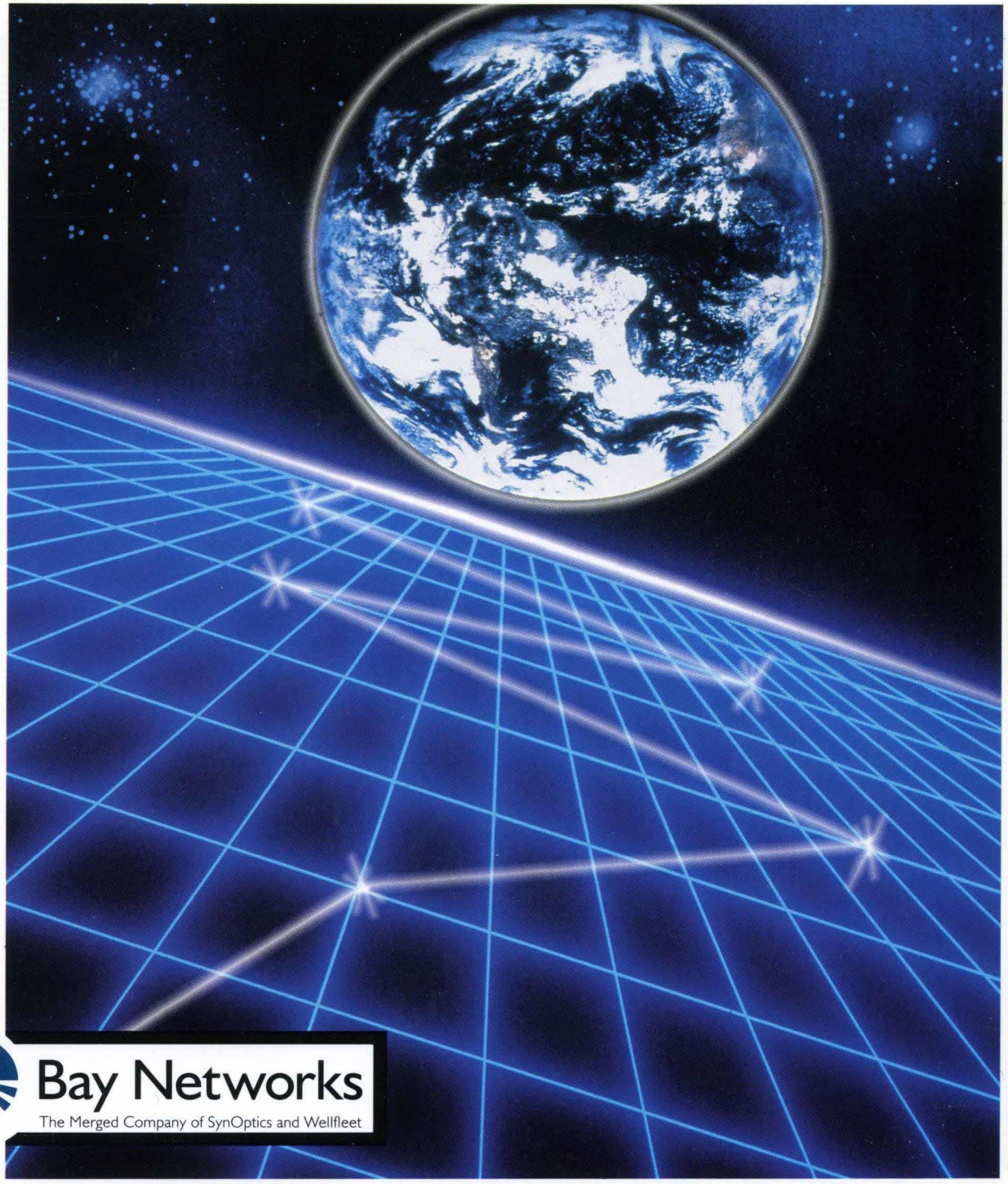

Bay Networks

The Merged Company of SynOptics and Wellfleet

Administering Networks for AN and ASN Routers

Part No. 110065 A

Administering Networks for AN and ASN Routers

Router Software Version 8.10
Site Manager Software Version 2.10

Part No. 110065 Rev. A
February 1995

Bay Networks

The Merged Company of SynOptics and Wellfleet

Bay Networks, Inc., 8 Federal Street, Billerica, MA 01821

Bay Networks Software License

This Software License shall govern the licensing of all software provided to licensee by Bay Networks ("Software"). Bay Networks will provide licensee with Software in machine-readable form and related documentation ("Documentation"). The Software provided under this license is proprietary to Bay Networks and to third parties from whom Bay Networks has acquired license rights. Bay Networks will not grant any Software license whatsoever, either explicitly or implicitly, except by acceptance of an order for either Software or for a Bay Networks product ("Equipment") that is packaged with Software. Each such license is subject to the following restrictions:

1. Upon delivery of the Software, Bay Networks grants to licensee a personal, nontransferable, nonexclusive license to use the Software with the Equipment with which or for which it was originally acquired, including use at any of licensee's facilities to which the Equipment may be transferred, for the useful life of the Equipment unless earlier terminated by default or cancellation. Use of the Software shall be limited to such Equipment and to such facility. Software which is licensed for use on hardware not offered by Bay Networks is not subject to restricted use on any Equipment, however, unless otherwise specified on the Documentation, each licensed copy of such Software may only be installed on one hardware item at any time.

2. Licensee may use the Software with backup Equipment only if the Equipment with which or for which it was acquired is inoperative.

3. Licensee may make a single copy of the Software (but not firmware) for safekeeping (archives) or backup purposes.

4. Licensee may modify Software (but not firmware), or combine it with other software, subject to the provision that those portions of the resulting software which incorporate Software are subject to the restrictions of this license. Licensee shall not make the resulting software available for use by any third party.

5. Neither title nor ownership to Software passes to licensee.

6. Licensee shall not provide, or otherwise make available, any Software, in whole or in part, in any form, to any third party. Third parties do not include consultants, subcontractors, or agents of licensee who have licensee's permission to use the Software at licensee's facility, and who have agreed in writing to use the Software only in accordance with the restrictions of this license.

7. Third-party owners from whom Bay Networks has acquired license rights to software that is incorporated into Bay Networks products shall have the right to enforce the provisions of this license against licensee.

8. Licensee shall not remove or obscure any copyright, patent, trademark, trade secret, or similar intellectual property or restricted rights notice within or affixed to any Software and shall reproduce and affix such notice on any backup copy of Software or copies of software resulting from modification or combination performed by licensee as permitted by this license.

9. Licensee shall not reverse assemble, reverse compile, or in any way reverse engineer the Software. [Note: For licensees in the European Community, the Software Directive dated 14 May 1991 (as may be amended from time to time) shall apply for interoperability purposes. Licensee must notify Bay Networks in writing of any such intended examination of the Software and Bay Networks may provide review and assistance.]

10. Notwithstanding any foregoing terms to the contrary, if licensee licenses the Bay Networks product "Site Manager," licensee may duplicate and install the Site Manager product as specified in the Documentation. This right is granted solely as necessary for use of Site Manager on hardware installed with licensee's network.

11. This license will automatically terminate upon improper handling of Software, such as by disclosure, or Bay Networks may terminate this license by written notice to licensee if licensee fails to comply with any of the material provisions of this license and fails to cure such failure within thirty (30) days after the receipt of written notice from Bay Networks. Upon termination of this license, licensee shall discontinue all use of the Software and return the Software and Documentation, including all copies, to Bay Networks.

12. Licensee's obligations under this license shall survive expiration or termination of this license.

Contents

Chapter 1
Product Overview

Chapter 6
Solving Startup Problems

Appendix C
Managing the Access Node Hub

Index

Figures

Tables

About This Guide

This guide provides information on how to set up and troubleshoot the BOOTP service for Wellfleet® Access Node (AN™), Access Node Hub (ANH™), and Access Stack Node (ASN™) routers.

The term "router" refers to all current versions of ANs, ANHs, and ASNs.

Refer to this guide for

- An overview of router hardware, configuration options, and startup instructions
- Guidelines for preparing configuration files and a software image
- Instructions on how to set up a UNIX® workstation as a BOOTP server
- Instructions on how to set up the paths between the BOOTP server and the routers
- Instructions on how to get the routers up and running on your network
- Troubleshooting guidelines and procedures (see Chapter 6)

Note: Be sure to read "Before You Begin" in Chapter 1.

Audience

This guide is written for network administrators with a background in network communications. It assumes that

- You have a working knowledge of a text editor on a UNIX workstation in which Site Manager is installed.
- You have a working knowledge of Site Manager.
- You have a working knowledge of Ethernet and IEEE 802.3 type networks and their physical layer components.

How to Get Help

For additional information or advice, contact the Bay Networks Help Desk in your area:

United States	1-800-2LAN-WAN
Valbonne, France	(33) 92-966-968
Sydney, Australia	(61) 2-903-5800
Tokyo, Japan	(81) 3-328-0052

Conventions

angle brackets (< >)	Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command. Example: if command syntax is **ifconfig** *<interface>*, you enter **ifconfig com1**
arrow character (➔)	Separates menu and option names in instructions. Example: Protocols➔IP identifies the IP option in the Protocols menu.
brackets ([ ])	Indicate optional elements. You can choose none, one, or all of the options.
user entry text	Denotes text that you need to enter. Example: Start up the Windows environment by entering the following after the prompt: **win**

command text	Denotes command names in text. Example: Use the **ifconfig** command.
italic text	Indicates variable values in command syntax descriptions, new terms, file and directory names, and book titles.
`screen text`	Indicates data that appears on the screen. Example: `bf=krnl_an.exe`
ellipsis points	Horizontal (. . .) and vertical (⋮) ellipsis points indicate omitted information.
quotation marks (" ")	Indicate the title of a chapter or section within a book.
vertical line (|)	Indicates that you enter only one of the parts of the command. The vertical line separates choices. Do not type the vertical line when entering the command. Example: If the command syntax is **bconfig image | config**, you enter either **bconfig image** or **bconfig config**, but not both.

Acronyms

AN	Access Node
ANH	Access Node Hub
ARP	Address Resolution Protocol
ASN	Access Stack Node
AUI	Attachment Unit Interface
BOFL	Breath of Life
BOOTP	Bootstrap Protocol
BOOTPD	Boot Protocol Daemon
BRI	Basic Rate Interface
CCITT	Consultative Committee on International Telegraph and Telephone
DCE	Data Communications Equipment
DLCI	data link connection identifier
DLCMI	data link control management interface
DTE	Data Terminal Equipment

FDDI	Fiber Distributed Data Interface
FTP	File Transfer Protocol
HDLC	high-level data link control
IP	Internet Protocol
IPX	Internet Packet Exchange
ISDN	Integrated Services Digital Network
LMI	Local Management Interface
LQR	Link Quality Reporting
MAU	media access unit
MIB	Management Information Base
MTU	Maximum Transmission Unit
NBMA	Non-Broadcast Multi-Access
OSPF	Open Shortest Path First
PAP	Packet-Level Procedure
PPP	Point-to-Point Protocol
PVC	permanent virtual circuit
RARP	Reverse Address Resolution Protocol
RFC	Request for Comments
RIP	Routing Information Protocol
SAM	System Administration Manager
SMDS	Switched Multimegabit Data Services
SMIT	System Management Interface Tool
SNMP	Simple Network Management Protocol
SPEX	Stack Packet Exchange
TELNET	Telecommunication Network
TFTP	Trivial File Transfer Protocol
TFTPD	Trivial File Transfer Protocol Daemon
UDP	User Datagram Protocol
UTP	unshielded twisted pair

Chapter 1
Product Overview

This chapter provides the following information for the Access Node (AN), the Access Node Hub (ANH), and the Access Stack Node (ASN) routers:

- Hardware connections
- Startup file options and guidelines for selecting them
- How to perform an EZ-Install, Netboot, or Directed Netboot
- System startup
- Implementation notes

Use this guide to

- Select configuration options
- Create a complete configuration file
- Prepare the image
- Set up the BOOTP server and Wellfleet routers to support EZ-Install, Netboot, or Directed Netboot over the network from a central site that may be remote from the router
- Support Local Boot, a booting option independent of the network

After you have selected the initial startup configuration option, you must tell the person installing the router at the remote router site the option you selected and when to use that option. (For more information, refer to "Initial Startup," later in this chapter.) This guide assumes that the person at the remote site has the appropriate installation manual for the router being installed. The following installation manuals are available:

- *Installing and Starting AN Routers*
- *Installing and Maintaining ASN Routers*
- *Installing and Starting 8-Port Access Node Hub (ANH) Systems*

These manuals explain everything the person at the installation site needs to know to start the devices: how to physically install and cable the routers and how to initiate the EZ-Install, Netboot, Directed Netboot, or Local Boot (Quick-Start) procedure.

You can physically install the router before or after you follow the instructions in Chapters 1 through 4 of this guide. It is assumed in Chapter 5 and the appendixes that the router is installed.

This guide refers you to the following manuals:

- The installation manuals listed above, as appropriate
- *Configuring Wellfleet Routers*
- *Customizing Frame Relay Services*
- *Modifying Software Images for Wellfleet Routers*
- *Using Technician Interface Software*
- *Managing Wellfleet Routers*
- *Customizing SNMP, BOOTP, and RARP Services*

Access Node and Access Node Hub Connections

Bay Networks offers a series of Access Node products. This section provides information on interfaces used by ANs and ANHs.

All ANs and ANHs include one console modem port (labeled CONSOLE) for local or remote access to the Technician Interface.

The AN is available in the following configurations:

- 1 Ethernet and 2 synchronous interfaces (Figure 1-1)
- 1 Token Ring and 2 synchronous interfaces (Figure 1-2)
- 1 Ethernet, 1 Token Ring, and 2 synchronous interfaces (Figure 1-3)

The ANH is available in the following configurations:

- 12 Ethernet repeater ports and 2 synchronous interfaces (Figure 1-4)
- 8 Ethernet repeater ports, 1 Ethernet interface, and 2 synchronous interfaces (Figure 1-5 and Figure 1-6)

Ethernet Interface — Two types of connector are available for the Ethernet interface: XCVR (Attachment Unit Interface or AUI) and UTP (unshielded twisted pair; 10BaseT).

Token Ring Interface — The Token Ring interface supports a 9-pin D-subminiature connector.

Synchronous Interfaces — The two synchronous interfaces (COM1 and COM2) can operate simultaneously and can independently support X.21, EIA232, EIA449/422, or V.35 for both internal and external clocking.

When you connect and configure an AN or an ANH with 8 or 12 Ethernet repeater ports, keep the following in mind:

- The AN and ANH allow connection to any and all Ethernet repeater ports at any given time and transmit the same information over all Ethernet ports simultaneously.
- Each repeater port contains an internal cross-over connection. This means you can use a straight-through cable when you connect to other network devices.

- The 12-port ANH contains an internal switch on the repeater daughterboard that allows you to toggle port 12 between a crossed-over and a straight-through configuration. The 8-port ANH contains an external button that allows you to toggle port 1 between a crossed-over and a straight-through configuration. Refer to the AN and ANH installation manuals for additional information about the cross-over switch/button.
- Configuration parameters (for example, the port IP address) apply to all Ethernet repeater ports. In other words, the ANH treats these ports as a single interface.

Refer to the appropriate installation manual for complete cabling instructions.

Note: For instructions on installing the 12-port ANH, refer to *Installing and Starting AN Routers*.

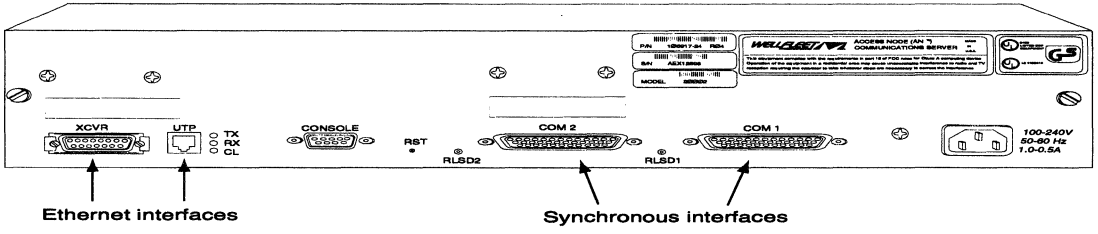

Figure 1-1. Rear Panel of an AN with Ethernet and Synchronous Interfaces

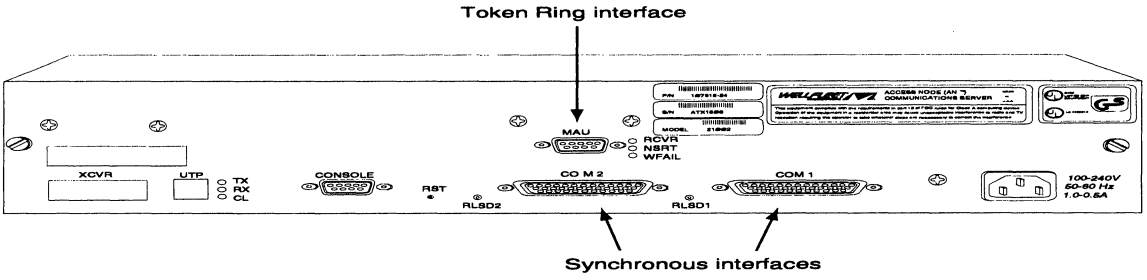

Figure 1-2. Rear Panel of an AN with Token Ring and Synchronous Interfaces

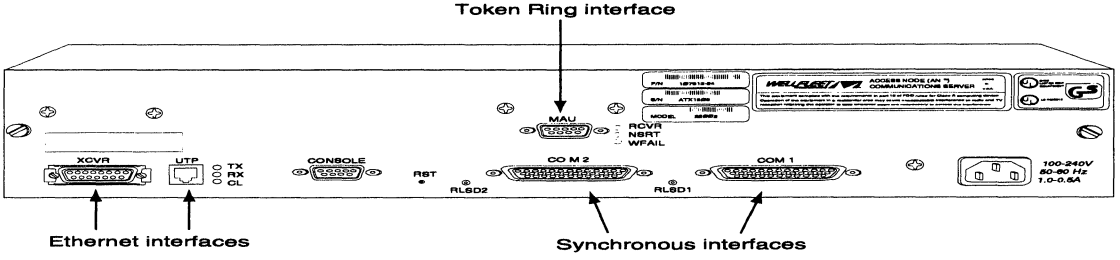

Figure 1-3. Rear Panel of an AN with Ethernet, Token Ring, and Synchronous Interfaces

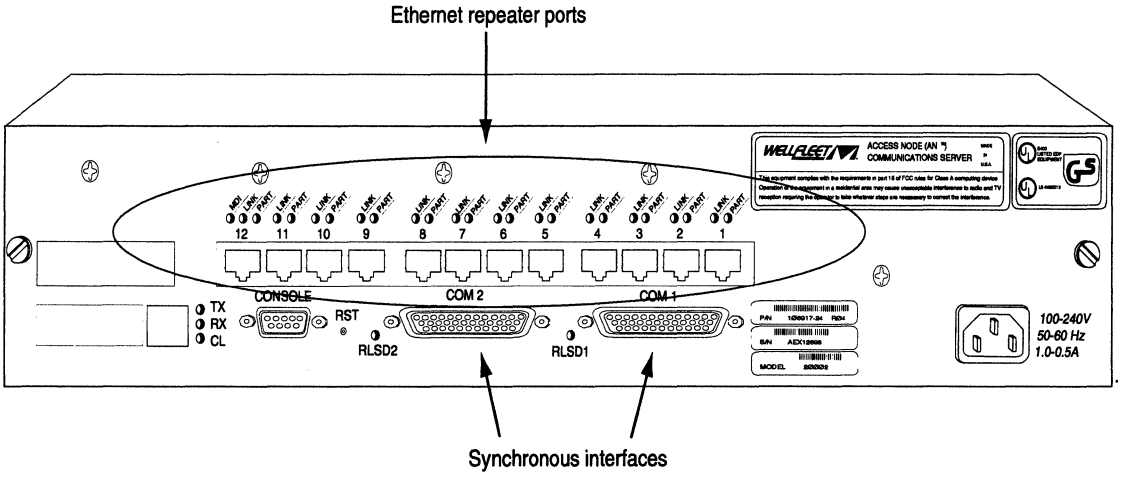

Figure 1-4. Rear Panel of a 12-Port ANH

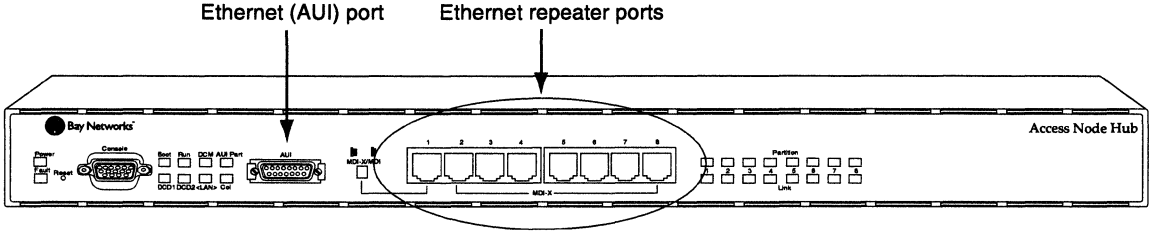

Figure 1-5. Front Panel of an 8-Port ANH

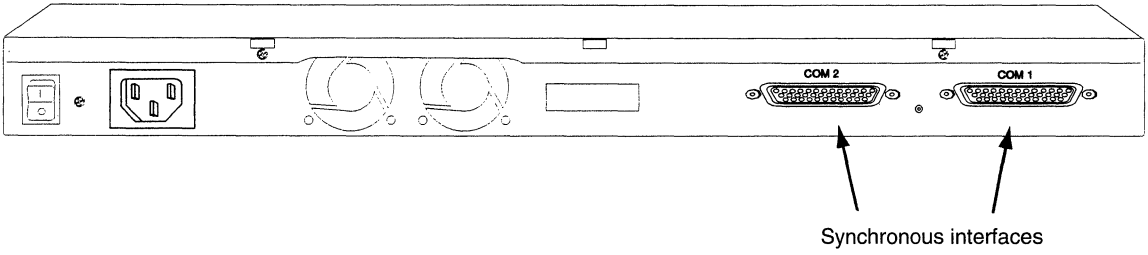

Figure 1-6. Rear Panel of an 8-Port ANH

Access Stack Node Connections

The ASN provides network interface options via the following net modules (I/O modules). The figures show the interfaces on the rear panel of each module:

- Dual Ethernet (Figure 1-7)
- Dual Sync (Figure 1-8)
- Dual Sync/ISDN BRI (Figure 1-9)
- FDDI (Figure 1-10)
- Dual Token Ring (Figure 1-11)
- SPEX (Figure 1-12). The ASN uses an optional Stack Packet Exchange (SPEX) Net Module that lets you connect ASNs in a stack (Figure 1-13). You can stack as many as four ASNs (one SPEX Net Module and three other net modules) and connect them so that they function as one logical router.

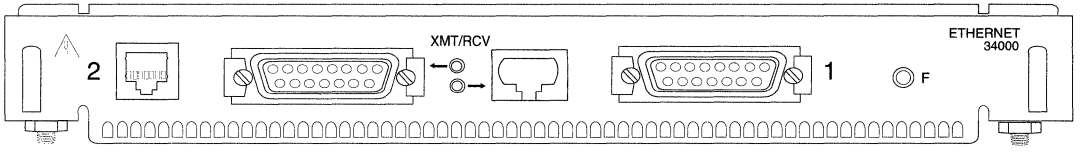

Figure 1-7. Dual Ethernet Net Module

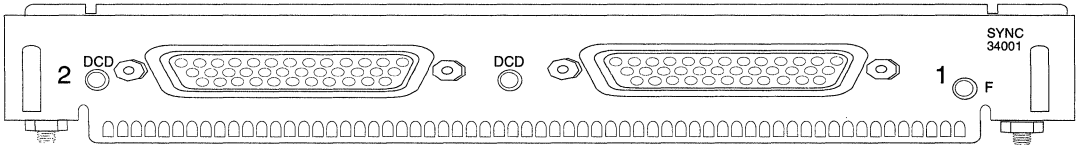

Figure 1-8. Dual Sync Net Module

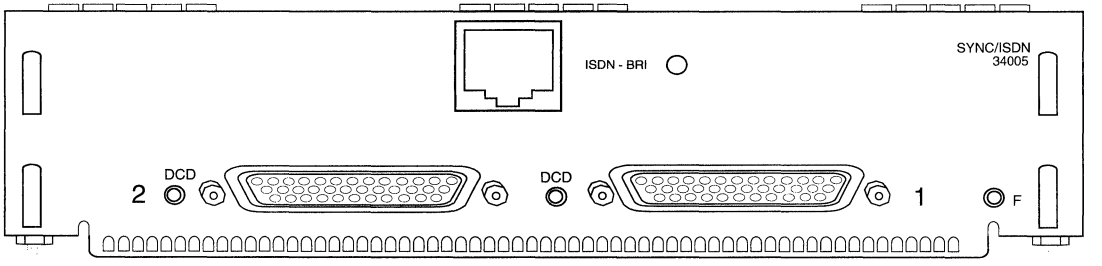

Figure 1-9. Dual Sync/ISDN BRI Net Module

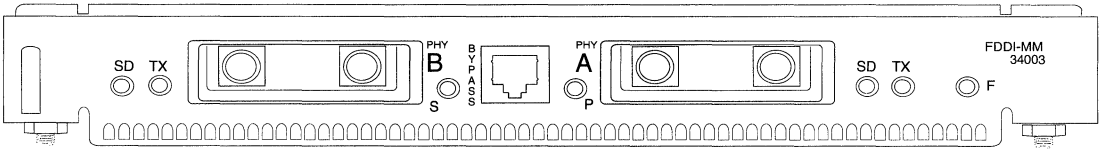

Figure 1-10. FDDI Net Module

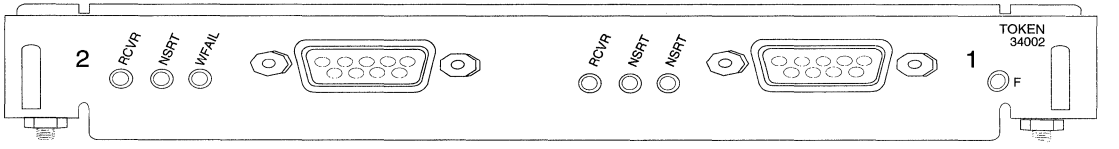

Figure 1-11. Dual Token Ring Net Module

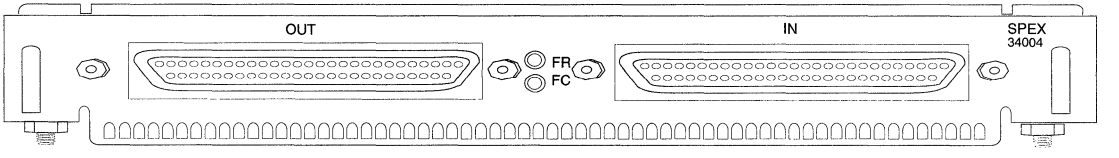

Figure 1-12. SPEX Net Module

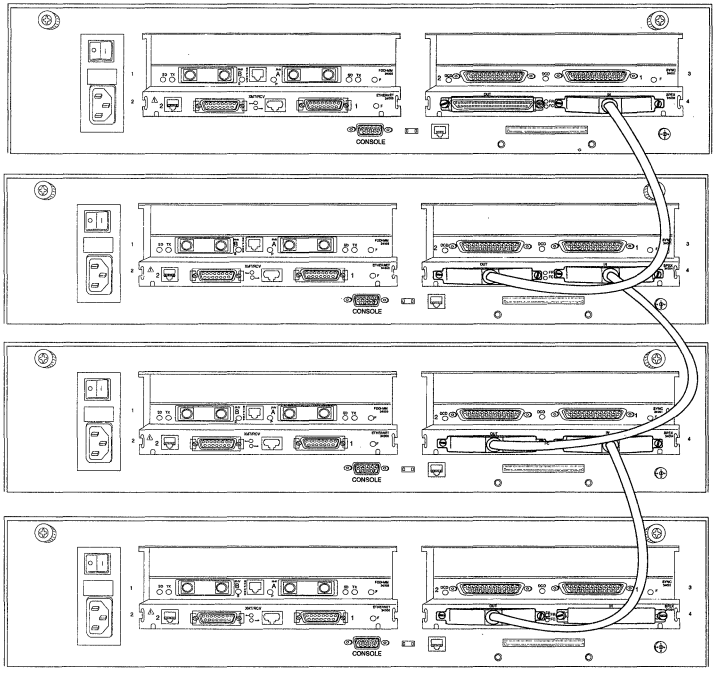

Figure 1-13. Connecting Stacked Nodes

Startup File Options

To bridge and route traffic, the router needs both a configuration file, customized for the network, and a software image. You have the following options for determining the source of these files:

- Configuration file(s)
  - — You can boot the router with the default configuration file in the router's local file system and customize the file for the network.
  - — You can create a customized configuration file remotely and allow the router to get it from the network.

- Software image file
  - — You can allow the router to get its software image from its local file system.
  - — You can configure the router to get its software image from the network.

Note: The terms *Netboot* and *Local Boot* in this guide are used in differing circumstances, as either the name of a startup option or the identification of a process for obtaining a startup file.

When used to indicate a startup option, either of the terms refers to one of the four booting procedures that starts the router running on the network (see "Selecting the Startup Options" in this section). When used in the context of obtaining files, the terms refer to the router getting an image or configuration file for its use during the booting procedure.

For example: When it is said the router *Netboots* a file, that means the router obtains the file from a BOOTP server over the network. When a router *local boots* a file, it is retrieving the file from its own internal local file system. By default, when you run the EZ-Install startup option, the router Netboots its configuration file and local boots its software image.

Note: An AN or ANH boots using its configured startup option. If the boot attempt fails, the AN or ANH attempts to boot once using the other startup option.

If both boot attempts fail, the AN or ANH Diagnostic Monitor Login prompt appears on the router console. In this case, you must troubleshoot the problem and reboot the router. Refer to Chapter 6, "Solving Startup Problems," for additional information and instructions.

An ASN also boots using its configured startup option. However, if a Netboot fails, the ASN will wait to be booted by a neighboring slot. An exception is a single-slot ASN. In this case, the ASN will boot locally.

Options for Getting the IP Address for Router Interfaces

The router Netboots over one of its synchronous or Ethernet links. For Netboot to succeed, the router interface you choose must have a valid IP address. You can assign this IP address manually or allow the router to get it from the network, via EZ-Install. For information about EZ-Install, see "Initial Startup."

This section provides information on the options for obtaining an IP address for router interfaces.

Netboot

When the router Netboots, at least one of its synchronous or Ethernet interfaces must get an IP address. After it obtains an IP address, the interface then requests the configuration and/or software image. Without an IP address, an interface cannot communicate in an IP network.

Note: The router cannot automatically get IP addresses or files using a Token Ring or FDDI interface.

You have the following options for assigning an IP address to an interface:

- You can configure the upstream router to support automated addressing.

  The *upstream router* is the booting router's next-hop router. By default, the booting router's synchronous interfaces automatically try to get IP addresses from the upstream router after the booting router completes its initial diagnostic tests. If one interface succeeds, the router Netboots. If all interfaces fail, the router Local Boots.

- You can interrupt AN and ANH diagnostics by pressing Ctrl-c, and then use the **ifconfig** (interface configuration) command to assign addresses manually to synchronous interfaces or the Ethernet interface(s).

- With ASNs, you can establish a Technician Interface session or use Site Manager to assign an address.

Note: By default, the interfaces that you configure with IP addresses automatically attempt to Netboot whenever the router starts up and completes initial diagnostics.

Directed Netboot

When you use Directed Netboot (usually for routine startups following the initial startup), you manually preconfigure the interface's IP address using the **ifconfig** command with the Technician Interface or Site Manager.

Local Boot

When you choose Local Boot as the initial boot option, you must assign an IP address to an interface when you customize the default configuration file. This interface allows you to use Site Manager's Configuration Manager option to connect to the router and complete the configuration. Refer to the Local Boot Quick-Start Procedure and associated worksheets in Appendix A.

If you choose the Local Boot option for routine startups, the router reads the IP addresses from the local configuration file and assigns them to the appropriate interfaces.

Options for Getting the Startup Files

The router requires a software image — *an.exe* for AN and ANH systems and *asn.exe* for ASNs — to operate. This software image is made up of the following startup files:

- A *krnl_an.exe* or *krnl_asn.exe* file that contains the operating system kernel.

- Application files — executable files needed to perform the functions specified in the configuration file. All application files have *.exe* filename extensions.

  For example, the router needs an *ipx.exe* executable file to run IPX if IPX is enabled in the configuration file.

- String files (for ANs and ANHs only) — compressed ASCII files needed when you use the Technician Interface to display the event log or Management Information Base (MIB) object names. Groups of string files remain in compressed format within the *an.exe* file until needed.

Netboot

When the router Netboots, a UNIX workstation configured as a Boot Protocol (BOOTP) server sends the file over the network to the router. The router uses BOOTP to request startup files from a server. The server receives requests from the router and uses *BOOTPD* (for BOOTP daemon) and *TFTPD* (for TFTPD daemon) to respond.

Note: A *daemon* is an unattended process (that is, one that runs in the background). An application typically calls up a daemon to perform a standard routine or service (in this case, either BOOTP or TFTP).

If the router Netboots its image, it gets the kernel file from the BOOTP server and then gets application files (and string files, if an AN or ANH) from the BOOTP server as it needs them. Getting these files individually, rather than getting the entire *an.exe* or *asn.exe* file, minimizes the cost of line usage and prevents saturation of the router's memory.

Directed Netboot

For routine startups subsequent to the initial startup, you would use Technician Interface commands or the Site Manager to preconfigure manually

- The router's IP address (using the **ifconfig** command)
- The complete pathnames of the software image (*krnl_an.exe* or *krnl_asn.exe*) and/or configuration file(s) to be acquired by the router from the TFTP server (using the **bfconfig** command)

Once you configure Directed Netboot and boot the router, the TFTP server proceeds to transfer the needed files to the router.

Note: The AN/ANH diagnostics **bfconfig** command also allows you to configure Directed Netboot.

Once you configure Directed Netboot, boot the router. If Directed Netboot cannot retrieve the appropriate file(s), the router attempts normal Netboot. If this fails, the router tries Local Boot.

Local Boot

If the router local boots its image, it reads the kernel file and application files (and string files if an AN or ANH), all of which are embedded within the local software image file.

Selecting the Startup Options

This section provides details on how to select the startup file options for the initial startup, day-to-day operations, and maintenance of the router.

Note: You can use Netboot for some procedures and Local Boot for others, provided you set up the network to support Netboot.

Bay Networks recommends that you set up the network to support Netboot, even if you plan to use the Local Boot option for the initial configuration and for subsequent restarts. Netboot lets you upgrade software easily. For an AN or ANH, Netboot is the only option that lets you restore the software in the local file system and memory.

We also recommend that you maintain the software image (*an.exe* or *asn.exe*) on the local file system at all times, in case you want to use Local Boot for either of these routers. But the image must be on the local file system for the ASN to Netboot.

You should also maintain a configuration file for the ASN. Although the configuration file is not required to Netboot the ASN successfully, it is useful if Netboot fails. The presence of the file locally provides network connectivity if TFTP transfer fails during Netboot.

Refer to the following subsections for help in selecting a particular startup option:

- "Initial Startup" and "Routine Startups," for guidelines on initial installation and subsequent startups.
- "Software Upgrades" and "File System Restorals (AN and ANH Only)," for details on the advantages of setting up Netboot in your network.
- "File System Restorals (AN and ANH Only)," for suggestions on how to avoid corrupting and, thereby, having to restore the AN's file system.

Initial Startup

You coordinate the initial startup with a person at the remote router site. As an alternative to another person performing the tasks at the router site, you can refer to the appropriate installation guide to perform the tasks from a remote site, using the router's modem connection.

Three startup options are listed in each of the installation manuals for the initial startup. (A fourth startup option discussed in those guides, Directed Netboot, is usually reserved for subsequent, routine startups.) Choose one option from the list below, for initial startup.

- *EZ-Install* — EZ-Install is the router default option. It is the easiest option for the person at the router site to perform because the network automatically supplies the configuration customized

for the network. This is the only option that does not require a router connection to a modem or console.

This option requires the following steps:

1. You use the Configuration Manager in local mode to create a complete configuration file for the router.
2. You then set up the network to support BOOTP.
3. The person at the router site connects and boots the router.
4. The installing router gets an IP address from the upstream router, a completed configuration file from the BOOTP server, and a software image from the local file system.
5. If the configuration file meets your network requirements, the router starts bridging and routing traffic.

   Even if you choose EZ-Install, we strongly recommend that you connect a modem or a console to the router to allow you to issue commands to the router and display messages.

- *Netboot* — This option requires the following steps:

1. You use the Configuration Manager in local mode to create a complete configuration file for the router.
2. You set up the network to support BOOTP.
3. If the router is an AN or ANH, the person at the router site boots the device and interrupts the initial diagnostic tests. If the router is an ASN, the person establishes a Technician Interface session.
4. Using a console connected to the router, the person at the router site issues the **ifconfig** command to configure a synchronous or Ethernet interface.
5. The person at the router site boots the router.

   After the router boots, it gets a configuration file from a BOOTP server and loads the software image from the local file system.

   If the configuration file meets your network requirements, the router starts bridging and routing traffic.

- *Local Boot* — This option requires the following steps:

1. The person at the router site boots the router and runs the Quick-Start configuration script (*install.bat*) to create a startup configuration.

   The startup configuration allows you to connect to the router remotely, using Site Manager.

2. You use Site Manager to remotely reconfigure and then reboot the router.

   If the configuration file you created meets your network requirements, the router starts bridging and routing traffic.

Routine Startups

This section presents comparisons between the Netboot, Directed Netboot, and Local Boot options for routine startups.

Netboot

Netbooting the software image and/or configuration file for routine startups allows you to

- Manage the files from a remote location by storing them on the BOOTP server.

  This option greatly simplifies the management of a number of routers by allowing you to concentrate on keeping the startup files up to date in a single, central location — the BOOTP server.

- Minimize the need to maintain the router's local file system.

  When the router gets files from a BOOTP server, it stores the files in memory, not in its file system, reducing the need for frequent file system compactions. (Refer to *Using Technician Interface Software* or *Managing Wellfleet Routers* to learn about file system compaction.)

Warning: On the AN or ANH, the file system compaction procedure may fail if the router runs low on memory during the compaction. If compaction fails and the router reports the error message `Insufficient system resources for`

`operation`, follow the procedure below to recover from the failure:

1. Reboot the router with the *ti.cfg* configuration file.
2. Run the compaction procedure.
3. When the compaction is complete, reboot the router using the original configuration file.

Directed Netboot

Directed Netboot reduces network traffic and is generally faster than normal Netboot. On routine startups, the router bypasses the original Netboot BOOTP negotiation with the BOOTP server for the IP address, software image file, and configuration file, and it enters the file transfer phase directly, at which time the TFTP server transfers the startup files to the router.

If Directed Netboot cannot retrieve the appropriate file(s), the router attempts normal Netboot. If this fails, the router tries to Local Boot.

Local Boot

Local booting the software image and/or configuration file for routine startups allows you to

- Minimize the time it takes to boot routers.

  Local booting an image takes 2 to 3 minutes. Typically, Netbooting an image takes a little longer. For example, over a low-speed WAN or after configuring the router to run numerous protocols, Netbooting an image can take up to 15 or 20 minutes.

  It also takes less time to local boot a configuration file than it does to Netboot one. In most configurations, the difference between the two options is only a few seconds.

- Minimize line usage.

  Getting files from a BOOTP server adds traffic to your network during the booting process.

Warning: If an AN's or ANH's boot options are set to **network**, yet you attempt to locally boot an image or configuration file before resetting the options for local booting, the Technician Interface **boot** command initiates the following error message:

```
Image source is network - override allowed only
when source is local
```

Before booting locally, you must change the boot option parameters from **network** to **local** using the **bconfig** command. For additional information, refer to other applicable sections of this guide and to *Managing Wellfleet Routers* and *Using Technician Interface Software*.

Note: The "-" (no volume) symbol allows a named boot or configuration if *at least one* of the two **bconfig** settings is **local**.

When you boot an AN or ANH locally, the name of the active image (*wfHwEntry.wfHwActiveImageName*) appears in the form <*volume*>:<*image name*>. When you Netboot either of the two routers, the active image parameter shows the full path to the active image on the remote server.

Software Upgrades

Warning: If a single ASN suffers a corrupted local file system that damages the image file on the flash card, you cannot boot the ASN. To avoid this problem, use media partitioning to duplicate the software image file on the flash card. If the partition you are using to provide the image becomes corrupted, the other is still available to supply the image. Refer to *Managing Wellfleet Routers* for detailed information about media partitioning.

You can upgrade a router's image using one or both of the following options:

- You can configure the router to Netboot the image and boot the router.

  This option upgrades the image in only the router's memory.

- You can use TFTP to transfer the image to the router's local file system and Local Boot the router.

  This option upgrades the image in both the router's local file system and its memory.

Warning: If you use TFTP to transfer an upgraded image to an AN or ANH, and an interruption in the file transfer occurs (for example, if the router resets, reboots, or loses power), the router's file system becomes corrupted and the router cannot boot locally.

If an AN or ANH fails to boot locally, it automatically Netboots the configuration and image files and loads them into memory. (You must have the network set up properly for a successful Netboot to occur.) After a successful Netboot, you can transfer the image from the network file server to the router's file system, using TFTP.

File System Restorals (AN and ANH Only)

Setting up the network to provide BOOTP service for an AN or ANH has advantages, even if you do not plan to Netboot. The router's file system resides on flash-based media inside the router. This part of the router is *not* user-serviceable.

If these files become corrupted, and the router resets, reboots, or loses power, it automatically Netboots the configuration file and software image. However, you must already have the network set up for Netboot to succeed.

If you previously set up the network to support Netboot, the interruption lasts a maximum of 15 or 20 minutes. But if you wait

until files are corrupted to set up the network for Netboot, the interruption lasts considerably longer.

Warning: You must restore the router's file system if the router resets, boots, or loses power while it is writing to or compacting its local file system.

Compaction of a router's file system can take up to 15 minutes. When you compact a router's file system, always let compaction complete before you reset the router.

Be *very* careful when you use the **format** command with the router. This command erases all files on the local file system, and the router will not be able to local boot an image or configuration file until you replace the files. You can avoid this situation by partitioning the file system media. See *Using Technician Interface Software* and *Managing Wellfleet Routers*.

After the router successfully Netboots, you can use TFTP to restore the software image and configuration file on the router's file system.

The instructions on managing and compacting flash cards in *Using Technician Interface Software* and *Managing Wellfleet Routers* also apply to the flash-based file system media within the router.

Note: When Technician Interface commands (such as **compact**) require you to specify a volume, specify volume 1.

How to Perform an EZ-Install, Netboot, or Directed Netboot

The first section below provides information on how a router using EZ-Install gets an IP address automatically over the network from an upstream router. The following two sections provide details on how a router — whether using automatically acquired or manually configured IP addresses — Netboots an image and configuration files for both normal and Directed Netboot.

Note: If you manually configure an IP address by entering a complete **ifconfig** command, the router stores the IP address entered with that command in nonvolatile RAM. The router can then retrieve the address during subsequent Netboots. But Netboot parameters in the *config* file take precedence over settings you made using the **ifconfig** command.

EZ-Install: Getting the IP Address

The router gets an IP address from the upstream router as follows:

1. When you power on the router, it runs a set of diagnostic tests.
2. By default, the booting router sends a BOOTP request for an IP address and subnet mask to the upstream router.

   The booting router issues this request through all synchronous ports at about the same time, even if cables are not connected to these ports. Each port successively tries the following protocols until it receives a response:

   - Wellfleet Standard (HDLC [high-level data-link control] encapsulation)
   - Frame Relay Annex D
   - Frame Relay Local Management Interface (LMI)
   - Frame Relay Annex A

   If the router does not receive a response, it boots with the files in the local file system. Otherwise, it goes to Step 3.

3. If the circuit on the upstream router is running Wellfleet Standard, or is a Frame Relay permanent virtual circuit (PVC) in direct access mode, the upstream router calculates the IP address of the router's synchronous interface. It calculates this address by adding 1 to the IP address of the interface that received the request.

   For example, in Figure 1-14, the upstream router's interface address is 192.32.1.1. This means that the upstream router calculates 192.32.1.2 as the booting router's IP interface.

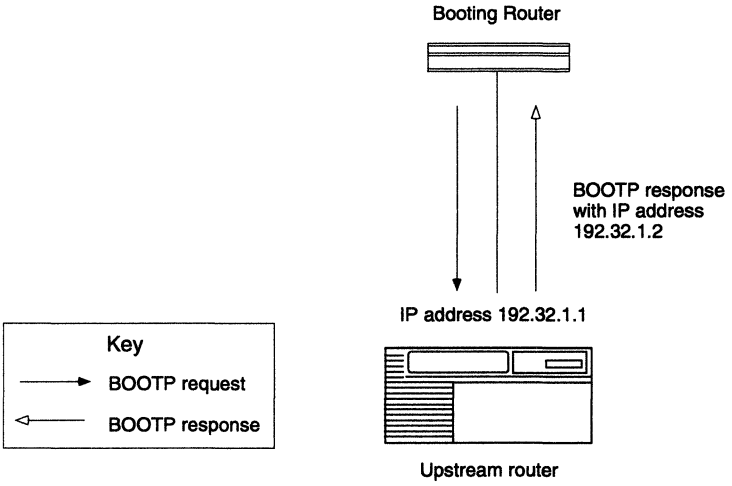

Figure 1-14. Getting an Address from a Wellfleet Standard Circuit or PVC in Direct Access Mode

However, if the IP address plus 1 equals a broadcast address, the upstream router calculates the IP address by subtracting 1.

For example, if its interface is 7.255.255.254, the IP interface for the booting router is 7.255.255.253.

The upstream router then sends the IP address and subnet mask to the booting router in a BOOTP response message.

If the circuit on the upstream router is a Frame Relay PVC in group access mode, the upstream router references the Data Link Connection Identifier (DLCI) of the PVC in its BOOTP client

interface table and finds an associated IP address for the booting router. The BOOTP client interface table contains a DLCI and IP address pair for each PVC to a booting router. (You use Site Manager to create this table when you follow the instructions in Chapter 4.)

The upstream router then sends the IP address and subnet mask to the booting router. For example, in Figure 1-15, routers 1, 2, and 3 send BOOTP requests for IP addresses.

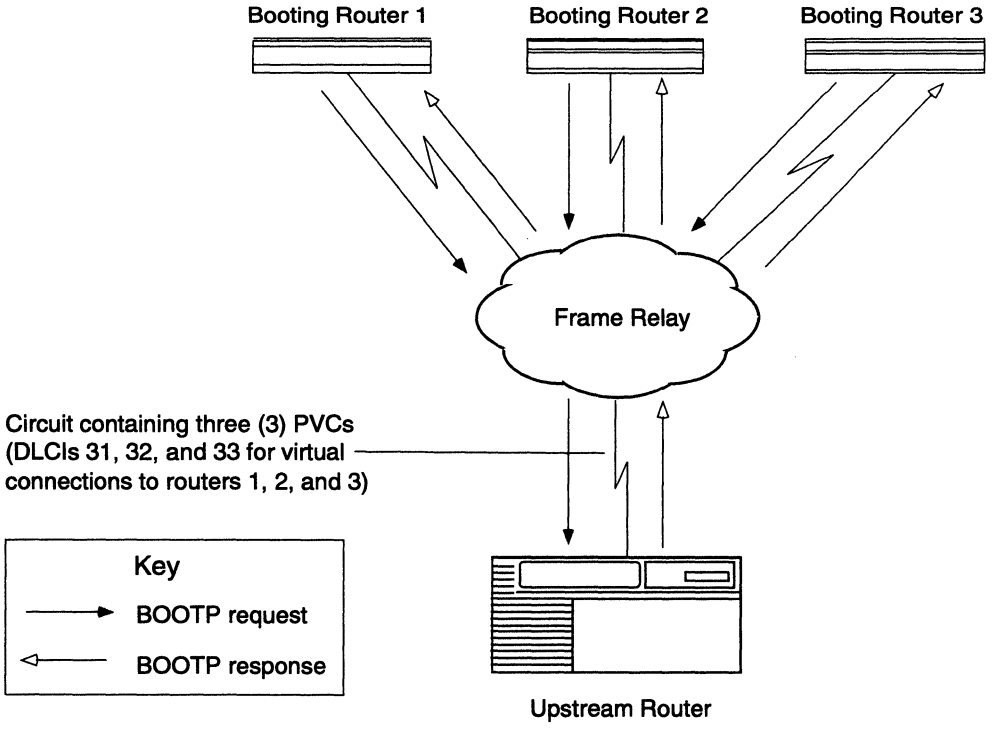

Figure 1-15. Getting an Address from a PVC in Group Access Mode

The upstream router receives the requests on PVCs 31, 32, and 33, respectively. The upstream router refers to DLCI 31 in the BOOTP client interface table shown in Table 1-1, finds the IP address

(192.32.16.17) associated with the DLCI, and sends a BOOTP response containing the IP address back to PVC 31. The upstream router does the same for the other two circuits.

Table 1-1. Sample BOOTP Client Interface Table in Upstream Router

DLCI of Incoming BOOTP Request for IP Address	Response
31	192.32.16.17
32	192.32.16.18
33	192.32.16.19

4. The booting router assigns the IP address and subnet mask to the synchronous interface that receives a BOOTP response. It stores these addresses, along with the address of the next-hop router, in RAM.

   If both synchronous interfaces receive BOOTP responses, the booting router assigns the respective IP addresses to both interfaces.

Netboot: Getting the Software Image and Configuration Files

This section describes how the router obtains a software image and configuration files.

All Routers

Note: If you choose to start up using Netboot rather than EZ-Install, use the **ifconfig** command to manually enter the IP address of the router's interface. Refer to the appropriate installation manual.

Although you can access the software image file from the router's local file system when you use Local Boot, the router in Figure 1-18, configured for Netboot, acquires both the configuration and image files from a BOOTP server on the network. After getting an IP address (whether automatically by EZ-Install or by manual configuration for Netboot), a router Netboots its image and configuration files automatically, as follows:

1. The router sends a BOOTP request for the pathnames of a configuration file and image kernel (Figure 1-16).

   The router issues this request simultaneously through all synchronous and Ethernet interfaces that have IP addresses. It issues this request periodically through these ports for about three minutes, regardless of whether a cable is connected.

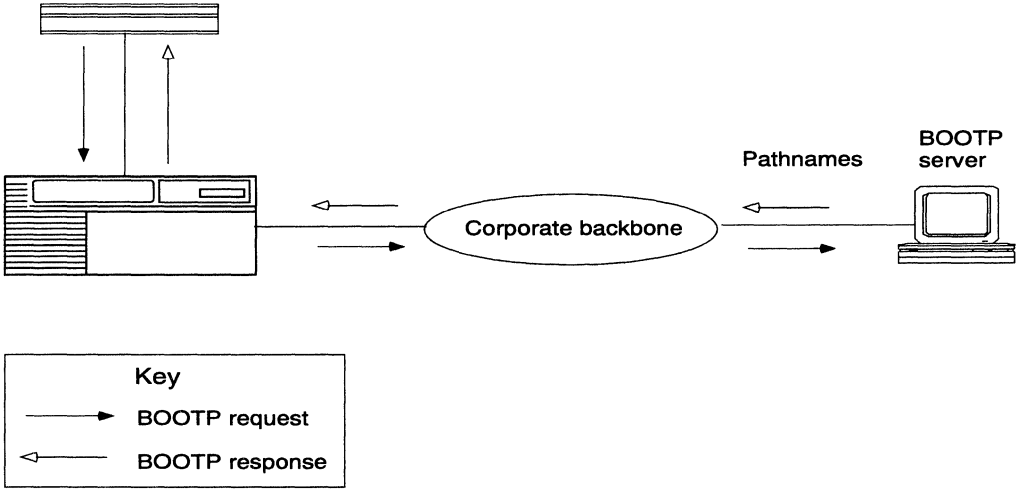

Figure 1-16. Getting the Pathnames of the Kernel and Configuration Files

2. A BOOTP server responds to the router's request with the directory pathnames.

3. The router stops sending BOOTP requests for the pathnames of a configuration file and kernel; the first interface that processes the BOOTP response acts as the TFTP client in the remaining steps.
4. The router sends a TFTP request for the configuration file (Figure 1-17).

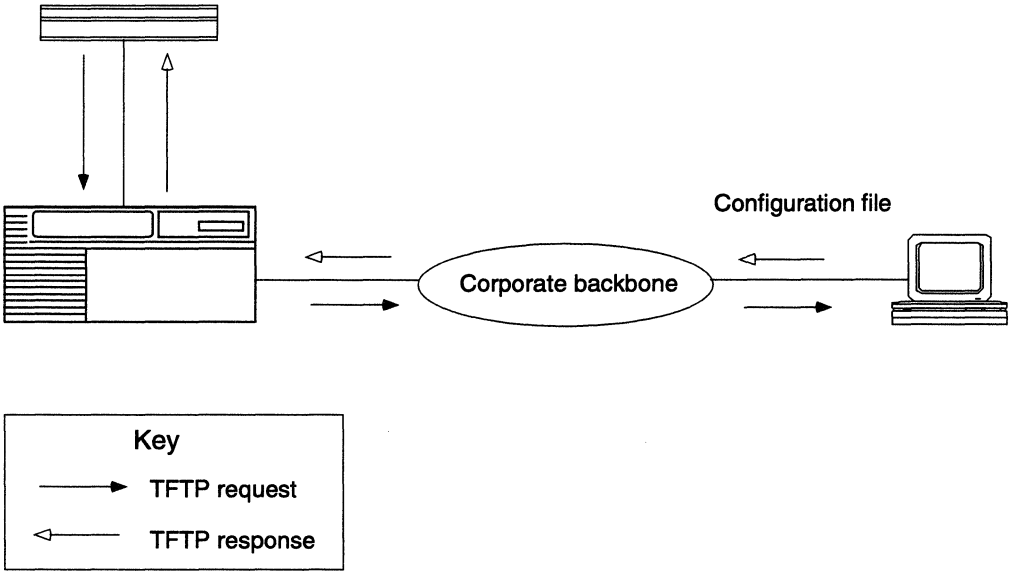

Figure 1-17. Getting the Configuration File

5. The workstation acting as the BOOTP server uses TFTP to transfer the configuration file.
6. The router sends a TFTP request for the router's image kernel (Figure 1-18).

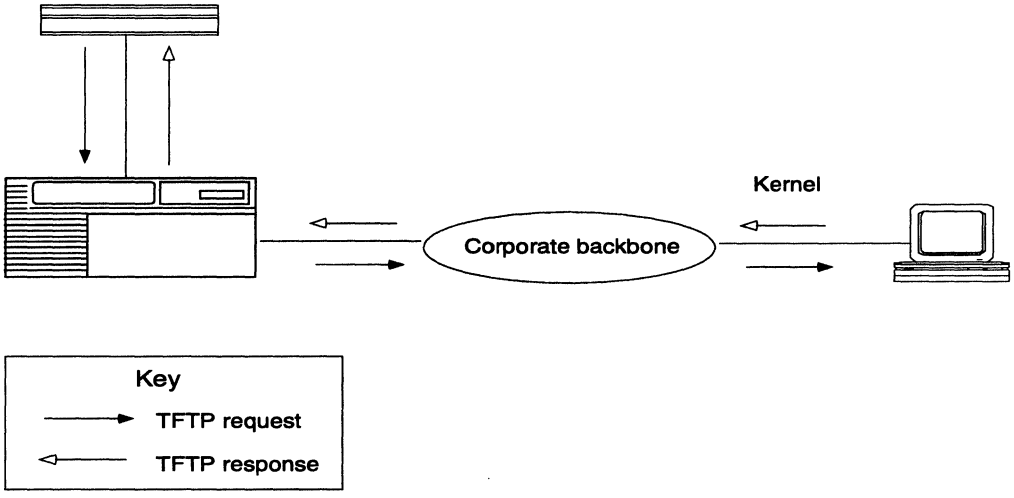

Figure 1-18. Getting the Kernel

7. The workstation configured as the BOOTP server uses TFTP to transfer the kernel.
8. The router boots.
9. The router uses TFTP to get application files as it needs them (as well as string files for the AN or ANH). It can continue to request these files as it needs them, even after it begins bridging and routing traffic.
10. The router begins bridging and routing network traffic in accordance with the configuration file.

If a failure occurs in Steps 1 through 8, the router attempts to boot locally.

ASN Routers

For the Netboot described above to succeed on an ASN, the software image file (*asn.exe*) must be on the local file system's flash card.

Netbooting an ASN's image file is then implemented as a two-stage process:

1. When you power on the ASN, the software image residing on the local file system configures the ASN's interfaces to use IP/TFTP.
2. With the BOOTP server, the local image then performs TFTP file transfer of the image's kernel from the server to the router — along with any applications files it needs at the time. Rebooting automatically, the Netbooted router then proceeds to use the transferred image.

Note: You can change the name of the *asn.exe* file in the local file — even if the **bconfig** command is `boot image=network`. If you rename the software image file, you must use the form *<new_name>.exe*. When you boot with a renamed image, you are performing a "named boot." However, this does not affect the pathname of the image retrieved from the network.

Note: The ASN supports Netbooting over multiple slots. The first slot to retrieve an image and/or configuration file(s) forces the other slots to use the file(s).

Directed Netboot Overview

Directed Netboot is usually reserved for subsequent, routine startups following the router's initial startup because — and most importantly — it reduces network traffic. Moreover, it is generally faster than normal Netboot.

On subsequent startups, the router bypasses the original Netboot BOOTP negotiation with the BOOTP server for the IP address, software image file, and configuration file, and enters the file transfer phase directly. After initial startup you would have enough knowledge about the network and the router's software image and configuration files to use the **ifconfig** and **bconfig** commands with the Technician Interface or Site Manager to preconfigure manually:

- The IP address of the TFTP server, using **bconfig**.

- The router's IP address, using **ifconfig**. On the ASN, we recommend you configure only one interface with an IP address to avoid confusion about the source of the image and configuration files.
- The complete pathnames of the kernel (*krnl_an.exe* or *krnl_asn.exe*) and/or configuration file(s) that the router will acquire from the TFTP server, using **bconfig.**

Note: The AN/ANH diagnostics **bconfig** command also allows you to configure Directed Netboot.

Once you configure Directed Netboot, boot the router. The TFTP server then proceeds automatically to transfer the startup files to the router. If Directed Netboot cannot retrieve the appropriate file(s), the router attempts normal Netboot. If this fails, the router Local Boots.

System Startup

The following two sections present summaries on how to start and configure the router to bridge and route traffic:

- "EZ-Install, Netboot, and Directed Netboot" lists the procedures described in this guide.
- "Local Boot" lists the procedures described in the installation manuals. Refer to the appropriate manual for details.

EZ-Install, Netboot, and Directed Netboot

To start up successfully, use the following procedure:

1. When you use EZ-Install and configure the router to run Frame Relay on a circuit to send BOOTP requests, make sure the upstream router is a Wellfleet router running Version 7.80 or later.

   If you're not using EZ-Install and configuring the router to run Frame Relay, make sure the upstream router is a Wellfleet router running Version 7.71 or higher.

2. Make sure all other routers in the path between the booting router and the BOOTP server are Wellfleet routers running Version 7.60 or higher.
3. Use the Image Builder tool to extract components from the router's software image (*an.exe or asn.exe*). Components are
   - Kernel file (*krnl_an.exe* or *krnl_asn.exe*)
   - Application (*.exe*) files
   - String (*.str*) files (for ANs and ANHs only)
   - The *netboot.exe* file (for ASNs only)

Note: You must install the *netboot.exe* file in the BOOTP server's file system, or the ASN will not Netboot.

4. Use Site Manager to create a unique configuration file for each router.
5. Transfer the components of the software image and the configuration files to the UNIX workstation you configure as a BOOTP server.

   Make sure the image and application files (and string files if the router is an AN or ANH, or the *netboot.exe* file if the router is an ASN) reside in the same directory in the BOOTP server's file system.

Note: When you run Site Manager on a UNIX workstation, you may want to use this workstation as the BOOTP server rather than transfer the files.

6. Configure the workstation as a BOOTP server.
7. Configure all routers between the BOOTP server and the booting router as BOOTP relay agents.

8. When you allow the booting router to get its address from the upstream router over a Frame Relay PVC in group access mode, create a BOOTP client interface table for the upstream router.
9. Use Site Manager to enable BOOTP on each Wellfleet router interface in the path between the router and the BOOTP server.
10. Power on the routers by inserting the AN's power plug into the proper receptacle or by pressing the ANH's or ASN's power switch. The router will start EZ-Install, unless the person at the installation site boots the router otherwise, as specified in the appropriate installation manual (see Step 11).
11. If you choose not to create a BOOTP relay interface table on the upstream router to support automated addressing, use the **ifconfig** command to manually enter the IP address of the router's interface. When you use Directed Netboot, you must configure at least one interface with an IP address.
12. Use the Site Manager Statistics Manager and Events Manager tools to verify that the router is routing traffic according to the configuration you want. For information on using these tools, see *Managing Wellfleet Routers.*

Local Boot

To start up using Local Boot:

1. Insert the AN's plug into the proper power receptacle or press the ANH's and ASN's power switch to boot the router.
2. Run the Quick-Start configuration script, *install.bat.*
3. The configuration software prompts for an IP address and the other configuration data necessary for establishing an initial connection to the IP network; it also records your responses in a configuration file.
4. Use the Configuration Manager tool to
   - Connect to the router
   - Open the configuration file

- Complete the configuration of the router
- Save the configuration to the router's file system

Or you can use the Configuration Manager tool to create a local configuration file and transfer it to the router's file system.

5. Use Site Manager to boot the router, using the new configuration file.
6. Use the Site Manager Statistics Manager and Events Manager tools to verify that the router is routing traffic according to the configuration you want. For information on using these tools, see *Managing Wellfleet Routers*.

Note: When you use the Local Boot option, and the router site is remote, complete the Quick-Start Worksheets (Appendix A) so that the person at the remote site can use the information to respond to the *install.bat* prompts. The same worksheets also appear in the three installation manuals. Instruct the person at the remote site to follow the instructions for performing a Local Boot in those guides.

Implementation Notes

Bay Networks supports BOOTP service on UNIX workstations, but does not currently support BOOTP service on PCs. If you want to use Netboot and you are using a PC as your Site Manager workstation, transfer the files you want to Netboot from the PC to a UNIX workstation and configure the workstation as a BOOTP server.

Note: You cannot EZ-Install or Netboot directly from the router Token Ring or FDDI interface.

Hints

This section contains a few helpful hints that you can use in setting up your router.

- Versions 7.80 and above feature the Wellfleet Technician Interface Packet Capture utility. You can use this utility to isolate BOOTP and TFTP errors to an interface on a Wellfleet router.
- If you upgrade all Wellfleet routers in the paths between the routers and the BOOTP server to Version 7.80 or later before you set up the paths, it may be easier to isolate BOOTP and TFTP configuration errors on the network.
- If you have a LAN protocol analyzer available, you may want to use it to troubleshoot BOOTP server communication errors. Chapter 6 provides guidelines for using Packet Capture and an analyzer to isolate these errors.
- We recommend that you first install a router in the same site as your BOOTP server, Site Manager workstation, and intermediate Wellfleet routers to test the software image, configuration file, and routing path. This test provides you with the startup and troubleshooting experience you need to perform these tasks on routers at remote sites. After you perform the test, move the test router to the remote location you want, modify the configuration file for that router, and set up the new paths.
- After you build and test a router configuration file, make copies of it on the Site Manager workstation. Then modify the copies for each router in your network rather than starting from scratch. To avoid mix-ups, make sure the filename you assign to each configuration file is unique and meaningful for each router.
- If you use TFTP to transfer the software image file to upgrade or restore the router's file system, specify the image shipped for the router you purchased. If you boot a router with an image designed for use with another Wellfleet router type, the router will fail to boot.

What to Do Next

When you use EZ-Install or Netboot for the initial startup:

- ❒ Follow the instructions in Chapters 2 through 4.
- ❒ Read Chapter 5.
- ❒ Ask the person at the remote router site to perform the EZ-Install or Netboot procedures in the appropriate installation manual.

When you use the Local Boot procedure for the initial startup:

- ❒ Complete the Quick-Start Worksheets (Appendix A).
- ❒ Provide the person at the remote router site the information necessary to complete the same worksheets in the appropriate installation manual.

If you have already set up your network for Netboot and you want to use the Local Boot procedure for the initial startup:

- ❒ Refer the person at the remote router site to the worksheets in the appropriate installation manual and provide that person with the information necessary to complete them.
- ❒ Follow the instructions in Chapters 2 through 4 in this guide.

Chapter 2
Preparing the Configuration Files and Image on the BOOTP Server

Your first task is to create a unique configuration file for each router, as well as a uniform software image that all routers in your network can use.

Note: The information in this manual, except for Appendix A about Local Boot, assumes you chose either to Netboot the configuration file and/or software image, or to make the Netboot option available for later use.

Creating Configuration Files

Use the Configuration Manager in local mode to create a configuration file for each router. Refer to *Configuring Wellfleet Routers* for instructions.

Note: Be sure to configure the router to obtain its image and configuration file. Refer to Appendix B for instructions.

Record the name of each configuration file and corresponding router for later reference. The configuration files saved on a BOOTP server do *not* have to be named *config*. When you name configuration files, keep the following restrictions in mind:

- Configuration filenames must begin with an alphabetical character. The remaining characters must be alphanumeric and may also include the underscore (_) character. You cannot use spaces.
- Configuration filenames can consist of 1 to 15 characters (including a dot [.]). We recommend that you limit filenames to eight characters to ensure that all operating systems Bay Networks supports can recognize the names.
- Configuration filename extensions are optional and must follow a filename and a dot. We recommend that you limit filename extensions to three characters.

BOOTP allows a maximum number of 49 characters in a path, including slashes, filename, optional dot, and filename extension.

If the BOOTP server and Site Manager do not reside on the same workstation, transfer the configuration files to the BOOTP server.

Preparing an Image

By default, the router local boots its image. If you want the router to automatically Netboot the image when starting up, using EZ-Install, Netboot, or Directed Netboot, you must use the Site Manager Image Builder to change the default setting before you attempt to start up. (If the router is an AN or ANH, you must also use the Image Builder when you need to Netboot the image over the network in the event the router's local file system becomes corrupted.)

To use Image Builder, perform these steps:

1. On the Site Manager workstation, open the software image file in the Image Builder. Refer to *Modifying Software Images for Wellfleet Routers* for more instructions.

Warning: Be sure to select the correct image for the router type involved. If you select an image for another type, you cannot generate the correct files. Also, if you configure the router to obtain its image from the network, it cannot Netboot the image unless the kernel image is already available on the BOOTP server.

In addition, make sure that you extract the kernel image and all of the application (*.exe*) files and string (*.str*) files for the AN or ANH in the router directory. The files must be from the same software image file whose components were created from the same version of software. If these files are from different software versions, the router may fail to boot or operate properly.

2. After you open the image file, the Image Builder automatically generates the kernel image, application files, and AN/ANH string files.

3. By default, the Image Builder stores these files in the */$HOME/.builder_dir/rel<rel>/an* (or *asn*) directory (where *<rel>* is the current router software release for the router).

   For example, Version 2.10 of the Site Manager Image Builder tool stores Version 8.10 files for an AN or ANH in the */$HOME/.builder_dir/rel810/an* directory.

For additional instructions on how to use the Image Builder, refer to *Modifying Software Images for Wellfleet Routers.*

When you use a different workstation as a BOOTP server, transfer all of the files in the directory that contains the kernel file to that workstation.

Chapter 3
Setting Up the BOOTP Server

You configure a UNIX workstation as a BOOTP server by

- Copying BOOTPD to the appropriate directory (Sun® workstations only)
- Setting up the send and receive sockets for the BOOTP server
- Setting up BOOTPD
- Setting up BOOTPD to respond to the routers
- Making sure that if you set up multiple workstations to provide BOOTP service for the same routers, that the kernel image, application files, and string files are consistent
- Setting up TFTPD
- Adding a TFTP user for an HP® 9000
- Setting up static routes to routers (optional)
- Loading the changes into memory

Note: Use a UNIX workstation to perform these tasks.

Copying the BOOTPD Program on Sun Workstations

Depending on the operating system you plan to use, Bay Networks may or may not ship BOOTPD with the Site Manager package. Since the AIX® and HP-UX operating systems already have BOOTPD, but

SunOS and Solaris® do not, Bay Networks only ships BOOTPD for SunOS and Solaris. BOOTPD arrives on the same media as Site Manager. The Site Manager installation software automatically installs BOOTPD on Sun workstations running SunOS and Solaris.

Copy the *bootpd* file to the */etc* directory as follows:

1. Log in to the UNIX workstation as *root*.
2. Enter the following command:

   cp /usr/wf/bin/bootpd /etc

Setting Up the Send and Receive Sockets

Set up the send and receive sockets as follows:

1. Log in as *root*.
2. Use a text editor to insert the following two lines into the */etc/services* file:

```
bootps          67/udp                  # bootp server
bootpc          68/udp                  # bootp client
```

Note: The remaining instructions in this chapter assume that you are logged in as *root*.

Setting Up BOOTPD to Run

Configure your workstation to run the BOOTPD program when it receives a BOOTP request packet, as follows:

1. Use a text editor to open the */etc/inetd.conf* file.
2. Make sure that there is no other line in the file that begins with "bootps."

   If there is, your workstation is already configured as a BOOTP server. Comment out this line by entering a pound sign (#) at the

beginning of the line, so that the server will use the BOOTPD program that you specify in the next step.

3. Insert the following line anywhere in the file to configure your workstation as a BOOTP server:

   ```
   bootps dgram udp wait root /etc/bootpd bootpd
   ```

4. Save and exit the file.

Setting Up BOOTPD to Respond to Routers

When the operating system receives a BOOTP packet, it starts up BOOTPD, which matches the source IP address of the packet to the IP address in the BOOTP table (*bootptab*) file. It finds the pathname of the configuration file associated with the IP address in this file. It also finds the pathname of the image associated with all booting routers.

Bay Networks ships the sample *bootptab* file shown in Table 3-1. It ships this file on the same media on which it ships Site Manager. The Site Manager installation software automatically installs it in the */usr/wf/config* directory. Use a copy of this sample file if you do not already have a *bootptab* file.

Set up BOOTPD to respond to booting routers, as follows:

1. View the contents of the */etc* directory to determine whether it already contains a *bootptab* file. If it does contain a *bootptab* file, disregard Steps 2 and 3 and refer to Step 4 to edit this file.
2. Log in to the UNIX workstation as *root*.
3. Issue the following command to copy the *bootptab* file to the */etc* directory:

   cp /usr/wf/config/bootptab /etc

4. Use an editor to open the *bootptab* file in the */etc* directory so that BOOTPD responds to all booting routers in your network.
5. Type the information that pertains to the booting routers in your network into the *bootptab* file. Read the definition format description that follows to understand the syntax. Use Table 3-1

and Table 3-2 to determine which tags and values you need. Figure 3-1 shows the sample *bootptab* file included with the Site Manager software. Read the comments in this file to understand the sample definitions.

6. Save the *bootptab* file.

The format of each definition in the *bootptab* file is as follows:

<hostname>:\

:<tg>=<value>:\
:<tg>=<value>:\
:<tg>=<value>:

where: *<hostname>* is a name you assign to a BOOTP client (each router is a client) and *<tg>* is a two-character BOOTP parameter name (tag). You must follow each tag with an equal sign (=) and a value.

A backslash (\) at the end of a line indicates continuation of the line.

A pound sign (#) at the beginning of a line indicates a comment.

Use each *<hostname>* in the *bootptab* file to name each router in your network. The *<hostname>* can contain a maximum of 79 characters and one null character. When you name your router(s), keep the following in mind:

- The first character must be alphabetic.
- All characters must be alphanumeric.

  You can use a dot (.) to separate characters, but the character immediately following the dot must be alphabetic.
- Make sure you enter a backslash (\), *not* a slash (/), at every line ending that does not conclude a definition.
- Make sure the hostname you assign to the BOOTP client in the *bootptab* file does *not* contain an underscore.

  If a hostname contains an underscore (for example, "AN_Boston"), the BOOTP server cannot find the host. This requirement applies only to the hostname, *not* to filenames.

- Make sure the *bootptab* file resides in the */etc* directory, where BOOTPD expects to find it. BOOTPD fails if it cannot find the *bootptab* file in this directory.

Table 3-1. BOOTPD Tags for a Boot Image Name

Tag	Required or Optional	Value	Example
`hd`	Required	Home directory–specifies the directory on the workstation containing the boot files. By default, the Image Builder writes its files to the directory specified in the example. The `rel...` number is the version number of the current router software release. If you change the default or move the files to another directory, specify that directory.	`hd=/$HOME/.builder_dir/rel810/an`
`bf`	Required	Boot file–specifies the name of the boot image.	`bf=krnl_an.exe`
`bs`	Required	Boot size–(in 512-octet blocks) indicates the size of the boot file. If you specify auto as the size, the BOOTP server calculates the size of the file for each BOOTP request.	`bs=auto`

(continued on the next page)

Table 3-1. BOOTPD Tags for a Boot Image Name *(continued)*

Tag	Required or Optional	Value	Example
vm	Required	Vendor magic cookie selector–indicates that the BOOTP server should always reply in a manner compliant with RFC 1048. You must enter **rfc1048** for this tag, so that the router can understand the BOOTP responses it receives.	`vm=rfc1048`

Table 3-2. BOOTPD Tags for a Router Host Name

Tag	Required or Optional	Value	Example
`ip`	Required	IP address–indicates the host IP address of the router.	`ip=192.32.5.2`
`sm`	Optional	Subnet mask–indicates the host subnet mask of the router.	`sm=255.255.255.0`
`T129`	Required	Pathname of the router configuration file. The maximum path length is 49 characters.	`T129="/rte3/cfg/AN_Bost.cfg"`
`T130`	Required	Size of the router configuration file in 512-byte blocks. The setting of this tag determines how much memory the router allocates for the file.	`T130=0x0004`
`tc`	Optional	Table continuation–points to a definition in another location in the same file for additional information. The information this tag points to is common to all routers that need to boot using BOOTP. If information in a definition for a specific router is inconsistent with the definition this tag points to, BOOTPD uses the information for the specific router.	`tc=general`

The sample *bootptab* file in Figure 3-1 enables two ANs (named "AN.Boston" and "AN.Chicago") to boot across the network. Use the basic format shown in Figure 3-1 to set up your own *bootptab* file.

```
# This file contains the default specification for the boot
# image file to be used by all ANs.

# "general" contains information that is common to all ANs
# that need to boot via BOOTP. You can use any word in place # of "general."
general:\

# "hd" specifies that /$HOME/.builder_dir/rel810/an is the
# directory on the workstation where the boot files are
# located. By default, the Image Builder writes its files to # this directory. If
you are using a router software version # later than 8.00, add the associated
three digits to the end
# of the "rel" directory name. If you moved the files to
# another directory, specify that directory.
        :hd=/$HOME/.builder_dir/rel810/an:\

# "bf" specifies that the name of the boot image kernel file
# is krnl_an.exe.
        :bf=krnl_an.exe:\

# "bs" indicates the size of the boot file. If you specify
# "auto" as the size, the BOOTP server calculates the size of
# the file for each BOOTP request.
        :bs=auto:\

# "vm" indicates that the BOOTP server should always reply in
# a manner compliant with RFC 1048. You must enter rfc1048
# for this tag so that the AN can understand the BOOTP
# responses it receives.
        :vm=rfc1048:

# This line marks the beginning of the active definition for
# the AN we are naming "AN.Boston."
         AN.Boston:\

# "ip" indicates the IP address of the AN.
        :ip=192.32.5.2:\

# "T130" indicates the size of the AN's configuration file in
# 512-byte blocks. Always use 0x0004.
        :T130=0x0004:\
# "T129" indicates the pathname of the configuration file
# for the AN.
        :T129="/usr1/cfg/AN_Bost.cfg":\

# "tc" indicates that the "general" definition contains more # information that
applies to BOOTP transmissions to
# "AN.Boston."
        :tc=general:

# This is the active definition for the AN we are naming
# "AN.Chicago."
AN.Chicago:\
        :ip=10.0.0.4:\
        :T130=0x0004:\
        :T129="/rte3/cfg/AN_Chic.cfg":\
        :tc=general:
```

Figure 3-1. Sample *bootptab* File

Verifying Consistent BOOTP Service

You may want to configure a second workstation as a BOOTP server for backup purposes. If you do, make sure the *bootptab* files match. Also, make sure that the kernel image, application files, and string files are consistent.

Setting Up TFTPD

This section provides information on how to configure a workstation to allow the router to Netboot. When you set up the TFTPD server on a UNIX workstation, you can allow TFTP to access the root directory and any subdirectory or restrict its access to a specified directory or pathname. Allowing the router to access the root directory and any subdirectory is the simpler procedure. Specifying a pathname provides security, but it requires linking BOOTPD to TFTPD.

Providing TFTPD Access to the Root Directory

Refer to the instructions that follow for your operating system to provide TFTPD access to files in the root directory and to all subdirectories.

SunOS

If TFTP is in its default location (the root directory), look for the following line in the */etc/inetd.conf* file. If the line is not present, insert it.

```
tftp dgram udp wait root /usr/etc/in.tftpd in.tftpd -s /
```

Solaris

If TFTP is in its default location (the root directory), look for the following line in the */etc/inetd.conf* file. If the line is not present, insert it.

```
tftp dgram udp wait root /usr/sbin/in.tftpd in.tftpd -s /
```

HP-UX

If TFTP is in its default location (the root directory), look for the following line in the */etc/inetd.conf* file. If it is not present, insert it.

```
tftp dgram udp wait root /etc/tftp tftp
```

AIX

Use the System Management Interface Tool (SMIT) to configure TFTP. For instructions, refer to the IBM manuals *Understanding the TCP/IP Daemons* and *Understanding the TFTP Protocol*.

Restricting TFTPD Access to a Specified Directory

The following sections describe how to restrict TFTPD file access to any specific directory.

The example in these sections restricts access to the */tftpboot* directory. Substitute any directory you want when following the instructions.

Specifying the Directory

Refer to the instructions that follow for your operating system to specify the directory to which you want to restrict TFTPD access.

SunOS

Look for the following line in the */etc/inetd.conf* file. If it is not present, insert it.

```
tftp dgram udp wait root /usr/etc/in.tftpd in.tftpd -s /
tftpboot
```

Solaris

Look for the following line in the */etc/inetd.conf* file. If it is not present, insert it.

```
tftp dgram udp wait root /usr/sbin/in.tftpd in.tftpd -s /
tftpboot
```

HP-UX

Look for the following line in the */etc/inetd.conf* file. If it is not present, insert it.

```
tftp dgram udp wait root /etc/tftp tftp -s /tftpboot
```

AIX

Use the System Management Interface Tool (SMIT) to configure TFTP. For instructions, refer to the IBM manuals *Understanding the TCP/IP Daemons* and *Understanding the TFTP Protocol*.

Creating a Link

You must create a symbolic link for every pathname you specify in the *bootptab* file.

For example, to set up the symbolic links for the */tftpboot* path, use the following procedure:

1. Log in to your UNIX workstation as *root*.
2. Enter the following commands:

   cd tftpboot

   ln -s . usr

   ln -s . tftpboot

Warning: Do *not* insert a slash (/) in the *cd tftpboot* command; a symbolic link cannot contain references to directories above the directory specified in the *tftpd* command line. Use the **-s** flag to provide additional security to your network. (This flag restricts TFTPD access to a specified directory.)

Adding a TFTP User for an HP 9000

Follow the instructions in this section only if you are using an HP 9000 as the Site Manager workstation.

To add a TFTP user for the HP 9000, enter a line with the following syntax in your */etc/passwd* file. We recommend that you use / as the tftp home directory.

```
tftp::<user_id>:<group_no.>::/:/bin/false
```

For example:

```
tftp::510:20::/:/bin/false
```

Warning: We recommend that you do *not* use the System Administration Manager (SAM) utility as an alternative to entering the commands above, because it prompts you to delete everything in your root directory.

Setting Up Static Routes to Routers

If your workstation requires static routes, use this section to specify a path to the network.

You may also want to specify a static route in a multihop environment or in an environment using routing protocols such as RIP, where minor routing update delays may extend the time it takes to Netboot.

Set up a static route for each path between the routers and the BOOTP server's next-hop router.

Add the following line to the *inetd.conf* file to set up a static route:

```
route add <destination> <gateway> <hops>
```

where:

<destination> is the IP address of the booting router or its network.

<gateway> is the IP address of the network destination to which packets are to be addressed.

<hops> is the number of hops to the network destination.

After adding a static route for each path to the booting routers, enter the following command to display the routing table and verify the route you added:

netstat -r

Loading the Changes into Memory

Once you modify the *inetd.conf* file, you must force the operating system to reread it by rebooting the workstation or by issuing a hang-up signal. Issue a hang-up signal if the workstation is performing a task that you do not want to interrupt.

Refer to the following sections to either reboot or issue a hang-up signal.

Rebooting

Reboot your workstation as follows:

1. Log in as *root.*
2. Issue the following command:

   /etc/shutdown now -r

   The **-r** flag reboots the workstation.

Issuing a Hang-up Signal

Issue a hang-up signal as follows:

1. Log in as *root.*
2. Issue the following command to hang up on the *inetd* process:

   ps -aux | grep inetd

   The system displays a line similar to

   ```
   root       148  0.0  0.0   48    0 ?  IW   Jan 14  0:07
   inetd
   ```

3. Issue the following command, using the first number in the line after the word "root" (in this case, 148):

   kill -1 148

   The *inetd* process rereads the *inetd.conf* file.

Chapter 4
Setting Up the Paths

You set up the routing paths between the BOOTP server and the routers by

- Enabling each Wellfleet router interface in the paths to the routers
- Creating a BOOTP relay agent forwarding table for each router in the path
- Creating a BOOTP client interface table for the upstream router when the booting router is on a Frame Relay PVC in group access mode

Note: If you are booting over an Ethernet LAN and the Site Manager workstation is directly cabled to the LAN, you do not need to configure a router in order to pass BOOTP packets between the router and the Site Manager workstation. Refer to Chapter 5 for instructions on how to configure the IP interface using the **ifconfig** command. Then refer to the appropriate installation manual.

Enabling the Router Interfaces

You must enable BOOTP relay (also called BOOTP pass-through or gateway) on all interfaces in the paths between the booting routers and the BOOTP server. For example, you would enable BOOTP relay on the interfaces indicated in Figure 4-1.

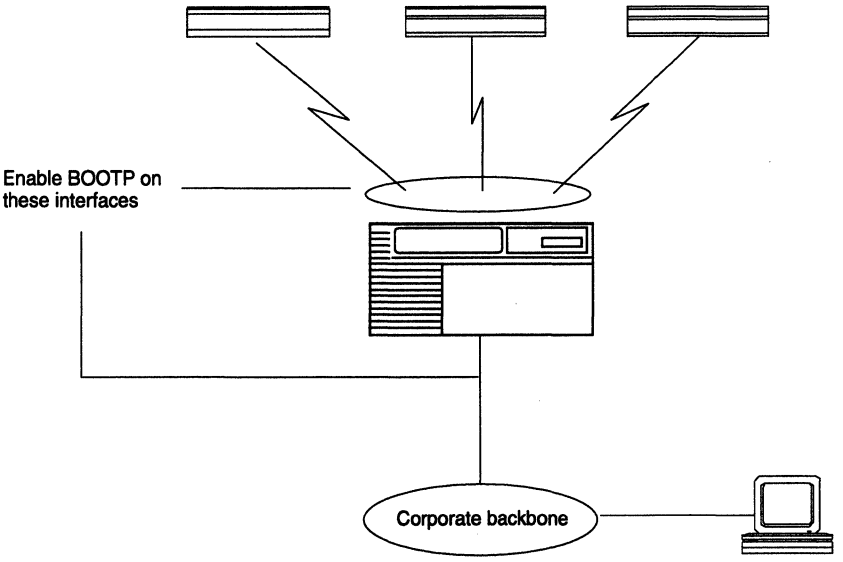

Figure 4-1. Enabling BOOTP in a Sample Network

Enable BOOTP relay on an interface as follows:

1. Click on the connector in the Configuration Manager window.
2. Select Edit Circuit in the Edit Connector window.
3. Select Protocols→Add→Delete in the Circuit Definition window.
4. Select BOOTP in the Select Protocols window and click on the OK button.
5. Select File→Exit to exit the Circuit Definition window.

Creating the BOOTP Relay Agent Forwarding Tables

You must create a BOOTP relay agent forwarding table for every router passing BOOTP traffic between the router and the Site Manager workstation.

The BOOTP relay agent forwarding table allows you to specify the IP interface that receives the incoming BOOTP request packets, and the associated IP interface that forwards them. You can add multiple pairs of incoming and outgoing interfaces to support connections to multiple routers in your network.

To create the BOOTP relay agent forwarding table, begin at the Wellfleet Configuration Manager window and complete the following steps.

1. Select Protocols→IP→BOOTP→Relay Agent Interface Table in the Configuration Manager window.

   The BOOTP Relay Agent Interface Table window appears (Figure 4-2). This window lists all IP interfaces on the router.

   Use the Help button or refer to the *Customizing SNMP, BOOTP, and RARP Services* guide for a description of the parameters in the BOOTP Relay Agent Interface Table window.

Note: Make sure the Timeout Secs. parameter is set to its default value: 0.

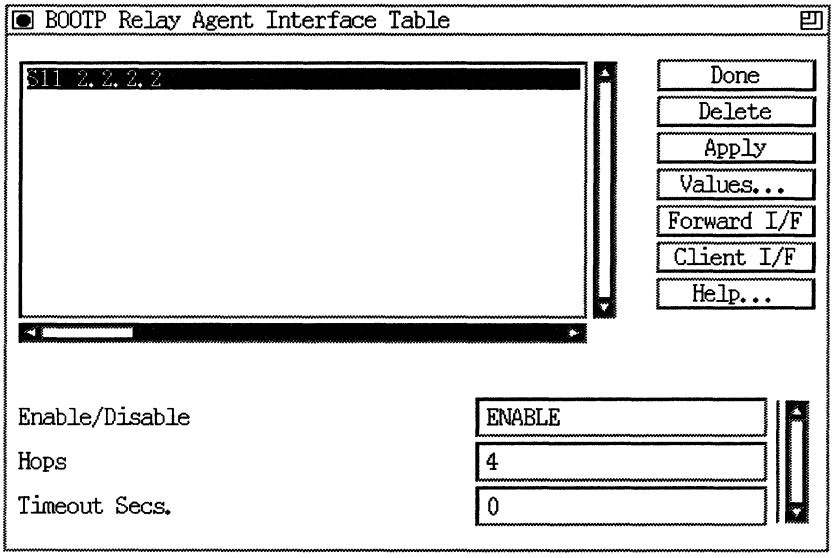

Figure 4-2. BOOTP Relay Agent Interface Table Window

2. Click on the Forward I/F (interface) button.

   The BOOTP Relay Agent Forwarding Table window appears (Figure 4-3).

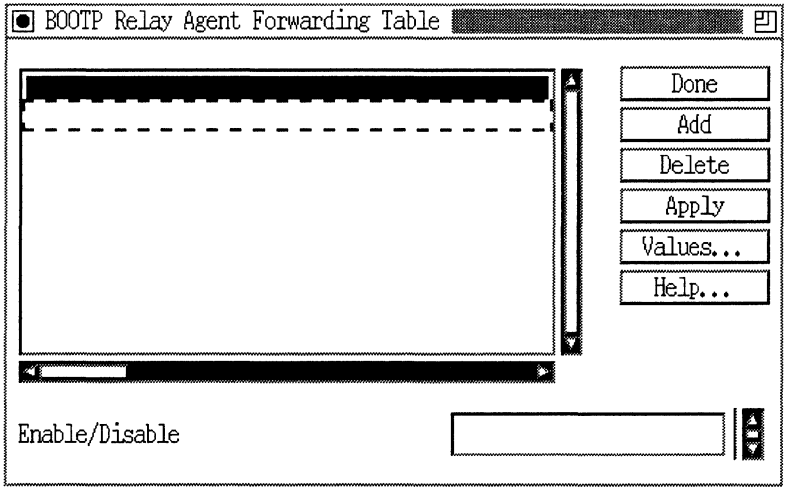

Figure 4-3. BOOTP Relay Agent Forwarding Table Window

3. Click on the Add button.

   The BOOTP Addresses window appears (Figure 4-4).

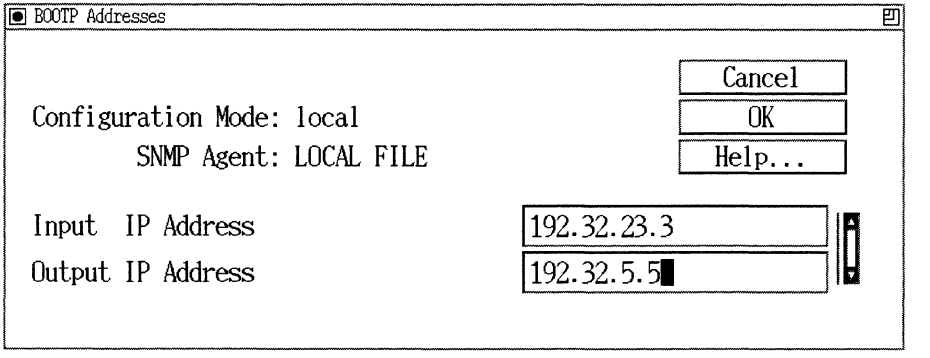

Figure 4-4. BOOTP Addresses Window

4. Specify the input IP address and output IP address parameters.

   For help, refer to the following parameter descriptions:

BOOTP Relay Agent Interface Parameters

Parameter:	**Input IP Address**
Default:	None
Options:	None
Function:	Specifies the IP interface that receives BOOTP request packets from an external network. This interface must have BOOTP configured on it.
Instructions:	Enter the IP address of the interface through which the router will receive BOOTP requests.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.8.3.2.1.3

Parameter:	**Output IP Address**
Default:	None
Options:	None
Function:	Specifies the IP interface that forwards BOOTP request packets to an external network.
Instructions:	Enter the IP address of the interface through which the router will forward BOOTP requests.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.8.3.2.1.4

5. Click on the OK button.

   The BOOTP Relay Agent Forwarding Table window lists the connector and input IP address on the left, and the connector and output IP address on the right.

If you enter an IP address of an interface that is not configured, "???" appears instead of the connector (for example, ??? 192.32.23.3). If you configure the IP address, Site Manager replaces the "???" with the appropriate connector.

6. Click on the Done button to exit the window.

Creating the BOOTP Client Interface Table

If the booting router gets its address from the upstream router, and the upstream router's interface to the booting router is a Frame Relay group access PVC, you must use Site Manager to connect to the upstream router and create a BOOTP client interface table (in addition to a BOOTP relay agent forwarding table).

Note: You do *not* need to create a BOOTP client interface table if the frame relay PVC is configured to operate in direct access mode, or if the circuit is configured to operate with the Wellfleet Standard (HDLC encapsulation) protocol.

The BOOTP client interface table allows you to specify and pair the IP address of the booting router with the DLCI of the Frame Relay group access PVC.

For more information about the DLCI and Frame Relay, refer to *Customizing Frame Relay Services*.

To create the BOOTP client interface table, begin at the BOOTP Relay Agent Interface Table window shown in Figure 4-2 and proceed as follows:

1. Click on the Client I/F button.

   The BOOTP Client Interface Table window appears (Figure 4-5).

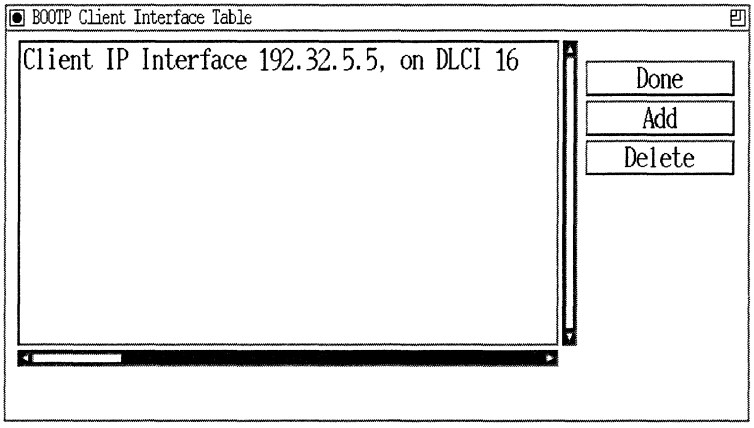

Figure 4-5. BOOTP Client Interface Table Window

2. Click on the Add button.

   The BOOTP Client Interface Address window appears (Figure 4-6).

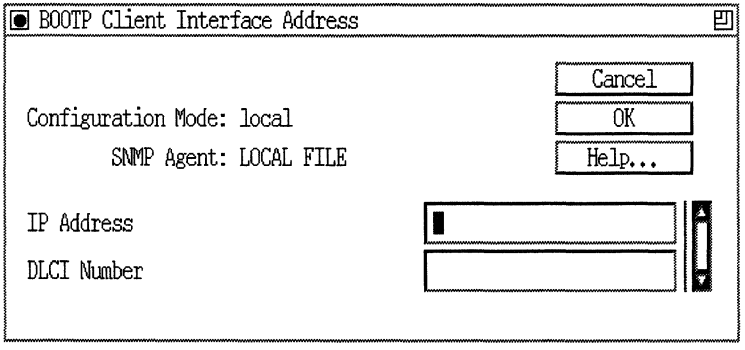

Figure 4-6. BOOTP Client Interface Address Window

3. Enter the booting router's IP address and its associated DLCI number.

   For help, refer to the following parameter descriptions:

BOOTP Client Interface Parameters

Parameter:	**IP Address**
Default:	None
Options:	Any valid IP address
Function:	Specifies the IP address of the booting router that is using EZ-Install. This parameter applies only to a Frame Relay group access PVC connection.
Instructions:	Enter the IP address (in dotted decimal notation) of the booting routers's interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.8.1.1.1.3

Parameter:	**DLCI Number**
Default:	None
Options:	16 to 1007
Function:	Specifies the identification number of the upstream router's PVC to the booting router. The Frame Relay network uses the DLCI number to direct data flow from the booting router to the upstream router.
Instructions:	Enter the number in decimal format. Use the DLCI number assigned by your Frame Relay service provider.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.8.1.1.1.2

4. Click on the OK button.

   The BOOTP Client Interface Table window now lists the client IP interface and the DLCI number you added.

5. Click on the Done button to exit the window.

Chapter 5
System Startup

You can now start up the routers and determine whether they are routing traffic. This chapter describes

- Where to find detailed instructions about booting the router
- How to configure the startup interface for Netboot and Directed Netboot
- How to monitor the system to determine whether the booted router is routing traffic and, if not, what to do about it

Booting

For booting a router, see the detailed instructions in the "Initial Startup" and "System Startup" sections of Chapter 1 and in the appropriate installation manual.

Router Administration

The installation manuals referred to in Chapter 1 provide complete instructions for setting up Netboot and Directed Netboot on the router. The instructions for the **ifconfig** and **bconfig** commands are repeated in this chapter, so you can determine which of the optional versions of these commands you want the router installer to enter when you proceed.

Note: Do *not* follow the instructions in this section when you use the EZ-Install option. Instead, refer to the appropriate installation manual.

You need to use the **ifconfig** and **bconfig** commands to configure the router:

- Use the **ifconfig** command to configure the router's initial IP interface to the network.
- Use the **bconfig** command to specify the location and name of the router's software image and configuration file.

If you choose to use Netboot or Directed Netboot, provide the person at the remote router site with one **ifconfig** command and two **bconfig** commands.

Note: The **ifconfig** and **bconfig** commands will commit the MIB when you execute them; therefore, you should not use them if you do not want a MIB commit. (The **getcfg** command does not commit the MIB.)

Configuration Software

As listed below, we use three software interfaces for configuring boot sources and interfaces.

Note: Site Manager software does not use the **ifconfig, bconfig**, and **getcfg** configuration commands used by Diagnostics Monitor and Technician Interface software.

ANs and ANHs

- Diagnostics Monitor, used at the installation site to configure routers to start up by Netboot or Local Boot (must be used in conjunction with Technician Interface for Local Boot)

- The Technician Interface, used at the installation site (or the remote site supported by a modem) to configure routers to start up by Directed Netboot or Local Boot (must be used in conjunction with Diagnostics Monitor for Local Boot)
- Site Manager, used at either the installation or remote site for configuring Directed Netboot

ASNs

- The Technician Interface, used at the installation site (or the remote site supported by a modem) to configure routers to start up by Netboot, Directed Netboot, or Local Boot
- Site Manager, used at either the installation or remote site for configuring Netboot or Directed Netboot

Configuring the Boot Source for a Router

To use Directed Netboot, you must use the **bconfig** command to specify the following:

- The IP address of the server where the router's software image and/or configuration file reside
- The full pathname of the software image and configuration file

You must use the **bconfig** command once to specify the location of the software image, and again to specify the location of the configuration file.

Warning: For an ASN to perform a successful Netboot, you must use the same **bconfig** setting for each slot in the stack, otherwise the ASN will behave unpredictably. If the settings are the same, you will see only one setting on your screen display in the Boot Options. If the settings differ, the **getcfg** command detects this and displays each different setting. If the settings are not the same, reset them via Site Manager or the Technician Interface before booting the router.

Use one of the following formats for the **bconfig** command:

bconfig [**image** | **config**] [**local** | **network** [<*TFTP host*><*TFTP pathname*>]]

bconfig -d [**image** | **config**]

Note: After making the change, enter the following command to save it to the configuration file in the router's file system, where *config* is the name of the configuration file:

save config 1:config

Refer to Table 5-1 for a complete description of the **bconfig** command:

Table 5-1. bconfig Command Settings

Option	Description
image	Specifies information about the router's software image.
config	Specifies information about the router's configuration file.
local	Indicates that the specified file (image or config) resides in the router's local file system.
network	Indicates that the specified file resides on a network server.
<*TFTP host*>	Specifies the IP address of the host where the image or configuration file resides. If both the software image and configuration file reside on the network, the files must reside on the same host. In other words, you must specify the same IP address for the *TFTP host* for both files.
<*TFTP pathname*>	Specifies the complete pathname of the software image or configuration file on the host.

(continued on the next page)

Table 5-1. bconfig Command Settings *(continued)*

Option	Description
-d	Resets the default values for the software image or configuration file. The command **bconfig -d image** tells the router to look for the image file locally, and nullifies the IP address and pathname for the file. The command **bconfig -d config** tells the router to obtain the configuration file over the network, and nullifies the IP address and pathname for the file. Without the IP address and pathnames, the router uses Netboot rather than Directed Netboot. However, if you want to get one file locally while using Directed Netboot for the other file, you can use the **bconfig** commands as the following examples show: **bconfig image local** **bconfig config network 21.3.5.62 /usr/anstartup/config** Or, **bconfig image network 21.3.5.62 /usr/mykernel.exe** **bconfig config local**

Configuring the Interface of a Router

You can use the **ifconfig** command to do the following:

- Configure the router's initial IP interface to the network.
- Configure Ethernet interfaces for the network booting procedure.
- Enable or disable network booting on an interface.

The following sections describe each use of the **ifconfig** command.

Configuring the Initial IP Synchronous Interface

To Netboot the router, you must first configure its initial IP synchronous interface to the network using the following interface configuration command:

ifconfig [**-s**<*slot no.*>] [*synchronous options*] <*interface*> [<*IP address*> <*subnet mask*> [<*next hop address*>]]

where [*synchronous options*] indicates some combination of the following settings:

[**-d** | **-fr** [**-annexd** | **-lmi** | **-annexa**] | **-int_clk**]

Note: You must insert a space to separate each command option from the next.

You can use the same command format to configure other synchronous interfaces on the router for network booting.

Table 5-2 describes the **ifconfig** command arguments for configuring a router's synchronous interface.

Table 5-2. ifconfig Command Settings

Setting	Description
Slot setting:	
-s<*slot no.*>	Specifies the slot containing the interface you want to configure. The slot corresponds to the ASN slot ID, which can be 1 through 4. If you omit this argument, **ifconfig** uses the current slot.
Default setting:	
-d	Resets the router's IP interface settings to the default values. This setting tries four WAN configurations in the following order until it finds the correct type for the router's connection to the network: 1. Wellfleet HDLC encapsulation (also referred to as Wellfleet Standard Point-to-Point) with external clocking 2. Frame Relay Annex D 3. Frame Relay LMI 4. Frame Relay Annex A
Frame Relay settings:	
-fr	Configures the router's synchronous port as a Frame Relay connection. With this setting, use one of the following options to specify a DLCMI setting: **-annexd**, **-annexa**, or **-lmi**.
-annexd **-annexa** **-lmi**	When one of these options is used with the **-fr** setting, it specifies a DLCMI setting. Use the same setting as the network to which the router's Frame Relay interface is connected. The default setting for Frame Relay is **-annexd**.
Internal clocking setting:	
<-int_clk>	Sets the router's synchronous port to internal clocking at 1.25 MB/s. If you do not specify the **-int_clk** setting, the router defaults to external clocking.

(continued on the next page)

Table 5-2. ifconfig Command Settings *(continued)*

Setting	Description
IP connector setting:	
<interface>	Specifies the type of IP connector you are configuring. For the AN/ANH, use **com1** or **com2** for synchronous media. For the ASN, use **com***<network module no.><port no.>*.
IP address settings:	
<IP address>	Specifies the IP address of the interface you set with *<interface>*. Provide this address in dotted decimal notation.
<subnet mask>	Specifies the IP subnet mask of the interface you set with *<interface>*. Provide this address in dotted decimal notation.
<next hop address>	Specifies the IP address of the next-hop router. Provide this address in dotted decimal notation. You only need to specify this address if there are intermediate routers between the router and the BOOTP server.

Configuring an Ethernet Interface for Network Booting

To configure an Ethernet interface for network booting of a router, use the following command format:

ifconfig [**-s***<slot no.>*] [**-d**] *<interface>* [*<IP address>* *<subnet mask>* [*<next hop address>*]]

Table 5-3 describes the **ifconfig** command arguments for configuring the router's Ethernet interface.

Table 5-3. ifconfig Settings for an Ethernet Interface

Setting	Description
Slot setting:	
-s<*slot no.*>	Specifies the slot containing the interface you want to configure. The slot corresponds to the ASN slot ID, which can be 1 through 4. If you omit this argument, **ifconfig** uses the current slot.
Default setting:	
-d	Resets the router's IP interface settings to the default values. Resetting an Ethernet interface makes it inactive in the network booting process. (The output of the **getcfg** command shows the default as "None.")
IP connector setting:	
<*interface*>	Specifies the type of IP connector you are configuring. For the AN/ANH, use **xcvr1**. For the ASN, use **xcvr**<*network module no.*><*port no.*>.
IP address settings:	
<*IP address*>	Specifies the IP address of the interface you set with <*interface*>. Provide this address in dotted decimal notation.
<*subnet mask*>	Specifies the IP subnet mask of the interface you set with <*interface*>. Provide this address in dotted decimal notation.
<*next hop address*>	Specifies the IP address of the next-hop router. Provide this address in dotted decimal notation. You need to specify this address only if there are intermediate routers between the router and the BOOTP server.

Enabling and Disabling Interfaces with ifconfig

To enable an AN/ANH interface for the network boot process or to disable an interface from the network boot process, use the following command formats:

ifconfig -disable *<interface>*

ifconfig -enable *<interface>*

To enable an ASN interface for the network boot process or to disable an interface from the network boot process, use the following command formats:

ifconfig [**-s***<slot no.>*] **-disable** *<interface>*

ifconfig [**-s***<slot no.>*] **-enable** *<interface>*

where

<slot no.>	Specifies the slot containing the interface you want to enable or disable. The slot corresponds to the ASN slot ID, which can be 1 through 4. If you omit this argument, **ifconfig** uses the current slot.
<interface>	Specifies the type of IP connector you are enabling or disabling. For the AN/ANH, use **com1** or **com2** (for synchronous media) or **xcvr1** (for Ethernet media). For the ASN, use **xcvr***<network module no.><port no.>*.

System Monitoring

When you boot the router, it should start routing traffic according to the configuration file it obtains from the BOOTP server. Use Site Manager to monitor the statistics and the Event Log to determine whether the router is routing traffic. Refer to *Managing Wellfleet Routers* for instructions on how to use the Statistics Manager and Events Manager tools. If the router is *not* routing traffic, refer to Chapter 6 of this guide for instructions.

Chapter 6
Solving Startup Problems

This chapter helps you isolate and solve router addressing or Netboot (normal or Directed) problems that cause startup or connectivity failures. It then helps you further isolate and correct errors, such as when the router

- Fails to get its IP address
- Fails to Netboot
- Fails to perform Directed Netboot
- Successfully boots but fails to load applications or get AN/ANH strings

This chapter also explains how to perform the following troubleshooting procedures:

- Display and change the router's parameter settings
- Debug the BOOTP server
- Verify the BOOTP server setup
- Display the BOOTP server's IP routes
- Display the number of BOOTP packets forwarded and dropped

You will find additional help in troubleshooting ASNs under "Solving Problems" in *Installing and Maintaining ASN Routers*.

Getting Started

The sections that follow provide guidelines for isolating a router addressing problem or a Netboot problem, either of which can lead to a startup or connectivity failure.

Displaying Messages from the Router

If you cannot connect to the router using Site Manager, we recommend that you connect the router to a modem or console.

If you cable the router to a modem, you can dial in and connect to the router remotely. This setup provides the same capabilities as an on-site console connection. Modem communications, however, are slower.

Viewing a router error message and entering commands through a modem connection may simplify troubleshooting if you are not at the router site. As an alternative, you can ask the person at the router site to read the console messages to you and then you can enter the commands you want.

Displaying Statistics and Error Messages

Use the Statistics Manager QuickGet tool or Technician Interface **get** command to display the number of BOOTP and TFTP packets forwarded and dropped for each interface in the path between the router and the BOOTP server. Use the Events Manager or Technician Interface **log** command to display the events associated with the interface and BOOTP and TFTP protocols.

Refer to *Managing Wellfleet Routers* for instructions on using the Statistics Manager's QuickGet tool and the Events Manager. That guide also describes each event displayed in the log.

Refer to *Using Technician Interface Software* for instructions on using the **get** and **log** commands.

Using Packet Capture: Guidelines

Use the Packet Capture utility to isolate BOOTP or TFTP errors to a specific router interface. This utility is available through the Technician Interface on Wellfleet routers running Version 7.80 or later.

Refer to *Using Technician Interface Software* for instructions on how to use Packet Capture. Refer to *Customizing SNMP, BOOTP, and RARP Services* for a description of BOOTP packets.

Note: The instructions that follow assume that Version 7.80 or later is running on all Wellfleet routers in the path between the router and the BOOTP server. If it is running on some routers in the path, but not all, use Packet Capture on those routers to isolate problems.

When you test an interface, view its incoming or outgoing BOOTP and TFTP packets. Stop when you isolate the problem to an interface and correct the cabling or the configuration of the problem interface.

Use Packet Capture as follows:

1. Test the BOOTP server's next-hop router in the path to the router. First test the interface to the BOOTP server. Then test the interface to the next router.
2. Test the upstream router's interface to the router. Then test the upstream router's interface to the next-hop router.
3. Test the interfaces that receive and forward the BOOTP and TFTP packets of the router in the middle of the path.
4. Continue testing each router in the path until you isolate the problem interface.

Using a LAN Protocol Analyzer: Guidelines

Refer to the following guidelines when you use a LAN protocol analyzer:

- If Netboot is failing, connect the analyzer to the BOOTP server interface to determine if it is receiving and responding to Netboot and TFTP requests.

  To read the ASCII translation, view the BOOTP reply packets for the configuration file pathname in hexadecimal mode.

Note: The LAN protocol analyzer does not decode all of the vendor tag fields.

- If the BOOTP server is not receiving the requests, make sure the upstream router is receiving and forwarding them. If it is, make sure each router interface between the upstream router and the BOOTP server is receiving and forwarding them.

  If the BOOTP server is receiving requests, but failing to respond, refer to "Router Fails to Netboot" later in this chapter.

Using the Troubleshooting Chart

Use one of the remaining sections in this chapter if it addresses a problem you have isolated. Otherwise, refer to the "Troubleshooting AN, ANH, and ASN Routers" chart that accompanies this guide. This chart provides troubleshooting procedures for general connectivity problems.

Note: Some procedures in the chart refer you to sections within this chapter. If you follow the instructions in a section, and you have not solved the problem, return to the same place in the chart to follow the remaining instructions.

Startup Problems

This section identifies the four most common router startup problems and recommends procedures for isolating and correcting them.

The console connected to the router console port displays error messages to indicate each problem. Refer to the appropriate section:

- "Router Fails to Get IP Address"
- "Router Fails to Netboot"
- "Router Fails to Perform Directed Netboot"
- "Router Netboots, But Fails to Load Applications or Get AN or ANH Strings"

Router Fails to Get IP Address

If a message at the router console indicates that the router failed to get an IP address from the upstream router, or if the upstream router is failing to receive BOOTP requests or respond to them, make sure the network cable between the router's synchronous port and the upstream router is firmly connected. Then refer to the instructions in the following sections, or in the section that applies to your problem, until you find and correct the problem:

- "Upstream Router Not Receiving BOOTP Requests"
- "Upstream Router Not Sending BOOTP Responses"

Contact the Bay Networks Help Desk if you follow the instructions in these sections and cannot find and correct the problem.

Upstream Router Not Receiving BOOTP Requests

If the upstream router is not receiving BOOTP request messages, use the **getcfg** command to display the router parameters and the **bconfig** command to correct them if necessary. Refer to "Displaying the Router's Parameter Settings" and "Changing the Router's Parameter Settings" later in this chapter if you need instructions.

Upstream Router Not Sending BOOTP Responses

If the upstream router is receiving BOOTP request messages but failing to send BOOTP responses, use Site Manager to do the following:

1. Make sure the upstream router's interface connecting the router is enabled.
2. Make sure BOOTP is enabled on the circuit connecting the router to the router.
3. Make sure the upstream router's link modules and drivers are loaded.
4. Make sure the upstream router's IP protocol is enabled.
5. Make sure the upstream router's BOOTP protocol is enabled.
6. Make sure the BOOTP Relay Agent Forwarding Table associated with the upstream router shows a valid IP address that is configured on the IP router. Make sure the input IP address is correct.
7. If you are using E-Z Install over a Frame Relay permanent virtual circuit (PVC) in group access mode, make sure the upstream router's BOOTP Client Interface table is configured properly.

Router Fails to Netboot

When you use the default (E-Z Install) setting for getting the IP address or when you use the **ifconfig** command, and the router fails to receive the configuration file or image, make sure that all cables between the router and the BOOTP server are firmly connected.

If you have not isolated the problem to a specific interface, retrieve the number of BOOTP packets forwarded and dropped from all routers between the router and the BOOTP server. Refer to "Displaying the Number of Packets Forwarded and Dropped" later in this chapter.

Then refer to the instructions in the following sections, or in the section that applies to your problem, until you find and correct the problem:

- "Upstream Router Not Receiving BOOTP Requests"
- "Router Not Sending BOOTP Responses"
- "BOOTP Server Not Sending BOOTP Responses"

Contact your local Bay Networks Help Desk if you perform the instructions in these sections and cannot find and correct the problem.

Upstream Router Not Receiving BOOTP Requests

If the upstream router is not receiving BOOTP request messages, do the following:

1. Issue the Technician Interface **getcfg** command to display the router parameters and the **bconfig** command to correct them if necessary. Refer to "Displaying the Router's Parameter Settings" and "Changing the Router's Parameter Settings" later in this chapter if you need instructions.
2. Make sure that you enter the proper command at the router console to configure the router's initial IP interface.

   Refer to "Configuring the Startup Interface for Netboot and Directed Netboot" in Chapter 5 if you need instructions.
3. Make sure that the router's synchronous port configured for E-Z Install is cabled to the upstream router or that the port configured for Netboot (synchronous or Ethernet) is cabled properly.

Router Not Sending BOOTP Responses

If a router is receiving BOOTP request messages but failing to return BOOTP responses, do the following:

1. Use Site Manager to make sure the BOOTP Relay Agent Forwarding Table associated with the router shows an IP address that is configured on the IP router. Make sure that the input IP address is correct. If the Hops count is lower than the router's position in the path, increase it.

Refer to "Creating the BOOTP Relay Agent Forwarding Tables" in Chapter 4 if you need instructions.

2. Use the Configuration Manager to make sure that BOOTP and IP are enabled on the incoming and outgoing interfaces.
3. Make sure that the link modules and drivers are enabled. Refer to *Configuring Wellfleet Routers* if you need instructions.

BOOTP Server Not Sending BOOTP Responses

If the BOOTP server is receiving BOOTP requests but failing to respond to them, do the following:

1. Follow the instructions in the section "Displaying the BOOTP Server's IP Routes" later in this chapter.
2. Follow the instructions in the section "Debugging the BOOTP Server" later in this chapter.
3. Make sure that the */etc/inetd.conf* file contains no more than one `bootps` entry. If it does, comment out the invalid entry. The valid entry should be

   ```
   bootps dgram udp wait root /etc/bootpd bootpd
   ```

4. Make sure that the `tftp dgram` entry in the */etc/inetd.conf* file is correct for your system. (Refer to "Setting Up TFTPD" in Chapter 3.)
5. Refer to "Verifying the BOOTP Server Setup" later in this chapter.

Router Fails to Perform Directed Netboot

If the router fails to perform Directed Netboot, do the following:

1. Make sure that the interface that connects the router to the TFTP file server is configured with an IP address.
2. Make sure that all necessary files are, in fact, residing on the TFTP file server.

Contact your local Bay Networks Help Desk if you perform the instructions in these sections and cannot find and correct the problem.

Router Netboots, But Fails to Load Applications or Get AN or ANH Strings

If the router Netboots a software image successfully, but displays an error message indicating that it cannot load specific applications or get specific AN/ANH strings, it is failing to retrieve files from the TFTP server that provided the software image. These files are necessary to perform functions such as run the protocols specified in the configuration file or display the log. Do the following:

1. Make sure that you have at least one router interface configured, after booting, through which the file server that supplied the kernel image can be reached. This is necessary for a router, which has obtained its image over the network, to load applications or AN/ANH string files.
2. Check that you have TFTP on the router. To determine this, display the router's `loadmap` screen message. If `tftp.exe` is missing, load it into the router.
3. Make sure that all of the application and AN/ANH string files (files with ".exe" and ".str" filename extensions) reside in the same directory as the kernel image.
4. Refer to "Verifying the BOOTP Server Setup" later in this chapter. Use Site Manager to make sure that IP is enabled and TFTP is created in the router's configuration file. Refer to *Configuring Wellfleet Routers* for additional information.
5. You should verify the status of your routers by entering all necessary commands with the Technician Interface, to make sure your routers have the required settings. Following are some examples of AN/ANH commands and their responses, as well as of some connector and interface settings you should consider (for more complete information, refer to *Using Technician Interface Software*):

   - Enter the following command to display the router driver:

     get wfLinkModules.15.0

     The following response indicates that the router's driver is configured to run in Slot 1 (the router's only slot):

```
wfLinkModules.wfANLoad.0 = 2147483648
```

The decimal number `2147483648` represents Slot 1. If the setting is not `2147483648`, enter the following command to correct it:

set wfLinkModules.15.0 2147483648;commit

- Make sure that the synchronous or Ethernet state of the router connector is up. (The value 1 for the interface state in the commands below indicates that the interface is up. Other settings may indicate why the connector is not up. If it is not up, configure the circuit.)
  - If the router is Netbooting with a synchronous connector, enter the following command to display the information about the connector, where *<connector>* is the connector number:

    get wfSyncEntry.*.1.*<connector>***

  - If the router is Netbooting with a synchronous connector, make sure that external clocking is set.
  - If the router is Netbooting with an Ethernet connector, enter the following command to display the information about the connector, where *<connector>* is the connector number:

    get wfCSMACDEntry.*.1. *<connector>*

- To display the drivers that are configured to run in Slot 1, enter the following command:

  g wfDrivers.*.0

  If the router has one Ethernet and two synchronous interfaces, the following settings should appear within the list of drivers:

```
wfDrivers.wfQsccSyncLoad.0 = 2147483648
wfDrivers.wfQsccEnetLoad.0 = 2147483648
```

If the router has one Token Ring and two synchronous interfaces, the following settings should appear within the list of drivers:

```
wfDrivers.wfTMS380Load.0 = 2147483648
wfDrivers.wfQsccSyncLoad.0 = 2147483648
```

If the router has one Ethernet, one Token Ring, and two synchronous interfaces, the following settings should appear within the list of drivers:

```
wfDrivers.wfTMS380Load.0 = 2147483648
wfDrivers.wfQsccSyncLoad.0 = 2147483648
wfDrivers.wfQsccEnetLoad.0 = 2147483648
```

If the router has twelve Ethernet ports and two synchronous interfaces, the following settings should appear within the list of drivers:

```
wfDrivers.wfQsccSyncLoad.0 = 2147483648
wfDrivers.wfHilanceLoad.0 = 2147483648
wfDrivers.wfQsccEnetLoad.0 = 2147483648
```

If the router has eight Ethernet ports and two synchronous interfaces, the following settings should appear within the list of drivers:

```
wfDrivers.wfQsccSyncLoad.0 = 2147483648
wfDrivers.wfHilanceLoad.0 = 2147483648
```

Use the **set** command to correct any settings that are incorrect. For example, if the router has a Token Ring port and the `wfDrivers.wfTMS380Load.0` setting is not `2147483648`, enter the following command to correct it:

set wfDrivers.wfTMS380Load.0 2147483648;commit

Troubleshooting Procedures

This section describes how to

- Display the router's parameter settings
- Change the router's parameter settings
- Debug the BOOTP server

- Verify the BOOTP server's setup
- Display the IP routes
- Display the number of BOOTP packets forwarded and dropped

If you want to configure the router's startup interface, refer to the appropriate installation manual.

Displaying the Router's Parameter Settings

Display the router parameter settings to determine

- If the router is set to boot using a local boot image or a remote boot image
- If the router is set to configure using a local configuration image or a remote configuration image
- The configuration of the synchronous and Ethernet connectors

Enter the following Technician Interface command to display the router parameter settings:

getcfg

The following sample responses show the default settings:

AN or ANH sample response:

```
Boot Options
      boot image=local
      boot config=network

Netboot Parameters:
      XCVR1..None
      COM1...EZ-Install
      COM2...EZ-Install
```

The `XCVR1` parameter shows the current setting of the routers' Ethernet connector.

The COM1 and COM2 parameters show the current settings of the routers' synchronous connectors.

ASN sample response:

```
Boot Options
      boot image=network
      boot config=network
Netboot Parameters:
      Slot 1:
      COM11...EZ-Install
      COM12...EZ-Install
      XCVR21..None
      XCVR22..None
      XCVR31..None
      XCVR32..None

      Slot 2:
      XCVR21..None
      XCVR22..None
      COM31...EZ-Install
      COM32...EZ-Install
```

The XCVR21/22/31/32 parameters show the current setting of the routers' Ethernet connectors.

The COM11/COM12 and COM31/COM32 parameters show the current settings of the router's synchronous connectors.

The possible boot image and boot config settings are network and local. If the setting is network, the router requests the boot image or configuration file from a BOOTP server when booting. If the setting is local, the router uses the boot image or configuration file stored in its file system.

The possible settings for synchronous connectors are as follows:

- EZ-Install (the default setting)
- The IP address, next hop IP address, subnet mask, and WAN protocol (Wellfleet HDLC or Frame Relay)

The possible settings for Ethernet connectors are as follows:

- None (the default setting)
- The IP address, subnet mask

Changing the Router's Parameter Settings

Refer to this section to configure the router to local boot or Netboot its image or configuration.

For an ASN, enter the following command using the Technician Interface. For an AN or ANH, enter it with either the Technician Interface or Diagnostics Monitor:

bconfig image | config network | local

where:

image | config is **image** if you are changing the source of the software image, or **config** if you are changing the source of the configuration file.

network | local is **network** if you are configuring the router to use the boot image or configuration file on the BOOTP server when booting, or **local** if you are configuring the router to use the boot image or configuration file stored on its own file system.

For example, to configure the router to use a local boot image when booting, enter the following command:

bconfig image local

Warning: If you enter this command after a Technician Interface prompt, enter **save config 1: config** to save the change to the configuration file in the router's file system, where *config* is the name of the configuration file. Otherwise, the change is lost when you boot the router.

Note: If you have not set up the network to Netboot the configuration file, an ASN's attempt to get the file over the network will continue for approximately four minutes, then the ASN will local boot the file. However, if your primary interest is Local Boot for routine startups, you can avoid this long wait by specifying **bconfig config local** after the Technician Interface screen activates.

Debugging the BOOTP Server

Debug the BOOTP server as follows:

1. Enter the following command at the UNIX command line:

   bootpd -s -d -d -d&

   The *bootpd* debugger tool reads the */etc/bootptab* file and generates the */etc/bootpd.dmp* file. The */etc/bootpd.dmp* file contains the portion of the */etc/bootptab* file that the *bootpd* debugger could read successfully. The debugger displays messages such as the following:

   ```
   [1] 12914
      hostname:/etc> reading "/etc/bootptab"
      read 19 entries from "/etc/bootptab"
      dumped 19 entries to "/etc/bootpd.dump".
   ```

2. Compare the *bootptab* file to the *bootpd.dmp* file. If the *bootpd.dmp* file is truncated or is otherwise different from the *bootptab* file, BOOTPD may have encountered a syntax error. Find the inconsistency in the two files.

3. Compare the inconsistency in the *bootptab* file to the sample *bootptab* file in Chapter 3 and correct the error.

4. If you cannot find an inconsistency, boot the router and view the *bootpd* debugger messages to determine the cause of the error.

The following sample messages show the sequence of messages when a Version 8.10 BOOTP exchange is successful. Match the number assigned to each message to the explanation that follows.

```
①hostname:/etc> request from IP addr 192.16.24.12
②found 192.16.24.12 AN.Boston
③bootfile2 /$HOME/.builder_dir/rel810/an krnl_an.exe
④couldn't access /$HOME/.builder_dir/rel810/an
krnl_an.exe.AN.Boston
⑤vendor magic field is 99.130.83.99
⑥sending RFC1048-style reply
```

①The UNIX hostname, the path (/etc) of the bootptab file, and the IP address of the AN.
②The IP address (192.16.24.12) mapped to the AN's hostname, AN.Boston, in the bootptab file.
③The pathname of the kernel file, as specified in the bootptab file.
④Disregard this message. The BOOTP server tries to access the AN host both by its name and by its IP address. The "couldn't access" message means that the server tried to access a host named "AN.Boston" but failed because the AN is not named. The attempt to access the AN by its IP address succeeds, as you can infer by reading the last message.
⑤Disregard this message.
⑥The BOOTP server is sending a BOOTP response in compliance with RFC-1048.

Verifying the BOOTP Server Setup

Refer to these instructions if the BOOTP server is receiving BOOTP requests but failing to respond, or failing to forward the kernel, configuration, application, or string files.

Verify the BOOTP server setup as follows:

1. Make sure that the kernel image and all of the application (*.exe*) and AN/ANH string (*.str*) files are in the same directory.

   You can place these files in any directory you want. The Image Builder automatically generates the kernel image, application files, and AN/ANH string files when you open the software image file. By default, the Image Builder stores these files in the */$HOME/.builder_dir/rel<rel>/an* (or *asn*) directory, where *<rel>*

is the current router software release for the router. For example, Version 2.10 of the Site Manager's Image Builder tool stores the Version 8.10 files in the */$HOME/.builder_dir/rel810/an* directory.

2. Make sure that the router extracts the kernel image and all of the application and string files from the same software image. If these files are from different software versions, the router may fail to boot or operate properly.
3. Make sure that the *bootptab* file is in the */etc* directory.
4. Make sure that the *bootptab* file contains the following entries, where `/$HOME/.builder_dir/rel810/an` (or `asn`) is the location of the kernel and all application and string files:

AN/ANH example:

```
general:\
:hd=/$HOME/.builder_dir/rel810/an:\
:bf=krnl_an.exe:\
:bs=auto:\
:vm=rfc1048:
```

ASN example:

```
general:\
:hd=/$HOME/.builder_dir/rel810/asn:\
:bf=krnl_asn.exe:\
:bs=auto:\
:vm=rfc1048:
```

5. Make sure that the *bootptab* file contains a definition for the particular router that is failing to Netboot.
6. Make sure that the configuration filename and path are correct in the *bootptab* file.

   For example, the following *bootptab* line indicates that the configuration file named *AN_Bost.cfg* is in the */rte3/cfg* directory path:

   ```
   T129="/rte3/cfg/AN_Bost.cfg"
   ```

7. Read the *bootptab* file carefully for misspellings or other errors. Compare it to the sample file shown in Chapter 3.

Displaying the BOOTP Server's IP Routes

Enter the following command at the UNIX command line of the BOOTP server to display the IP address of the next hop to a netbooting router, where *<IP_address>* is the IP address of the netbooting router's network:

netstat -rn | grep -i -n*<IP_address>*

For example, enter **netstat -rn|grep -i -n 192.32.155**to display the IP address of the next hop to the network address 192.32.155. If the BOOTP server is receiving RIP advertisements of the netbooting router's network, a message such as the following appears:

```
121:192.32.155.0     192.32.13.53    UG    0    0    le0
```

The number `121` is the number of the entry in the workstation's static routing table. The number `192.32.155.0` is the IP address of the destination network. The number `192.32.13.53` is the address of the next-hop route. If the next-hop route is unavailable or it is wrong, refer to "Setting Up Static Routes to Routers" in Chapter 3.

Displaying the Number of Packets Forwarded and Dropped

This section describes how to display the number of BOOTP packets forwarded and dropped by a router. Perform this procedure for each router between the router and the BOOTP server.

You can use either the Quick Get function within the Statistics Manager tool or the Technician Interface **get** command to retrieve this information. Refer to one of the following sections.

Quick Get Instructions

Select the following path:

```
wfApplication/wfInternet/wfBootpGroup/
wfBootpRelayAgentGroup/wfBootpRelayIntfTable
```

To display the number of packets forwarded, select
`wfBootpRelayIntfRequests`

To display the number of packets dropped, select
`wfBootpRelayIntfHopsDrops`

Refer to *Managing Wellfleet Routers* for additional information regarding Quick Get.

Technician Interface Instructions

Enter the following command to display information that may help you determine if and why a device is dropping packets, where *<IP_address>* is the address of the interface receiving the packets:

get wfBootpRelayIntfEntry.*.*<IP_address>*

Appendix A
Local Boot: The Quick-Start Procedure

This appendix assumes that you have read Chapter 1 and want to configure the router locally. To configure the router locally, you must provide the person at the remote router site with the network information required to complete the Quick-Start procedure.

The Quick-Start procedure is the initial configuration that starts a Wellfleet router running on the network. The procedure enables Internet Protocol (IP) so that the router can connect to Site Manager.

Quick-Starting the router consists of running the *install.bat* script and entering information at the Quick-Start prompts. The router automatically selects options for some prompts, and you can accept default values for many of the other prompts.

Note: The *install.bat* script allows for many possible configurations. Since typical remote access uses a synchronous interface over a wide area connection, the following Quick-Start worksheets provide *only* the options involved with a synchronous configuration. When you configure a LAN interface, base your decisions on the information provided with each *install.bat* prompt.

To assist you and the person at the remote router site in answering Quick-Start prompts, we have included a series of worksheets in this guide — and in the installation guide at the router site — for both you and the site person to fill out. The worksheets in each guide are

identical, contain all of the options that appear at each prompt, and have space for you to record the options you select.

Note: There are different sets of worksheets in this guide, depending on whether the router is an AN or ANH, or an ASN. The AN/ANH worksheets are near the front of this appendix, while the ASN worksheets are near the end.

The last two sections in this appendix, "Using the Quick-Start Commands" and "Running the Quick-Start Script," provide additional information about the Quick-Start procedure.

Organize the network information you need for your specific configuration by filling out

- The Global Information Worksheet — This worksheet lists options common to all synchronous interface configurations.
- One Router Protocol Worksheet — This worksheet lists specific options for RIP, OSPF, or Static Route configurations.
- One Wide-Area Protocol Worksheet — This worksheet lists specific options for Wellfleet (proprietary) Point-to-Point Protocol (PPP), Frame Relay, Standard PPP, and Switched Multimegabit Data Service (SMDS) configurations.

We suggest the following procedure when you fill out worksheets:

1. Fill out the Global Information Worksheet completely. (These options are the same for all synchronous interface configurations.)
2. After you record your protocol selections on the Global Information Worksheet, fill out *only* the worksheets for these protocols in the "Router Protocol Worksheets" and "Wide Area Protocol Worksheets" sections. (For example, if you select RIP as your routing protocol and Frame Relay as your wide area protocol, you need only fill out the worksheets pertaining to these specific protocols.)

After you relay the worksheet information to the person at the remote router site, instruct this person to use the appropriate installation manual to Local Boot the router and run *install.bat*.

After you establish an initial connection to the network, refer to *Configuring Wellfleet Routers* to configure the router remotely using Site Manager.

Worksheets for ANs and ANHs

The following worksheets apply only to the AN and ANH.

Global Information Worksheet for ANs and ANHs

This section contains the prompts and possible options relating to all AN and ANH synchronous configurations.

Global Information Worksheet for ANs and ANHs

Step	Requested Information	Options	Your Response
1	Specify the slot number where the Link Module resides.	Since an AN or ANH is not a Link Module, the router bypasses this step and automatically accepts a default slot of "1."	None.
2	Specify the Link Module and network interface information for the initial IP connection to Site Manager.	The router automatically provides a representative letter code depending on the type of router you have. Depending on your router type, the network interface options include — Ethernet — Token Ring — Synchronous Select the number associated with the synchronous interface.	
	Enter connector number [1]:	1. COM1 2. COM2	
	Enter clock source number [2]:	1. Internal 2. External	
	Enter circuit name [S#]:	The router recommends a circuit name for the COM interface you select (for example, S11 for COM 1 and S12 for COM 2).	Press the Return key.

(continued on the next page)

Global Information Worksheet for ANs and ANHs *(continued)*

Step	Requested Information	Options	Your Response
3	Enter IP address in dotted decimal notation:	Enter the IP address for the COM interface.	
	Enter the subnetwork mask in dotted decimal notation:	Enter the subnetwork mask for the COM interface IP address.	
	Is the router connected to the same local area network as the Site Manager workstation? (y/n) [n]:	y(es) n(o)	Press the Return key.
	Enter routing protocol number [1]:	1. RIP 2. OSPF 3. Static Route to Site Manager	Complete the worksheet for the protocol you select.
	Enter wide area protocol number [1]:	1. Wellfleet Point-to-Point Protocol (proprietary) 2. Frame Relay 3. Point-to-Point Protocol Standard (PPP) 4. Switched Multimegabit Data Service (SMDS)	Complete the worksheet for the protocol you select.
	Do you wish to set SNMP community management? (y/n) [n]:	y(es) n(o) Setting up SNMP community management is optional.	

(continued on the next page)

Global Information Worksheet for ANs and ANHs *(continued)*

Step	Requested Information	Options	Your Response
4	TFTP default volume [1]:	The router automatically assigns the TFTP default volume to "1."	None.
5	Do you want to enable FTP? (y/n) [n]:	y(es) n(o) **Note:** If you answer y(es), the router requests a volume number	
6	Do you want to enable TELNET? (y/n) [n]:	y(es) n(o) Enabling TELNET is optional	
7	Do you wish to save this configuration to a file? (y/n) [y]:	y(es) n(o)	Press the Return key.
	Enter filename [*startup.cfg*]:	We recommend using the default file name.	Press the Return key.

Router Protocol Worksheets for ANs and ANHs

This section contains requested information and possible options that relate to the router protocol choices on the Global Information Worksheet.

RIP Worksheet for ANs and ANHs

Requested Information	Options	Your Response
Should RIP listen to the default route? (y/n) [n]:	y(es) n(o) **Note:** RIP listens to a specific network or subnet route where Site Manager is located. Answering y(es) to this request forces RIP to also listen to the default route (0.0.0.0). This is useful when no specific route is available in the RIP updates that the router receives.	

OSPF Worksheet for ANs and ANHs

Requested Information	Options	Your Response
Enter the OSPF router ID in dotted decimal notation [the router provides the IP address of the COM port]:	Enter an IP address to uniquely identify the router in the OSPF domain. We suggest using the default IP address provided.	
Enter the OSPF area ID in dotted decimal notation [0.0.0.0]:	Enter the area ID. This ID must match the area ID of the router's neighbor. **Note:** The backbone area ID is always 0.0.0.0.	
Enable Simple Password authentication? (y/n) [n]:	y(es) n(o) **Note:** If you answer y(es), the router requests a password.	Password: _____
Enter the OSPF MTU size selection [1]:	1. Default 2. Ethernet-size (Wellfleet 5-series compatible)	
Enter OSPF interface type selection [1]:	1. Broadcast 2. NBMA 3. Point to Point **Note:** When using a wide area protocol other than Wellfleet Proprietary PPP, we suggest selecting NBMA.	

(continued on the next page)

OSPF Worksheet for ANs and ANHs *(continued)*

Requested Information	Options	Your Response
Enter decimal value in seconds for Hello Interval [10]: **Note:** This value must match all other interfaces in the OSPF area for connection to take place.	The router suggests the following intervals: Broadcast — 10 sec Point-to-Point — 15 sec NBMA — 20 sec	
Enter decimal value in seconds for Router Dead Interval [40]: **Note:** This value must match all other interfaces in the OSPF area for connection to take place.	The router suggests the following intervals: Broadcast — 40 sec Point-to-Point — 60 sec NBMA — 80 sec	
Enter decimal value for Router Priority [1]:	Enter a router priority value. The lower the value (above zero), the higher the priority. **Note:** If you set the router priority to zero (0), the router is not eligible to become the designated router on this particular network.	
Enter decimal value in seconds for Poll Interval [20]: (For NBMA only)	Enter the largest number of seconds allowed between Hello packets it sends to an inactive NBMA neighbor. The router suggests a 20-sec interval.	

(continued on the next page)

OSPF Worksheet for ANs and ANHs *(continued)*

Requested Information	Options	Your Response
Enter IP address of neighbor in dotted decimal notation or enter **q** to quit: (For NBMA only)	Enter addresses for all NBMA neighbors you want the router to communicate with. Enter **q** and press the Return key when you finish entering addresses.	
Enter IP address of neighbor in dotted decimal notation: (For PPP only)	Enter addresses for the PPP neighbor you want the router to communicate with.	

Static Route to Site Manager Worksheet for ANs and ANHs

Requested Information	Options	Your Information
Destination Network [0.0.0.0]:	Enter the gateway address of the destination network. An address of 0.0.0.0 specifies the default route.	
Destination Network Mask [0.0.0.0]:	Enter the subnetwork mask of the destination network. A mask of 0.0.0.0 specifies the default route.	
Next Hop Address:	Enter a next-hop address. All static routes require a next-hop address in the same subnet as the initial IP interface.	

Wide Area Protocol Worksheets for ANs and ANHs

This section contains requested information and possible options relating to Wide Area Protocol choices on the Global Worksheet.

Wellfleet Proprietary PPP Worksheet for ANs and ANHs

Requested Information	Options	Your Information
Enter BOFL (Breath of Life) timer value (1-60) [5]:	Enter the maximum amount of time that can elapse between the successful transmission of BOFL messages.	
Enter Local Address Selection [3]:	1. DCE 2. DTE 3. EXPLICIT **Note:** Reverse local and remote address values when you configure the device at the other end of the circuit. (Exception: When you connect to a 5-series router that uses DCE/DTE addressing, use the SAME local address value.)	
Enter Remote Address Selection [3]:	1. DCE 2. DTE 3. EXPLICIT **Note:** Reverse local and remote address values when you configure the device at the other end of the circuit. (Exception: When you connect to a 5-series router that uses DCE/DTE addressing, use the SAME local address value.)	

Frame Relay Worksheet for ANs and ANHs

Requested Information	Options	Your Information
Enter Management type [3]:	1. DLCMI None 2. Rev 1 LMI 3. ANSI T1 617D 4. CCITT Annex A 5. LMI Switch 6. Annex D Switch 7. Annex A Switch	
Enter addressing type [4]:	1. ADDR Q.921 2. ADDR Q.922 (MARCH '90) 3. ADDR Q.922 (NOVEMBER '90) 4. ADDR Q.922	
Enter address field length:	2. Two Bytes 3. Three Bytes 4. Four Bytes	
Enter DLCI number [30]: (For DLCMI None, LMI Switch, Annex D Switch, and Annex A Switch only)	Enter the Permanent Virtual Channel (PVC) number. **Note:** The valid range for the DCLI number is between 16 and 1007.	

PPP Standard Worksheet for ANs and ANHs

Requested Information	Options	Your Information
Enter Remote IP address in dotted decimal notation:	Enter the IP address of the peer connection.	
Do you wish to turn on the PPP echo function? (y/n) [n]:	y(es) n(o)	
Enable Local Authentication Protocol? (y/n) [n]:	y(es) n(o) **Note:** If you answer y(es), the router requests a PAP ID for this interface.	
Does the Remote Peer have PAP authentication enabled? (y/n) [n]:	y(es) n(o) **Note:** If you answer y(es), the router requests the PAP ID for the remote interface.	
Enable the LQR (Link Quality Reporting) Protocol? (y/n) [n]:	y(es) n(o) **Note:** Link Quality Monitoring on a Wellfleet 5-series router is not compatible with this feature, because the 5-series LQ functions are based on older, incompatible RFCs.	

(continued on the next page)

PPP Standard Worksheet for ANs and ANHs *(continued)*

Requested Information	Options	Your Information
Enable use of the Remote Peer router's LQR Timer? (y/n) [y]: (For LQR Protocol only)	y(es) n(o) **Note:** If the LQR Timer is enabled, the remote peer router maintains its own LQR Timer for this interface. When you disable the LQR Timer, the router is responsible for maintaining the timer for this interface.	
Number of seconds (1-120) [3]: (For LQR Protocol only)	Enter the maximum number of seconds between the transmission of LQR packets.	
Enter [inbound] success rate percentage (1-100) [90]:	Enter the minimal acceptable success rate (percentage) of packets transmitted by the peer router and received on this interface over the last five LQR reporting periods.	
Enter [outbound] success rate percentage (1-100) [90]:	Enter the minimal acceptable success rate (percentage) of packets transmitted by this interface and received by the peer router over the last five LQR reporting periods.	

SMDS Worksheet for ANs and ANHs

Requested Information	Options	Your Information
Enter 10-digit individual address:	Enter the individual address assigned to you by your SMDS service provider.	
Enter 10-digit group address:	Enter the group address assigned to you by your SMDS service provider.	
Enter 10-digit arp address:	Enter the ARP address assigned to you by your SMDS service provider.	

Worksheets for ASNs

The following worksheets apply only to the ASN.

Global Information Worksheet for ASNs

This section contains requested information and possible options relating to configuring a synchronous interface on the ASN.

Global Information Worksheet for ASNs

Step	Requested Information	Options	Your Information
1	Specify the slot number where the net module resides.	The ASN lists the slots and modules that are currently available. Enter the slot number that corresponds to the slot ID of the ASN. Valid values are 1 through 4.	
	Enter the module number.	The module corresponds to the position of the net module in the ASN. Enter the module number that corresponds to the Dual Sync Net Module (DSNM). Valid values are 1 through 4.	

(continued on the next page)

Global Information Worksheet for ASNs *(continued)*

Step	Requested Information	Options	Your Information
2	Specify the net module and network interface information for the initial IP connection to Site Manager.	Specify information for the Dual Sync Net Module.	
	Enter connector number [1]:	1. COM1 2. COM2	
	Enter clock source number [2]:	1. Internal 2. External	
	Enter circuit name [S#]:	The ASN recommends a circuit name for the COM interface you select (for example, S121 for COM 1 and S122 for COM 2).	Press the Return key.

(continued on the next page)

Global Information Worksheet for ASNs *(continued)*

Step	Requested Information	Options	Your Information
3	Enter IP address in dotted decimal notation:	Enter the IP address for the COM interface.	
	Enter the subnetwork mask in dotted decimal notation:	Enter the subnetwork mask for the COM interface IP address.	
	Is the router connected to the same local area network as the Site Manager workstation? (y/n) [n]:	y(es) n(o)	Press the Return key.
	Enter routing protocol number [1]:	1. RIP 2. OSPF 3. Static Route to Site Manager	Complete the worksheet for the protocol you select.
	Enter wide-area protocol number [1]:	1. Wellfleet Point-to-Point Protocol (Proprietary) 2. Frame Relay 3. Point-to-Point Protocol Standard (PPP) 4. Switched Multimegabit Data Service (SMDS)	Complete the worksheet for the protocol you select.
	Do you wish to set SNMP community management? (y/n) [n]:	y(es) n(o) Setting up SNMP community management is optional.	
4	TFTP default volume [1]:	Enter the ASN slot ID that corresponds to the default volume.	

(continued on the next page)

Global Information Worksheet for ASNs *(continued)*

Step	Requested Information	Options	Your Information
5	Do you want to enable FTP? (y/n) [n]:	y(es) n(o) **Note:** If you answer y(es), the router requests a volume number	
6	Do you want to enable TELNET? (y/n) [n]:	y(es) n(o) Enabling TELNET is optional	
7	Do you wish to save this configuration to a file? (y/n) [y]	y(es) n(o)	Press the Return key.
	Enter filename [*startup.cfg*]:	We recommend using the default file name.	Press the Return key.

Router Protocol Worksheets for ASNs

This section contains requested information and possible options relating to the router protocol choices on the Global Worksheet.

RIP Worksheet for ASNs

Requested Information	Options	Your Information
Should RIP listen to the default route? (y/n) [n]:	y(es) n(o) **Note:** RIP listens to a specific network or subnet route where Site Manager is located. Answering y(es), forces RIP to also listen to the default route (0.0.0.0). This is useful when no specific route is available in the RIP updates that the router receives.	

OSPF Worksheet for ASNs

Requested Information	Options	Your Information
Enter the OSPF router ID in dotted decimal notation [the router provides the IP address of the COM port]:	Enter an IP address to uniquely identify the router in the OSPF domain. We suggest using the default IP address provided.	
Enter the OSPF area ID in dotted decimal notation [0.0.0.0]:	Enter the area ID. This ID must match the area ID of the router's neighbor. **Note:** The backbone area ID is always 0.0.0.0	
Enable Simple Password authentication? (y/n) [n]:	y(es) n(o) **Note:** If you answer y(es), the router requests a password.	Password: _____
Enter the OSPF MTU size selection [1]:	1. Default 2. Ethernet-size (Wellfleet 5-series compatible)	
Enter OSPF interface type selection [1]:	1. Broadcast 2. NBMA 3. Point to Point **Note:** When using a wide-area protocol other than Wellfleet Proprietary PPP, we suggest selecting NBMA.	

(continued on the next page)

OSPF Worksheet for ASNs *(continued)*

Requested Information	Options	Your Information
Enter decimal value in seconds for Hello Interval [10]: **Note:** This value must match all other interfaces in the OSPF area for connection to take place.	The ASN suggests the following intervals: Broadcast — 10 seconds Point-to-Point — 15 seconds NBMA — 20 seconds	
Enter decimal value in seconds for Router Dead Interval [40]: **Note:** This value must match all other interfaces in the OSPF area for connection to take place.	The ASN suggests the following intervals: Broadcast — 40 seconds Point-to-Point — 60 seconds NBMA — 80 seconds	
Enter decimal value for Router Priority [1]:	Enter a router priority value. The lower the value (above zero), the higher the priority. **Note:** If you set the router priority to zero (0), the router is not eligible to become the designated router on this particular network.	
Enter decimal value in seconds for Poll Interval [20]: (For NBMA only)	Enter the largest number of seconds allowed between Hello packets sent to an inactive NBMA neighbor. The router suggests a 20-second interval.	

(continued on the next page)

OSPF Worksheet for ASNs *(continued)*

Requested Information	Options	Your Information
Enter IP address of neighbor in dotted decimal notation or enter **q** to quit: (For NBMA only)	Enter the addresses for all NBMA neighbors you want the router to communicate with. Type **q** and press the Return key when you finish entering addresses.	
Enter IP address of neighbor in dotted decimal notation: (For PPP only)	Enter the addresses for the PPP neighbors you want the router to communicate with.	

Static Route to Site Manager Worksheet for ASNs

Requested Information	Options	Your Information
Destination Network [0.0.0.0]:	Enter the gateway address of the destination network. An address of 0.0.0.0 specifies the default route.	
Destination Network Mask [0.0.0.0]:	Enter the subnetwork mask of the destination network. A mask of 0.0.0.0 specifies the default route.	
Next Hop Address:	Enter a next-hop address. All static routes require a next-hop address in the same subnet as the initial IP interface.	

Wide-Area Protocol Worksheets for ASNs

This section contains requested information and possible options relating to wide-area protocol choices on the Global Worksheet.

Wellfleet Proprietary PPP Worksheet for ASNs

Requested Information	Options	Your Information
Enter BOFL (Breath of Life) timer value (1-60) [5]:	Enter the maximum amount of time that can elapse between the successful transmission of BOFL messages.	
Enter Local Address Selection [3]:	1. DCE 2. DTE 3. EXPLICIT **Note:** Reverse local and remote address values when you configure the device at the other end of the circuit. (Exception: When you connect to a 5-series router that uses DCE/DTE addressing, use the *same* local address value.)	
Enter Remote Address Selection [3]:	1. DCE 2. DTE 3. EXPLICIT **Note:** Reverse local and remote address values when you configure the device at the other end of the circuit. (Exception: When you connect to a 5-series router that uses DCE/DTE addressing, use the *same* local address value.)	

Frame Relay Worksheet for ASNs

Requested Information	Options	Your Information
Enter Management type [3]:	1. DLCMI None 2. Rev 1 LMI 3. ANSI T1 617D 4. CCITT Annex A 5. LMI Switch 6. Annex D Switch 7. Annex A Switch	
Enter addressing type [4]:	1. ADDR Q.921 2. ADDR Q.922 (MARCH '90) 3. ADDR Q.922 (NOVEMBER '90) 4. ADDR Q.922	
Enter address field length:	2. Two Bytes 3. Three Bytes 4. Four Bytes	
Enter DLCI number [30]: (For DLCMI None, LMI Switch, Annex D Switch, and Annex A Switch only)	Enter the Permanent Virtual Channel (PVC) number. **Note:** The valid range for the DLCI number is between 16 and 1007.	

PPP Standard Worksheet for ASNs

Requested Information	Options	Your Information
Enter Remote IP address in dotted decimal notation:	Enter the IP address of the peer connection.	
Do you wish to turn on the PPP echo function? (y/n) [n]:	y(es) n(o)	
Enable Local Authentication Protocol? (y/n) [n]:	y(es) n(o) **Note:** If you answer y(es), the router requests a PAP ID for this interface.	
Does the Remote Peer have PAP authentication enabled? (y/n) [n]:	y(es) n(o) **Note:** If you answer y(es), the router requests the PAP ID for the remote interface.	
Enable the LQR (Link Quality Reporting) Protocol? (y/n) [n]:	y(es) n(o) **Note:** Link Quality Monitoring on a Wellfleet 5-series router is not compatible with this feature, because the 5-series LQ functions are based on older, incompatible RFCs.	

(continued on the next page)

PPP Standard Worksheet for ASNs *(continued)*

Requested Information	Options	Your Information
Enable use of the Remote Peer router's LQR Timer? (y/n) [y]: (For LQR Protocol only)	y(es) n(o) **Note:** If the LQR Timer is enabled, the remote peer router maintains its own LQR Timer for this interface. When the LQR Timer is disabled, the ASN is responsible for maintaining the timer for this interface.	
Number of seconds (1-120) [3]: (For LQR Protocol only)	Enter the maximum number of seconds between the transmission of LQR packets.	
Enter [inbound] success rate percentage (1-100) [90]:	Enter the minimal acceptable success rate (percentage) of packets transmitted by the peer router and received on this interface over the last five LQR reporting periods.	
Enter [outbound] success rate percentage (1-100) [90]:	Enter the minimal acceptable success rate (percentage) of packets transmitted by this interface and received by the peer router over the last five LQR reporting periods.	

SMDS Worksheet for ASNs

Requested Information	Options	Your Information
Enter 10-digit individual address:	Enter the individual address assigned to you by your SMDS service provider.	
Enter 10-digit group address:	Enter the group address assigned to you by your SMDS service provider.	
Enter 10-digit arp address:	Enter the ARP address assigned to you by your SMDS service provider.	

Using the Quick-Start Commands

Refer to the following list of commands when you quick-start the router.

Table A-1. Quick-Start Commands

To Do the Following	Action	Details
Accept a default value	Press Return	Your console displays default values in brackets; for example, [E11].
Repeat a step (for example, if you make a mistake)	Press **Control-c** Press **n**	When prompted, "Terminate script y/n?" press the **n** key. You return to the beginning of the step so you can re-enter the information.
Stop the Quick-Start installation procedure	Press **Control-c** Press **y**	When prompted, "Terminate script y/n?" press the **y** key. The Quick-Start procedure is terminated and you return to the Technician Interface prompt. To restart the Quick-Start procedure, you must reboot the router by entering **boot** and pressing the Return key.

Running the Quick-Start Script

After you enter **run install.bat**, the router progresses through the Quick-Start script as follows:

1. The router begins prompting you for the initial Global Worksheet information.
2. After you select a router protocol option, the router prompts for specific protocol information.
3. After finishing the router protocol configuration, the router requests a wide-area protocol selection.
4. After you select a wide-area protocol, the router prompts for specific protocol information.
5. After finishing the wide-area protocol configuration, the router prompts for the rest of the Global Worksheet information.

When the configuration is complete, the router runs through a test procedure for the IP interface. When the test is complete, the bottom line on the screen directs

```
Enter IP address of Site Manager workstation:
```

Provide this address to the person at the router site.

Appendix B
Configuring Interfaces for Netboot and Directed Netboot

This appendix describes how to configure a router to obtain its image and/or configuration file using Site Manager software. A router can obtain these files over the network from a BOOTP server or directly from its local file system.

Note: The changes you make when you follow the instructions in this appendix do not affect the operation of the router until it starts up.

Before the router can get files over the network, you must set up the network to support Netboot. Refer to Chapters 2, 3, and 4 for instructions.

This appendix is organized as follows:

- "Editing Netboot Global Parameters" describes how to configure the router to obtain startup files from a BOOTP server or from its local file system.
- "Adding a Netboot Interface" describes how to configure an interface on the router to obtain startup files from a BOOTP server.

Editing Global Parameters for Netboot and Directed Netboot

By default, the router obtains its software image from its local file system and its configuration file from a BOOTP server. Display and change these settings as follows:

1. Select Protocols→Global Protocols→Net Boot→Global from the Wellfleet Configuration Manager window.

   The Edit Netboot Global Parameters window appears (Figure B-1).

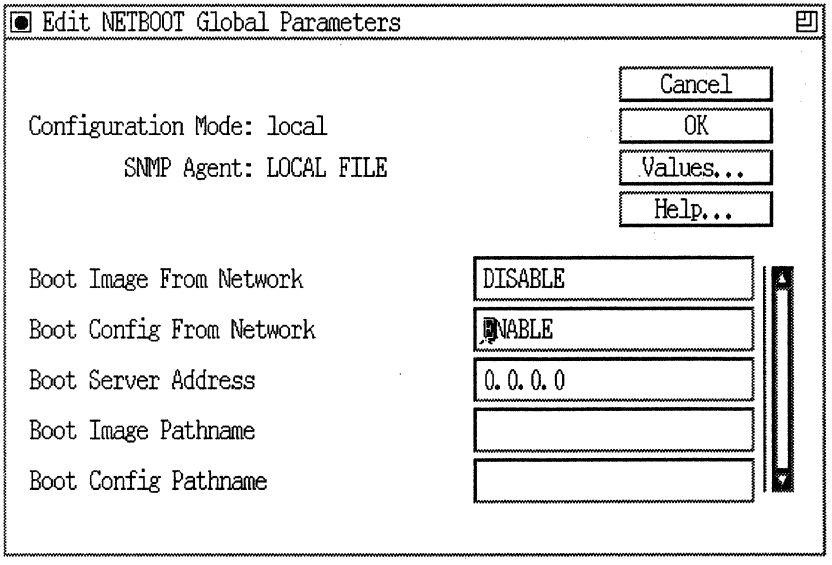

Figure B-1. Edit Netboot Global Parameters Window

2. Select new settings in the window for the parameters you want to edit. For guidelines, see descriptions of the parameters that follow step 3.

Note: Of the five parameter fields shown in Figure B-1, only the first two apply to both Netboot and Directed Netboot. The final three parameters are for Directed Netboot only. However, to use Directed Netboot, you must specify Enable for at least one of the first two parameters.

3. After entering the parameter edits, click on the OK button.

Netboot and Directed Netboot Parameters

Parameter:	**Boot Image From Network**
Default:	Disable
Options:	Enable | Disable
Function:	Enables or disables retrieval of the software image from the BOOTP server the next time the router starts up.
Instructions:	Set to Disable if you want to boot using the image in the router's file system. This setting reduces the time it takes to boot the router and eliminates using network bandwidth to obtain the image. Set to Enable if ❒ You want the router to obtain the image from a BOOTP server and you have already set up the network to support BOOTP service. ❒ You are upgrading the image on a number of routers. The routers can then boot using a single image on the BOOTP server. You must ensure that the directory name in the *bootptab* file matches the location of the upgraded image before you boot the routers.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.1.1

Note: As an alternative to enabling the Boot Image From Network parameter to upgrade the image, you can use the Router Files Manager to transfer an upgraded image to the router so that it reads the file the next time it starts up. To use this alternative, delete the router's old software image file from its file system, compact the file system, and transfer the upgraded software image file to it. Use the Router Files Manager to make sure the upgraded software image file in the router's file system is the same size as the one in the Site Manager workstation's file system. This verifies that the file transfer was successful.

Parameter:	**Boot Config From Network**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables retrieval of the configuration file from a BOOTP server the next time the router starts up.
Instructions:	Set to Disable if you have already saved the configuration file in the router's memory to the router's file system, and you want to boot using this configuration file. This setting reduces the time it takes to boot the router and eliminates using network resources to obtain the configuration file. Set to Enable if you want the router to obtain the configuration file from a BOOTP server and you have already set up the network to support BOOTP service.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.1.2

Parameter:	**Boot Server Address**
Default:	None
Options:	A valid IP address of a BOOTP Server
Function:	When either or both of the parameters Boot Image From Network and Boot Config From Network is set to Enable, this parameter specifies the BOOTP server from which the router will obtain the boot image and boot configuration file(s).
Instructions:	Use this parameter only when configuring Directed Netboot. Enter the valid IP address of the BOOTP Server, in dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.1.3

Parameter:	**Boot Image Pathname**
Default:	None
Options:	A valid image file pathname
Function:	When the parameter Boot Image From Network is set to Enable, this parameter specifies the absolute pathname of the boot image file on the BOOTP server.
Instructions:	Use this parameter only when configuring Directed Netboot. Make sure the file you specify is the valid image file on the BOOTP server.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.1.4

Parameter:	**Boot Config Pathname**
Default:	None
Options:	A valid configuration file pathname
Function:	When the parameter Boot Config From Network is set to Enable, this parameter specifies the absolute pathname of the boot configuration file on the BOOTP server.
Instructions:	Use this parameter only when configuring Directed Netboot. Make sure the file you specify is the valid configuration file on the BOOTP server.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.1.5

Adding a Netboot Interface

If you are using EZ-Install for the router, you do not need to configure Netboot interfaces. Please refer to Chapter 1 and the appropriate installation manual for more information.

If you are not using EZ-Install and you want the router to boot using its image and/or configuration file from a BOOTP server, you must add a Netboot interface.

Follow these instructions to add a Netboot interface if Enable is entered in one or both of the first two parameter boxes in the Netboot Global Parameters window (Figure B-1):

1. Select Protocols→Global Protocols→Net Boot→Interfaces from the Wellfleet Configuration Manager window.

   The Netboot Interfaces window appears (Figure B-2).

Note: Do not attempt at this step to make entries in the parameter boxes shown in the window. Instead, go to step 2.

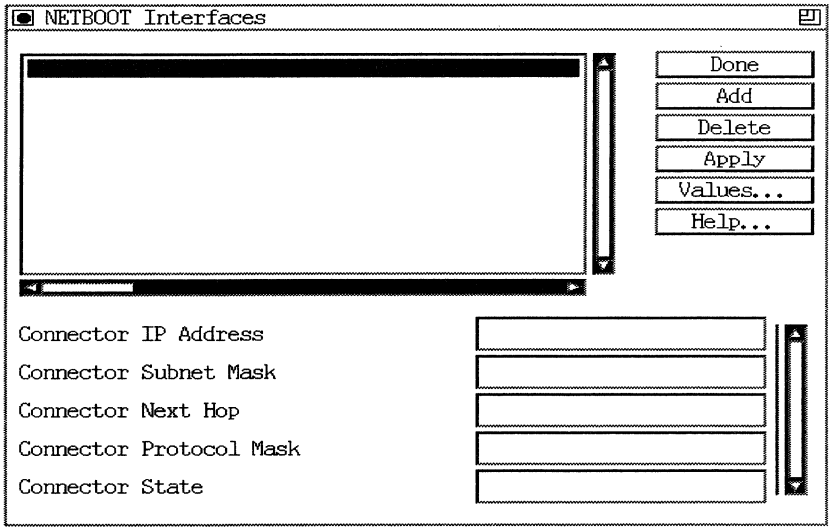

Figure B-2. Netboot Interfaces Window

2. Click on the Add button in the above window.

   A Netboot Interface window appears (Figure B-3 or Figure B-4) in the same screen as the open Netboot Interfaces window in Figure B-2. The second window will be either for the AN or ANH (Figure B-3) or for the ASN (Figure B-4), depending on the type of router you are configuring.

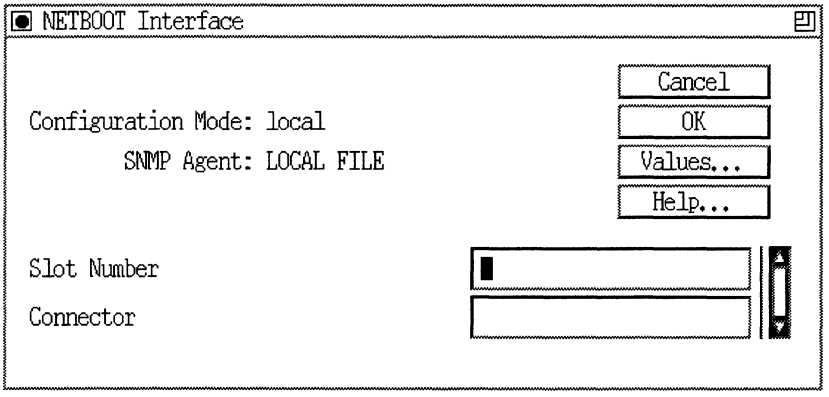

Figure B-3. AN/ANH Netboot Interface Window

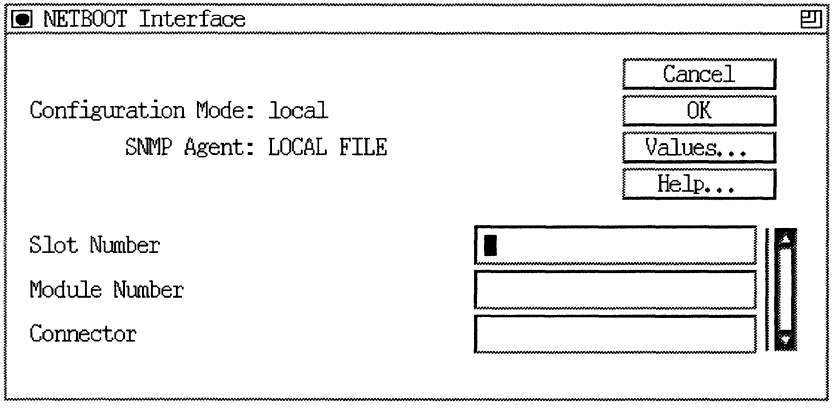

Figure B-4. ASN Netboot Interface Window

3. Enter the appropriate settings for the parameters in one of the above windows, as applicable. For guidelines, see the parameter descriptions that follow step 8.

Note: If you configure more than one interface to Netboot, the first interface to receive a reply from the BOOTP server will use Netboot to reach the router.

4. After you enter the above parameter settings, click on the OK button in the Netboot Interface window (Figure B-3 or Figure B-4).

   This window closes. The slot number, module number (ASN only), and port number (connector identification) now appear at the upper left corner of the Netboot Interfaces (Figure B-2) window that remains on the screen.

5. Select the slot number, module number (ASN only), and port number (connector identification).
6. Enter the desired settings for the parameters in this window (Figure B-2). For guidelines, see the parameter descriptions that follow step 8.
7. Click on Apply.
8. Click on Done to exit the Netboot Interfaces window.

Netboot Interface Parameters

Parameter:	**Slot Number**
Default:	None
Options:	1 for ANs and ANHs, and from 1 to 4 for ASNs
Function:	Specifies the slot in which the router's hardware module is installed (ANs and ANHs have only one slot, ASNs have four).
Instructions:	Type the appropriate slot number in the Slot Number box.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.3.1.2

Parameter:	**Module Number (for ASNs only)**
Default:	None
Options:	From 1 to 4
Function:	Specifies the module supporting the connector being addressed (see Connector, below)
Instructions:	Type the appropriate module number in the Module Number box.
MIB Object ID:	None

Parameter:	**Connector**
Default:	None
Options:	AN/ANH: COM1 | COM2 If the AN/ANH is equipped with an Ethernet port, XCVR1 is also an option ASN: Synchronous: COM1 | COM2 Ethernet: XCVR1 | XCVR2
Function:	Identifies the connector configured as a Netboot interface.
Instructions:	Enter COM1 | COM2 if you want to use Netboot over a synchronous interface. Enter XCVR1 | XCVR2 if you want to use Netboot over an Ethernet interface.
MIB Object ID:	1.3.6.1.4.1.18.3.3.3.2.10.3.1.3

Parameter:	**Connector IP Address**
Default:	None
Options:	Any valid IP address
Function:	Specifies the IP address of the remote netbooting router that is using EZ-Install. This parameter applies only to a frame relay group access PVC connection.
Instructions:	Enter the IP address of the remote netbooting router's interface, in dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.3.1.4

Parameter:	**Connector Subnet Mask**
Default:	None
Options:	The Configuration Manager automatically calculates an appropriate subnet mask, depending on the class of the network to which the interface connects. However, you can change the subnet mask with this parameter.
Function:	Specifies the network and subnetwork portion of the 32-bit IP address of this interface.
Instructions:	Either accept the assigned subnet mask or enter another subnet mask, in dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.3.1.5

Parameter:	**Connector Next Hop**
Default:	None
Options:	Any valid IP address
Function:	Specifies the IP address of the next-hop router connected to this interface. When the router starts up, the next-hop router passes the BOOTP requests and responses that initiate the transfer of the image and/or configuration file between the router and the BOOTP server. If the router and BOOTP server are on the same IP subnet, you do not have to set this parameter.
Instructions:	Enter the IP address of the next-hop router connected to the interface you are adding, in dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.3.1.6

Parameter:	**Connector Protocol Mask**
Default:	Point to Point
Options:	Point to Point | Point to Point Internal Clock | Fr Relay Annexd | Fr Relay Annexa | Fr Relay LMI
Function:	During the boot process the router will configure the synchronous interface to the specified protocol.
Instructions:	Specify the desired protocol option.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.3.1.7

Parameter:	**Connector State**
Default:	Enable
Options:	Enable | Disable
Function:	When you open this window, the default setting for this parameter appears—if not previously reset to Disable— and any settings already entered in the other four parameter boxes in the window appear and are noted by Site Manager so that Netboot may occur. If the setting is Disable the router cannot Netboot.
Instructions:	If you do not want the setting that appears when you open the Netboot Interfaces window, type the alternative option. However, if any of the other four parameters in the window at Figure B-2 show a setting, you must set this parameter to Enable.
MIB Object ID:	1.3.6.1.4.1.18.3.3.2.10.3.1.1

Appendix C
Managing the Access Node Hub

You manage the 12-repeater port ANH and the 8-repeater port ANH using the Wellfleet Site Manager software. For instructions on starting Site Manager, see *Using Site Manager Software*. For instructions on selecting the router you want to manage, see *Configuring Wellfleet Routers*.

Resetting and Testing the ANH

Use the following procedure to reset and test the router:

1. From the Wellfleet Site Manager window, which appears at Site Manager startup, select Tools→Configuration Manager→Dynamic. The Wellfleet Configuration Manager window appears, displaying the real-time router hardware and software configuration.
2. From the Wellfleet Configuration Manager window, select Platform→Setup Repeater→Group Parameters (Figure C-1). The Group Parameters window appears (Figure C-2), allowing you to reset the router or issue the self-test command to the router.

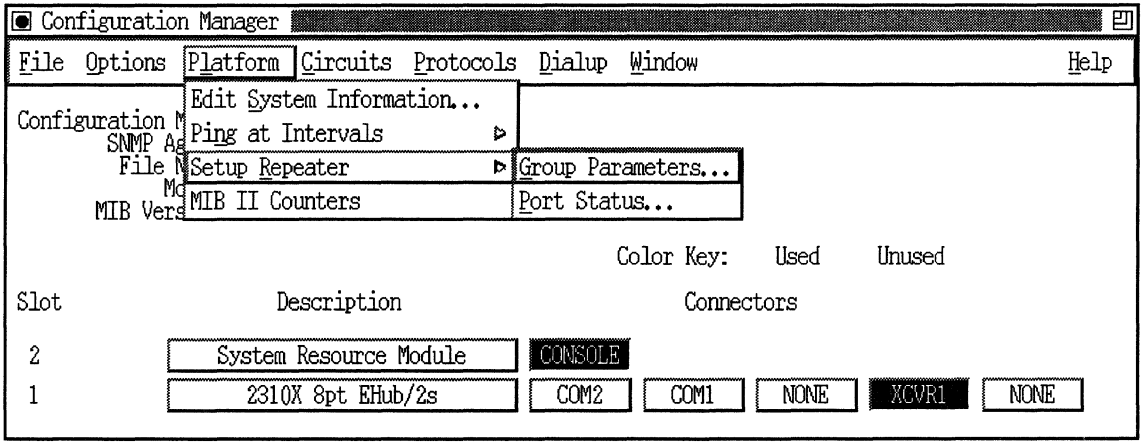

Figure C-1. Configuration Manager Window

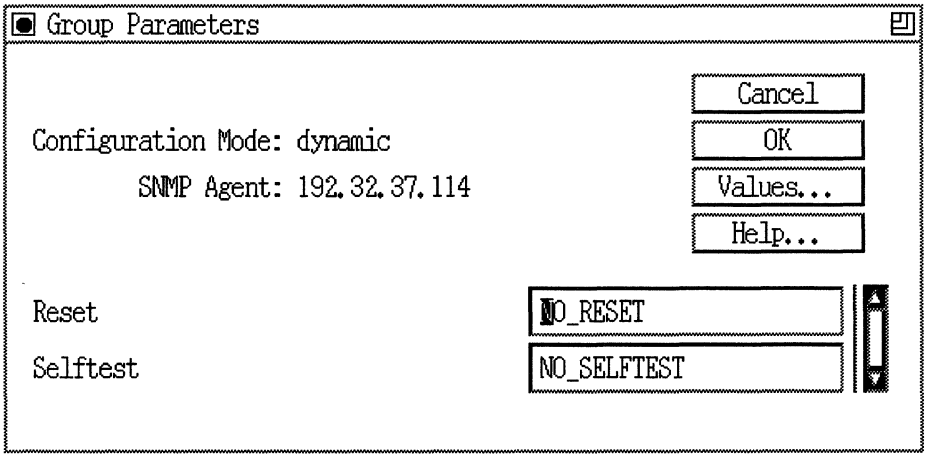

Figure C-2. Group Parameters Window

3. **Edit the parameters you want to change, using the parameter descriptions that follow as guidelines.**

4. When you are finished, click on the OK button. The Configuration Manager executes the action or actions you indicated in the Group Parameters window and exits the window.

Group Parameter Descriptions

This section describes all parameters shown on the Group Parameters window (Figure C-2).

Parameter:	**Reset**
Default:	NO_RESET
Options:	NO_RESET | RESET
Function:	Resets the repeater. Configuration Manager tests each repeater port and records to a log file whether a port passed diagnostics. The reset does not affect the management counters defined in the RFC 1516 MIB nor does it affect the status of the ports. It does disrupt traffic flow.
Instructions:	Accept the default, NO_RESET, or select RESET.
MIB Object ID:	1.3.6.1.2.1.22.1.1.4

Parameter:	**Selftest**
Default:	NO_SELFTEST
Options:	NO_SELFTEST | SELFTEST
Function:	Causes the router to perform an agent-specific test on itself. This test does not disrupt traffic flow.
Instructions:	Accept the default, NO_SELFTEST, or select SELFTEST.
MIB Object ID:	1.3.6.1.2.1.22.1.1.5

Enabling the Repeater Ports

Use the following procedure to enable or disable the repeater ports on the router. If you have just completed the procedure described in the section "Resetting and Testing the ANH," skip to Step 2.

1. From the Site Manager window, which appears at Site Manager startup, select Tools→Configuration Manager→Dynamic. The Configuration Manager window appears, displaying the real-time router hardware and software configuration.
2. From the Configuration Manager window, select Platform→Setup Repeater→Port Status (Figure C-1). The Port Status window appears (Figure C-3), allowing you to enable or disable the ports on the router.

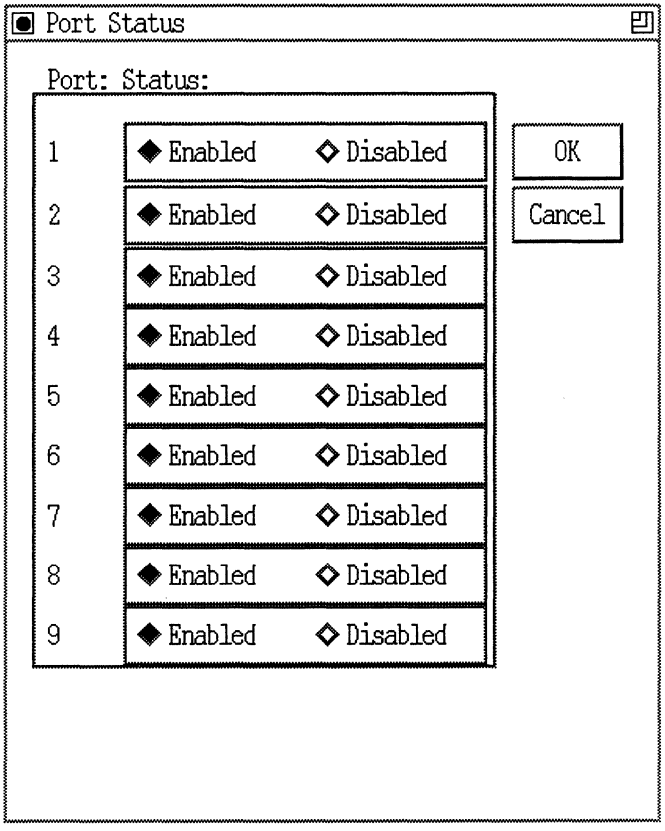

Figure C-3. Port Status Window

3. To change the status of a port, click on the Enable or Disable option to the right of the port number.
4. When you are finished, click on the OK button to exit the window and save your changes.

Index

Symbols

A

B

C

D

E

F

G

H

I

K

L

Q

R

S

T

Bay Networks

The Merged Company of SynOptics and Wellfleet

8 Federal Street
Billerica, MA 01821

Printed in U.S.A. on Recycled Paper