirm the resetting of the defaults.

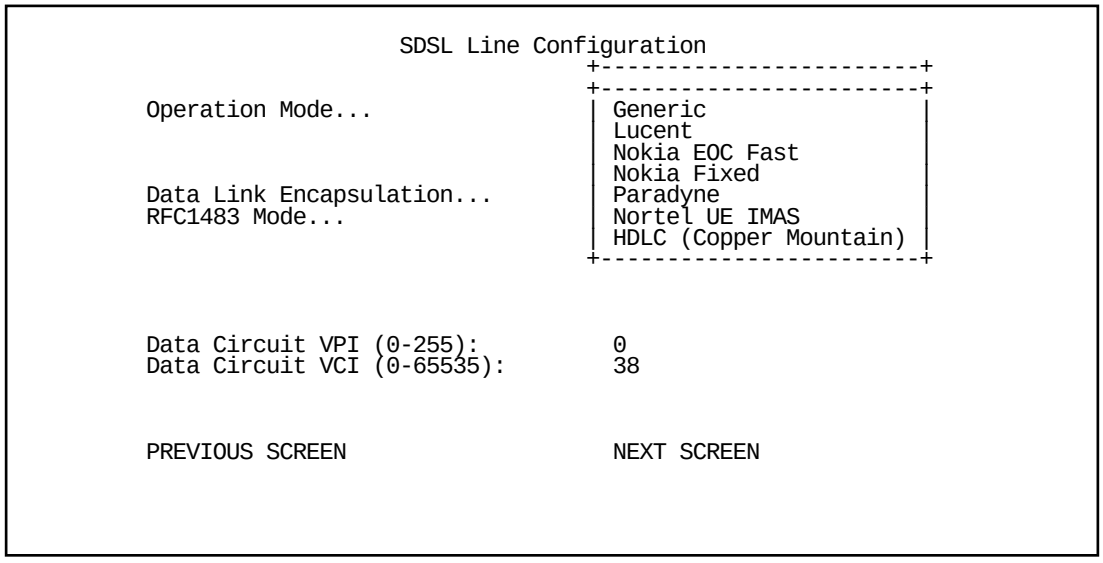


- If you are using the HDLC (Copper Mountain) Operation Mode, you need only specify your data link encapsulation method.



- Select **Data Link Encapsulation** and from the pop-up menu, choose Frame Relay (the default), PPP, or RFC1483 (or possibly PPPoE).

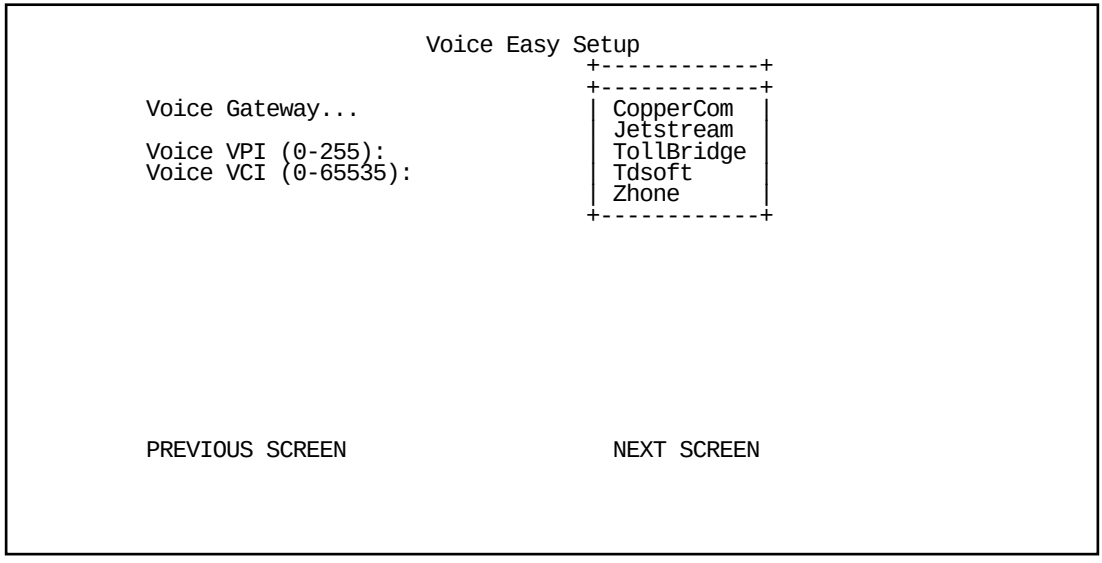
If you are using an ATM-based Mode, the SDSL Line Configuration screen offers additional parameters.



- Select **Data Link Encapsulation** and from the pop-up menu choose either RFC1483 (the default) or PPP.
  - If you selected RFC1483, the next pop-up menu **RFC1483 Mode** offers the choice of Bridged 1483 or Routed 1483. If you select Bridged 1483, a new option **PPP over Ethernet (PPPoE)** appears. You can then toggle PPPoE On or Off. Choosing Routed 1483 hides the PPPoE option.
  - If you selected PPP, the next pop-up menu **PPP Mode** offers the choice of VC Multiplexed or LLC SNAP.
- The next two fields, **Data Circuit VPI** and **Data Circuit VCI** are editable. Enter the Virtual Path Identifier and Virtual Channel Identifier values that your provider specifies. For more information on VPIs and VCIs, see "Multiple ATM Permanent Virtual Circuit Support" on page 9-5.

2. Press the Down arrow key until you reach **NEXT SCREEN**. Press Return to bring up the next screen.

Voice Easy Setup



1. Select **Voice Gateway** and press Return. The pop-up menu will offer you the choice of popular voice gateway devices. Your selection depends on which type your ISP uses: CopperCom, JetStream, TollBridge, TDSoft, or Zhone.
2. For any Voice Gateway other than Tollbridge, the **Voice VPI** and **Voice VCI fields** are editable. (If you select Tollbridge, the VPI and VCI fields do not appear.) Enter the Virtual Path Identifier and Virtual Channel Identifier values that your provider specifies. For more information on VPIs and VCIs, see "Multiple ATM Permanent Virtual Circuit Support" on page 9-5.
3. Press the Down arrow key until you reach **NEXT SCREEN**. Press Return to bring up the next screen.

Easy Setup Profile

The Easy Setup Profile screen is where you configure the parameters that control the Netopia 4752's connection to a specific remote destination, usually your ISP or a corporate site.

On a Netopia 4752 SDSL Integrated Access Device you can add up to 15 more connection profiles, for a total of 16, although, except for Virtual Private Networks, you can only use one at a time.

```
                Connection Profile 1: Easy Setup Profile




        Address Translation Enabled:        Yes
        IP Addressing...                    Numbered

        Local WAN IP Address:               0.0.0.0

        Remote IP Address:                  127.0.0.2
        Remote IP Mask:                     255.255.255.255

        PPP Authentication...               PAP
        Send User Name:                     jarjar
        Send Password:                      binks


        PREVIOUS SCREEN                     NEXT SCREEN

Return accepts * ESC cancels * Left/Right moves insertion point * Del deletes.
Enter basic information about your WAN connection with this screen.
```

1. To enable address translation, toggle **Address Translation Enabled** to **Yes** (the default). For more information on Network Address Translation, see Chapter 10, "IP Setup," on page 10-1.

   The **IP Addressing** menu item allows you to choose between Unnumbered and Numbered addressing. Numbered is the default for SDSL. It assigns a unique IP address to the SDSL WAN interface, as required by most ISPs' routers. Unnumbered may be used for simpler configurations such as point-to-point short haul applications.

2. Select the editable field labeled **Local WAN IP Address**.

   The default address is 0.0.0.0, which allows for dynamic addressing, when your ISP assigns an address each time you connect. However, you can enter another specific address if you want to use static addressing. In that case, enter the local WAN address your ISP gave you. Press Return.

3. If you selected PPP data link encapsulation in the SDSL Line Configuration screen, a PPP Authentication menu item appears. The authentication protocol and user name/password combinations you enter must be assigned or agreed to in advance between you and your ISP. Select **PPP Authentication** and press Return.

   From the pop-up menu that appears, select the authentication method your ISP uses: PAP (Password Authentication Protocol), CHAP (Challenge Handshake Authentication Protocol), or None.

   - PAP is the most common, and requires you to enter a User Name and Password in the next two fields.
   - CHAP requires you to enter a Host Name and Secret in the next two fields.

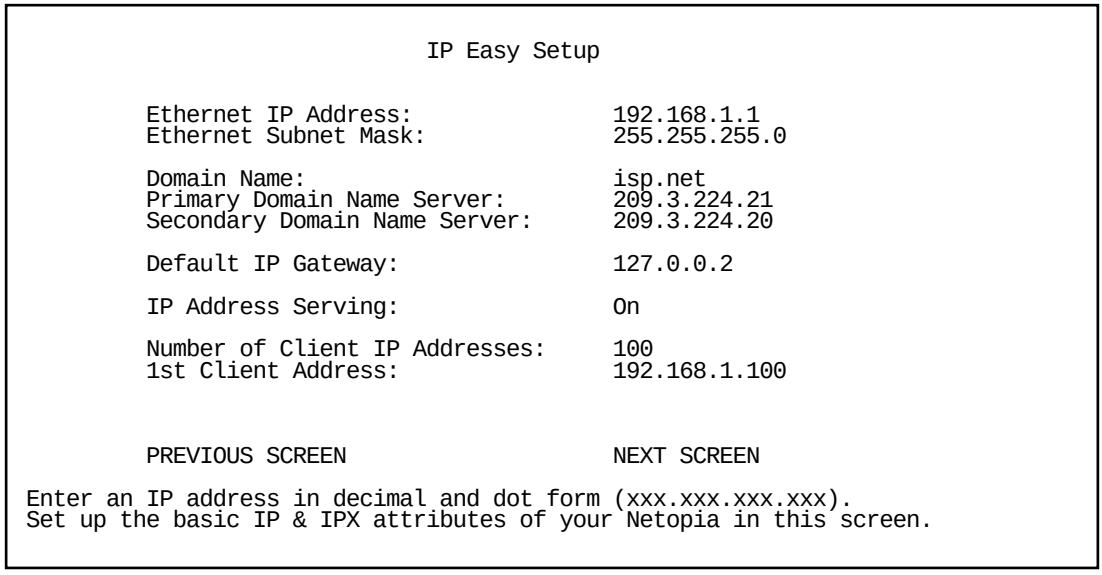
4. Press the Down arrow key until you reach **NEXT SCREEN**. Press Return to bring up the next screen.

IP Easy Setup

The IP Easy Setup screen is where you enter information about your Netopia Router's:

- Ethernet IP address
- Ethernet Subnet mask
- Domain Name
- Domain Name Server IP address
- Default gateway IP address

Consult with your network administrator to obtain the information you will need. For more information about setting up IP, see "IP Setup" on page 10-1.



1. Select **Ethernet IP Address** and enter the first IP address from the IP address range your ISP has given you. This will be the Netopia Router's IP address.

   The Ethernet IP Address defaults to an address (192.168.1.1) within a range reserved by the Internet address administration authority for use within private networks.

   Because this is a private network address, it should never be directly connected to the Internet. Using NAT for all your connection profiles will ensure this restriction. See "Multiple Network Address Translation" on page 11-1 of this guide for more information.

2. Select **Ethernet Subnet Mask** and enter the subnet mask your ISP has given you. The Ethernet Subnet Mask defaults to a standard class mask derived from the class of the Ethernet IP address you entered in the previous step.

3. Press the Down arrow key until the editable field labeled **Domain Name** is highlighted.

4. Type the Domain Name your ISP gave you. Press Return. The next field **Primary Domain Name Server** will be highlighted.

5. Type the Primary Domain Name Server address your ISP gave you. Press Return. A new field **Secondary Domain Name Server** will appear. If your ISP gave you a secondary domain name server address, enter it here. Press Return until the next field **Default IP Gateway** is highlighted.
6. If you do not enter a **Default IP Gateway** value, the router defaults to the remote IP address you entered in the Easy Setup connection profile. If the device does not recognize the destination of any IP traffic, it forwards that traffic to this gateway.

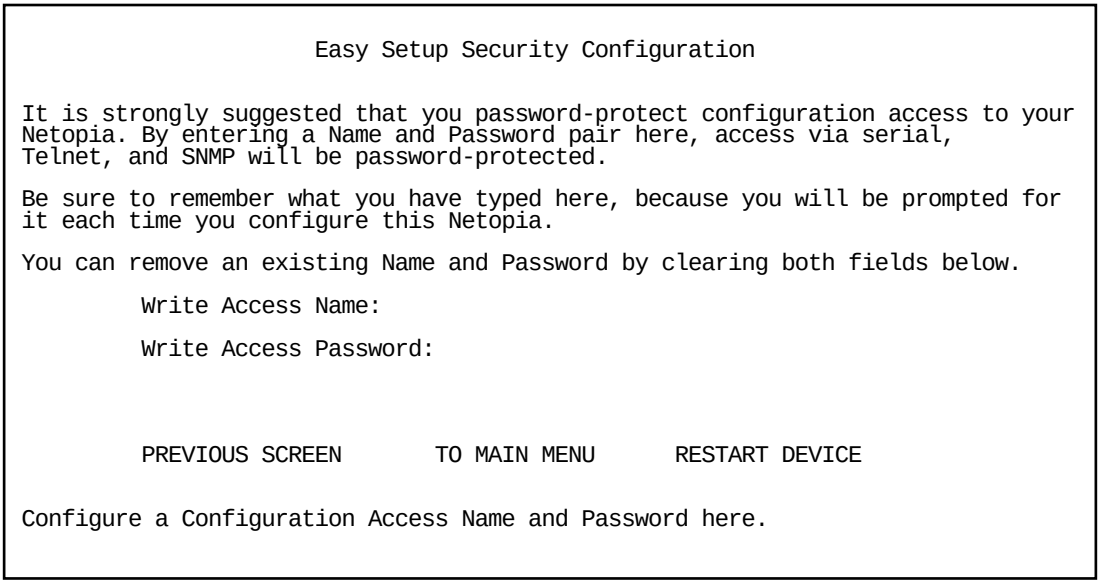
   Do not confuse the remote IP address and the Default IP Gateway's address with the block of local IP addresses you receive from your ISP. You use the local IP addresses for the Netopia 4752's Ethernet port and for IP clients on your local network. The remote IP address and the default gateway's IP address should point to your ISP's router.
7. Toggle **IP Address Serving** to On or Off, depending on whether you want the device's IP address server to supply dynamic IP addresses to your client workstations. Normally, you would accept the default On so that workstations on your LAN can use a single IP address assigned by your ISP to connect to the Internet.
8. The IP address server will provide 100 IP addresses automatically to workstations on your LAN. You only need to change the **Number of Client IP Addresses** if you have some other IP addressing scheme.
9. By default, the **1st Client Address** is 192.168.1.100, based on the device's default IP address of 192.168.1.1. You only need to change this if you have some other IP addressing scheme.
10. Press the Down arrow key until you reach **NEXT SCREEN**. Press Return.

Easy Setup Security Configuration

The Easy Setup Security Configuration screen lets you password-protect your Netopia 4752. Input your **Write Access Name** and **Write Access Password** with names or numbers totaling up to eleven digits.

If you password protect the console screens, you will be prompted to enter the name and password you have specified every time you log in to the console screens. Do not forget your name and password. If you do, you will be unable to access any of the configuration screens.

Additional security features are available. See "Security" on page 13-1.



The final step in configuring the Easy Setup console screens is to restart the Netopia 4752, so that the configuration settings take effect.

1. Select **RESTART DEVICE**. A prompt asks you to confirm your choice.
2. Select **CONTINUE** to restart the Netopia Router and have your selections take effect.

Note: You can also restart the system at any time by using the Restart System menu item (see "Restarting the System" on page 15-12) or by turning the Netopia Router off and on with the power switch.

The Router will restart and your configuration settings will be activated. You can then Exit or Quit your Telnet application.

Easy Setup is now complete.

Chapter 8

Voice Configuration

This chapter describes the telephony services and configuration of the Netopia 4752 SDSL Integrated Access Device. For specific details on configuration and use of the Netopia 4752's Internet connection, refer to Chapter 7, "Easy Setup" and Chapter 9, "WAN and System Configuration."

This chapter covers the following topics:

Introduction

The Netopia 4752 provides small and medium sized businesses with a complete Centrex PBX system. It supports voice call switching between the SDSL link and eight local extensions. Call management features can include distinctive ringing, intelligent call forwarding, Direct Inward Dial (DID), Caller ID, and hunt groups. Important key system features such as call hold, call transfer, and call waiting are all supported.

Note: Since the Netopia 4752 is a Centrex-based IAD, specific voice features available to you via the Netopia 4752 will depend on the services for which you contract with your service provider.

The Netopia 4752 supports up to eight telephone extensions and up to eight derived voice lines. Like the rest of the 4700-series line, the Netopia 4752 includes the Netopia data routing engine for any number of attached computers or other network devices connected to a single 10/100 Ethernet port.

Key features include:

- Fax/Modem: Configurable Voice port for incoming or modem calls. This is the secret term for echo cancellation support.
- Voice Gateway Interoperability: CopperCom, Jetstream, TollBridge Tdsoft, Zhone. General Bandwidth support to follow in an upcoming firmware release.

Centrex is a simpler variation on the PBX. It is a PBX with all switching occurring at a local telephone office instead of at the company's premises. Typically, the telephone company owns and manages all the communications equipment necessary to implement the PBX and then sells various services to the company.

Explanation of terms

Some telephony terms mean different things in Centrex mode and PBX/local switching mode: Toll Restriction and Speed Dial. Since the Netopia 4752 operates in Centrex mode, it may be useful for you to understand how Centrex and local PBX work differently.

- Toll Restriction Operation - Centrex Mode: When you pick up the phone, you receive a dial tone from the central office. When 9 is pressed, the Netopia 4752 detects 9 and returns a busy tone (locally generated). Incoming calls are allowed. This allows local extension calling through the central office, but not long

distance or local calls.

Toll Restriction Operation - PBX/Local Switching Mode: When you pick up the phone, you receive local PBX dial tone. When a 9 (or outside line code) is pressed, the IAD detects the digit and returns busy (locally generated). Incoming calls are allowed. Extension calls (locally switched) are allowed.

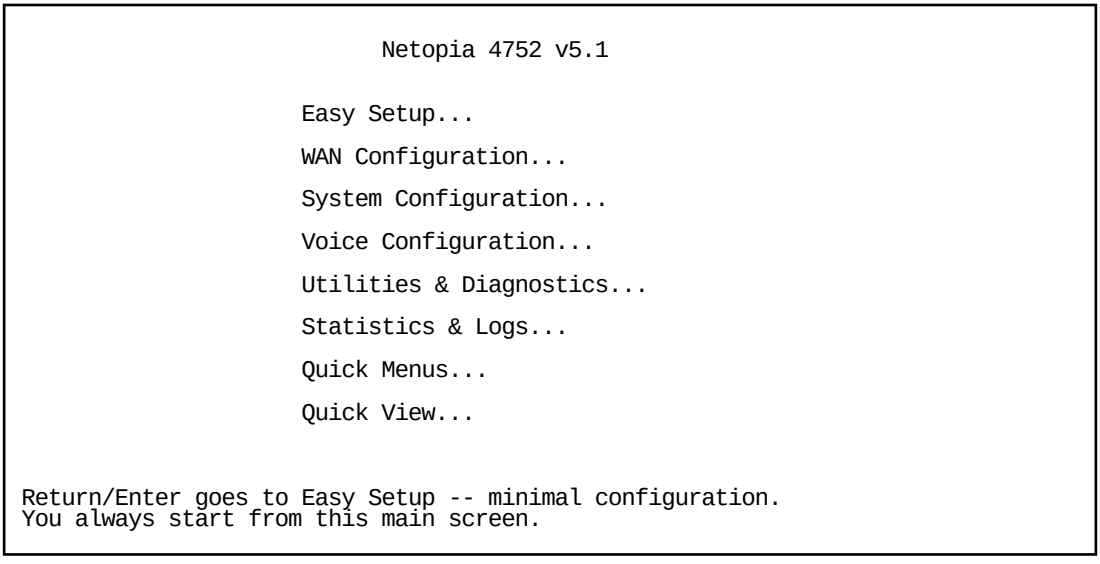
- Speed Dial - Centrex Mode: In Centrex Mode, when you pick up the phone, dial-tone from the central office is present. It is therefore, not possible to program the phone or use speed dial in this mode from the phone.

  Speed Dial - PBX/Local Switching mode: In this mode, you have the ability to pick up the phone, receive local dial tone and proceed to program the phone w/ local speed dial options. In addition, taking the phone off hook and pressing speed dial numbers will cause the stored speed dial digits to be sent out. This is independent of the previous mode.

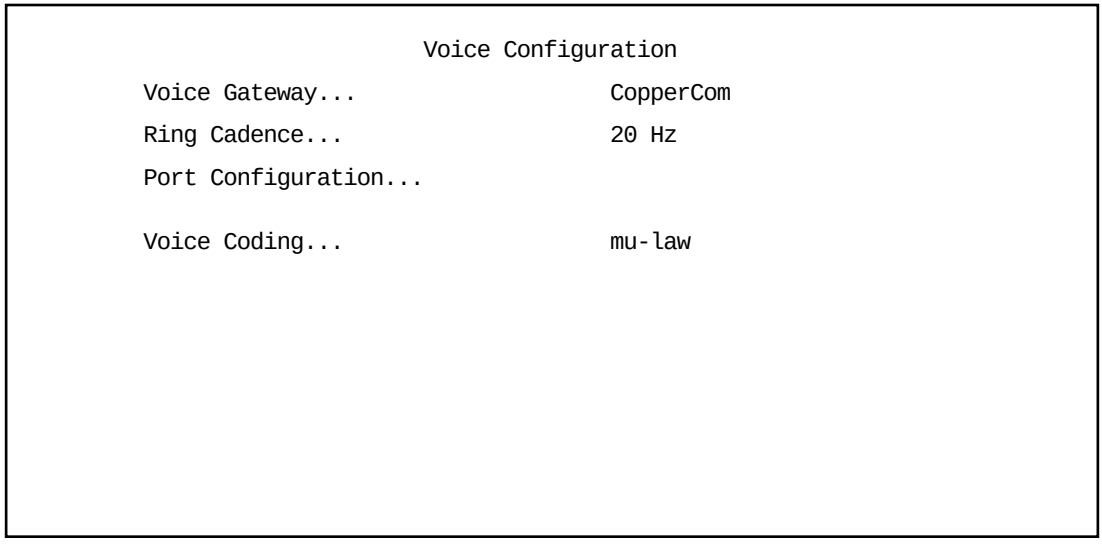
Configuring the Voice Features

This section describes how to configure the voice telephone features of the Netopia 4752.

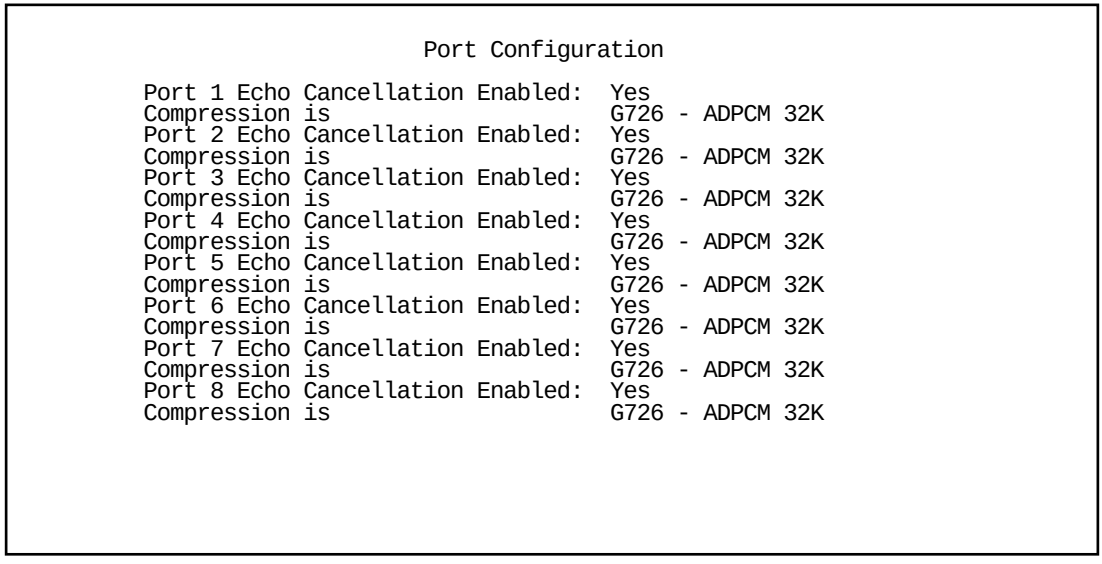
From the Main Menu select **Voice Configuration**.



The Voice Configuration screen appears.



- Select **Voice Gateway** and from the pop-up menu, choose the type of voice gateway device to which you will be connected. The choices are: CopperCom, JetStream, TollBridge, TDSoft, or Zhone.
- Select **Ring Cadence** and press Return. A pop-up menu allows you to choose between 20Hz (the default) and 25Hz for compliance with several non-North American telephone systems.
- Select **Port Configuration** and press Return. The Port Configuration screen appears.



Echo cancellation is set to Yes by default. For ordinary telephone handsets, echo cancellation should be set to Yes (turned on) to eliminate echoes on the voice line. Toggling a port to No allows you to use a fax machine or modem on that phone port (since fax machines and modems automatically cancel echoes). If you want to disable echo cancellation, toggle this item to **No**.

Once you have set echo cancellation, press Escape to return to the Voice Configuration screen. You can enable or disable echo cancellation for each port on the Netopia 4752.

- Select **Voice Coding** and press Return. From the pop-up menu choose the voice coding method you will be using. The default is mu-law, which is the standard 8-bit, 8 kHz, mono format intended primarily for the requirements of voice in North America. You can also choose a-law, a more common audio format outside North America.

Part II: Advanced Configuration

Chapter 9

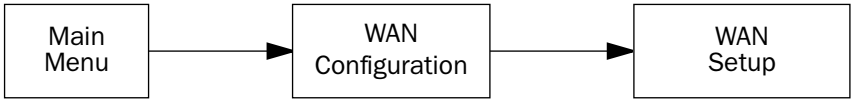
WAN and System Configuration

This chapter describes how to use the console-based management screens to access and configure advanced features of your Netopia 4752 SDSL Integrated Access Device. You can customize these features for your individual setup. These menus provide a powerful method for experienced users to set up their device's connection profiles and system configuration.

This section covers the following topics:

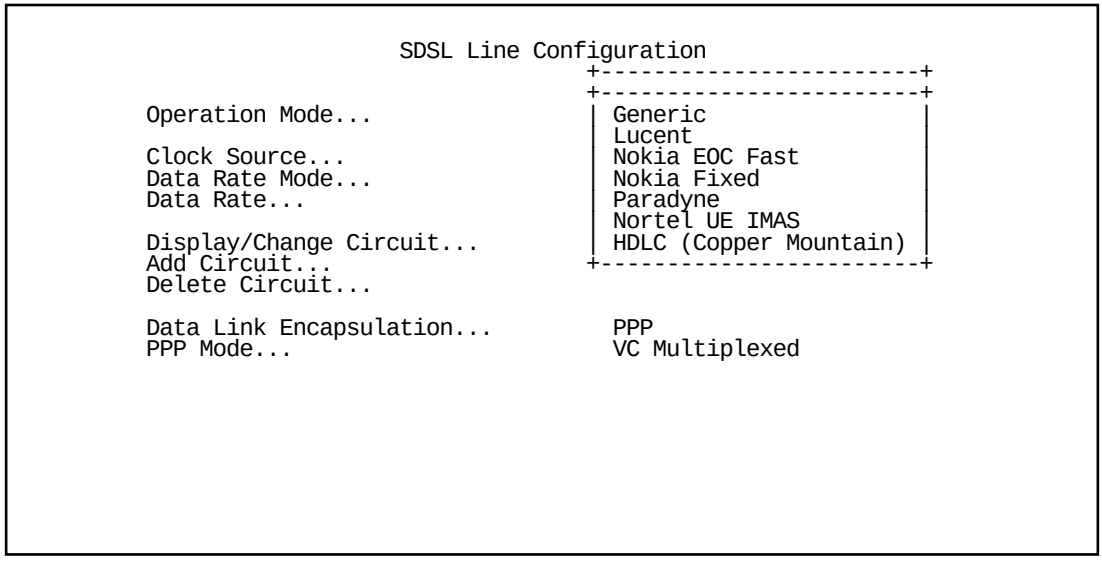
WAN Configuration

To configure your Wide Area Network (WAN) connection, navigate to the WAN Configuration screen from the Main Menu and select **WAN Configuration**, then **WAN Setup**.




```
                          WAN Configuration

                    WAN (Wide Area Network) Setup...

                    Display/Change Connection Profile...
                    Add Connection Profile...
                    Delete Connection Profile...


                    ATMP/PPTP Default Profile...
                    Scheduled Connections...


                    Configuration Changes Reset WAN Connection:     Yes




From here you will configure yours and the remote sites' WAN information.
```

The SDSL Line Configuration screen appears.

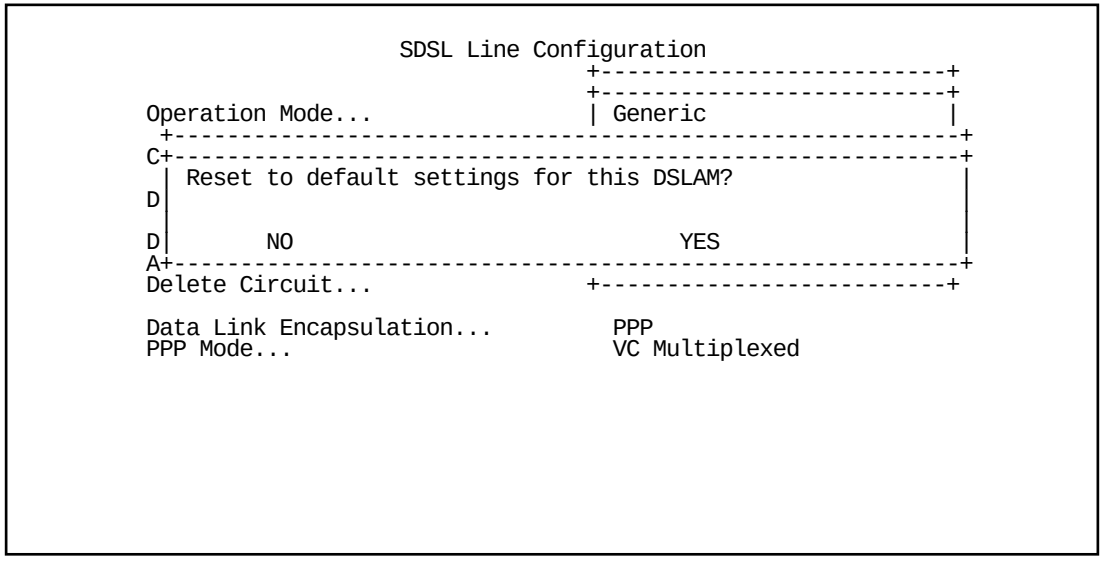


- Select **Operation Mode** and from the pop-up menu choose the type of DSLAM to which you will be connecting.

  Each access concentrator (DSLAM) has a different set of default data rates and other parameters.

  Your service provider should supply you with the appropriate information about the type and capabilities of the access concentrator equipment they use.

  The Operation Mode selection will reset a number of default values that pertain to that particular DSLAM. If the changes are such that the defaults completely change the configuration, you will see an alert message asking you to confirm the resetting of the defaults.



For example, for the ATM-based DSLAM mode Nokia Fixed, the following screen displays.

```
                          SDSL Line Configuration

        Operation Mode...                   Nokia Fixed

        Clock Source...                     Network
        Data Rate Mode...                   Hunt
        Data Rate...                        384

        Display/Change Circuit...
        Add Circuit...
        Delete Circuit...

        Data Link Encapsulation...          RFC1483
        RFC1483 Mode...                     Routed 1483




Enter Information supplied to you by your telephone company.
```

- For all except the (HDLC) Copper Mountain Operation Mode, the **Data Rate Mode** pop-up menu offers the choice of Hunt or Locked mode.
  - If you select **Hunt** (the default) the device will attempt to connect at the data rate you specify in the Data Rate selection, but if it cannot do so, it will then hunt through all the available data rates until it finds one at which it can establish a connection. When it does establish a connection, it will store that data rate and use it the next time you connect.
  - If you select **Locked**, the device will always attempt to connect at the data rate you select in the next step.
- The **Data Rate** pop-up menu allows you to set the initial or locked data rate for the SDSL link (and the attached CPE device). The pop-up menu offers you a choice of connection speeds that vary depending on the rates that your selected DSLAM supports.
- The **Display/Change Circuit**, **Add Circuit**, **Delete Circuit** menus permit you to assign multiple permanent virtual circuits. For detailed information on multiple PVCs, see "Multiple ATM Permanent Virtual Circuit Support" on page 9-5.
- Select **Data Link Encapsulation** and press Return. The pop-up menu will offer you the choice of PPP or RFC1483. The HDLC (Copper Mountain) Operation Mode also offers Frame Relay. Your selection depends on which type your ISP uses.
  - If you selected PPP as your data link encapsulation method, the **PPP Mode** pop-up menu offers the choice of VC Multiplexed (the default) or LLC SNAP.
  - If you selected RFC1483 your data link encapsulation method, two additional options display: an **RFC1483 Mode** pop-up menu offers the choice of Bridged 1483 or Routed 1483. Bridged 1483 permits use of **PPP over Ethernet (PPPoE)** and is the default. You can then toggle PPPoE On or Off. Choosing Routed 1483 hides the PPPoE option.

Multiple ATM Permanent Virtual Circuit Support

The Netopia 4752 supports up to eight permanent virtual circuits.

Multiple ATM PVC overview

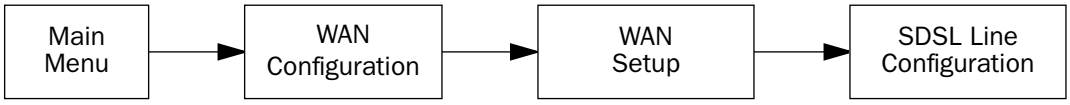
On cell-based SDSL and ADSL WAN interfaces, the ATM connection between the device and the central office equipment (DSLAM) is divided logically into one or more virtual circuits (VCs). A virtual circuit may be either a permanent virtual circuit (PVC) or a switched virtual circuit (SVC). Netopia devices support PVCs.

VCs are identified by a Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI). A VPI is an 8-bit value between 0 and 255, inclusive, while a VCI is a 16-bit value between 0 and 65535, inclusive.

- Circuits now support attributes in addition to their VPI and VCI values. When configuring a circuit, you can specify an optional circuit name of up to 14 characters. The circuit name is used only to identify the circuit for management purposes as a convenience to aid in selecting circuits from lists. The default circuit name is “Circuit <n>”, where <n> is some number between one and eight corresponding to the circuit’s position in the list of up to eight circuits.
- You can also individually enable or disable a circuit without deleting it. This is useful for temporarily removing a circuit without losing the configured attributes.
- In order to function, each circuit must be bound to a Connection Profile or to the Default Profile. Among other attributes, the profile binding specifies the IP addressing information for use on the circuit. Each circuit must be bound to a distinct Connection Profile. You cannot bind multiple circuits to the same Connection Profile.

Multiple ATM PVC configuration

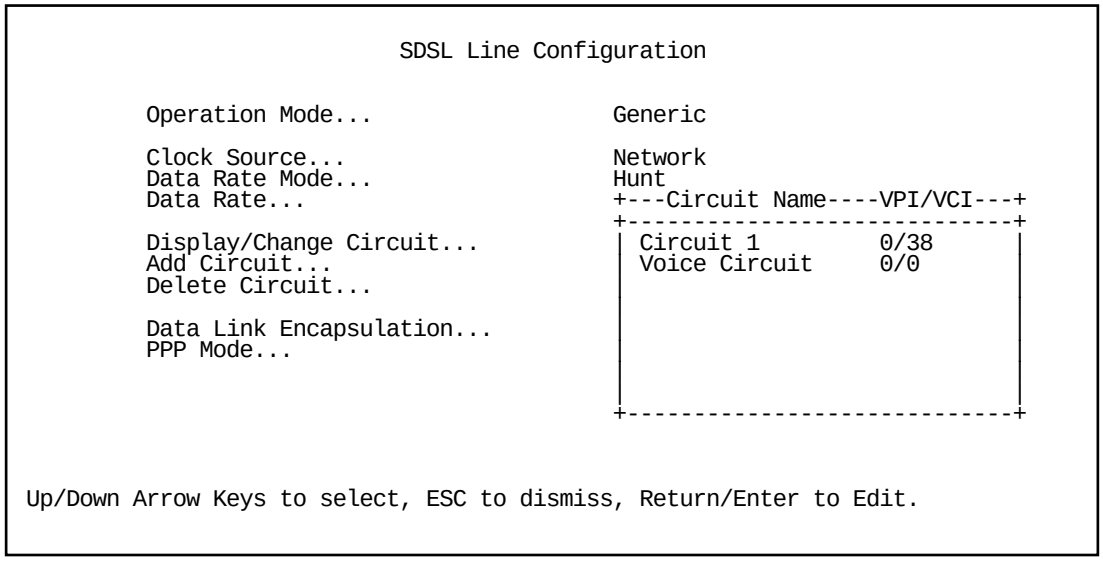
You configure Virtual Circuits in the Add/Change Circuit screen. From the Main Menu, navigate to the SDSL Line Configuration screen.




```
                          SDSL Line Configuration

        Operation Mode...                   Nokia Fixed

        Clock Source...                     Network
        Data Rate Mode...                   Hunt
        Data Rate...                        384

        Display/Change Circuit...
        Add Circuit...
        Delete Circuit...

        Data Link Encapsulation...          RFC1483
        RFC1483 Mode...                     Routed 1483




Enter Information supplied to you by your telephone company.
```

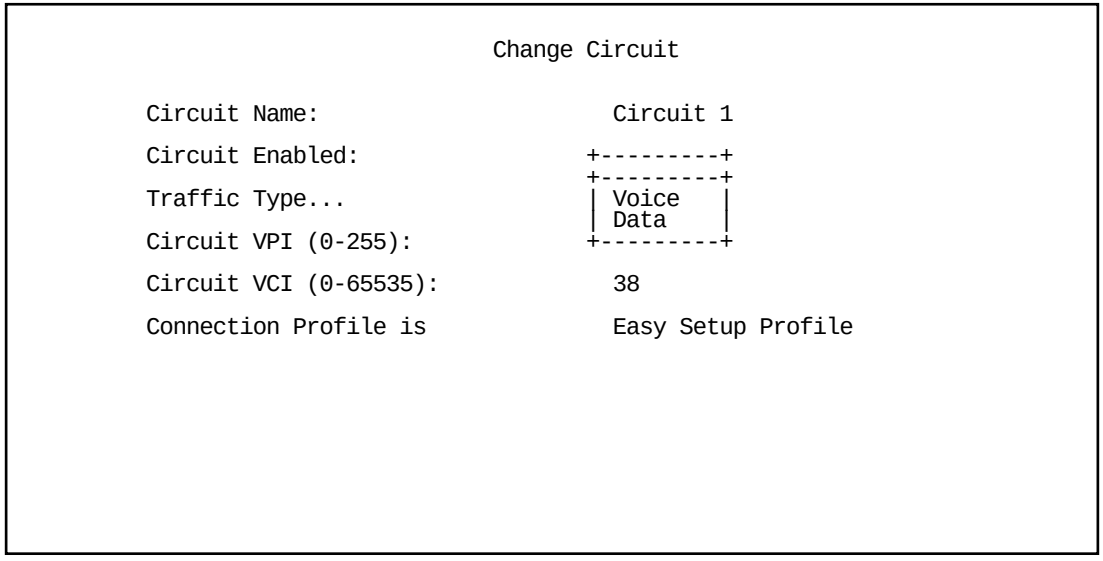
Select **Display/Change Circuit** and press Return.

Choosing **Display/Change Circuit** (or **Delete Circuit)** displays a pop-up menu that allows you to select the circuit to be modified or deleted.



Changing a circuit

If you want to make any changes to the circuit you select, you make them in the Change Circuit screen.



- **Circuit Name** allows you to associate a one- to fourteen-character name with the circuit. The default circuit name is “Circuit <n>”, where <n> is some number between one and eight corresponding to the circuit’s position in the list of up to eight circuits.

- **Circuit Enabled** allows you to enable or disable the circuit, using the Tab key. The default is enabled.
- **Traffic Type** allows you to select which type of traffic will be routed on this circuit, Voice or Data. If you choose Voice, the Connection Profile is field becomes unavailable and does not display.
- **Circuit VPI** allows you to specify the Virtual Path Identifier (VPI) value for the circuit. The default VPI value for both ADSL and cell-based SDSL is zero (0).
- **Circuit VCI** allows you to specify the Virtual Channel Identifier (VCI) value for the circuit. The default VCI value depends on the type of DSLAM to which you are connecting.
- Accessing the **Connection Profile Is** field in the Change Circuit menu depends not on the number of Connection Profiles you have created, but the number of *data* VCs you have added. (See "Adding a circuit" on page 9-9.) If you have more than one data VC you can choose how Connection Profiles are associated with VCs, otherwise you get default behavior and the Connection Profile Is field cannot be selected.

Note: With multiple VCs you must explicitly statically bind the *second* (and all subsequent) VCs to a profile. The first VC will automatically statically bind according to pre-defined dynamic binding rules when you add the second VC. It will revert back to dynamic binding if the number of VCs is reduced to one; for example, by deleting previously defined VCs.

When the link comes up the device binds the VC dynamically to the first suitable Connection Profile or to the Default Profile if there is no Connection Profile configured.

- If you factory default the device, the VC binds to the Default Profile.

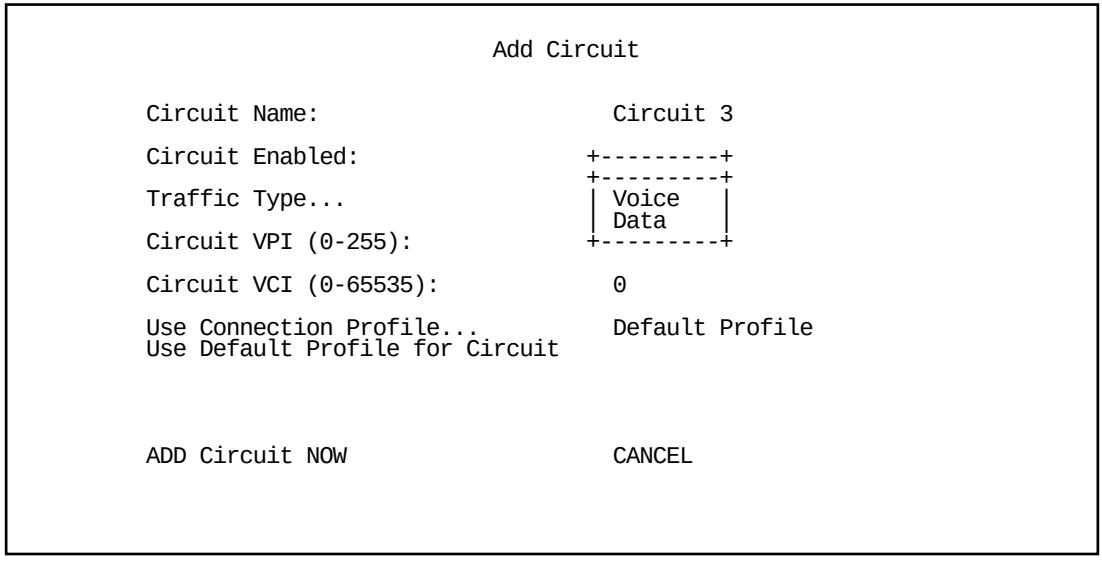
- If you delete a Connection Profile that is statically bound to a VC, the VC binding is set back to the Default Profile. If there is only one VC defined, the VC dynamically binds to the first suitable profile or to the Default Profile. If there are multiple VCs defined, it binds to the Default Profile.

- If you add a second VC, it is initialized to the Default Profile, and the menu screens display the VC Connection Profile-related items, allowing you to bind to a specific Connection Profile instead of the Default Profile. In addition, the device statically binds the first VC according to the rules used to select a profile for dynamic binding. At this point, each profile uses static binding when the link is brought up.

If there are no VCs when you add a VC – for example, if you deleted all your previous VCs and started adding them again – dynamic binding will occur when the link comes up. If you delete a VC, leaving only one VC, that VC resumes dynamically binding again.

Adding a circuit

Choosing **Add Circuit** displays the Add Circuit screen.



The fields in the Add Circuit screen are the similar to the fields in the Change Circuit screen described above. You can add up to seven circuits (for a total of eight) and bind them to separate Connection Profiles.

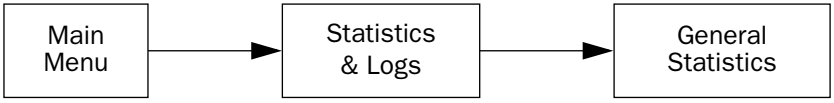
- **Use Connection Profile** and **Use Default Profile for Circuit** allow you to choose the profile that you want to associate with that circuit. Choosing Use Connection Profile presents a pop-up menu that lists all of your enabled Connection Profiles. Choosing a profile from the list statically binds the circuit to the selected profile. Choosing Use Default Profile for Circuit statically binds the circuit to the Default Profile. When the circuit is bound to a Connection Profile, Use Connection Profile displays the name of the profile; when the circuit is associated with the Default Profile, Use Connection Profile displays Default Profile.

  When more than one circuit is enabled, you must explicitly statically bind each circuit to the Connection Profile to be used on the circuit, or to the Default Profile. To do this you use Use Connection Profile or Use Default Profile for Circuit.

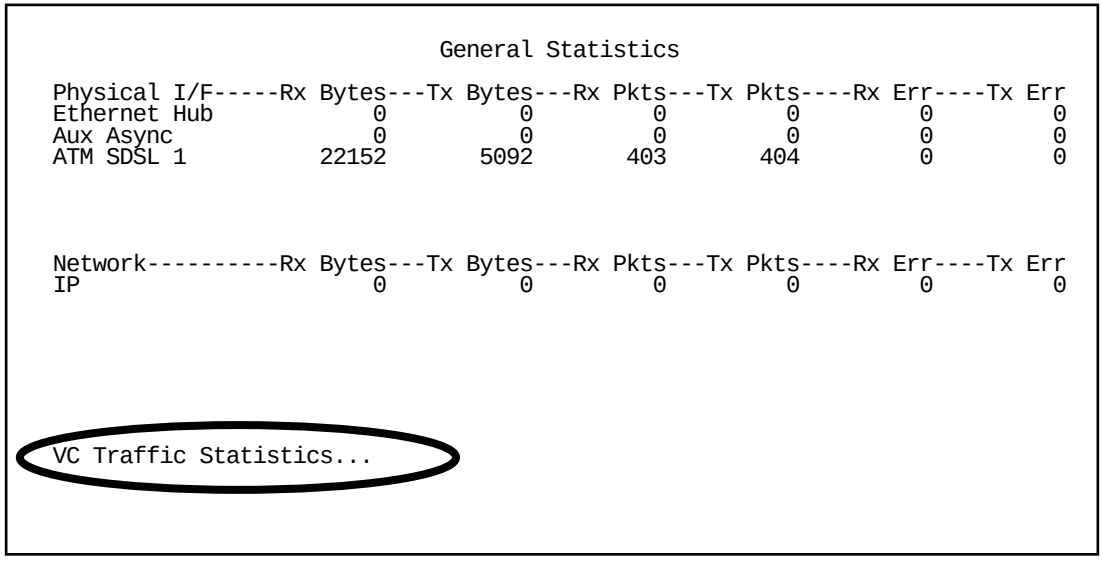
Monitoring multiple virtual circuits

The General Statistics screen adds a selection for ATM VC Statistics.

To access the ATM VC Statistics screen navigate from the Main Menu to Statistics & Logs then General Statistics.



The General Statistics screen appears.



Select **VC Traffic Statistics**.

The ATM VC Statistics screen appears.

```
                              ATM VC Statistics

VPI/VCI------Local IP Addr---------Frames Rx--Frames Tx---Bytes Rx---Bytes Tx
---------------------------------SCROLL UP-----------------------------------
  0/39       111.222.333.4                0          0          0          0
  8/36                  --                1          0         70          0









---------------------------------SCROLL DOWN---------------------------------
```

- To display more information about each circuit associated with the selected WAN module, use the up or down arrow key to highlight the circuit you want to view. Press Return.

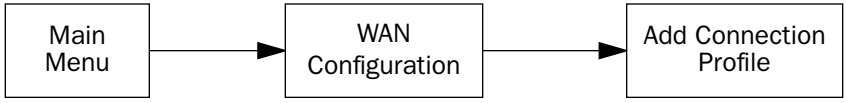
  A pop-up window appears, displaying detailed information for the selected circuit.

```
                              ATM VC Statistics

View St+-------------------------------------------------------------------+
VPI/VCI+-------------------------------------------------------------------+
-------|                                                                   |
  0/39 | Circuit Name:                    Circuit 4                        |
  8/36 | Connection Profile Name:         Profile 4                        |
       |                                                                   |
       | Bytes Rx:             0                                           |
       | Bytes Tx              0                                           |
       |                                                                   |
       | Frames Rx:            0          Frames Tx:            0          |
       | Frames Rx Discarded:  0          Frames Tx Discarded:  0          |
       |                                                                   |
       | Errors Rx:            0                                           |
       | Errors Tx:            0                                           |
       |                                                                   |
       |                              OK                                   |
       |                                                                   |
-------+-------------------------------------------------------------------+
```

Creating a New Connection Profile

For a Netopia 4752, connection profiles are useful for configuring the connection and authentication settings for negotiating a PPP connection on the SDSL link. If you are using the PPP data link encapsulation method, you can store your authentication information in the connection profile so that your user name and password (or host name and secret) are transmitted when you attempt to connect.

Connection profiles define the networking protocols necessary for the device to make a remote connection. A connection profile is like an address book entry describing how the device is to get to a remote site, or how to recognize and authenticate a connection. To create a new connection profile, you navigate to the WAN Configuration screen from the Main Menu, and select **Add Connection Profile**.



The **Add Connection Profile** screen appears.

```
                          Add Connection Profile

        Profile Name:                       Profile 1
        Profile Enabled:                    Yes

        Data Link Encapsulation...          PPP
        Data Link Options...


        IP Profile Parameters...









        COMMIT                              CANCEL

Return accepts * ESC cancels * Left/Right moves insertion point * Del deletes.
Configure a new Conn. Profile. Finished?  COMMIT or CANCEL to exit.
```

On a Netopia 4752 SDSL Integrated Access Device you can add up to 15 more connection profiles, for a total of 16, but you can only use one at a time.

1. Select **Profile Name** and enter a name for this connection profile. It can be any name you wish. For example: the name of your ISP.
2. Toggle **Profile Enabled** to **Yes** or **No**. The default is Yes.

3. Select **Data Link Encapsulation** and press Return. The pop-up menu offers the possible data link encapsulation methods for connection profiles used for a variety of purposes: PPP, HDLC, Frame Relay, RFC1483, ATMP, PPTP, or IPsec. If you select any data link encapsulation method other than HDLC or RFC1483, a **Data Link Options** menu item is displayed; if you select HDLC or RFC1483, Data Link Options is hidden.
4. If you chose any data link encapsulation method other than HDLC or RFC1483 as your data link encapsulation method in the previous step, select **Datalink Options** and press Return. The Datalink Options screen appears.

```
                        Datalink (PPP/MP) Options

        Data Compression...              Standard LZS

        Send Authentication...           PAP

        Send User Name:
        Send Password:

        Receive User Name:
        Receive Password:




        Maximum Packet Size:             1500


In this Screen you will configure the PPP/MP specific connection params.
```

Select **Data Compression** and press Return. The pop-up menu offers the choices of None, Ascend LZS, or Standard LZS. Unless you are otherwise specifically directed, you can accept the default.

Select **Send Authentication** and press Return.

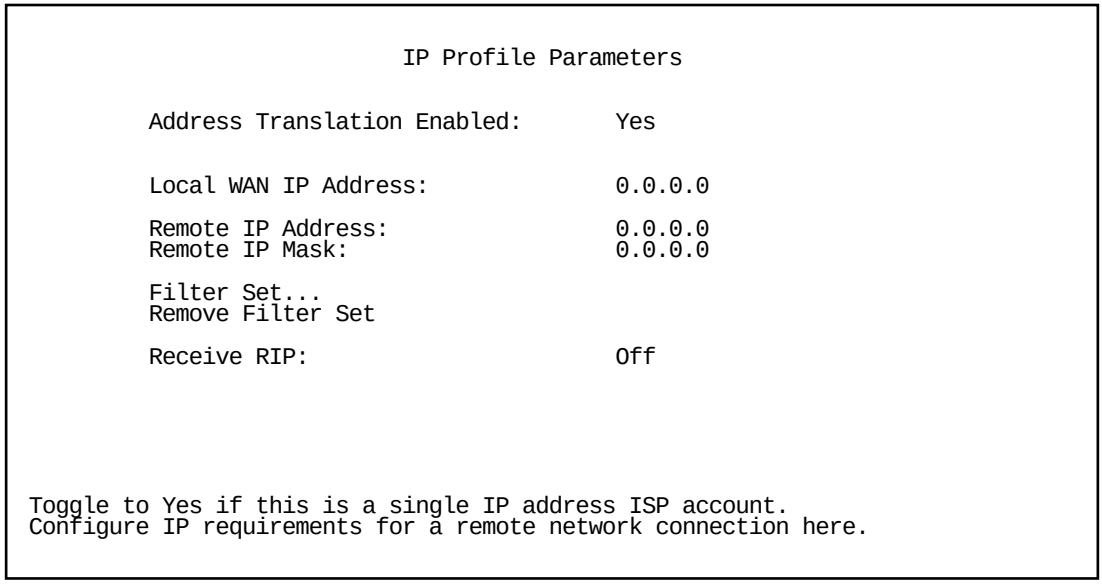
From the pop-up menu that appears, select the authentication method your ISP uses, if any: PAP (Password Authentication Protocol), CHAP (Challenge Handshake Authentication Protocol), or None.

- PAP is the most common, and requires you to enter a User Name and Password in the next two fields.
- CHAP requires you to enter a Host Name and Secret in the next two fields.

You can specify user name and password for both outgoing and incoming connections. the Send User Name/Password parameters are used to specify your identity when connecting to a remote location. The Receive User Name/Password parameters are used when receiving dial-in clients such as via RAS configuration.

5. You can edit the **Maximum Packet Size** field, if you want packets limited to a lower value than 1500.

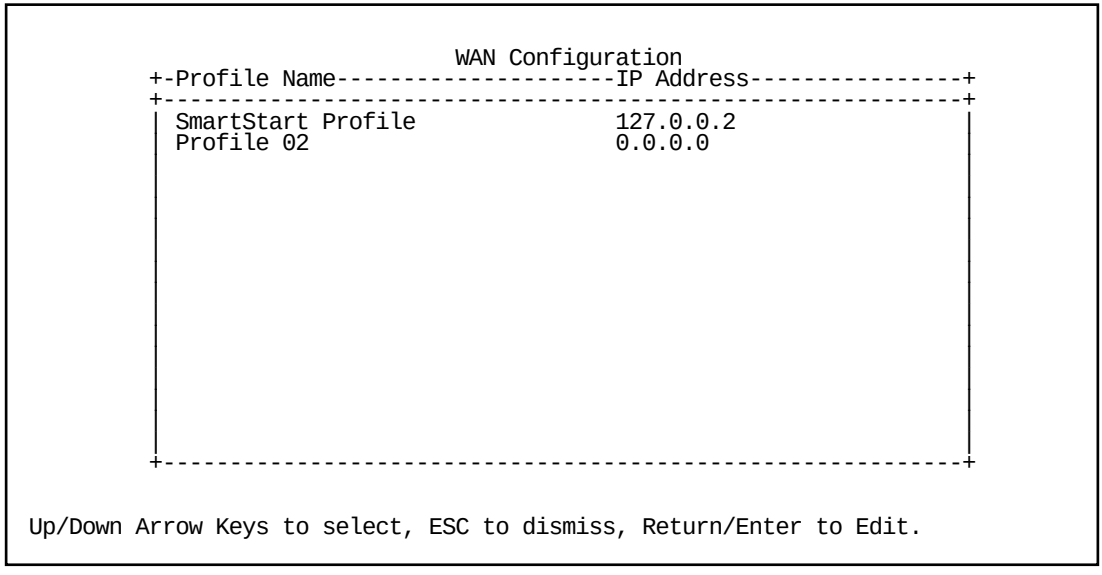
   Return to the Add Connection Profile screen by pressing Escape.
6. Select **IP Profile Parameters** and press Return. The IP Profile Parameters screen appears.



7. Toggle or enter any IP Parameters you require and return to the Add Connection Profile screen by pressing Escape. For more information, see “IP Setup” on page 10-1.

8. Select **COMMIT** and press Return. Your new Connection Profile will be added.

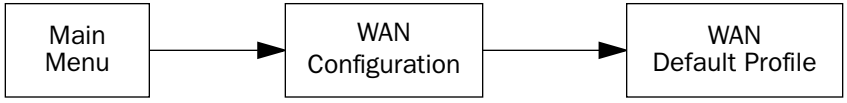
   If you want to view the Connection Profiles in your device, return to the WAN Configuration screen, and select **Display/Change Connection Profile**. The list of Connection Profiles is displayed in a scrolling pop-up screen.



The WAN Default Profile

If you are using RFC1483 datalink encapsulation, the WAN Default Profile screen controls whether or not the SDSL link will come up without an explicitly configured connection profile. (PPP datalink encapsulation does not support a default profile, and the corresponding menu item is unavailable.) See "Creating a New Connection Profile" on page 9-12 for more information.

You access the Default Profile screen from the Main Menu by selecting WAN Configuration and then selecting **Default Profile**.



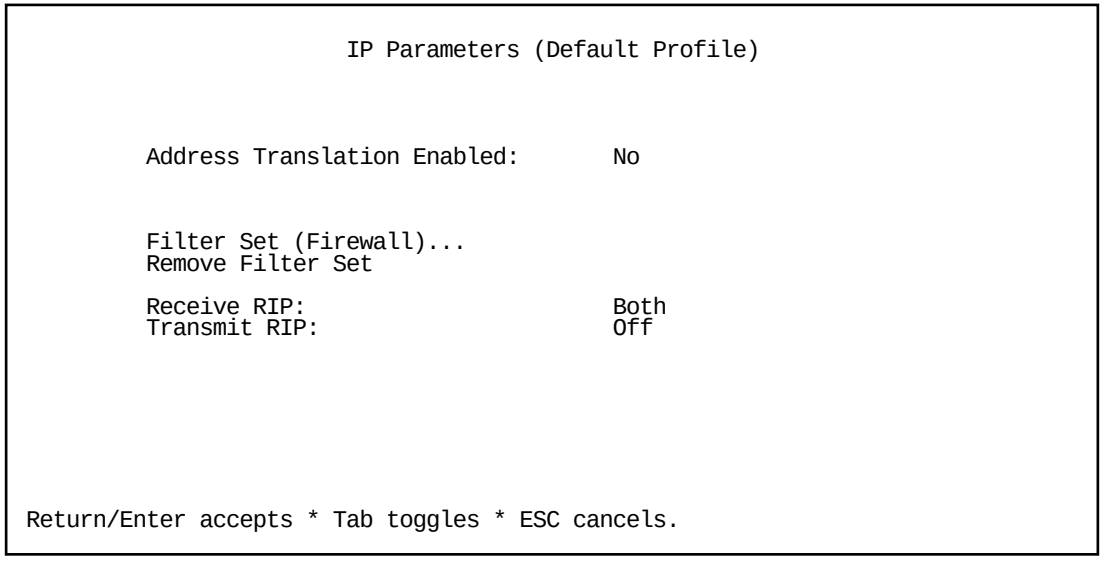
The Default Profile screen appears.

```
                          WAN Default Profile

        Must Match a Defined Profile:      No

        IP Parameters...









Return/Enter accepts * Tab toggles * ESC cancels.
Configure Default WAN Connection Parameters here.
```

- You can set **Must Match a Defined Profile** item to **Yes** or **No** (the default). This item controls whether or not the SDSL link will come up without an explicitly configured connection profile. If your ISP is serving you a dynamic IP Address, you need not explicitly configure a connection profile, and the default behavior of the device will be to connect automatically once it is powered on.
- If you select **IP Parameters** the IP Parameters screen appears (see "IP Parameters (Default Profile) screen" on page 9-16). This screen allows you to configure various IP parameters for SDSL connections established without an explicitly configured connection profile.

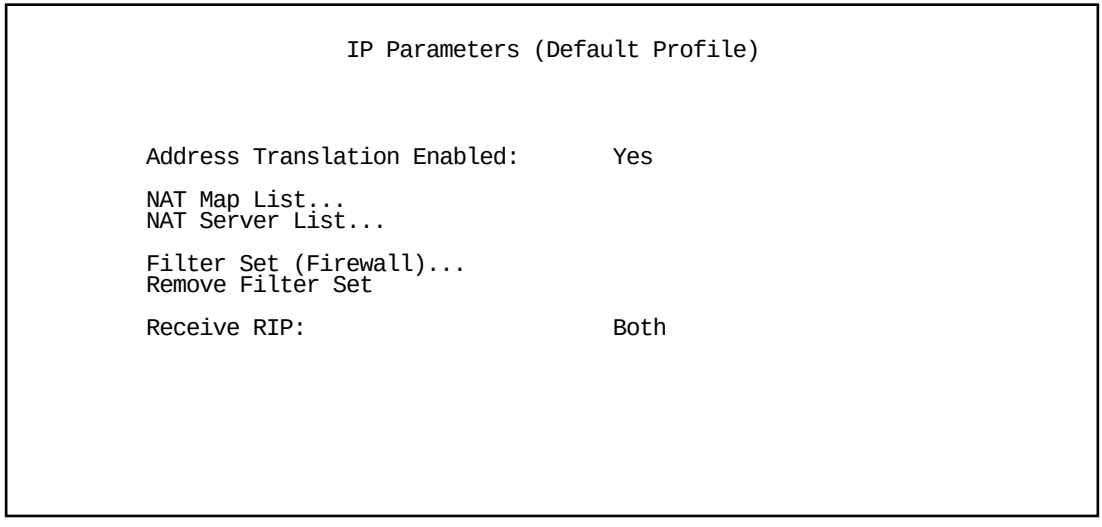
IP Parameters (Default Profile) screen

If you are using RFC1483 datalink encapsulation, the IP Parameters (Default Profile) screen allows you to configure various IP parameters for SDSL connections established without an explicitly configured connection profile:



For most DSL links, Network Address Translation (NAT) is disabled by default in the Default Profile, unless you use HDLC (Copper Mountain) operation Mode with RFC1483 as the data link encapsulation method. You can enable it by toggling to Yes.

If you use HDLC (Copper Mountain) operation Mode with RFC1483 as the data link encapsulation method, NAT is enabled by default, as shown below.



For details on setting up IP Parameters see “IP Setup” on page 10-1.

The ATMP/PPTP Default Profile

The ATMP/PPTP Default Profile screen controls whether or not your device will answer VPN connection attempts without an explicitly configured connection profile. See "Virtual Private Networks (VPNs)" on page 12-1 for more information.

System Configuration Screens

You can connect to the Netopia 4752's system configuration screens in either of two ways:

- By using Telnet with the device's Ethernet port IP address
- Through the console port, using a local terminal (see "Connecting a Console Cable to Your Device" on page 6-3)

You can also retrieve the Netopia 4752's configuration information and remotely set its data routing parameters using the Simple Network Management Protocol (see "SNMP" on page 14-13).

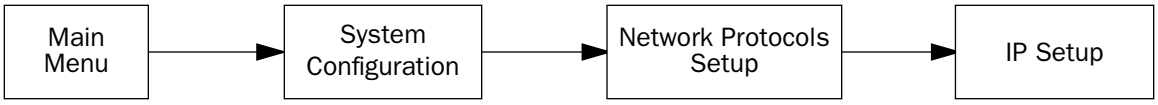
Open a Telnet connection to the device's IP address; for example, "192.168.1.1."

The console screen will open to the Main Menu, similar to the screen shown below:

```
                        Netopia 4752 v5.1

                    Easy Setup...
                    WAN Configuration...
                    System Configuration...
                    Voice Configuration...
                    Utilities & Diagnostics...
                    Statistics & Logs...
                    Quick Menus...
                    Quick View...


Return/Enter goes to Easy Setup -- minimal configuration.
You always start from this main screen.
```

Navigating through the System Configuration screens

To help you find your way to particular screens, some sections in this guide begin with a graphical path guide similar to the following example:



This particular path guide shows how to get to the Network Protocols Setup screens. The path guide represents these steps:

1. Beginning in the Main Menu, select **System Configuration** and press Return. The System Configuration screen appears.
2. Select **Network Protocols** and press Return. The Network Protocols screen appears.
3. Select **IP Setup** and press Return. The IP Setup screen appears.

To go back in this sequence of screens, use the Escape key.

System Configuration Features

The Netopia 4752 SDSL Integrated Access Device's default settings may be all you need to configure your Netopia 4752. Some users, however, require advanced settings or prefer manual control over the default selections. For these users, the Netopia 4752 provides system configuration options.

To help you determine whether you need to use the system configuration options, review the following requirements. If you have one or more of these needs, use the system configuration options described in later chapters.

- System configuration of dynamic IP address distribution through DHCP or BootP
- Greater network security through the use of filters
- System configuration of connection profiles

To access the system configuration screens, select **System Configuration** in the Main Menu, then press Return.

The System Configuration menu screen appears:

```
                          System Configuration

                    IP Setup...
                    Filter Sets...
                    IP Address Serving...

                    Date and Time...

                    Console Configuration...

                    SNMP (Simple Network Management Protocol)...

                    Security...

                    Upgrade Feature Set...


                    Logging...

Use this screen if you want options beyond Easy Setup.
```

IP setup

These screens allow you to configure your network's use of the standard networking protocol:

- IP: Details are given in "IP Setup" on page 10-2.

Filter sets

These screens allow you to configure security on your network by means of filter sets and a basic firewall.

- Details are given in "Security" on page 13-1.

IP address serving

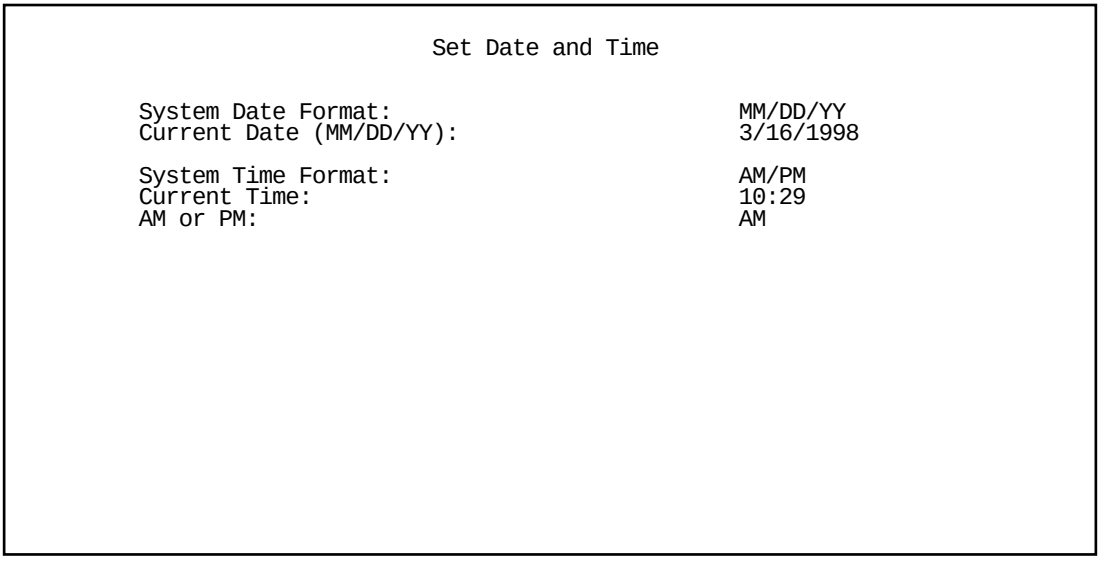
These screens allow you to configure IP address serving on your network by means of DHCP, WANIP, and BootP.

- Details are given in "IP Address Serving" on page 10-10.

Date and time

You can set the system's date and time in the Set Date and Time screen.

Select **Date and Time** in the System Configuration screen and press Return. The Set Date and Time screen appears.



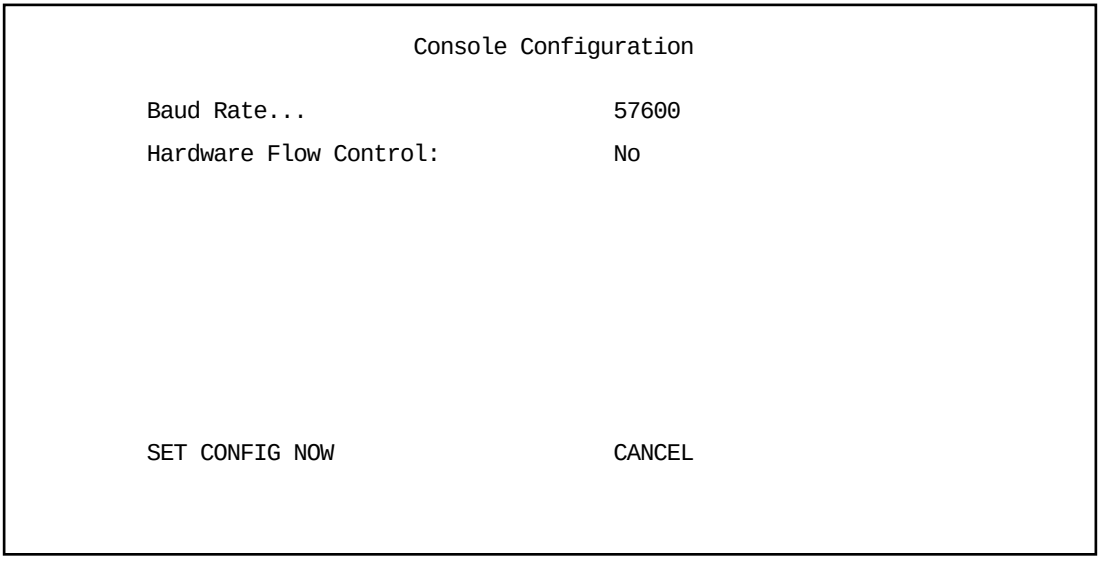
Follow these steps to set the system's date and time:

1. Select **Current Date** and enter the date in the appropriate format. Use one- or two-digit numbers for the month and day, and the last two digits of the current year. The date's numbers must be separated by forward slashes (/).
2. Select **Current Time** and enter the time in the format HH:MM, where HH is the hour (using either the 12-hour or 24-hour clock) and MM is the minutes.
3. Select **AM or PM** and choose **AM** or **PM**.

Console configuration

You can change the default terminal communications parameters to suit your requirements.

To go to the Console Configuration screen, select **Console Configuration** in the System Configuration screen.



Follow these steps to change a parameter's value:

1. Select the parameter you want to change.
2. Select a new value for the parameter. Return to step 1 if you want to configure another parameter.
3. Select **SET CONFIG NOW** to save the new parameter settings. Select **CANCEL** to leave the parameters unchanged and exit the Console Configuration screen.

SNMP (Simple Network Management Protocol)

These screens allow you to monitor and configure many of the data routing features of your network by means of a standard Simple Network Management Protocol (SNMP) agent.

- Details are given in "SNMP" on page 14-13.

Security

These screens allow you to add users and define passwords on your network.

- Details are given in "Security" on page 13-1.

Upgrade feature set

You can upgrade your Netopia 4752 by adding new feature sets through the Upgrade Feature Set utility.

See the release notes that came with your device or feature set upgrade, or visit the Netopia Web site at www.netopia.com for information on new feature sets, how to obtain them, and how to install them on your Netopia 4752.

Logging

You can configure a UNIX-compatible syslog client to report a number of subsets of the events entered in the device's WAN Event History. See "WAN Event History" on page 14-5.

The Syslog client (for the PC only) is supplied as a .ZIP file on the Netopia CD.

Select **Logging** from the System Configuration menu.

The Logging Configuration screen appears.

```
                          Logging Configuration


        WAN Event Log Options
        Log Boot and Errors:              Yes
        Log Line Specific:                Yes
        Log Connections:                  Yes
        Log PPP, DHCP, CNA:               Yes
        Log IP:                           Yes

        Syslog Parameters
        Syslog Enabled:                   No
        Hostname or IP Address:
        Facility...                       Local 0




Return/Enter accepts * Tab toggles * ESC cancels.
```

By default, all events are logged in the event history.

- By toggling each event descriptor to either **Yes** or **No**, you can determine which ones are logged and which are ignored.
- You can enable or disable the syslog client dynamically. When enabled, it will report any appropriate and previously unreported events.
- You can specify the syslog server's address either in dotted decimal format or as a DNS name up to 63 characters.
- You can specify the UNIX syslog Facility to use by selecting the **Facility** pop-up.

Installing the Syslog client

The Goodies folder on the Netopia CD contains a Syslog client daemon program that can be configured to report the WAN events you specified in the Logging Configuration screen.

To install the Syslog client daemon, exit from the graphical Netopia CD program and locate the CD directory structure through your Windows desktop or through Windows Explorer. Go to the Goodies directory on the CD and locate the Sds15000.exe program. This is the Syslog daemon installer. Run the Sds15000.exe program and follow the on-screen instructions for enabling the Windows Syslog daemon.

The following screen shows a sample syslog dump of WAN events:

```
May  5 10:14:06 tsnext.netopia.com   Link 1 down: PPP PAP failure
May  5 10:14:06 tsnext.netopia.com >>Issued Speech Setup Request from our DN: 5108645534
May  5 10:14:06 tsnext.netopia.com   Requested Disc. from DN: 917143652500
May  5 10:14:06 tsnext.netopia.com   Received Clear Confirm for our DN: 5108645534
May  5 10:14:06 tsnext.netopia.com   Link 1 down: Manual disconnect
May  5 10:14:06 tsnext.netopia.com >>Issued Speech Setup Request from our DN: 5108645534
May  5 10:14:06 tsnext.netopia.com   Requested Disc. from DN: 917143652500
May  5 10:14:06 tsnext.netopia.com   Received Clear Confirm for our DN: 5108645534
May  5 10:14:06 tsnext.netopia.com   Link 1 down: No answer
May  5 10:14:06 tsnext.netopia.com --Device restarted----------------------------------------
May  5 10:14:06 tsnext.netopia.com >>Received Speech Setup Ind. from DN: (not supplied)
May  5 10:14:06 tsnext.netopia.com   Requested Connect to our DN: 5108645534
May  5 10:14:06 tsnext.netopia.com   ASYNC: Modem carrier detected (more) Modem reports: 26400 V34
May  5 10:14:06 tsnext.netopia.com >>WAN: 56K Modem 1 activated at 115 Kbps
May  5 10:14:06 tsnext.netopia.com   Connect Confirmed to our DN: 5108645534
May  5 10:14:06 tsnext.netopia.com   PPP: Channel 1 up, Answer Profile name: Default Profile
May  5 10:14:06 tsnext.netopia.com   PPP: NCP up, session 1, Channel 1 Final (fallback) negotiated
auth: Local PAP , Remote NONE
May  5 10:14:06 tsnext.netopia.com   PPP: PAP  we accepted remote, Channel 1 Remote name: guest
May  5 10:14:06 tsnext.netopia.com   PPP: MP negotiated, session 1 Remote EDO: 06 03 0000C5700624 0
May  5 10:14:06 tsnext.netopia.com   PPP: CCP negotiated, session 1, type: Ascend LZS Local mode:
1, Remote mode: 1
May  5 10:14:06 tsnext.netopia.com   PPP: BACP negotiated, session 1 Local MN: FFFFFFFF, Remote
MN: 00000001
May  5 10:14:06 tsnext.netopia.com   PPP: IPCP negotiated, session 1, rem: 192.168.10.100 local:
192.168.1.1
May  5 10:14:06 tsnext.netopia.com >>WAN: 56K Modem 1 deactivated
May  5 10:14:06 tsnext.netopia.com   Received Clear Ind. from DN: 5108645534, Cause: 0
May  5 10:14:06 tsnext.netopia.com   Issued Clear Response to DN: 5108645534
May  5 10:14:06 tsnext.netopia.com   Link 1 down: Remote clearing
May  5 10:14:06 tsnext.netopia.com   PPP: IPCP down, session 1
May  5 10:14:06 tsnext.netopia.com >>Received Speech Setup Ind. from DN: (not supplied)
```

Chapter 10

IP Setup

The Netopia 4752 uses Internet Protocol (IP) to communicate both locally and with remote networks. This chapter shows you how to configure the router to route IP traffic. You also learn how to configure the router to serve IP addresses to hosts on your local network.

Netopia's IP routing features Network Address Translation, Virtual Private Networking (VPNs), and IP address serving.

This section covers the following topics:

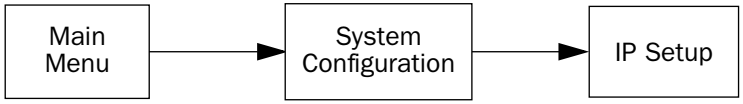
Network Address Translation allows communication between the LAN connected to the Netopia 4752 and the Internet using a single (or a few) IP address(es) instead of a routed account with separate IP addresses for each computer on the network.

Network Address Translation also provides increased security by hiding the local IP addresses of the LAN connected to the Netopia 4752 from the outside world.

The setup is simpler, so ISPs typically offer Internet accounts supporting Network Address Translation at a significant cost savings.

For a detailed discussion of Network Address Translation, see Chapter 11, "Multiple Network Address Translation."

IP Setup



The IP Setup options screen is where you configure the Ethernet side of the Netopia 4752. The information you enter here controls how the router routes IP traffic.

Consult your network administrator or ISP to obtain the IP setup information (such as the Ethernet IP address, Ethernet subnet mask, default IP gateway, and Primary Domain Name Server IP address) you will need before changing any of the settings in this screen. Changes to these settings that you make in this screen will take effect only after the Netopia 4752 is reset.

To go to the IP Setup options screen, from the Main Menu, select **System Configuration**, then **IP Setup**.

The IP Setup screen appears.

```
                                IP Setup

        Ethernet IP Address:                192.128.117.162
        Ethernet Subnet Mask:               255.255.255.0
        Define Additional Subnets...

        Default IP Gateway:                 192.128.117.163
        Backup IP Gateway:                  0.0.0.0
        Primary Domain Name Server:         0.0.0.0
        Secondary Domain Name Server:       0.0.0.0
        Domain Name:                        yourdomain.com

        Receive RIP...                      Both
        Transmit RIP...                     Off



     Static Routes...                          IP Address Serving...
     Network Address Translation (NAT)...      Filter Sets...

Set up the basic IP attributes of your Netopia in this screen.
```

Follow these steps to configure IP setup for your Netopia 4752:

- Select **Ethernet IP Address** and enter the IP address for the Netopia 4752's Ethernet port.
- Select **Ethernet Subnet Mask** and enter the subnet mask for the Ethernet IP address that you entered in the last step.
- If you desire multiple subnets select **Define Additional Subnets**. If you select this item you will be taken to the IP Subnets screen. This screen allows you to define IP addresses and masks for additional subnets. See "IP subnets" on page 10-4 for details.

The Netopia 4752 SDSL Integrated Access Device supports multiple IP subnets on the Ethernet interface. You may want to configure multiple IP subnets to service more hosts than are possible with your primary subnet. It is not always possible to obtain a larger subnet from your ISP. For example, if you already have a full Class C subnet, your only option is multiple Class C subnets, since it is virtually impossible to justify a Class A or Class B assignment.

If you are using NAT, you can use the reserved Class A or Class B subnet.

- Select **Default IP Gateway** and enter the IP address for a default gateway. This can be the address of any major router accessible to the Netopia 4752.

  A default gateway should be able to successfully route packets when the Netopia 4752 cannot recognize the intended recipient's IP address. A typical example of a default gateway is the ISP's router.

- Select **Primary Domain Name Server** and enter the IP address for a domain name server. The domain name server matches the alphabetic addresses favored by people (for example, robin.hood.com) to the IP addresses actually used by IP routers (for example, 163.7.8.202).

- If a secondary DNS server is available, select **Secondary Domain Name Server** and enter its IP address. The secondary DNS server is used by the Netopia 4752 when the primary DNS server is inaccessible. Entering a secondary DNS is useful but not necessary.

- Select **Domain Name** and enter your network's domain name (for example, netopia.com). Netopia strongly recommends that you enter a domain name.

- Routing Information Protocol (RIP) is needed if there are IP routers on other segments of your Ethernet network that the Netopia 4752 needs to recognize. If this is the case select **Receive RIP** and select **v1**, **v2**, or **Both** from the pop-up menu. With Receive RIP set to v1, the Netopia 4752's Ethernet port will accept routing information provided by RIP packets from other routers that use the same subnet mask. Set to v2, the Netopia 4752 will accept routing information provided by RIP packets from other routers that use different subnet masks. Set to Both, the Netopia 4752 will accept information from either RIP v1 or v2 routers.

- If you want the Netopia 4752 to advertise its routing table to other routers via RIP, select **Transmit RIP** and select **v1**, **v2 (broadcast)**, or **v2 (multicast)** from the pop-up menu. With Transmit RIP v1 selected, the Netopia 4752 will generate RIP packets only to other RIP v1 routers. With Transmit RIP v2 (broadcast) selected, the Netopia 4752 will generate RIP packets to all other hosts on the network. With Transmit RIP v2 (multicast) selected, the Netopia 4752 will generate RIP packets only to other routers capable of recognizing RIP v2 packets.

- Select **Static Routes** to manually configure IP routes. See the section "Static routes," below.

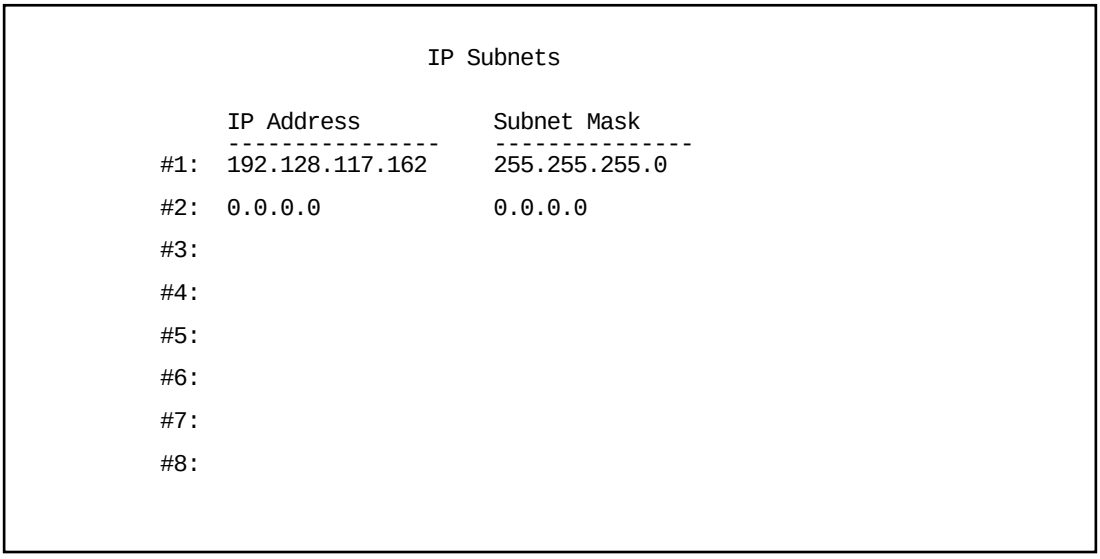
- Select **Network Address Translation** to configure advanced MultiNAT features. See "Multiple Network Address Translation" on page 11-1.

- If you select **IP Address Serving** you will be taken to the IP Address Serving screen (see "IP Address Serving" on page 10-10). Since no two hosts can use the same IP address at the same time, make sure that the addresses distributed by the Netopia 4752 and those that are manually configured are not the same. Each method of distribution must have its own exclusive range of addresses to draw from.

- If you select **Filter Sets** you will be taken directly to the screen for configuring IP packet filters. For information see "About Filters and Filter Sets," beginning on page 13-4.

IP subnets

The IP Subnets screen allows you to configure up to eight Ethernet IP subnets on unlimited-user models, one "primary" subnet and up to seven secondary subnets, by entering IP address/subnet mask pairs:

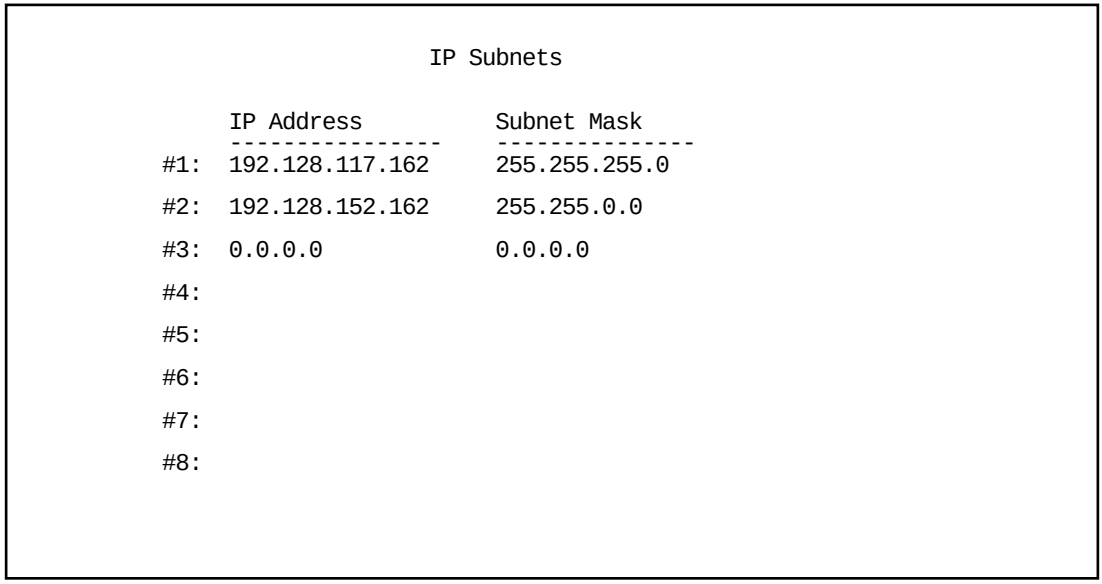


Note: You need not use this screen if you have only a single Ethernet IP subnet. In that case, you can continue to enter or edit the IP address and subnet mask for the single subnet on the IP Setup screen.

This screen displays up to eight rows of two editable columns, preceded by a row number between one and eight. If you have eight subnets configured, there will be eight rows on this screen. Otherwise, there will be one more row than the number of configured subnets. The last row will have the value 0.0.0.0 in both the IP address and subnet mask fields to indicate that you can edit the values in this row to configure an additional subnet. All eight row labels are always visible, regardless of the number of subnets configured.

- To add an IP subnet, enter the Netopia 4752's IP address on the subnet in the **IP Address** field in a particular row and the subnet mask for the subnet in the **Subnet Mask** field in that row.

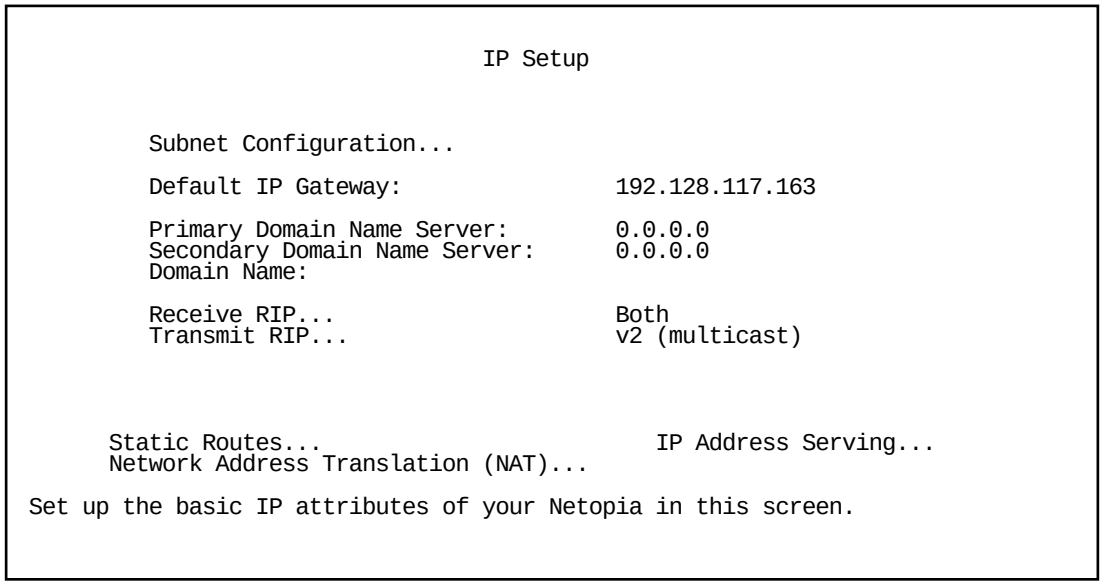
For example:



- To delete a configured subnet, set both the IP address and subnet mask values to 0.0.0.0, either explicitly or by clearing each field and pressing Return to commit the change. When a configured subnet is deleted, the values in subsequent rows adjust up to fill the vacant fields.

The subnets configured on this screen are tied to the address serving pools configured on the IP Address Pools screen, and that changes on this screen may affect the IP Address Pools screen. In particular, deleting a subnet configured on this screen will delete the corresponding address serving pool, if any, on the IP Address Pools screen.

If you have configured multiple Ethernet IP subnets, the IP Setup screen changes slightly:



The IP address and Subnet mask items are hidden, and the **Define Additional Subnets...** item becomes **Subnet Configuration...**. If you select **Subnet Configuration**, you will return to the IP Subnets screen that allows you to define IP addresses and masks for additional Ethernet IP subnets.

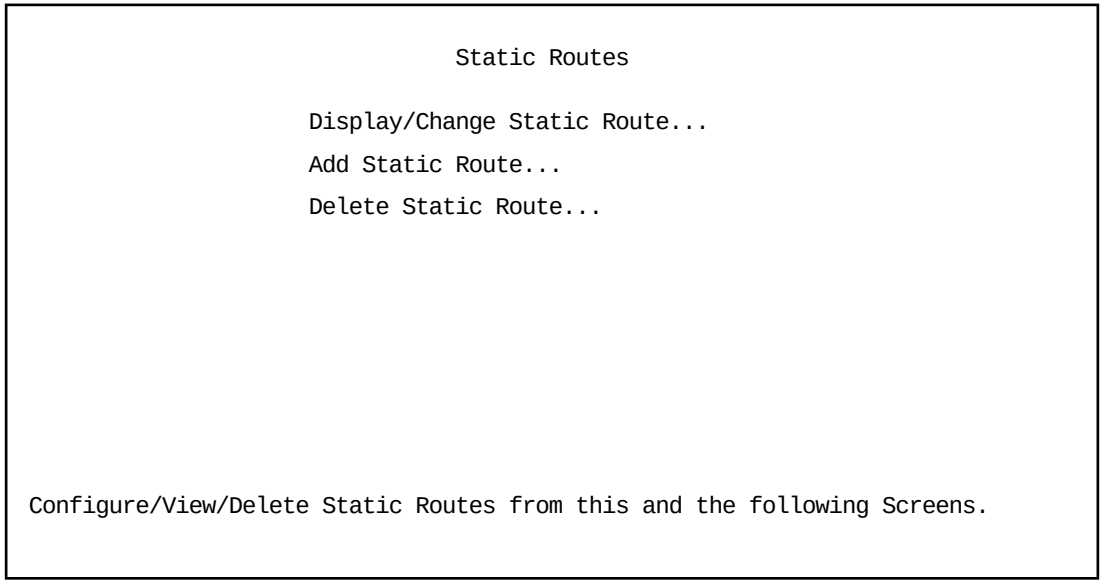
Static routes

Static routes are IP routes that are maintained manually. Each static route acts as a pointer that tells the Netopia 4752 how to reach a particular network. However, static routes are used only if they appear in the IP routing table, which contains all of the routes used by the Netopia 4752 (see "IP Routing Table" on page 14-9).

Static routes are helpful in situations where a route to a network must be used and other means of finding the route are unavailable. For example, static routes are useful when you cannot rely on RIP.

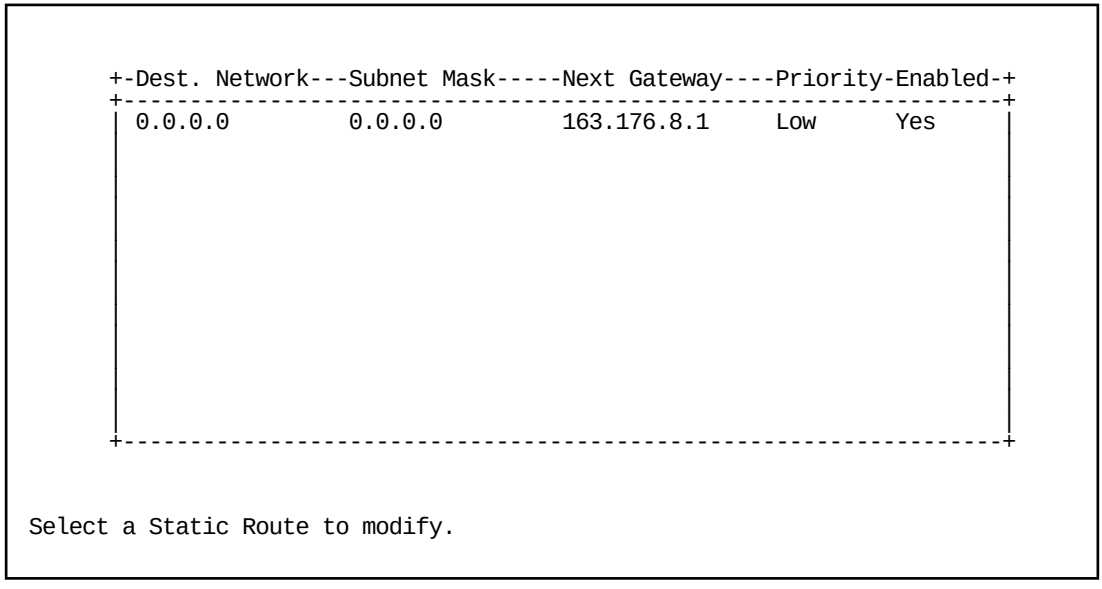
To go to the Static Routes screen, select **Static Routes** in the IP Setup screen and press Return.

The Static Routes screen will appear.



Viewing static routes

To display a view-only table of static routes, select **Display/Change Static Route**. The table shown below will appear.



The table has the following columns:

Dest. Network: The network IP address of the destination network.

Subnet Mask: The subnet mask associated with the destination network.

Next Gateway: The IP address of the router that will be used to reach the destination network.

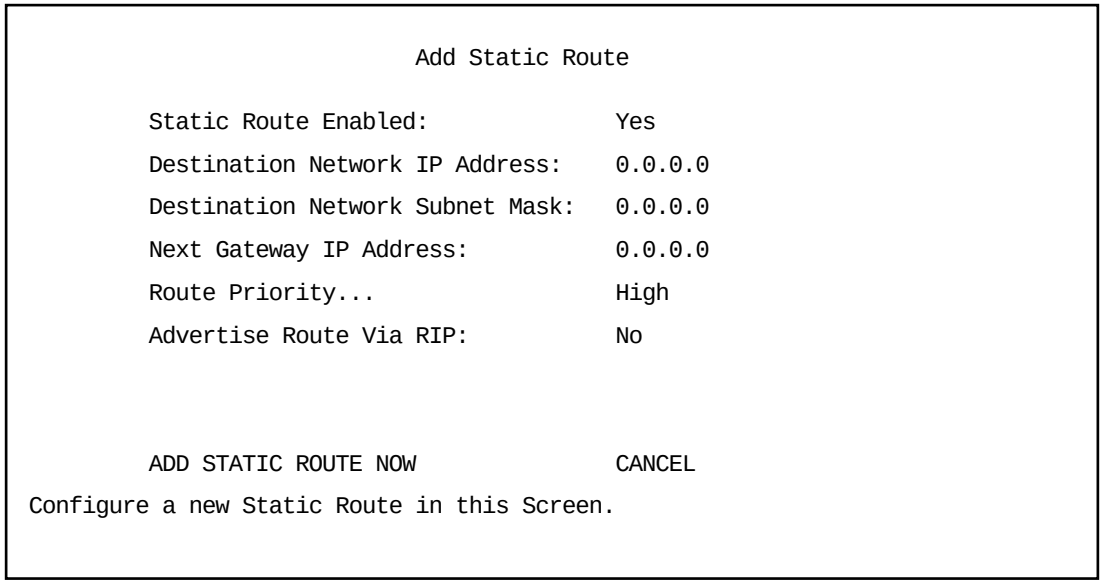
Priority: An indication of whether the Netopia 4752 will use the static route when it conflicts with information received from RIP packets.

Enabled: An indication of whether the static route should be installed in the IP routing table.

To return to the Static Routes screen, press Escape.

Adding a static route

To add a new static route, select **Add Static Route** in the Static Routes screen. The Add Static Route screen will appear.



- To install the static route in the IP routing table, select **Static Route Enabled** and toggle it to **Yes**. To remove the static route from the IP routing table, select **Static Route Enabled** and toggle it to **No**.
- Be sure to read the rules on the installation of static routes in the IP routing table. See "Rules of static route installation" on page 10-9.
- Select **Destination Network IP Address** and enter the network IP address of the destination network.
- Select **Destination Network Subnet Mask** and enter the subnet mask used by the destination network.
- Select **Next Gateway IP Address** and enter the IP address for the router that the Netopia 4752 will use to reach the destination network. This router does not necessarily have to be part of the destination network, but it must at least know where to forward packets destined for that network.
- Select **Route Priority** and choose **High** or **Low**. High means that the static route takes precedence over RIP

information; Low means that the RIP information takes precedence over the static route.

- If the static route conflicts with a connection profile, the connection profile will always take precedence.
- To make sure that the static route is known only to the Netopia 4752, select **Advertise Route Via RIP** and toggle it to **No**. To allow other RIP-capable routers to know about the static route, select **Advertise Route Via RIP** and toggle it to **Yes**. When Advertise Route Via RIP is toggled to **Yes**, a new item called **RIP Metric** appears below **Advertise Route Via RIP**.

  With RIP Metric you set the number of routers, from 1 to 15, between the sending router and the destination router. The maximum number of routers on a packet's route is 15. Setting **RIP Metric** to **1** means that a route can involve 15 routers, while setting it to **15** means a route can only involve one router.
- Select **ADD STATIC ROUTE NOW** to save the new static route, or select **CANCEL** to discard it and return to the Static Routes screen.
- Up to 32 static routes can be created, but one is always reserved for the default gateway, which is configured using either Easy Setup or the IP Setup screen in system configuration.

Modifying a static route

To modify a static route, in the Static Routes screen select **Display/Change Static Route** to display a table of static routes.

Select a static route from the table and go to the Change Static Route screen. The parameters in this screen are the same as the ones in the Add Static Route screen (see "Adding a static route" on page 10-8).

Deleting a static route

To delete a static route, in the Static Routes screen select **Delete Static Route** to display a table of static routes. Select a static route from the table and press Return to delete it. To exit the table without deleting the selected static route, press Escape.

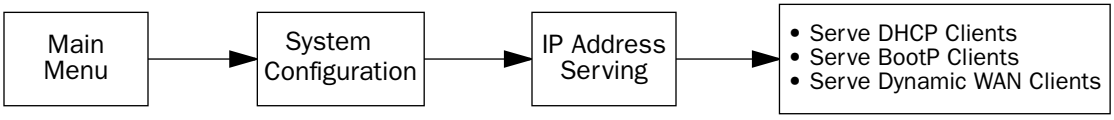
Rules of static route installation

The Netopia 4752 applies certain rules before installing enabled static routes in the IP routing table. An enabled static route will not be installed in the IP routing table if any of the following conditions are true:

- The static route's **Next Gateway IP Address** matches an IP address in the range of IP addresses being distributed by DHCP.
- The static route's **Next Gateway IP Address** is determined to be unreachable by the Netopia 4752.
- The static route's route information conflicts with a connection profile's route information.
- The connection profile associated with the static route has a disabled dial-on-demand setting, and there is no current connection using that connection profile.

A static route that is already installed in the IP routing table will be removed if any of the conditions listed above become true for that static route. However, an enabled static route is automatically reinstalled once the conditions listed above are no longer true for that static route.

IP Address Serving



In addition to being a router, the Netopia 4752 is also an IP address server. There are three protocols it can use to distribute IP addresses.

- The first, called Dynamic Host Configuration Protocol (DHCP), is widely supported on PC networks, as well as Apple Macintosh computers using Open Transport and computers using the UNIX operating system. Addresses assigned via DHCP are “leased” or allocated for a short period of time; if a lease is not renewed, the address becomes available for use by another computer. DHCP also allows most of the IP parameters for a computer to be configured by the DHCP server, simplifying setup of each machine.
- The second, called BootP (also known as Bootstrap Protocol), is the predecessor to DHCP and allows older IP hosts to obtain most of the information that a DHCP client would obtain. However, in contrast, BootP address assignments are “permanent” since there is no lease renewal mechanism in BootP.
- The third protocol, called Dynamic WAN, is part of the PPP/MP suite of wide area protocols used for WAN connections. It allows remote terminal adapters and NAT-enabled routers to be assigned a temporary IP address for the duration of their connection.

Since no two hosts can use the same IP address at the same time, make sure that the addresses distributed by the Netopia 4752 and those that are manually configured are not the same. Each method of distribution must have its own exclusive range of addresses to draw from.

Go to the System Configuration screen. Select **IP Address Serving** and press Return. The IP Address Serving screen will appear.

```
                        IP Address Serving
                                    +--------------------+
                                    +--------------------+
IP Address Serving Mode...          | Disabled           |
                                    | DHCP Server        |
Number of Client IP Addresses:      | DHCP Relay Agent   |
1st Client Address:                 +--------------------+
Client Default Gateway...             192.168.1.1


Serve DHCP Clients:                   Yes
DHCP Lease Time (Hours):              1
DHCP NetBIOS Options...

Serve BOOTP Clients:                  Yes

Serve Dynamic WAN Clients             Yes
```

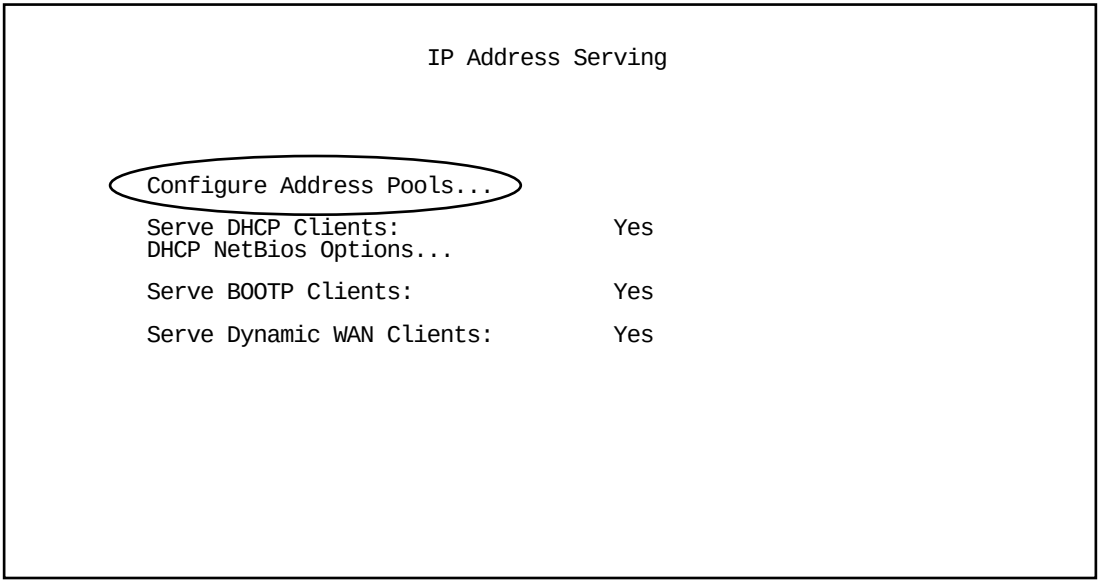
Follow these steps to configure IP Address Serving:

- If you enabled IP Address Serving, then DHCP, BootP clients and Dynamic WAN clients are automatically enabled.
- The **IP Address Serving Mode** pop-up menu allows you to choose the way in which the Netopia 4752 will serve IP addresses. The device can act as either a DHCP Server or a DHCP Relay Agent. (See "DHCP Relay Agent" on page 10-23 for more information.) In most cases, you will use the device to serve its own pool of IP addresses, hence DHCP Server is the default. Address serving can also be disabled.
- Select **Number of Client IP Addresses** and enter the total number of contiguous IP addresses that the Netopia 4752 will distribute to the client machines on your local area network. Twelve-user models are limited to twelve IP addresses.

  In the screen example shown above, five Client IP addresses have been allocated.
- Select **1st Client Address** and enter the first client IP address that you will allocate to your first client machine. For instance, on your local area network you may want to first figure out which machines are going to be allocated specific static IP addresses so that you can determine the pool of IP addresses that you will be serving addresses from via DHCP, BootP, and/or Dynamic WAN.

  Example: Your ISP has given your Netopia 4752 the IP address 192.168.6.137, with a subnet mask of 255.255.255.248. The subnet mask allocated will give you six IP addresses to use when connecting to the ISP over the Internet (for more information on IP addressing refer to Appendix C, "Understanding IP Addressing."). Your address range will be from **.137-.143**. In this example you would enter **192.168.6.138** as the 1st Client Address, since the router itself must have an IP address.
- To enable DHCP, select **Serve DHCP Clients** and toggle it to **Yes**. DHCP serving is automatic when IP Address Serving is enabled.
- The default DHCP Lease time is one hour. This may be unnecessarily brief in your network environment. Consequently, the DHCP lease time is now configurable. The **DHCP Lease Time (Hours)** setting allows you to modify the router's default lease time of one hour. You can enter any number up to and including 168 hours (one week) for the DHCP lease.

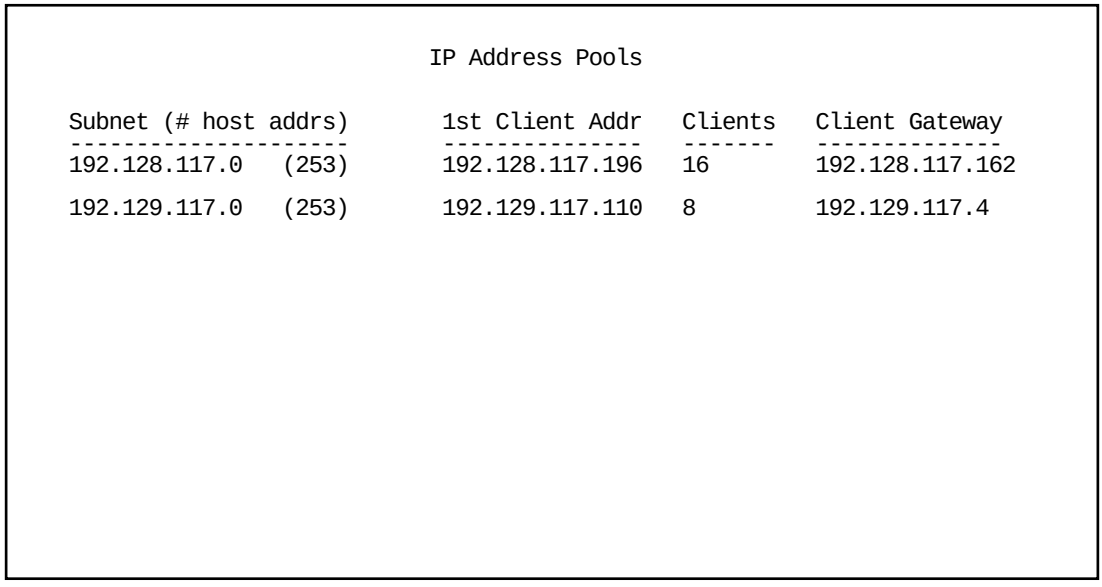
If you have configured multiple Ethernet IP subnets, the appearance of the IP Address Serving screen is altered slightly:



The first three menu items are hidden, and **Configure Address Pools...** appears instead. If you select **Configure Address Pools...** you will be taken to the IP Address Pools screen that allows you to configure an address serving pool for each of the configured Ethernet IP subnets. See “IP Address Pools” on page 10-13.

IP Address Pools

The IP Address Pools screen allows you to configure a separate IP address serving pool for each of up to eight configured Ethernet IP subnets:



This screen consists of between two and eight rows of four columns each. There are exactly as many rows as there are Ethernet IP subnets configured on the IP Subnets screen.

- The **Subnet (# host addrs)** column is non-selectable and non-editable. It indicates the network address of the Ethernet IP subnet for which an address pool is being configured and the number of host addresses available on the subnet. The network address is equal to the router's IP address on the subnet bitwise-ANDed with the subnet mask. The host address count is equal to the subnet size minus three, since one address is reserved for the network address, one for the subnet broadcast address, and one for the router's interface address on the subnet.

  You can edit the remaining columns in each row.

- The **1st Client Addr** and **Clients** columns allow you to specify the base and extent of the address serving pool for a particular subnet. Entering 0.0.0.0 for the first client address or 0 for the number of clients indicates that no addresses will be served from the corresponding Ethernet IP subnet.

- The Client Gateway column allows you to specify the default gateway address that will be provided to clients served an address from the corresponding pool. The value defaults to the Netopia 4752's IP address on the corresponding subnet (or the Netopia 4752's default gateway, if that gateway is located on the subnet in question). You can override the value by entering any address that is part of the subnet.

  DHCP, BootP, and dynamic WAN clients may receive an address from any one of the address serving pools configured on this screen.

Numerous factors influence the choice of served address. It is difficult to specify the address that will be served to a particular client in all circumstances. However, when the address server has been configured, and the clients involved have no prior address serving interactions, the Netopia 4752 will generally serve the first unused address from the first address pool with an available address. The Netopia 4752 starts from the pool on the first row and continues to the pool on the last row of this screen.

Once the address server and/or the clients have participated in address serving transactions, different rules apply:

- When requesting an address, a client will often suggest an address to be assigned, such as the one it was last served. The Netopia 4752 will attempt to honor this request if the address is available. The client stores this address in non-volatile storage, for example, on disk, and the specific storage method/location differs depending on the client operating system.
- When requesting an address, a client may provide a client identifier, or, if it does not, the Netopia 4752 may construct a pseudo-client identifier for the client. When the client subsequently requests an address, the Netopia 4752 will attempt to serve the address previously associated with the pseudo-client identifier. This is normally the last address served to the client.
- Otherwise, the Netopia will select the least-recently used available address, starting from the first address in the first pool and ending with the last address in the last pool.

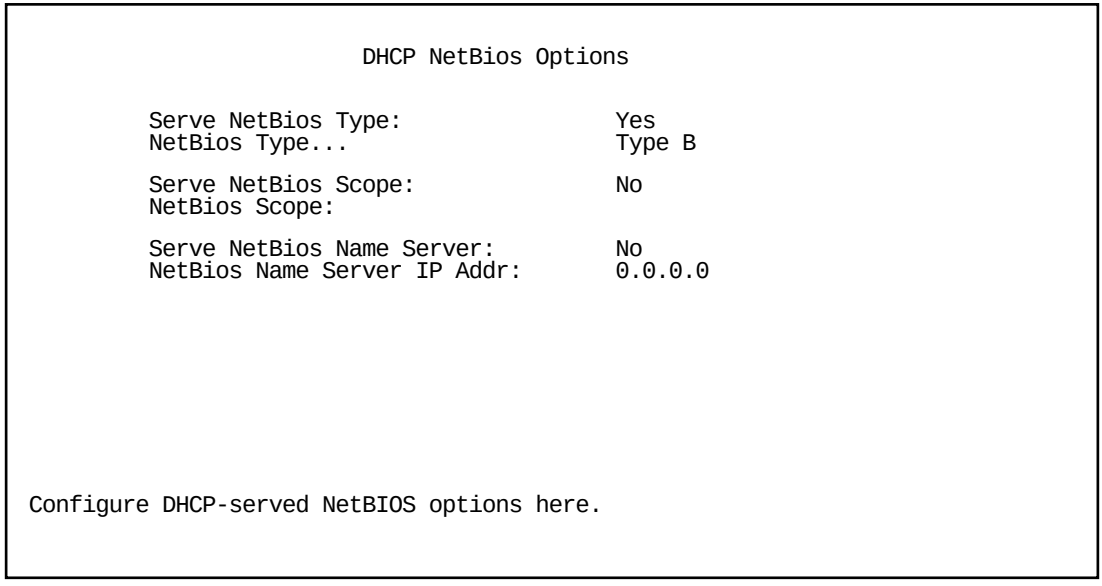
Note: The address serving pools on this screen are tied to the IP subnets configured on the IP Subnets screen. Changes to the IP Subnets screen may affect this screen. In particular, deleting a subnet on the IP Subnets screen will delete the corresponding address serving pool, if any, on this screen.

DHCP NetBIOS Options

If your network uses NetBIOS, you can enable the Netopia 4752 to use DHCP to distribute NetBIOS information.

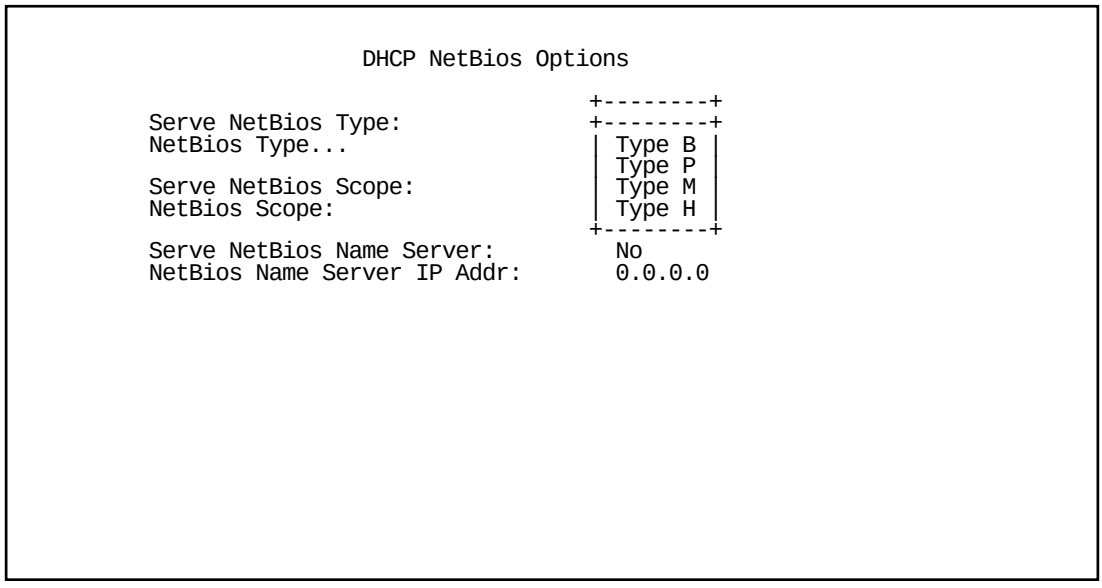
NetBIOS stands for Network Basic Input/Output System. It is a layer of software originally developed by IBM and Sytek to link a network operating system with specific hardware. NetBIOS has been adopted as an industry standard. It offers LAN applications a variety of “hooks” to carry out inter-application communications and data transfer. Essentially, NetBIOS is a way for application programs to talk to the network. To run an application that works with NetBIOS, a non-IBM network operating system or network interface card must offer a NetBIOS emulator. Many vendors either provide a version of NetBIOS to interface with their hardware or emulate its transport layer communications services in their network products. A NetBIOS emulator is a program provided by NetWare clients that allow workstations to run applications that support IBM’s NetBIOS calls.

- Select **DHCP NetBios Options** and press Return. The DHCP NetBIOS Options screen appears.



- To serve DHCP clients with the type of NetBIOS used on your network, select **Serve NetBios Type** and toggle it to **Yes**.

- From the **NetBios Type** pop-up menu, select the type of NetBIOS used on your network.



- To serve DHCP clients with the NetBIOS scope, select **Serve NetBios Scope** and toggle it to **Yes**.

  Select **NetBios Scope** and enter the scope.

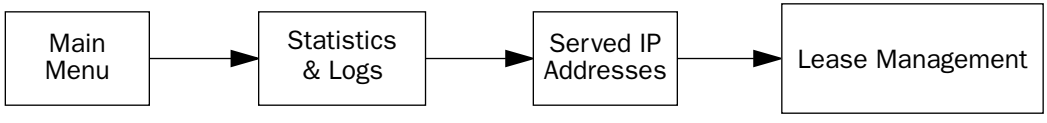
- To serve DHCP clients with the IP address of a NetBIOS name server, select **Serve NetBIOS Name Server** and toggle it to **Yes**.

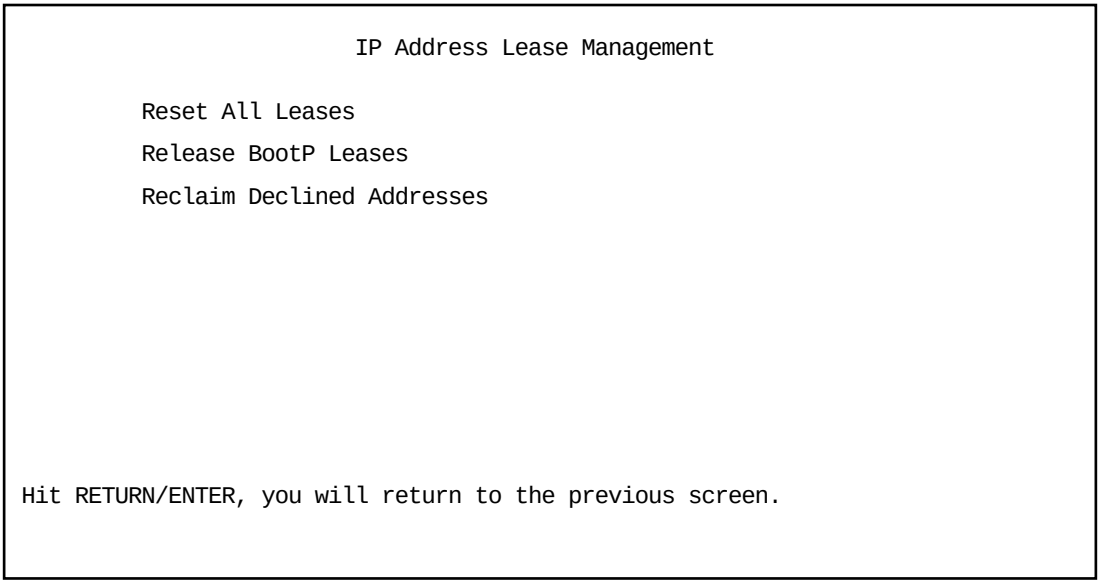
  Select **NetBios Name Server IP Addr** and enter the IP address for the NetBIOS name server.

  You are now finished setting up DHCP NetBIOS Options. To return to the IP Address Serving screen, press Escape.

- To enable BootP's address serving capability, select **Serve BOOTP Clients** and toggle to **Yes**.

  Note: Addresses assigned through BootP are permanently allocated from the IP Address Serving pool until you release them. To release these addresses, navigate back to the Main Menu, then Statistics & Logs, Served IP Addresses, and Lease Management.





Select **Release BootP Leases** and press Return.

More Address Serving Options

The Netopia 4752 includes a number of enhancements in the built-in DHCP IP address server. These enhancements include:

- The ability to exclude one or more IP addresses from the address serving pool so the addresses will not be served to clients.
- The ability to reserve a particular IP address for a client with a particular Ethernet MAC address.
- The ability to view the host name associated with a client to which the router has leased an IP address.
- The ability for the router's Ethernet IP address(es) to overlap the DHCP address serving pool(s).
- The ability to serve as a DHCP Relay Agent.

The Netopia 4752 supports reserving an IP address only for a type 1 client identifier (i.e., an Ethernet hardware address). It does not support reserving an IP address for an arbitrary client identifier. (For more information on client identifiers, see RFC 2131, section 9.14.)

Configuring the IP Address Server options

To access the enhanced DHCP server functions, from the Main Menu navigate to **Statistics & Logs** and then **Served IP Addresses**.

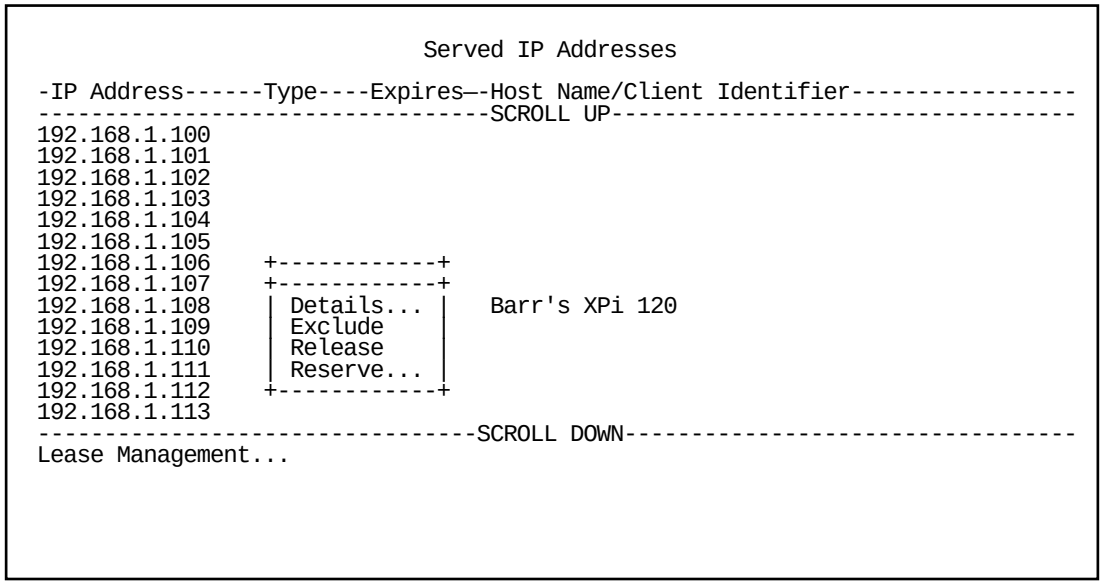
The following example shows the Served IP Addresses screen after three clients have leased IP addresses. The first client did not provide a Host Name in its DHCP messages; the second and third clients did.

```
                              Served IP Addresses

-IP Address------Type----Expires—-Host Name/Client Identifier-----------------
---------------------------------SCROLL UP-----------------------------------
192.168.1.100
192.168.1.101
192.168.1.102
192.168.1.103    DHCP    00:59    EN: 00-00-C5-70-00-04
192.168.1.104    DHCP    00:59    Bill's Pentium
192.168.1.105    DHCP    00:45    Steve's Power Mac
192.168.1.106
192.168.1.107
192.168.1.108
192.168.1.109
192.168.1.110
192.168.1.111
192.168.1.112
192.168.1.113
---------------------------------SCROLL DOWN---------------------------------
Lease Management...
```

The rightmost column displays the host name supplied by the client if one was provided; otherwise it displays the client identifier. (If a host name is displayed, the client identifier is still accessible in a Details pop-up menu. See below.)

Note: The server does not query the client for its host name. Macintosh computers running versions of MacOS prior to MacOS version 8.5 (OT 2.0.1, TCP/IP 2.0.1) do not supply a host name option in their DHCP messages, so no host name will appear in the Served IP Addresses list.

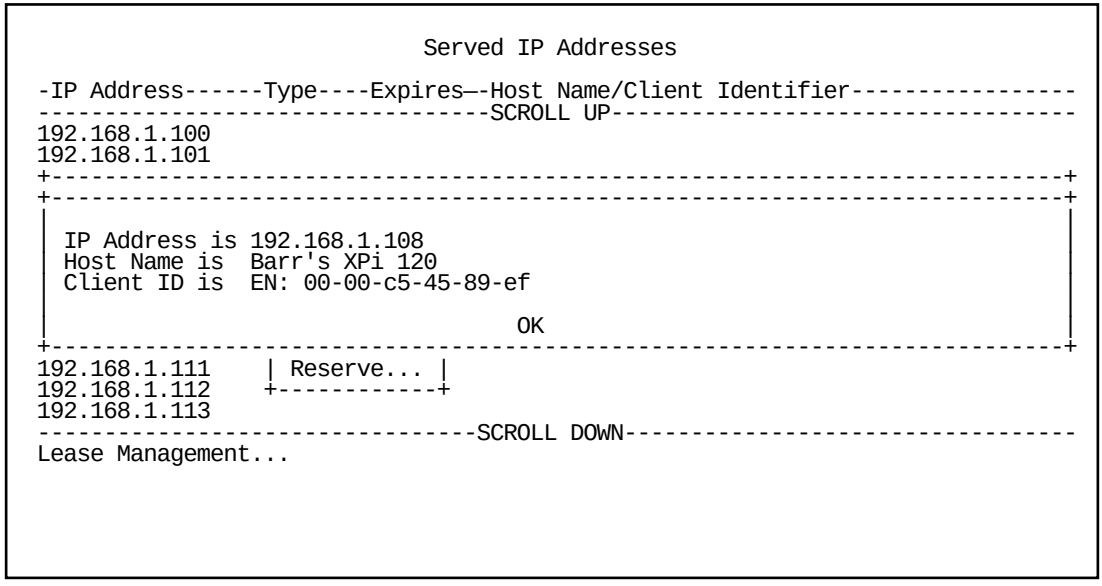
You can select the entries in the Served IP Addresses screen. Use the up and down arrow keys to move the selection to one of the entries in the list of served IP addresses.



Once you select an entry, pressing Return displays an action pop-up menu that lists operations that can be performed on that entry. Possible operations are **Details...**, **Exclude**, **Include**, **Release**, and **Reserve...** The action popup is context-sensitive and lists only those operations that apply to the selected IP address in its current lease state.

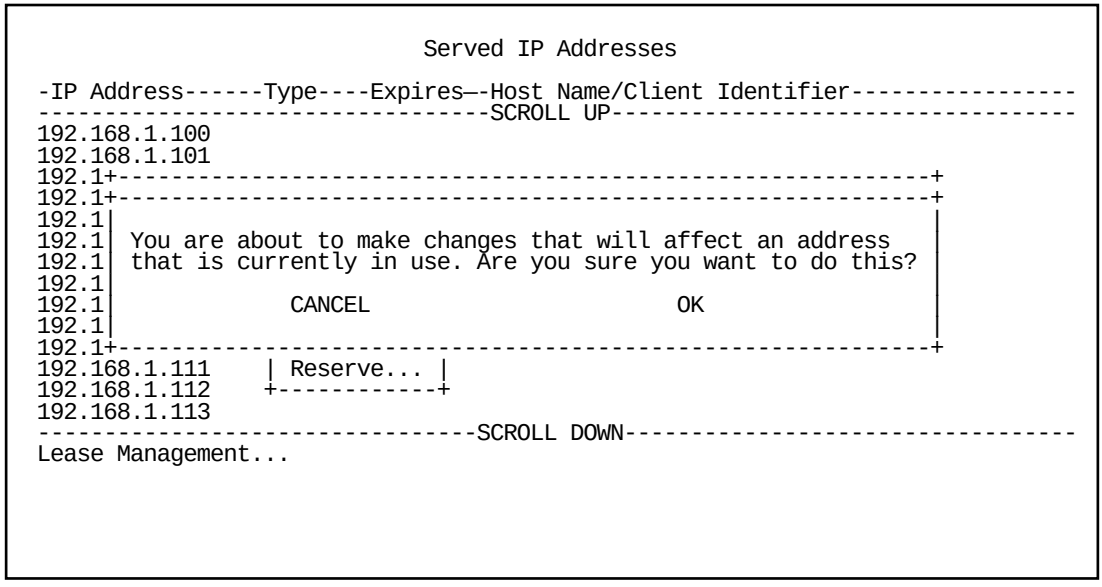
- **Details...** is displayed if the entry is associated with both a host name and a client identifier.

  Selecting **Details...** displays a pop-up menu that provides additional information associated with the IP address. The pop-up menu includes the IP address as well as the host name and client identifier supplied by the client to which the address is leased.



- **Exclude** is displayed if the entry is not already excluded.

  Selecting **Exclude** excludes the IP address from the address serving pool so the address will not be served to a client. If the IP address is currently leased to or reserved for a client, you will be presented with a warning dialog asking you to confirm the operation.



- **Include** is displayed if the entry is either excluded or declined.

  An IP address is marked declined when a client to whom the DHCP server offers the address declines the address. A client declines an address if it determines that a leased address is already in use by another device.

  Selecting **Include** restores the selected IP address to the address serving pool so that the IP address is once again eligible to be served to a client.

- **Release** is displayed if the entry is currently offered, leased, or reserved.

  Selecting **Release** puts the selected entry in the available state. You will be presented with a warning dialog asking you to confirm the operation since the IP address is in use. There is no mechanism to notify the client to whom the address is leased that the lease has been terminated. Thus, the client will continue to use the address until the next time it attempts to renew its lease. In the interim, the server may lease the same IP address to a different client, thereby creating an address conflict. For this reason, releasing an address that is actively being used by a client is generally not recommended.

- **Reserve...** is displayed if the entry is available, declined, excluded, leased, offered, or reserved.

  Reserving an IP address for a client with a particular Ethernet MAC address guarantees that a client with the specified MAC address will be offered or leased the specified IP address. Moreover, it prevents the specified IP address from being offered or leased to any other client.

  Selecting **Reserve...** displays a pop-up dialog box that displays the IP address and editable item in which you can enter an Ethernet MAC address. The pop-up dialog box includes **OK** and **CANCEL** buttons for confirming or cancelling the operation. If the IP address is currently offered or leased to, or reserved for, a client, you will be presented with a warning dialog asking you to confirm the operation. Reserving an IP address guarantees that the IP address will only be leased.

```
                              Served IP Addresses

 -IP Address------Type----Expires—-Host Name/Client Identifier-----------------
 ---------------------------------SCROLL UP-------------------------------------
 192.168.1.100
 192.168.1.101
 192.168.1.102   +--------------------------------------+
 192.168.1.103   +--------------------------------------+
 192.168.1.104   |                                      |
 192.168.1.105   | IP Address is 192.168.1.108          |
 192.168.1.106   | MAC Address:  00-00-c5-45-89-ef      |
 192.168.1.107   |                                      |
 192.168.1.108   |          CANCEL       OK             |
 192.168.1.109   |                                      |
 192.168.1.110   |                                      |
 192.168.1.111   +--------------------------------------+
 192.168.1.112    +------------+
 192.168.1.113
 ---------------------------------SCROLL DOWN-----------------------------------
 Lease Management...
```

The router's Ethernet IP address(es) will be automatically excluded from the address serving pool(s) on startup. Entries in the served IP address list corresponding to the router's Ethernet IP address(es) that have been automatically excluded on startup are not selectable.

```
                              Served IP Addresses

 -IP Address------Type----Expires--Host Name/Client Identifier-----------------
 ---------------------------------SCROLL UP-------------------------------------
 192.168.1.1      Excluded for the router's IP address
 192.168.1.2      Excluded
 192.168.1.3      DHCP    00:24    Barr's XPi 120
 192.168.1.4
 192.168.1.5
 192.168.1.6
 192.168.1.7
 192.168.1.8
 192.168.1.9
 192.168.1.10
 192.168.1.11
 192.168.1.12
 192.168.1.13
 192.168.1.14
 ---------------------------------SCROLL DOWN-----------------------------------
 Lease Management...

Hit RETURN/ENTER for available operations.
```

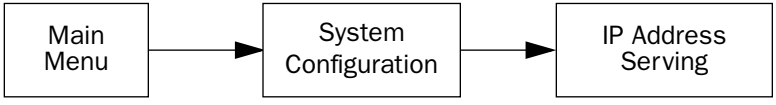
DHCP Relay Agent

The Netopia 4752 offers DHCP Relay Agent functionality, as defined in RFC1542. A DHCP relay agent is a computer system or a router that is configured to forward DHCP requests from clients on the LAN to a remote DHCP server, and to pass the replies back to the requesting client systems.

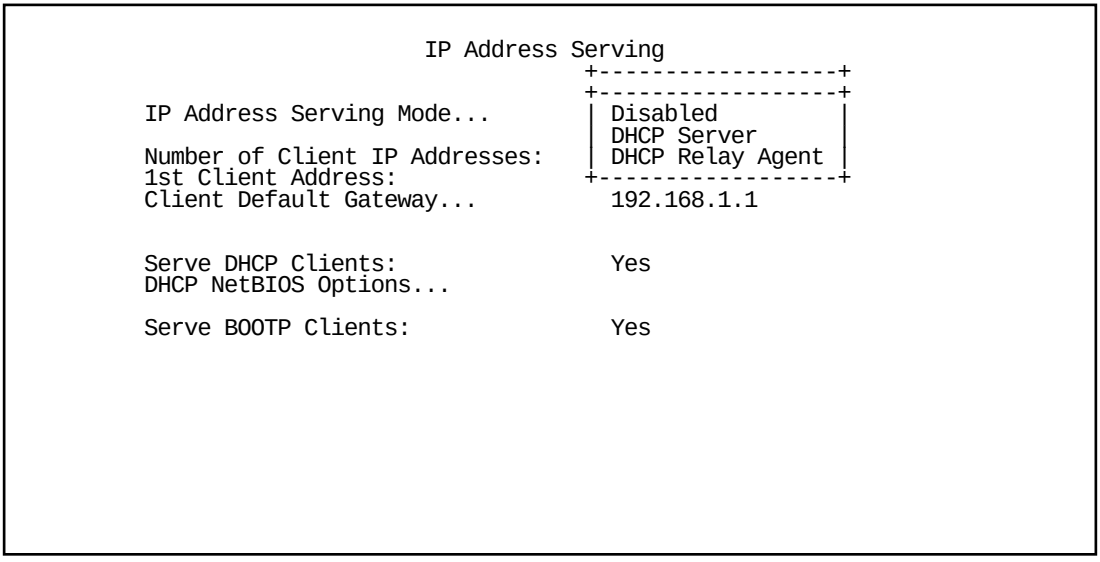
When a DHCP client starts up, it has no IP address, nor does it know the IP address of a DHCP server. Therefore, it uses an IP broadcast to communicate with one or more DHCP servers. These broadcasts are normally limited to the network segment on which the client is located, and do not pass through routers such as the Netopia Router. If the Netopia Router is configured to act as a DHCP server, it will assign the client an address from an address pool configured locally in the Netopia Router and respond to the client's request itself.

However, if the Netopia Router is configured to act as a DHCP relay agent, it does not satisfy the DHCP request itself, but instead forwards the request to one or more remote DHCP servers. These servers process the request, assign an address from an address pool configured on the remote server, and forward the response back to the Netopia Router for delivery back to the client. The agent then sends the response to the client on behalf of the DHCP server. This process is transparent to the client, which doesn't know that it is communicating through an intermediary rather than directly to a local server. Using DHCP relay, it is possible to centralize the configuration information for the host computers at many remote sites at a single location, easing the burden of administering configuration management for remote sites.

To configure the Netopia Router to act as a DHCP relay agent, from the Main Menu navigate to the System Configuration menu.

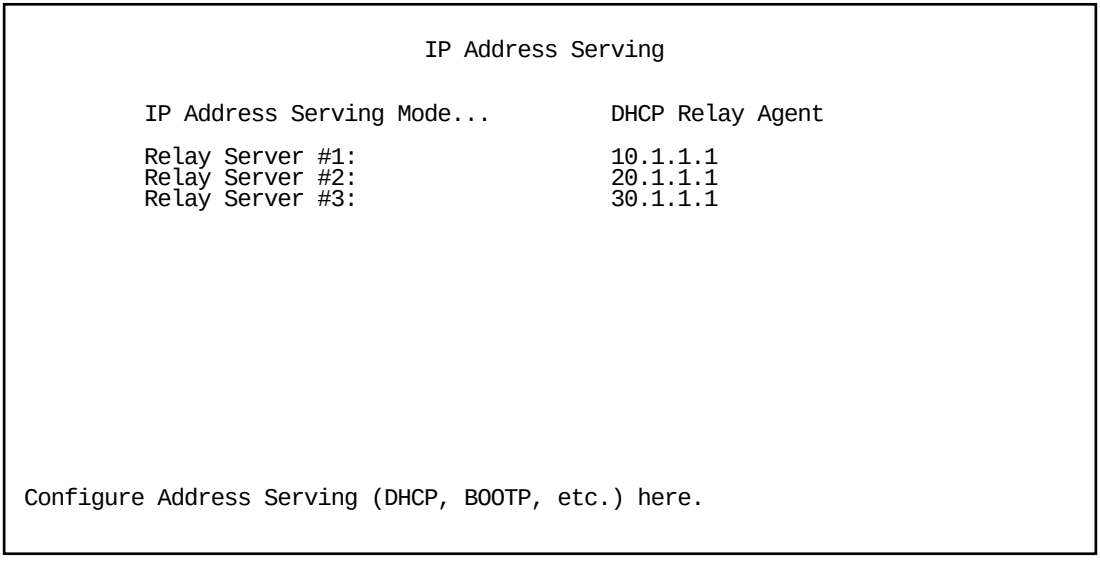


Select **IP Address Serving** and press Return. The IP Address Serving screen appears.



Select **IP Address Serving Mode**. The pop-up menu offers the choices of **Disabled**, **DHCP Server** (the default), and **DHCP Relay Agent**.

If you select DHCP Relay Agent and press Return, the screen changes as shown below.



Now you can enter the IP address(es) of your remote DHCP server(s), such as might be located in your company's corporate headquarters. Each time you enter an IP address and press Return, an additional field appears. You can enter up to four DHCP server addresses.

In the example above, DHCP requests from clients on the LAN will be relayed to the DHCP servers at IP addresses 10.1.1.1, 20.1.1.1, and 30.1.1.1.

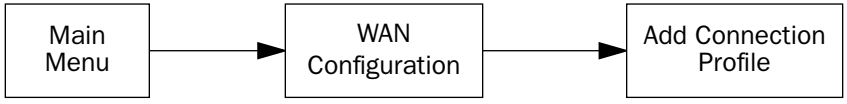
Note: The remote DHCP server(s) to which the Netopia Router is relaying DHCP requests must be capable of servicing relayed requests. Not all DHCP servers support this feature. For example, the DHCP server in the Netopia Router does *not*.

The DHCP server(s) to which the Netopia Router is relaying DHCP requests must be configured with one or more address pools that are within the Netopia Router's primary Ethernet LAN subnet. (There is no mechanism for DHCP clients to receive an address on a secondary subnet via a relayed DHCP request.)

Connection Profiles

Since you will probably only have a single connection to your ISP over the DSL link, you may not need to create multiple connection profiles. Additional profiles may be useful for creating VPNs.

Connection Profiles define the line and networking protocols necessary for the router to make a remote connection. A connection profile is like an address book entry describing how the router is to get to a remote site, or how to recognize and authenticate a remote user connecting to the router. To create a new Connection Profile, you navigate to the WAN Configuration screen from the Main Menu, and select **Add Connection Profile**.



The Add Connection Profile screen appears.

```
                          Add Connection Profile

          Profile Name:                       Profile 1
          Profile Enabled:                    Yes

          Data Link Encapsulation...          PPP
          Data Link Options...


          IP Profile Parameters...









          COMMIT                              CANCEL

 Configure a new Conn. Profile. Finished?  COMMIT or CANCEL to exit.
```

On a Netopia 4752 SDSL Integrated Access Device you can add up to 15 more connection profiles, for a total of 16, although only one can be used at a time, unless you are using VPNs.

1. Select **Profile Name** and enter a name for this connection profile. It can be any name you wish. For example: the name of your ISP.
2. Toggle the **Profile Enabled** value to **Yes** or **No**. The default is Yes.
3. Select **IP Profile Parameters** and press Return. The IP Profile Parameters screen appears.

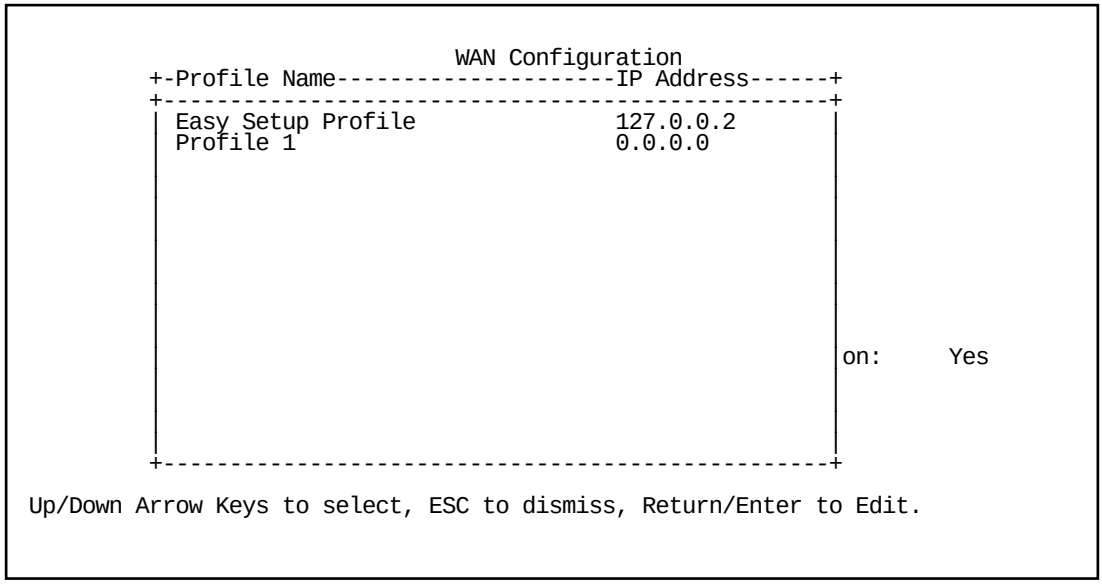
```
                          IP Profile Parameters

        Address Translation Enabled:       Yes
        IP Addressing...                   Numbered

        NAT Map List...                    Easy-PAT List
        NAT Server List...                 Easy-Servers

        Local WAN IP Address:              0.0.0.0
        Local WAN IP Mask:                 0.0.0.0
        Remote IP Address:                 0.0.0.0
        Remote IP Mask:                    0.0.0.0

        Filter Set...
        Remove Filter Set



        RIP Profile Options...

Configure IP requirements for a remote network connection here.
```

4. Toggle or enter any IP parameters you require and return to the Add Connection Profile screen by pressing Escape. For more information on NAT, see "Multiple Network Address Translation," beginning on page 11-1. For more information on IP addressing, see Appendix C, "Understanding IP Addressing."

   The Local WAN IP Address is displayed for numbered or NAT profiles. The Local WAN IP Mask is displayed for numbered profiles. The Remote IP Address and Remote IP Mask are displayed for unnumbered profiles.

5. Select **ADD PROFILE NOW** and press Return. Your new connection profile will be added.

   If you want to view the connection profiles in your router, return to the WAN Configuration screen, and select **Display/Change Connection Profile**. The list of connection profiles is displayed in a scrolling pop-up screen.



Chapter 11

Multiple Network Address Translation

The Netopia 4752 offers advanced Multiple Network Address Translation functionality.

You should read this chapter completely before attempting to configure any of the advanced NAT features.

This chapter covers the following topics:

Overview

NAT (Network Address Translation) is a means of mapping one or more IP addresses and/or IP service ports into different values. This *mapping* serves two functions:

- It allows the addresses of many computers on a LAN to be represented to the public Internet by only one or a few addresses, saving you money.
- It can be used as a security feature by obscuring the true addresses of important machines from potential hackers on the Internet.

To help you understand some of the concepts discussed here, it may be helpful to introduce some NAT terminology.

The term *mapping* refers to rules that associate one or more private addresses on the Netopia Router's LAN to one or more public addresses on the Netopia Routers WAN interface (typically the Internet).

The terms *private* and *internal* refer to addresses on the Netopia Router's LAN. These addresses are considered private because they are protected or obscured by NAT and cannot be directly accessed from the WAN (or Internet) side of the Netopia Router unless specifically configured otherwise.

The terms *public* and *external* refer to the WAN (or Internet) side of the Netopia Router.

Features

MultiNAT features can be divided into several categories that can be used simultaneously in different combinations on a per-Connection Profile basis.

The following is a general description of these features:

Port Address Translation

The simplest form of classic Network Address Translation is *PAT* (Port Address Translation). PAT allows a group of computers on a LAN, such as might be found in a home or small office, to share a single Internet connection using one IP address. The computers on the LAN can surf the Web, read e-mail, download files, etc., but their individual IP addresses are never exposed to the public network. Instead, a single IP address acts as the source IP address of traffic originating from the LAN. The Netopia Router allows you to define multiple PAT mappings, which can be individually mapped to different public IP addresses. This offers more control over the access permitted to users on the LAN.

A limitation of PAT is that communication must be initiated from the internal network. A user on the external side cannot access a machine behind a PAT connection. A PAT enhancement introduced in firmware version 4.4 is the ability to define multiple PAT mappings. Each of these can optionally map to a section or *range* of IP addresses of the internal network. PAT mapping allows only internal users to initiate traffic flow between the internal and external networks.

Server lists

Server lists, previously known as exported services, make it possible to provide access from the public network to hosts on the LAN. Server lists allow you to define particular services, such as Web, ftp, or e-mail, which are available via a public IP address. You define the type of service you would like to make available and the internal IP address to which you would like to provide access. You may also define a specific public IP address to use for this service if you want to use an IP other than the WAN IP address of the Netopia Router.

Static mapping

If you want to host your own Website or provide other Internet services to the public, you need more than classic NAT. The reason is noted under Port Address Translation above – external users cannot initiate traffic to computers on your LAN because external users can never see the real addresses of the computers on your LAN. If you want users outside your LAN to have access, for example, to a Web or FTP server that you host, you need to make a public representation of the real IP addresses of those servers.

Static mappings are a way to make one or more private IP addresses fully accessible from the public network via corresponding public IP addresses. Some applications may negotiate multiple TCP connections in the process of communication, which often does not work with traditional PAT. Static mapping offers the ability to use these applications through NAT. Each private IP address is mapped, on a one-to-one basis, to a public IP address that can be accessed from the Internet or public network. As with PAT mappings, you may have multiple static mappings to map a range of private IP addresses to a range of public IP addresses if desired.

Dynamic mapping

Dynamic mapping, often referred to as many-to-few, offers an extension to the advantages provided by static mapping. Instead of requiring a one-to-one association of public addresses and private addresses, as is required in static mapping, dynamic mapping uses a group of public IP addresses to dynamically allocate static mappings to private hosts that are communicating with the public network. If a host on the private network initiates a connection to the Internet, for example, the Netopia Router automatically sets up a one-to-one mapping of that host's private IP address to one of the public IP addresses allocated to be used for Dynamic NAT. As long as this host is communicating with the Internet, it will be able to use that address. When traffic from that host ceases, and no traffic is passed from that host for five minutes, the public address is made available again for other private hosts to use as necessary.

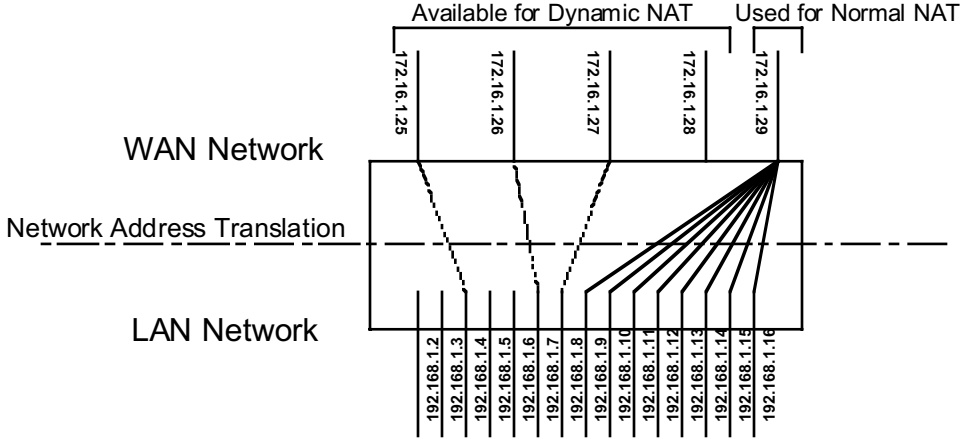
When addresses are returned to the group of available addresses, they are returned to the head of the group, being the most recently used. If that same host requests a connection an hour later, and the same public address is still available, then it will be mapped to the same private host. If a new host, which has not previously requested a connection, initiates a connection it is allocated the last, or oldest, public address available.

Dynamic NAT is a way of sharing a range of public, or exterior, NAT addresses among one or more *groups* of private, or interior, hosts. This is intended to provide superior support for applications that traditionally have difficulty communicating through NAT. Dynamic NAT is intended to provide functionality beyond many-to-one and one-to-one translation. Netopia's NAT implementation makes it possible to have a static mapping of one public address to one private address, thus allowing applications such as NetMeeting to work by assuring that any traffic sent back to the source IP address is forwarded through to the internal machine.

Static one-to-one mapping works well if you have enough IP addresses for all the workstations on your LAN. If you do not, Dynamic NAT allows machines to make full use of the publicly routable IP addresses provided by the ISP as necessary, on demand. When these public IP addresses are no longer being used by a particular workstation, they are returned to a pool of available addresses for other workstations to use.

A common example is a DSL customer's application. Most DSL ISPs only provide customers with a few IP addresses for use on their network. For networks with more than four or five machines it is usually mandatory to use NAT. A customer may have 15 workstations on the LAN, all of which need Internet access. The customer is only provided five IP addresses by their ISP. The customer has eight hosts, which only need to use email and have Web access, but another seven hosts, which use NetMeeting to communicate with clients once or twice a day. NetMeeting will not work unless a static one-to-one mapping exists for the machine running NetMeeting to use for communication. The customer does not have enough IP addresses to create a one-to-one mapping for each of the seven users. This is where dynamic NAT applies.

The customer can configure four of these addresses to be used for Dynamic NAT. The fifth address is then used for the eight other machines that do not need one-to-one mappings. As each machine configured to use addresses from the dynamic pool tries to connect to the Internet it is allocated a public IP address to use temporarily. Once the communication has been terminated, that IP address is freed for one of the other six hosts to use.



Exterior addresses are allocated to internal hosts on a demand, or as-needed, basis and then made available when traffic from that host ceases. Once an internal host has been allocated an address, it will use that address for all traffic. Five minutes after all traffic ceases – no pings, all TCP connections closed, no DNS requests, etc. – the address is put at the head of an *available* list. If an interior host needs an exterior address an hour later, and the previously used address is still available, it will acquire the same address. If an interior host that has not previously been allocated an exterior address needs one, it will be allocated the last, hence the oldest, exterior address on the available list.

All NAT configurations are *rule-based*. This means that traffic passed through NAT from either the public or the private network is compared to the rules and mappings configured in the Netopia Router in a particular order. The first rule that applies to the traffic being initiated is used.

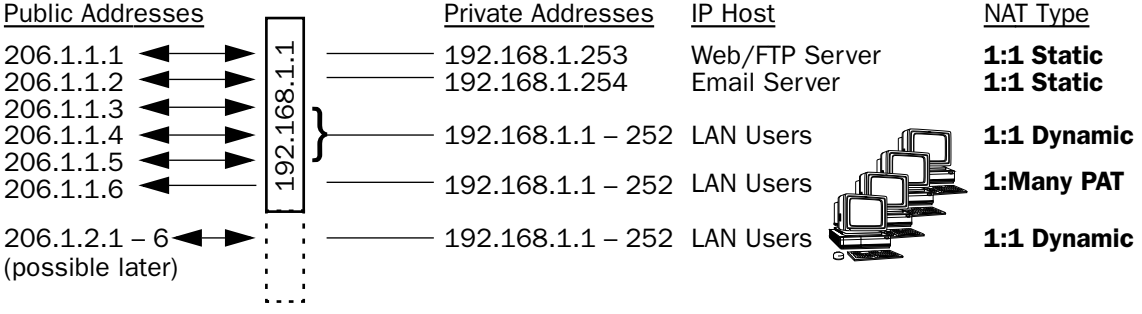
For example, if a connection is initiated from the public network and is destined for a public IP address configured on the Netopia Router, the following comparisons are made in this order.

1. The Netopia Router first checks its internal NAT cache to see if the data is part of a previously initiated connection, if not…
2. The Netopia Router checks the configured server lists to see if this traffic is intended to be forwarded to an internal host based on the type of service.
3. The Netopia Router then checks to see if there is a static, dynamic, or PAT mapping for the public IP address that the connection is being initiated to.
4. The Netopia Router answers the request itself if the data is destined for the Netopia's WAN interface IP address. Otherwise the data is discarded.

Complex maps

Map lists and server lists are completely independent of each other. A Connection Profile can use one or the other or both.

MultiNAT allows complex mapping and requires more complex configuration than in earlier firmware versions. Multiple mapped interior subnets are supported, and the rules for mapping each of the subnets may be different. The figure below illustrates a possible multiNAT configuration.



In order to support this type of mapping, you define two address ranges. First, you define a public range which contains the first and last public address to be used and the way in which these addresses should be used (PAT, static, or dynamic). You then configure an address map which defines the private IP address or addresses to be used and which public range they should be mapped to. You add the address map to the list of address maps which are configured, creating a map list. The mappings in the map list are order-dependent and are compared in order from the top of the list to the bottom. If a particular resource is not available, subordinate mappings can be defined that will redirect traffic.

Supported traffic

MultiNat supports the following IP protocols:

- PAT: TCP/UDP traffic which does not carry source or destination IP addresses or ports in the data stream (i.e., HTTP, Telnet, 'r' commands, tftp, NFS, NTP, SMTP, NNTP, etc.).
- Static NAT: All IP protocol traffic which does not carry or otherwise rely on the source or destination IP addresses in the data stream.
- Dynamic NAT: All IP protocol traffic which does not carry or otherwise rely on the source or destination IP addresses in the data stream.

MultiNAT Configuration

You configure the MultiNAT features through the console menu:

- For a simple 1-to-many NAT configuration (classic NAT or PAT), use the Easy Setup Profile configuration, described below.
- For the more advanced features, such as server lists and dynamic NAT, follow the instructions in:
  - IP setup, described on page 11-7
  - IP profile parameters, described on page 11-22

Easy Setup Profile configuration

The screen below is an example. Depending on the type of router you are using, fields displayed in this screen may vary.

```
                Connection Profile 1: Easy Setup Profile




        Address Translation Enabled:       Yes
        IP Addressing...                   Numbered

        Local WAN IP Address:              206.1.1.6
        Local WAN IP Mask:                 255.255.255.0
        Remote IP Address:                 127.0.0.2
        Remote IP Mask:                    255.255.255.255

        PPP Authentication...              PAP
        Send User Name:         tonyf
        Send Password:          ********************


        PREVIOUS SCREEN                    NEXT SCREEN

Return/Enter brings you to next screen.
```

The **Local WAN IP Address** is used to configure a NAT public address range consisting of the Local WAN IP Address and all its ports. The public address map list is named *Easy-PAT List* and the port map list is named *Easy-Servers*.

The two map lists, Easy-PAT List and Easy-Servers, are created by default and NAT configuration becomes effective.This will map all your private addresses (0.0.0.0 through 255.255.255.255) to your public address. These map lists are bound to the Easy Setup Profile. See Binding Map Lists and Server Lists on page 11-22.

This is all you need to do if you want to continue to use a single PAT, or 1-to-many, NAT configuration.

Server Lists and Dynamic NAT configuration

You use the advanced NAT feature sets by first defining a series of mapping rules and then grouping them into a *list*. There are two kinds of lists – *map lists*, made up of dynamic, PAT and static mapping rules, and *server lists*, a list of internal services to be presented to the external world. Creating these lists is a four-step process:

1. **Define the public range** of addresses that external computers should use to get to the NAT internal machines. These are the addresses that someone on the Internet would see.
2. **Create a List name** that will act as a rule or server holder.
3. **Create a *map* or rule** that specifies the internal range of NATed addresses and the external range they are to be associated with.
4. **Associate the Map or Server List to your WAN interface** via a Connection Profile or the Default Profile.

The three NAT features all operate completely independently of each other, although they can be used simultaneously on the same Connection Profile.

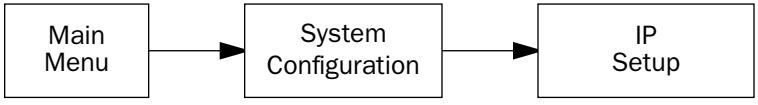
You can configure a simple 1-to-many PAT (often referred to simply as NAT) mapping using Easy Setup. More complex setups require configuration using the **Network Address Translation** item on the IP Setup screen.

An example MultiNAT configuration at the end of this chapter describes some applications for these features. See the MultiNAT Configuration Example on page 11-28.

In order to configure the router to make servers on your LAN visible to the Internet, you use advanced features in the System Configuration screens, described in IP setup.

IP setup

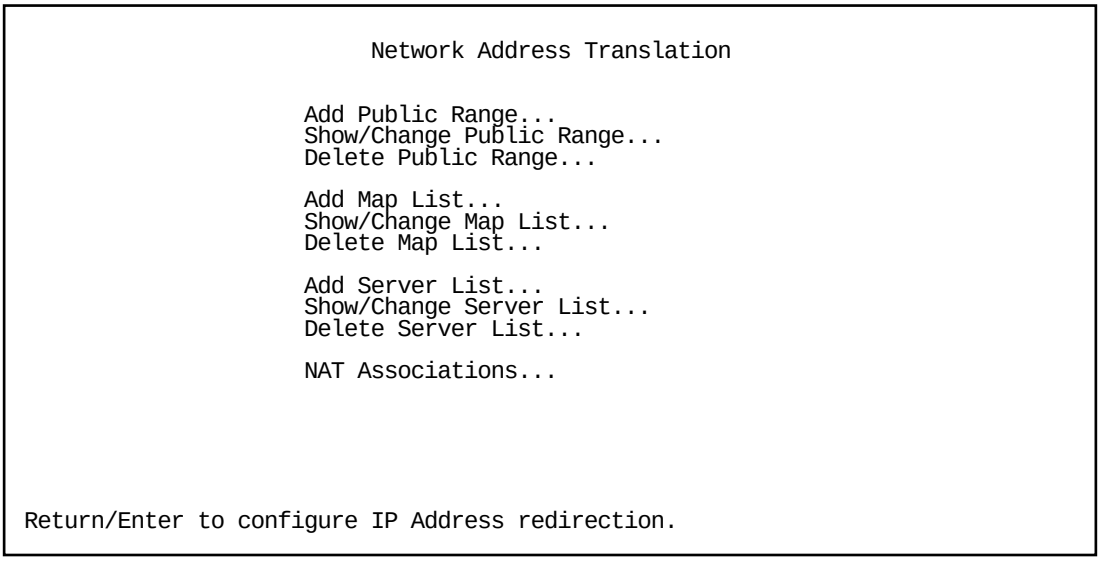
To access the NAT configuration screens, from the Main Menu navigate to IP Setup:




```
                              IP Setup

        Ethernet IP Address:              192.168.1.1
        Ethernet Subnet Mask:             255.255.255.0
        Define Additional Subnets...

        Default IP Gateway:               127.0.0.2

        Primary Domain Name Server:       0.0.0.0
        Secondary Domain Name Server:     0.0.0.0
        Domain Name:                      isp.com

        Receive RIP...                    Both
        Transmit RIP...                   Off



     Static Routes...                        IP Address Serving...
     Network Address Translation (NAT)...

Set up the basic IP attributes of your Netopia in this screen.
```

Select **Network Address Translation (NAT)** and press Return.

The Network Address Translation screen appears.



Public Range defines an external address range and indicates what type of mapping to apply when using this range. The types of mapping available are *dynamic*, *static* and *pat*.

Map Lists define collections of mapping rules. A rule maps interior range addresses to exterior range addresses by the mapping techniques defined in the map list.

Server Lists bind internal IP addresses and ports to external IP addresses and ports so that connections initiated from the outside can access an interior server.

NAT rules

The following rules apply to assigning NAT ranges and server lists:

- Static public address ranges must not overlap other static, PAT, public addresses, or the public address assigned to the router's WAN interface.
- A PAT public address must not overlap any static address ranges. It may be the same as another PAT address or server list address, but the port range must not overlap.

You configure the ranges of exterior addresses by first adding public ranges.

Select **Add Public Range** and press Return.

The Add NAT Public Range screen appears.

```
                    Add NAT Public Range

        Range Name:                     my_first_range
        Type...                         pat
        Public Address:                 206.1.1.6

        First Public Port:              49152
        Last Public Port:               65535


        ADD NAT PUBLIC RANGE            CANCEL
```

- Select **Range Name** and give a descriptive name to this range.
- Select **Type** and from the pop-up menu, assign its type. Options are **static**, **dynamic**, or **pat** (the default).
  - If you choose pat as the range type, select **Public Address** and enter the exterior IP address in the range you want to assign. Select **First** and **Last Public Port** and enter the first and last exterior ports in the range. These are the ports that will be used for traffic initiated from the private LAN to the outside world.

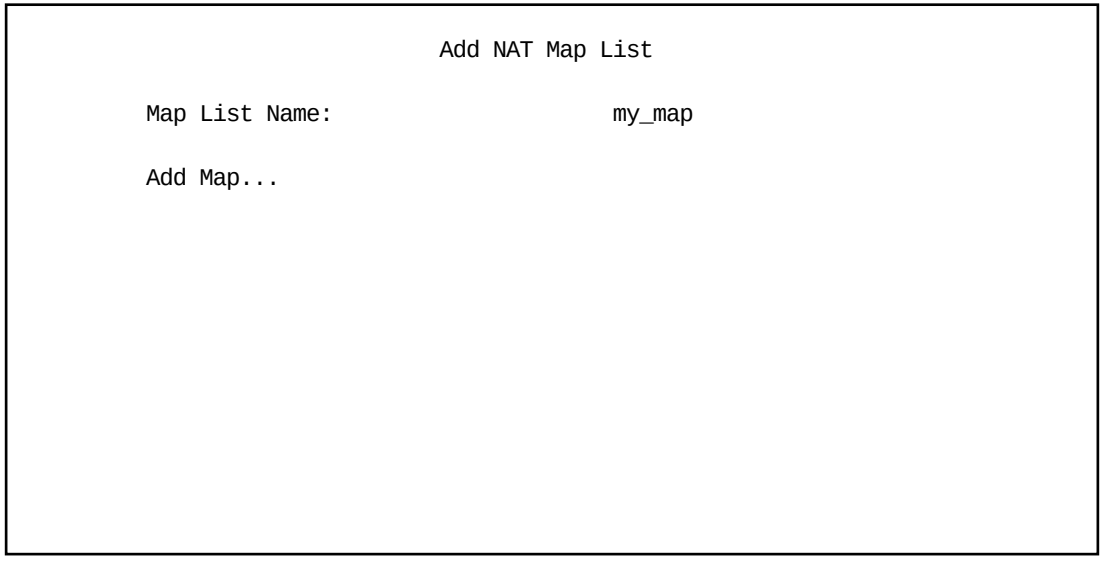
Note: For PAT map lists and server lists, if you use the Public Address 0.0.0.0, the list will acquire its public IP address from the WAN IP address specified by your WAN IP configuration in the Connection Profile. If that is a static IP address, then the PAT map list and server lists will acquire that address. If it is a negotiated IP address, such as may be assigned via DHCP or PPP, the PAT map list and server lists will acquire that address each time it is negotiated.

  - If you choose dynamic as the range type, a new menu item, **First Public Address**, becomes visible. Select **First Public Address** and enter the first exterior IP address in the range you want to assign. Select **Last Public Address** and enter an IP address at the end of the range.
  - If you choose static as the range type, a new menu item, **First Public Address**, becomes visible. Select **First Public Address** and enter the first exterior IP address in the range you want to assign. Select **Last Public Address** and enter an IP address at the end of the range.
- Select **ADD NAT PUBLIC RANGE** and press Return. The range will be added to your list and you will be returned to the Network Address Translation screen.

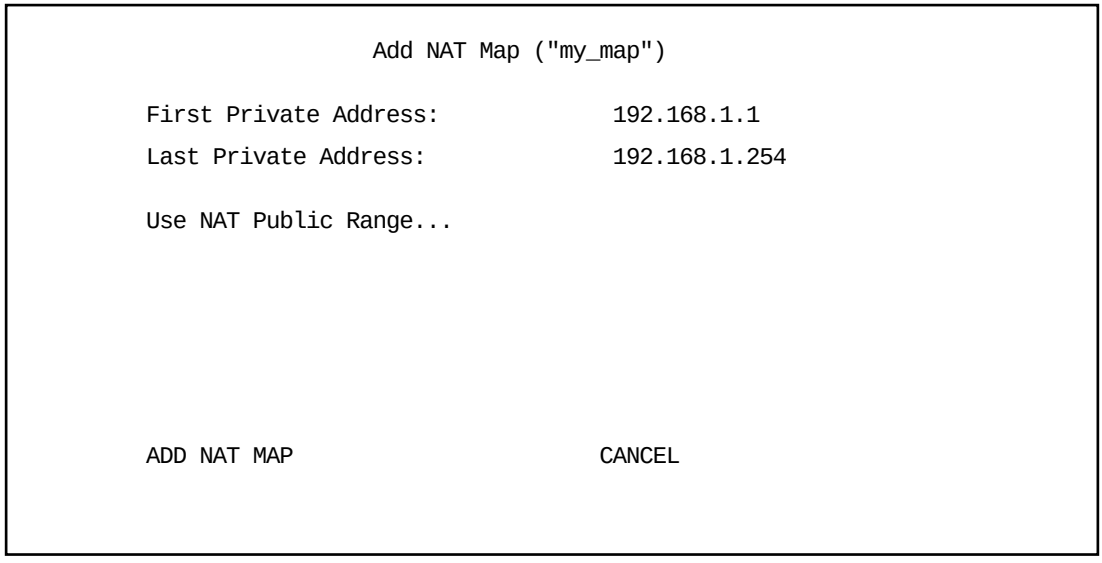
Once the public ranges have been assigned, the next step is to bind interior addresses to them. Because these bindings occur in ordered lists, called *map lists*, you must first define the list, then add mappings to it.

From the Network Address Translation screen select **Add Map List** and press Return.

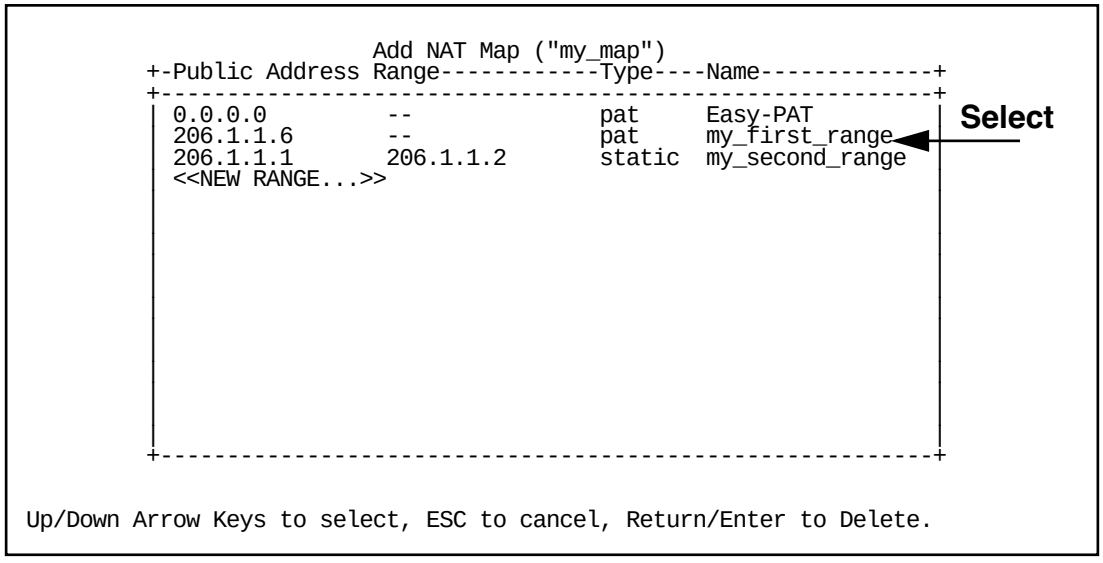
The Add NAT Map List screen appears.



- Select **Map List Name** and enter a descriptive name for this map list. A new menu item, **Add Map**, appears.
- Select **Add Map** and press Return. The Add NAT Map screen appears.



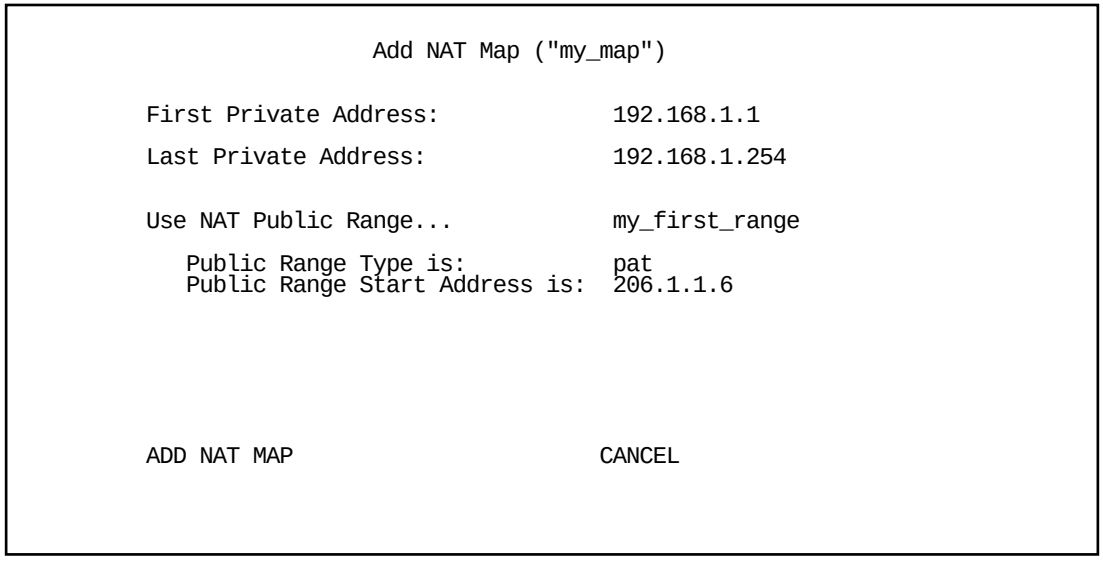
- Select **First** and **Last Private Address** and enter the first and last interior IP addresses you want to assign to this mapping.
- Select **Use NAT Public Range** and press Return. A screen appears displaying the public ranges you have defined.



- From the list of public ranges you defined, select the one that you want to map to the interior range for this mapping and press Return.

  If none of your preconfigured ranges are suitable for this mapping, you can select **<<NEW RANGE>>** and create a new range. If you choose **<<NEW RANGE>>**, the Add NAT Public Range screen displays and you can create a new public range to be used by this map. See Add NAT Public Range on page 11-9.

- The Add NAT Map screen now displays the range you have assigned.



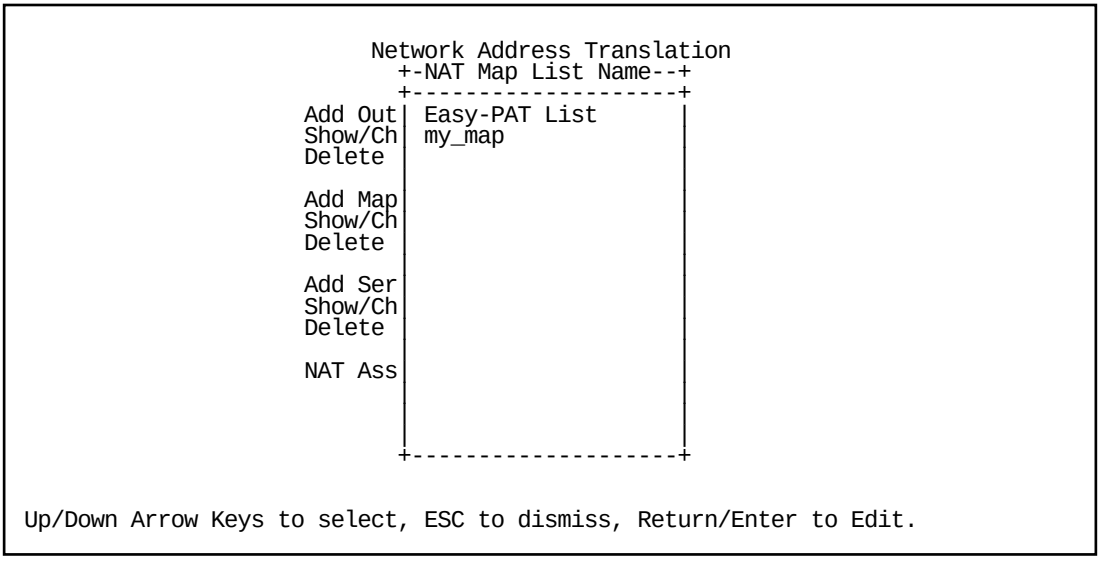
- Select **ADD NAT MAP** and press Return. Your mapping is added to your map list.

Modifying map lists

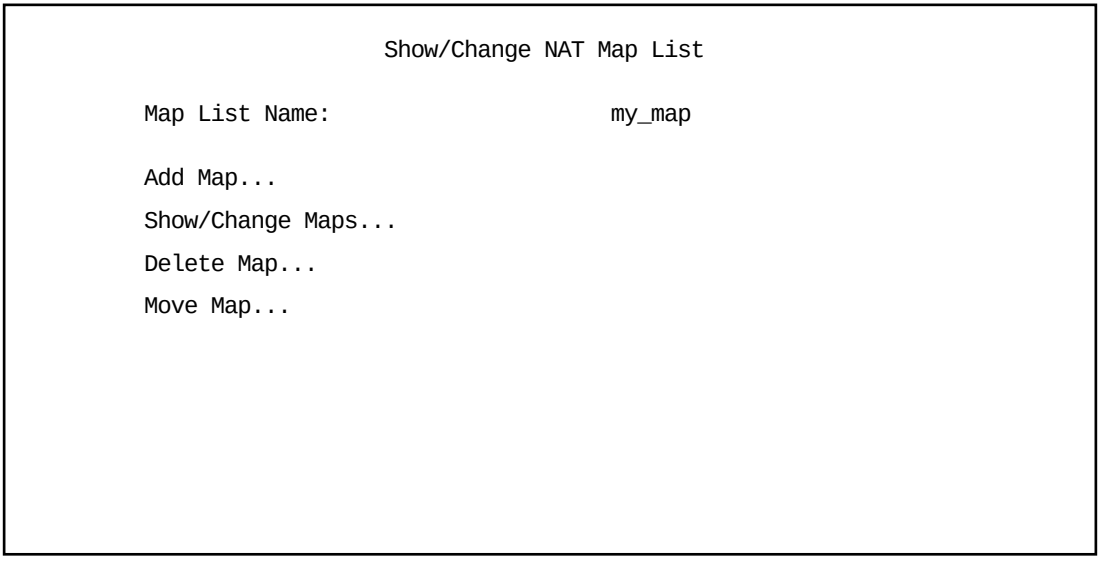
You can make changes to an existing map list after you have created it. Since there may be more than one map list you must select which one you are modifying.

From the Network Address Translation screen select **Show/Change Map List** and press Return.

- Select the map list you want to modify from the pop-up menu.

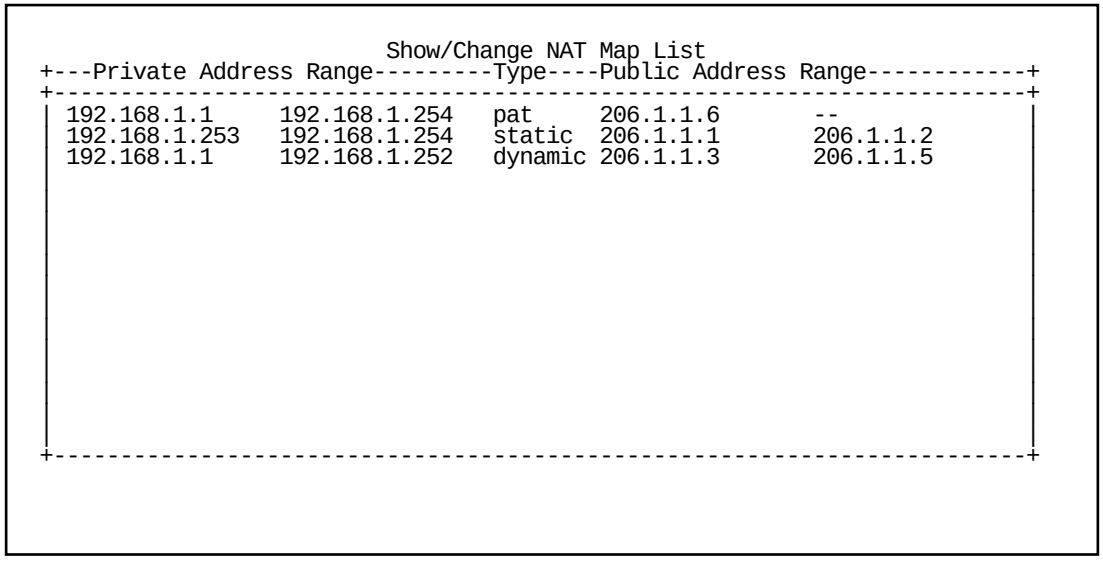


The Show/Change NAT Map List screen appears.



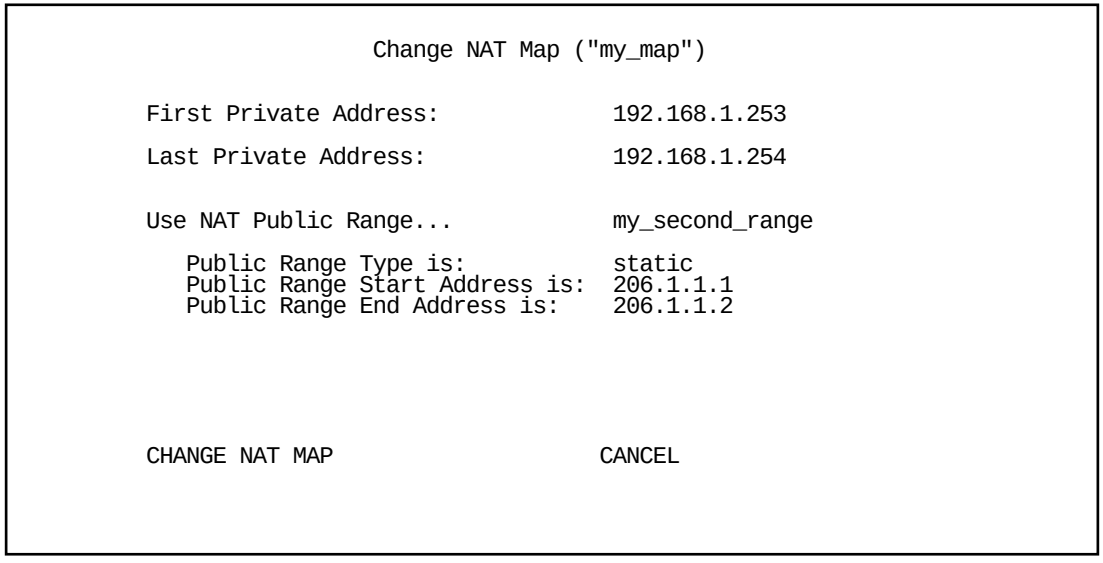
- **Add Map** allows you to add a new map to the map list.
- **Show/Change Maps** allows you to modify the individual maps within the list.
- **Delete Map** allows you to delete a map from the list.
- **Move Map** allows you to change the priority order in which the map is evaluated within the list. See Moving maps on page 11-14.

Selecting **Show/Change Maps**, **Delete Map**, or **Move Map** displays the same pop-up menu.



Scroll to the map you want to modify using the arrow keys and press Return.

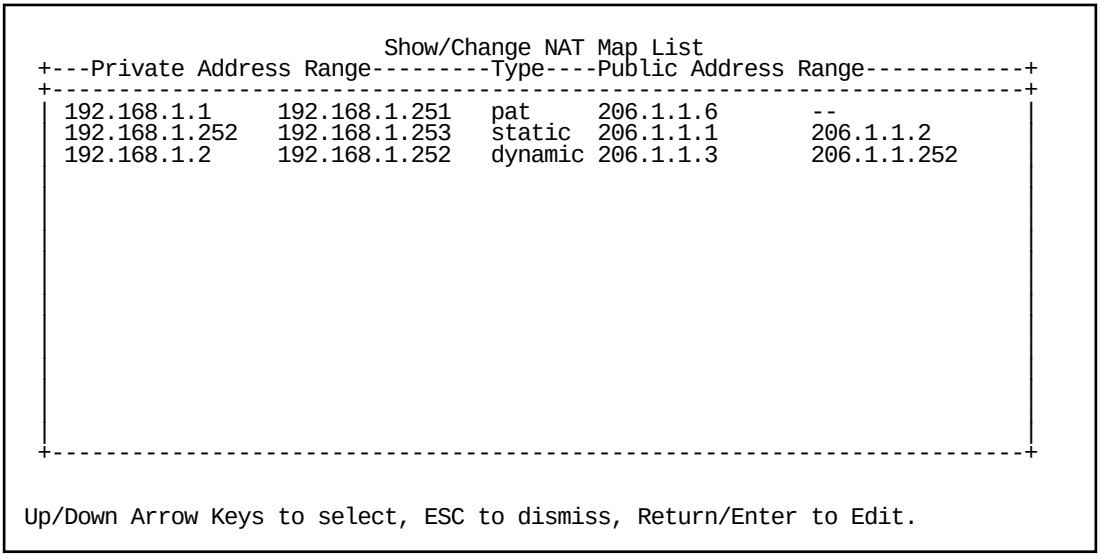
The Change NAT Map screen appears.



Make any modifications you need and then select **CHANGE NAT MAP** and press Return. Your changes will become effective and you will be returned to the Show/Change NAT Map List screen.

Moving maps

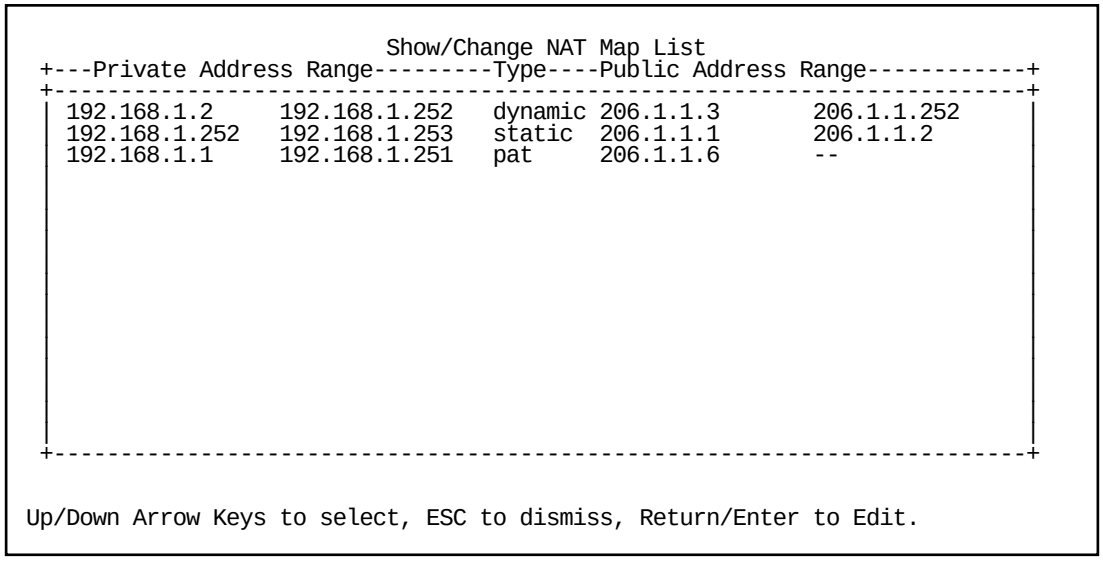
The Move Maps screen permits reordering the priority of maps in a map list. Since the maps are read from top to bottom, those at the top have the highest priority and those at the bottom have the lowest. If you used Easy Setup for your initial configuration, and added subsequent maps and server lists, you may need to reorder their priority since new maps are added to the top of the list.



In the example screen above, you may want to reorder the priority of the maps such that the dynamic map applies first and any additional traffic is routed via PAT or static.

All operations are done from a single pop-up menu.

- In the Show/Change Map List screen, select **Move Map**. A selection mode pop-up menu appears. In this mode you scroll to the map you want to move and press Return to select it for moving.
- After pressing **Return** you are in Move mode. Arrow keys move the selected map up or down. When you press Return again the map is put in the new location permanently and the pop-up menu is dismissed.



- You can press Escape at any time in the pop-up menu to abort the move and restore the map list to its original ordering.

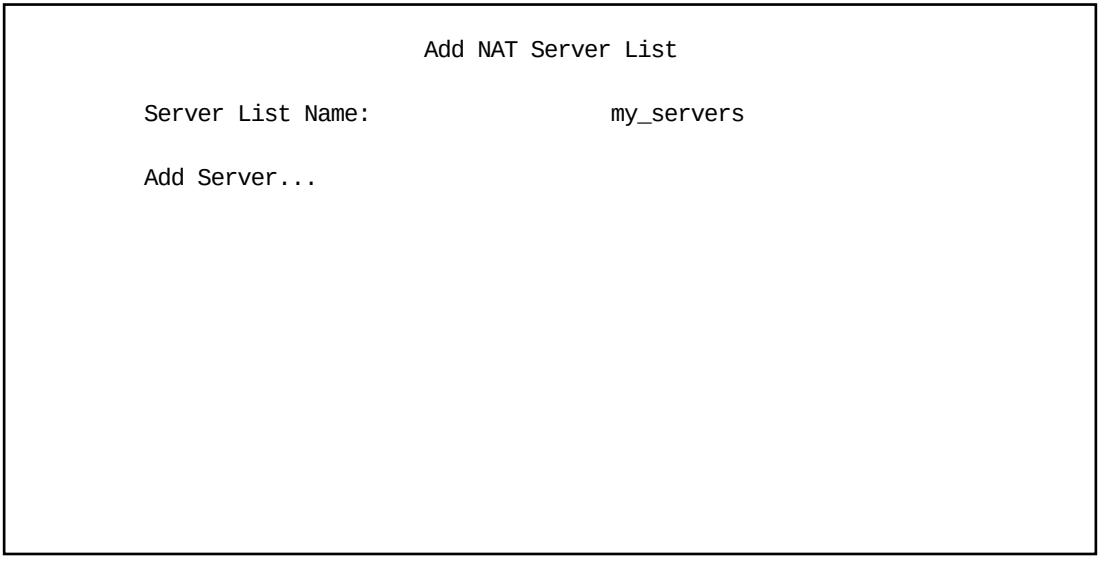
Note: The *pat* map is generally left at the bottom of the list.

Adding Server Lists

Server lists, also known as Exports, are handled similarly to map lists. If you want to make a particular server's port accessible (and it isn't accessible through other means, such as a static mapping), you must create a server list.

Select **Add Server List** from the Network Address Translation screen.

The Add NAT Server List screen appears.



- Select **Server List Name** and type in a descriptive name. A new menu item, **Add Server**, appears.

- Select **Add Server** and press Return. The Add NAT Server screen appears.

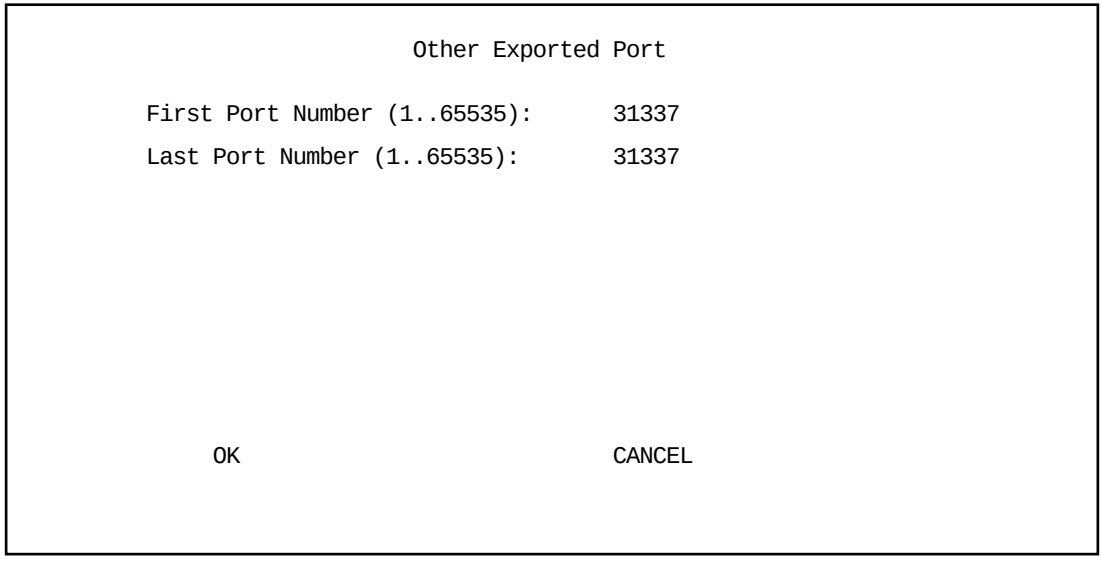
```
                    Add NAT Server ("my_servers")

        Service...
        Server Private IP Address:          192.168.1.45
        Public IP Address:                  206.1.1.1









        ADD NAT SERVER                      CANCEL
```

- Select **Service** and press Return. A pop-up menu appears listing a selection of commonly exported services.

```
                    Add NAT Server ("my_servers")
                                    +-Type------Port(s)-------+
                                    +-------------------------+
        Service...                  | ftp       21            |
                                    | telnet    23            |
        Server Private IP Address:  | smtp      25            |
                                    | tftp      69            |
        Public IP Address:          | gopher    70            |
                                    | finger    79            |
                                    | www-http  80            |
                                    | pop2      109           |
                                    | pop3      110           |
                                    | snmp      161 - 162     |
                                    | timbuktu  407           |
                                    | pptp      1723          |
                                    | irc       6665 - 6669   |
                                    | Other...                |
                                    +-------------------------+
        ADD NAT SERVER                CANCEL
```

- Choose the service you want to export and press Return.

  You can choose a preconfigured service from the list, or define your own by selecting **Other**. If you select **Other**, a screen is displayed that allows you to enter the port number range for your customized service.



- Enter the **First** and **Last Port Number** between ports 1 and 65535. Select **OK** and press Return. You will be returned to the Add NAT Server screen.

- Enter the **Server Private IP Address** of the server whose service you are exporting.

  Since MultiNAT permits the mapping of multiple private IP addresses to multiple public IP addresses, your ISP or corporate site's router must be configured such that it knows that your multiple public addresses are accessible via your router.

  If you want to use static mappings to map internal servers to public addresses, your ISP or corporate site's router must also be configured for static routes to these public addresses on the Netopia Router.

- Enter the **Public IP Address** to which you are exporting the service.

Note: For PAT map lists and server lists, if you use the Public Address 0.0.0.0, the list will acquire its public IP address from the WAN IP address specified by your WAN IP configuration in the Connection Profile. If that is a static IP address, then the PAT map list and server lists will acquire that address. If it is a negotiated IP address, such as may be assigned via DHCP or PPP, the PAT map list and server lists will acquire that address each time it is negotiated.

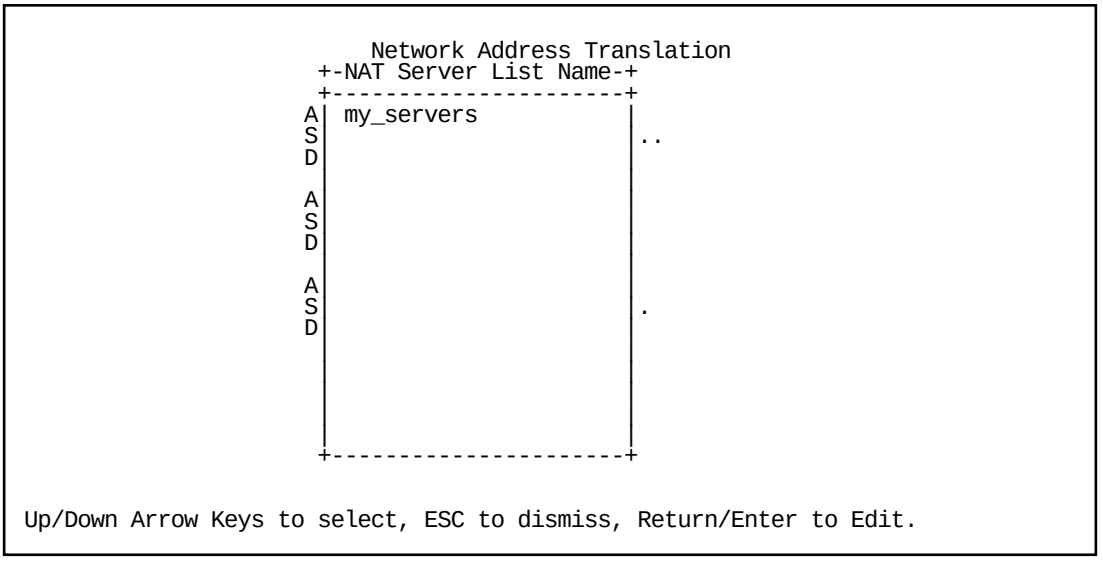
- Select **ADD NAT SERVER** and press Return. The server will be added to your server list and you will be returned to the Add NAT Server List screen.

Note: CUSeeMe (or other services that listen on specific ports) through MultiNat works as it did for non-MultiNat releases prior to version 4.4. In order to use **CUSeeMe** through the Netopia Router, you must export the ports 7648 *and* 7649. In MultiNat, you may use a port range export. Without the export, CUSeeMe will fail to work. This is true unless a static mapping is in place for the host using CUSeeMe. In that case no server list entry is necessary.

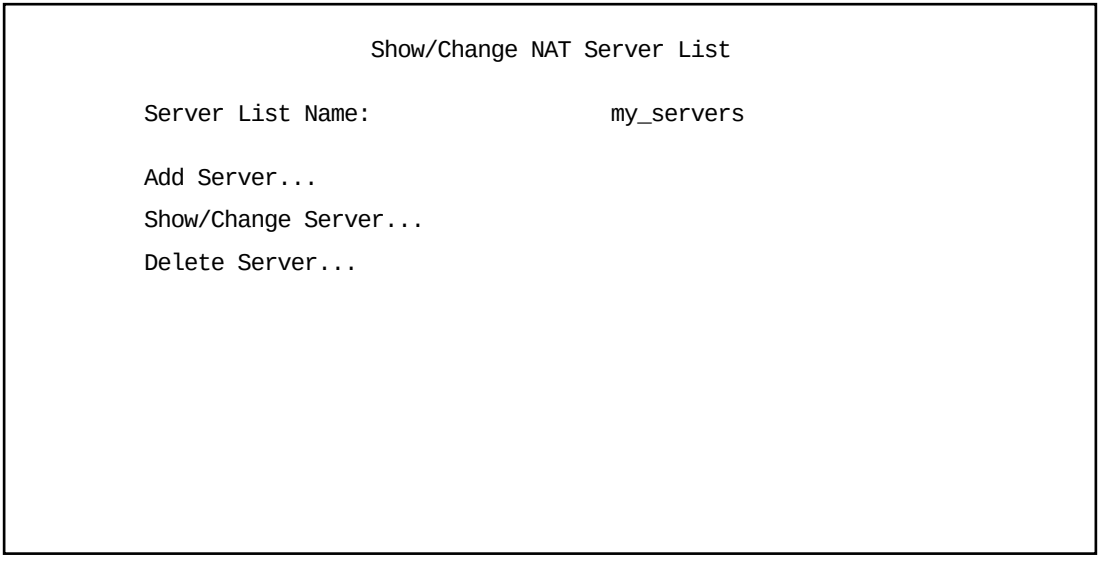
Modifying server lists

Once a server list exists, you can select it for modification or deletion.

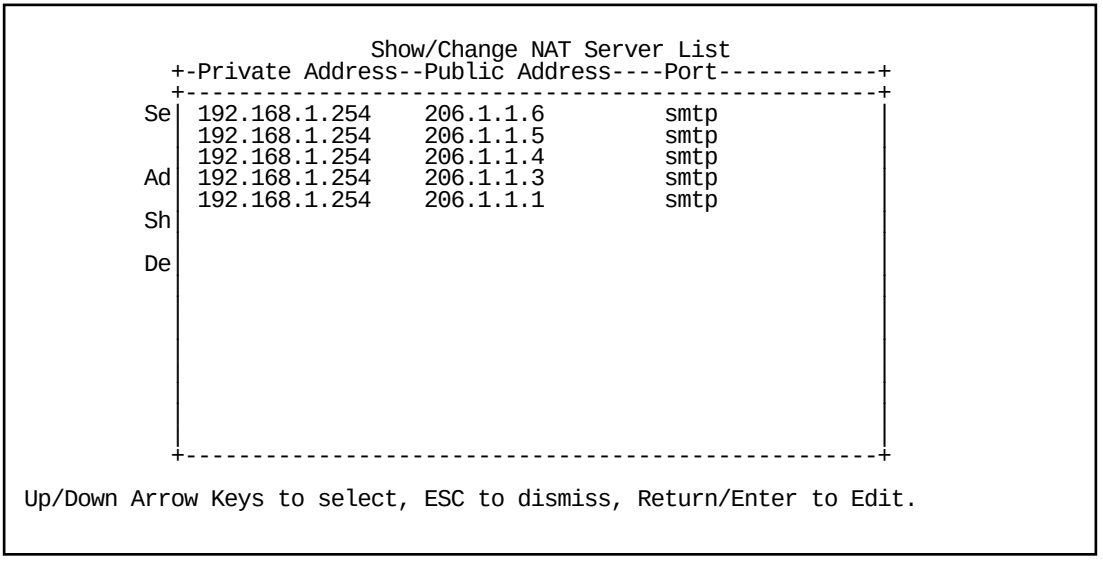
- Select **Show/Change Server List** from the Network Address Translation screen.
- Select the Server List Name you want to modify from the pop-up menu and press Return.



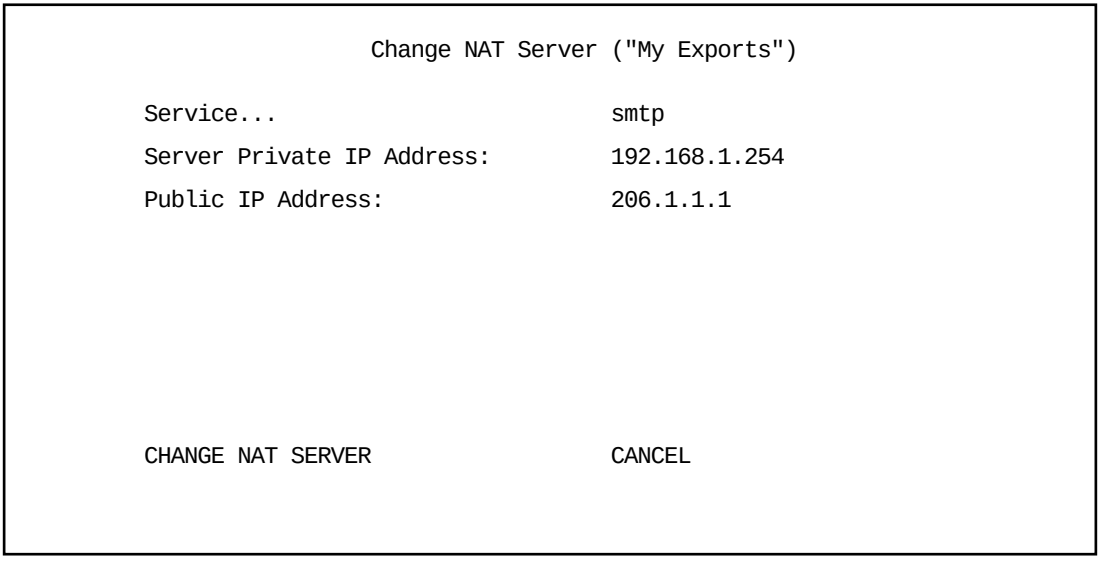
The Show/Change NAT Server List screen appears.



- Selecting **Show/Change Server** or **Delete Server** displays the same pop-up menu.



Select any server from the list and press Return. The Change NAT Server screen appears.



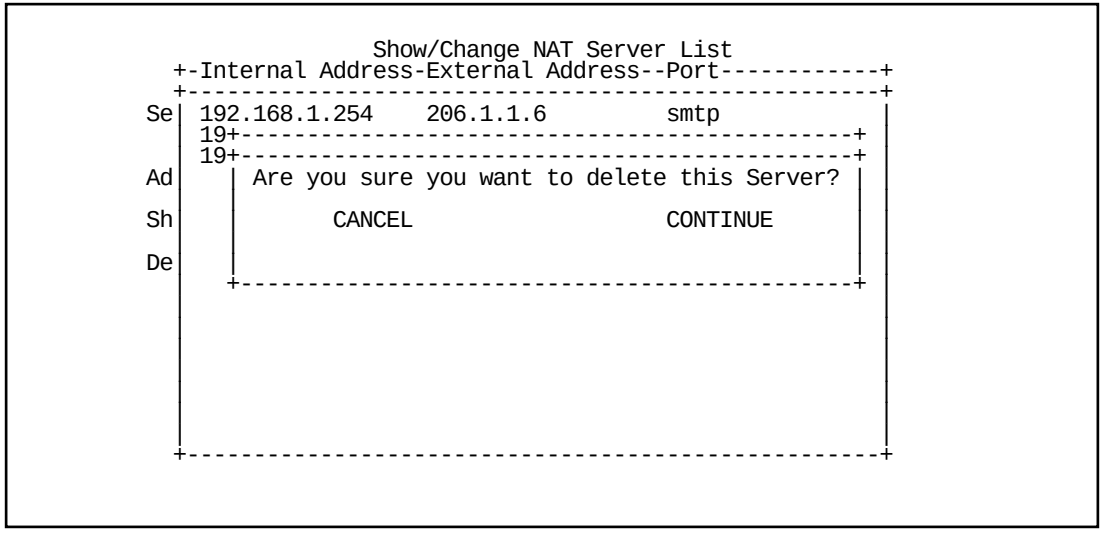
You can make changes to the server's service and port or internal or external address.

Select **CHANGE NAT SERVER** and press Return. Your changes take effect and you are returned to the Show/Change NAT Server List screen.

Deleting a server

To delete a server from the list, select **Delete Server** from the Show/Change NAT Server List menu and press Return.

A pop-up menu lists your configured servers. Select the one you want to delete and press Return. A dialog box asks you to confirm your choice.



Choose **CONTINUE** and press Return. The server is deleted from the list.

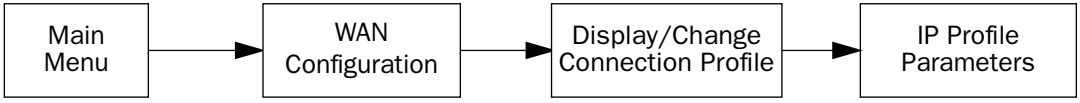
Binding Map Lists and Server Lists

Once you have created your map lists and server lists, for most Netopia Router models you must bind them to a profile, either a Connection Profile or the Default Profile. You do this in one of the following screens:

- the IP profile parameters screen (see below) of the Connection Profile configuration menu
- the IP Parameters (WAN Default Profile) screen (see page 11-24) of the Default Profile configuration menu
- the Binding Map Lists and Server Lists screen (see page 11-22)

IP profile parameters

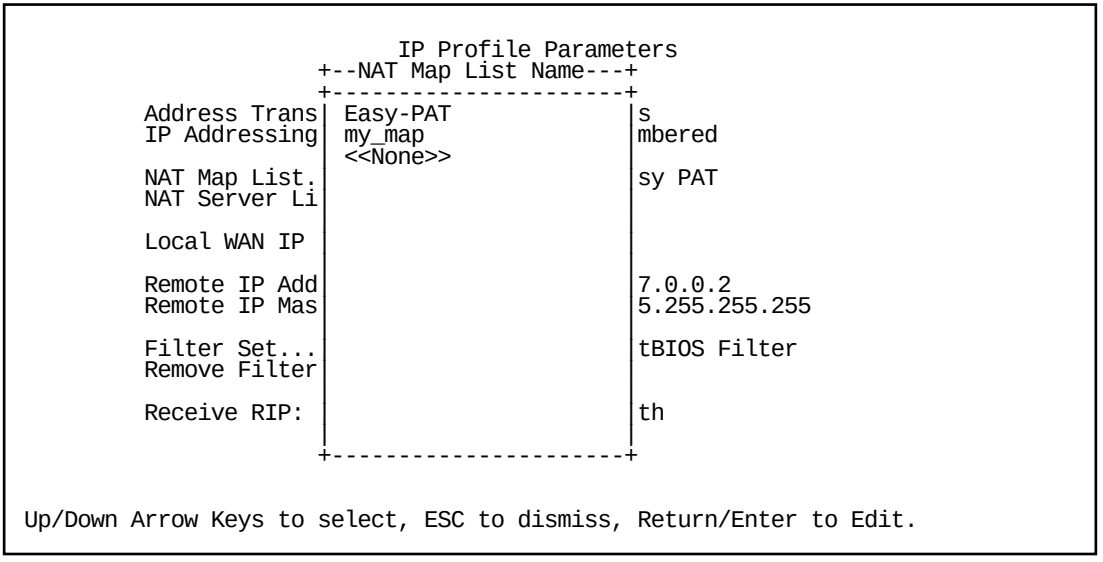
To bind a map list to a Connection Profile, from the Main Menu go to the WAN Configuration screen then the Display/Change Connection Profile screen. From the pop-up menu list of your Connection Profiles, choose the one you want to bind your map list to. Select **IP Profile Parameters** and press Return.



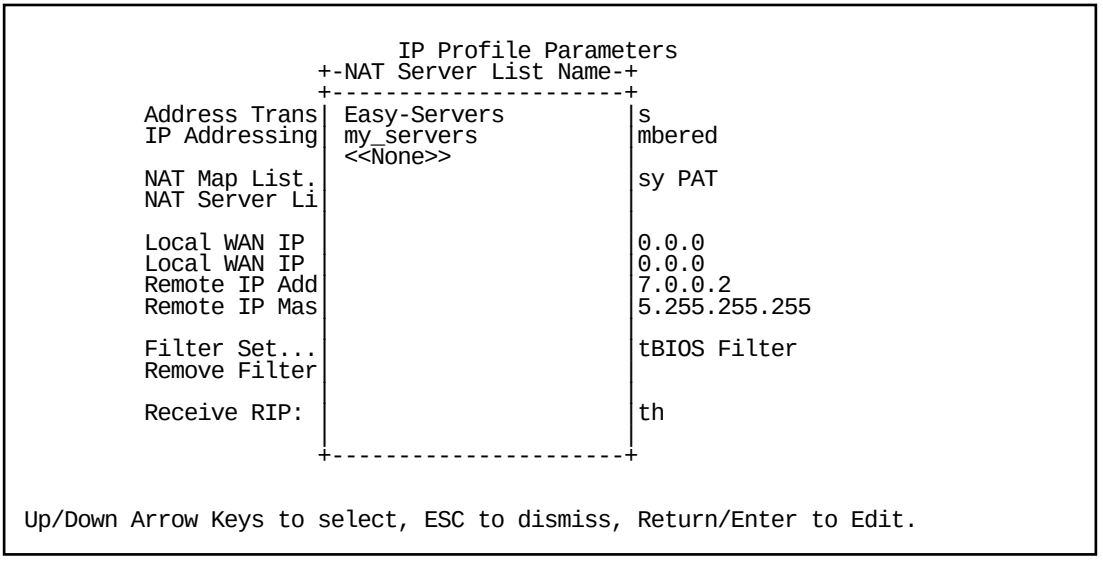
The IP Profile Parameters screen appears.

```
                          IP Profile Parameters

         Address Translation Enabled:       Yes
         IP Addressing...                   Unnumbered

         NAT Map List...                    Easy-PAT List
         NAT Server List...                 Easy-Servers

         Local WAN IP Address:              206.1.1.6

         Remote IP Address:                 127.0.0.2
         Remote IP Mask:                    255.255.255.255

         Filter Set...                      Basic Firewall
         Remove Filter Set



         RIP Profile Options...

Configure IP requirements for a remote network connection here.
```

- Select **NAT Map List** and press Return. A pop-up menu displays a list of your defined map lists.



- Select the map list you want to bind to this Connection Profile and press Return. The map list you selected will now be bound to this Connection Profile.
- Select **NAT Server List** and press Return. A pop-up menu displays a list of your defined server lists.



- Select the server list you want to bind to this Connection Profile and press Return. The server list you selected will now be bound to this Connection Profile.

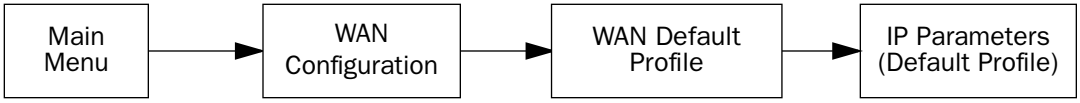
Note: There is no interdependency between NAT and IP Addressing. Also, the Local WAN IP Address and Mask fields' visibility are dependent only on the IP Addressing type.

IP Parameters (WAN Default Profile)

The Netopia 4752 in HDLC (Copper Mountain) Operation Mode supports a WAN default profile that permits several parameters to be configured without an explicitly configured Connection Profile.

The procedure is similar to the procedure to bind map lists and server lists to a Connection Profile.

From the Main Menu go to the WAN Configuration screen, then the Default Profile screen. Select **IP Parameters** and press Return.

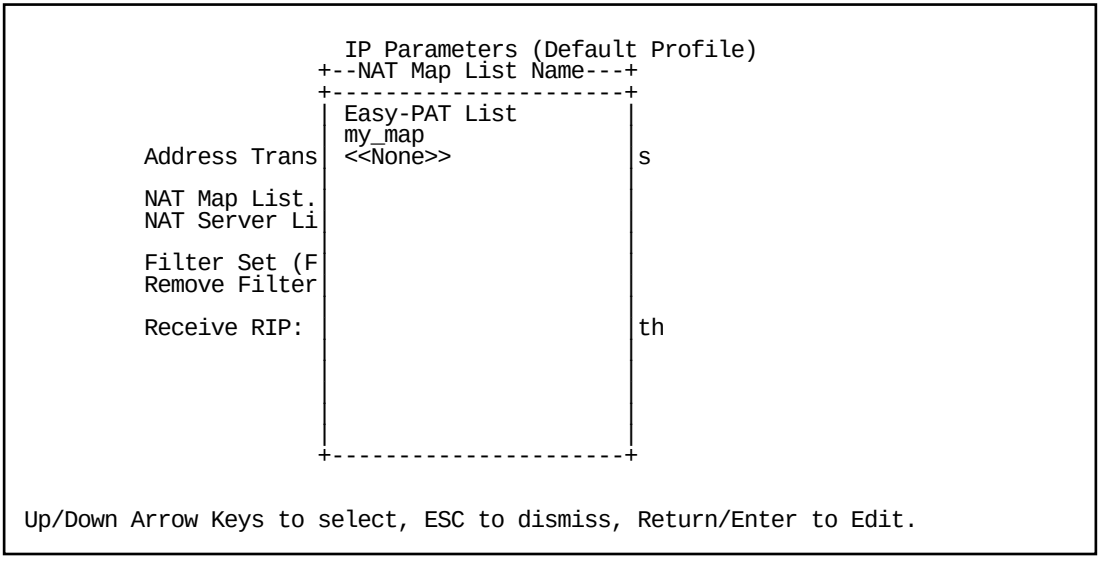


The IP Parameters (Default Profile) screen appears.

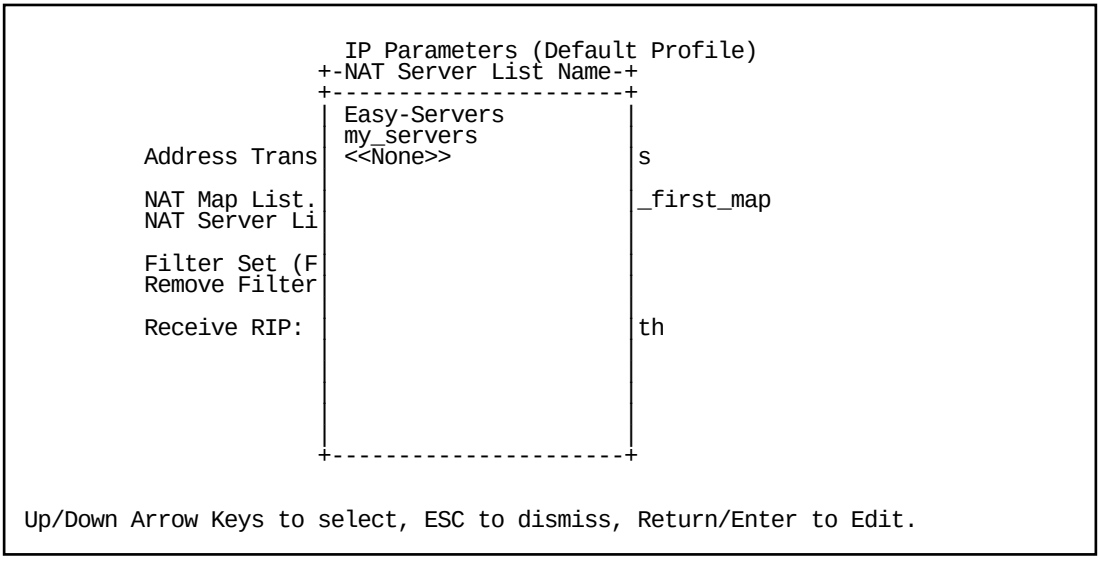
```
                    IP Parameters (Default Profile)



        Address Translation Enabled:       Yes

        NAT Map List...                    Easy-PAT List
        NAT Server List...                 Easy-Servers

        Filter Set (Firewall)...
        Remove Filter Set

        Receive RIP:                       Both




Return/Enter to select <among/between> ...
```

- Toggle **Address Translation Enabled** to Yes.

- Select **NAT Map List** and press Return. A pop-up menu displays a list of your defined map lists.



- Select the map list you want to bind to the default profile and press Return. The map list you selected will now be bound to the default profile.
- Select **NAT Server List** and press Return. A pop-up menu displays a list of your defined server lists.



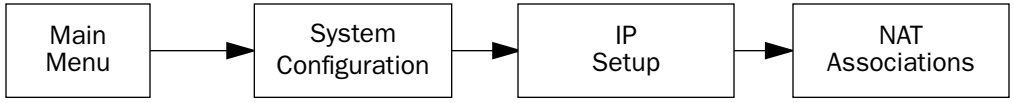
- Select the server list you want to bind to the default profile and press Return. The server list you selected will now be bound to the default profile.

Note: There is no interdependency between NAT and IP Addressing. Also, the Local WAN IP Address and Mask fields' visibility are dependent only on the IP Addressing type.

NAT Associations

Configuration of map and server lists alone is not sufficient to enable NAT for a WAN connection because map and server lists must be linked to a profile that controls the WAN interface. This can be a Connection Profile, a WAN Ethernet interface, a default profile, or a default answer profile. Once you have configured your map and server lists, you may want to reassign them to different interface-controlling profiles, for example, Connection Profiles. To permit easy access to this IP Setup functionality, you can use the NAT Associations screen.

You access the NAT Associations screen from the Network Address Translation screen.

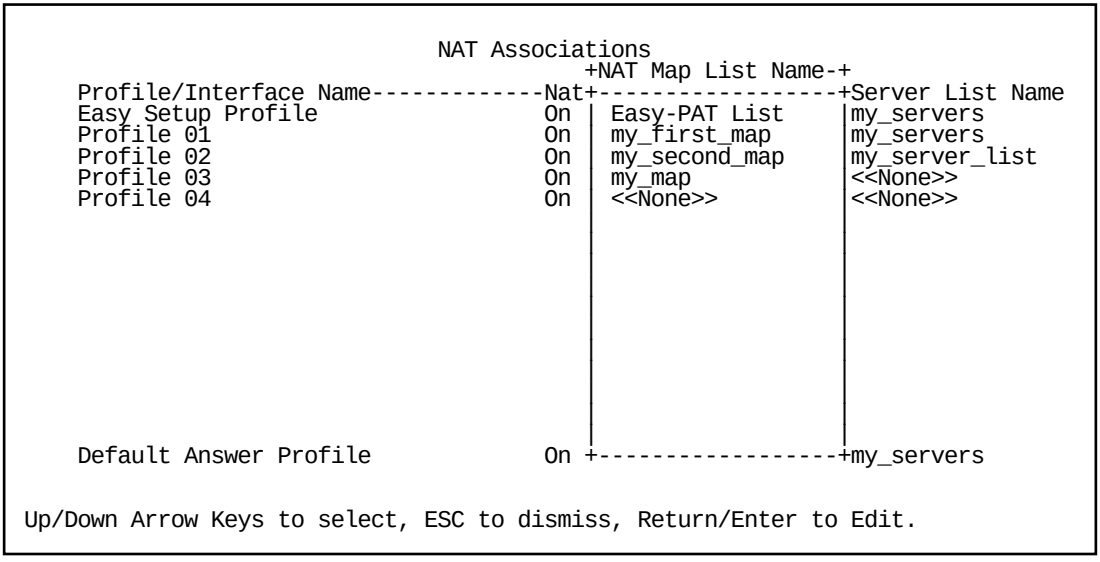


Select **NAT Associations** and press Return. The NAT Associations screen appears.

```
                          NAT Associations

Profile/Interface Name-------------Nat?-Map List Name-----Server List Name
Default Answer Profile               On   my_first_map      my_servers
Easy Setup Profile                   On   Easy-PAT          my_servers
Profile 01                           On   my_second_map     my_servers
Profile 02                           On   my_first_map      my_server_list
Profile 03                           On   <<None>>          <<None>>
```

- You can toggle **NAT? On** or **Off** for each Profile/Interface name. You do this by navigating to the **NAT?** field associated with each profile using the arrow keys. Toggle NAT on or off by using the Tab key.
- You can reassign any of your map lists or server lists to any of the Profile/Interfaces. You do this by navigating to the **Map List Name** or **Server List Name** field associated with each profile using the arrow

keys. Select the item by pressing Return to display a pop-up menu of all of your configured lists.



- Select the list name you want to assign and press Return again. Your selection will then be associated with the corresponding profile or interface.

MultiNAT Configuration Example

To help you understand a typical MultiNAT configuration, this section describes an example of the type of configuration you may want to implement on your site. The values shown are for example purposes only. *Make your own appropriate substitutions.*

A typical DSL service from an ISP might include five user addresses. Without PAT, you might be able to attach only five IP hosts. Using simple 1-to-many PAT you can connect more than five devices, but use only one of your addresses. Using multiNAT you can make full use of the address range. The example assumes the following range of addresses offered by a typical ISP:

Local WAN IP address:	206.1.1.6
Local WAN subnet mask:	255.255.255.248
Remote IP address:	206.1.1.254
Default gateway:	206.1.1.254

Public IP addresses assigned by the ISP are 206.1.1.1 through 206.1.1.6 (255.255.255.248 subnet mask).

Your internal devices have IP addresses of 192.168.1.1 through 192.168.1.254 (255.255.255.0 subnet mask).

Netopia Router's address is:	192.168.1.1
Web server's address is:	192.168.1.253
Mail server's address is:	192.168.1.254
FTP server's address is:	192.168.1.253

In this example you will statically map the first five public IP addresses (206.1.1.1 - 206.1.1.5) to the first five corresponding private IP addresses (192.168.1.1 - 192.168.1.5). You will use these 1-to-1 mapped addresses to give your servers “real” addresses. You will then map 206.1.1.6 to the remaining private IP addresses (192.168.1.6 - 192.168.1.254) using PAT.

The configuration process is as follows:

From the Main Menu go to the Easy Setup and then the Connection Profile screen.

Enter your ISP-supplied values as shown below.

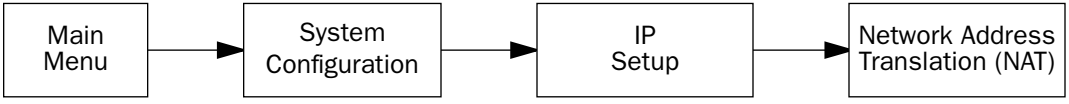
```
                Connection Profile 1: Easy Setup Profile

        Connection Profile Name:          Easy Setup Profile


        Address Translation Enabled:      Yes
        IP Addressing...                  Numbered

        Local WAN IP Address:             206.1.1.6
        Local WAN IP Mask:                255.255.255.248









        PREVIOUS SCREEN                   NEXT SCREEN

Enter a subnet mask in decimal and dot form (xxx.xxx.xxx.xxx).
Enter basic information about your WAN connection with this screen.
```

Select **NEXT SCREEN** and press Return.

Your IP values are shown here.

```
                            IP Easy Setup


        Ethernet IP Address:              192.168.1.1
        Ethernet Subnet Mask:             255.255.255.0

        Domain Name:                      ISP.net
        Primary Domain Name Server:       173.166.101.1
        Secondary Domain Name Server:     173.166.102.1

        Default IP Gateway:               206.1.1.254
        IP Address Serving:               On

        Number of Client IP Addresses:    20
        1st Client Address:               192.168.1.2



        PREVIOUS SCREEN                   NEXT SCREEN

Set up the basic IP & IPX attributes of your Netopia in this screen.
```

Then navigate to the Network Address Translation (NAT) screen.



Select **Show/Change Public Range**, then **Easy-PAT Range**, and press Return. Enter the value your ISP assigned for your public address (206.1.1.6, in this example). Toggle **Type** to pat. Your public address is then mapped to the remaining private IP addresses using PAT. (If you were not using the Easy-PAT Range and Easy-PAT List that are created by default by using Easy Setup, you would have to *define* a public range and map list. For the purpose of this example you can just *alter* this range and list.)

```
                    Change NAT Public Range

        Range Name:                     Easy-PAT Range
        Type...                         pat
        Public Address:                 206.1.1.6

        First Public Port:              49152
        Last Public Port:               65535



        CHANGE NAT PUBLIC RANGE         CANCEL
```

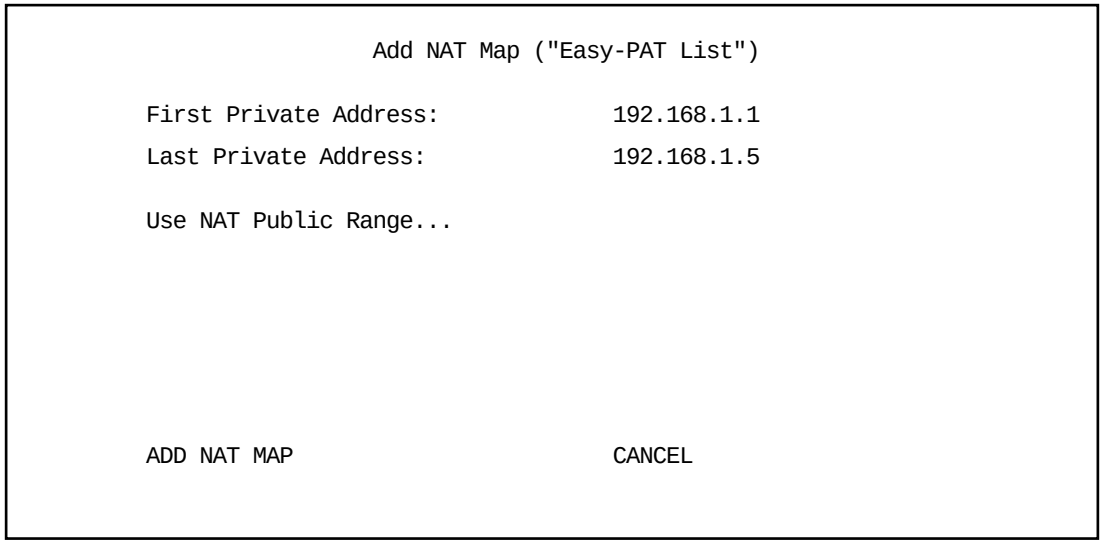
Select **CHANGE NAT PUBLIC RANGE** and press Return. This returns you to the Network Address Translation screen.

Select **Add Public Range** and press Return. Type a name for this static range, as shown below. Enter the first and last public addresses your ISP assigned in their respective fields as shown. The first five public IP addresses (206.1.1.1 - 206.1.1.5, in this example) are statically mapped to the first five corresponding private IP addresses (192.168.1.1 - 192.168.1.5).

```
                    Add NAT Public Range

        Range Name:                     Static Range
        Type...                         static
        First Public Address:           206.1.1.1
        Last Public Address:            206.1.1.5







        ADD NAT PUBLIC RANGE            CANCEL
Return/Enter to commit changes.
```

Select **ADD NAT PUBLIC RANGE** and press Return. You are returned to the Network Address Translation screen.

Next, select **Show/Change Map List** and choose **Easy-PAT List**. Select **Add Map**. The **Add NAT Map** screen appears. (Now the name *Easy-PAT List* is a misnomer since it has a static map included in its list.) Enter in 192.168.1.1 for the **First Private Address** and 192.168.1.5 for the **Last Private Address**.



Select **Use NAT Public Range** and from the pop-up menu choose **Static Range**. Select **ADD NAT MAP** and press Return.

This will statically map the first five public IP addresses to the first five corresponding private IP addresses and will map 206.1.1.6 to the remaining private IP addresses using PAT.

Notes on the example

The Easy-Map List and the Easy-PAT List are attached to any new Connection Profile by default. If you want to use this NAT configuration on a previously defined Connection Profile then you need to *bind* the Map List to the profile. You do this through either the NAT Associations screen or the profile's configuration screens.

The PAT part of this example setup will allow any user on the Netopia Router's LAN with an IP address in the range of 192.168.1.6 through 192.168.1.254 to *initiate* traffic flow to the outside world (for example, the Internet). No one on the Internet would be able to initiate a conversation with them.

The Static mapping part of this example will allow any of the machines in the range of addresses from 192.168.1.1 through 192.168.1.5 to communicate with the outside world as if they were at the addresses 206.1.1.1 through 206.1.1.5, respectively. It also allows any machine on the Internet to access any service (port) on any of these five machines.

You may decide this poses a security risk. You may decide that anyone can have complete access to your FTP server, but not to your router, and only limited access to the desired services (ports) on the Web and Mail servers.

To make these changes, first limit the range of remapped addresses on the Static Map and then edit the default server list called Easy-Servers.

- First, navigate to the **Show/Change Map List** screen, select **Easy-PAT List** and then **Show/Change Maps**. Choose the **Static Map** you created and change the **First Private Address** from 192.168.1.1 to 192.168.1.4. Now the router, Web, and Mail servers' IP addresses are no longer included in the range of static mappings and are therefore no longer accessible to the outside world. Users on the Internet will not be able to Telnet, Web, SNMP, or ping to them. It is best also to navigate to the public range screen and change the **Static Range** to go from 206.1.1.5.
- Next, navigate to **Show/Change Server List** and select **Easy-Servers** and then **Add Server**. You should export both the Web (www-http) and Mail (smtp) ports to one of the now free public addresses. Select **Service...** and from the resulting pop-up menu select **www-http**. In the resulting screen enter your Web server's address, 192.168.1.2, and the public address, for example, 206.1.1.2, and then select **ADD NAT SERVER**. Now return to **Add Server**, choose the **smtp** port and enter 192.168.1.3, your Mail server's IP address for the **Server Private IP Address**. You can decide if you want to present both your Web and Mail services as being on the same public address, 206.1.1.2, or if you prefer to have your Mail server appear to be at a different IP address, 206.1.1.3. For the sake of this example, alias both services to 206.1.1.2.

Now, as before, the PAT configuration will allow any user on the Netopia Router's LAN with an IP address in the range of 192.168.1.6 through 192.168.1.254 to initiate traffic flow to the Internet. Someone at the FTP server can access the Internet and the Internet can access all services of the FTP machine as if it were at 206.1.1.5. The router cannot directly communicate with the outside world. The only communication between the Web server and the Internet is through port 80, the Web port, as if the server were located on a machine at IP address 206.1.1.2. Similarly, the only communication with the Mail server is through port 25, the SMTP port, as if it were located at IP address 206.1.1.2

Chapter 12

Virtual Private Networks (VPNs)

The Netopia 4752 offers IPsec, PPTP, and ATMP tunneling support for Virtual Private Networks (VPN).

The following topics are covered in this chapter:

Overview

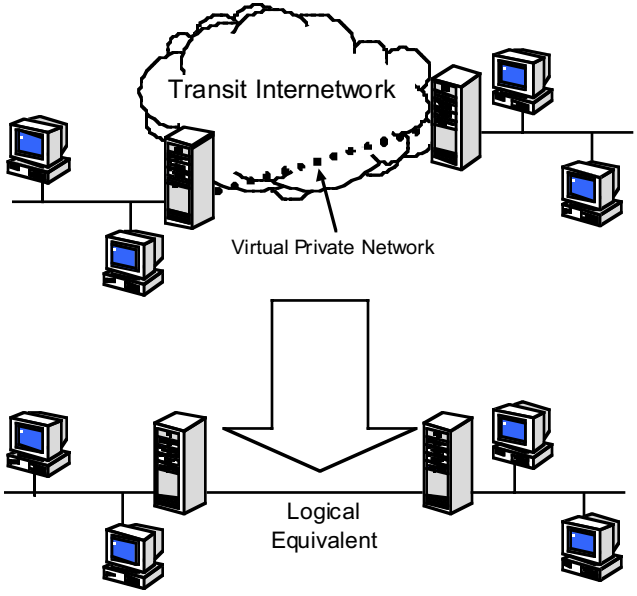
When you make a long distance telephone call from your home to a relative far away, you are creating a private network. You can hold a conversation, and exchange information about the happenings on opposite sides of the state, or the continent, that you are mutually interested in. When your next door neighbor picks up the phone to call her daughter at college, at the same time you are talking to your relatives, your calls don't overlap, but each is separate and private. Neither house has a direct wire to the places they call. Both share the same lines on the telephone poles (or underground) on the street.

These calls are *virtual private networks*. *Virtual*, because they appear to be direct connections between the calling and answering parties, even though they travel over the public wires and switches of the phone company; *private*, because neither pair of calling and answering parties interacts with the other; and *networks*, because they exchange information.

Computers can do the same thing; it's called Virtual Private Networks (VPNs). Equipped with a Netopia 4752, a single computer or private network (LAN) can establish a private connection with another computer or private network over the public network (Internet).

The Netopia 4752 can be used in VPNs either to initiate the connection or to answer it. When used in this way, the routers are said to be *tunnelling* through the public network (Internet). The advantages are that, like your long distance phone call, you don't need a direct line between one computer or LAN and the other, but use the local connections, making it much cheaper; and the information you exchange through your tunnel is private and secure.

Tunneling is a process of creating a private path between a remote user or private network and another private network over some intermediate network, such as the IP-based Internet. A VPN allows remote offices or employees access to your internal business LAN through means of encryption allowing the use of the public Internet to look “virtually” like a private secure network. When two networks communicate with each other through a network based on the Internet Protocol, they are said to be *tunneling* through the IP network.



Unlike the phone company, private and public computer networks can use more than one protocol to carry your information over the wires. Three such protocols are in common use for tunnelling, Point-to-Point Tunnelling Protocol (PPTP), Ascend Tunnel Management Protocol (ATMP), and IP Security (IPsec). The Netopia Router can use any one.

- Point-to-Point Tunneling Protocol (PPTP) is an extension of Point-to-Point Protocol (PPP) and uses a client and server model. Netopia’s PPTP implementation is compatible with Microsoft’s and can function as either the client (PAC) or the server (PNS). As a client, a Netopia R-series router can provide all users on a LAN with secure access over the Internet to the resources of another LAN by setting up a tunnel with a Windows NT server running Remote Access Services (RAS) or with another Netopia Router. As a server, a Netopia R-series router can provide remote users a secure connection to the resources of the LAN over a dial-up, cable, DSL, or any other type of Internet access. Because PPTP can create a VPN tunnel using the Dial-Up Networking (DUN) (see Dial-Up Networking for VPN on page 12-15) utility built into Windows 95, 98, or NT, no additional client software is required.
- Ascend Tunnel Management Protocol (ATMP) is the protocol that is implemented in many Ascend routers. ATMP is a simple protocol for connecting nodes and/or networks together over the Internet via a tunnel. ATMP encapsulates IP or other user data without PPP headers within General Routing Encapsulation (GRE) protocol over IP. ATMP is more efficient than PPTP for network-to-network tunnels.
- *IPsec* stands for IP Security, a set of protocols that supports secure exchange of IP packets at the IP layer. IPsec is deployed widely to implement Virtual Private Networks (VPNs). IPsec supports two encryption modes: Transport and Tunnel. Transport mode encrypts only the data portion (payload) of each packet, but leaves the header untouched. The more secure Tunnel mode encrypts both the header and the payload. On

the receiving side, an IPsec-compliant device decrypts each packet. The Netopia 4752 supports the more secure Tunnel mode.

DES stands for Data Encryption Standard, a popular symmetric-key encryption method. DES uses a 56-bit key. The Netopia 4752 offers IPsec DES encryption over the VPN tunnel.

When used to initiate the tunnelled connection, the Netopia 4752 is called a *PPTP Access Concentrator* (*PAC*, in PPTP language), or a *foreign agent* (in ATMP language). When used to answer the tunnelled connection, the Netopia Router is called a *PPTP Network Server* (*PNS*, in PPTP language) or a *home agent* (in ATMP language).

In either case, the Netopia Router wraps, or encapsulates, information that one end of the tunnel exchanges with the other, in a wrapper called General Routing Encapsulation (GRE), at one end of the tunnel, and unwraps, or decapsulates, it at the other end.

Configuring the Netopia Router for use with the different protocols is done through the console-based menu screens. Each type is described in its own section:

- About PPTP Tunnels on page 12-3
- About IPsec Tunnels on page 12-7
- About ATMP Tunnels on page 12-20

Your configuration depends on which protocol you (and the router at the other end of your tunnel) will use, and whether or not you will be using the VPN client software in a standalone remote connection.

Note: You must choose which protocol you will be using, since you cannot both export PPTP and use ATMP, or vice versa, at the same time.

Having both an ATMP tunnel and a PPTP export is not possible because functions require GRE and the router's PPTP export/server does not distinguish the GRE packets it forwards. Since it processes all of them, ATMP tunneling is impaired. For example, you cannot run an ATMP tunnel between two routers and also have PPTP exported on one side.

Summary

A Virtual Private Network (VPN) connects the components of one network over another network. VPNs accomplish this by allowing you to *tunnel* through the Internet or another public network in a manner that provides the same security and features formerly available only in private networks.

VPNs allow networks to communicate across an IP network. Your local networks (connected to the Netopia Router) can exchange data with remote networks that are also connected to a VPN-capable router.

This feature provides individuals at home, on the road, or in branch offices with a cost-effective and secure way to access resources on remote LANs connected to the Internet with Netopia Routers. The feature is built around three key technologies: PPTP, IPsec, and ATMP.

About PPTP Tunnels

To set up a PPTP tunnel, you create a Connection Profile including the IP address and other relevant information for the remote PPTP partner. You use the same procedure to initiate a PPTP tunnel that terminates at a remote PPTP server or to terminate a tunnel initiated by a remote PPTP client.

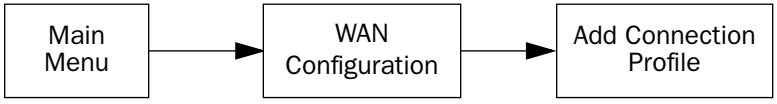
PPTP configuration

To set up the router as a PPTP Network Server (PNS) capable of answering PPTP tunnel requests you must also configure the VPN Default Answer Profile. See ATMP/PPTP Default Answer Profile on page 12-13 for more information.

PPTP is a Datalink Encapsulation option in Connection Profiles. It is not an option in device or link configuration screens, as PPTP is not a native encapsulation. Consequently, the Easy Setup Profile does not offer PPTP datalink encapsulation. See the *User's Reference Guide* for information on creating Connection Profiles.

Channel 4 (and higher) events, such as connections and disconnections, reported in the WAN Event Histories are VPN tunnel events.

To define a PPTP tunnel, navigate to the Add Connection Profile menu from the Main Menu.




```
                    Add Connection Profile

Profile Name:                      Profile 1
Profile Enabled:                 +---------------+
                                 +---------------+
Data Link Encapsulation...       | PPP           |
                                 | Frame Relay   |
                                 | RFC1483       |
                                 | ATMP          |
IP Profile Parameters...         | PPTP          |
                                 | IPsec         |
                                 +---------------+




COMMIT                             CANCEL
```

When you define a Connection Profile as using PPTP by selecting PPTP as the datalink encapsulation method, and then select **Data Link Options**, the PPTP Tunnel Options screen appears.

```
                              PPTP Tunnel Options

          PPTP Partner IP Address:           173.167.8.134
          Tunnel Via Gateway:                0.0.0.0

          Data Compression...                None
          Authentication...                  CHAP


          Send Host name:                    tony
          Send Secret:                       *****
          Receive Host name:                 kimba
          Receive Secret:                    ******

          Initiate Connections:              Yes
          On Demand:                         Yes

          Optional Windows NT Domain Name:

          Idle Timeout (seconds):            300

Return accepts * ESC cancels * Left/Right moves insertion point * Del deletes.
In this Screen you will configure the GRE/PPTP specific connection params.
```

Note: Profiles using PPTP do not offer a Telco Options screen.

- Enter the **PPTP Partner IP Address**. This specifies the address of the other end of the tunnel.

  If you do not specify the PPTP Partner IP Address the gateway cannot initiate tunnels, i.e., act as a PPTP Access Concentrator (PAC) for this profile. It can only accept tunnel requests as a PPTP Network Server (PNS).

- If you specify the PPTP Partner IP Address, and the address is in the same subnet as the Remote IP Address you specified in the IP Profile Parameters, the **Tunnel Via Gateway** option becomes visible. You can enter the address by which the gateway partner is reached.

  If you do not specify the PPTP Partner IP Address, the router will use the default gateway to reach the partner and the **Tunnel Via Gateway** field is hidden. If the partner should be reached via an alternate port (i.e. the LAN instead of the WAN), the **Tunnel Via Gateway** field allows this path to be resolved.

- You can specify a **Data Compression** algorithm, either None or Standard LZS, for the PPTP connection.

  Note: When the Authentication protocol is MS-CHAP, compression is set to None, and the **Data Compression** option is hidden.

- From the pop-up menu select an **Authentication** protocol for the PPP connection. Options are PAP, CHAP, or MS-CHAP. The default is PAP. The authentication protocol must be the same on both ends of the tunnel.

- When the authentication protocol is MS-CHAP, you can specify a **Data Encryption** algorithm for the PPTP connection. Available options are MPPE and None (the default). For other authentication protocols, this option is hidden. When MPPE is negotiated, the WAN Event History reports that it is negotiated as a CCP (compression) type. This is because the MPPE protocol uses a compression engine, even though it is not

itself a compression protocol.

Note: The Netopia 4752 supports 128-bit ("strong") encryption. Unlike MS-CHAP version 1, which supports one-way authentication, MS-CHAP version 2 supports mutual authentication between connected routers and is incompatible with MS-CHAP version 1 (MS-CHAP-V1). When you choose MS-CHAP as the authentication method for the PPTP tunnel, the Netopia router will start negotiating MS-CHAP-V2. If the router you are connecting to does not support MS-CHAP-V2, it will fall back to MS-CHAP-V1, or, if the router you are connecting to does not support MPPE at all, the PPP session will be dropped.

- You can specify a **Send Host Name** which is used with Send Secret for authenticating with a remote PNS when the profile is used for initiating a tunnel connection.
- You must specify a **Send Secret** (the CHAP and MS-CHAP term for password), used for authenticating the tunnel when initiating a tunnel connection.
- You can specify a **Receive Host Name** which is used with the Receive Secret for authenticating a remote PPTP client.
- You must specify a **Receive Secret**, used for authenticating the remote PPTP client.
- You can specify that this router will **Initiate Connections** (acting as a PAC) or only answer them (acting as a PNS).
- Tunnels are normally initiated **On Demand**; however, you can disable this feature. When disabled, the tunnel must be manually established via the call management screens or may be scheduled using the scheduled connections feature. See "Scheduled Connections" in the *User's Reference Guide*.
- Some networks that use Microsoft Windows NT PPTP Network Servers require additional authentication information, called *Windows NT Domain Name*, when answering PPTP tunnel connection requests. Not all Windows NT installations require this information, since not all such installations use this authentication feature. The Windows NT Domain Name is not the same as the Internet domain name, but is the name of a group of servers that share common security policy and user account databases. Your PPTP tunnel partner's administrator will supply this Windows NT Domain Name if it is required. If you configure your Netopia 4752 to initiate PPTP tunnel connections by toggling **Initiate Connections** to **Yes**, the **Optional Windows NT Domain Name** field appears. Enter the domain name your network administrator has supplied.
- You can specify the **Idle Timeout**, an inactivity timer, whose expiration will terminate the tunnel. A value of zero disables the timer. Because tunnels are subject to abrupt termination when the underlying datalink is torn down, use of the Idle Timeout is strongly encouraged.
- Return to the Connection Profile screen by pressing Escape.
- Select **IP Profile Parameters** and press Return.

The IP Profile Parameters screen appears.

```
                          IP Profile Parameters

        Address Translation Enabled:       Yes

        NAT Map List...                    Easy-PAT
        NAT Server List...                 Easy-Servers

        Local WAN IP Address:              0.0.0.0

        Remote IP Address:                 173.167.8.10
        Remote IP Mask:                    255.255.0.0

        Filter Set...
        Remove Filter Set

        Receive RIP:                       Both


Enter a subnet mask in decimal and dot form (xxx.xxx.xxx.xxx).
```

- Enter the **Remote IP Address** and **Remote IP Mask** for the host to which you want to tunnel.

About IPsec Tunnels

IPsec stands for IP Security, a set of protocols that supports secure exchange of IP packets at the IP layer. IPsec is deployed widely to implement Virtual Private Networks (VPNs). See Overview on page 12-1 for more information.

IPsec supports two encryption modes: Transport and Tunnel. Transport mode encrypts only the data portion (payload) of each packet, but leaves the header untouched. The more secure Tunnel mode encrypts both the header and the payload. On the receiving side, an IPsec-compliant device decrypts each packet. Netopia Routers support the more secure Tunnel mode.

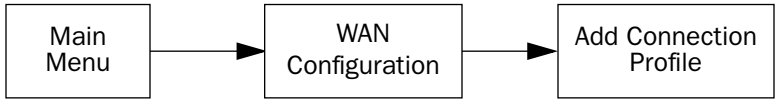
DES stands for Data Encryption Standard, a popular symmetric-key encryption method. DES uses a 56-bit key.

The Netopia 4752 offers IPsec DES encryption over the VPN tunnel.

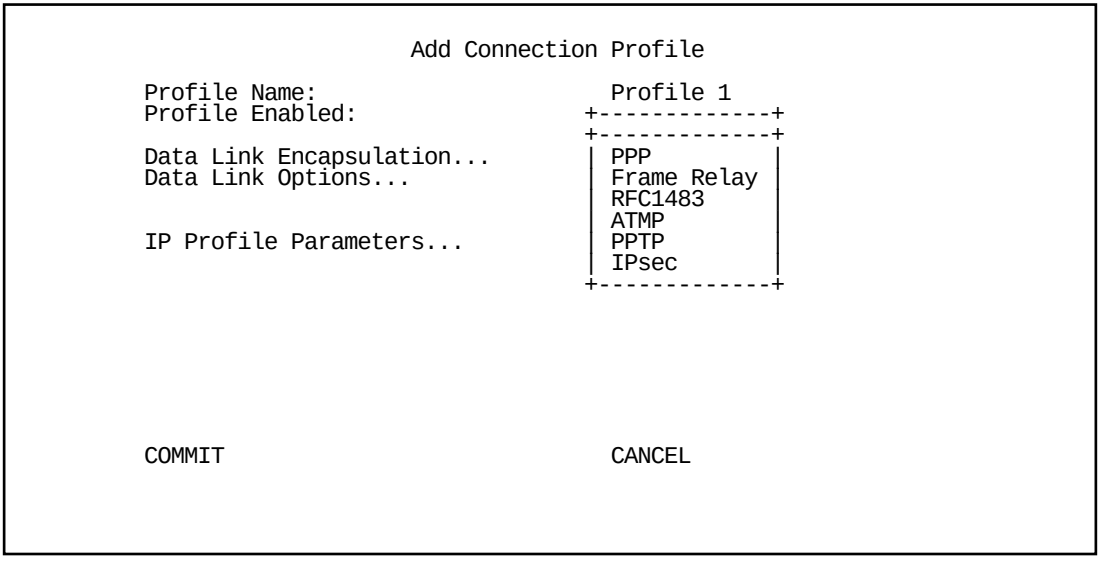
Configuration

IPsec tunnels are defined in the same manner as PPTP tunnels. You configure the Connection Profile as follows.

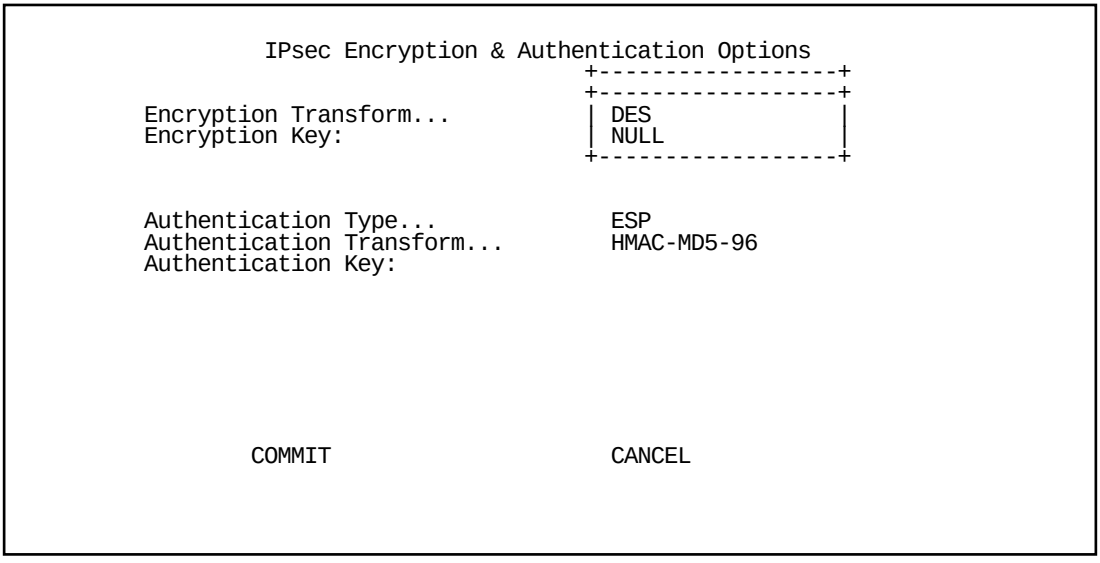
From the Main Menu navigate to WAN Configuration and then Add Connection Profile.



The Add Connection Profile screen appears.



- From the **Data Link Encapsulation** pop-up menu select **IPsec**.
- Then select **Data Link Options**. The IPsec Encryption & Authentication Options screen appears.



- You must specify an **Encryption Transform**. The choices are **DES** or **NULL**. The default is **DES**.

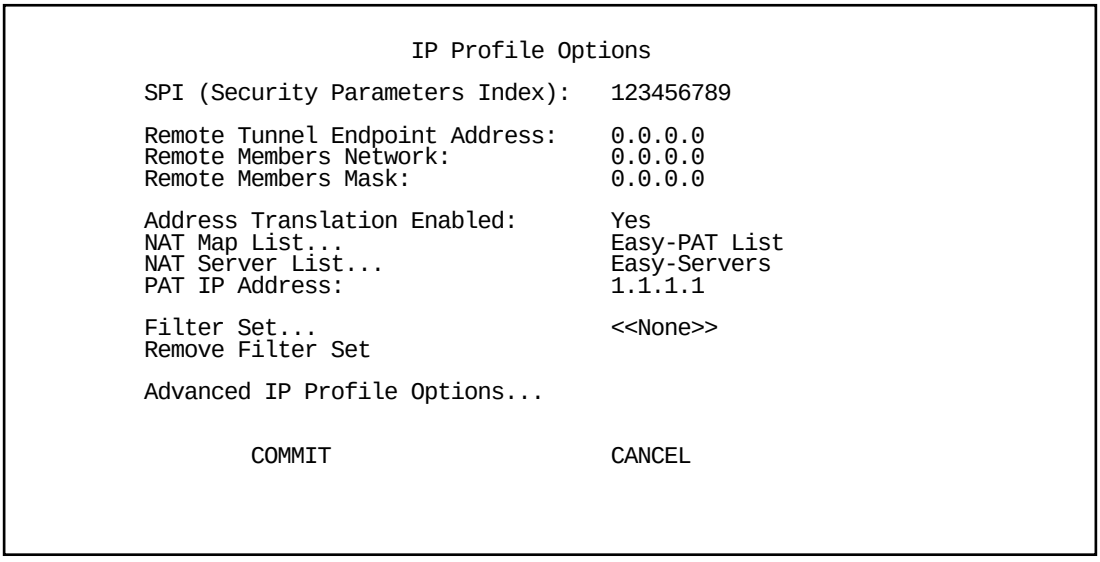
```
                IPsec Encryption & Authentication Options

        Encryption Transform...            DES
        Encryption Key:



        Authentication Type...             ESP
        Authentication Transform...        HMAC-MD5-96
        Authentication Key:









                COMMIT                     CANCEL

Enter a key of 16 Hex digits, e.g. '1234567890ABCDEF'
```

- You must enter an **Encryption Key** if the Encryption Transform is DES. The key for DES must be a hexadecimal string of 16 characters, using Hex characters only: '0'-'9', 'A'-'F' and 'a' - 'f'. No key entry appears if the encryption transform is NULL.
- You must specify an **Authentication Type**. The default is **ESP**, and the choices are **ESP**, **None**, or **AH**. **ESP** provides confidentiality over the IP payload and optional authentication of the IP payload and ESP header. **AH** (Authentication Header) provides authentication over the immutable parts of the IP header, AH header and the IP payload. ESP is preferred.
- You must specify an **Authentication Transform** if the Authentication Type is anything other than None. The default is **HMAC-MD5-96**, and the choices are **HMAC-MD5-96** or **HMAC-SHA1-96** for both AH and ESP.
- You must specify an **Authentication Key** if the Authentication Type is anything other than None. The key must be an ASCII string of up to 48 characters for both HMAC-MD5-96 and HMAC-SHA1-96.

  Key: The key is a hexadecimal entry of 16 bytes (32 characters of input) for MD5 and 20 bytes (40 characters of input) for SHA1. It is not possible to view the Encryption Keys or Authentication Key once they have been set.
- Press **COMMIT** to return to the Add Connection Profile screen.
- Select **IP Profile Parameters**.

IP Profile Parameters

The following IP Profile Options screen is displayed for an IPsec Connection Profile.



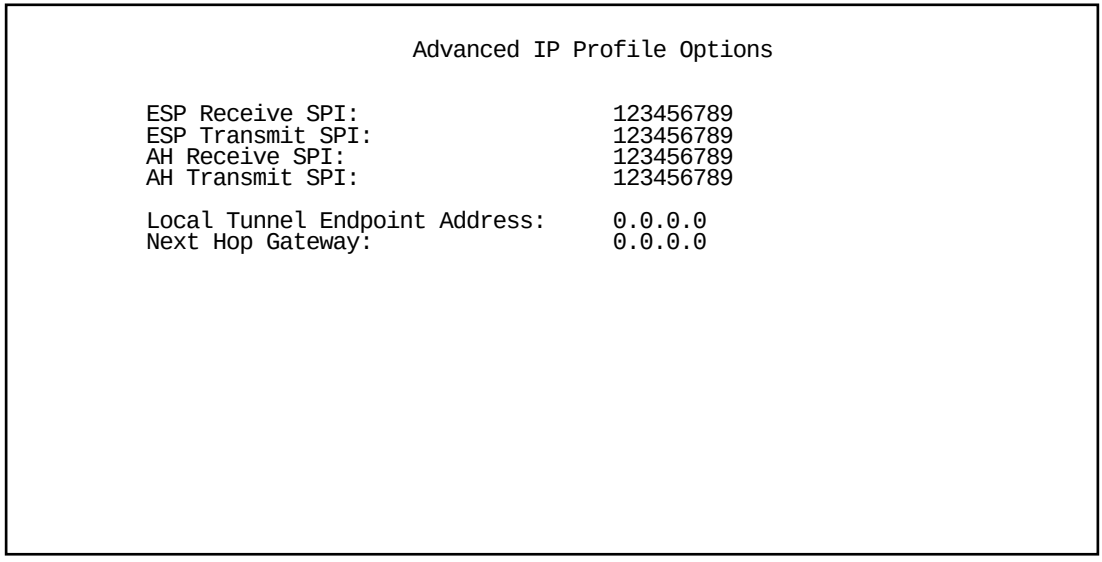
- You must specify an **SPI (Security Parameters Index)**, which is the ESP receive side SPI and the default SPI for ESP transmit, AH receive, and AH transmit. It must be unique relative to any other configuration profile "ESP Receive SPIs." (See Advanced IP Profile Options on page 12-11.)
- You must specify a **Remote Tunnel Endpoint Address**. Specify the IP address of your tunnel partner, the endpoint of the tunnel. The Remote Tunnel Endpoint Address may be 0.0.0.0, which implies that the IPsec tunnel will not be established until packets are received on the SPI specified. At that time the tunnel will be bound to the Remote Tunnel Endpoint until traffic from the remote gateway ceases for a timeout period.
- You must specify a **Remote Members Network** address. This specifies the subnet of the remote IPsec tunnel and will be used with the Remote Members Mask to determine and set the route.
- You must specify a **Remote Members Mask**. This is the subnet mask of the remote subnet to which the IPsec tunnel will route.
- You can specify **Address Translation Enabled**. For more information see Chapter 11, "Multiple Network Address Translation." If Address Translation Enabled is set to **Yes**, you can specify the following three fields:
  - **NAT Map List**
  - **NAT Server List**
  - **PAT IP Address**
    (**Note:** Since there is no protocol to derive this address, 0.0.0.0 is not permitted.)

  Map Lists, Server Lists, and PAT addresses are described in detail in Chapter 11, "Multiple Network Address Translation."
- You can specify a **Filter Set**. See About Filters and Filter Sets on page 13-4.

- You can remove a **Filter Set**.
- You can choose to configure **Advanced IP Profile Options** (see "Advanced IP Profile Options," in the following section).

Note: The SPI title field above changes to **SPI (Security Parameters Index) – Use Advanced IP Profile Options** if any of the SPI values differ from each other.

Advanced IP Profile Options



- You can specify an **ESP Receive SPI**. The value must be unique over the set of all ESP SPIs specified for the remote tunnel endpoint.
- You can specify an **ESP Transmit SPI**. The value must be unique over the set of all ESP SPIs specified for the remote tunnel endpoint.
- You can specify an **AH Receive SPI** if AH authentication has been requested. The value must be unique over the set of all AH SPIs specified for the router.
- You can specify an **AH Transmit SPI** if AH authentication has been requested. The value must be unique over the set of all AH SPIs specified for the remote tunnel endpoint.
- You can specify a **Local Tunnel Endpoint Address**. If not 0.0.0.0, this value must be one of the assigned interface addresses, either WAN or LAN. This is used as the source address of all IPsec traffic.
- You can specify a **Next Hop Gateway**. If you specify the Remote Tunnel Endpoint Address, and the address is in the same subnet as the Remote Members Network you specified in the IP Profile Parameters, the **Next Hop Gateway** option allows you to enter the address by which the gateway partner is reached.

  If you do not specify the Remote Tunnel Endpoint Address, the router will use the default gateway to reach the partner. If the partner should be reached via an alternate port (for example, the LAN instead of the WAN), the **Next Hop Gateway** field allows this path to be resolved.

Interoperation with other features

- Address serving is not supported through IPsec Tunnels.
- AH is not supported through an interface that has NAT applied to it. NAT may be applied to the inner payload.
- AH is not supported through an interface which is either Unnumbered or Numbered with a dynamically assigned address unless the Local Tunnel Endpoint address is specified in the Advanced IP Profile Options screen.

Encryption Support

Encryption is a method for altering user data into a form that is unusable by anyone other than the intended recipient. The recipient must have the means to decrypt the data to render it usable to them. The encryption process protects the data by making it difficult for any third party to get at the original data.

Netopia PPTP is fully compatible with Microsoft Point-to-Point Encryption (MPPE) data encryption for user data transfer over the PPTP tunnel. Microsoft Windows NT Server provides MPPE encryption capability only when Microsoft Challenge Handshake Authentication Protocol (MS-CHAP) is enabled. Netopia complies with this feature to allow MPPE only when MS-CHAP is negotiated. MS-CHAP and MPPE are user-selectable options in the PPTP Tunnel Options screen. If either the client or the server side specifies encryption, then encryption becomes mandatory for both.

Netopia's ATMP implementation supports Data Encryption Standard (DES) data encryption for user data transfer over the ATMP tunnel between two Netopia routers. The encryption option, none or DES, is a selectable option in the ATMP Tunnel Options screen.

MS-CHAP V2 and 128-bit strong encryption

Notes:

- The Netopia 4752 supports 128-bit ("strong") encryption when using PPTP tunnels.

  ATMP does not have an option of using 128-bit MPPE. If you are using ATMP between two Netopia routers you can optionally set 56-bit DES encryption.
- When you choose MS-CHAP as the authentication method for a PPTP tunnel, the Netopia router will start negotiating MS-CHAPv2. If the router or VPN adapter client you are connecting to does not support MS-CHAPv2, the Netopia router will fall back to MS-CHAPv1, or, if the router or VPN adapter client you are connecting to does not support MPPE at all, the PPP session will be dropped. This is done automatically and transparently.

ATMP/PPTP Default Answer Profile

The WAN Configuration menu offers a ATMP/PPTP Default Answer Profile option. Use this selection when your router is acting as the server for VPN connections, that is, when you are on the answering end of the tunnel establishment. The ATMP/PPTP Default Answer Profile determines the way the attempted tunnel connection is answered.

```
                              WAN Configuration

                      WAN (Wide Area Network) Setup...

                      Display/Change Connection Profile...
                      Add Connection Profile...
                      Delete Connection Profile...

                      WAN Default Profile...
                      ATMP/PPTP Default Profile...
                      Scheduled Connections...


                      Configuration Changes Reset WAN Connection:     Yes
                      Frame Relay Configuration...
                      Frame Relay DLCI Configuration...

                      Establish WAN Connection...
                      Disconnect WAN Connection...

From here you will configure yours and the remote sites' WAN information.
```

To set the parameters under which the router will answer attempted VPN connections, select **ATMP/PPTP Default Answer Profile** and press Return. The Default VPN Profile screen appears.

```
                           ATMP/PPTP Default Profile

         Answer VPN connections:            No

         PPTP Configuration Options:
         Receive Authentication...          PAP
         Data Compression...                None









Configure Default VPN Connection Parameters here.
```

- Toggle **Answer VPN Connections** to **Yes** if you want the router to accept VPN connections or **No** (the

default) if you do not. This applies to both ATMP and PPTP connections.

- For PPTP tunnel connections only, you must define what type of authentication these connections will use. Select **Receive Authentication** and press Return. A pop-up menu offers the following options: PAP (the default), CHAP, or MS-CHAP.
- If you chose PAP or CHAP authentication, from the **Data Compression** pop-up menu select either None (the default) or Standard LZS.

  If you chose MS-CHAP authentication, the **Data Compression** option is not required, and this menu item becomes hidden.

VPN QuickView

You can view the status of your VPN connections in the VPN QuickView screen.

From the Main Menu select QuickView and then VPN QuickView.

The VPN QuickView screen appears.

```
                              VPN Quick View

Profile Name----------Type--Rx Pckts--Tx Pckts------Est.-Partner Address------
HA <-> FA1 (Jony Fon  ATMP        99        99      Rmt  173.166.82.8
HA <-> FA3 (Sleve M.  ATMP        13        14      Rmt  63.193.117.91
```

Profile Name: Lists the name of the Connection Profile being used, if any.

Type: Shows the data link encapsulation method (PPTP or ATMP).

Rx Pckts: Shows the number of packets received via the VPN tunnel.

Tx Pckts: Shows the number of packets transmitted via the VPN tunnel.

Est: Indicates whether the connection was locally (“Lcl”) or remotely (“Rmt”) established.

Partner Address: Shows the tunnel partner’s IP address.

Dial-Up Networking for VPN

Microsoft Windows Dial-Up Networking software permits a remote standalone workstation to establish a VPN tunnel to a PPTP server such as a Netopia Router located at a central site. Dial-Up Networking also allows a mobile user who may not be connected to a PAC to dial into an intermediate ISP and establish a VPN tunnel to, for example, a corporate headquarters, remotely. Netopia Routers also can serve as a PAC at the workstation's site, making it unnecessary for the standalone workstation to initiate the tunnel. In such a case, the Dial-Up Networking software is not required, since the Netopia Router initiates the tunnel.

This section is provided for users who may require the VPN client software for Dial-Up Networking in order to connect to an ISP who provides a PPTP account.

Microsoft Windows Dial-Up Networking (DUN) is the means by which you can initiate a VPN tunnel between your individual remote client workstation and a private network such as your corporate LAN via the Internet. DUN is a software adapter that allows you to establish a tunnel.

DUN is a free add-on available for Windows 95, and comes standard with Windows 98 and Windows NT. The VPN tunnel behaves as a private network connection, unrelated to other traffic on the network. Once you have installed Dial-Up Networking, you will be able to connect to your remote site as if you had a direct private connection, regardless of the intervening network(s) through which your data passes. You may need to install the Dial-Up Networking feature of Windows 95, 98, or 2000 to take advantage of the virtual private networking feature of your Netopia router.

Note: For the latest information and tech notes on Dial-Up Networking and VPNs be sure to visit the Netopia website at http://www.netopia.com and, for the latest software and release notes, the Microsoft website at http://www.microsoft.com.

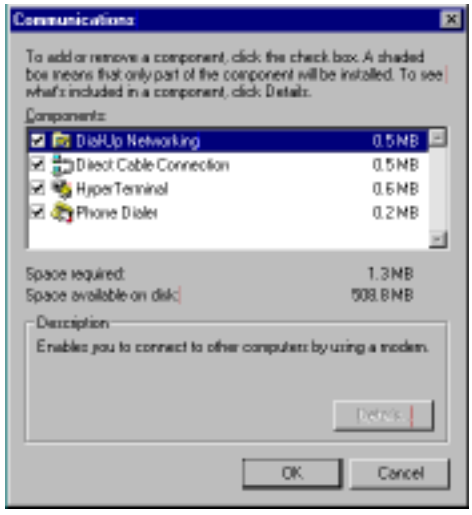
Installing Dial-Up Networking

Check to see if Dial-Up Networking is already installed on your PC. Open your My Computer (or whatever you have named it) icon on your desktop. If there is a folder named Dial-Up Networking, you don't have to install it. If there is no such folder, you must install it from your system disks or CDROM. Do the following:

1. From the **Start** menu, select **Settings** and then **Control Panel**.
2. In the Control Panel window, double-click the **Add/Remove Programs** icon.

   The Add/Remove Programs Properties window appears.
3. Click the **Windows Setup** tab.
4. Double-click **Communications**.

The Communications window appears.



5. In the Communications window, select **Dial-Up Networking** and click the **OK** button.

   This returns you to the Windows Setup screen. Click the **OK** button.

6. Respond to the prompts to install Dial-Up Networking from the system disks or CDROM.

7. When prompted, reboot your PC.

Creating a new Dial-Up Networking profile

A Dial-Up Networking profile is like an address book entry that contains the information and parameters you need for a secure private connection. You can create this profile by using either the Internet Connection Wizard or the Make New Connection feature of Dial-Up Networking. The following instructions tell you how to create the profile with the Make New Connection feature. Do the following:

1. Double-click the **My Computer** (or whatever you have named it) icon on your desktop.

   Open the Dial-Up Networking folder, and then double-click **Make New Connection**. The Make New Connection wizard window appears.

2. Type a name for this connection (such as the name of your company, or the computer you are dialing into).

   From the pull-down menu, select the device you intend to use for the virtual private network connection. This can be any device you have installed or connected to your PC. Click the **Next** button. A screen appears with fields for you to enter telephone numbers for the computer you want to connect to.

3. Type the directory number or the **Virtual Circuit Identifier** number.

   This number is provided by your ISP or corporate administrator. Depending on the type of device you are using, the number may or may not resemble an ordinary telephone directory number.

4. Click the **Next** button.

   The final window will give you a chance to accept or change the name you have entered for this profile. If you are satisfied with it, click the **Finish** button. Your profile is complete.

Configuring a Dial-Up Networking profile

Once you have created your Dial-Up Networking profile, you configure it for TCP/IP networking to allow you to connect to the Internet through your Internet connection device. Do the following:

1. Double-click the **My Computer** (or whatever you have named it) icon on your desktop.

   Open the Dial-Up Networking folder. You will see the icon for the profile you created in the previous section.

2. Right-click the icon and from the pop-up menu select **Properties**.

3. In the Properties window click the **Server Type** button.

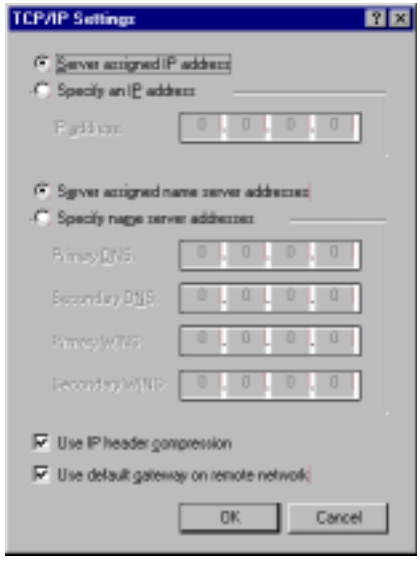
   From the Type of Dial-up Server pull-down menu select the appropriate type of server for your system version:

   - Windows 95 users select **PPP: Windows 95, Windows NT 3.5, Internet**
   - Windows 98 users select **PPP: Windows 98, Windows NT Server, Internet**

   In the Allowed network protocols area check **TCP/IP** and uncheck all of the other checkboxes.

   Note: Netopia's PPTP implementation does not currently support tunnelling of IPX and NetBEUI protocols.

4. Click the **TCP/IP Settings** button.



   - If your ISP uses dynamic IP addressing (DHCP), select the Server assigned IP address radio button.
   - If your ISP uses static IP addressing, select the Specify an IP address radio button and enter your assigned IP address in the fields provided. Also enter the IP address in the Primary and Secondary DNS fields.

5. Click the **OK** button in this window and the next two windows.

Installing the VPN Client

Before Installing the VPN Client you must have TCP/IP installed and have an established Internet connection.

Windows 95 VPN installation

1. From your Internet browser navigate to the following URL:

   http://www.microsoft.com/NTServer/nts/downloads/recommended/dunl3win95/releasenotes.aso

   Download the Microsoft Windows 95 VPN patch dun 1.3 to the Windows 95 computer you intend to use as a VPN client with PPTP. Follow the installation instructions.

2. From the Windows 95 **Start** menu select **Settings**, then **Control Panel** and click once.

   The Control Panel screen appears.

3. Double-click **Add/Remove Programs**.

   The Add/Remove Programs screen appears.

4. Click the **Windows Setup** tab.

   The Windows Setup screen will be displayed within the top center box.

5. Highlight **Communications** and double-click.

This displays a list of possible selections for the communications option. Active components will have a check in the checkboxes to their left.

6. Check **Dial Up Networking** at the top of the list and **Virtual Private Networking** at the bottom of the list.
7. Click **OK** at the bottom right on each screen until you return to the Control Panel. Close the Control Panel by clicking the upper right corner X.
8. Double-click the **My Computer** icon (normally at the left upper corner of the screen).

   This will display the devices within My Computer. Scroll down the list to **Dial-Up Networking** and double-click it.
9. Double click **Make New Connection**.

   This displays the Make New Connection installation screen. In this screen you will see a box labelled **Select a device**. From the pull-down menu to the right, select **Microsoft VPN Adapter**.

   Click the **Next** button at the bottom of the screen

   This displays the **VPN Host** screen. In the box to the top center of the screen enter your VPN server's IP address (for example, 192.168.xxx.xxx. This is not a proper Internet address)

Windows 98 VPN installation

1. From the Windows 98 **Start** menu select **Settings**, then **Control Panel** and click once.

   The Control Panel screen appears.
2. Double-click **Add/Remove Programs**.

   The Add/Remove Programs screen appears.
3. Click the **Windows Setup** tab.

   The Windows Setup screen will be displayed within the top center box.
4. Double-click **Communications**.

   This displays a list of possible selections for the communications option. Active components will have a check in the checkboxes to their left.
5. Check **Dial Up Networking** at the top of the list and **Virtual Private Networking** at the bottom of the list.
6. Click **OK** at the bottom right on each screen until you return to the Control Panel. Close the Control Panel by clicking the upper right corner X.
7. Double-click the **My Computer** icon (normally at the left upper corner of the screen).

   This will display the devices within My Computer. Scroll down the list to **Dial-Up Networking** and double-click it.
8. Double click **Make New Connection**.

   This displays the Make New Connection installation screen. In this screen you will see a box labelled **Select a device**. From the pull-down menu to the right, select **Microsoft VPN Adapter**.

   Click the **Next** button at the bottom of the screen

   This displays the **VPN Host** screen. In the box to the top center of the screen enter your VPN server's IP address (for example, 192.168.xxx.xxx. This is not a proper Internet address)

Connecting using Dial-Up Networking

A Dial-Up Networking connection will be automatically launched whenever you run a TCP/IP application, such as a web browser or email client. When you first run the application a Connect To dialog box appears in which you enter your User name and Password. If you check the Save password checkbox, the system will remember your User name and Password, and you won't be prompted for them again.

About ATMP Tunnels

To set up an ATMP tunnel, you create a Connection Profile including the IP address and other relevant information for the remote ATMP partner. ATMP uses the terminology of a *foreign agent* that initiates tunnels and a *home agent* that terminates them. You use the same procedure to initiate or terminate an ATMP tunnel. Used in this way, the terms *initiate* and *terminate* mean the beginning and end of the tunnel; they do not mean *activate* and *deactivate*.

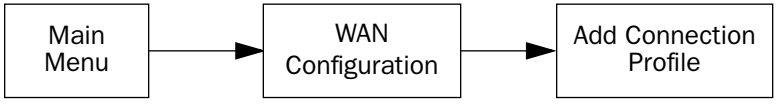
ATMP is a tunneling protocol, with two basic aspects. Tunnels are created and torn down using a session protocol that is UDP-based. User (or client) data is transferred across the tunnel by encapsulating the client data within Generic Routing Encapsulation (GRE). The GRE data is then routed using standard methods.

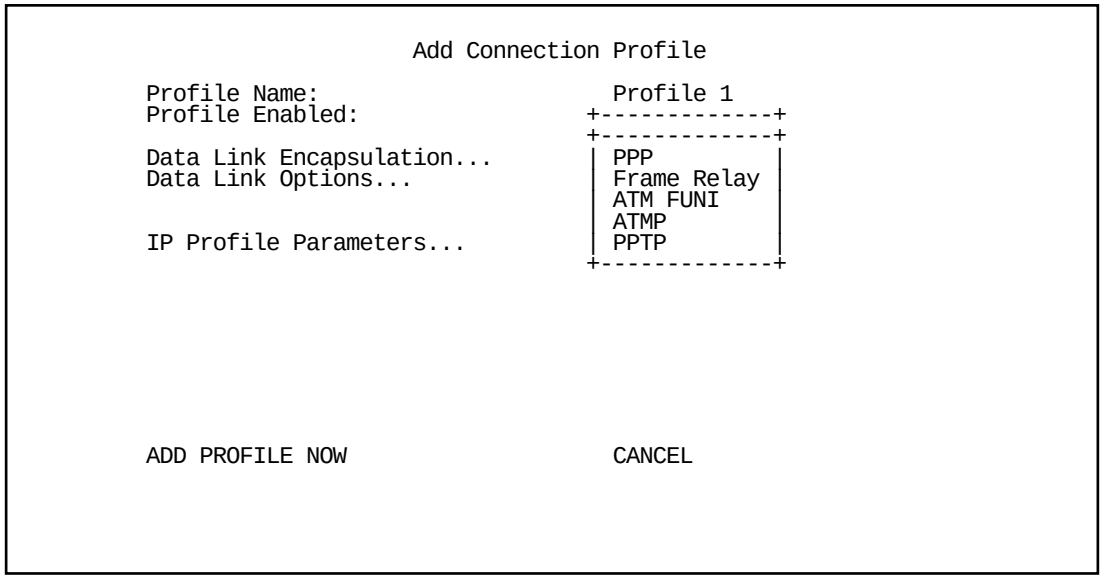
ATMP configuration

ATMP is a Datalink Encapsulation option in Connection Profiles. It is not an option in device or link configuration screens, since ATMP is not a native encapsulation. The Easy Setup Profile does not offer ATMP datalink encapsulation. See the *User's Reference Guide* for information on creating Connection Profiles.

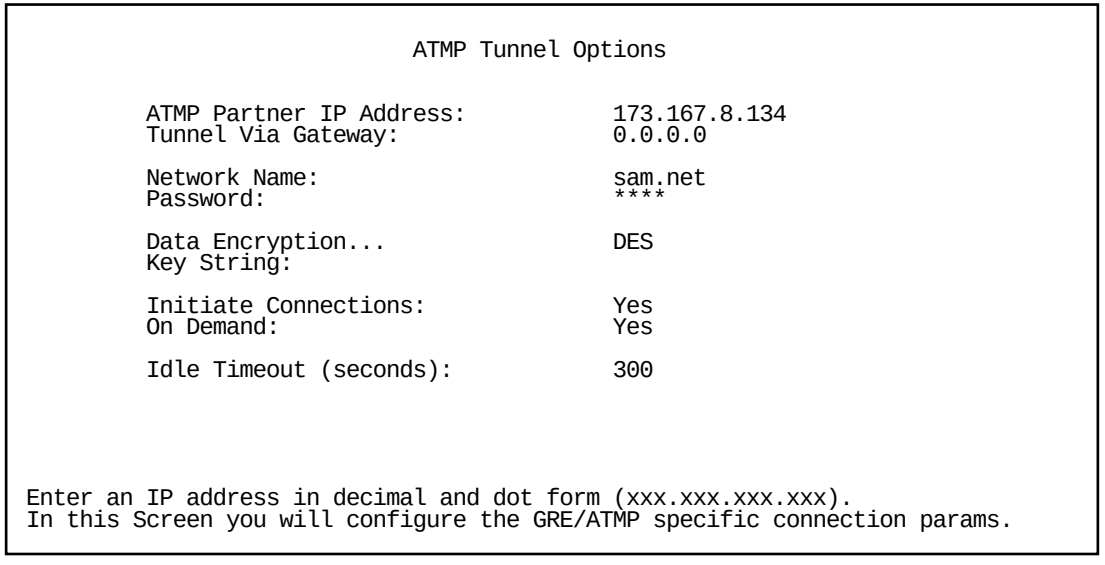
The WAN Event History screens will report VPN tunnel events, such as connections and disconnections, as Channel 4 (and higher) events.

To define an ATMP tunnel, navigate to the **Add Connection Profile** menu from the Main Menu.





When you define a Connection Profile as using ATMP by selecting ATMP as the datalink encapsulation method, and then select **Data Link Options**, the ATMP Tunnel Options screen appears.



Note: An ATMP tunnel cannot be assigned a dynamic IP address by the remote server, as in a PPP connection. When you define an ATMP tunnel profile, the Local WAN IP Address, assigned in the IP Profile Parameters screen, must be the true IP address, not 0.0.0.0, if NAT is enabled.

Profiles using ATMP do not offer a Telco Options screen.

- **ATMP Partner IP Address** specifies the address of the other end of the tunnel. When unspecified, the

gateway can not initiate tunnels (i.e., act as a foreign agent) for this profile; it can only accept tunnel requests as a home agent.

- When you specify the ATMP Partner IP Address, and the address is in the same subnet as the Remote IP Address you specified in the IP Profile Parameters, you can specify the route (**Tunnel Via Gateway**) by which the gateway partner is reached. If you do not specify the ATMP Partner IP Address, the router will use the default gateway to reach the partner and the **Tunnel Via Gateway** field is hidden. If the partner should be reached via an alternate port (i.e., the LAN instead of the WAN), the **Tunnel Via Gateway** field allows this path to be resolved.
- You can specify a **Network Name**. When the tunnel partner is another Netopia router, this name may be used to match against a Connection Profile. When the partner is an Ascend router in Gateway mode, then **Network Name** is used by the Ascend router to match a gateway profile. When the partner is an Ascend router in Router mode, leave this field blank.
- You must specify a **Password**, used for authenticating the tunnel.

  Note: The Password entry will be the same for both ends of the tunnel.
- For Netopia-to-Netopia connections only, you can specify a **Data Encryption** algorithm for the ATMP connection from the pop-up menu, either DES or None. None is the default.

  Note: Ascend does not support DES encryption for ATMP tunnels.
- You must specify a **Key String** of up to (and including) 20 characters when DES is selected. When encryption is None, this field is invisible.
- You can specify that this router will **Initiate Connections**, acting as a foreign agent (**Yes**), or only answer them, acting as a home agent (**No**).
- Tunnels are normally initiated **On Demand**; however, you can disable this feature. When disabled, the tunnel must be manually established through the call management screens.
- You can specify the **Idle Timeout**, an inactivity timer, whose expiration will terminate the tunnel. A value of zero disables the timer. Because tunnels are subject to abrupt termination when the underlying datalink is torn down, use of the Idle Timeout is strongly encouraged.
- Return to the Connection Profile screen by pressing Escape.

- Select **IP Profile Parameters** and press Return. The IP Profile Parameters screen appears.

```
                          IP Profile Parameters

        Address Translation Enabled:        Yes

        NAT Map List...                     Easy-PAT
        NAT Server List...                  Easy-Servers

        Local WAN IP Address:               0.0.0.0

        Remote IP Address:                  173.167.8.10
        Remote IP Mask:                     255.255.0.0

        Filter Set...
        Remove Filter Set

        Receive RIP:                        Both


Enter a subnet mask in decimal and dot form (xxx.xxx.xxx.xxx).
```

- Enter the **Remote IP Address** and **Remote IP Mask** for the host to which you want to tunnel.

Allowing VPNs through a Firewall

An administrator interested in securing a network will usually combine the use of VPNs with the use of a firewall or some similar mechanism. This is because a VPN is not a complete security solution, but rather a component of overall security. Using a VPN will add security to transactions carried over a public network, but a VPN alone will not prevent a public network from infiltrating a private network. Therefore, you should combine use of a firewall with VPNs, where the firewall will secure the private network from infiltration from a public network, and the VPN will secure the transactions that must cross the public network.

A strict firewall may not be provisioned to allow VPN traffic to pass back and forth as needed. In order to ensure that a firewall will allow a VPN, certain attributes must be added to the firewall's provisioning. The provisions necessary vary slightly between ATMP and PPTP, but both protocols operate on the same basic premise: there are control and negotiation operations, and there is the tunnelled traffic that carries the payload of data between the VPN endpoints. The difference is that ATMP uses UDP to handle control and negotiation, while PPTP uses TCP. Then both ATMP and PPTP use GRE to carry the payload.

For PPTP negotiation to work, TCP packets inbound and outbound destined for port 1723 must be allowed. Likewise, for ATMP negotiation to work, UDP packets inbound and outbound destined for port 5150 must be allowed. Source ports are dynamic, so, if possible, make this flexible, too. Additionally, PPTP and ATMP both require a firewall to allow GRE bi-directionally.

The following sections illustrate a sample filtering setup to allow either PPTP or ATMP traffic to cross a firewall:

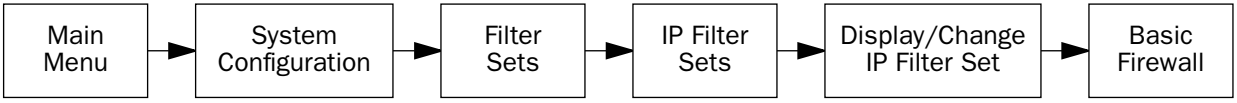
- PPTP example on page 12-24
- ATMP example on page 12-27

Make your own appropriate substitutions. For more information on filters and firewalls, see Chapter 13, “Security.”.

PPTP example

To enable a firewall to allow PPTP traffic, you must provision the firewall to allow inbound and outbound TCP packets specifically destined for port 1723. The source port may be dynamic, so often it is not useful to apply a compare function upon this portion of the control/negotiation packets. You must also set the firewall to allow inbound and outbound GRE packets, enabling transport of the tunnel payload.

From the Main Menu navigate to Display/Change IP Filter Set, and from the pop-up menu select **Basic Firewall**.



Select **Display/Change Input Filter**.

Display/Change Input Filter screen

```
+-#----Source IP Addr----Dest IP Addr------Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------------+
| 1    0.0.0.0          0.0.0.0          TCP   NC       =1723   Yes Yes |
| 2    0.0.0.0          0.0.0.0          GRE   --       --      Yes Yes |
|
```

For Input Filter 1 set the Destination Port information as shown below.

```
                        Change Input Filter 1

      Enabled:                          Yes
      Forward:                          Yes


      Source IP Address:                0.0.0.0
      Source IP Address Mask:           0.0.0.0

      Dest. IP Address:                 0.0.0.0
      Dest. IP Address Mask:            0.0.0.0

      Protocol Type:                    TCP
      Source Port Compare...            No Compare
      Source Port ID:                   0
      Dest. Port Compare...             Equal
      Dest. Port ID:                    1723
      Established TCP Conns. Only:      No
```

For Input Filter 2 set the Protocol Type to allow GRE as shown below.

```
                        Change Input Filter 2

        Enabled:                          Yes
        Forward:                          Yes


        Source IP Address:                0.0.0.0
        Source IP Address Mask:           0.0.0.0

        Dest. IP Address:                 0.0.0.0
        Dest. IP Address Mask:            0.0.0.0

        Protocol Type:                    GRE
```

In the Display/Change IP Filter Set screen select **Display/Change Output Filter**.

Display/Change Output Filter screen

```
+-#----Source IP Addr----Dest IP Addr------Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------------+
| 1    0.0.0.0          0.0.0.0           TCP   NC       =1723   Yes Yes |
| 2    0.0.0.0          0.0.0.0           GRE   --       --      Yes Yes |
```

For Output Filter 1 set the Protocol Type and Destination Port information as shown below.

```
                        Change Output Filter 1

        Enabled:                          Yes
        Forward:                          Yes


        Source IP Address:                0.0.0.0
        Source IP Address Mask:           0.0.0.0

        Dest. IP Address:                 0.0.0.0
        Dest. IP Address Mask:            0.0.0.0

        Protocol Type:                    TCP
        Source Port Compare...            No Compare
        Source Port ID:                   0
        Dest. Port Compare...             Equal
        Dest. Port ID:                    1723
        Established TCP Conns. Only:      No
```

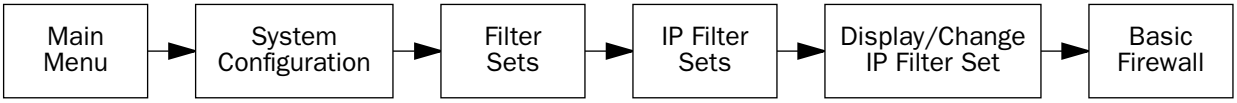
For Output Filter 2 set the Protocol Type to allow GRE as shown below.

```
                    Change Output Filter 2

Enabled:                            Yes
Forward:                            Yes


Source IP Address:                  0.0.0.0
Source IP Address Mask:             0.0.0.0

Dest. IP Address:                   0.0.0.0
Dest. IP Address Mask:              0.0.0.0

Protocol Type:                      GRE
```

ATMP example

To enable a firewall to allow ATMP traffic, you must provision the firewall to allow inbound and outbound UDP packets specifically destined for port 5150. The source port may be dynamic, so often it is not useful to apply a compare function on this portion of the control/negotiation packets. You must also set the firewall to allow inbound and outbound GRE packets (Protocol 47, Internet Assigned Numbers Document, RFC 1700), enabling transport of the tunnel payload.

From the Main Menu navigate to Display/Change IP Filter Set, and from the pop-up menu select **Basic Firewall**.



Select **Display/Change Input Filter**.

Display/Change Input Filter screen

```
+-#----Source IP Addr----Dest IP Addr------Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------------+
| 1    0.0.0.0          0.0.0.0          UDP   NC       =5150   Yes Yes |
| 2    0.0.0.0          0.0.0.0          GRE   --       --      Yes Yes |
|                                                                         |
```

For Input Filter 1 set the Destination Port information as shown below.

```
                        Change Input Filter 1

        Enabled:                            Yes
        Forward:                            Yes


        Source IP Address:                  0.0.0.0
        Source IP Address Mask:             0.0.0.0

        Dest. IP Address:                   0.0.0.0
        Dest. IP Address Mask:              0.0.0.0

        Protocol Type:                      TCP
        Source Port Compare...              No Compare
        Source Port ID:                     0
        Dest. Port Compare...               Equal
        Dest. Port ID:                      1723
        Established TCP Conns. Only:        No
```

For Input Filter 2 set the Protocol Type to allow GRE as shown below.

```
                        Change Input Filter 2

        Enabled:                          Yes
        Forward:                          Yes


        Source IP Address:                0.0.0.0
        Source IP Address Mask:           0.0.0.0

        Dest. IP Address:                 0.0.0.0
        Dest. IP Address Mask:            0.0.0.0

        Protocol Type:                    GRE
```

In the Display/Change IP Filter Set screen select **Display/Change Output Filter**.

Display/Change Output Filter screen

```
+-#----Source IP Addr----Dest IP Addr------Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------------+
| 1    0.0.0.0           0.0.0.0           UDP   NC       NC      Yes Yes |
| 2    0.0.0.0           0.0.0.0           GRE   --       --      Yes Yes |
|                                                                         |
```

For Output Filter 1 set the Protocol Type and Destination Port information as shown below.

```
                        Change Output Filter 1

        Enabled:                          Yes
        Forward:                          Yes


        Source IP Address:                0.0.0.0
        Source IP Address Mask:           0.0.0.0

        Dest. IP Address:                 0.0.0.0
        Dest. IP Address Mask:            0.0.0.0

        Protocol Type:                    UDP
        Source Port Compare...            No Compare
        Source Port ID:                   0
        Dest. Port Compare...             No Compare
        Dest. Port ID:                    5150
```

For Output Filter 2 set the Protocol Type to allow GRE as shown below.

```
                    Change Output Filter 2

Enabled:                            Yes
Forward:                            Yes


Source IP Address:                  0.0.0.0
Source IP Address Mask:             0.0.0.0

Dest. IP Address:                   0.0.0.0
Dest. IP Address Mask:              0.0.0.0

Protocol Type:                      GRE
```

Chapter 13

Security

The Netopia 4752 provides a number of security features to help protect its configuration screens and your local network from unauthorized access. Although these features are optional, it is strongly recommended that you use them.

This section covers the following topics:

Suggested Security Measures

In addition to setting up user accounts, Telnet access, and filters (all of which are covered later in this chapter), there are other actions you can take to make the Netopia 4752 and your network more secure:

- Change the SNMP community strings (or passwords). The default community strings are universal and could easily be known to a potential intruder.
- Set the answer profile so it must match incoming calls to a connection profile.
- Leave the Enable Dial-in Console Access option set to No.
- When using AURP, accept connections only from configured partners.
- Configure the Netopia 4752 through the serial console port to ensure that your communications cannot be intercepted.

User Accounts

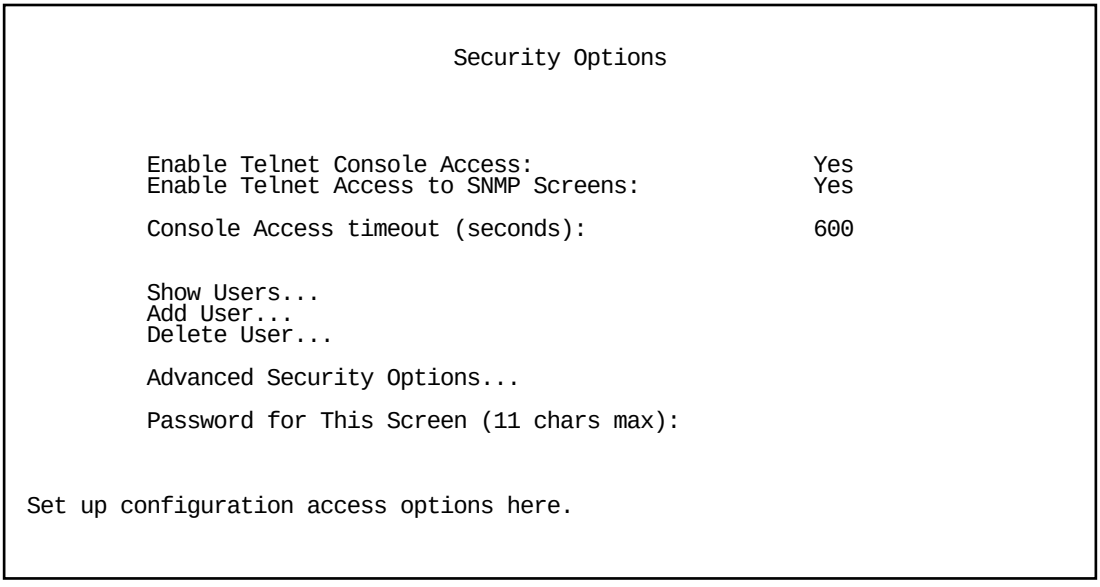
When you first set up and configure the Netopia 4752, no passwords are required to access the configuration screens. Anyone could tamper with the router's configuration by simply connecting it to a console.

However, by adding user accounts, you can protect the most sensitive screens from unauthorized access. User accounts are composed of name/password combinations that can be given to authorized users.

CAUTION! You are strongly encouraged to add protection to the configuration screens. Unprotected screens could allow an unauthorized user to compromise the operation of your entire network.

Once user accounts are created, users who attempt to access protected screens will be challenged. Users who enter an incorrect name or password are returned to a screen requesting a name/password combination to access the Main Menu.

To set up user accounts, in the System Configuration screen select **Security** and press Return. The Security Options screen appears.



Protecting the Security Options screen

The first screen you should protect is the Security Options screen, because it controls access to the configuration screens. Access to the Security Options screen can be protected with a password.

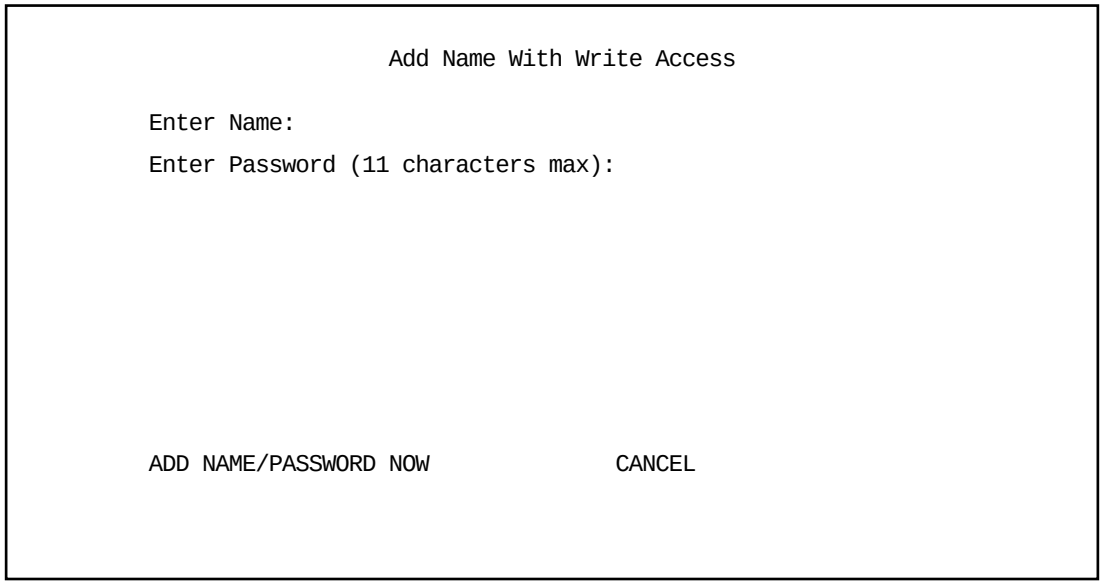
Select **Password for This Screen** in the Security Options screen and enter a password. Make sure this password is secure and is different from any of the user account passwords.

Protecting the configuration screens

You can protect the configuration screens with user accounts. You can administer the accounts from the Security Options screen. You can create up to four accounts.

To display a view-only list of user accounts, select **Show Users** in the Security Options screen.

To add a new user account, select **Add User** in the Security Options screen and press Return. The Add Name With Write Access screen appears.



Follow these steps to configure the new account:

1. Select **Enter Name** and enter a descriptive name (for example, the user's first name).
2. Select **Enter Password** and enter a password.
3. To accept the new name/password combination, select **ADD NAME/PASSWORD NOW** and press Return. To exit the Add Name With Write Access screen without saving the new account, select **CANCEL**. You are returned to the Security Options screen.

To delete a user account, select **Delete User** to display a list of accounts. Select an account from the list and press Return to delete it. To exit the list without deleting the selected account, press Escape.

Telnet Access

Telnet is a TCP/IP service that allows remote terminals to access hosts on an IP network. The Netopia 4752 supports Telnet access to its configuration screens.

CAUTION! You should consider password-protecting or restricting Telnet access to the Netopia 4752 if you suspect there is a chance of tampering.

To password-protect the configuration screens, select Easy Setup from the Main Menu, and go to the Easy Setup Security Configuration screen. By entering a name and password pair in this screen, all access via serial, Telnet, SNMP, and Web server will be password-protected.

To restrict Telnet access, select **Security** in the Advanced Configuration menu. The Security Options screen will appear. There are two levels of Telnet restriction available:

- To restrict Telnet access to the SNMP screens, select **Enable Telnet Access to SNMP Screens** and toggle

it to **No**. (See "SNMP traps" on page 14-15.)

- To restrict Telnet access to all of the configuration screens, select **Enable Telnet Console Access** and toggle it to **No**.

About Filters and Filter Sets

Security should be a high priority for anyone administering a network connected to the Internet. Using packet filters to control network communications can greatly improve your network's security.

The Netopia 4752's packet filters are designed to provide security for the Internet connections made to and from your network. You can customize the router's filter sets for a variety of packet filtering applications. Typically, you use filters to selectively admit or refuse TCP/IP connections from certain remote networks and specific hosts. You will also use filters to screen particular types of connections. This is commonly called firewalling your network.

Before creating filter sets, you should read the next few sections to learn more about how these powerful security tools work.

What's a filter and what's a filter set?

A filter is a rule that lets you specify what sort of data can flow in and out of your network. A particular filter can be either an input filter—one that is used on data (packets) coming in to your network from the Internet—or an output filter—one that is used on data (packets) going out from your network to the Internet.

A filter set is a group of filters that work together to check incoming or outgoing data. A filter set can consist of a combination of input and output filters.

How filter sets work

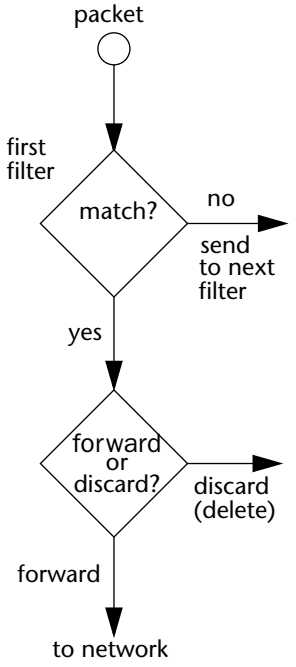
A filter set acts like a team of customs inspectors. Each filter is an inspector through which incoming and outgoing packages must pass. The inspectors work as a team, but each inspects every package individually.

Each inspector has a specific task. One inspector's task may be to examine the destination address of all outgoing packages. That inspector looks for a certain destination—which could be as specific as a street address or as broad as an entire country—and checks each package's destination address to see if it matches that destination.

A filter inspects data packets like a customs inspector scrutinizing packages.

Filter priority

Continuing the customs inspectors analogy, imagine the inspectors lined up to examine a package. If the package matches the first inspector's criteria, the package is either rejected or passed on to its destination, depending on the first inspector's particular orders. In this case, the package is never seen by the remaining inspectors.



If the package does not match the first inspector's criteria, it goes to the second inspector, and so on. You can see that the order of the inspectors in the line is very important.

For example, let's say the first inspector's orders are to send along all packages that come from Rome, and the second inspector's orders are to reject all packages that come from France. If a package arrives from Rome, the first inspector sends it along without allowing the second inspector to see it. A package from Paris is ignored by the first inspector, rejected by the second inspector, and never seen by the others. A package from London is ignored by the first two inspectors, so it's seen by the third inspector.

In the same way, filter sets apply their filters in a particular order. The first filter applied can forward or discard a packet before that packet ever reaches any of the other filters. If the first filter can neither forward nor discard the packet (because it cannot match any criteria), the second filter has a chance to forward or reject it, and so on. Because of this hierarchical structure, each filter is said to have a priority. The first filter has the highest priority, and the last filter has the lowest priority.

How individual filters work

As described above, a filter applies criteria to an IP packet and then takes one of three actions:

- Forwards the packet to the local or remote network
- Blocks (discards) the packet
- Ignores the packet

A filter forwards or blocks a packet only if it finds a match after applying its criteria. When no match occurs, the filter ignores the packet.

A filtering rule

The criteria are based on information contained in the packets. A filter is simply a rule that prescribes certain actions based on certain conditions. For example, the following rule qualifies as a filter:

Block all Telnet attempts that originate from the remote host 199.211.211.17.

This rule applies to Telnet packets that come from a host with the IP address 199.211.211.17. If a match occurs, the packet is blocked.

Here is what this rule looks like when implemented as a filter on the Netopia 4752:

```
+-#--Source IP Addr--Dest IP Addr-----Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------+
| 1  199.211.211.17  0.0.0.0          TCP   23               Yes No  |
+-------------------------------------------------------------------+
```

To understand this particular filter, look at the parts of a filter.

Parts of a filter

A filter consists of criteria based on packet attributes. A typical filter can match a packet on any one of the following attributes:

- The source IP address (where the packet was sent from)
- The destination IP address (where the packet is going)
- The type of higher-layer Internet protocol the packet is carrying, such as TCP or UDP

Port numbers

A filter can also match a packet's port number attributes, but only if the filter's protocol type is set to TCP or UDP, since only those protocols use port numbers. The filter can be configured to match the following:

- The source port number (the port on the sending host that originated the packet)
- The destination port number (the port on the receiving host that the packet is destined for)

By matching on a port number, a filter can be applied to selected TCP or UDP services, such as Telnet, FTP, and World Wide Web. The following tables show a few common services and their associated port numbers:

Internet service	TCP port	Internet service	TCP port
FTP	20/21	Finger	79
Telnet	23	World Wide Web	80
SMTP (mail)	25	News	144
Gopher	70	rlogin	513

Internet service	UDP port	Internet service	UDP port
Who Is	43	AppleTalk Routing Maintenance (at-rtmp)	202
World Wide Web	80	AppleTalk Name Binding (at-nbp)	202
SNMP	161	AURP (AppleTalk)	387
TFTP	69	who	513

Port number comparisons

A filter can also use a comparison option to evaluate a packet's source or destination port number. The comparison options are:

No Compare: No comparison of the port number specified in the filter with the packet's port number.

Not Equal To: For the filter to match, the packet's port number cannot equal the port number specified in the filter.

Less Than: For the filter to match, the packet's port number must be less than the port number specified in the filter.

Less Than or Equal: For the filter to match, the packet's port number must be less than or equal to the port number specified in the filter.

Equal: For the filter to match, the packet's port number must equal the port number specified in the filter.

Greater Than: For the filter to match, the packet's port number must be greater than the port number specified in the filter.

Greater Than or Equal: For the filter to match, the packet's port number must be greater than or equal to the port number specified in the filter.

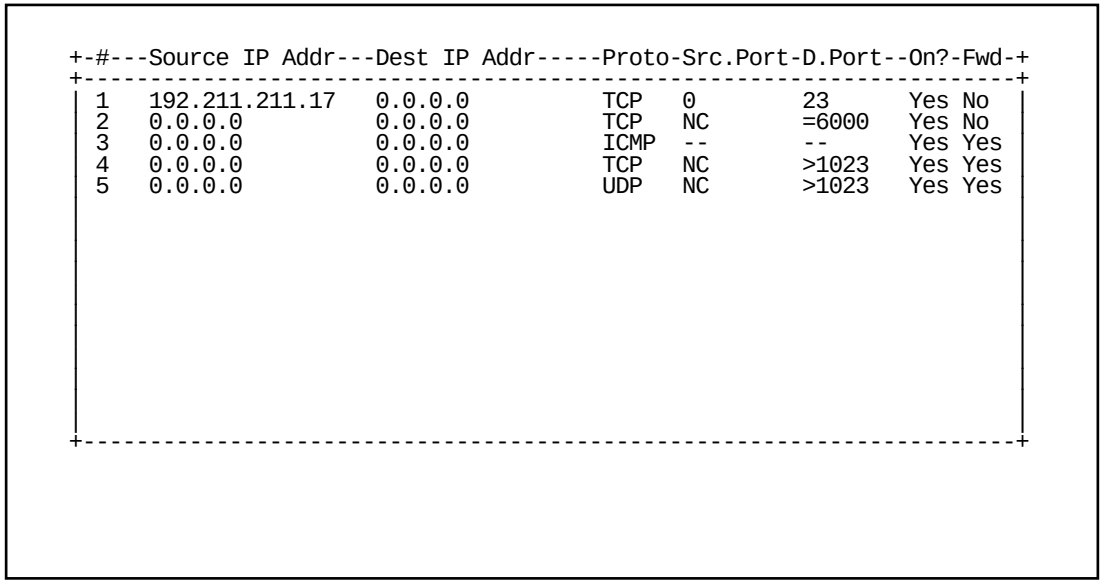
Other filter attributes

There are three other attributes to each filter:

- The filter's order (i.e., priority) in the filter set
- Whether the filter is currently active
- Whether the filter is set to forward packets or to block (discard) packets

Putting the parts together

When you display a filter set, its filters are displayed as rows in a table:



```
+-#---Source IP Addr---Dest IP Addr-----Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------+
| 1   192.211.211.17   0.0.0.0          TCP   0        23      Yes No  |
| 2   0.0.0.0          0.0.0.0          TCP   NC       =6000   Yes No  |
| 3   0.0.0.0          0.0.0.0          ICMP  --       --      Yes Yes |
| 4   0.0.0.0          0.0.0.0          TCP   NC       >1023   Yes Yes |
| 5   0.0.0.0          0.0.0.0          UDP   NC       >1023   Yes Yes |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
+-------------------------------------------------------------------+
```

The table's columns correspond to each filter's attributes:

#: The filter's priority in the set. Filter number 1, with the highest priority, is first in the table.

Source IP Addr: The packet source IP address to match.

Dest IP Addr: The packet destination IP address to match.

Proto: The protocol to match. This can be entered as a number (see the table below) or as TCP or UDP if those protocols are used.

Protocol	Number to use	Full name
N/A	0	Ignores protocol type
ICMP	1	Internet Control Message Protocol
TCP	6	Transmission Control Protocol
UDP	17	User Datagram Protocol

Src. Port: The source port to match. This is the port on the sending host that originated the packet.

D. Port: The destination port to match. This is the port on the receiving host for which the packet is intended.

On?: Displays **Yes** when the filter is in effect or **No** when it is not.

Fwd: Shows whether the filter forwards (**Yes**) a packet or discards (**No**) it when there's a match.

Filtering example #1

Returning to our filtering rule example from above (see page 13-6), look at how a rule is translated into a filter. Start with the rule, then fill in the filter's attributes:

1. The rule you want to implement as a filter is:

   Block all Telnet attempts that originate from the remote host 199.211.211.17.

2. The host 199.211.211.17 is the source of the Telnet packets you want to block, while the destination address is any IP address. How these IP addresses are masked determines what the final match will be, although the mask is not displayed in the table that displays the filter sets (you set it when you create the filter). In fact, since the mask for the destination IP address is 0.0.0.0, the address for Dest IP Addr could have been anything. The mask for Source IP Addr must be 255.255.255.255 since an exact match is desired.

   - Source IP Addr = 199.211.211.17
   - Source IP address mask = 255.255.255.255
   - Dest IP Addr = 0.0.0.0
   - Destination IP address mask = 0.0.0.0

   Note: To learn about IP addresses and masks, see Appendix C, "Understanding IP Addressing."

3. Using the tables on page 13-7, find the destination port and protocol numbers (the *local* Telnet port):

   - Proto = TCP (or 6)
   - D. Port = 23

4. The filter should be enabled and instructed to block the Telnet packets containing the source address shown in step 2:

   - On? = Yes
   - Fwd = No

This four-step process is how we produced the following filter from the original rule:

```
+-#---Source IP Addr---Dest IP Addr-----Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------+
| 1   192.211.211.17   0.0.0.0          TCP   0        23      Yes No  |
|                                                                     |
+-------------------------------------------------------------------+
```

Filtering example #2

Suppose a filter is configured to block all incoming IP packets with the source IP address of 200.233.14.0, regardless of the type of connection or its destination. The filter would look like this:

```
+-#---Source IP Addr---Dest IP Addr-----Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------+
| 1   200.233.14.0     0.0.0.0               0               Yes No  |
|                                                                   |
+-------------------------------------------------------------------+
```

This filter blocks any packets coming from a remote network with the IP network address 200.233.14.0. The 0 at the end of the address signifies *any* host on the class C IP network 200.233.14.0. If, for example, the filter is applied to a packet with the source IP address 200.233.14.5, it will block it.

In this case, the mask, which does not appear in the table, must be set to 255.255.255.0. This way, all packets with a source address of 200.233.14.x will be matched correctly, no matter what the final address byte is.

Note: The protocol attribute for this filter is 0 by default. This tells the filter to ignore the IP protocol or type of IP packet.

Design guidelines

Careful thought must go into designing a new filter set. You should consider the following guidelines:

- Be sure the filter set's overall purpose is clear from the beginning. A vague purpose can lead to a faulty set, and that can actually make your network *less* secure.
- Be sure each individual filter's purpose is clear.
- Determine how filter priority will affect the set's actions. Test the set (on paper) by determining how the filters would respond to a number of different hypothetical packets.
- Consider the combined effect of the filters. If every filter in a set fails to match on a particular packet, the packet is:
  - Forwarded if all the filters are configured to discard (*not* forward)
  - Discarded if all the filters are configured to forward
  - Discarded if the set contains a combination of forward and discard filters

Disadvantages of filters

Although using filter sets can greatly enhance network security, there are disadvantages:

- Filters are complex. Combining them in filter sets introduces subtle interactions, increasing the likelihood of implementation errors.
- Enabling a large number of filters can have a negative impact on performance. Processing of packets will take longer if they have to go through many checkpoints.
- Too much reliance on packet filters can cause too little reliance on other security methods. Filter sets are *not* a substitute for password protection, effective safeguarding of passwords, caller ID, the "must match"

option in the answer profile, PAP or CHAP in connection profiles, callback, and general awareness of how your network may be vulnerable.

An approach to using filters

The ultimate goal of network security is to prevent unauthorized access to the network without compromising authorized access. Using filter sets is part of reaching that goal.

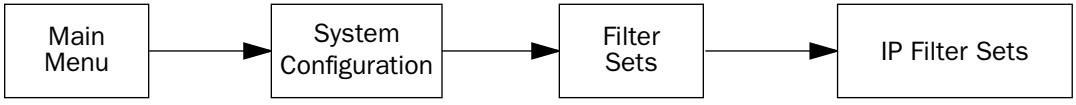
Each filter set you design will be based on one of the following approaches:

- That which is not expressly prohibited is permitted.
- That which is not expressly permitted is prohibited.

It is strongly recommended that you take the latter, and safer, approach to all of your filter set designs.

Working with IP Filters and Filter Sets

This section covers IP filters and filter sets.



To work with filters and filter sets, begin by accessing the filter set screens.

Note: Make sure you understand how filters work before attempting to use them. Read the section "About Filters and Filter Sets," beginning on page 13-4.

```
                              IP Filter Sets

                          Display/Change IP Filter Set...
                          Add IP Filter Set...
                          Delete IP Filter Set...









Return/Enter to configure and add a new Filter Set
Set Up IP Filter Sets (Firewalls) from this and the following Menus.
```

The procedure for creating and maintaining filter sets is as follows:

1. Add a new filter set.
2. Create the filters for the new filter set.
3. View, change, or delete individual filters and filter sets.

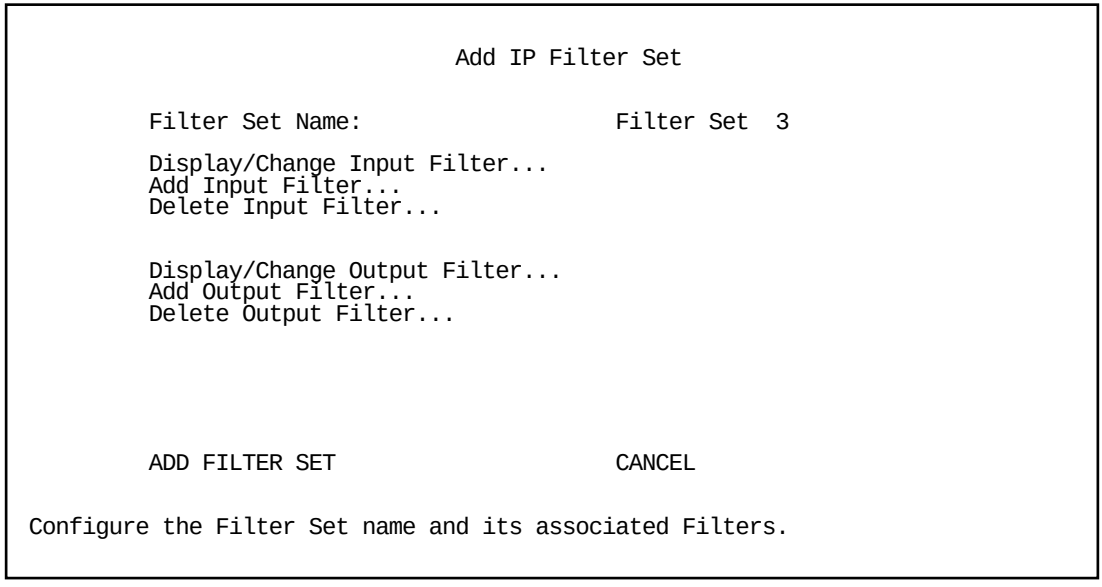
The sections below explain how to execute these steps.

Adding a filter set

You can create up to eight different custom filter sets. Each filter set can contain up to 16 output filters and up to 16 input filters.

To add a new filter set, select **Add IP Filter Set** in the IP Filter Sets screen and press Return. The Add Filter Set screen appears.

Note: There are two groups of items in the Add IP Filter Set screen, one for input filters and one for output filters. The two groups work in essentially the same way, as you'll see below.



Naming a new filter set

All new filter sets have a default name. The first filter set you add will be called Filter Set 1, the next filter will be Filter Set 2, and so on.

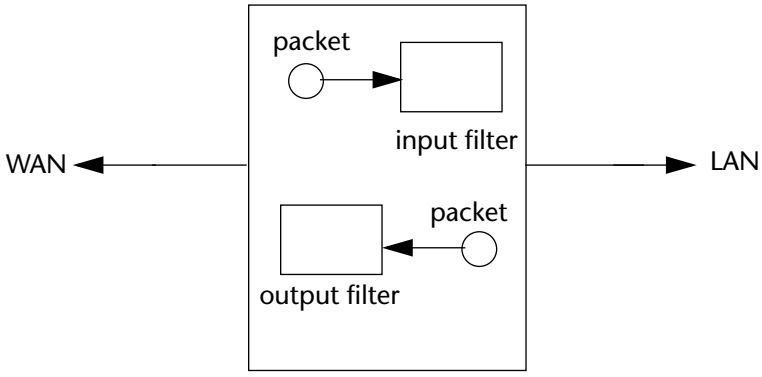
To give a new filter set a different name, select **Filter Set Name** and enter a new name for the filter set.

To save the filter set, select **ADD FILTER SET**. The saved filter set is empty (contains no filters), but you can return to it later to add filters (see "Modifying filter sets" on page 13-16). Or you can add filters to your new set before saving it (see "Adding filters to a filter set" on page 13-13).

To leave the Add Filter Set screen without saving the new filter set select **CANCEL**. You are returned to the IP Filter Sets screen.

Input and output filters—source and destination

There are two kinds of filters you can add to a filter set: input and output. Input filters check packets received from the Internet, destined for your network. Output filters check packets transmitted from your network to the Internet.



The Netopia R-Series Router

Packets in the Netopia 4752 pass through an input filter if they originate in the WAN and through an output filter if they're being sent out to the WAN.

The process for adding input and output filters is exactly the same. The main difference between the two involves their reference to source and destination. From the perspective of an input filter, your local network is the destination of the packets it checks, and the remote network is their source. From the perspective of an output filter, your local network is the source of the packets, and the remote network is their destination.

Type of filter	Source means	Destination means
Input filter	The remote network	The local network
Output filter	The local network	The remote network

Adding filters to a filter set

In this section you'll learn how to add an input filter to a filter set. Adding an output filter works exactly the same way, providing you keep the different source and destination perspectives in mind.

To add an input filter, select **Add Input Filter** in the Add IP Filter Set screen. The Add Filter screen appears. (To add an output filter, select **Add Output Filter**.)

```
                                Add Filter

                        Enabled:                    No
                        Forward:                    No

                        Source IP Address:          0.0.0.0
                        Source IP Address Mask:     0.0.0.0

                        Dest. IP Address:           0.0.0.0
                        Dest. IP Address Mask:      0.0.0.0

                        Protocol Type:              0

                        Source Port Compare...      No Compare
                        Source Port ID:             0
                        Dest. Port Compare...       No Compare
                        Dest. Port ID:              0

                        ADD THIS FILTER NOW         CANCEL


Enter the IP specific information for this filter.
```

1. To make the filter active in the filter set, select **Enabled** and toggle it to **Yes**. If **Enabled** is toggled to **No**, the filter can still exist in the filter set, but it will have no effect.
2. If you want the filter to forward packets that match its criteria to the destination IP address, select **Forward** and toggle it to **Yes**. If **Forward** is toggled to **No**, packets matching the filter's criteria will be discarded.
3. Select **Source IP Address** and enter the source IP address this filter will match on. You can enter a subnet or a host address.
4. Select **Source IP Address Mask** and enter a mask for the source IP address. This allows you to further modify the way the filter will match on the source address. Enter 0.0.0.0 to force the filter to match on all source IP addresses, or enter 255.255.255.255 to match the source IP address exclusively.
5. Select **Dest. IP Address** and enter the destination IP address this filter will match on. You can enter a subnet or a host address.
6. Select **Dest. IP Address Mask** and enter a mask for the destination IP address. This allows you to further modify the way the filter will match on the destination address. Enter 0.0.0.0 to force the filter to match on all destination IP addresses.
7. Select **Protocol Type** and enter **ICMP**, **TCP**, **UDP**, **Any**, or the number of another IP transport protocol (see the table on page 13-8).

   Note: If Protocol Type is set to TCP or UDP, the settings for port comparison that you configure in steps 8 and 9 will appear. These settings only take effect if the Protocol Type is TCP or UDP.
8. Select **Source Port Compare** and choose a comparison method for the filter to use on a packet's source port number. Then select **Source Port ID** and enter the actual source port number to match on (see the table on page 13-7).
9. Select **Dest. Port Compare** and choose a comparison method for the filter to use on a packet's destination port number. Then select **Dest. Port ID** and enter the actual destination port number to match on (see the table on page 13-7).

10. When you are finished configuring the filter, select **ADD THIS FILTER NOW** to save the filter in the filter set. Select **CANCEL** to discard the filter and return to the Add IP Filter Set screen.

Viewing filters

To display a view-only table of input or output filters, select **Display/Change Input Filter** or **Display/Change Output Filter** in the Add IP Filter Set screen.

Modifying filters

To modify a filter, select **Display/Change Input Filter** or **Display/Change Output Filter** in the Add IP Filter Set screen to display a table of filters.

Select a filter from the table and press Return. The Change Filter screen appears. The parameters in this screen are set in the same way as the ones in the Add Filter screen (see "Adding filters to a filter set" on page 13-13).

```
                                Change Filter

                    Enabled:                    No
                    Forward:                    No

                    Source IP Address:          0.0.0.0
                    Source IP Address Mask:     0.0.0.0

                    Dest. IP Address:           0.0.0.0
                    Dest. IP Address Mask:      0.0.0.0

                    Protocol Type:              0

                    Source Port Compare...      No Compare
                    Source Port ID:             0
                    Dest. Port Compare...       No Compare
                    Dest. Port ID:              0




Enter the IP specific information for this filter.
```

Deleting filters

To delete a filter, select **Delete Input Filter** or **Delete Output Filter** in the Add IP Filter Set screen to display a table of filters.

Select the filter from the table and press Return to delete it. Press Escape to exit the table without deleting the filter.

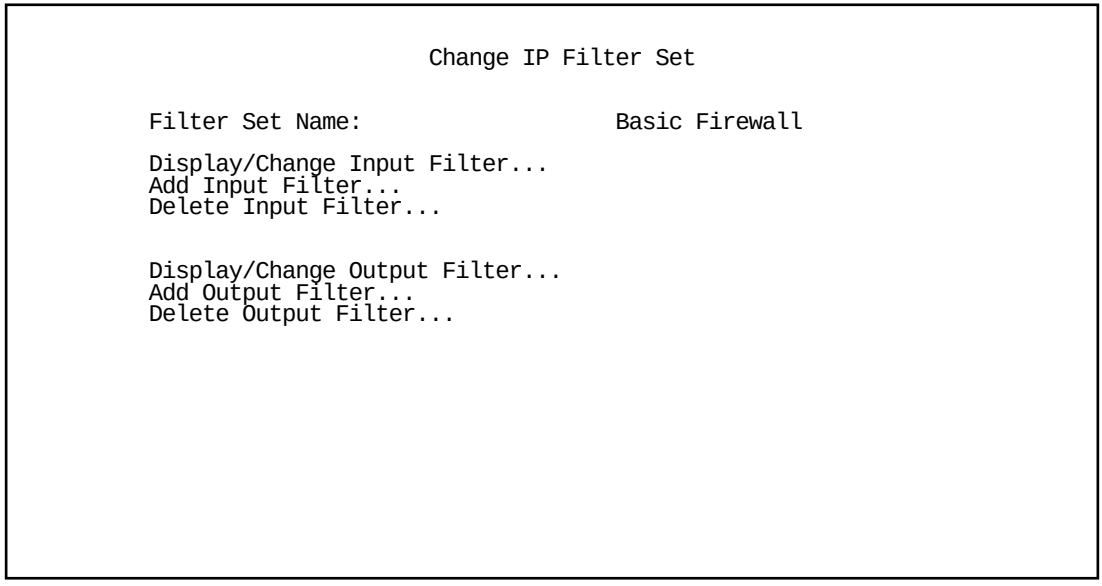
Viewing filter sets

To display a view-only list of filter sets, select **Display/Change IP Filter Set** in the IP Filter Sets screen.

Modifying filter sets

To modify a filter set, select **Display/Change IP Filter Set** in the IP Filter Sets screen to display a list of filter sets.

Select a filter set from the list and press Return. The Change IP Filter Set screen appears. The items in this screen are the same as the ones in the Add Filter screen (see “Adding filters to a filter set” on page 13-13).



Deleting a filter set

Note: If you delete a filter set, all of the filters it contains are deleted as well. To reuse any of these filters in another set, before deleting the current filter set you’ll have to note their configuration and then recreate them.

To delete a filter set, select **Delete IP Filter Set** in the IP Filter Sets screen to display a list of filter sets.

Select a filter set from the list and press Return to delete it. Press Escape to exit the list without deleting the filter set.

A sample IP filter set

This section contains the settings for a filter set called Basic Firewall, which is part of the Netopia 4752’s factory configuration.

Basic Firewall blocks undesirable traffic originating from the WAN (in most cases, the Internet), but forwards all traffic originating from the LAN. It follows the conservative “that which is not expressly permitted is prohibited” approach: unless an incoming packet expressly matches one of the constituent input filters, it will not be forwarded to the LAN.

The five input filters and one output filter that make up Basic Firewall are shown in the table below.

Setting	Input filter 1	Input filter 2	Input filter 3	Input filter 4	Input filter 5	Output filter 1
Enabled	Yes	Yes	Yes	Yes	Yes	Yes
Forward	No	No	Yes	Yes	Yes	Yes
Source IP address	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Source IP address mask	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Dest. IP address	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Dest. IP address mask	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Protocol type	TCP	TCP	ICMP	TCP	UDP	0
Source port comparison	No Compare	No Compare	N/A	No Compare	No Compare	N/A
Source port ID	0	0	N/A	0	0	N/A
Dest. port comparison	Equal	Equal	N/A	Greater Than	Greater Than	N/A
Dest. port ID	2000	6000	N/A	1023	1023	N/A

Basic Firewall's filters play the following roles.

Input filters 1 and 2: These block WAN-originated OpenWindows and X-Windows sessions. Service origination requests for these protocols use ports 2000 and 6000, respectively. Since these are greater than 1023, OpenWindows and X-Windows traffic would otherwise be allowed by input filter 4. Input filters 1 and 2 must precede input filter 4; otherwise they would have no effect since filter 4 would have already forwarded OpenWindows and X-Windows traffic.

Input filter 3: This filter explicitly forwards all WAN-originated ICMP traffic to permit devices on the WAN to ping devices on the LAN. Ping is an Internet service that is useful for diagnostic purposes.

Input filters 4 and 5: These filters forward all TCP and UDP traffic, respectively, when the destination port is greater than 1023. This type of traffic generally does not allow a remote host to connect to the LAN using one of the potentially intrusive Internet services, such as Telnet, FTP, and WWW.

Output filter 1: This filter forwards all outgoing traffic to make sure that no outgoing connections from the LAN are blocked.

Basic Firewall is suitable for a LAN containing only client hosts that want to access servers on the WAN, but not for a LAN containing servers providing services to clients on the WAN. Basic Firewall's general strategy is to explicitly forward WAN-originated TCP and UDP traffic to ports greater than 1023. Ports lower than 1024 are the service origination ports for various Internet services such as FTP, Telnet, and the World Wide Web (WWW).

A more complicated filter set would be required to provide WAN access to a LAN-based server. See the next section, "Possible modifications," for ways to allow remote hosts to use services provided by servers on the LAN.

Possible modifications

You can modify the sample filter set Basic Firewall to allow incoming traffic using the examples below. These modifications are not intended to be combined. Each modification is to be the only one used with Basic Firewall.

The results of combining filter set modifications can be difficult to predict. It is recommended that you take special care if you are making more than one modification to the sample filter set.

Trusted host. To allow unlimited access by a trusted remote host with the IP address a.b.c.d (corresponding to a numbered IP address such as 163.176.8.243), insert the following input filter ahead of the current input filter 1:

- Enabled: Yes
- Forward: Yes
- Source IP Address: a.b.c.d
- Source IP Address Mask: 255.255.255.255
- Dest. IP Address: 0.0.0.0
- Dest. IP Address Mask: 0.0.0.0
- Protocol Type: 0

Trusted subnet. To allow unlimited access by a trusted remote subnet with subnet address a.b.c.d (corresponding to a numbered IP address such as 163.176.8.0) and subnet mask e.f.g.h (corresponding to a numbered IP mask such as 255.255.255.0), insert the following input filter ahead of the current input filter 1:

- Enabled: Yes
- Forward: Yes
- Source IP Address: a.b.c.d
- Source IP Address Mask: e.f.g.h
- Dest. IP Address: 0.0.0.0
- Dest. IP Address Mask: 0.0.0.0
- Protocol Type: 0

FTP sessions. To allow WAN-originated FTP sessions to a LAN-based FTP server with the IP address a.b.c.d (corresponding to a numbered IP address such as 163.176.8.243), insert the following input filter ahead of the current input filter 1:

- Enabled: Yes
- Forward: Yes
- Source IP Address: 0.0.0.0
- Source IP Address Mask: 0.0.0.0
- Dest. IP Address: a.b.c.d
- Dest. IP Address Mask: 255.255.255.255
- Protocol Type: TCP
- Source Port Comparison: No Compare
- Source Port ID: 0
- Dest. Port Comparison: Equal
- Dest. Port ID: 21

Note: A similar filter could be used to permit Telnet or WWW access. Set the Dest. Port ID to 23 for Telnet or to 80 for WWW.

Deleting a filter set does not delete the filters in that set. However, the filters in the deleted set are no longer in effect (unless they are part of another set). The deleted set will no longer appear in the answer profile or any connection profiles to which it was added.

Firewall Tutorial

General firewall terms

Filter rule: A filter set is comprised of individual filter rules.

Filter set: A grouping of individual filter rules.

Firewall: A component or set of components that restrict access between a protected network and the Internet, or between two networks.

Host: A workstation on the network.

Packet: Unit of communication on the Internet.

Packet filter: Packet filters allow or deny packets based on source or destination IP addresses, TCP or UDP ports, or the TCP ACK bit.

Port: A number that defines a particular type of service.

Basic IP packet components

All IP packets contain the same basic header information, as follows:

Source IP Address	163.176.132.18
Destination IP Address	163.176.4.27
Source Port	2541
Destination Port	80
Protocol	TCP
ACK Bit	Yes
DATA	User Data

This header information is what the packet filter uses to make filtering decisions. It is important to note that a packet filter does not look into the IP data stream (the User Data from above) to make filtering decisions.

Basic protocol types

TCP: Transmission Control Protocol. TCP provides reliable packet delivery and has a retransmission mechanism (so packets are not lost). RFC 793 is the specification for TCP.

UDP: User Datagram Protocol. Unlike TCP, UDP does not guarantee reliable, sequenced packet delivery. If data does not reach its destination, UDP does not retransmit the data. RFC 768 is the specification for UDP.

There are many more ports defined in the Assigned Addresses RFC. The table that follows shows some of these port assignments.

Example TCP/UDP Ports

TCP Port	Service
20/21	FTP
23	Telnet
25	SMTP
80	WWW
144	News

UDP Port	Service
161	SNMP

UDP Port	Service
69	TFTP
387	AURP

Firewall design rules

There are two basic rules to firewall design:

- "What is not explicitly allowed is denied."

and

- "What is not explicitly denied is allowed."

The first rule is far more secure, and is the best approach to firewall design. It is far easier (and more secure) to allow in or out only certain services and deny anything else. If the other rule is used, you would have to figure out everything that you want to disallow, now and in the future.

Firewall Logic

Firewall design is a test of logic, and filter rule ordering is critical. If a packet is forwarded through a series of filter rules and then the packet matches a rule, the appropriate action is taken. The packet will not forward through the remainder of the filter rules.

For example, if you had the following filter set...

Allow WWW access;

Allow FTP access;

Allow SMTP access;

Deny all other packets.

and a packet goes through these rules destined for FTP, the packet would forward through the first rule (WWW), go through the second rule (FTP), and match this rule; the packet is allowed through.

If you had this filter set for example....

Allow WWW access;

Allow FTP access;

Deny FTP access;

Deny all other packets.

and a packet goes through these rules destined for FTP, the packet would forward through the first filter rule (WWW), match the second rule (FTP), and the packet is allowed through. Even though the next rule is to deny all FTP traffic, the FTP packet will never make it to this rule.

Binary representation

It is easiest when doing filtering to convert the IP address and mask in question to binary. This will allow you to perform the logical AND to determine whether a packet matches a filter rule.

Logical AND function

When a packet is compared (in most cases) a logical AND function is performed. First the IP addresses and subnet masks are converted to binary and then combined with AND. The rules for the logical use of AND are as follows:

0 AND 0 = 0

0 AND 1 = 0

1 AND 0 = 0

1 AND 1 = 1

For example:

Filter rule:

Deny

IP: 163.176.1.15BINARY: 10100011.10110000.00000001.00001111

Mask: 255.255.255.255BINARY:11111111.11111111.11111111.11111111

Incoming Packet:

IP 163.176.1.15BINARY: 10100011.10110000.00000001.00001111

If you put the incoming packet and subnet mask together with AND, the result is:

10100011.10110000.00000001.00001111

which matches the IP address in the filter rule and the packet is denied.

Implied rules

With a given set of filter rules, there is an Implied rule that may or may not be shown to the user. The implied rule tells the filter set what to do with a packet that does not match any of the filter rules. An example of implied rules is as follows:

Implied	Meaning
Y+Y+Y=N	If all filter rules are YES, the implied rule is NO.
N+N+N=Y	If all filter rules are NO, the implied rule is YES.
Y+N+Y=N	If a mix of YES and NO filters, the implied rule is NO.

Established connections

The TCP header contains one bit called the ACK bit (or TCP Ack bit). This ACK bit appears only with TCP, not UDP. The ACK bit is part of the TCP mechanism that guarantees the delivery of data. The ACK bit is set whenever one side of a connection has received data from the other side. Only the first TCP packet will not have the ACK bit set; once the TCP connection is in place, the remainder of the TCP packets with have the ACK bit set.

The ACK bit is helpful for firewall design and reduces the number of potential filter rules. A filter rule could be created just allowing incoming TCP packets with the ACK bit set, since these packets had to be originated from the local network.

Example IP filter set screen

This is an example of the Netopia IP filter set screen:

```
                                Change Filter

          Enabled:                              Yes
          Forward:                              No

          Source IP Address:                    0.0.0.0
          Source IP Address Mask:               0.0.0.0

          Dest. IP Address:                     0.0.0.0
          Dest. IP Address Mask:                0.0.0.0

          Protocol Type:                        TCP

          Source Port Compare...                No Compare
          Source Port ID:                       0
          Dest. Port Compare...                 Equal
          Dest. Port ID:                        2000
          Established TCP Conns. Only:          No


Return/Enter accepts * Tab toggles * ESC cancels.
Enter the IP specific information for this filter.
```

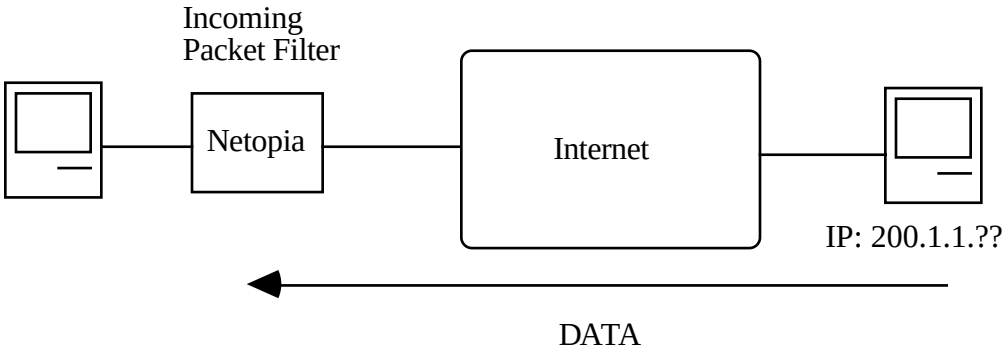
Filter basics

In the source or destination IP address fields, the IP address that is entered must be the network address of the subnet. A host address can be entered, but the applied subnet mask must be 32 bits (255.255.255.255).

The Netopia 4752 has the ability to compare source and destination TCP or UDP ports. These options are as follows:

Item	What it means
No Compare	Does not compare TCP or UDP port
Not Equal To	Matches any port other than what is defined
Less Than	Anything less than the port defined
Less Than or Equal	Any port less than or equal to the port defined
Equal	Matches only the port defined
Greater Than or Equal	Matches the port or any port greater
Greater Than	Matches anything greater than the port defined

Example network



Example filters

Example 1

Filter Rule:	200.1.1.0	(Source IP Network Address)
	255.255.255.128	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.28

IP Address	Binary Representation	
200.1.1.28	00011100	(Source address in incoming IP packet)
AND		
255.255.255.128	10000000	(Perform the logical AND)
	00000000	(Logical AND result)

This incoming IP packet has a source IP address that matches the network address in the Source IP Address field (00000000) in the Netopia 4752. This will *not* forward this packet.

Example 2

Filter Rule:	200.1.1.0	(Source IP Network Address)
	255.255.255.128	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.184.

IP Address	Binary Representation	
200.1.1.184	10111000	(Source address in incoming IP packet)
AND		
255.255.255.128	10000000	(Perform the logical AND)
	10000000	(Logical AND result)

This incoming IP packet (10000000) has a source IP address that does not match the network address in the Source IP Address field (00000000) in the Netopia 4752. This rule *will* forward this packet because the packet does not match.

Example 3

Filter Rule:	200.1.1.96	(Source IP Network Address)
	255.255.255.240	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.184.

IP Address	Binary Representation	
200.1.1.184	10111000	(Source address in incoming IP packet)
AND		
255.255.255.240	11110000	(Perform the logical AND)
	10110000	(Logical AND result)

Since the Source IP Network Address in the Netopia 4752 is 01100000, and the source IP address after the logical AND is 1011000, this rule does *not* match and this packet will be forwarded.

Example 4

Filter Rule:	200.1.1.96	(Source IP Network Address)
	255.255.255.240	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.104.

IP Address	Binary Representation	
200.1.1.104	01101000	(Source address in incoming IP packet)
AND		
255.255.255.240	11110000	(Perform the logical AND)
	01100000	(Logical AND result)

Since the Source IP Network Address in the Netopia 4752 is 01100000, and the source IP address after the logical AND is 01100000, this rule *does* match and this packet will *not* be forwarded.

Example 5

Filter Rule:	200.1.1.96	(Source IP Network Address)
	255.255.255.255	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.96.

IP Address	Binary Representation	
200.1.1.96	01100000	(Source address in incoming IP packet)
AND		
255.255.255.255	11111111	(Perform the logical AND)
	01100000	(Logical AND result)

Since the Source IP Network Address in the Netopia 4752 is 01100000, and the source IP address after the logical AND is 01100000, this rule *does* match and this packet will *not* be forwarded. This rule masks off a *single* IP address.

LAN IP Filtersets

The Netopia 4752 offers LAN-side filtering on the Ethernet hub. This permits multiple IP addresses or subnets on the Ethernet LAN to be kept separate from one another and operate as virtual independent networks sharing a single Internet connection. Small- to medium-sized offices can benefit by using a single router to connect to the Internet, with multiple businesses within the office using independent subnets on the network. Schools can benefit by separating the administrative network from the student network.

A LAN-side filter is the reverse of a WAN-side filter. When you use a WAN-side filter you are restricting external access to your internal network. The most common type of WAN-side filter is the Basic Firewall that is enabled by default in Netopia routers.

When you create a LAN-side filter you are restricting access from your internal network to the external world, or to other subnets on your internal network.

The main advantage of filtering from the LAN is to limit users (or a set of users on a subnet) from accessing services such as telnet to the router to make configuration changes or accessing the Internet via HTTP.

Companies desiring to limit certain departments from accessing the Internet can use LAN-side filtering, as well as schools desiring to prevent their student network from downloading files via FTP etc.

The default WAN filtersets Basic Firewall and NetBIOS Filter should never be applied to your internal LAN because they can cut off access from all of your internal computers to the router itself. Instead, you should create separate new filtersets to be applied to the router's Ethernet hub to restrict user and subnet access to other subnets or to the Internet.

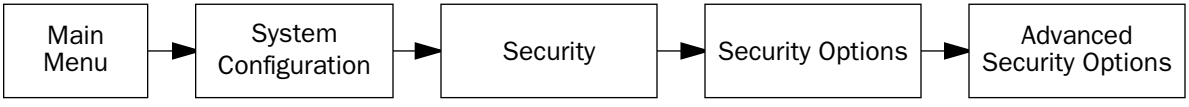
Filtersets are very powerful access-restriction tools, and for this reason, the LAN-side filterset binding menu is placed in the Advanced Security Options screen.

Before attempting to create and use LAN-side filtersets, you should read and understand fully the information on subnet and filterset creation presented in the on-line documentation on your Netopia CD.

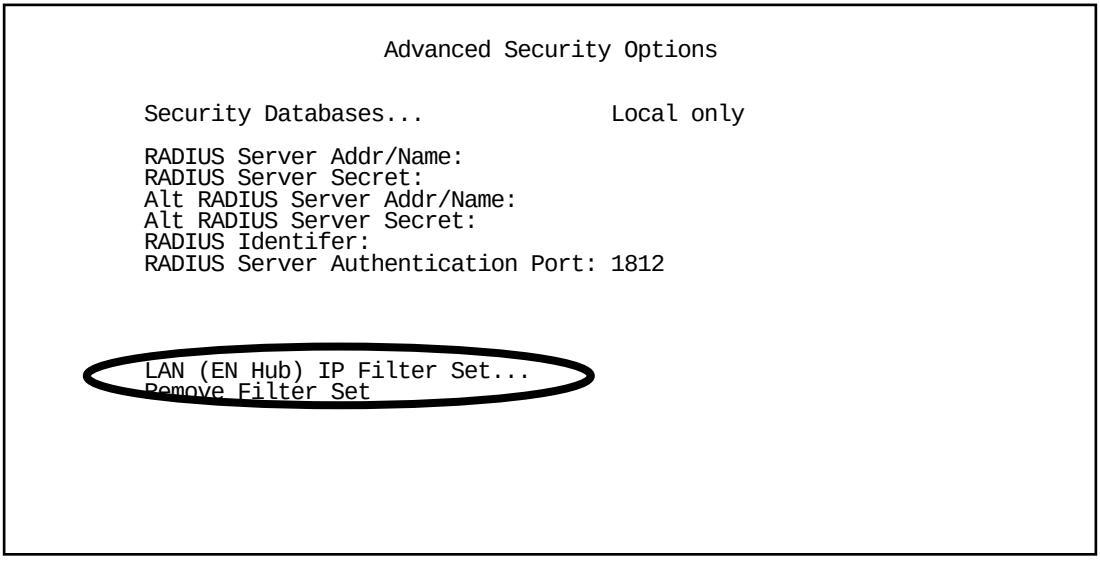
- For information on creating multiple subnets, see the *User's Reference Guide* chapter on "IP Setup".
- For more information on filters and filter sets, see the *User's Reference Guide* chapter on "Security."

After you have created an appropriate filterset, you apply it to the Ethernet hub interface as follows:

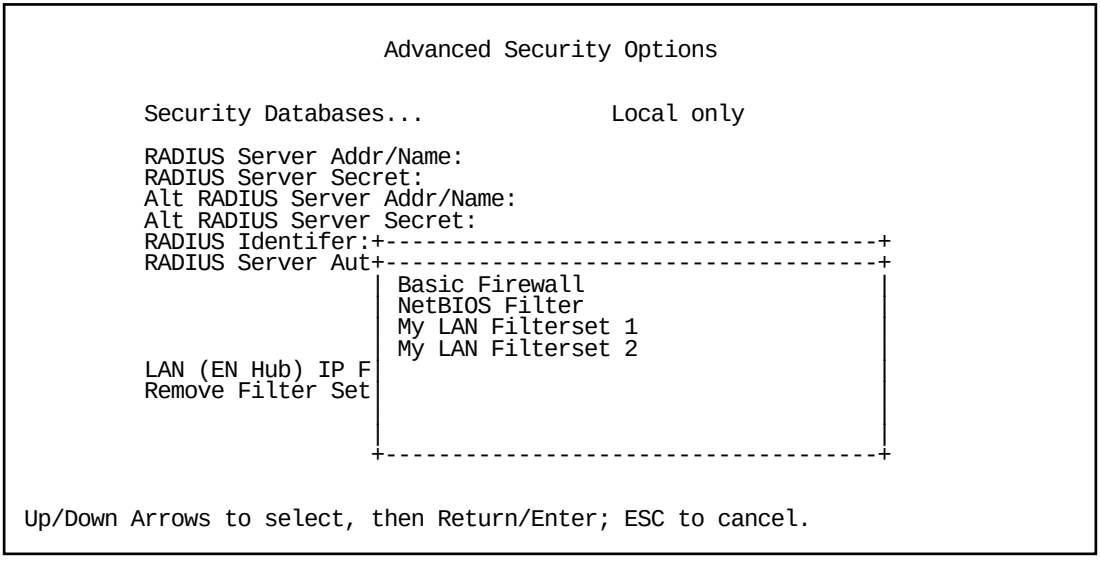
To attach a filter set to the Ethernet hub interface, navigate to the **Advanced Security Options** screen from the **Main Menu**.



Any customized filter set you create can be associated with the Ethernet hub as shown below:



Select **LAN (EN Hub) IP Filter Set** and from the pop-up menu, select the filter set you want to associate with the LAN interface.



Press **Return**. The filter set you select will be applied to the Ethernet hub interface.

CAUTION! You should not attach the default filter sets **Basic Firewall** or **NetBIOS Filter** to the Ethernet LAN or its subnets. This may result in a loss of connectivity to the network or subnet. Instead, create a **new** filter set in accordance with the standard filtering rules described earlier.

To remove the filter set from the Ethernet hub interface, select **Remove Filter Set** and press **Return**. The filter set will be disconnected from the LAN interface.

Note: Removing the filter set from the LAN does not delete the filter set. It is still available to be reassociated with the same or another interface, or modified further.

RADIUS Client Support

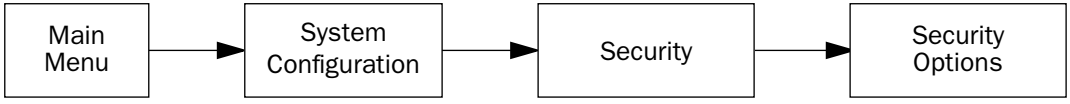
The Netopia 4752 implements a Remote Authentication Dial-In User Service (RADIUS) client (RFC 2138) and adds the ability to authenticate console configuration access using a RADIUS server. This feature is strictly for console menu access authentication only and is not intended for WAN connectivity access authentication.

The Netopia 4752 has the ability to authenticate users seeking console configuration access by using a remote authentication database maintained by a RADIUS server. It supports four security database modes:

- Local Only
- RADIUS only
- RADIUS then Local
- Local then RADIUS

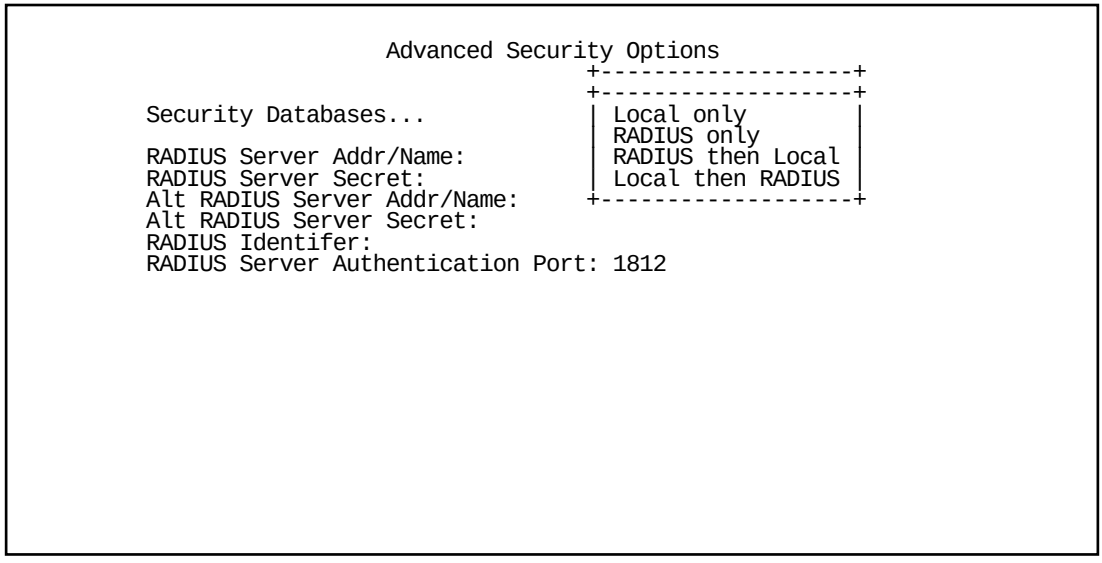
RADIUS client configuration

To display the Security Options screen, from the Main Menu select System Configuration, Security, then Security Options.




```
                          Security Options

        Enable Dial-in Console Access:                    Yes

        Enable SmartStart/Web Server:                     Yes

        Enable Telnet Console Access:                     Yes
        Enable Telnet Access to SNMP Screens:             Yes
        Console Access timeout (seconds):                 600

        Show Users...
        Add User...
        Delete User...

        Advanced Security Options...

        Password for this Screen (11 chars max):


Set up configuration access options here.
```

If you select **Advanced Security Options** and press Return, the Advanced Security Options screen appears.



- You select your desired mode by using the **Security Databases** pop-up menu.
  - Choosing **Local Only**, the default, selects the pre-4.8 authentication mechanism.
  - Choosing **RADIUS Only** causes the router to ignore the local database and to authenticate users using the configured RADIUS server.
  - Choosing **RADIUS then Local** causes the router to attempt to authenticate a user first using a RADIUS server and then, if that fails, using the local authentication database.
  - Choosing **Local then RADIUS** causes the router to attempt to authenticate a user first using the local authentication database, and then, if that fails using the configured RADIUS server.

Note: In the latter two modes that involve both RADIUS and the local database, if the local database includes no username/password pairs, authentication will succeed only if the RADIUS server authenticates the user. This differs from the Local Only mode where no authentication is performed when the local database is empty.

If the primary RADIUS server responds with an access rejection or an access challenge, the alternate RADIUS server is not contacted. Only if the primary RADIUS server fails to respond at all is the alternate RADIUS server contacted.

Therefore, do not attempt to select any of the RADIUS options unless you have a RADIUS server correctly configured for this purpose. If you attempt to use RADIUS authentication without a RADIUS server, you will lose your configuration access to the router.

The Advanced Security Options screen supports both a primary RADIUS server and an alternate RADIUS server. When the router is configured to authenticate using RADIUS, it will first attempt to contact the primary RADIUS server; if the primary RADIUS server responds, RADIUS authentication succeeds or fails based on the response returned by the primary server. If and only if the primary server fails to respond, the router will attempt to contact the alternate RADIUS server to authenticate the user. The router makes two attempts per server, three seconds apart.

- You can specify the **RADIUS Server Addr/Name** and the **Alt RADIUS Server Addr/Name** either by using a

hostname to be resolved using the Domain Name System (DNS) information configured in the router or by using an IP address in dotted-quad notation. The RADIUS Server Addr/Name items are limited to 63 characters.

- In addition to specifying the server's hostname or IP address, you must also specify a **RADIUS Server Secret** and an **Alt RADIUS Server Secret** (if configured) known to both the router and the RADIUS server. The secret is used to encrypt RADIUS transactions in transit. The RADIUS Server Secret items are limited to 31 characters.

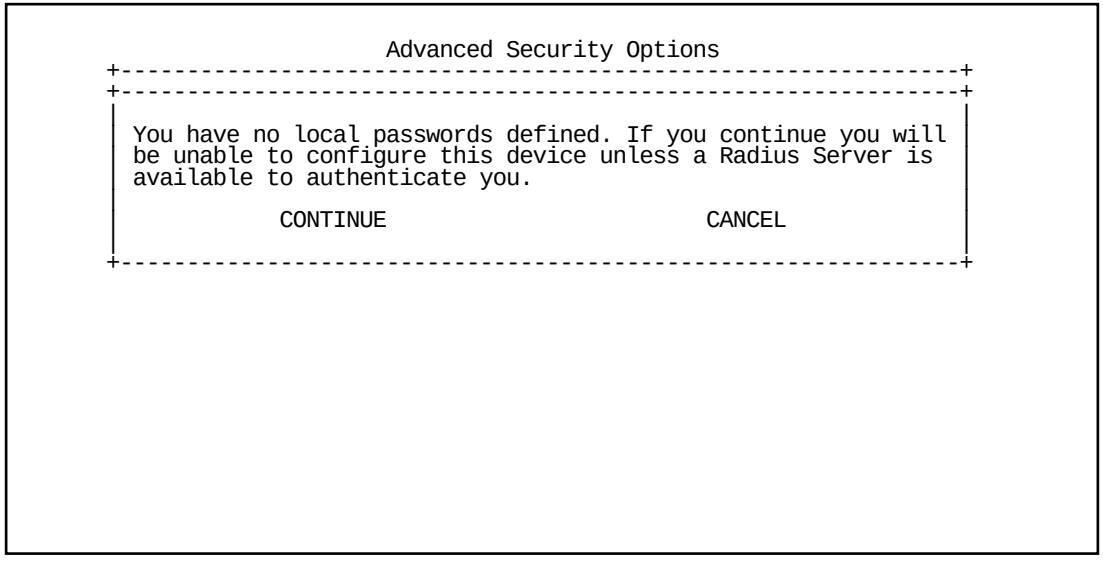
  The router's RADIUS client implementation supports passwords longer than 16 characters and properly encrypts such passwords per RFC 2138. Not all RADIUS server implementations handle passwords longer than 16 characters.

- **RADIUS Identifier** can be either an IP address or an arbitrary string to be used as the identifier in the router's outgoing Access-Request packets. The RADIUS identifier is limited to 63 characters.

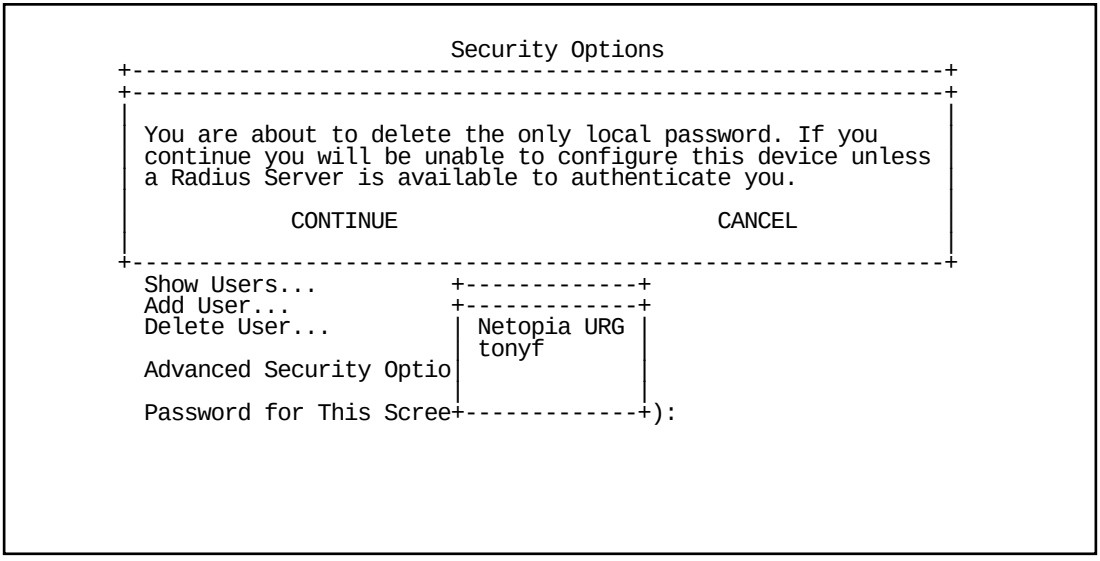
- **RADIUS Server Authentication Port** specifies the UDP destination port to which the router's RADIUS authentication requests will be sent. The default value is 1812, the official IANA-assigned UDP port number for the RADIUS authentication service.

Warning alerts

Certain security-related configuration changes cause the router to display a warning alert. Choosing either **Local then RADIUS** or **RADIUS then Local** from the Security Databases pop-up menu when there are no configured username/password pairs causes the router to present the following warning alert:



Attempting to delete the last non-URG username/password pair from the local authentication database when the Security Databases pop-up menu is set to either **Local then RADIUS** or **RADIUS then Local** causes the router to present the following warning alert:



Chapter 14

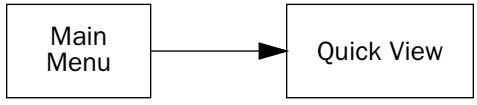
Monitoring Tools

This chapter discusses the Netopia 4752's device and network monitoring tools. These tools can provide statistical information, report on current network status, record events, and help in diagnosing and locating problems.

This section covers the following topics:

Quick View Status Overview

You can get a useful, overall status report from the Netopia 4752 in the Quick View screen. To go to the Quick View screen, select **Quick View** in the Main Menu.

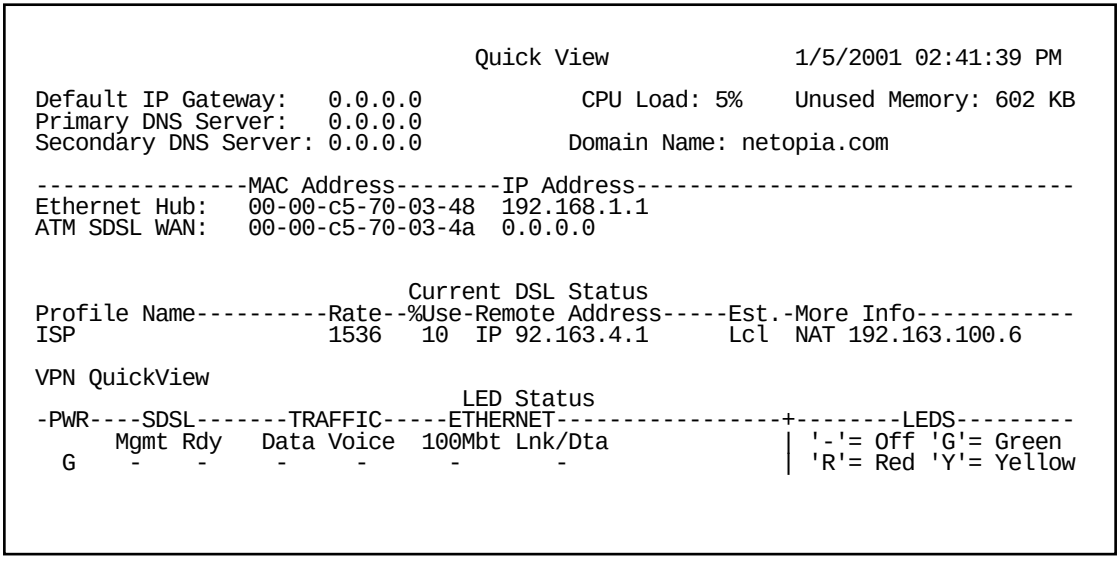


The Quick View screen has three status sections:

- General status
- Current WAN Connection Status
- LED Status

The status sections vary according to the interface of your Netopia 4752.

General status



Current Date: The current date; this can be set with the Date and Time utility (see "Date and time" on page 9-19).

Default IP Gateway: The router's default gateway, which may be either manually configured or learned via DHCP. This is the value you assigned in the Default IP Gateway field on page 10-3. If you are using the router's defaults (DHCP and NAT) this value will be 0.0.0.0. If you have assigned an IP address as your default gateway, it is shown here.

CPU Load: Percentage of the system's resources being used by all current transmissions.

Unused Memory: The total remaining system memory available for use.

Primary DNS Server: If you are using the router's defaults (DHCP and NAT) this value will be 0.0.0.0. If you have assigned an IP address as your primary default gateway, it is shown here.

Secondary DNS Server: If you are using the router's defaults (DHCP and NAT) this value will be 0.0.0.0. If you have assigned an IP address as a secondary gateway, it is shown here.

Domain Name: The domain name you have assigned, typically the name of your ISP.

MAC Address: The Netopia 4752's hardware address, for those interfaces that support DHCP.

IP Address: The Netopia 4752's IP address, entered in the IP Setup screen.

Current status

The current status section is a table showing the current status of the WAN. For example:

```
                          Current DSL Status
Profile Name----------Rate--%Use-Remote Address-----Est.-More Info------------
ISP                   1536  10  IP 92.163.4.1      Lcl  NAT 192.163.100.6
```

Profile Name: Lists the name of the connection profile being used, if any.

Rate: Shoes the line rate for this connection.

%Use: Indicates the average percent utilization of the maximum capacity of the channels in use for the connection.

Remote Address: Shows the IP address of the connected remote router if the connection is using IP.

Est: Indicates whether the connection was locally (“Lcl”) or remotely (“Rmt”) established.

More Info: Indicates, in order of priority, the NAT address in use for this connection or the caller identification (if available).

Status lights

This section shows the current real-time status of the Netopia 4752’s status lights (LEDs). It is useful for remotely monitoring the router’s status. The Quick View screen’s arrangement of LEDs corresponds to the physical arrangement of LEDs on the router.

```
                                LED Status
-PWR----SDSL-------TRAFFIC-----ETHERNET-----------------+--------LEDS---------
      Mgmt Rdy   Data Voice  100Mbt Lnk/Dta             | '-'= Off 'G'= Green
  G    -    -     -     -      -       -                | 'R'= Red 'Y'= Yellow
```

Each LED representation can report one of four states:

–: The LED is off.

R: The LED is red.

G: The LED is green.

Y: The LED is yellow.

The section “Netopia 4752 Status Lights” on page 3-4 describes the meanings of the colors for each LED.

Statistics & Logs

When you are troubleshooting your Netopia 4752, the Statistics & Logs screens provide insight into the recent event activities of the router.

From the Main Menu go to Statistics & Logs and select one of the options described in the sections below.

Event Histories

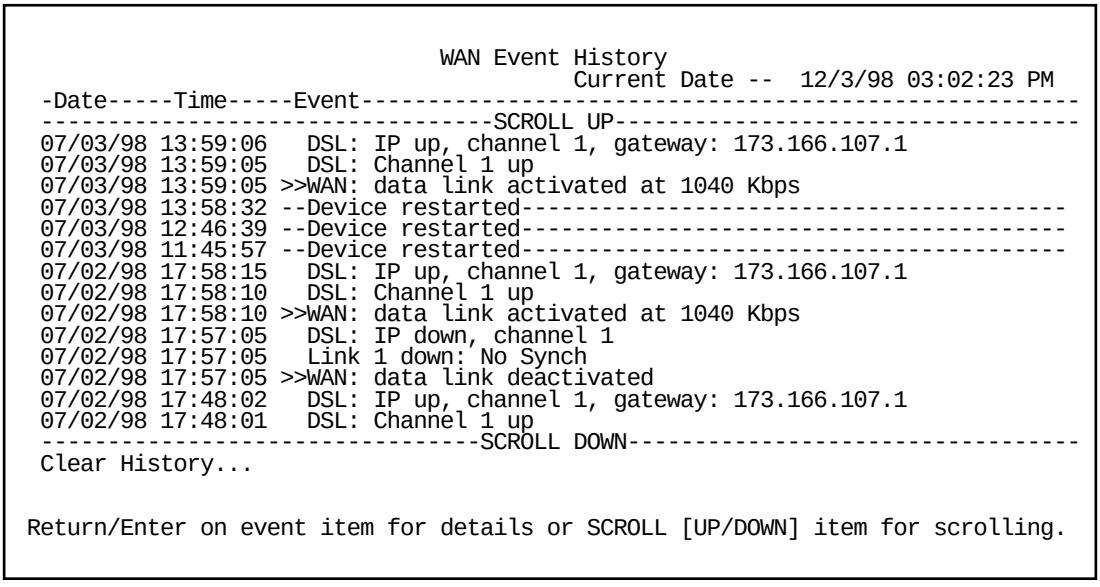
The Netopia 4752 records certain relevant occurrences in event histories. Event histories are useful for diagnosing problems because they list what happened before, during, and after a problem occurs. You can view two different event histories: one for the router's system and one for the WAN. The Netopia 4752's built-in battery backup prevents loss of event history from a shutdown or reset.

The router's event histories are structured to display the most recent events first, and to make it easy to distinguish error messages from informational messages. Error messages are prefixed with an asterisk. Both the WAN Event History and Device Event History retain records of the 128 most recent events.

In the Statistics & Logs screen, select **WAN Event History**. The WAN Event History screen appears.

WAN Event History

The WAN Event History screen lists a total of 128 events on the WAN. The most recent events appear at the top.



Each entry in the list contains the following information:

Date: Date of the event.

Time: Time of the event.

Event: A brief description of the event.

Ch.: The channel involved in the event.

Dir. Number: The directory number (number dialed) involved in the event (switched circuit models only).

The first event in each call sequence is marked with double arrows (>>).

Failures are marked with an asterisk (*).

If the event history exceeds the size of the screen, you can scroll through it by using the SCROLL UP and SCROLL DOWN items.

To scroll up, select **SCROLL UP** at the top of the list and press Return. To scroll down, select **SCROLL DOWN** at the bottom of the list and press Return.

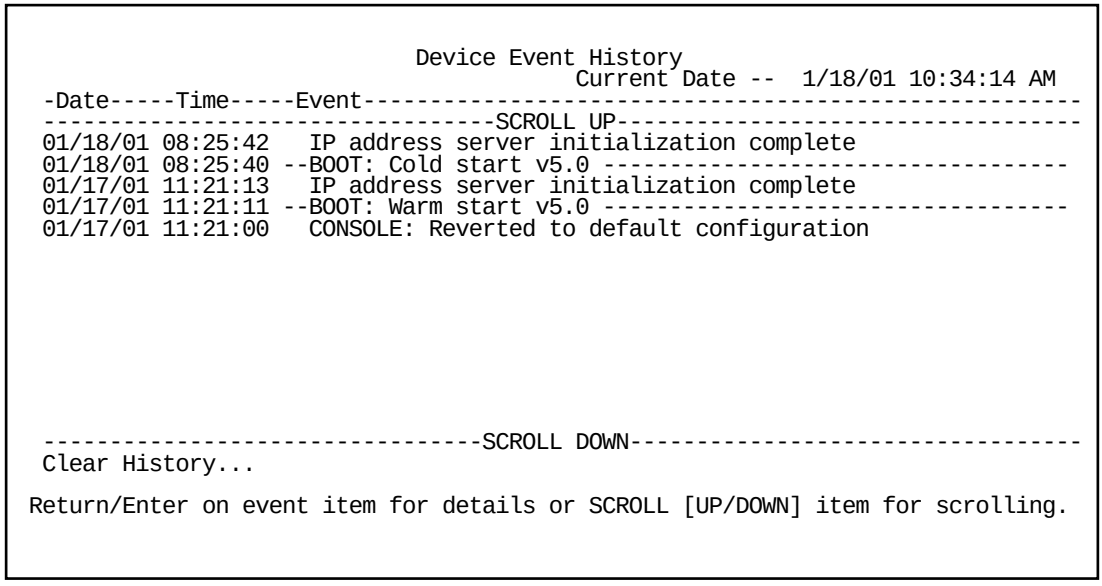
To get more information about any event listed in the WAN Event History, select the event and then press Return. A dialog box containing more information about the selected event will appear. Press Return or Escape to dismiss the dialog box.

To clear the event history, select **Clear History** at the bottom of the history screen and press Return.

Device Event History

The Device Event History screen lists a total of 128 port and system events, giving the time and date for each event, as well as a brief description. The most recent events appear at the top.

In the Statistics & Logs screen, select **Device Event History**. The Device Event History screen appears.



If the event history exceeds the size of the screen, you can scroll through it by using SCROLL UP and SCROLL DOWN.

To scroll up, select **SCROLL UP** at the top of the list and press Return. To scroll down, select **SCROLL DOWN** at the bottom of the list and press Return.

To obtain more information about any event listed in the Device Event History, select the event and then press Return. A dialog box containing more information about the selected event appears. Press Return or Escape to dismiss the dialog box.

To clear the Device Event History, select **Clear History** and press Return.

Voice Logs

Voice Log

The Voice Log screen lists a total of 128 voice-related events, giving the time and date for each event, as well as a brief description. The most recent events appear at the top.

In the Statistics & Logs screen, select **Voice Log**. The Voice Log screen appears.

```
                              Voice Log
                                          Current Date --   1/5/01 06:00:45 AM
-Date-----Time-----Event-------------------------------------------------------

----------------------------------SCROLL UP-------------------------------------
01/05/01 11:03:27   Voice gateway link yes.    IP: 163.176.232.4
01/05/01 05:26:23   Voice gateway link yes.    IP: 163.176.232.4
01/05/01 12:02:41   Voice gateway link no.
01/05/01 12:02:31   Voice gateway link yes.    IP: 163.176.232.4
01/05/01 11:52:25   Voice gateway link yes.    IP: 163.176.232.4
01/05/01 11:49:23   Voice gateway link yes.    IP: 163.176.232.4
01/05/01 11:46:26   Voice gateway link yes.    IP: 163.176.232.4
01/05/01 11:44:39   Voice gateway provisioned for TOLLBRIDGE









----------------------------------SCROLL DOWN-----------------------------------
Clear History...
```

If the log exceeds the size of the screen, you can scroll through it by using SCROLL UP and SCROLL DOWN.

To scroll up, select **SCROLL UP** at the top of the list and press Return. To scroll down, select **SCROLL DOWN** at the bottom of the list and press Return.

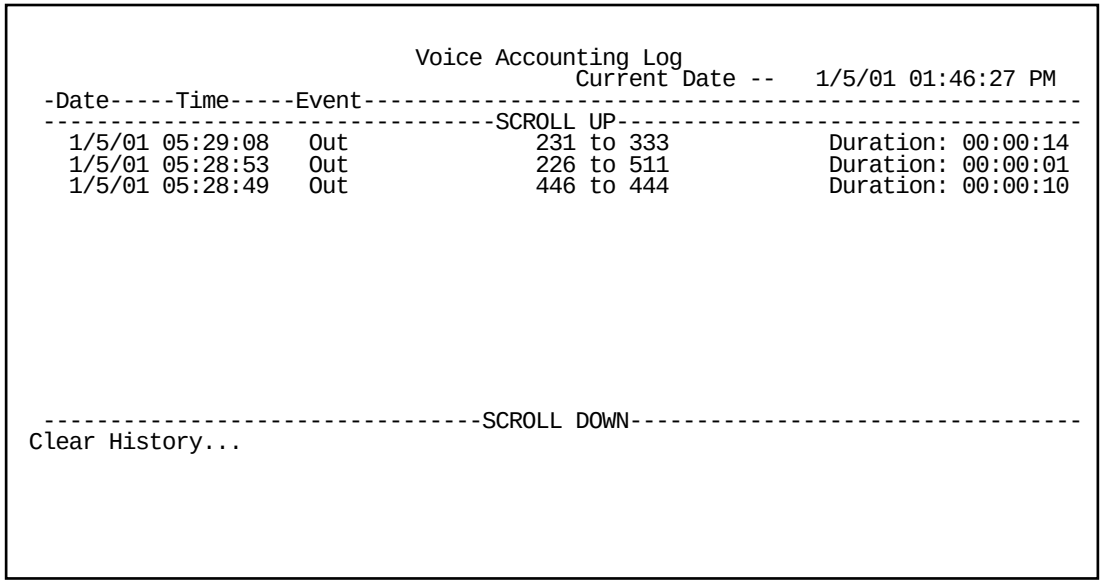
To obtain more information about any event listed in the Voice Log, select the event and then press Return. A dialog box containing more information about the selected event appears. Press Return or Escape to dismiss the dialog box.

To clear the Voice Log, select **Clear History** and press Return.

Voice Accounting Log

The Voice Accounting Log screen lists a total of 128 voice-related events, giving the time and date for each event, as well as a brief description. The most recent events appear at the top.

In the Statistics & Logs screen, select **Voice Accounting Log**. The Voice Accounting Log screen appears.



If the log exceeds the size of the screen, you can scroll through it by using SCROLL UP and SCROLL DOWN.

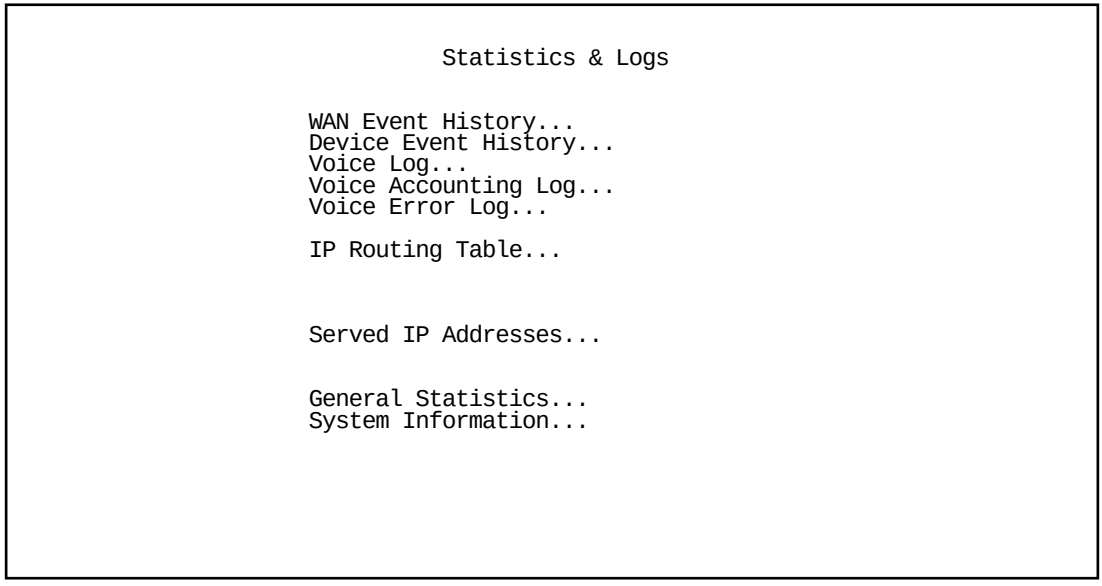
To scroll up, select **SCROLL UP** at the top of the list and press Return. To scroll down, select **SCROLL DOWN** at the bottom of the list and press Return.

To obtain more information about any event listed in the Voice Accounting Log, select the event and then press Return. A dialog box containing more information about the selected event appears. Press Return or Escape to dismiss the dialog box.

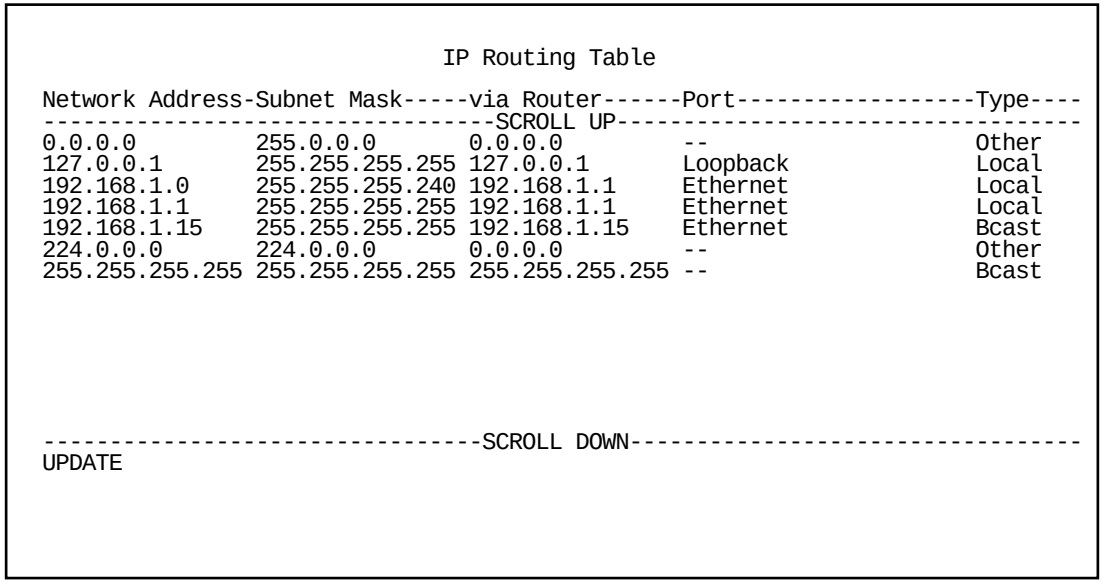
To clear the Voice Accounting Log, select **Clear History** and press Return.

IP Routing Table

In the Statistics & Logs screen, select **IP Routing Table** and press Return.



The IP routing table displays all of the IP routes currently known to the Netopia 4752.

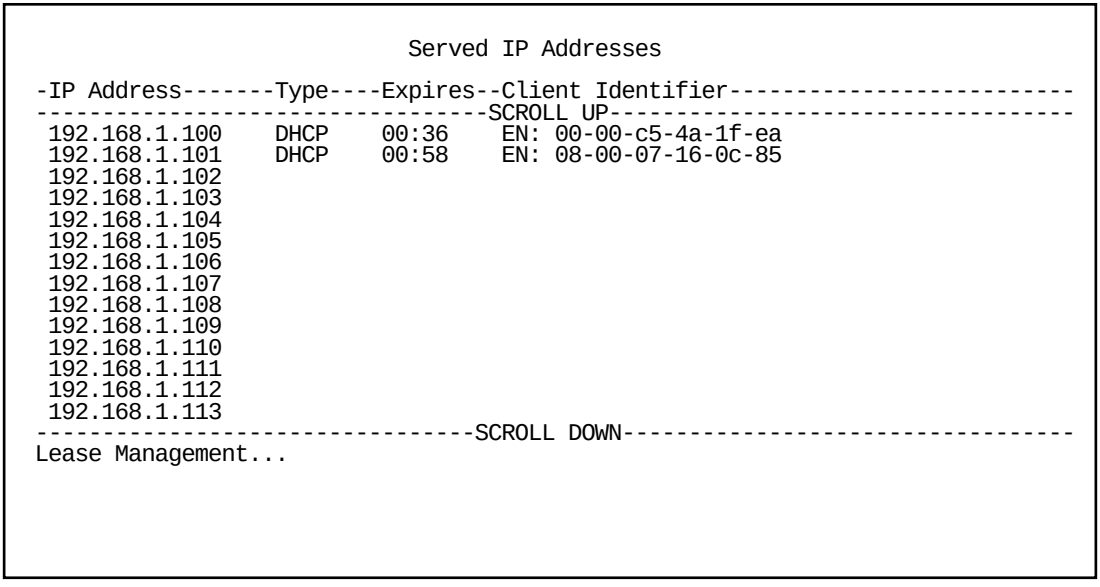


The routing table screen represents a snapshot of the routing table information at the time the screen is first invoked. To take a new snapshot, select **Update** at the bottom of the screen and press Return.

Served IP Addresses

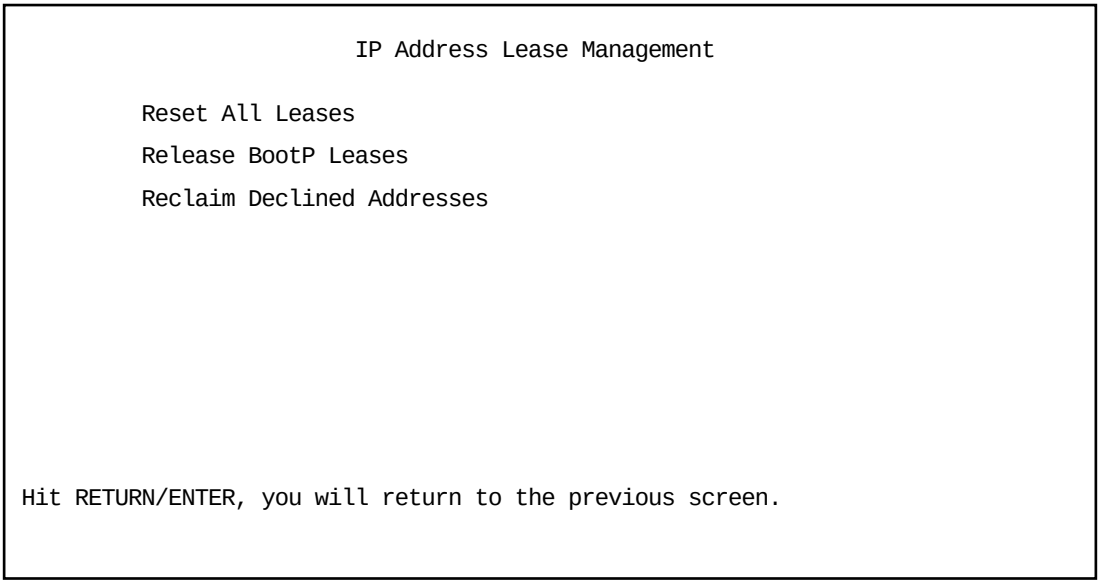
You can view all of the IP addresses currently being served by the Netopia 4752 SDSL Integrated Access Device from the **Served IP Addresses** screen.

From the Statistics & Logs menu, select **Served IP Addresses**. The Served IP Addresses screen appears.



To manage DHCP leases, select **Lease Management** in this screen.

The IP Address Lease Management screen appears.

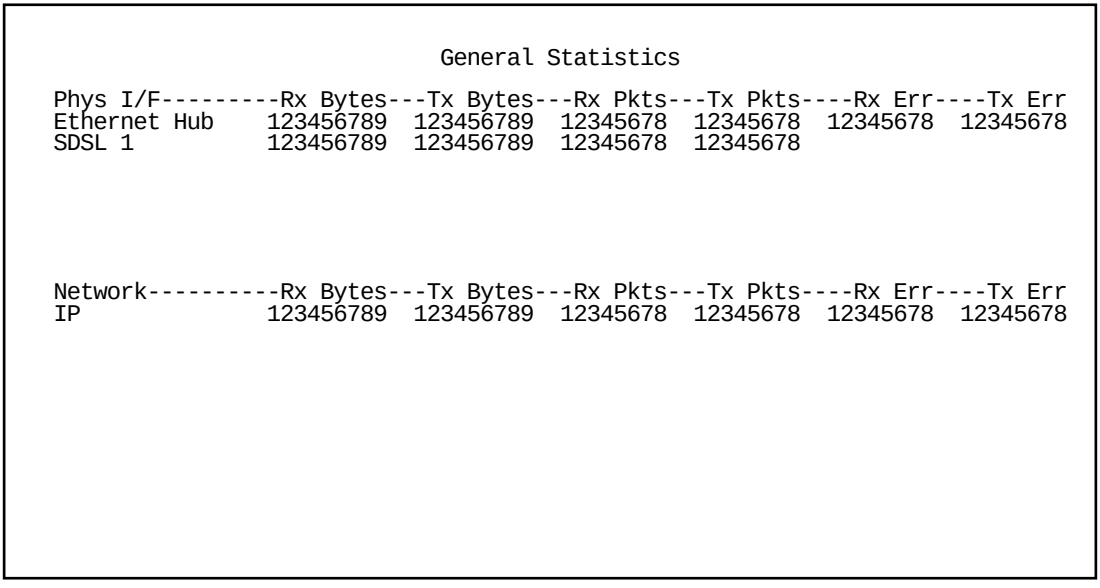


This screen has three options:

- **Reset All Leases**: Resets all current IP addresses leased through DHCP without waiting for the default one–hour lease period to elapse
- **Release BootP Leases**: Releases any BootP leases that may be in place and which may no longer be required.
- **Reclaim Declined Addresses**: Reclaims served leases that have been declined; for example by devices that may no longer be on the network.

General Statistics

To go to the General Statistics screen, select **General Statistics** and press Return. The General Statistics screen appears.



The General Statistics screen displays information about data traffic on the Netopia 4752's data ports. This information is useful for monitoring and troubleshooting your LAN. Note that the counters roll over at their maximum field width, that is, they restart again at 0.

Physical Interface

The top left side of the screen lists total packets received and total packets transmitted for the following data ports:

- Ethernet Hub
- SDSL 1

Network Interface

The bottom left side of the screen lists total packets received and total packets transmitted for the following protocols:

- IP (IP packets on the Ethernet)

The right side of the table lists the total number of occurrences of each of six types of communication statistics:

Rx Bytes: The number of bytes received

Tx Bytes: The number of bytes transmitted

Rx Packets: The number of packets received

Tx Pkts: The number of packets transmitted

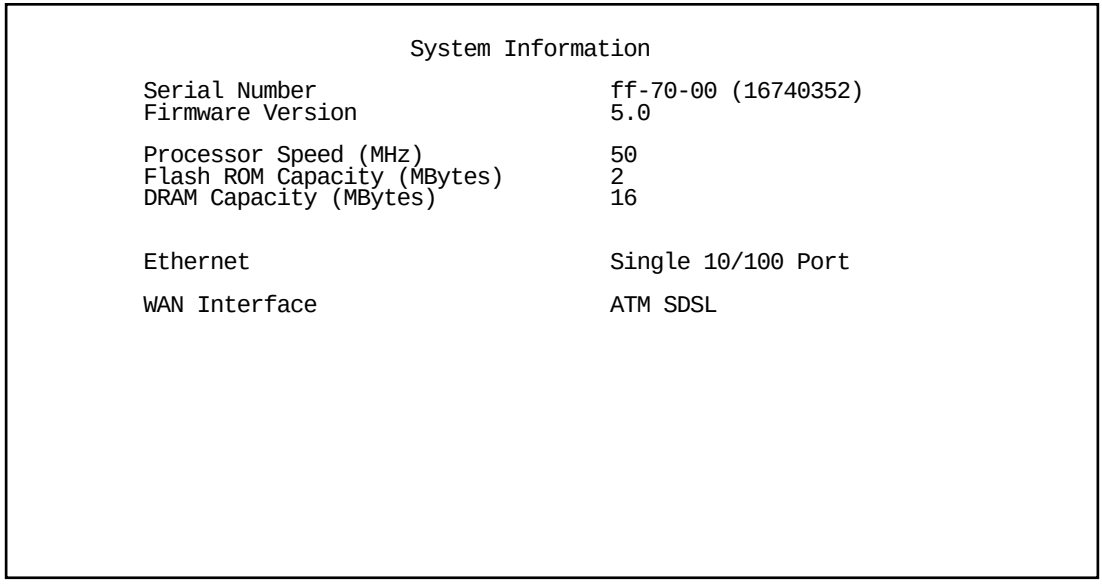
Rx Err: The number of bad Ethernet packets received

Tx Err: The number of errors occurring when Ethernet packets are transmitted simultaneously by nodes on the LAN

System Information

The System Information screen gives a summary view of the general system level values in the Netopia 4752 SDSL Integrated Access Device.

From the Statistics & Logs menu select **System Information**. The System Information screen appears.



The information display varies by model, firmware version, feature set, and so on. You can tell at a glance your particular system configuration.

SNMP

The Netopia 4752 includes a Simple Network Management Protocol (SNMP) agent, allowing monitoring and configuration of many of the data routing features by a standard SNMP manager.

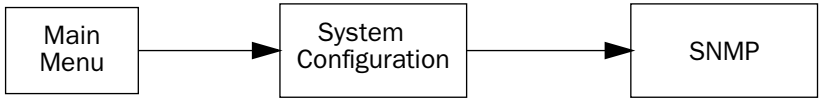
The Netopia 4752 supports the following management information base (MIB) documents:

- MIB II (RFC 1213)
- Interface MIB (RFC 1229)
- Ethernet MIB (RFC 1643)
- Netopia MIB

These MIBs are on the Netopia 4752 CD included with the Netopia 4752. Load these MIBs into your SNMP management software in the order they are listed here. Follow the instructions included with your SNMP manager on how to load MIBs.

The SNMP Setup screen

From the Main Menu, select **SNMP** in the System Configuration screen and press Return. The SNMP Setup screen appears.




```
                                SNMP Setup

          System Name:
          System Location:
          System Contact:


          Read-Only Community String:                  public
          Read/Write Community String:                 private

          Authentication Traps Enable:                 Off

          IP Trap Receivers...




 Configure optional SNMP parameters from here.
```

Follow these steps to configure the first three items in the screen:

1. Select **System Name** and enter a descriptive name for the Netopia 4752's SNMP agent.
2. Select **System Location** and enter the router's physical location (room, floor, building, etc.).
3. Select **System Contact** and enter the name of the person responsible for maintaining the router.

System Name, System Location, and System Contact set the values returned by the Netopia 4752 SNMP agent for the SysName, SysLocation, and SysContact objects, respectively, in the MIB II system group. Although optional, the information you enter in these items can help a system administrator manage the network more efficiently.

Community strings

The **Read-Only Community String** and the **Read/Write Community String** are like passwords that must be used by an SNMP manager querying or configuring the Netopia 4752. An SNMP manager using the **Read-Only Community String** can examine statistics and configuration information from the router, but cannot modify the router's configuration. An SNMP manager using the **Read/Write Community String** can both examine and modify configuration parameters.

By default, the read-only and read/write community strings are set to public and private, respectively. You should change both of the default community strings to values known only to you and trusted system administrators.

To change a community string, select it and enter a new value.

Starting with the version 4.3 firmware, setting the Read-Only and Read-Write community strings to the empty string will block all SNMP requests to the router. (The router may still send SNMP Traps if those are properly enabled.)

Previously, if either community string was the empty string, SNMP Requests specifying an empty community string were accepted and processed.

This change is designed to allow the administrator to block SNMP access to the router and to provide more granular control over the allowed SNMP operations to the router.

- Setting only the Read-Write community string to the empty string will block SNMP Set Requests to the router, but Get Requests and Get-Next Requests will still be honored using the Read-Only community string (assuming that is not the empty string).
- Setting only the Read-Only community string to the empty string will *not* block Get Requests or Get-Next Requests since those operations (and Set Requests) are still allowed using the (non-empty) Read-Write community string.

Even if you decide not to use SNMP, you should change the community strings. This prevents unauthorized access to the Netopia 4752 through SNMP. For more information on security issues, see "Suggested Security Measures" on page 13-1.

SNMP traps

An SNMP trap is an informational message sent from an SNMP agent (in this case, the Netopia 4752) to a manager. When a manager receives a trap, it may log the trap as well as generate an alert message of its own.

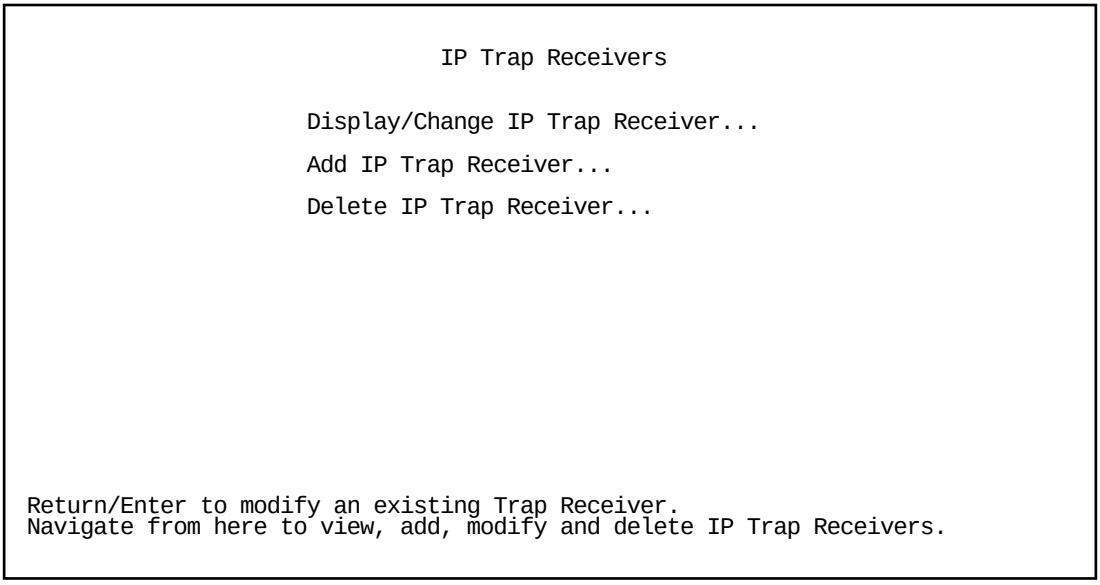
Standard traps generated by the Netopia 4752 include the following:

- An authentication failure trap is generated when the router detects an incorrect community string in a received SNMP packet. **Authentication Traps Enable** must be **On** for this trap to be generated.
- A cold start trap is generated after the router is reset.
- An interface down trap (ifDown) is generated when one of the router's interfaces, such as a port, stops functioning or is disabled.
- An interface up trap (ifUp) is generated when one of the router's interfaces, such as a port, begins functioning.

The Netopia 4752 sends traps using UDP (for IP networks).

You can specify which SNMP managers are sent the IP traps generated by the Netopia 4752. Up to eight receivers can be set. You can also review and remove IP traps.

To go to the IP Trap Receivers screen, select **IP Trap Receivers**. The IP Trap Receivers screen appears.



Setting the IP trap receivers

1. Select **Add IP Trap Receiver**.
2. Select **Receiver IP Address or Domain Name**. Enter the IP address or domain name of the SNMP manager you want to receive the trap.
3. Select **Community String** if you enabled one in the SNMP Setup screen, and enter the appropriate password.
4. Select **Add Trap Receiver Now** and press Return. You can add up to seven more receivers.

Viewing IP trap receivers

To display a view-only table of IP trap receivers, select **Display/Change IP Trap Receiver** in the IP Trap Receivers screen.

Modifying IP trap receivers

1. To edit an IP trap receiver, select **Display/Change IP Trap Receiver** in the IP Trap Receivers screen.
2. Select an IP trap receiver from the table and press Return.
3. In the **Change IP Trap Receiver** screen, edit the information as needed and press Return.

Deleting IP trap receivers

1. To delete an IP trap receiver, select **Delete IP Trap Receiver** in the IP Trap Receivers screen.
2. Select an IP trap receiver from the table and press Return.
3. In the dialog box, select **Continue** and press Return.

Chapter 15

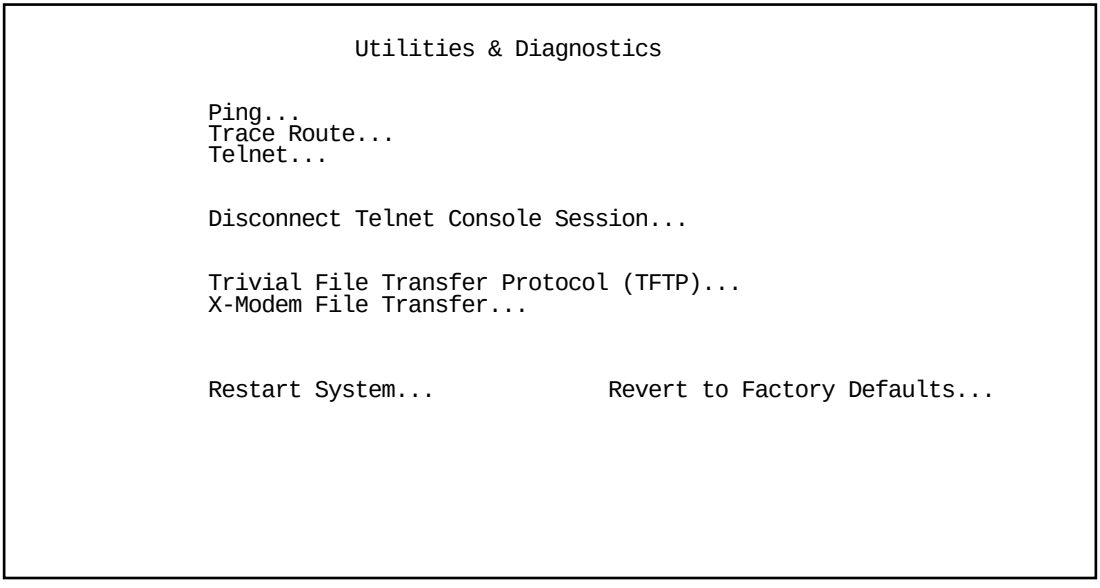
Utilities and Diagnostics

A number of utilities and tests are available for system diagnostic and control purposes.

This section covers the following topics:

Note: These utilities and tests are accessible only through the console-based management screens. See Chapter 6, "Console-Based Management," for information on accessing the console-based management screens.

You access the Utilities & Diagnostics screens from the Main Menu.

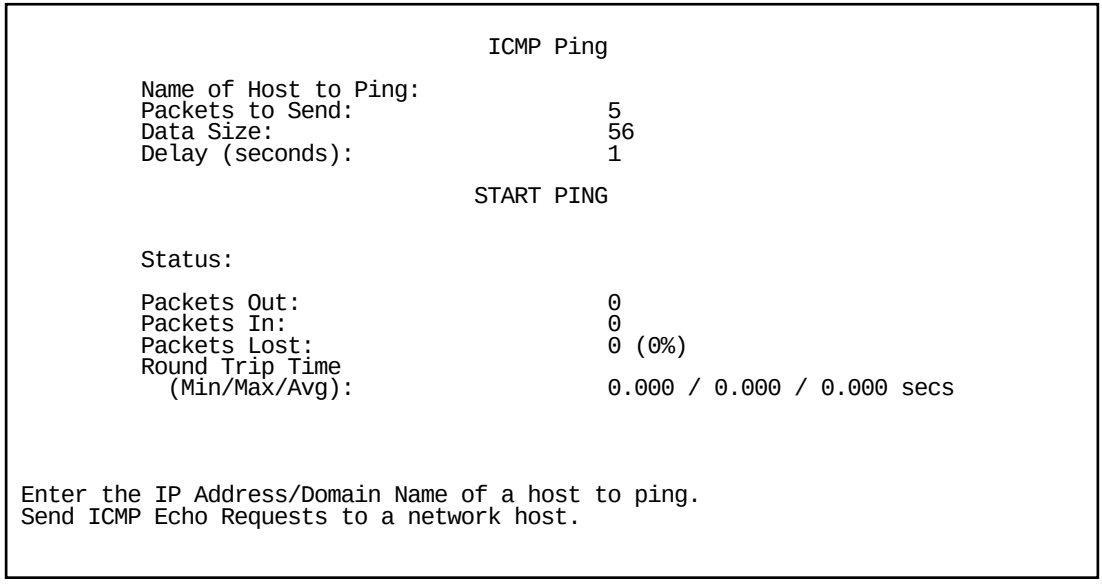


Ping

The Netopia 4752 includes a standard Ping test utility. A Ping test generates IP packets destined for a particular (Ping-capable) IP host. Each time the target host receives a Ping packet, it returns a packet to the original sender.

Ping allows you to see whether a particular IP destination is reachable from the Netopia 4752. You can also ascertain the quality and reliability of the connection to the desired destination by studying the Ping test's statistics.

In the Utilities & Diagnostic screen, select **Ping** and press Return. The ICMP Ping screen appears.



To configure and initiate a Ping test, follow these steps:

1. Select **Name of Host to Ping** and enter the destination domain name or IP address.
2. Select **Packets to Send** to change the default setting. This is the total number of packets to be sent during the Ping test. The default setting is adequate in most cases, but you can change it to any value from 1 to 4,294,967,295.
3. Select **Data Size** to change the default setting. This is the size, in bytes, of each Ping packet sent. The default setting is adequate in most cases, but you can change it to any value from 0 (only header data) to 1664.
4. Select **Delay (seconds)** to change the default setting. The delay, in seconds, determines the time between Ping packets sent. The default setting is adequate in most cases, but you can change it to any value from 0 to 4,294,967. A delay of 0 seconds forces packets to be sent immediately, one after another.
5. Select **START PING** and press Return to begin the Ping test. While the test is running, the **START PING** item becomes **STOP PING**. To manually stop the Ping test, select **STOP PING** and press Return or Escape.

While the Ping test is running and when it is over, a status field and a number of statistical items are active on the screen. These are described below.

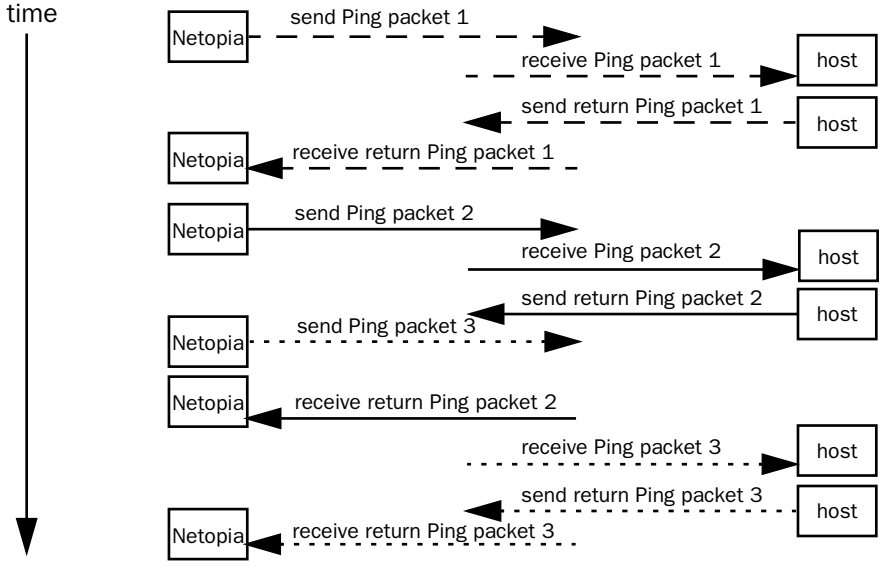
Status: The current status of the Ping test. This item can display the status messages shown in the able below:

Message	Description
Resolving host name	Finding the IP address for the domain name-style address
Can't resolve host name	IP address can't be found for the domain name–style address
Pinging	Ping test is in progress
Complete	Ping test was completed
Cancelled by user	Ping test was cancelled manually
Destination unreachable from w.x.y.z	Ping test was able to reach the router with IP address w.x.y.z, which reported that the test could not reach the final destination
Couldn't allocate packet buffer	Couldn't proceed with Ping test; try again or reset system
Couldn't open ICMP port	Couldn't proceed with Ping test; try again or reset system

Packets Out: The number of packets sent by the Ping test.

Packets In: The number of return packets received from the target host. To be considered on time, return packets are expected back before the next packet in the sequence of Ping packets is sent. A count of the number of late packets appears in parentheses to the right of the **Packets In** count.

In the example that follows, a Netopia 4752 is sending Ping packets to another host, which responds with return Ping packets. Note that the second return Ping packet is considered to be late because it is not received by the Netopia 4752 before the third Ping packet is sent. The first and third return Ping packets are on time.



Packets Lost: The number of packets unaccounted for, shown in total and as a percentage of total packets sent. This statistic may be updated during the Ping test, and may not be accurate until after the test is over. However, if an escalating one-to-one correspondence is seen between **Packets Out** and **Packets Lost**, and **Packets In** is noticeably lagging behind **Packets Out**, the destination is probably unreachable. In this case, use **STOP PING**.

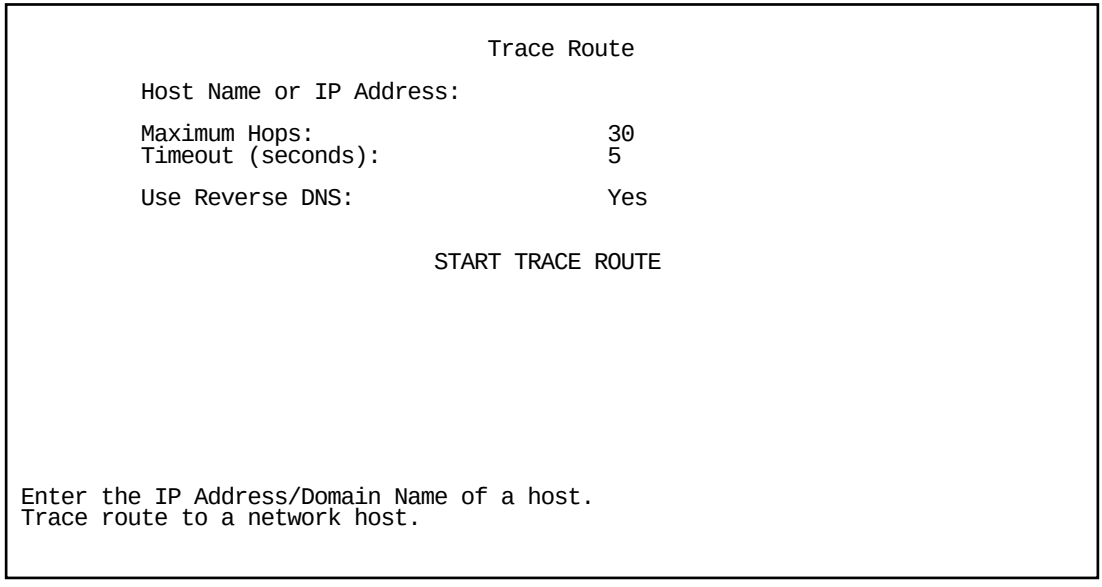
Round Trip Time (Min/Max/Avg): Statistics showing the minimum, maximum, and average number of seconds elapsing between the time each Ping packet was sent and the time its corresponding return Ping packet was received.

The time-to-live (TTL) value for each Ping packet sent by the Netopia 4752 is 255, the maximum allowed. The TTL value defines the number of IP routers that the packet can traverse. Ping packets that reach their TTL value are dropped, and a "destination unreachable" notification is returned to the sender (see the table on the previous page). This ensures that no infinite routing loops occur. The TTL value can be set and retrieved using the SNMP MIB-II ip group's ipDefaultTTL object.

Trace Route

You can count the number of routers between your Netopia Router and a given destination with the Trace Route utility.

In the Statistics & Diagnostics screen, select **Trace Route** and press Return. The Trace Route screen appears.



To trace a route, follow these steps:

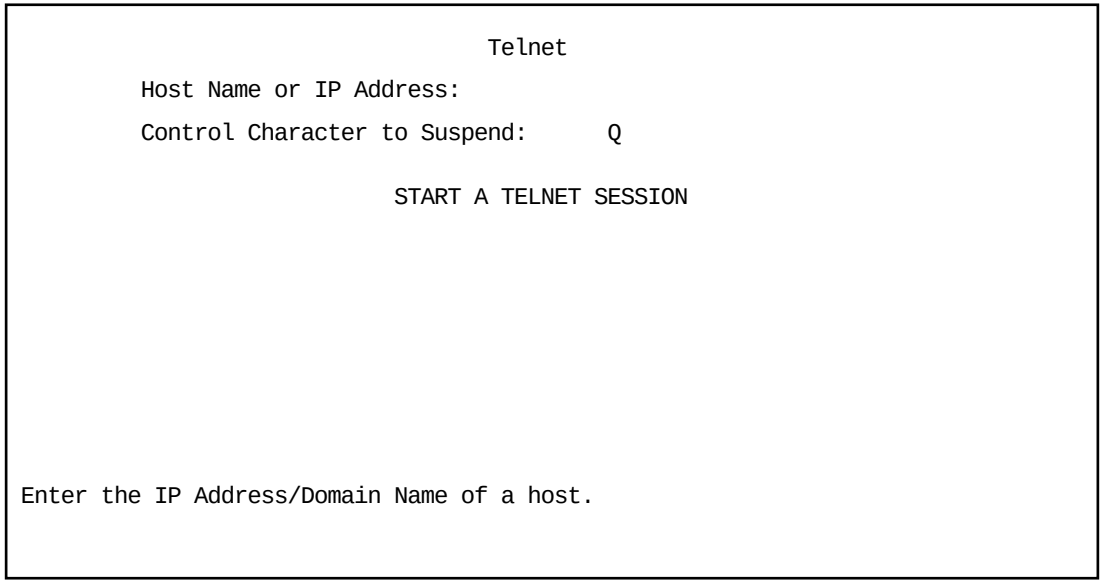
1. Select **Host Name or IP Address** and enter the name or address of the destination you want to trace.
2. Select **Maximum Hops** to set the maximum number of routers to count between the Netopia Router and the destination router, up to the maximum of 64. The default is 30 hops.
3. Select **Timeout (seconds)** to set when the trace will timeout for each hop, up to 10 seconds. The default is 3 seconds.

4. Select **Use Reverse DNS** to learn the names of the routers between the Netopia Router and the destination router. The default is Yes.
5. Select **START TRACE ROUTE** and press Return. A scrolling screen will appear that lists the destination, number of hops, IP addresses of each hop, and DNS names, if selected.
6. Cancel the trace by pressing Escape. Return to the Trace Route screen by pressing Escape twice.

Telnet Client

The Telnet client mode replaces the normal menu mode. Telnet sessions can be cascaded, that is, you can initiate a Telnet client session when using a Telnet console session. To activate the Telnet client, select **Telnet** from the Utilities & Diagnostics menu.

The Telnet client screen appears.



- Enter the host name or the IP address in dotted decimal format of the machine you want to Telnet into and press Return.
- Either accept the default control character “Q” used to suspend the Telnet session, or type a different one.
- **START A TELNET SESSION** becomes highlighted.
- Press Return and the Telnet session will be initiated.
- To suspend the session, press Control-Q or whatever other control character you specified.

  Two new options will appear in the Telnet screen (not shown):

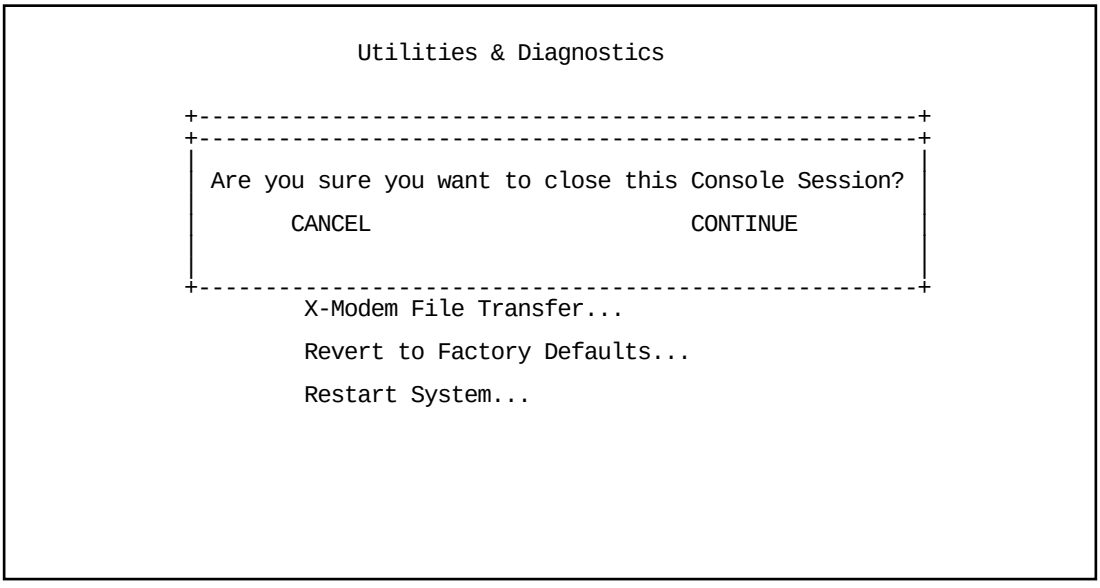
  Resume Suspended Session – select if you want to go back to your Telnet session

  Terminate Suspended Session – select if you want to end the session

Disconnect Telnet Console Session

If you want to close your Telnet console session, select **Disconnect Telnet Console Session** and press Return.

A dialog box appears asking you to cancel or continue your selection.



If you select **Continue**, you will immediately terminate your session.

Factory Defaults

You can reset the Netopia 4752 to its factory default settings. In the Utilities & Diagnostics screen, select **Revert to Factory Defaults** and press Return. Select **CONTINUE** in the dialog box and press Return. The Netopia 4752 will reboot and its settings will return to the factory defaults, deleting your configurations.

In an emergency, you can also use the Reset switch to return the router to its factory default settings. Call Netopia Technical Support for instructions on using the Reset switch.

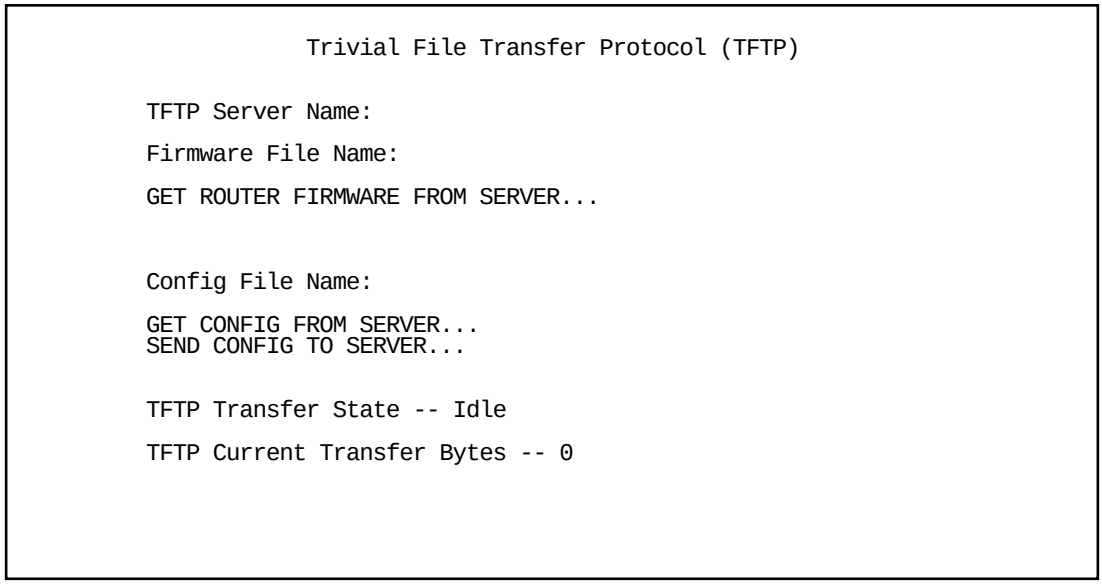
Note: Reset to factory defaults with caution. You will need to reconfigure all of your settings in the router.

If you lose your password and are unable to access the console screens, you can manually reset the router in an emergency. See Appendix A, “Troubleshooting.”

Transferring Configuration and Firmware Files with TFTP

Trivial File Transfer Protocol (TFTP) is a method of transferring data over an IP network. TFTP is a client-server application, with the router as the client. To use the Netopia 4752 as a TFTP client, a TFTP server must be available. Netopia, Inc., has a public access TFTP server on the Internet where you can obtain the latest firmware versions.

To use TFTP, select **Trivial File Transfer Protocol (TFTP)** in the Statistics & Diagnostics screen and press Return. The Trivial File Transfer Protocol (TFTP) screen appears.



The sections below describe how to update the Netopia 4752's firmware and how to download and upload configuration files.

Updating firmware

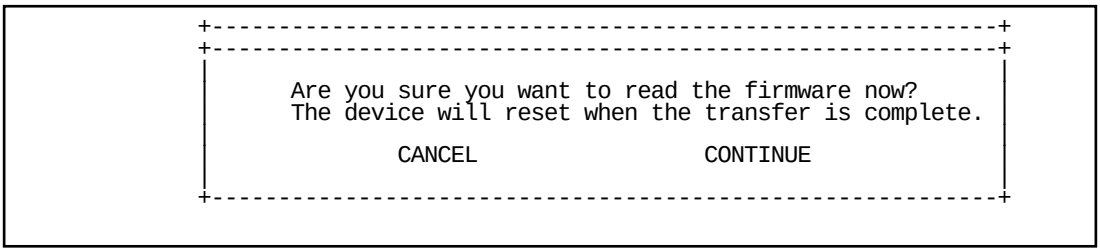
Firmware updates may be available periodically from Netopia or from a site maintained by your organization's network administrator.

The Netopia 4752 SDSL Integrated Access Device ships with an embedded operating system referred to as firmware. The firmware governs how the device communicates with your network and the WAN or remote site. Firmware updates are periodically posted on the Netopia website.

To update either the device's firmware, follow these steps:

- Select **TFTP Server Name** and enter the server name or IP address of the TFTP server you will use. The server name or IP address is available from the site where the server is located.
- Select **Firmware File Name** and enter the name of the file you will download. The name of the file is available from the site where the server is located. You may need to enter a file path along with the file name (for example, bigroot/config/myfile).

- Select **GET ROUTER FIRMWARE FROM SERVER** and press Return. You will see the following dialog box:



- Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file. The system will reset at the end of the file transfer to put the new firmware into effect. While the system resets, the LEDs will blink on and off.

CAUTION! Be sure the firmware update you load onto your router is the correct version for your particular model. Some models do not support all firmware versions. Loading an incorrect firmware version can permanently damage the unit.

Do not manually power down or reset the Netopia 4752 while it is automatically resetting or it could be damaged.

If you choose to download the firmware, the **TFTP Transfer State** item will change from **Idle** to **Reading Firmware**. The **TFTP Current Transfer Bytes** item will reflect the number of bytes transferred.

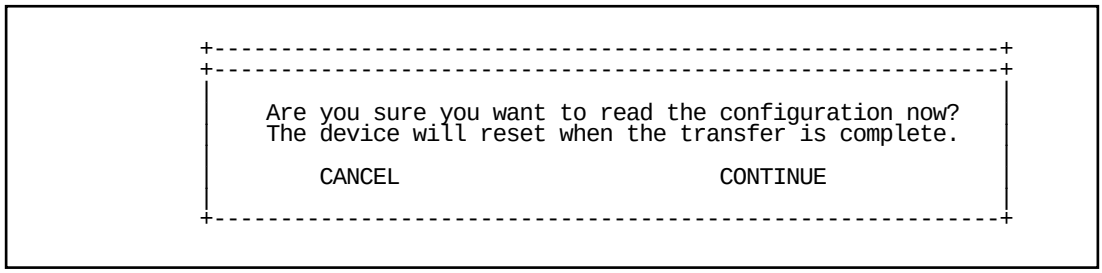
Downloading configuration files

The Netopia 4752 can be configured by downloading a configuration file using TFTP. Once downloaded, the file reconfigures all of the router's parameters as if someone had manually done so through the console port.

To download a configuration file, follow these steps:

- Select **TFTP Server Name** and enter the server name or IP address of the TFTP server you will use. The server name or IP address is available from the site where the server is located.
- Select **Config File Name** and enter the name of the file you will download. The name of the file is available from the site where the server is located. You may need to enter a file path along with the file name (for example, bigroot/config/myfile).

- Select **GET CONFIG FROM SERVER** and press Return. You will see the following dialog box:



- Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file. The system will reset at the end of the file transfer to put the new configuration into effect.
- If you choose to download the configuration file, the **TFTP Transfer State** item will change from **Idle** to **Reading Config**. The **TFTP Current Transfer Bytes** item will reflect the number of bytes transferred.

Uploading configuration files

Using TFTP, you can send a file containing a snapshot of the router's current configuration to a TFTP server. The file can then be downloaded by a different Netopia 4752 unit to configure its parameters (see "Downloading configuration files" on page 15-8). This is useful for configuring a number of routers with identical parameters or just for creating configuration backup files.

Uploading a file can also be useful for troubleshooting purposes. The uploaded configuration file can be tested on a different Netopia 4752 unit by Netopia or your network administrator.

To upload a configuration file, follow these steps:

1. Select **TFTP Server Name** and enter the server name or IP address of the TFTP server you will use. The server name or IP address is available from the site where the server is located.
2. Select **Config File Name** and enter a name for the file you will upload. The file will appear with the name you choose on the TFTP server. You may need to enter a file path along with the file name (for example, Mypc/Netopia/myfile).
3. Select **SEND CONFIG TO SERVER** and press Return. Netopia will begin to transfer the file.
4. The **TFTP Transfer State** item will change from **Idle** to **Writing Config**. The **TFTP Current Transfer Bytes** item will reflect the number of bytes transferred.

Transferring Configuration and Firmware Files with XMODEM

You can transfer configuration and firmware files with XMODEM through the Netopia 4752's console port. Be sure your terminal emulation program supports XMODEM file transfers.

To go to the **X-Modem File Transfer** screen, select it in the Utilities & Diagnostics menu.

Note: The X-Modem File Transfer screen is only available if you are connected via the Console port.

It is good practice when updating programmable devices to disable any other programs or network activity on the device or the attached computer. This includes WAN traffic such as a DSL connection or screen savers or other automatic programs running on the attached computer. Such activity can slow down or interrupt the file transfer requiring you to rerun the upgrade.

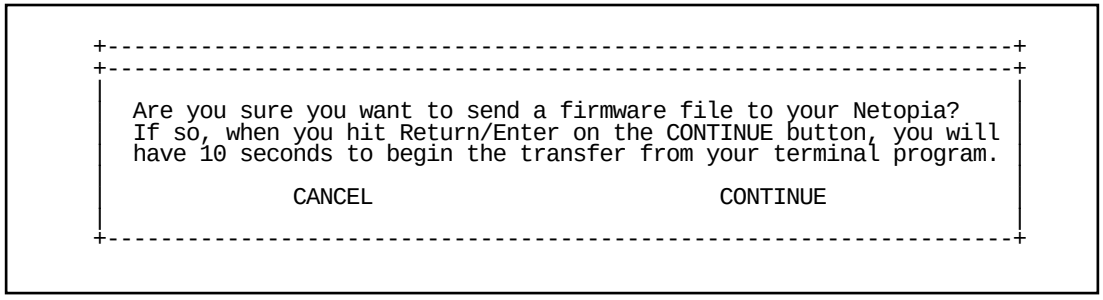
```
                    X-Modem File Transfer

        Send Firmware to Netopia...
        Send Config to Netopia...
        Receive Config from Netopia...
```

Updating firmware

Firmware updates may be available periodically from Netopia or from a site maintained by your organization's network administration.

Follow these steps to update the Netopia 4752's firmware:

1. Make sure you have the firmware file on disk and know the path to its location.
2. Select **Send Firmware to Netopia** and press Return. The following dialog box appears:



3. Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file.

   If you choose CONTINUE, you will have ten seconds to use your terminal emulation software to initiate an XMODEM transfer of the firmware file. If you fail to initiate the transfer in that time, the dialog box will disappear and the terminal emulation software will inform you of the transfer's failure. You can then try again.

   The system will reset at the end of a successful file transfer to put the new firmware into effect. While the system resets, the LEDs will blink on and off.

Caution!

Do not manually power down or reset the Netopia 4752 while it is automatically resetting or it could be damaged.

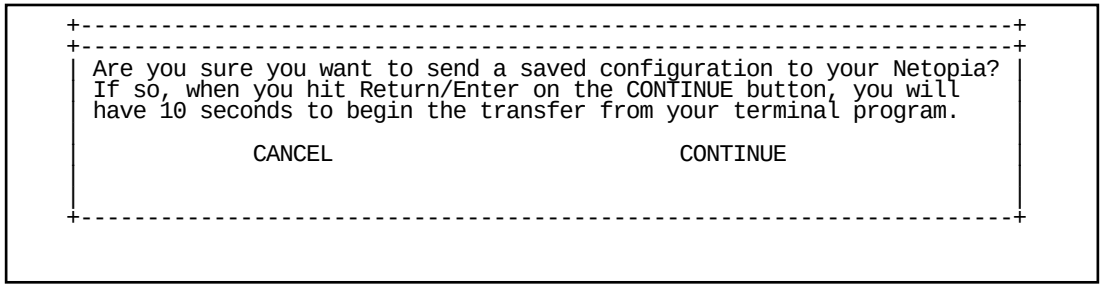
Downloading configuration files

The Netopia 4752 can be configured by downloading a configuration file. The downloaded file reconfigures all of the Router's parameters.

Configuration files are available from a site maintained by your organization's network administrator or from your local site (see "Uploading configuration files," below).

Follow these steps to download a configuration file:

1. Make sure you have the configuration file on disk and know the path to its location.
2. Select **Send Config to Netopia** and press Return. The following dialog box appears:



3. Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file.

If you choose CONTINUE, you will have ten seconds to use your terminal emulation software to initiate an XMODEM transfer of the configuration file. If you fail to initiate the transfer in that time, the dialog box will disappear and the terminal emulation software will inform you of the transfer's failure. You can then try again.

The system will reset at the end of a successful file transfer to put the new configuration into effect.

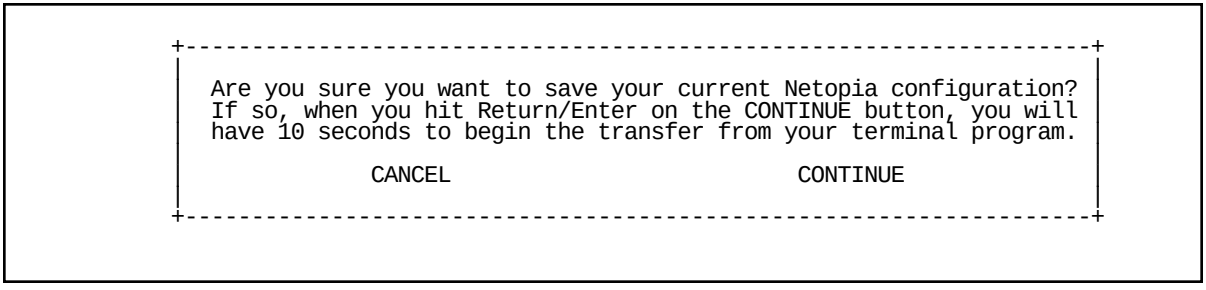
Uploading configuration files

A file containing a snapshot of the Netopia 4752's current configuration can be uploaded from the router to disk. The file can then be downloaded by a different Netopia 4752 to configure its parameters (see "Downloading configuration files," above). This is useful for configuring a number of routers with identical parameters or for creating configuration backup files.

Uploading a file can also be useful for troubleshooting purposes. The uploaded configuration file can be tested on a different Netopia 4752 by Netopia or your network administrator.

The procedure below applies whether you are using the console or the WAN interface. To upload a configuration file:

1. Decide on a name for the file and a path for saving it.
2. Select **Receive Config from Netopia** and press Return. The following dialog box appears:



3. Select **CANCEL** to exit without uploading the file, or select **CONTINUE** to upload the file.

   If you choose CONTINUE, you will have ten seconds to use your terminal emulation software to initiate an XMODEM transfer of the configuration file. If you fail to initiate the transfer in that time, the dialog box will disappear and the terminal emulation software will inform you of the transfer's failure. You can then try again.

Restarting the System

You can restart the system by selecting the **Restart System** item in the Utilities & Diagnostics screen.

You must restart the system whenever you reconfigure the Netopia 4752 and want the new parameter values to take effect. Under certain circumstances, restarting the system may also clear up system or network malfunctions. Some configuration processes automatically restart the system to apply the changes you have made.

Part III: Appendixes

Appendix A

Troubleshooting

This appendix is intended to help you troubleshoot problems you may encounter while setting up and using the Netopia 4752. It also includes information on how to contact Netopia Technical Support.

Important information on these problems can be found in the event histories kept by the Netopia 4752. These event histories can be accessed in the Statistics & Logs screen.

This section covers the following topics:

Configuration Problems

If you encounter problems during your initial configuration process, review the following suggestions before calling for technical support. There are five zones to consider when troubleshooting initial configuration:

1. The computer's connection to the Netopia 4752
2. The Netopia 4752's connection to the telecommunication line(s)
3. The telecommunication line's connection to your ISP
4. The ISP's connection to the Internet
5. The Netopia 4752's connection to the voice provider

If the connection from the computer to the Netopia 4752 was not successful, verify that the following conditions are in effect:

- The Netopia 4752 is turned on.
- An Ethernet cable connects your PC's Ethernet card or built-in Ethernet port to the Netopia 4752.
- Telnet is available on your PC or Macintosh. (On a PC, it must be specified in your system path. You can usually find the application as "c:\windows\telnet.exe".)
- Your PC or Macintosh is properly configured for TCP/IP.
- Your PC or Macintosh has an IP address.
- Your PC or Macintosh has a subnet mask that matches or is compatible with the Netopia 4752's subnet mask.

Note: If you are attempting to modify the IP address or subnet mask from a previous, successful configuration attempt, you will need to clear the IP address or reset your Netopia 4752 to the factory default before reinitiating the configuration process. For further information on resetting your Netopia 4752 to factory default, see "Factory Defaults" on page 15-6.

Console connection problems

Can't see the configuration screens (nothing appears)

- Make sure the cable connection from the Netopia 4752's console port to the computer being used as a console is securely connected.
- Make sure the terminal emulation software is accessing the correct port on the computer that's being used as a console.
- Try pressing Ctrl-L or Return or the up or down arrow key several times to refresh the terminal screen.
- Make sure that flow control on serial connections is turned off.

Junk characters appear on the screen

- Check that the terminal emulation software is configured correctly.
- Check the baud rate. The default values are 9600, N, 8, and 1.

Characters are missing from some of the configuration screens

- Try changing the Netopia 4752's default speed of 9600 bps and setting your terminal emulation software to match the new speed.

Network problems

Problems communicating with remote IP hosts

- Verify the accuracy of the default gateway's IP address (entered in the IP Setup or Easy Setup screen).
- Use the Netopia 4752's Ping utility, in the Utilities & Diagnostics screen, and try to Ping local and remote hosts. See "Ping" on page 15-2 for instructions on how to use the Ping utility. If you can successfully Ping hosts using their IP addresses but not their domain names (198.34.7.1 but not garcia.netopia.com, for example), verify that the DNS server's IP address is correct and that it is reachable from the Netopia 4752 (use Ping).
- If you are using filters, check that your filter sets are not blocking the type of connections you are trying to make.

Local routing problems

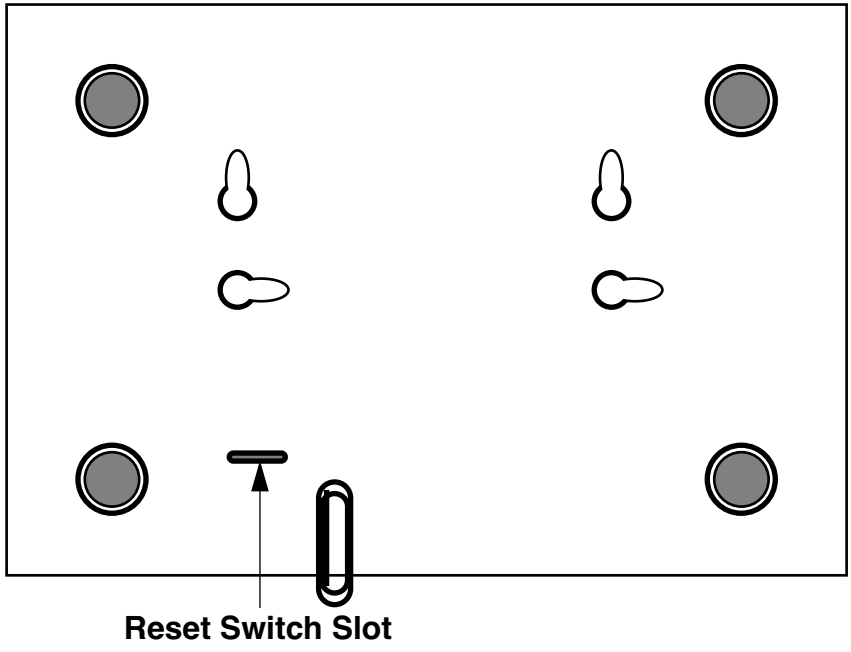
- Observe the Ethernet LEDs to see if data traffic flow appears to be normal.
- Check the WAN statistics and LAN statistics screens to see more specific information on data traffic flow and address serving. See "Statistics & Logs" on page 14-4 for more information.

How to Reset the Netopia 4752 to Factory Defaults

Lose your password? This section shows how to reset the Netopia 4752 so that you can access the console screens once again. Keep in mind that all of your connection profiles and settings will need to be reconfigured.

If you don't have a password, the only way to get back into the Netopia 4752 is the following:

1. Turn the Netopia 4752 upside down.
2. Referring to the diagram below, find the paper clip-size Reset Switch slot.



3. Carefully insert the larger end of a standard size paper clip until you contact the internal Reset Switch. (No need to unwind the paper clip.)
4. Press this switch.
5. This will reset the unit to factory defaults and you will now be able to reprogram the Netopia 4752.

Power Outages

If you suspect that power was restored after a power outage and the Netopia 4752 is connected to a remote site, you may need to switch the Netopia 4752 off and then back on again. After temporary power outages, a connection that still seems to be up may actually be disconnected. Rebooting the Netopia 4752 should reestablish the connection.

Technical Support

Netopia, Inc. is committed to providing its customers with reliable products and documentation, backed by excellent technical support.

Before contacting Netopia

Look in this guide for a solution to your problem. You may find a solution in this troubleshooting appendix or in other sections. Check the index for a reference to the topic of concern. If you cannot find a solution, complete the environment profile below before contacting Netopia Technical Support.

Environment profile

- Locate the Netopia 4752's model number, product serial number, and firmware version. The serial number is on the bottom of the Netopia 4752, along with the model number. The firmware version appears in the Netopia 4752's Main Menu screen.

  Model number:

  Serial number:

  Firmware version:

- What kind of local network(s) do you have, with how many devices?

  Ethernet

  TCP/IP

  Other

- What kind of telephone(s) and/or fax machine(s) or other devices do you have, and how many each?

How to reach us

We can help you with your problem more effectively if you have completed the environment profile in the previous section. If you contact us by telephone, please be ready to supply Netopia Technical Support with the information you used to configure the Netopia 4752. Also, please be at the site of the problem and prepared to reproduce it and to try some troubleshooting steps.

When you are prepared, contact Netopia Technical Support by e-mail, telephone, fax, or post:

Internet: techsports@netopia.com (for technical support)
info@netopia.com (for general information)

Phone: 1 800-782-6449
Fax: 1 510-814-5023

Netopia, Inc.
Customer Service
2470 Mariner Square Loop
Alameda, California 94501
USA

Netopia Bulletin Board Service: 1 510-865-1321

Online product information

Product information can be found in the following:

Netopia World Wide Web server via http://www.netopia.com
Internet via anonymous FTP to ftp.netopia.com/pub

FAX-Back

This service provides technical notes that answer the most commonly asked questions and offers solutions for many common problems encountered with Netopia products.

FAX-Back: 1 510-814-5040

Appendix B

About SDSL

The Netopia 4752 SDSL Integrated Access Device (Symmetric Digital Subscriber Line) technology uses standard copper phone lines to send a digital signal between two points. Because the signal stays digital and does not go through the public switched telephone network SDSL allows a much faster data connection. Offering the same data rate in both directions, the SDSL Router provides symmetric bandwidth needed for business applications such as e-mail, file transfer, web browsing, corporate Intranet access, web hosting, and remote LAN access. The SDSL Router improves businesses productivity and competitiveness by providing cost effective, high speed Internet access over ordinary copper phone lines. SDSL creates a point-to-point link over a single copper wire so bandwidth isn't shared by anyone outside the remote office.

SDSL will allow you to connect to the Internet at a minimum of 128Kbps bi-directional, up to 1.568Mbps. Your LAN will constantly be connected and you will not have to dial into the Internet. DSL utilizes more of the bandwidth on copper phone lines than what is currently used for plain old telephone service (POTS). By utilizing frequencies between 26 kHz and 1MHz, DSL can encode more data to achieve higher data rates than would otherwise be possible in the restricted frequency range of a POTS network (up to 4 kHz). In order to utilize the frequencies above the voice audio spectrum, DSL equipment must be installed on both ends and the copper wire in between must be clean enough to sustain the higher frequencies for the entire route. This means that bandwidth limiting devices such as loading coils can prevent DSL from being used.

SDSL is more appropriate for business users because bandwidth is the same in both directions. Asymmetric DSL Service is better suited for individual consumers who generally require more speed in the download stream (web surfing) with little data going in the other direction.

Netopia's SDSL router has fewer implementation issues than ADSL routers. It uses 2B1Q line encoding (same as T1 or ISDN) and this doesn't produce the same noise and interference as ADSL, which uses DMT or CAP encoding. In some cases the phone company may refuse to provision ADSL service due to crosstalk with other voice and data lines bundled in the same cable.

Historically, HDSL has been primarily used to deploy repeaterless T1 and E1 services in areas where repeater installation was costly or problematic. Today there are over 300,000 such lines installed in the U.S. While these implementations typically require two or three pairs of copper wire, a new form of HDSL has emerged that uses a single pair of copper (i.e., SDSL) but still delivers up to 2 Mbps of symmetrical bandwidth depending on loop length and quality.

Single pair HDSL (S-HDSL or SDSL) offers workable solutions to several of the challenges faced today by its less mature cousin, ADSL. Both technologies will have their place in the service provider's network, and that will be based on the specific customer applications that are supported over the last mile connection. However, SDSL offers some very attractive solutions to today's main drivers—remote data connectivity for corporate or Internet applications.

Because SDSL uses the same technology as the market-proven HDSL, it benefits from the maturity of HDSL implementations. For example, SDSL silicon chipsets cost about a third of that for ADSL chipsets. The lower per line cost means service providers can launch high speed data services sooner rather than later.

Higher speed ADSL solutions can then be brought on line when they are more cost effective.

The maturity of SDSL silicon also includes an advantage in the area of power consumption. Where most ADSL implementations require 6-8 watts of power, current SDSL modems consume 4 watts of power or less.

Because over 300,000 lines are already deployed using HDSL, service providers feel comfortable with SDSL since it uses the same technology as its predecessor and ISDN. The line coding employed by both HDSL and ISDN has not caused any interference with existing services like T1. This means service providers deploy SDSL solutions without worry about impact on other services in neighboring binder groups.

Appendix C

Understanding IP Addressing

This appendix is a brief general introduction to IP addressing. A basic understanding of IP will help you in configuring the Netopia 4752 and using some of its powerful features, such as static routes and packet filtering.

This section covers the following topics:

What is IP?

All networks use protocols to establish common standards for communication. One widely used network protocol is the Internet Protocol, also known as IP. Like many other protocols, IP uses packets, or formatted chunks of data, to communicate. In packets, a header is part of the envelope information that surrounds the actual data being transmitted. In e-mail, a header is usually the address and routing information found at the top of messages.

Note: This guide uses the term "IP" in a very general and inclusive way to identify all of the following:

- Networks that use the Internet Protocol, along with accompanying protocols such as TCP, UDP, and ICMP
- Packets that include an IP header within their structure
- Devices that send IP packets

About IP Addressing

Every networking protocol uses some form of addressing in order to ensure that packets are delivered correctly. In IP, individual network devices that are initial sources and final destinations of packets are usually called hosts instead of nodes, but the two terms are interchangeable. Each host on an IP network must have a unique IP address. An IP address, also called an Internet address, is a 32-bit number usually expressed as four decimal numbers separated by periods. Each decimal number in an IP address represents a 1-byte (8-bit) binary number. Thus, values for each of the four numbers range from 00000000 to 11111111 in binary notation, or from 0 to 255 in decimal notation. The expression 192.168.1.1 is a typical example of an IP address.

IP addresses indicate both the identity of the network and the identity of the individual host on the network. The number of bits used for the network number and the number of bits used for the host number can vary, as long as certain rules are followed. The local network manager assigns IP host numbers to individual machines.

IP addresses are maintained and assigned by the InterNIC, a quasi-governmental organization now increasingly under the auspices of private industry.

Note: It's very common for an organization to obtain an IP address from a third party, usually an Internet service provider (ISP). ISPs usually issue an IP address when they are contracted to provide Internet access services.

The InterNIC (the NIC stands for Network Information Center) divides IP addresses into several classes. Classes A, B, and C are assigned to organizations that request addresses. In Class A networks, the first byte of an IP address is reserved for the network portion of the address. Class B networks reserve the first two bytes of an IP address for the network address. Class C networks reserve the first three bytes of an IP address for the network address. In all cases, a network manager can decide to use subnetting to assign even more bits to the network portion of the IP address, but never less than the class requires. The following section gives more information on subnetting.

Class A networks have a small number of possible network numbers, but a large number of possible host numbers. Conversely, Class C networks have a small number of possible host numbers, but a large number of possible network numbers. Thus, the InterNIC assigns Class A addresses to large organizations that have very large numbers of IP hosts, while smaller organizations, with fewer hosts, get Class B or Class C addresses. You can tell the various classes apart by the value of the first (or high-order) byte. Class A networks use values from 1 to 127, Class B networks use values from 128 to 191, and Class C networks use values from 192 to 223. The following table summarizes some of the differences between Class A, B, and C networks.

Class	First byte	Number of networks possible per class	Number of hosts possible per network	Format of address (without subnetting)	Example
A	1–127	127	16,777,214	net.host.host.host	97.3.14.250
B	128–191	16,384	65,534	net.net.host.host	140.100.10.11
C	192–223	2,097,152	254	net.net.net.host	197.204.13.7

Subnets and subnet masks

Often an entire organization is assigned only one IP network number. If the organization has several IP networks connected together with IP routers, the network manager can use subnetting to distinguish between these networks, even though they all use the same network number. Each physical network becomes a subnet with a unique subnet number.

Subnet numbers appear within IP addresses, along with network numbers and host numbers. Since an IP address is always 32 bits long, using subnet numbers means either the network number or the host numbers must use fewer bits in order to leave room for the subnet numbers. Since the InterNIC assigns the network number proper, it should not change, so the subnet numbers must be created out of bits that would otherwise be part of the host numbers.

Subnet masks

To create subnets, the network manager must define a subnet mask, a 32-bit number that indicates which bits in an IP address are used for network and subnetwork addresses and which are used for host addresses. One subnet mask should apply to all IP networks that are physically connected together and share a single assigned network number. Subnet masks are often written in decimal notation like IP addresses, but they are most easily understood in binary notation. When a subnet mask is written in binary notation, each numeral 1 indicates that the corresponding bit in the IP address is part of the network or subnet address. Each 0 indicates that the corresponding bit is part of the host address. The following table shows the proper subnet masks to use for each class of network when no subnets are required.

Class	Subnet mask for a network with no subnets
A	Binary: 11111111.00000000.00000000.00000000 Decimal: 255.0.0.0
B	Binary: 11111111.11111111.00000000.00000000 Decimal: 255.255.0.0
C	Binary: 11111111.11111111.11111111.00000000 Decimal: 255.255.255.0

To know whether subnets are being used or not, you must know what subnet mask is being used—you cannot determine this information simply from an IP address. Subnet mask information is configured as part of the process of setting up IP routers and gateways such as the Netopia 4752.

Note: If you receive a routed account from an ISP, there must be a mask associated with your network IP address. By using the IP address with the mask you can discover exactly how many IP host addresses you actually have.

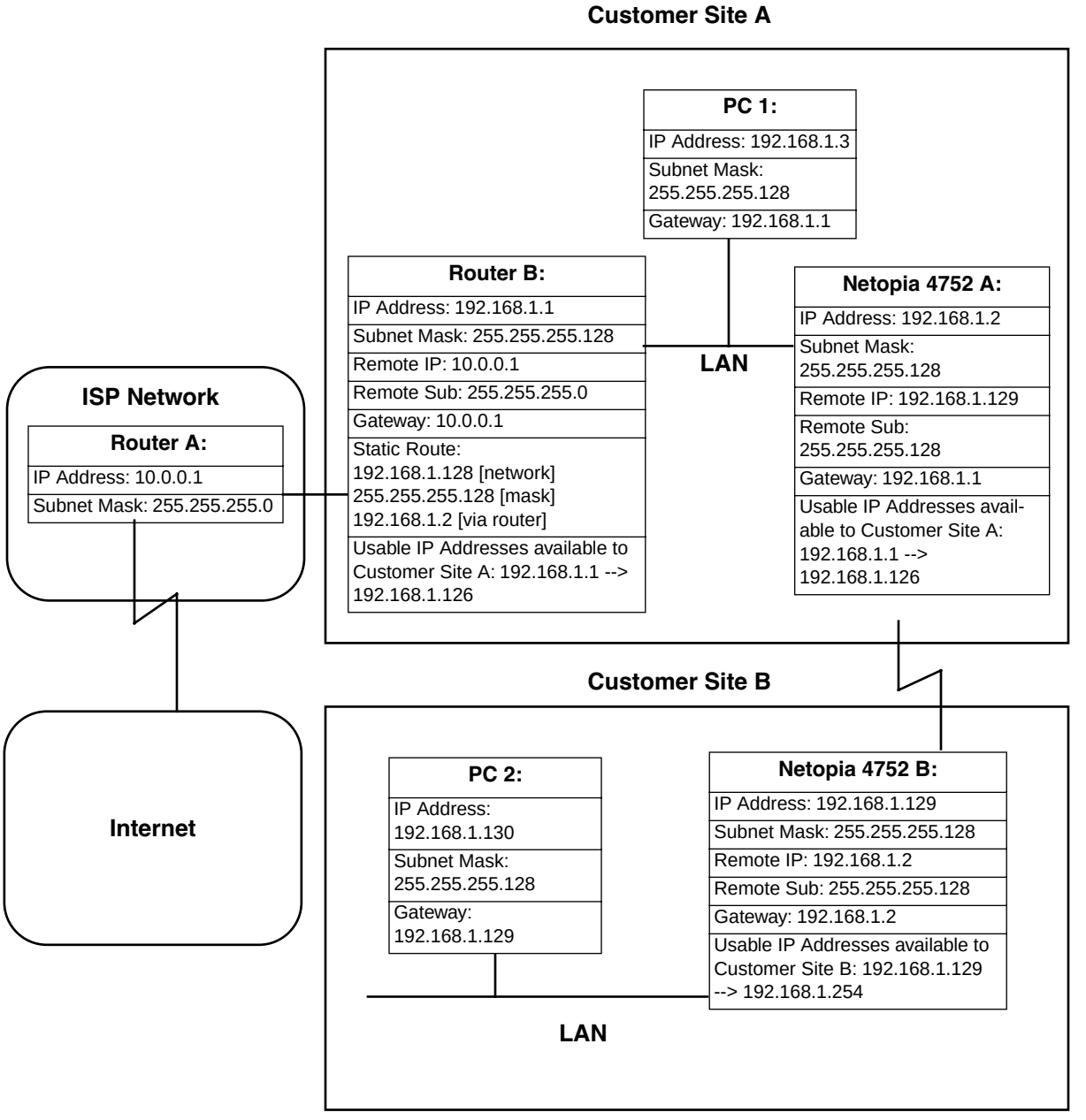
To configure subnets properly, you must also be able to convert between binary notation and decimal notation.

Example: Using subnets on a Class C IP internet

When setting up IP routing with a Class A address, or even with multiple Class C addresses, subnetting is fairly straightforward. Subnetting a single Class C address between two networks, however, is more complex. This section describes the general procedures for subnetting a single Class C network between two Netopia routers so that each can have Internet access.

Network configuration

Below is a diagram of a simple network configuration. The ISP is providing a Class C address to the customer site, and both networks A and B want to gain Internet access through this address. Netopia 4752 B connects to Netopia 4752 A and is provided Internet access through Routers A and B.



Background

The IP addresses and routing configurations for the devices shown in the diagram are outlined below. In addition, each individual field and its meaning are described.

The IP Address and Subnet Mask fields define the IP address and subnet mask of the device's Ethernet connection to the network while the Remote IP and Remote Sub fields describe the IP address and subnet mask of the remote router. This information is entered in the connection profile of the Netopia 4752.

The Gateway field describes the router or workstation's default gateway, or where they will send their packets if the appropriate route is not known. The Static Route field, which is only shown on Router B, tells Router B what path to take to get to the network defined by Netopia 4752 B. Finally, the Usable IP Address field shows the range of IP addresses available to the hosts of that network.

Note that the IP addresses given in this section are for example purposes only. Do not use these addresses when configuring your network.

With this configuration, both Customer Site A and B can gain Internet access through Routers A and B, with no reconfiguration of the ISP's equipment. The most important item in this configuration is the static route defined on Router B. This tells Router B what path to take to get to the network defined by Netopia 4752 B. Without this information, Customer Site B will be able to access Customer Site A, but not the Internet.

If it is not possible to define a static route on Router B, RIP could be enabled to serve the same purpose. To use RIP instead of a static route, enable Transmit RIP on Netopia 4752 A and Transmit and Receive RIP on Router B. This will allow the route from Customer Site B to propagate on Router B and Customer Site A.

Example: Working with a Class C subnet

Suppose that your organization has a site with only 10 hosts and no plans to add any new hosts. You don’t need a full Class C address for this site. Many ISPs offer Internet access with only a portion of a full Internet address.

For example, you might obtain the Class C address 199.14.17.48, with the mask 255.255.255.240. From the previous example, you can see that this gives you 14 host addresses to distribute to the hosts at your site. In effect, your existing network of 10 hosts is a subnet of the ISP’s network. Since the Class C address has already been reduced to subnets, you cannot further subnet your network without the risk of creating network routing problems (since you must use the mask issued by the ISP). This, however, is not a problematic limitation for your small network.

The advantages of this situation are the greater ease and lower cost of obtaining a subnet rather than a full Class C address from an ISP.

Distributing IP Addresses

To set up a connection to the Internet, you may have obtained a block of IP host addresses from an ISP. When configuring the Netopia 4752, you gave one of those addresses to its Ethernet port, leaving a number of addresses to distribute to computers on your network.

There are two schemes for distributing the remaining IP addresses:

- Manually give each computer an address
- Let the Netopia 4752 automatically distribute the addresses

These two methods are not mutually exclusive; you can manually issue some of the addresses while the rest are distributed by the Netopia 4752. Using the router in this way allows it to function as an address server.

One reason to use the Netopia 4752 as an address server is that it takes less time than manually distributing the addresses. This is particularly true if you have many addresses to distribute. You need to enter information only once, rather than having to enter it on each host separately. This also reduces the potential for misconfiguring hosts.

Another reason to use the Netopia 4752 as an address server is that it will distribute addresses only to hosts that need to use them.

All Netopia 4752s come with an integrated Dynamic Host Control Protocol (DHCP) server. Some routers also come with a Macintosh Internet Protocol (MacIP) server. These servers provide a means of distributing IP addresses to either a Mac or PC workstation as needed.

When setting up the DHCP or MacIP servers in the Netopia 4752, it is necessary to understand how workstations lease, renew, and release their IP addresses. This information is helpful in determining dynamic address allocation for a network.

The term “lease” describes the action of a workstation requesting and using an IP address. The address is dynamic and can be returned to the address pool at a later time.

The term “renew” refers to what the workstations do to keep their leased IP address. At certain intervals, the workstation talks to the DHCP or MacIP server and renews the lease on that IP address. This renewal allows the workstation to keep and use the assigned IP address until the next renewal period.

The term “release” refers to a situation where the workstation is no longer using its assigned IP address or has been shut down. IP addresses can be manually released as well. The IP address goes back into the DHCP or MacIP address pool to be reassigned to another workstation as needed.

Technical note on subnet masking

Note: The IP address supplied by the Netopia 4752 will be a unique number. You may want to replace this number with a number that your ISP supplies if you are configuring the router for a static IP address. The automatic IP mask supplied by SmartStart is a Class C address. However, the Netopia 4752 and all devices on the same local network must have the same subnet mask. If you require a different class address, you can edit the IP Mask field to enter the correct address. Refer to the table below.

Number of Devices (other than Netopia 4752) on Local Network	Largest Possible Ethernet Subnet Mask
1	255.255.255.252
2-5	255.255.255.248
6-13	255.255.255.240
14-29	255.255.255.224

Number of Devices (other than Netopia 4752) on Local Network	Largest Possible Ethernet Subnet Mask
30-61	255.255.255.192
62-125	255.255.255.128
125-259	255.255.255.0

Configuration

This section describes the specific IP address lease, renew, and release mechanisms for both the Mac and PC, with either DHCP or MacIP address serving.

DHCP address serving

Windows 95 workstation:

- The Win95 workstation requests and renews its lease every half hour.
- The Win95 workstation does NOT relinquish its DHCP address lease when the machine is shut down.
- The lease can be manually expired using the WINIPCFG program, a command line program executable from the DOS prompt or from the START:RUN menu on a Windows-based computer.

Windows 3.1 workstation (MSTCP Version 3.11a):

- The Win3.1 workstation requests and renews its lease every half hour.
- The Win3.1 workstation does NOT relinquish its DHCP address lease when the user exits Windows and goes to DOS.
- The lease can be manually expired by typing IPCONFIG/RELEASE from a DOS window within Windows or from the DOS prompt.

Macintosh workstation (Open Transport Version 1.1 or later):

- The Mac workstation requests and renews its lease every half hour.
- The Mac workstation relinquishes its address upon shutdown in all but one case. If the TCP/IP control panel is set to initialize at startup, and no IP services are used or the TCP/IP control panel is not opened, the DHCP address will NOT be relinquished upon shutdown. However, if the TCP/IP control panel is opened or if an IP application is used, the Mac WILL relinquish the lease upon shutdown.
- If the TCP/IP control panel is set to acquire an address only when needed (therefore a TCP/IP application must have been launched to obtain a lease) the Mac WILL relinquish its lease upon shutdown every time.

Netopia 4752 DHCP server characteristics

- The Netopia 4752 ignores any lease-time associated with a DHCP request and automatically issues the DHCP address lease for one hour.
- The number of devices a Netopia 4752 can serve DHCP to is 512. This is imposed by global limits on the size of the address serving database, which is shared by all address serving functions active in the router.

- The Netopia 4752 releases the DHCP address back to the available DHCP address pool exactly one hour after the last-heard lease request. Some other DHCP implementations may hold on to the lease for an additional time after the lease expired to act as a buffer for variances in clocks between the client and server.

MacIP serving

Macintosh workstation (MacTCP or Open Transport):

Once the Mac workstation requests and receives a valid address, the Netopia 4752 actively checks for the workstation's existence once every minute.

- For a dynamic address, the Netopia 4752 releases the address back to the address pool after it has lost contact with the Mac workstation for over 2 minutes.
- For a static address, the Netopia 4752 releases the address back to the address pool after it has lost contact with the Mac workstation for over 20 minutes.

Netopia 4752 MacIP server characteristics

The Mac workstation uses ATP to both request and receive an address from the Netopia 4752's MacIP server. Once acquired, NBP confirm packets will be sent out every minute from the Netopia 4752 to the Mac workstation.

Manually distributing IP addresses

If you choose to manually distribute IP addresses, you must enter each computer's address into its TCP/IP stack software. Once you manually issue an address to a computer, it possesses that address until you manually remove it. That's why manually distributed addresses are called static addresses.

Static addresses are useful in cases when you want to make sure that a host on your network cannot have its address taken away by the address server. Appropriate candidates for a static address include a network administrator's computer, a computer dedicated to communicating with the Internet, and routers.

Using address serving

The Netopia 4752 provides three ways to serve IP addresses to computers on a network. The first, Dynamic Host Configuration Protocol (DHCP), is supported by PCs with Microsoft Windows and a TCP/IP stack. Macintosh computers using Open Transport and computers using the UNIX operating system may also be able to use DHCP. The second way, MacIP, is for Macintosh computers. The third way, called Serve Dynamic WAN Clients (IPCP), is used to fulfill WAN client requirements

The Netopia 4752 can use both DHCP and MacIP. Whether you use one or both depends on your particular networking environment. If that environment includes both PCs and Macintosh computers that do not use Open Transport, you need to use both DHCP and MacIP to distribute IP addresses to all of your computers.

Serve dynamic WAN clients

The third method, used to fulfill WAN client requirements, is called Serve Dynamic WAN Clients. The correct term or protocol is a subset of the PPP suite call IPCP. Originally, this would apply only to switched WAN interface routers, and not to leased line routers. However, a new feature can give you Asynchronous PPP dial-in support on the Auxiliary port on any router including leased line Netopia routers.

In any situation where a device is dialing into a Netopia router, the router may need to be configured to serve IP via the WAN interface. This is only a requirement if the calling device has not been configured locally to know what its address(es) are. So when a client, dialing into a Netopia router's WAN interface, is expecting addresses to be served by the answering router, you must set the answering Netopia router to serve IP via its WAN interface.

You can do this in either of two ways:

- use the Serve Dynamic WAN Clients option in the Address Serving Setup screen.

  Enabling Serve Dynamic WAN Clients only allows you to specify a pool of addresses from which the dial-in client may get an IP address. It does not allow static addressing.

  If you want to serve addresses dynamically, use Serve Dynamic WAN Clients.

- define the address that you want to serve in the Connection Profile's IP Setup screen.

  This method requires a static value to be used. Thus any user dialing in can obtain the same IP address for every connection to the profile.

  If you want to serve addresses statically, define the address in the Connection Profile.

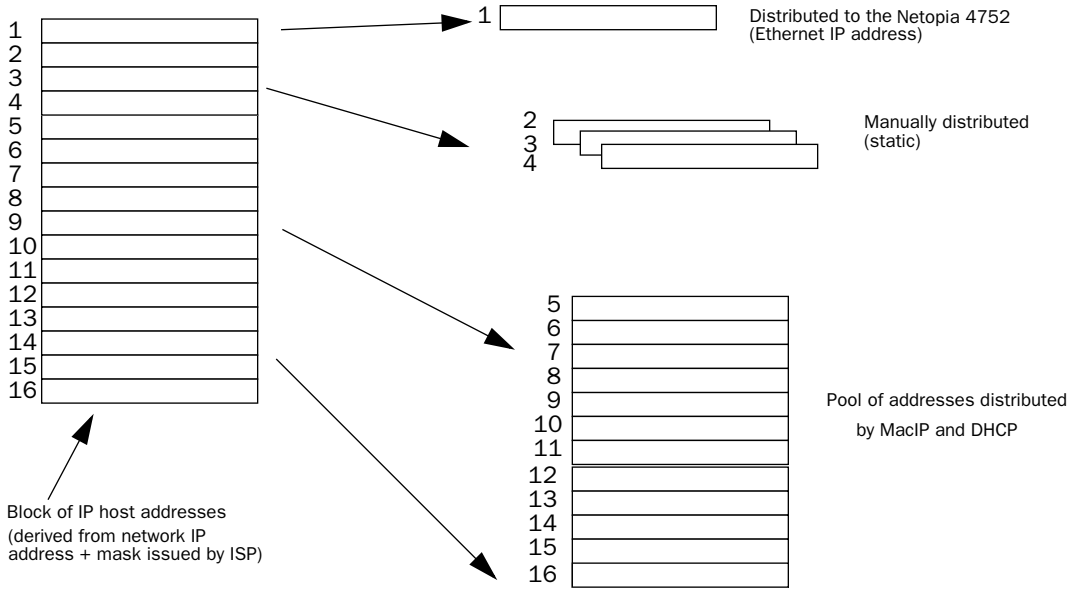
  Notes:

  - The addresses that are to be served cannot be used elsewhere. For example you wouldn't want to define a static address in a Connection Profile to be served via the WAN that is already defined in the DHCP pool of addresses.
  - In order to work correctly, you must define a host or node address in the IP Profile Parameters of the Connection Profile.

    This is accomplished by specifying the IP address that is to be statically served via the WAN, and then by entering a mask value of 255.255.255.255.

Tips and rules for distributing IP addresses

- Before you allocate IP addresses using DHCP and MacIP, consider whether you need to set aside any static addresses.
- Note any planned and currently used static addresses before you use DHCP and MacIP.
- Avoid fragmenting your block of IP addresses. For example, try to use a continuous range for the static addresses you choose.



The figure above shows an example of a block of IP addresses being distributed correctly.

The example follows these rules:

- An IP address must not be used as a static address if it is also in a range of addresses being distributed by DHCP or MacIP.
- A single IP address range is used by all the address-served clients. These include DHCP, BootP, MacIP, and WAN clients, even though BootP and static MacIP clients might not be considered served.
- The address range specified for address-served clients cannot wrap around from the end of the total available range back to the beginning. See below for a further explanation and an example.
- The network address issued by an ISP cannot be used as a host address.

A DHCP example

Suppose, for example, that your ISP gave your network the IP address 199.1.1.32 and a 4-bit subnet mask. Address 199.1.1.32 is reserved as the network address. Address 199.1.1.47 is reserved as the broadcast address. This leaves 14 addresses to allocate, from 199.1.1.33 through 199.1.1.46. If you want to allocate a sub-block of 10 addresses using DHCP, enter “10” in the DHCP Setup screen’s **Number of Addresses to Allocate** item. Then, in the same screen’s **First Address** item, enter the first address in the sub-block to allocate so that all 10 addresses are within your original block. You could enter 199.1.1.33, or 199.1.1.37, or any address between them. Note that if you entered 199.1.1.42 as the first address, network routing errors would probably result because you would be using a range with addresses that do not belong to your network (199.1.1.49, 199.1.1.50, and 199.1.1.51).

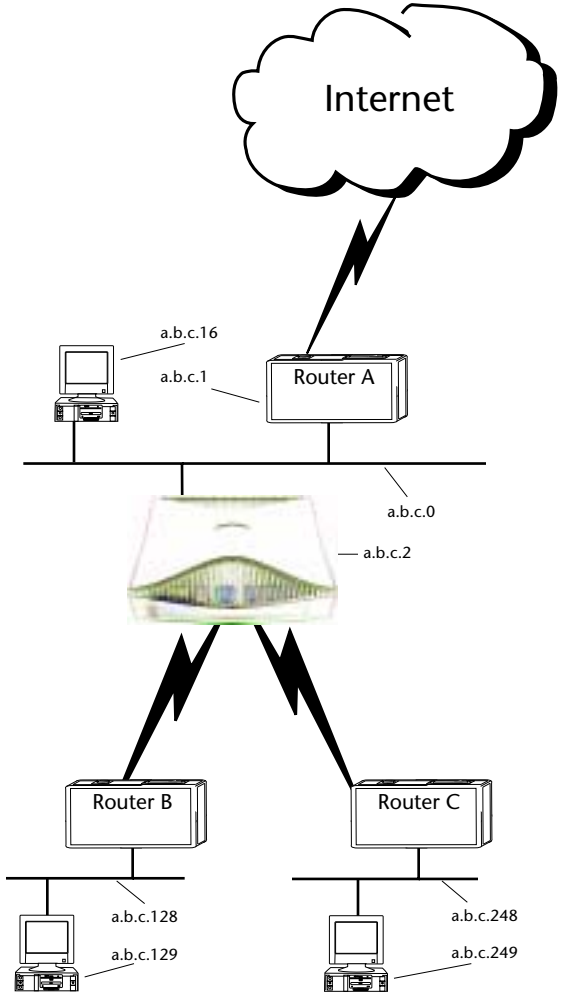
Nested IP Subnets

Under certain circumstances, you may want to create remote subnets from the limited number of IP addresses issued by your ISP or other authority. You can do this using connection profiles. These subnets can be nested within the range of IP addresses available to your network.

For example, suppose that you obtain the Class C network address a.b.c.0 to be distributed among three networks. This network address can be used on your main network, while portions of it can be subnetted to the two remaining networks.

Note: The IP address a.b.c.0 has letters in place of the first three numbers to generalize it for this example.

The figure shows a possible network configuration following this scheme. The main network is set up with the Class C address a.b.c.0, and contains Router A (which could be a Netopia 4752), a Netopia 4752, and a number of other hosts. Router A maintains a link to the Internet and can be used as the default gateway.



Routers B and C (which could also be Netopia 4752s) serve the two remote networks that are subnets of a.b.c.0. The subnetting is accomplished by configuring the Netopia 4752 with connection profiles for Routers B and C (see the following table).

Connection profile	Remote IP address	Remote IP mask	Bits available for host address
For Router B	a.b.c.128	255.255.255.192	7
For Router C	a.b.c.248	255.255.255.248	3

The Netopia 4752's connection profiles for Routers B and C create entries in its IP routing table. One entry points to the subnet a.b.c.128, while a second entry points to the subnet a.b.c.248. The IP routing table might look similar to the following:

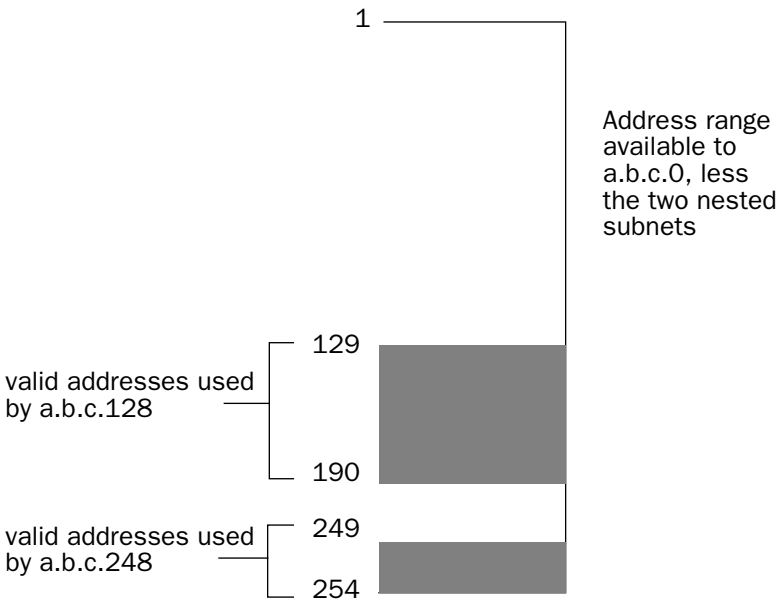
```
                              IP Routing Table

Network Address-Subnet Mask-----via Router------Port------------------Type----
---------------------------------SCROLL UP---------------------------------
0.0.0.0         0.0.0.0         a.b.c.1         --                      Other
127.0.0.1       255.255.255.255 127.0.0.1       Loopback                Local
a.b.c.128       255.255.255.192 a.b.c.128       WAN                     Local
a.b.c.248       255.255.255.248 a.b.c.248       WAN                     Local









---------------------------------SCROLL DOWN-------------------------------
UPDATE
```

Let's see how a packet from the Internet gets routed to the host with IP address a.b.c.249, which is served by Router C. The packet first arrives at Router A, which delivers it to its local network (a.b.c.0). The packet is then received by the Netopia 4752, which examines its destination IP address.

The Netopia 4752 compares the packet's destination IP address with the routes in its IP routing table. It begins with the route at the bottom of the list and works up until there's a match or the route to the default gateway is reached.

When a.b.c.249 is masked by the first route's subnet mask, it yields a.b.c.248, which matches the network address in the route. The Netopia 4752 uses the connection profile associated with the route to connect to Router C, and then forwards the packet. Router C delivers the packet to the host on its local network.

The following diagram illustrates the IP address space taken up by the two remote IP subnets. You can see from the diagram why the term nested is appropriate for describing these subnets.



Broadcasts

As mentioned earlier, binary IP host or subnet addresses composed entirely of ones or zeros are reserved for broadcasting. A broadcast packet is a packet that is to be delivered to every host on the network if both the host address and the subnet address are all ones or all zeros, or to every host on the subnetwork if the host address is all ones or all zeros but the subnet address is a combination or zeros and ones. Instead of making many copies of the packet, individually addressed to different hosts, all the host machines know to pay attention to broadcast packets, as well as to packets addressed to their specific individual host addresses. Depending on the age and type of IP equipment you use, broadcasts will be addressed using either all zeros or all ones, but not both. If your network requires zeros broadcasting, you must configure this through SNMP.

Packet header types

As previously mentioned, IP works with other protocols to allow communication over IP networks. When IP is used on an Ethernet network, IP works with the Ethernet or 802.3 framing standards, among other protocols. These two protocols specify two different ways to organize the very first signals in the sequence of electrical signals that make up an IP packet travelling over Ethernet. By default, the Netopia 4752 uses Ethernet packet headers for IP traffic. If your network requires 802.3 IP framing, you must configure this through SNMP.

Appendix D

Binary Conversion Table

This table is provided to help you choose subnet numbers and host numbers for IP and MacIP networks that use subnetting for IP addresses.

Decimal	Binary	Decimal	Binary	Decimal	Binary	Decimal	Binary
0	0	32	100000	64	1000000	96	1100000
1	1	33	1000001	65	1000001	97	1100001
2	10	34	100010	66	1000010	98	1100010
3	11	35	100011	67	1000011	99	1100011
4	100	36	100100	68	1000100	100	1100100
5	101	37	100101	69	1000101	101	1100101
6	110	38	100110	70	1000110	102	1100110
7	111	39	100111	71	1000111	103	1100111
8	1000	40	101000	72	1001000	104	1101000
9	1001	41	101001	73	1001001	105	1101001
10	1010	42	101010	74	1001010	106	1101010
11	1011	43	101011	75	1001011	107	1101011
12	1100	44	101100	76	1001100	108	1101100
13	1101	45	101101	77	1001101	109	1101101
14	1110	46	101110	78	1001110	110	1101110
15	1111	47	101111	79	1001111	111	1101111
16	10000	48	110000	80	1010000	112	1110000
17	10001	49	110001	81	1010001	113	1110001
18	10010	50	110010	82	1010010	114	1110010
19	10011	51	110011	83	1010011	115	1110011
20	10100	52	110100	84	1010100	116	1110100
21	10101	53	110101	85	1010101	117	1110101
22	10110	54	110110	86	1010110	118	1110110
23	10111	55	110111	87	1010111	119	1110111
24	11000	56	111000	88	1011000	120	1111000
25	11001	57	111001	89	1011001	121	1111001
26	11010	58	111010	90	1011010	122	1111010
27	11011	59	111011	91	1011011	123	1111011
28	11100	60	111100	92	1011100	124	1111100
29	11101	61	111101	93	1011101	125	1111101
30	11110	62	111110	94	1011110	126	1111110
31	11111	63	111111	95	1011111	127	1111111

Decimal	Binary	Decimal	Binary	Decimal	Binary	Decimal	Binary
128	10000000	160	10100000	192	11000000	224	11100000
129	10000001	161	10100001	193	11000001	225	11100001
130	10000010	162	10100010	194	11000010	226	11100010
131	10000011	163	10100011	195	11000011	227	11100011
132	10000100	164	10100100	196	11000100	228	11100100
133	10000101	165	10100101	197	11000101	229	11100101
134	10000110	166	10100110	198	11000110	230	11100110
135	10000111	167	10100111	199	11000111	231	11100111
136	10001000	168	10101000	200	11001000	232	11101000
137	10001001	169	10101001	201	11001001	233	11101001
138	10001010	170	10101010	202	11001010	234	11101010
139	10001011	171	10101011	203	11001011	235	11101011
140	10001100	172	10101100	204	11001100	236	11101100
141	10001101	173	10101101	205	11001101	237	11101101
142	10001110	174	10101110	206	11001110	238	11101110
143	10001111	175	10101111	207	11001111	239	11101111
144	10010000	176	10110000	208	11010000	240	11110000
145	10010001	177	10110001	209	11010001	241	11110001
146	10010010	178	10110010	210	11010010	242	11110010
147	10010011	179	10110011	211	11010011	243	11110011
148	10010100	180	10110100	212	11010100	244	11110100
149	10010101	181	10110101	213	11010101	245	11110101
150	10010110	182	10110110	214	11010110	246	11110110
151	10010111	183	10110111	215	11010111	247	11110111
152	10011000	184	10111000	216	11011000	248	11111000
153	10011001	185	10111001	217	11011001	249	11111001
154	10011010	186	10111010	218	11011010	250	11111010
155	10011011	187	10111011	219	11011011	251	11111011
156	10011100	188	10111100	220	11011100	252	11111100
157	10011101	189	10111101	221	11011101	253	11111101
158	10011110	190	10111110	222	11011110	254	11111110
159	10011111	191	10111111	223	11011111	255	11111111

Appendix E

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Appendix F

Technical Specifications and Safety Information

Description

Dimensions: 130.48 cm (w) x 24.13 cm (d) x 4.445 cm (h)
12” (w) x 9.5” (d) x 1.75” (h)

Communications interfaces: The Netopia 4752 SDSL Integrated Access Device has an RJ-45 jack for SDSL line connections; a 10/100Base-T Ethernet port for your LAN connection; 8 telephone extension jacks; and a DB-9 Console port.

Power requirements

- 12 VDC input
- 1.5 amps

Environment

Operating temperature: 0° to +40° C

Storage temperature: 0° to +70° C

Relative storage humidity: 20 to 80% noncondensing

Software and protocols

Software media: Software preloaded on internal flash memory; field upgrades done via download to internal flash memory via XMODEM or TFTP

Routing: TCP/IP Internet Protocol Suite, RIP

WAN support: SDSL

Security: IP firewalls, UI password security, PAP, CHAP.

SNMP network management: SNMPv1, MIB-II (RFC 1213), Interface MIB (RFC 1229), Ethernet MIB (RFC 1643), Netopia 4752 MIB

Management/configuration methods: Serial console, remote modem console, Telnet, SNMP

Diagnostics: Ping, event logging, routing table displays, trace route, statistics counters

Agency Approvals

North America

Safety Approvals:

- United States – UL Standard for Information Technology Equipment, UL 60950, Third Edition, Dated December 1, 2000
- Canada – CSA: CAN/CSA-C22.2 No. 950-95

EMI:

- FCC Part 15 Class B

International

Safety Approvals:

- Low Voltage (European directive) 73/23/EEC
- EN60950 1992 (Europe)

EMI Compatibility:

- European Directive 89/336/EEC
- EN 300 368.2-1997

Telco:

- European Directive 1999/5/EC

Regulatory notices

Warning

This is a Class B product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures. Adequate measures include increasing the physical distance between this product and other electrical devices.

United States. 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 when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Service requirements. In the event of equipment malfunction, all repairs should be performed by our Company or an authorized agent. Under FCC rules, no customer is authorized to repair this equipment. This restriction applies regardless of whether the equipment is in or our of warranty. It is the responsibility of users requiring service to report the need for service to our Company or to one of our authorized agents. Service can be obtained at Netopia, Inc., 2470 Mariner Square Loop, Alameda, California, 94501.

Important

This product was tested for FCC compliance under conditions that included the use of shielded cables and connectors between system components. Changes or modifications to this product not authorized by the manufacturer could void your authority to operate the equipment.

Canada. This digital apparatus does not exceed the Class B limits for radio noise emission from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Réglement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Declaration for Canadian users

The Canadian Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operation, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to the certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment or equipment malfunctions may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution. Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The load number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop that is used by the device to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the load numbers of all the devices does not exceed 100.

Important Safety instructions

CAUTIONS

CAUTION: Depending on the power supply provided with the product, either the direct plug-in power supply blades, power supply cord plug or the appliance coupler serves as the mains power disconnect. It is important that the direct plug-in power supply, socket-outlet or appliance coupler be located so it is readily accessible.

CAUTION (North America Only): For use only with a CSA Certified or UL Listed Limited Power Source or Class 2 power supply, rated 12Vdc, 1.5A.

CAUTION (Europe Only): For use only with a GS approved Limited Power Source, rated 12Vdc, 1.5A.

TELECOMMUNICATION INSTALLATION CAUTIONS

When using your telephone equipment, basic safety precautions should always be followed to reduce the risk of fire, electric shock and injury to persons, including the following:

1. Do not use this product near water, for example, near a bathtub, wash bowl, kitchen sink or laundry tub, in a wet basement or near a swimming pool.
2. Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electrical shock from lightning.
3. Do not use the telephone to report a gas leak in the vicinity of the leak.

SAVE THESE INSTRUCTIONS

Battery

The Netopia 4752's lithium battery is designed to last for the life of the product. The battery is not user-serviceable.

Caution! Danger of explosion if battery is incorrectly replaced.

Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Netopia 4752 Specifications

Physical interface

WAN interface

- SDSL port with support for symmetric connections from 160 Kbps to 1.568 Mbps (uses RJ45 connector
- Interoperable with SDSL equipment from Copper Mountain, Lucent, Nokia, Nortel, Paradyne, and others.

LAN interface

10/100BaseT Ethernet port

Voice interfaces

- 8 Analog loopstart telephone interfaces (RJ11) for connection to phone handsets or fax.
- Supports optional FSK Caller ID and message waiting
- Supports G.711 64 Kbps PCM and G.726 32 Kbps ADPCM
- Interoperable with VoDSL equipment from Jetstream, CopperCom, Zhone, TdSoft, and Tollbridge

Management interface

- Console port for direct access to console management screens or CLI
- In band management via Telnet to console management screens, CLI, also SNMP

Data features

Routing

- Network Protocols: IP routing
- Dynamic Host Configuration Protocol (DHCP) Server (RFC 2131), Client (RFC 2131) and Relay Agent (RFC 1542)
- NAT/NAPT: (Network Address and Network Address Port Translation (RFC 1631) Port Translation allows mail, Web, PPTP, IPsec and other servers on the LAN to be accessible from the Internet
- MultiNAT: Sophisticated NAT extension that provides security of a NAT “wall” to hide LAN IP addresses on LAN while providing flexible use of all addresses offered by an ISP
- RADIUS Client support for authenticating system configuration access
- Built-in Firewall: Pre-configured firewall to disallow all inbound traffic originated from the internet; Includes IP filtering; Filter packets on a per-connection profile basis for source/destination address, service, and protocol. Up to 255 rules in up to 8 filter sets.
- Secure VPN: ATMP client and server, PPTP client (PAC) and server (PNS), PPTP NAT pass through, IPSec with DES

Protocols

- ATM Protocols: ATM Multiprotocol Encapsulation over ATM Adaption Layer 5 (RFC 1483): Logical Link Control (LLC) encapsulation routed modes
- Support for up to 16 PVCs
- PPP Over ATM, PPP over Ethernet: PAP, CHAP or no authentication (RFC 2364). Compression Control Protocol (RFC 1974)
- Frame Relay Supports: ANSI T1.617 and ANSI T1.618 Annex D LMI, Annex A and Cisco LMI, (RFC 1490) multiprotocol Interconnect over Frame Relay. FRF.12 Fragmentation, and FRF.16 IMUX
- Compression: IP Control Protocol (RFC 1332), PPP Stac LZS Compression Protocol (RFC 1974), Ascend LZS Compression Protocol, Van Jacobson Header Compression
- Virtual Circuit: Terminates ATM Permanent Virtual Circuit (PVC) with ATM Adaptation Layer 5 (AAL5); Allows manual configuration of Virtual Path Identifier (VPI) and Virtual Channel Identifier (VCI). Supports Multiple PVCs, and multiple VCI/VPI support.
- Routing: Transmit and Receive RIPV1 and RIPV2 (RFC 2453) and RIPV1 compatibility mode, up to 32 static routes with default route and the option to not advertise routes, configurable with up to 8 subnets on LAN with DHCP pool associated with each subnet
- IP Addressing: Dynamic Host Configuration Protocol (DHCP) and BootP servers. Supports up to 8 different pools of IP addresses (one per subnet) with a maximum of 512 addresses.
- WAN IP Interface: Numbered or Unnumbered Interface

Quality of service

- TOS Bit Type of Service or application based queuing.
- Frame Relay: FRF.12 support
- ATM: UBR support

Management

- Auto SpeedSet (with some DSLAMs): Automatically hunts through available speed modes until successfully trains at the speed set by remote DSL concentrator
- Management Security: Password-protected with up to 4 user names and passwords
- LEDs: Diagnostic lights for at-a-glance management of Ethernet, WAN, and power connections
- Firmware: Upgrade firmware in flash memory via TFTP or X-Modem transfer using modem or direct cable connection; configuration retained with upgrades; battery backup to protect configuration across power failures
- Trivial File Transfer Protocol (TFTP) Client: Allows remote upload and download firmware and configuration files directly to the router
- Integrated Management Utilities: ICMP Ping: Tests IP connectivity from router to local or remote site. Trace Route: Determines routing path to particular host name or IP address. Telnet Client: Provides remote management access to Telnet hosts on the LAN and WAN. Syslog Client: Maintains ongoing activity log on

a syslog server

- SNMPv1: (RFC 1157) and MIB II (RFC 1213), Ethernet MIB and enterprise MIB for remote management using console applications

Hardware specifications

- Memory: 16 MB DRAM memory
- Environmental Requirement: Operating: 0∞ to +40∞ C. Storage: 0∞ to +70∞ C (20 to 80% non-condensing)
- Power Requirements: AC 100-240 V; 50/60 Hz; 1.66A
- Dimensions: 11.8" (299.7 mm) Wide X 1.7" (43.2 mm) High X 9.2" (233.7 mm) Long
- Weight: 2.25 lb. (1.03 kg) (unit carton)
- UL Listed, CSA Approved, FCC part 68 and part 15, Class A

Voice features

POTS support

- Touch-tone support
- Direct Outward Dialing (DOD) provides dial tone for outside calling to any connected extension
- CallerID support with connected CallerID equipment, delivers name and telephone number during call waiting
- Selective Compression Each port configurable for either 64 Kbps PCM or 32 Kbps ADPCM

Voice quality

- G.168 echo cancellation, 16 millisecond fixed tail length
- Crosstalk of no more than 40 db
- Time slips corrected on hold times of up to 15 minutes

Voice feature support

- DTMF tones for call signaling
- Call Hold (call placed on hold with HKSW)
- Call Forwarding (on no answer, busy, variable) to local or remote number
- Call Waiting (origination and termination) and Cancel Call Waiting
- Call Return
- Call Trace
- Call Blocking
- Call Screening, Selective Call Pickup, Call Rejection and Anonymous Call Rejection (based on CallerID)
- Call Pickup by dialing a feature code

- Speed Dialing by dialing a feature code
- Three Way Calling
- Custom Ringing
- Distinctive Ringing

Glossary

access line: A telephone line reaching from the telephone company central office to a point usually on your premises. Beyond this point the wire is considered inside wiring.

analog: In telecommunications, telephone transmission and/or switching that is not digital. An analog phone transmission is one that was originally intended to carry speech or voice, but may with appropriate modifications be used to carry data of other types.

ANSI (American National Standards Institute): Devises and proposes recommendations for international communications standards. See also *CCITT*.

backbone: A network topology consisting of a single length of cable with multiple network connection points.

bandwidth: The range of frequencies, expressed in Kilobits per second, that can pass over a given data transmission channel within a network. The bandwidth determines the rate at which information can be sent through a channel - the greater the bandwidth, the more information that can be sent in a given amount of time.

baud rate: The rate of the signaling speed of a transmission medium.

bit: A binary digit; the smallest unit of data in the binary counting system. A bit has a value of either 0 or 1.

bits per second (bps): A measure of the actual data transmission rate. The bps rate may be equal to or greater than the baud rate, depending on the modulation technique used to encode bits into each baud interval. The correct term to use when describing modem data transfer speeds.

bps: See *bits per second*.

branch: A length of cable in a star network that goes from the center of the star to a wall jack.

broadcast: A network transaction that sends data to all hosts connected to the network.

burstiness: Data that uses bandwidth only sporadically; that is, information that does not use the total bandwidth of a circuit 100 percent of the time. During pauses, channels are idle, and no traffic flows across them in either direction. Interactive and LAN-to-LAN data is bursty in nature, because it is sent intermittently, and between data transmissions the channel experiences idle time waiting for the DTEs to respond to transmitted data user's input and waiting for the user to send more data.

byte: A group of bits, normally eight, which represent one data character.

CallerID: A feature that allows the called customer premises equipment (CPE) to receive a calling party's directory number during the call establishment phase.

CCITT (Comite Consultatif International Telegraphique et Telephonique): International Consultative Committee for Telegraphy and Telephony, a standards organization that devises and proposes recommendations for international communications. See also *ANSI (American National Standards Institute)*.

Challenge Handshake Authentication Protocol (CHAP): A form of PPP authentication that requires an exchange of user names and secrets (encrypted passwords) between two devices. This security feature is supported on lines using PPP encapsulation. CHAP passwords are called secrets because they are sent encrypted.

CHAP (Challenge Handshake Protocol): A method for ensuring secure network access and communications.

Class A, B, and C networks: The values assigned to the first few bits in an IP network address determine which class designation the network has. In decimal notation, Class A network addresses range from 1.X.X.X to 126.X.X.X, Class B network addresses range from 128.1.X.X to 191.254.X.X, and Class C addresses range from 192.0.1.X to 223.255.254.X. For more information on IP network address classes, see Appendix C, "Understanding IP Addressing."

client: An intelligent workstation that makes requests to other computers known as servers. PC computers on a LAN can be clients.

community strings: Sequences of characters that serve much like passwords for devices using SNMP. Different community strings may be used to allow an SNMP user to gather device information or change device configurations.

CRC (Cyclic Redundancy Check): A computational means to ensure the integrity of a block of data. The mathematical function is computed, before the data is transmitted at the originating device. Its numerical value is computed based on the content of the data. This value is compared with a recomputed value of the function at the destination device.

DCE (Data Communications Equipment): Term defined by standards committees that applies to communications equipment, typically modems or printers, as distinct from other devices that attach to the network, typically personal computers or data terminals (DTE). The distinction generally refers to which pins in an RS-232-C connection transmit or receive data. Also see *DTE*.

DHCP (Dynamic Host Configuration Protocol): A service that lets clients on a LAN request configuration information, such as IP host addresses, from a server.

DNS (Domain Name Service): A TCP/IP protocol for discovering and maintaining network resource information distributed among different servers.

download: The process of transferring a file from a server to a client.

DTE (Data Terminal Equipment): Term defined by standards committees, that applies to communications equipment, typically personal computers or data terminals, as distinct from other devices that attach to the network, typically modems or printers (DCE). The distinction generally refers to which pins in an RS-232-C connection transmit or receive data. Pins 2 and 3 are reversed. Also see *DCE*.

EIA (Electronic Industry Association): A North American standards association.

Ethernet: A networking protocol that defines a type of LAN characterized by a 10 Mbps (megabits per second) data rate. Ethernet is used in many mainframe, PC, and UNIX networks, as well as for EtherTalk.

Ethernet address: Sometimes referred to as a hardware address. A 48-bits long number assigned to every Ethernet hardware device. Ethernet addresses are usually expressed as 12-character hexadecimal numbers, where each hexadecimal character (0 through F) represents four binary bits. Do not confuse the Ethernet address of a device with its network address.

firmware: System software stored in a device's memory that controls the device. The Netopia 4752's firmware can be updated.

gateway: A device that connects two or more networks that use different protocols. Gateways provide address translation services, but do not translate data. Gateways must be used in conjunction with special software packages that allow computers to use networking protocols not originally designed for them.

HDLC (High-Level Data Link Control): A generic link-level communications protocol developed by the International Organization for Standardization (ISO). HDLC manages synchronous, code-transparent, serial information transfer over a link connection. See also *SDLC (Synchronous Data Link Control).*

header: In packets, a header is part of the envelope information that surrounds the actual data being transmitted. In e-mail, a header is usually the address and routing information found at the top of messages.

hop: A single traverse from one node to another on a LAN.

hop count: The number of nodes (routers or other devices) a packet has gone through. If there are six routers between source and destination nodes, the hop count for the packet will be six when it arrives at its destination node. The maximum allowable hop count is usually 15.

host: A single, addressable device on a network. Computers, networked printers, and routers are hosts.

host computer: A communications device that enables users to run applications programs to perform such functions as text editing, program execution, access to data bases, etc.

internet: A set of networks connected together by routers. This is a general term, not to be confused with the large, multi-organizational collection of IP networks known as the Internet. An internet is sometimes also known as an internetwork.

internet address, IP address: Any computing device that uses the Internet Protocol (IP) must be assigned an internet or IP address. This is a 32-bit number assigned by the system administrator, usually written in the form of 4 decimal fields separated by periods, e.g., 192.9.200.1. Part of the internet address is the IP network number (IP network address), and part is the host address (IP host address). All machines on a given IP network use the same IP network number, and each machine has a unique IP host address. The system administrator sets the subnet mask to specify how much of the address is network number and how much is host address. See also *Class A, B, and C networks*.

Internet Protocol (IP) address: A network address that uniquely identifies a device on an IP network. This type of address consists of 4 bytes, represented as decimal values, separated by periods, e.g., 192.168.2.143. All IP addresses of the form 192.168.1.xxx are private IP addresses.

IP (Internet Protocol): A networking protocol developed for use on computer systems that use the UNIX operating system. Often used with Ethernet cabling systems. In this manual, IP is used as an umbrella term to cover all packets and networking operations that include the use of the Internet Protocol. See also *TCP/IP*.

IP address, IP host address, IP network address: See *internet address*.

IP broadcast: See *broadcast*.

ISP (Internet service provider): A company that provides Internet-related services. Most importantly, an ISP provides Internet access services and products to other companies and consumers.

ITU (International Telecommunication Union): United Nations specialized agency for telecommunications. Successor to CCITT.

LAN (local area network): A privately owned network that offers high-speed communications channels to connect information processing equipment in a limited geographic area.

Media Access Control (MAC) address: This 48 bit address is assigned by the device manufacturer for its Ethernet connection. All Netopia 4752 units have MAC addresses of the form 00-C5-9X-XX-XX-XX. Each byte is represented as a conventional two digit hexadecimal number.

MIB (management information base): A standardized structure for SNMP management information.

modem: A device used to convert digital signals from a computer into analog signals that can be transmitted across standard analog (not ISDN) telephone lines. Modem is a contraction of modulator-demodulator.

NAT (Network Address Translation): A feature that allows communication between the LAN connected to the Netopia ISDN Router and the Internet using a single IP address, instead of having a separate IP address for each computer on the network.

NetBIOS: A network communications protocol used on PC LANs.

network: A group of computer systems and other computer devices that communicate with one another.

network administrator: A person who coordinates the design, installation, and management of a network. A network administrator is also responsible for troubleshooting and for adding new users to the network.

network log: A record of the names of devices, location of wire pairs, wall-jack numbers, and other information about the network.

node: See *host*.

packet: A group of fixed-length binary digits, including the data and call control signals, that are transmitted through an X.25 packet-switching network as a composite whole. The data, call control signals, and possible error control information are arranged in a predetermined format. Packets do not always travel the same pathway but are arranged in proper sequence at the destination side before forwarding the complete message to an addressee.

packet-switching network: A telecommunications network based on packet-switching technology, wherein a transmission channel is occupied only for the duration of the transmission of the packet.

PAP (PPP authentication protocol): A method for ensuring secure network access.

Password Authentication Protocol (PAP): A form of PPP authentication that requires an exchange of user names and clear-text passwords between two devices. PAP passwords are sent unencrypted.

parameter: A numerical code that controls an aspect of terminal and/or network operation. Parameters control such aspects as page size, data transmission speed, and timing options.

Point-to-Point Protocol (PPP): A serial protocol defined in RFC 1661 that is used to provide point-to-point connectivity over serial links.

port: A location for passing data in and out of a device, and, in some cases, for attaching other devices or cables.

port number: A number that identifies a TCP/IP-based service. Telnet, for example, is identified with TCP port 23.

POTS (plain old telephone service): Ordinary analog telephone service such as that used for voice transmission, as distinct from digital service.

PPP (Point-to-Point Protocol): A protocol for framing IP packets and transmitting them over a serial line.

protocol: A set of rules for communication, sometimes made up of several smaller sets of rules also called protocols. AppleTalk is a protocol that includes the LocalTalk, EtherTalk, and TokenTalk protocols.

remapping: See *network number remapping*.

RFC (Request for Comment): A series of documents used to exchange information and standards about the Internet.

RIP (Routing Information Protocol): A protocol used for the transmission of IP routing information.

RJ-11: A telephone-industry standard connector type, usually containing four pins.

RJ-45: A telephone-industry standard connector type usually containing eight pins.

router: A device that supports network communications. A router can connect identical network types, such as LocalTalk-to-LocalTalk, or dissimilar network types, such as LocalTalk-to-Ethernet. However—unless a gateway is available—a common protocol, such as TCP/IP, must be used over both networks. Routers may be equipped to provide WAN line support to the LAN devices they serve. They may also provide various management and monitoring functions as well as a variety of configuration capabilities.

routing table: A list of networks maintained by each router on an internet. Information in the routing table helps the router determine the next router to forward packets to.

SDLC (Synchronous Data Link Control): A link-level communications protocol used in an International Business Machines (IBM) Systems Network Architecture (SNA) network that manages synchronous, code-transparent, serial information transfer over a link connection. SDLC is a subset of the more generic HDLC (High-Level Data Link Control) protocol developed by the International Organization for Standardization (ISO).

serial port: A connector on the back of the workstation through which data flows to and from a serial device.

server: A device or system that has been specifically configured to provide a service, usually to a group of clients.

SNMP (Simple Network Management Protocol): A protocol used for communication between management consoles and network devices. The Netopia ISDN Router can be managed through SNMP.

subnet: A network address created by using a subnet mask to specify that a number of bits in an internet address will be used as a subnet number rather than a host address.

subnet mask: A 32-bit number to specify which part of an internet address is the network number, and which part is the host address. When written in binary notation, each bit written as 1 corresponds to 1 bit of network address information. One subnet mask applies to all IP devices on an individual IP network.

Symmetric Digital Subscriber Line (SDSL): A digital communication medium that operates over existing analog telephone lines provided by the telephone company. SDSL will allow you to connect to the Internet at a minimum of 128Kbps bi-directional, up to 2.320 Mbps. Your LAN will constantly be connected and you will not have to dial into the Internet. SDSL uses more of the bandwidth on copper phone lines than what is currently used for plain old telephone service (POTS). By using frequencies between 26 kHz and 1MHz, SDSL can encode more data to achieve higher data rates than would otherwise be possible in the restricted frequency range of a POTS network (up to 4 kHz). In order to use the frequencies above the voice audio spectrum, DSL equipment must be installed on both ends.

TCP/IP (Transmission Control Protocol/Internet Protocol): An open network standard that defines how devices from different manufacturers communicate with each other over one or more interconnected networks. TCP/IP protocols are the foundation of the Internet, a worldwide network of networks connecting businesses, governments, researchers, and educators.

telephone wall cable: 2-pair, 4-pair, or 8-pair, 22- or 24-gauge solid copper wire cable. Telephone wall cable is sometimes called telephone station cable or twisted-pair cable.

TFTP (Trivial File Transfer Protocol): A protocol used to transfer files between IP nodes. TFTP is often used to transfer firmware and configuration information from a UNIX computer acting as a TFTP server to an IP networking device, such as the Netopia ISDN Router.

thicknet: Industry jargon for 10Base5 coaxial cable, the original Ethernet cabling.

thinnet: Industry jargon for 10Base2 coaxial cable, which is thinner (smaller in diameter) than the original Ethernet cabling.

UDP (User Datagram Protocol): A TCP/IP protocol describing how packets reach applications in destination nodes.

wall jack: A small hardware component used to tap into telephone wall cable. An RJ-11 wall jack usually has four pins; an RJ-45 wall jack usually has eight pins.

WAN (wide area network): A network that consists of nodes connected by long-distance transmission media, such as telephone lines. WANs can span a state, a country, or even the world.

WAN IP: In addition to being a router, the Netopia ISDN Router is also an IP address server. There are four protocols it can use to distribute IP addresses over the WAN which include: DHCP, BootP, IPCP, and MacIP. WAN IP is a feature for both the Small Office and Corporate Netopia ISDN Router models.

wiring closet: A central location where a building's telephone and network wiring is connected. Multi-story buildings often have a main wiring closet in the basement and satellite wiring closets on each floor.

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Limited Warranty and Limitation of Remedies

Netopia warrants to you, the end user, that the Netopia 4752 SDSL Integrated Access Device (the "Product") will be free from defects in materials and workmanship under normal use for a period of one (1) year from date of purchase. Netopia's entire liability and your sole remedy under this warranty during the warranty period is that Netopia shall, at its option, either repair the Product or refund the original purchase price of the Product.

In order to make a claim under this warranty you must comply with the following procedure:

1. Contact Netopia Customer Service within the warranty period to obtain a Return Materials Authorization ("RMA") number.
2. Return the defective Product and proof of purchase, shipping prepaid, to Netopia with the RMA number prominently displayed on the outside of the package.

If you are located outside of the United States or Canada, please contact your dealer in order to arrange for warranty service.

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