HE/200E/LE ATM Adapters for the PC User's Manual

ForeThought for Windows Version 5.1.x

ForeThought for Netware Version 4.1.7

Marconi Communications

Legal Notices

TRADEMARKS

FCC CLASS A NOTICE

FCC CLASS B NOTICE

The *LE* 25 adapter has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

Changes and Modifications not expressly approved by the manufacturer or reistrant of this equipment can void your authority to operate this equipment under Federal Communications Commission rules.

DOC CLASS A NOTICE

This digital apparatus does not exceed Class A limits for radio noise emission for a digital device as set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques de la class A prescrites dans le reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada.

CE NOTICE

Marking by the symbol **CE** indicates compliance of this system to the EMC (Electromagnetic Compatibility) directive of the European Community and compliance to the Low Voltage (Safety) Directive. Such marking is indicative that this system meets or exceeds the following technical standards:

- EN 55022 - "Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment."
- EN 50082-1 - "Electromagnetic compatibility - Generic immunity standard Part 1: Residential, commercial, and light industry."
- IEC 1000-4-2 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 2: Electrostatic discharge requirements."
- IEC 1000-4-3 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 3: Radiate electromagnetic field requirements."
- IEC 1000-4-4 - "Electromagnetic compatibility for industrial-process measurement and control equipment Part 4: Electrical fast transient/burst requirements."

CERTIFICATIONS

ETL certified to meet Information Technology Equipment safety standards UL 1950, CSA 22.2 No. 950, and EN 60950.

Japan VCCI conformity.

LE 25 -

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> 　取扱説明書に従って正しい取り扱いをして下さい。

This equipment is in the Class 2 category (Information Technology Equipment to be used in a residential area or an adjacent area thereto) and conforms to the standards set by the Voluntary Control Council For Interference by Information Technology Equipment aimed at preventing radio interference in such residential area. When used near a radio or TV receiver, it may become the cause of radio interference. Read the instructions for correct handling.

PCA-200EPC, LE 155, and *HE* 622-

> 　この装置は、第一種情報処理装置（商工業地域において使用されるべき情報処理装置）で商工業地域での電波障害防止を目的とした情報処理装置等電波障害自主規制協議会(VCCI)基準に適合しております。
> 　従って、住宅地域またはその隣接した地域で使用すると、ラジオ、テレビジョン受信機等に受信障害を与えることがあります。
> 　取扱説明書に従って正しい取り扱いをして下さい。

This equipment is in the Class 1 category (Information Technology Equipment to be used in commercial and/or industrial areas) and conforms to the standards set by the Voluntary Control Council For Interference by Information Technology Equipment aimed at preventing radio interference in commercial and/or industrial areas.Consequently, when used in a residential area or in an adjacent area thereto, radio interference may be caused to radios and TV receivers, etc. Read the instructions for correct handling.

PCA-200EPC/SMF

The following information applies to the PCA-200EPC/SMF adapter (single-mode fiber LAN adapter that contains a Class 1 laser):

Class 1 Laser Product: This product conforms to applicable requirements of 21 CFR 1040 at the date of manufacture.

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Preface

This manual provides the necessary information to install the PCA-200EPC, LE[TM], and HE[TM] ATM adapters and driver software. Also included is general product information, network configuration information and information about software administration capabilities. This manual is for users with various levels of experience. If you have any questions or problems with the installation, please contact Marconi's Technical Support using the information on page iii.

Chapter Summaries

Chapter 1 - Introduction - Provides an overview of the Marconi adapter hardware and software, and general information to prepare for the installation of the Marconi adapter.

Chapter 2 - Overview of ATM and Supported Standards - Provides an overview of ATM, LAN Emulation using ATM (LANE), Multi-Protocol Over ATM (MPOA), and Classical IP.

Chapter 3 - Hardware Installation - Provides instructions for installing the Marconi adapter hardware.

Chapter 4 - Pre-Installation Checklist - Provides a checklist for the required information for installing the adapter drivers.

Chapter 5 - Windows 9x Installation - Provides the requirements and instructions for installing the Marconi adapter drivers on a system running the Microsoft Windows 95, 98, and 2000 operating system.

Chapter 6 - Windows NT Installation - Provides the requirements and instructions for installing the Marconi adapter drivers on a system running the Microsoft Windows NT 4.0 operating system.

Chapter 7 - NetWare Driver Installation - Provides the requirements and instructions for installing the *ForeThought* 4.1.7 Marconi ATM and LANE drivers on a system running the Novell 4.11 and 5.0 operating system.

Chapter 8 - Upgrading the Marconi Adapter Drivers - Provides instructions for upgrading the Marconi ATM and LANE drivers on a Windows 95, 98, or NT operating system.

Chapter 9 - Configuring MPOA and Quality of Service Parameters - Provides procedures for configuring MPOA and QoS parameters for the Windows 95 and Windows NT drivers.

Chapter 10 - Using InFOREmation Center - Describes the InFOREmation Center utility for Windows NT and Windows 95/98, which provides performance monitoring and debugging tools for a Marconi adapter running on the Windows NT or Windows 95 operating system.

Chapter 11 - Viewing ATM Statistics in NetWare - Describes the FORESTAT utility for use on NetWare systems using the ForeThought 4.1.7 ATM and LANE drivers.

Appendix A - LED Indicators - Describes the meaning of the LED status indicators on the Marconi adapter.

Appendix B - Network Troubleshooting in Windows - Describes troubleshooting techniques for the adapter in a Windows NT or Windows 95/98 system.

Appendix C - Novell NetWare Network Troubleshooting - Describes troubleshooting techniques for the adapter in a NetWare system.

Appendix D - Using the Marconi ATM Service Provider with WinSock2 - Describes how to use the Marconi WinSock Service Provider Interface (SPI) provided with the Marconi adapter drivers. This SPI can be used with WinSock running on Windows 95/98 or NT. Use of the SPI requires knowledge of ATM networking and WinSock programming.

Technical Support

In the U.S.A., customers can reach Marconi's Technical Assistance Center (TAC) using any one of the following methods:

1. Select the "Support" link from the Marconi (formerly FORE Systems) World Wide Web page:

    http://www.fore.com/

2. Send questions, via e-mail, to:

    support@fore.com

3. Telephone questions to "support" at:

    800-671-FORE (3673) or **724-742-6999**

4. FAX questions to "support" at:

    724-742-7900

Technical support for customers outside the United States should be handled through the local distributor or via telephone at the following number:

+1 724-742-6999

No matter which method is used to reach Marconi Support, customers should be ready to provide the following:

- A support contract ID number
- The serial number of each product in question
- All relevant information describing the problem or question

The Marconi Technical Manual Website

For the latest technical documentation and release notes for your ATM adapter and other Marconi products, visit the Marconi technical manual website at:

http://www.fore.com/support/manuals/home/home.htm

The website provides manuals in Portable Document Format (PDF). They can be viewed or printed using Adobe Acrobat Version 3.0 Readers.

Typographical Styles

This manual uses different typefaces to represent different types of user input, system responses, and elements of the graphical user interface (GUI).

Bold indicates GUI elements, control buttons and keys found on the keyboard. For example:

- Drag the **ASX**-**1000** icon to the **MPS** container and click **OK**.
- Press **Enter** to proceed.

`Courier` font represents command line interaction and file names and paths. **`Bold Courier`** indicates commands and input that is typed by the user, and *`italic courier`* represents variable parameters for which you must supply a value. For example:

- Issue the **`uname -a`** command and check that the SunOS version is 5.5.1 or 5.6.
- Enter **`et1516`** in the **ELAN Name** field.
- From the `\fvtop` directory, change the current directory to `\fvtop\install`, and run the **`fvovlink`** script.
- You can also display information for a specific domain by entering the following:

```
myswitch::display atmroute> ptab [<domainid> [<prefix> [<plen>]]]
myswitch::display atmroute> ptab 1
```

Menu items are shown in regular typeface, with > characters specifying submenus. For example:

- Select File>New>Shortcut.
- Select VLAN>Configure>Devices.

Important Information Indicators

To call your attention to safety and otherwise important information that must be reviewed to insure correct and complete installation, as well as to avoid damage to the Marconi adapter or your system, Marconi utilizes the following *WARNING/CAUTION/NOTE* indicators.

WARNING statements contain information that is critical to the safety of the operator and/or the system. Do not proceed beyond a *WARNING* statement until the indicated conditions are fully understood or met. This information could prevent serious injury to the operator and damage to the Marconi adapter, the system, or currently loaded software, and will be indicated as:

WARNING!

Hazardous voltages are present. To lessen the risk of electrical shock and danger to personal health, follow the instructions carefully.

Information contained in CAUTION statements is important for proper installation/operation. Compliance with CAUTION statements can prevent possible equipment damage and/or loss of data and will be indicated as:

CAUTION

You risk damaging your equipment and/or software if you do not follow these instructions.

Information contained in NOTE statements has been found important enough to be called to the special attention of the operator and will be set off from the text as follows:

NOTE

Steps 1, 3, and 5 are similar to the installation for the computer type above. Review the previous installation procedure before installation in your particular model.

Safety Agency Compliance

This preface provides safety precautions to follow when installing a Marconi product.

Safety Precautions

For your protection, observe the following safety precaution when setting up your equipment:

 • Follow all warnings and instructions marked on the equipment.

Symbols

The following symbols appear in this book.

CAUTION

If instructions are not followed, there is a risk of damage to the equipment.

WARNING!

Hazardous voltages are present. If the instructions are not heeded, there is a risk of electrical shock and danger to personal health.

Modifications to Equipment

Do not make mechanical or electrical modifications to the equipment. Marconi is not responsible for regulatory compliance of a modified Marconi product.

CHAPTER 1   Introduction

This chapter provides an overview of the following Marconi adapters:

- HE 155 and 622 Mbps adapter for the PCI bus
- LE 25 and 155 Mbps adapters for the PCI bus (also referred to as the LE adapters)
- PCA-200EPC adapter for the PCI bus (also referred to as the PCA adapter)

Hardware and software requirements and the contents of the Marconi adapter packages are also discussed.

1.1   PCA Adapter Overview

The PCA-200EPC adapter, shown in Figure 1.1 is a high-performance, single-slot ATM adapter designed for use on an PCI bus. The PCA adapter features Marconi's Advanced Cell Processing Architecture and provides maximum networking performance to applications running on PC systems. The firmware for the PCA adapter can be downloaded, allowing convenient upgrades to support evolving signalling and AAL standards. In addition, the PCA adapter provides transparent support for various networking protocols, Switched Virtual Circuits (SVCs) through the UNI 3.0/3.1 protocol, and Permanent Virtual Circuits (PVCs).
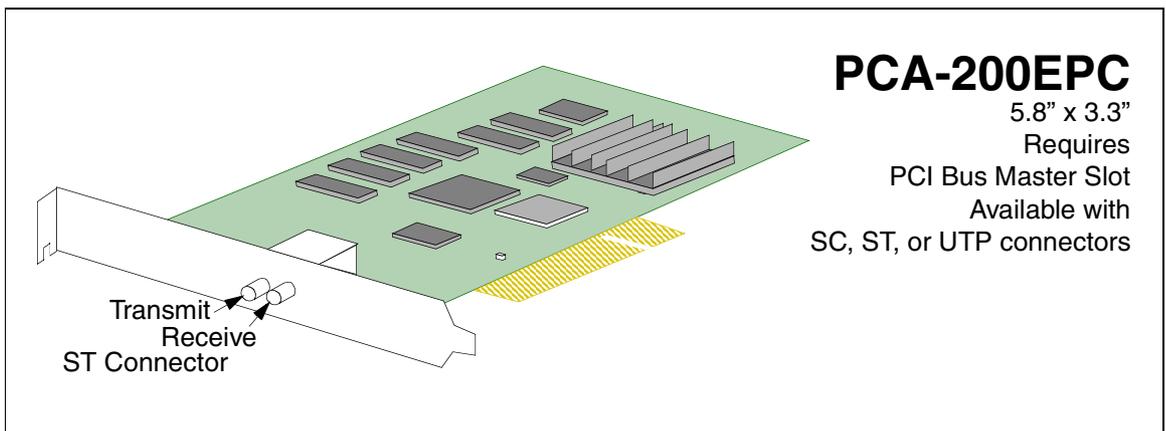
Figure 1.1 - PCA Adapter

1.1.1   Hardware Overview

The Advanced Cell Processing Architecture featured in the PCA adapter uses a dedicated embedded Intel i960 RISC processor, along with special-purpose AAL 5 and 3/4 Segmentation and Reassembly (SAR) hardware, and fly-by, scatter-gather DMA. The adapter provides PCI bus master burst transfers. The adapter enables users to add ATM networking capabilities to their applications leaving the low-level ATM cell processing, segmentation and reassembly, and signalling to the adapter hardware and device driver.

1.2   LE Adapter Overview

The LE 25 and 155 adapters (shown in Figure 1.2) are high-performance, single-slot ATM adapters. They use a 32-bit, 33 MHz PCI-bus architecture with integrated SAR and PCI-bus mastering capabilities. Using single-sided SMT technology, the adapter consists of three basic elements, the SAR+PCI bus interface, the physical media chip, and the physical media interface.

The same Marconi ATM driver is used for either version of the LE adapter.

LE 155 Mbps
5.8" x 3.3"
Requires
PCI Bus Master Slot
Available with
SC or UTP connectors

SC Connector
(available in UTP also)

LE 25 Mbps
4.7" x 3.3"
Requires
PCI Bus Master Slot
Available with
UTP connectors only

UTP Connector
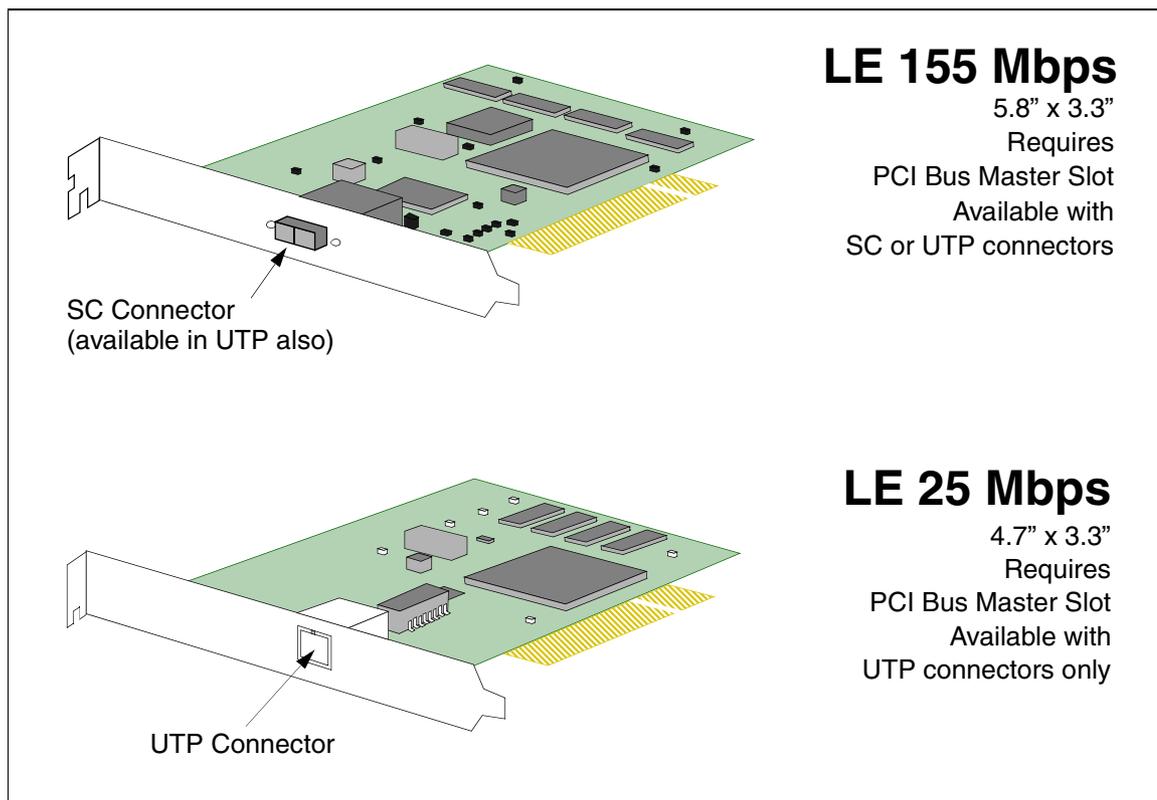
Figure 1.2 - LE Adapters

1.3 HE Adapter Overview

The HE 155 and 622 adapters are high performance adapters designed for use in servers and high-performance workstations with a PCI bus. Each adapter features Marconi's Advanced Cell Processing architecture, providing maximum network performance to all running applications. In addition, the HE adapter provides transparent support for TCP/IP, Switched Virtual Circuits (SVCs) through the UNI 3.0 or 3.1 signalling protocols, Permanent Virtual Circuits (PVCs), LAN emulation, Multi-Protocol Over ATM, an ATM Applications Programmer Interface (API), and an SNMP agent for network management.

The HE 622 supports high-quality image, full-motion video, CD-quality audio, and high speed data communications over a single ATM network connection. Each physical connection in an ATM LAN is a point-to-point link between switches and/or hosts.

1.3.1 Hardware Overview

The HE adapter features Marconi's Advanced Cell Processing Architecture which utilizes a dedicated embedded Intel i960 RISC processor along with special-purpose AAL5 and 3/4 Segmentation and Reassembly (SAR) hardware and scatter-gather DMA. With the HE adapter, users can add ATM networking capabilities to their applications, leaving the low-level ATM cell processing, segmentation and reassembly, and signalling to the adapter's hardware and device driver.

HE 155 Mbps
5.8" x 3.3"
Requires
PCI Bus Master Slot
Available with
UTP or SC connectors
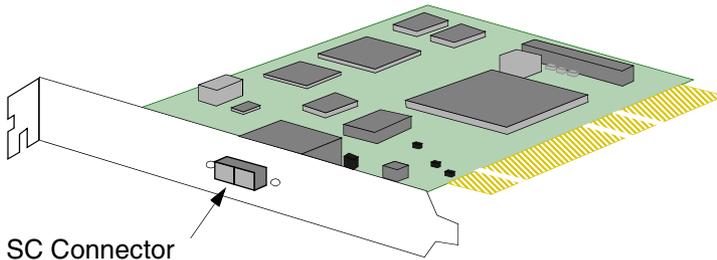
SC Connector

HE 622 Mbps
5.8" x 3.3"
Requires
PCI Bus Master Slot
Available with
UTP or SC connector

SC Connector

Introduction
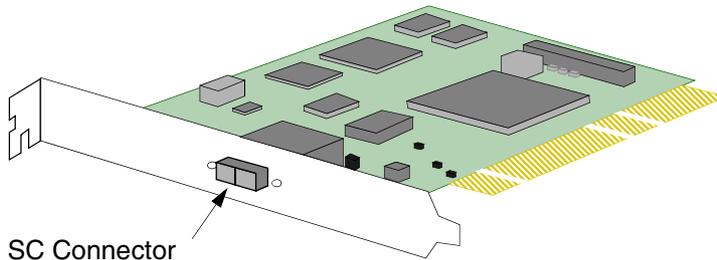
Figure 1.3 - HE Adapters

1.4   Supported Platforms and Operating Systems

Supported operating systems and hardware platforms for the Marconi PC adapters are shown in Table 1.1.

Table 1.1 - PCA, LE, and HE Requirements

Adapter	Supported Operating Systems	Supported Hardware Platforms	Bus Slot	Minimum RAM
LE	Microsoft Windows NT, Version 4.0 Microsoft Windows 95/98/2000	Intel 386, 486, Pentium	PCI 2.0/2.1 Bus Master	16M
PCA-200EPC	Microsoft Windows NT, Version 4.0 Microsoft Windows 95/98 Novell NetWare 4.11 Novell NetWare 5.0			
HE	Microsoft Windows NT, Version 4.0 Novell NetWare 4.11 Novell NetWare 5.0		PCI 2.1 Bus Master	64M

NOTE You cannot install a PCA-200EPC and a LE or HE adapter in the same PC.

1.5   Software Overview

The Marconi adapters use Marconi's market-proven support for various network protocols, allowing existing applications to operate with no modifications. Major advantages include high-performance network throughput delivered to applications and the flexibility for future upgrades.

The software drivers are based on the ATM Forum UNI 3.0 and 3.1 specification. In addition, the Emulated LAN driver is compliant with the ATM Forum document *LAN Emulation Over ATM, Version 1.0*. This driver also runs a Multi-Protocol Client for use in a network using Multi-Protocol Over ATM. The Classical IP Over ATM driver, available for Windows 95/98 and Windows NT, is compliant with RFC 1577. The software is provided on CD or by download from Marconi's TACTics Online web site.
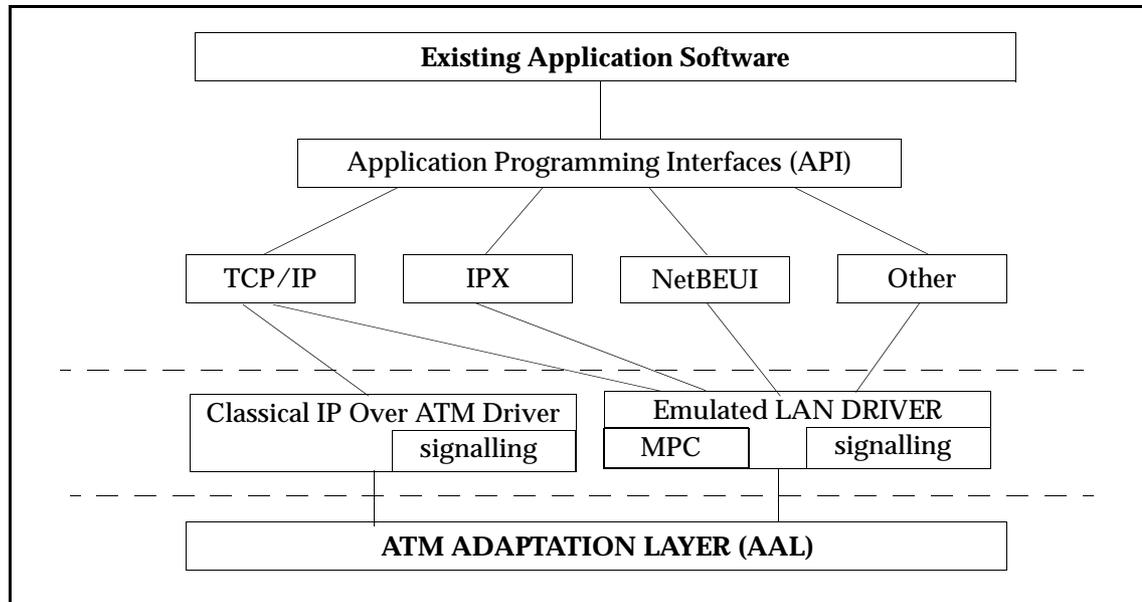
Figure 1.4 - Software Architecture

1.6   Winsock2 Service Provider Interface

The Marconi Windows NT and Windows 95/98 drivers support the Marconi ATM Service Provider, a protocol stack that complies with the Windows Sockets 2 (WinSock2) Service Provider Interface (SPI) specification. WinSock2 allows an application to use the familiar socket interface to achieve simultaneous access to any number of installed transport protocols, including ATM. The Marconi ATM Service Provider can be used for native ATM applications developed in WinSock 2.

1.7   SNMP Agent Support (Windows NT Only)

The Marconi Windows NT driver supports an SNMP agent. This agent will respond to READ requests by an SNMP network management system. The agent supports the following Marconi MIB files:

- `fore-adapter.mib`
- `fore-sonet.mib`
- `fore-lane.mib`

To use the SNMP agent you must first install Windows NT SNMP Service for Windows.

1.8   Load-Balancing and Failover (Windows NT Only)

The Marconi Windows NT driver supports load-balancing and failover (LB/FO), allowing multiple adapters installed in a single host to share the outgoing network traffic and provide redundancy in the event of a failure in an adapter.

With this option enabled, the driver configures all adapters in the host that have LB/FO enabled to balance the outgoing network traffic among them, and, in the event of the failure of an adapter, failover all network traffic to the remaining adapters.

Note the following restrictions when enabling LB/FO:

- All adapters in the host with LB/FO enabled must be on the same physical ATM network.
- All adapters in the host with LB/FO enabled should be configured to use the same UNI version.
- All adapters in the host with LB/FO enabled should be of the same speed. For example, all LE 155 adapters rather than a mix of LE 155s and LE 25s.

1.9   Fiber-Optic Cable Specifications

The HE, PCA, and LE 155 Mbps adapters are available with fiber-optic connectors. Table 1.2 lists the recommended cable specifications to ensure optimal adapter and switch performance. These specifications do not apply to the LE 25 Mbps adapters, which do not support fiber optic connectors.

Table 1.2 - Fiber-Optic Cable Specifications

Description	Specification for Multi-Mode Products
Core Diameter	62.5 µm
Fiber Diameter	125 µm
Wavelength	1310 nm
Loss Characteristic	~0.5 dB/km
Connector Style	SC or ST
Power Budget	11 dB[1]
Approximate Distance	2 km
Transmit Power	-19 dBm (minimum)
Receive Power	-30 dBm (minimum)

[1.] If a 50 mm core fiber is used, the power budget is derated by 4 dB.

1.10 UTP Specifications

The LE and PCA adapters are available with RJ-45 connectors for use with UTP category 5 cable. The UTP cable specifications are shown in Table 1.3.

Table 1.3 - UTP Category Cable Specifications

Description	Value
AWG	24
Impedance (Ω)	100 ±15%
Attenuation (dB/1000 ft. Max)	25 dB @ 16 mHz
	52 dB @ 62.5 mHz
	67 dB @ 100 mHz
Maximum Run	100 m[1]
Connector Style	RJ-45

[1.] Within the 100 meter run, a maximum of two connections is permissible.

The pinouts for the RJ-45 connector on a LE or PCA adapter are shown in Table 1.4.

Table 1.4 - RJ-45 Connector Pinouts

Pin Number	Transmit/Receive
1	Transmit (+)
2	Transmit (-)
3 - 6	Not Used
7	Receive (+)
8	Receive (-)

1.11 Single-Mode Fiber Specifications

The PCA-200EPC and HE adapters are available with single-mode fiber (SMF) connectors. Table 1.5 and Table 1.6 provide the specifications of the transmitter and receiver optical interfaces on the supported hardware. Table 1.7 provides interconnecting link specifications.

Table 1.5 - SMF Transmitter Interface Specifications

Transmitter Optical Interface Specifications	
Wavelength	1261 - 1360 nm
Spectral Width	7.7 nm rms (maximum)
Mean Launch Power	-15 to -8 dBm
Extinction Ratio	8.2 dB (minimum)

Table 1.6 - SMF Receiver Interface Specifications

Receiver Optical Interface Specifications	
Sensitivity	-28 dBm (minimum)
Overload	-8 dBm (minimum)
Optical path power penalty	1 dB

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Table 1.7 - Interconnecting Link Specifications

Interconnecting Link Specifications	
Connector Type	Duplex SC
Fiber Specification	Per CCITT recommendation G.652, also known as EIA Class IVa
Mode Field Diameter	9 - 10 micrometers
Fiber Cladding Diameter	125 micrometers
Fiber Loss Characteristics	1.0 dB/km (typical)
Power Budget	12 dB
Maximum Link Length (@1.0 dB/km)	10 km (includes 2 dB connector loss)

1.12 Unpacking Information

When you receive the adapter, inspect the package for any shipping damage. If the package shows any signs of external damage and/or rough handling, notify your carrier's representative.

When unpacking the adapter package, be sure to keep all original packing materials. They may be needed for storing, transporting, or return of the product.

CAUTION

All products returned to Marconi, under warranty, must be packed in their original packing materials.

Verify the package contents against your shipping list. If any items are missing or damaged, please contact Marconi's Technical Assistance Center immediately.

Keep the adapter in its anti-static protective bag until installation. Electronic components are subject to damage from even small amounts of static discharge. Be sure to use an anti-static grounding strap and properly ground the equipment when installing the adapter.

CAUTION

To avoid equipment damage due to electrostatic discharge, use an anti-static grounding strap when handling this, or any other electronic components. Handle the adapter only by the edges, avoiding all components and metal parts.

Introduction

CHAPTER 2   Overview of ATM and Supported Standards

This chapter provides an overview of the ATM Standard, the LAN Emulation Over ATM Standard, the Multi-Protocol Over ATM standard, and Classical IP.

2.1 Overview of the ATM Standard

Asynchronous Transfer Mode, or ATM, is a communication architecture based on the switching of small fixed length packets of data called *cells*. In ATM, all data is transferred in 53-byte cells. Each cell has a 5-byte header that identifies the cell's route through the network and 48-bytes containing user data. This user data, in turn, carries any headers or trailers required by higher level protocols.

Perhaps the single most important advantage offered by ATM, in addition to data transfer speed, is its open-ended growth path. ATM is not locked into a single physical medium or speed. The fixed-size ATM cell allows traffic from multiple sources (simultaneous video, audio, and data communication) to be switched to multiple destinations by fast ATM switches. For example, an ASX-1000 ATM Switch can connect up to 96 users and has an aggregate capacity of 10 gigabits per second. Larger LANs can be built by interconnecting multiple ATM switches.

2.2 LANE and MPOA

Marconi's *ForeThought* 5.0 software is compliant with the ATM Forum's *LAN Emulation Over ATM Version 1.0* and the *Multi-Protocol Over ATM* specification. LAN Emulation (LANE) allows higher level protocols and LAN applications to interoperate, without modifications, with an ATM network. Multi-Protocol Over ATM (MPOA) facilitates traffic between emulated LANs to avoid the significant transmission delays imposed by routers.

The LANE components, running on the ATM network, interact to emulate an Ethernet or Token Ring LAN. This emulated Ethernet or Token Ring LAN is called an *emulated LAN* (ELAN). The ELAN components resolve MAC addresses to ATM addresses, replace the connectionless operation of legacy LANs with point-to-point connections, and provide broadcast and multicast services. The ELAN consists of a LANE/MPOA Client (LEC/MPC) running on each host in the ELAN, and the following LANE Services:

- The LAN Emulation Server (LES) and the Broadcast and Unknown Server (BUS). In *ForeThought* 5.0 and later releases, the LES and BUS are co-located on the same device.
- The LAN Emulation Configuration Server (LECS).

In *ForeThought* 5.0 and later releases, the LANE services may operate on a Marconi switch, *PowerHub* 7000, or Solaris workstation. *ForeThought* 5.0 introduced support for Distributed LAN Emulation (DLE) which provides load-sharing and improved fault-tolerance within an ELAN. In DLE, multiple LES-BUS pairs serve the ELAN.

LANE also is the foundation on which MPOA is built.

2.3   Overview of LANE

LAN Emulation (LANE) is the foundation on which Multi-Protocol Over ATM (MPOA) is built. Therefore, before presenting an explanation of MPOA, an understanding of LANE components and their operation in an emulated LAN (ELAN) is needed.

2.3.1   LANE Components

An ELAN includes the following components:

LANE/MPOA Client (LEC/MPC)	The LEC/MPC performs two different tasks, depending on the destination and source of the traffic:

• When acting as an LEC it simply communicates with other ELAN components (the LES and BUS) to resolve MAC addresses into ATM addresses.

• When acting as an MPC it sources and sinks internetwork shortcuts.

LAN Emulation Configuration Server (LECS)	Runs on a Solaris workstation or a Marconi switch. Maintains information about all ELANs within the administrative domain. When the LEC/MPC successfully communicates with the LECS, the LECS provides a list of ELANs which the LEC/MPC can join. The LECS may be MPOA-aware (*ForeThought* 5.0 or greater) or MPOA-ignorant (*ForeThought* 4.x). A *ForeThought* 5.0 or greater LECS can be configured with various MPOA parameters.

• LEC/MPCs that connect to LANE/MPOA services through an MPOA-aware LECS are configured with these centrally-supplied MPOA parameters.

• LEC/MPCs that connect through an MPOA-ignorant LECS do not receive centrally supplied MPOA parameters, but still perform flow analysis and attempt inter-ELAN shortcuts according to their user-editable or factory-default settings.

LAN Emulation Server (LES)	Runs on a *PowerHub* 7000, a Marconi ATM switch, or a Solaris workstation. Maintains information about the LEC/MPCs within a single ELAN and performs address resolution. The LES can be configured to support or disable MPOA operation in an ELAN. The LES accepts MPOA parameters from registering LEC/MPCs and MPSs, and also distributes MPOA parameters to LEC/MPCs in response to queries. (This is the mechanism used by LEC/MPCs to determine whether routers in the ELAN are MPOA-aware).
Broadcast and Unknown Server (BUS)	Runs on a *PowerHub* 7000, a Marconi ATM switch, or a Solaris workstation. Provides services within a single ELAN allowing broadcasts, multicast, and unknown unicasts. The BUS is MPOA-ignorant.

2.3.2   An Example LANE Configuration

Figure 2.1 shows an example configuration of a single ELAN in a Marconi network. The ELAN includes:

- PC Workstations, each running a LEC/MPC. Each has a Marconi ATM adapter, the Marconi driver for the adapter, and one or more Marconi ELAN drivers installed.

- Two Marconi ASX-200BX switches running LESs, BUSs, and LEC/MPCs. Each switch is also running an LECS. The LES/BUS pairs are configured as *peers* under DLE. The peer configuration allows the LEC/MPCs associated with a particular LES/BUS automatically to reconnect to the remaining functional peer if their "home" LES/BUS fails.

- A *Powerhub* 7000 running a LEC/MPC, and providing access to non-ATM networks.
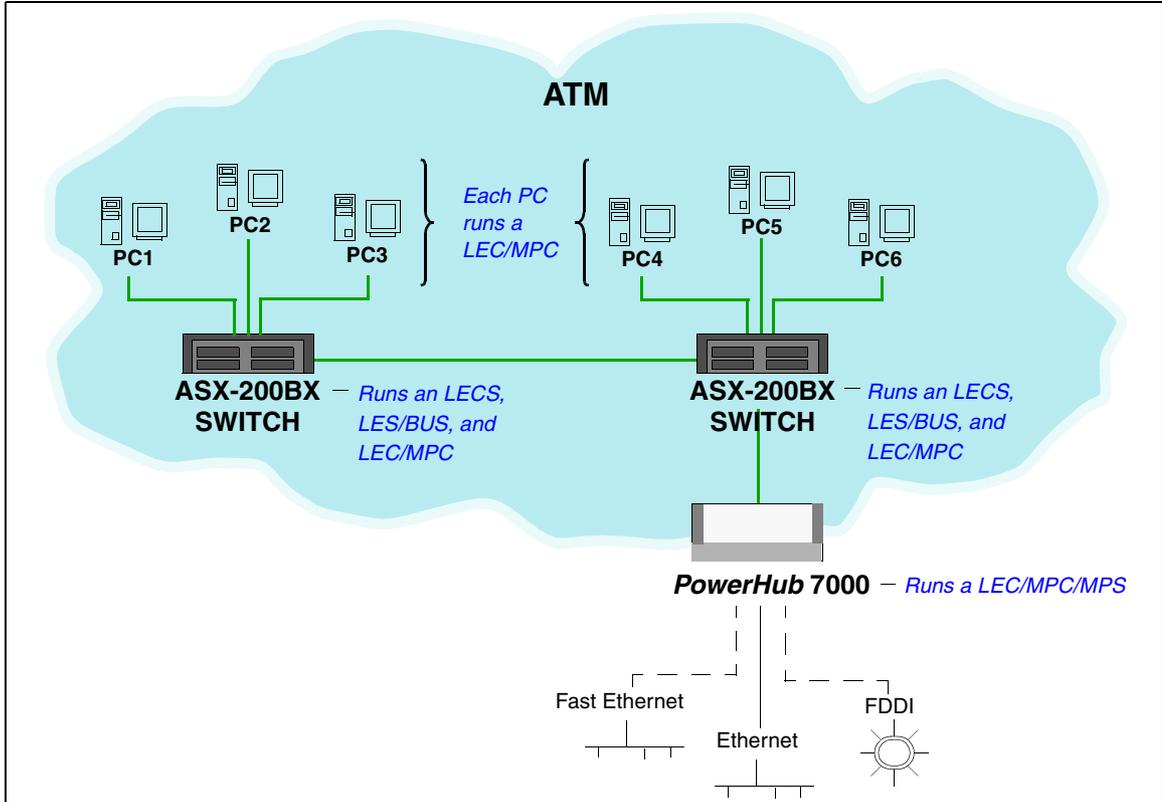
Figure 2.1 - An Example of an ELAN

2.3.2.1   The Initialization Process

Each LEC/MPC goes through the following process when it starts up:

1. The LEC/MPC obtains its own ATM address via address registration. Optionally, you can manually specify the ATM address.

2. The LEC/MPC establishes a connection to a LECS using a well-known address, the Permanent Virtual Circuit (0,17), or via ILMI. Optionally, you can manually specify the address of the LECS.

3. The LEC/MPC requests the information necessary to join a specified ELAN or the default ELAN. The LECS has information about available ELANs, what ELANs each LEC/MPC can join, which peer server in a DLE ELAN that each LEC/MPC should join, and which ELAN the LEC/MPC should attempt to join first.

   If a LECS is not available, or if you choose not to use it, you can manually specify the information required to join a specific ELAN.

4. The LEC/MPC contacts the LES associated with the ELAN it wants to join and registers its MAC-ATM address pair. It also contacts the BUS associated with the ELAN. At this point, the LEC/MPC and the LES have the information required to allow this host to communicate with other hosts on the ELAN as if it were an Ethernet (or Token-Ring) network. Refer to the following section for a description of how the LEC/MPC connects to other hosts on the ELAN.

2.3.2.2 The Connection Process

To send packets to another host on the ELAN:

1. The LEC/MPC calls the LES to map the MAC destination address into an ATM address. (The LES maintains a mapping table of the address of all LEC/MPCs on the ELAN.)

2. If the LES finds an entry in its table for the destination MAC address, it returns the destination ATM address to the LEC/MPC.

3. The LEC/MPC then opens up a point-to-point ATM connection to the destination host to send the packet.

2.3.2.3 Multicast and Broadcast Packets

The LEC/MPC sends outgoing multicast and broadcast packets to the BUS which uses a point-to-multipoint connection to send the packets to multiple ATM addresses in the ELAN.

2.3.2.4 Accessing Fast Ethernet and FDDI Networks

Note that the diagram in Figure 2.1 shows dotted lines from the *PowerHub* 7000 to the Fast Ethernet and FDDI networks. This is because the *PowerHub* does not use bridging to reach these networks but must route to them.

2.3.2.5 Intelligent BUS

This feature reduces broadcast traffic by using the MAC address information in the LES. When an intelligent BUS receives a unicast frame, the BUS first checks the LES's mapping table to see if the MAC address is registered there. If it is, the BUS routes the frame directly to the destination, instead of broadcasting.

2.3.2.6   Multiple ELANs

It is possible to set up more than one ELAN in a Marconi network. For each new ELAN, you must configure another LES and BUS instance for that LAN. On the access devices, bridge groups must be used to associate physical Ethernet ports with ELANs on the ATM side.

An end station with a Marconi adapter can connect to a number of ELANs simultaneously:

- If running Windows NT or NetWare, the end station can connect to a maximum of 16 ELANs simultaneously. (If you are also using IP Over ATM drivers, you can install a combined total of 16 ELAN and IP Over ATM connections).

- If running Windows 95, the end station can connect to a maximum of 4 ELANs simultaneously.

2.3.2.7   Distributed LAN Emulation

To ensure that a single LES/BUS failure does not disable an entire ELAN, *ForeThought* 5.0 introduced Distributed LAN Emulation (DLE). DLE allows the LES/BUS functions to be distributed among multiple interconnected LES/BUS instances called *peers*. In the example ELAN shown in Figure 2.1, the two LES/BUS pairs running in the switches function as peers in the same ELAN. The LEC/MPCs are distributed such that they are not all connected to the same server. With this arrangement, should one of the peer servers fail, the clients connected to the remaining server continue to maintain connectivity; while the clients that were connected to the failed server automatically reestablish connectivity to the ELAN within 60 seconds.

2.3.2.8   Automatic ELAN Selection

To simplify configuration of the ELAN, *ForeThought* 5.0 and later releases allow a host to join an ELAN without specifying an ELAN name. If the LECS has been configured to provide the required information, and you do not manually specify an ELAN name to join when you configure the ELAN driver, the host initially attempts to join the ELAN specified by the LECS.The host successfully joins the ELAN if the LECS is available, the proper LES address for the ELAN has been specified in the LECS, and the LES and BUS are available.

2.3.2.9   ILMI LECS Discovery

The *ForeThought* PC drivers support discovery of the LECS address via ILMI.

- If a LECS address has been manually specified, it will try that address. If that address fails, it will try PVC (0,17).

- If a LECS address has not been manually configured, the driver will first attempt to retrieve the LECS address via ILMI, then attempt the LECS well-known address, and then try PVC (0,17).

2.4   Overview of MPOA

MPOA adds functionality to LAN Emulation (LANE) to avoid the significant transmission delays imposed by routers in a LANE network. It does this by performing flow analysis on routed traffic and, when appropriate, creating a direct ATM connection (called a shortcut) for the traffic, eliminating the routed connection. For non-routed traffic within the ELAN, connections are established as they are in a non-MPOA LANE environment.

An MPOA network includes all the components of a LANE network, with the addition of:

- LAN Emulation/Multi-Protocol Clients (LEC/MPCs) running on each endstation.
- Multi-Protocol Server (MPS) running on a PowerHub in the network.

The MPCs communicate with the MPS to replace routed paths in the network with shortcuts, avoiding routers.

2.4.1   LANE Without MPOA

ATM networks co-exist with and support network applications which may not be ATM-aware. Consequently, ATM protocols are needed to monitor network protocol (IP, IPX, Appletalk, etc.) packets and perform translation into ATM cells and circuits. This monitoring and translation can be performed in one of the following ways:

- In a host protocol stack *after* packet construction and *before* packet transmission
- In a LAN-to-ATM edge device *as* packets move through the network

LANE is the standard protocol for performing this translation. It resolves datalink layer addresses into ATM addresses and establishes circuits to the destination addresses. Network addresses *within* a subnet can be learned by distributing network address queries using LANE's broadcast support, the BUS.

However, LANE relies on routers to deliver packets *across* subnets (see Figure 2.2). At *every* router, the router must perform the following tasks on the traffic:

1. Reassembles packets from ATM cells
2. Modifies the packets with routing information
3. Re-segments the packets for transmission to the next hop.

This process imposes significant transmission delays between the source and destination of the network traffic.
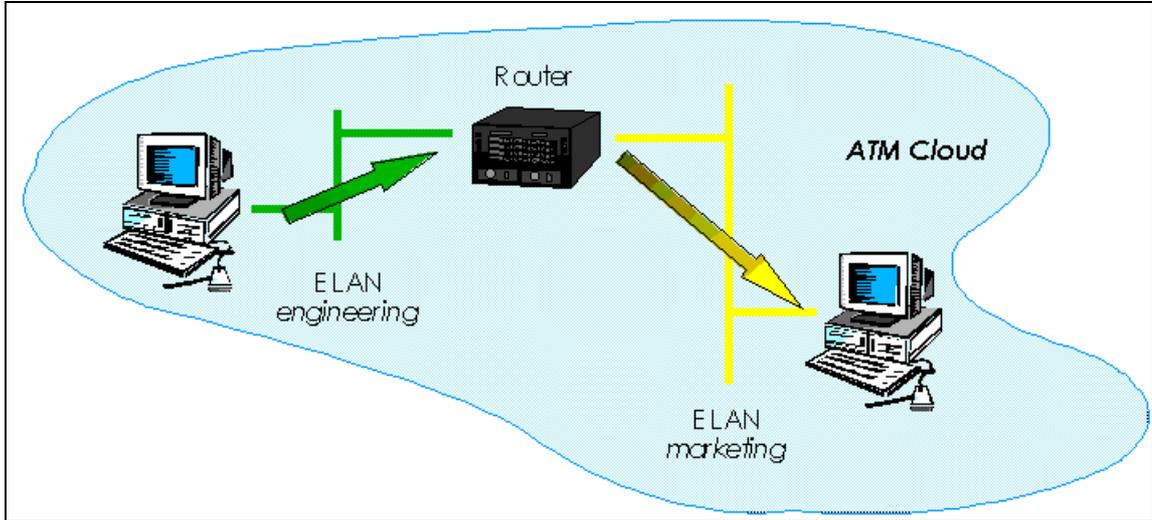
Figure 2.2 - LANE Without MPOA

2.4.2   Next Hop Resolution Protocol (NHRP)

LANE controls communication among clients in the *same* broadcast domain. Different protocols are used *between* domains. (A broadcast domain corresponds roughly to a network subnet or ELAN). In particular, IP routers in ATM networks can communicate with each other using the IETF Internetworking Over NBMA Networks (ION) Working Group's *Next Hop Resolution Protocol* (NHRP). NHRP allows the ATM network to be divided into Logical IP Subnets (LISs). Using NHRP, routers are still required to interconnect these subnets; but NHRP permits intermediate routers to be bypassed on the *data* path. NHRP allows entities called Next Hop Clients (NHCs) to send queries between different subnets. These queries are propagated using Next Hop Servers (NHSs) via paths found using standard routing protocols. Consequently, NHRP enables the establishment of VCC data paths across subnet boundaries *without requiring physical routers in the data path.*

2.4.3   MPOA Integrates LANE and NHRP

The ATM Forum developed the Multi-Protocol over ATM (MPOA) specification to integrate the intra-ELAN communications that LANE supports, with the cross-subnet communications that routers and NHRP support. By integrating these two protocols, MPOA provides faster, more predictable cross-subnet connections.

MPOA introduces LANE/MPOA Clients (LEC/MPCs) and MPOA Servers (MPSs) and defines the protocols that are required for LEC/MPCs and MPSs to communicate. LEC/MPCs issue queries for ATM addresses, and receive replies from the MPS using these protocols. MPOA also maintains interoperability with the existing infrastructure of routers. MPOA Servers reside in routers that run standard Internetwork Layer routing protocols such as OSPF, thus providing integration with existing networks.

2.4.3.1 MPOA Shortcuts

ForeThought 5.0 and later releases implement MPOA shortcuts for IP traffic, shown in Figure 2.3. (Other protocols, such as IPX, are supported by the MPOA clients and servers, but traffic using these protocols continues to use the traditional routed path.) It does this by *adding* capabilities to LANE, *not* by replacing LANE. LANE/MPOA client drivers are extended LANE drivers. When handling traffic within the *same* ELAN and subnet, they function like LECs. However, when handling traffic that *crosses* subnets, LEC/MPCs initially work with MPOA servers (MPSs) to use MPS-established hop-by-hop circuits. Then, for traffic flows that exceed configurable limits, shortcut circuits are built to and from the destination that allow the traffic to bypass the normal path through the router, and avoid the router's processing delays.

Consequently, traffic flowing through an MPOA shortcut moves at essentially wire speed from source to destination (see Figure 2.3). Furthermore, because the *shortcut* circuits are re-directing their traffic from the routed path, other traffic that still uses the routers experience less congestion and delay.
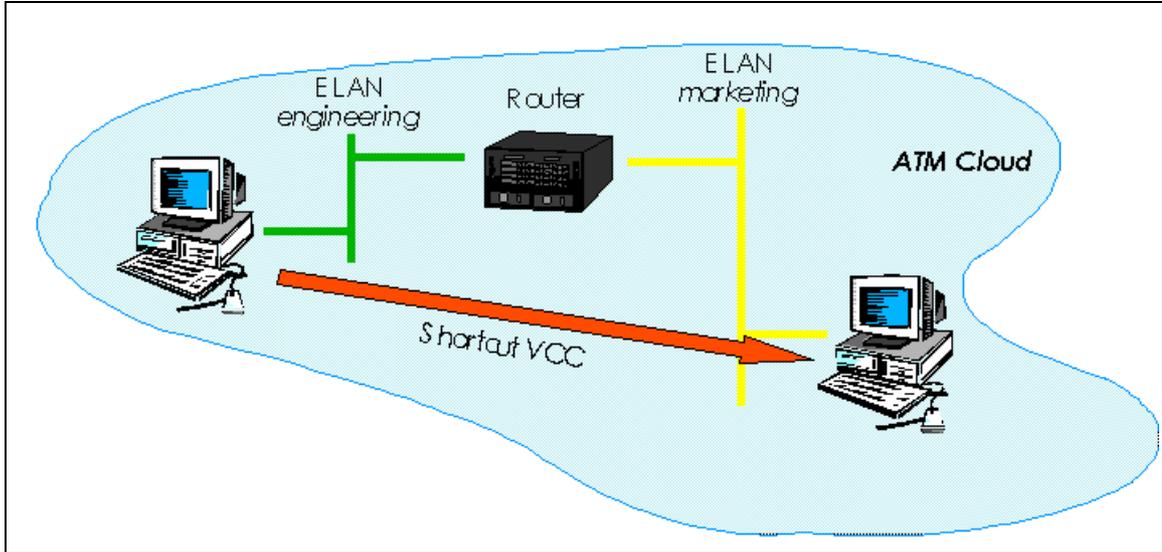
Figure 2.3 - LANE With MPOA

2.4.4   MPOA Components

MPOA requires LANE services for both ELAN traffic handling and MPOA configuration. In addition to the LANE components of LECS, LES, and BUS, an MPOA network includes an extended LEC, referred to as a LEC∕MPC, and a Multi-Protocol Server (MPS).

2.4.4.1   LANE/MPOA Client (LEC/MPC)

The LEC∕MPC has two functions, depending on the traffic it is handling:

For traffic within the ELAN	The LEC∕MPC acts as a LEC and simply communicates with other ELAN components (the LES and BUS) to resolve MAC addresses into ATM addresses.
For traffic outside the ELAN (i.e. routed traffic)	The LEC∕MPC acts as an MPC, communicating with the MPS to be a source of and destination of MPOA shortcuts. A LEC∕MPC that is the source of a shortcut is known as an *ingress* LEC∕MPC. A LEC∕MPC that is the destination of a shortcut is known as an *egress* LEC∕MPC. The LEC∕MPC includes an NHRP Client (NHC).

An ingress LEC/MPC monitors traffic flow that is being forwarded over an ELAN to a router that contains an MPS. When the ingress LEC/MPC recognizes a flow rate that could benefit from a shortcut (and thus bypass the routed path), it asks the MPS for the ATM address of the destination. If the MPS provides the destination ATM address, the ingress LEC/MPC sets up a shortcut VCC, and forwards traffic for the destination over the shortcut. You can configure the flow rates which trigger the shortcut creation.

An egress LEC/MPC receives internetwork traffic from other LEC/MPCs to be forwarded to its local interfaces/users. For traffic received over a shortcut, the egress LEC/MPC encapsulates the packets as if they had been received via the routed path, and forwards them via a LAN interface (that may be a bridge or switch port, an internal host stack, etc.).

2.4.4.2 MPOA Server (MPS)

An MPS includes an NHRP Server (NHS) and is the logical component of a router that provides internetwork layer forwarding information to LEC/MPCs. The MPS answers MPOA queries from ingress LEC/MPCs and provides encapsulation information to egress LEC/MPCs.

The MPS runs on a PowerHub.

2.4.5   MPOA Example

The following are the basic requirements for establishing a shortcut across an MPOA-enabled network:

- The traffic flow must consist of IP traffic.
- There must be LEC/MPCs at each end of the network between which a shortcut is desired.
- The local router interface at each end must be running an MPS.
- A Next Hop Resolution Protocol (NHRP) path must exist between MPSs.

The following example illustrates a typical ATM network that allows MPOA shortcuts to be employed.
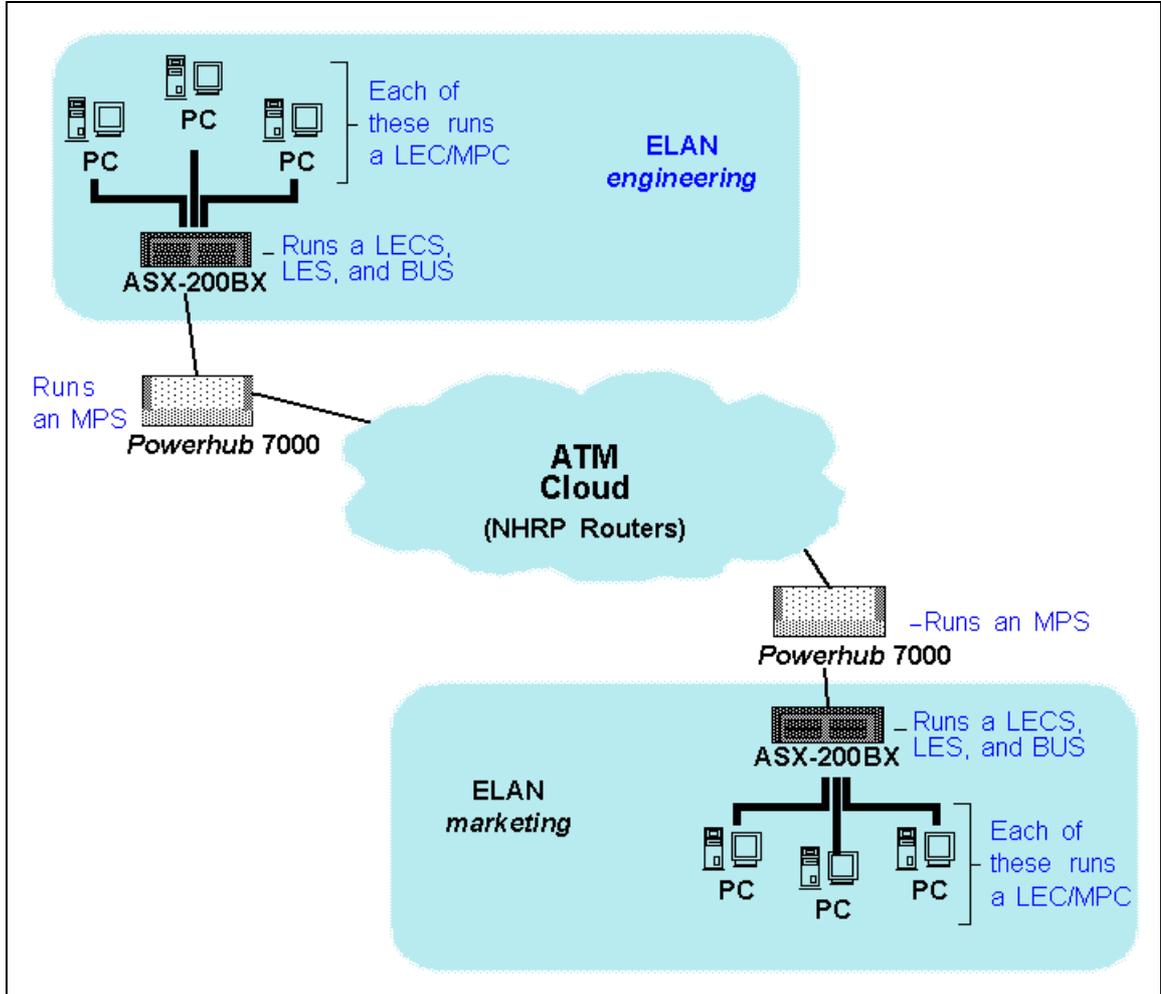
Figure 2.4 - MPOA Example Network

2.4.5.1 MPS Configuration

As with any other router, the network administrator must configure each MPS with the site-specific IP address matching the gateway address being used by LEC/MPCs in its ELAN.

The MPS on each *PowerHub* 7000 is configured as follows:

1. For each LANE/MPOA virtual port, specify an ELAN name. The LECS configuration must also be updated to allow the MPS to join these ELANs.

2. For each LANE/MPOA virtual port, specify an IP address.

3. Enable LANE/MPOA support.

4. Enable routing.

5. Save the configuration and reboot the MPS if necessary to make the changes effective

Router table information need not be configured. The MPS will instead gather this information through routing protocol exchanges with other MPSs.

2.4.5.2 LEC/MPC Initialization

When its host boots, *each* LEC/MPC automatically goes through the following sequence to establish a connection to the MPS.

1. The host registers via ILMI with the switch to which it is attached in order to learn its ATM address.

2. The LEC/MPC connects to an LECS to which it sends its own ATM address and the name of the ELAN it wishes to join (the ELAN name is an empty string unless the LEC/MPC has been site-configured with an ELAN name). The LEC/MPC also supplies a LANE 1.0 compliant parameter identifying itself as an MPOA-aware client.

3. Next, the LEC/MPC receives the following from the LECS:

   - The name of the ELAN to which it is assigned.

   - The ATM address of the LES for the ELAN it is joining.

   - If the LECS is MPOA-aware and has been configured with them, the parameters containing the flow detection and shortcut establishment policies it is to use.

4. The LEC/MPC then connects to its assigned LES, and provides the LES with a parameter identifying itself as MPOA-aware.

5. Finally, the LEC/MPC connects to the ELAN's BUS.

Once these connections are established, third-party network-layer protocol drivers on the host can establish network-layer connectivity. The methods these upper-layer drivers use to determine host IP addresses, default gateway, and backup gateway addresses vary depending on the third-party product. For example, the LANE/MPOA driver itself permits these drivers to use BOOTP or DHCP to obtain IP configuration information.

2.4.5.3 Flow Analysis

On a LEC/MPC's host or edge device, IP packets with destinations *within* the host's subnet are sent using LANE 1.0 methods; i.e., the client acts as an LEC and works directly with its ELAN's services to connect with local destinations. Packets destined for *remote* subnets cause the LEC/MPC to act as an MPC. This client is then referred to as an "ingress LEC/MPC".

Ingress LEC/MPCs associate destination IP addresses with shortcut circuits. Ingress LEC/MPCs use configurable parameters called *flow descriptors* to determine *whether* and *when* to trigger creation of shortcut circuits. The ingress LEC/MPC also monitors the most recent use of a shortcut circuit to determine when to tear down the shortcut. Specifically, when an ingress LEC/MPC sends a packet:

1. If a shortcut circuit *already exists* to the IP destination, the LEC/MPC sends the packet over this circuit.

2. If no shortcut circuit exists, the LEC/MPC determines *whether* shortcuts to this IP address are allowed. If shortcuts to the destination IP address are *not* allowed, the LEC/MPC sends the packet to the gateway router.

3. If no shortcut circuits exist, *and* shortcuts to the IP address *are* allowed, the LEC/MPC determines if the packet traffic flow exceeds the shortcut enable trigger value (set by the flow descriptors) for the destination IP address's flow.

    -   If the flow exceeds the trigger value, the LEC/MPC tries to establish a shortcut circuit to the destination LEC/MPC (called the egress LEC/MPC).

    -   If the flow does not exceed the trigger value, the ingress LEC/MPC simply sends the packet traffic to the gateway router.

2.4.5.4 Making a Shortcut

When the ingress LEC/MPC determines that the packet traffic flow exceeds the shortcut trigger value, the ingress LEC/MPC tries to establish a shortcut circuit to the egress LEC/MPC. The following describes how a shortcut is set-up:

1. The ingress LEC/MPC initiates the shortcut creation process by sending a request, called a next hop resolution protocol (NHRP) request, to the MPS it uses as a gateway router (this MPS is called the *ingress* MPS). This NHRP request includes the destination's IP address and asks for the corresponding ATM destination address.

2. This request is passed along hop-by-hop until it reaches the final MPS (called the *egress* MPS) on the route to the destination IP address.

3. The egress MPS looks up the ATM address corresponding to the destination IP address, and checks if the device at that address has registered with the local LES as MPOA-capable. If so, it returns the destination ATM address in a NHRP response hop-by-hop to the ingress LEC/MPC.

4. When the ingress LEC/MPC receives the NHRP response containing the destination's ATM address, it first checks if a shortcut circuit to that ATM address already exists. If a shortcut circuit to that address already exists, it sends the packets via the existing shortcut circuit. (For example, this would occur if the ingress MPC was trying to set up a shortcut to a second Ethernet IP station attached to a single PowerHub.) If no shortcut circuit exists it opens a new shortcut circuit and begins sending packets over it to the destination.

2.4.5.5 Shortcut Teardown

Application programs and networking protocol stacks are MPOA-ignorant and therefore do not tear down shortcut circuits when the shortcut is no longer needed. Therefore the MPOA layer itself tears down seldom-used shortcuts to avoid circuit exhaustion in the client and network. When a shortcut is idle for a period exceeding 20 minutes (unless set to a different period by the LECS), the shortcut is torn down.

2.5   Overview of Classical IP (Windows 95/98 and NT)

Marconi's *ForeThought* IP Over ATM driver (available for Windows 95/98 and Windows NT) is compliant with the RFC 1577 specification for Classical IP. The term *classical* indicates that the ATM network has the same properties as existing legacy LANs. That is, even though ATM technology allows for large globally connected networks, for example, it is only used in the LAN environment as a direct replacement of existing LAN technology. The classical model of LANs connected through IP routers is maintained in Classical IP over ATM networks.

Classical IP over ATM is different than IP in legacy LANs in that ATM provides a virtual connection environment through the use of PVCs and/or SVCs. SVC management is performed via UNI 3.0 or 3.1 signalling. UNI is a broadband signalling protocol designed to establish connections dynamically. UNI uses Service Specific Connection Oriented Protocol (SSCOP) as a reliable transport protocol, and all signalling occurs over VPI: 0, VCI: 5. UNI connections are bi-directional, with the same VPI/VCI pair used to transmit and receive. Currently, Marconi supports UNI signalling as defined by the ATM Forum UNI 3.0 or 3.1 specification.

Once a Classical IP connection has been established, IP datagrams are encapsulated using IEEE 802.2 LLC/SNAP and are segmented into ATM cells using ATM Adaptation Layer type 5 (AAL5). In addition, the default Maximum Transmission Unit (MTU) is 9,180 bytes (the SNAP header adds 8 more bytes) with a maximum packet size of 65,535 bytes. There is currently no support for IP broadcast datagrams or IP multicast datagrams in a Classical IP environment.

2.5.1   Logical IP Subnets

An important concept in Classical IP networks is that of a Logical IP Subnet (LIS). An LIS is a group of hosts configured to be members of the same IP subnet (that is, they have the same IP network and subnetwork numbers). In this sense, one LIS can be equated to one legacy LAN. It is possible to maintain several overlaid LISs on the same physical ATM network. Therefore, in a Classical IP ATM network, placing a host on a specific subnet is a logical choice rather than a physical one. In this type of environment, communication between hosts in different LISs is only permitted by communicating through an IP router which is a member of both LISs (as per RFC-1577).

The number of LISs, and the division of hosts into each LIS, is purely an administrative issue. Limitations of IP addressing, IP packet filtering, and administrative boundaries may guide a manager into establishing several LISs onto a single ATM network. Keep in mind, though, that communication between LISs must occur through IP routers.

CHAPTER 3   Hardware Installation

This section provides procedures for installing a PCA-200EPC, LE or HE ATM adapter in a PC. These adapters are listed in Table 3.1.

Table 3.1 - Marconi PC Adapters

Adapter	Bus Requirement
LE	PCI 2.0 ⁄ 2.1 Bus Master Slot
PCA-200EPC (also referred to as the PCA adapter)	PCI 2.0 ⁄ 2.1 Bus Master Slot
HE	PCI 2.1 Bus Master Slot

Please read all information carefully before attempting installation.

NOTE You cannot install a PCA-200EPC and a LE or HE adapter in the same PC.

3.1   General Installation Procedures

Installation of a Marconi adapter into a PC is a simple procedure. However, because there are wide variations in the procedures used to open the various PC system units, these instructions provide the common steps for all PCs. These instructions may not exactly match the procedure for your specific PC.

NOTE When installing a Marconi adapter, please refer to your PC system user's manual for additional installation information.

3.1.1 PCI Slot Configuration

Some PCs may have a BIOS that requires configuration of the PCI slot. PCs with a BIOS that conforms to the Plug & Play standard probably do not require PCI slot configuration. However, for those BIOSs that **DO** require slot configuration, refer to the PC documentation for configuration instructions. If the PCI slot requires configuration, you must perform the configuration prior to installing the driver software.

3.2 Shutting Down the PC

Before installing a Marconi adapter, you must shut down the PC using the following procedure.

CAUTION

The PC should be shut down in an orderly manner. Always quit all open applications and user processes. Improperly quitting an application may damage files.

1. Save all work and exit any open applications.
2. Shut down the PC in an orderly manner.
3. Turn off the PC and any attached peripherals.
4. Unplug the AC power cord from the PC.

NOTE

For additional information about shutting down the PC, please refer to your PC system User's Manual.

3.3   Hardware Installation

This section provides the information necessary to install a Marconi adapter into a PC. These installation procedures reflect the common steps needed for installing the adapter card, regardless of the target system.

3.3.1   Opening the System Unit

CAUTION

Electronic components are extremely sensitive to static electricity. You should wear a properly grounded anti-static strap while installing the adapter card. This can prevent electrostatic discharge damage to the adapter and other static-sensitive electronic components.

Perform the following steps to open the system unit:

1.   Shut down the PC as described in Section 3.2.

2.   Follow the instructions in your PC system User's Manual to allow access to the PC's card bay. A typical card bay is shown in Figure 3.1.

Card Bay with PCI Bus Master Slots
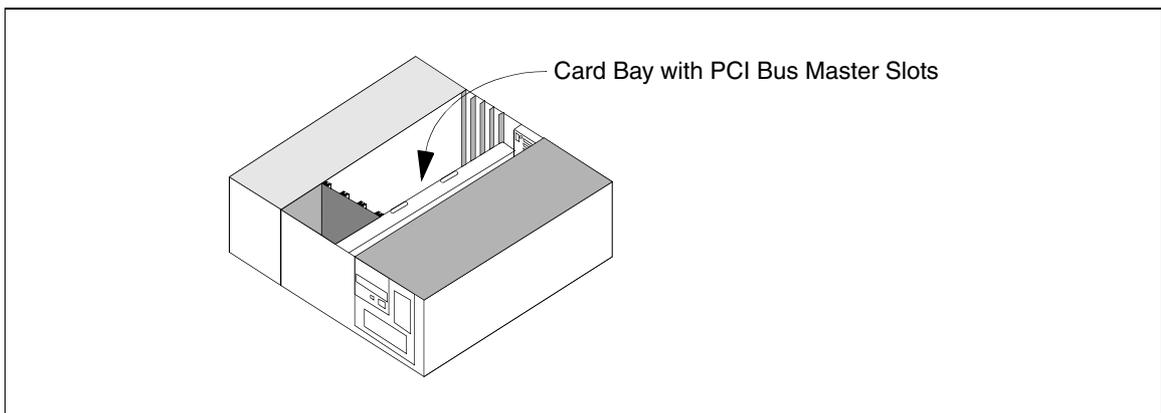
Figure 3.1 - Card Bay

3.3.2   Installing the Adapter

Perform the following steps to install the Marconi adapter:

1. Ground yourself to a metal part of the PC chassis using a grounding wrist strap.

2. Locate the PC expansion slots, as shown in Figure 3.2. (The adapters can be installed in a PCI bus master slot **only**.).

3. If necessary, remove the cover plate at the rear of the PC to allow the adapter to be inserted.

4. Align the connector side of the board with the metal grooves of the PCI slot.

5. Align the fiber-optic or UTP connectors on the board with the connector opening in the back of the PC case.

6. Push the board into the PCI slot until the connector is firmly seated. Figure 3.2 shows the installation of a LE adapter. Note that the edge connector of a HE adapter overhangs the end of a 32-bit PCI slot. This is normal.

Marconi Adapter
(HE, LE, or PCA)

Note that the edge connector
of an HE adapter will overhang
the end of a 32-bit PCI slot.
This is normal.

Cover Plate
Removed

PCI Expansion Slots
in Card Bay
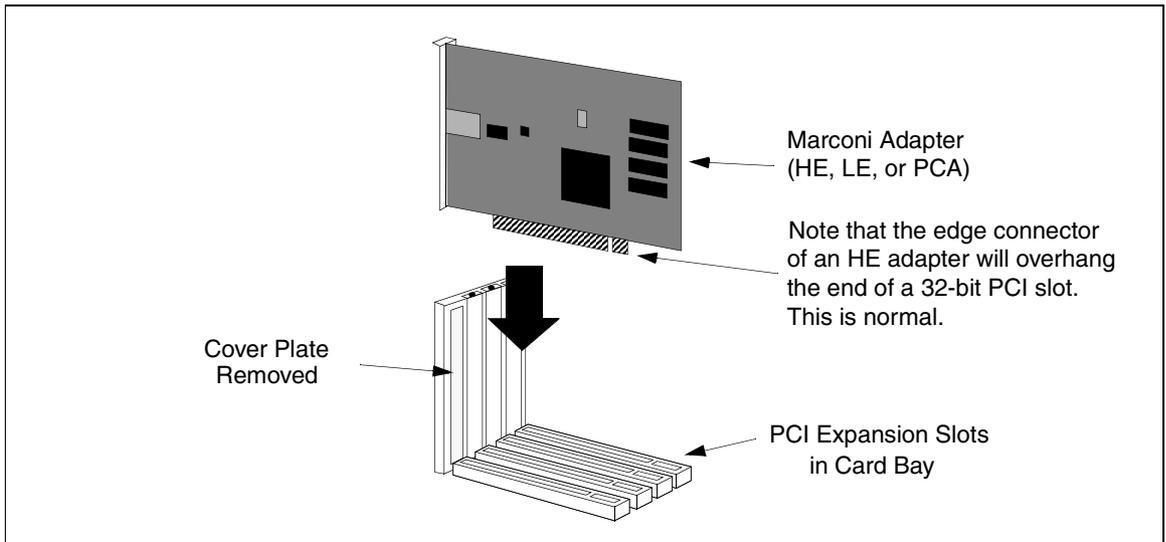
Figure 3.2 - Inserting the Adapter into the Connector Slot

7. Secure the board to the chassis, using a screw or clip, depending on the method used by your PC. A screw opening is located on the metal bracket attached to the Marconi adapter.

8. Repeat the procedure for additional Marconi adapters.

> **NOTE** ▶ You cannot install a PCA-200EPC and a LE or HE adapter in the same PC.

9. Close the case, replacing the panels you removed in Section 3.3.1. Refer to your PC system User's Manual for more information.

> **NOTE** ▶ Current implementations of the PCI bus typically provide for automatic slot configuration. Earlier implementations of the PCI bus may require manual slot configuration. Please refer to your PC system User's Manual.

10. Connect the adapter to the ATM switch, using the appropriate media for your adapter type. After you connect the adapter, the receive LED should display a green light, indicating the presence of carrier.
    -   The LE 25 and PCA-200EPC adapter receive LEDs display a red light if no carrier is present.
    -   The HE and LE 155 adapter receive LEDs display a yellow light if no carrier is present.
11. The adapter hardware installation is complete and you can proceed to install the Marconi software driver for your operating system.

Hardware Installation

CHAPTER 4   Pre-Installation Checklist

Review the following sections before you install the Marconi adapter (listed in Table 4.1) software drivers. The pre-installation checklist helps determine the information required for your installation, including ATM addresses that you will need. Get any ATM addresses, and other required information, from your system administrator. This chapter also includes a description of an ATM address, and other information that is useful prior to installing the drivers.

Table 4.1 - Marconi PC Adapters

Adapter	Bus Requirement
LE	PCI 2.0/2.1 Bus Master Slot
PCA-200EPC (also referred to as the PCA adapter)	PCI 2.0/2.1 Bus Master Slot
HE	PCI 2.1 Bus Master Slot

4.1   UNI and ILMI Configuration

The version of the UNI signalling protocol used by the adapter must match that used by the switch to which it is connected. By default, the Marconi ATM driver is configured to use the ILMI protocol to automatically determine which version of UNI to use, 3.0 or 3.1. If your site is not using ILMI, when you configure your driver not to use ILMI the UNI version automatically reverts to UNI 3.0. If the switch to which the adapter is connected is using UNI 3.1, you must manually configure the driver to use UNI 3.1.

Pre-Installation Checklist

4.2   Pre-Installation Checklist

Please review the following checklist of required information.

Table 4.2 - Information Required for Installation

Are you...	You must know...
Installing more than one adapter card?	• The relative position of each adapter card in the PCI slots. • Which ELANs or Classical IP LISs you want to access through each adapter card.
Not Using ILMI?	• You must specify the ATM address for all adapter cards. If the switch is not using UNI 3.0, you must specify the UNI version.
Connecting to an emulated LAN?	You do not have to specify an ELAN name, or any other ELAN information if a automatic ELAN name has been configured on the LECS. Ask your system administrator for this information. If your site isn't using an automatic ELAN name, you must know the following information: • The name of each ELAN to which you want to connect (if not using the Automatic ELAN Name feature). If you have multiple adapters, know which adapter connects to each ELAN. • The ELAN media type (Ethernet or Token-Ring) of each ELAN to which you want to connect. • If you are not using the well-known address or PVC (0.17) to determine the address of the LECS, you must know the ATM address of the LECS. • If you are not using the LECS, you must know the ATM address of the LES.
Connecting to a Classical IP LIS?	• The ATM address of the ARP Server for each Classical IP LIS to which you want to connect. If you have multiple adapters, know which adapter connects to each LIS.

4.2.1   Multiple Adapters Worksheet

You may copy Table 4.3 to use as a worksheet to record information about your adapter cards and ELANs. You can use this information when you perform the driver installation for the operating system you are using. You will have to get some of this information from your system administrator.

PCI Slot Number	Write down the number of the PCI slot that contains the adapter.
ELAN(s) or LIS(s) on Adapter	Write down the name of each ELAN or LIS to which this adapter will connect. (The total number of ELANs or LISs to which you can connect depends on your operating system.)

Table 4.3 - Multiple Adapters/ELANs/LISs Worksheet

PCI Slot Number	ELAN(s) or LIS(s) on Adapter

4.3   How to Specify an ATM Address

Depending on whether you're using ILMI and the LANE services, you may have to specify one or more ATM addresses when installing the adapter drivers. The ATM address is 20 bytes in length and is specified as 40 hexadecimal characters. The logical components of an ATM address are:

- The *switch prefix*, consisting of the first 13 bytes, which is typically the same for all ports on a single switch. For example:

    47000580ffe1000000f2150f5b

- The *end system identifier* (ESI), consisting of bytes 14 through 19, which usually is the six-byte hardware MAC address of a particular adapter card. For example:

    002048102aef

- The *selector byte*, the last byte of the ATM address. For example:

    0a

The following is a sample of the entire ATM address:

    47000580ffe1000000f2150f5b002048102aef0a

If you are specifying the address in NetWare or a Windows operating system, you can use periods to separate the logical components of the address:

    47000580ffe1000000f2150f5b.002048102aef.0a

The periods used in the sample address above are included to make the address easier to read. Their use is not required, and they can be placed at irregular intervals as frequently as every byte.

4.4   How to Create Installation Diskettes

If you cannot install the *ForeThought* drivers from the Marconi adapter software CD, you can create diskettes using the CRDISK utility included with the CD.

When creating diskettes, note that you must create separate installation diskettes for LE, PCA or HE adapters. You must also create separate diskettes for the LE driver with ABR support. You will need four diskettes to hold the installation files.

> **NOTE** ➤ To create diskettes for Windows NT, use a PC running Windows NT. To create diskettes for Windows 95/98, use a PC running Windows 95/98.

1.   When creating Windows NT installation diskettes, before you run CRDISK, you must set the Windows CPU variable to match that of the system for which you are creating the disk. For example:

    SET CPU=I386

2.   In a DOS window, open the `\WINNT\PATCH` or `\WIN95\PATCH` directory of the ForeThought 5.1 distribution files, either on the Marconi 5.1 adapter software CD or at a location to which you downloaded them from the Marconi Technical Assistance Center (TAC) website, TACtics Online.

3.   Insert a blank floppy diskette in your disk drive.

4. From the DOS prompt, run the `CRDISK.BAT` file. This command has the following syntax:

    CRDISK [*source-directory***] <pca|le|leabr|he> [atm_only]**

    source-directory is the path of the directory containing the Windows NT or Windows 95 driver files. If you don't specify a source-directory, the default is the current working directory.

    pca indicates that you want to create a diskette with the files for a PCA adapter.

    le indicates that you want to create a diskette with the files for a LE adapter.

    leabr indicates that you want to create a diskette with the files for a LE adapter driver with ABR support.

    he indicates that you want to create a diskette with the files for a HE adapter.

    atm_only can optionally be specified to create a single diskette to install or upgrade the ATM driver only (and not the Information Center utility or the Marconi Winsock SPI).

    For example, if you want to create a diskettes for a PCA adapter, and the current directory is the directory containing the *ForeThought* 5.1 Windows NT files (`...\WINNT\PATCH`, not`...\WINNT\PATCH\I386`), use the following command:

    CRDISK PCA

    The `CRDISK.BAT` file copies all the required files to the first diskette, and then prompts for the second, third, and fourth diskettes.

5. Proceed to install the drivers using the procedure in the manual. However, instead of inserting the CD when indicated, insert the diskette in your drive and accept the default path of `A:`, where `A:` indicates your floppy drive.

4.5   LECS.CFG Usage Notes

The following notes apply to statements in the `LECS.CFG` file, on the machine on which the LECS is running. It is edited when the system administrator configures the LECS.

For complete information on LECS operation, refer to the Marconi documentation for the platform running the LECS, either a Marconi switch or a Solaris workstation with a Marconi adapter and driver.

4.5.1   Usage of Match.Ordering with Automatic ELAN Selection

To assure proper operation of the Automatic ELAN Selection feature, the `Match.Ordering` statement must list ELANs in order of decreasing MTU size. When using Automatic ELAN Selection, the `Match.Ordering` statement determines which ELAN the client will join. The client will join the first ELAN in the `Match.Ordering` list with which it is compatible that has a configured MTU size that is equal or lesser than that specified on the client. To ensure that the client only joins an ELAN with a matching MTU size, the `Match.Ordering` statement must list ELANs in order of decreasing MTU size. Otherwise, the client will join the first ELAN with an MTU size that is lower than or equal to that defined in the client.

For example, the `Match.Ordering` statement indicates the following ELANs with the indicated MTU sizes:

```
Match.Ordering: ethernet1516, ethernet4544, ethernet9234,
                        ethernet18190
```

If the ELAN driver on the client is configured as `Ethernet` with an MTU size of `18190`, that client will join `ethernet1516`, because that is the first ELAN in the list with an MTU size that is lower than or equal to that defined in the client.

To ensure that the client joins the ELAN that matches its configured MTU size, the `Match.Ordering` statement must be re-ordered:

```
Match.Ordering: ethernet18190, ethernet9234, ethernet4544,
                        ethernet1516
```

4.5.2   Usage of MAC Addresses in Accept Statements

To assure proper operation of the `Accept` and `Reject` statements, if you use MAC addresses in the `Accept` statements (rather than ATM addresses) you must use MAC addresses in the `Reject` statements for the ELAN. Also, if you are using `Reject` statements you must also have `Accept` statements for the ELAN, otherwise no users will be able to join the ELAN. Refer to the Marconi *ATM Switch Configuration Manual* for more information.

CHAPTER 5   **Windows 9x Installation**

This chapter describes how to install the Marconi ATM drivers on a Windows 95, Windows 98, or Windows 2000 operating system and gives requirements for the Marconi drivers. The InFOREmation Center utility, for viewing driver statistics and configuring MPOA parameters and Classical IP PVCs, is automatically installed with the driver.

CAUTION

If you are upgrading your Marconi drivers, use the upgrade facility described in Chapter 8. The upgrade facility provided by Marconi ensures that old Marconi driver files are deleted and correctly replaced with new versions. Attempting to upgrade the drivers without using the provided utility can cause problems with Windows 95/98 and driver installation.

5.1   Procedures for Marconi LE and PCA Adapters

These procedures can be used to install the Windows 95/98 drivers for any of these Marconi PC adapters:

- LE adapter
- PCA-200EPC, also referred to as the PCA adapter

In the examples throughout the chapter, the examples show the installation of the driver for an LE adapter. During the installation, the model name for your adapter appears in the dialog boxes relating to the ATM adapter driver.

NOTE

The HE adapter does not support Windows 95/98/2000.

5.2   The Marconi ATM and LANE Drivers

As shown in Figure 5.1, you must install both a Marconi ATM driver and one or more of the following Marconi drivers:

- Emulated LAN (ELAN) driver to connect to an Emulated LAN.
- IP over ATM (RFC 1577) (referred to as Classical IP or CLIP) driver to connect to a CLIP Logical IP Subnet (LIS).

Contact your system administrator for information about which drivers you must install.
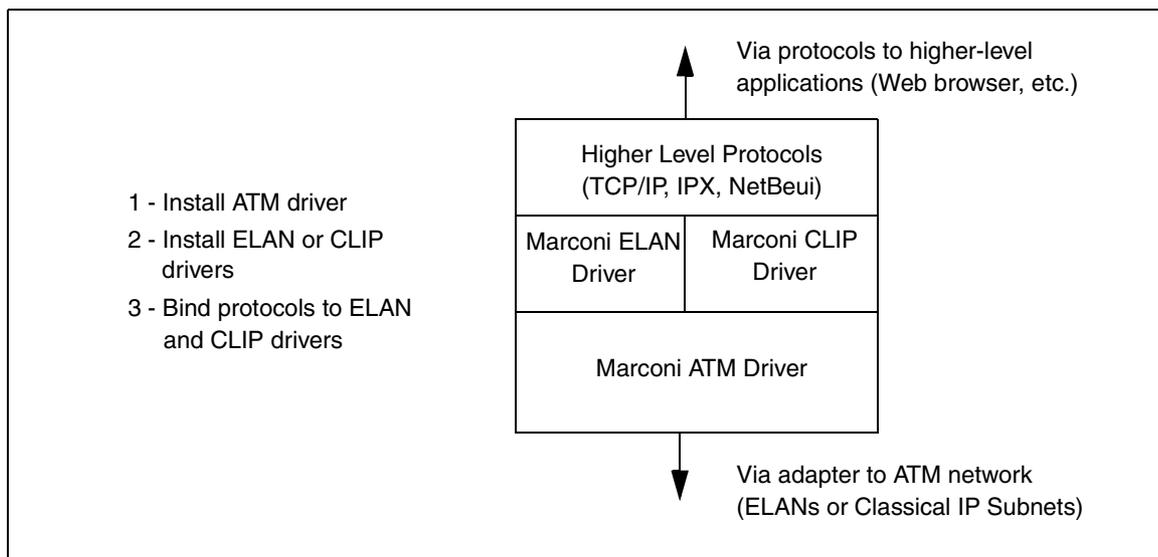
Figure 5.1 - Marconi Driver Configuration

5.3 Installation Requirements

Requirements to ensure proper installation of the Marconi drivers are:

- Approximately 1 M of free disk space in the installation directory file system
- 16 M of RAM minimum
- Microsoft Windows 95 or Windows 98
- A PCI 2.0/2.1 specification compliant PC that appears on the Microsoft, Inc., Hardware Compatibility List
- Successful installation of the Marconi adapter card (see Chapter 3) (Note that you cannot install an LE and PCA adapter together in the same PC.)
- The *ForeThought* 5.1 distribution files for Windows 95/98/2000. These files are available from the Marconi's TAC or the Marconi driver software CD.

> **NOTE**
>
> If you must install the files from a diskette, refer to "How to Create Installation Diskettes" on page 4-5 for information about creating a Windows 95/98 installation diskette.

The relevant files for *ForeThought* 5.1 Windows 95/98 installation are listed in Table 5.1.

Table 5.1 - Relevant Installation Files

Driver Files for Windows 95/98		
/debug	forehlpr.exe	forestat.exe
/java	foreinfo.cpl	foreuni.hlp
/winsock2	foreinfo.dll	forevir.hlp
crdisk.bat	foreinfo.exe	forews2.dll
disk1	foreinfo.hlp	forews2.exe
disk2	foreinfo.jar	netfore.inf
disk3	forelan.hlp	netfore.inf.le
disk4	forelan.nms	netfore.inf.pca
foreadp.hlp	forelan.vxd	pca200.bin
foreclip.vxd	forele.vxd	pca200em.bin
foreclp1.hlp	forendi.dll	regutil.exe
foreclp2.hlp	forepca.vxd	upgrade.args
foreclp3.hlp	foresee.exe	upgrade.exe

5.4   Installing the Marconi Adapter Software

5.4.1   Notes for Windows 95

Installation of the Marconi ATM adapter software on Windows 95 consists of the following steps:

1. Install the Marconi ATM Adapter driver when the adapter is automatically discovered by Windows 95 via plug-and-play.

> **NOTE** This chapter also describes how to use the System control panel to install the ATM Adapter driver in circumstances when Windows 95/98 does not auto-discover the adapter and prompt for installation of the driver. See "Installing the ATM Driver Manually on Windows 95" on page 5-38.

2. Configure the Marconi ATM Adapter driver for each adapter card that has been installed on your PC. This is required ***only*** if one of the following is true:
   - You are not using ILMI and must manually enter the ATM address of the host.
   - You want to change the default transmit or receive buffer and queue sizes.

3. Install and configure one or more of the following:

   a. A *ForeRunner* ELAN Adapter driver for each ELAN to which you want to connect.

   b. A *ForeRunner* IP over ATM (RFC 1577) Adapter driver for each Classical IP LIS to which you want to connect.

   You can install up to four copies of each driver, as long as you remain within Windows 95/98 networking limitations.

4. Reboot the system.

5. If you are using Winsock2 applications designed for use with the Marconi Service Provider Interface (SPI), install the SPI as described in "Installing and Upgrading the Service Provider" on page D-7.

Windows 95/98 offers a variety of methods for installing and upgrading your networking software. This chapter describes how to use auto-discovery to install the ATM adapter driver and use the Network control panel to install and configure your Marconi ELAN and IP Over ATM drivers.

5.4.2 "Thin" Driver Installation on Windows 98

NOTE ▶ If you are using MPOA or want to use additional features of the Marconi "fat" drivers, use the procedures in "Installing the ATM Driver Manually on Windows 95" on page 5-38.

After installing the adapter hardware, when you start up the computer Windows 98/2000 recognizes the adapter and displays the New Hardware Found dialog box.

New Hardware Found

IDT77211 Based PCI ATM Adapter

Windows is installing the software for your new hardware.

Figure 5.2 - New Hardware Found on Windows 98

Windows 98/2000 then automatically installs the IDT77211 driver for the adapter, binding it with the Microsoft ELAN client. You can then assign parameters as necessary for your site and reboot as prompted. This completes the installation. Figure 5.3 shows the IDT77211 driver and bindings in the Network control panel.
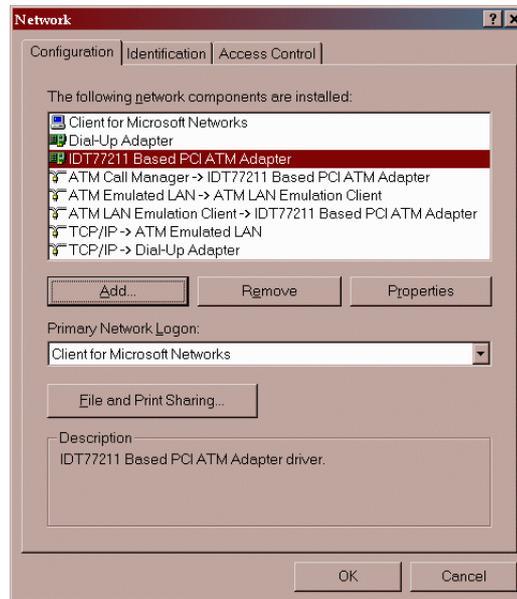
Figure 5.3 - Network Control Panel with IDT77211 Driver and Bindings

5.4.3   LE "Thin" Driver Installation on Windows 2000

When using a PCA adapter with Windows 2000, when you start the PC after installing the adapter, Windows 2000 discovers the hardware and automatically installs the Marconi driver for the adapter. For the LE adapter, you must manually install the driver.

Use the following procedure to install the LE adapter driver for Windows 2000:

1. After installing the adapter, when you start up the computer Windows 2000 displays the New Hardware Found dialog box. This indicates that the Windows 2000's Plug-and-Play feature has detected the LE adapter that you installed.

   Windows 2000 then also displays the Welcome to the New Hardware Wizard dialog box.

2. Click **Next** to proceed. Windows 2000 displays the Found New Hardware Wizard - Install Hardware Device Drivers dialog box.

3. Select the **Search for a suitable driver for my device (recommended)** option (the default option) and click **Next** to proceed. The Found New Hardware Wizard - Locate Driver Files dialog box appears.

4. Insert the *ForeRunner* ATM Adapter Software CD in your CD drive.

5. Select **Specify a location** and de-select the other options.
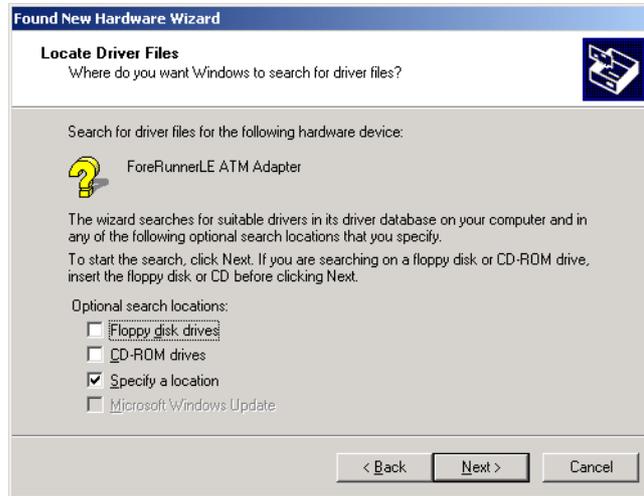
6.   Click **Next** to proceed. A dialog box appears in which you can specify the location of the driver files.

7.   Specify the path `d:\windows\Windows2000` (where `d:\` indicates your CD drive) and click **OK**.

The Found New Hardware Wizard - Driver Files Search Results dialog box appears.

8.   Click **Next** to proceed. Because the LE adapter did not undergo the formal Microsoft Certification and receive a digital signature, the Digital Signature Not Found dialog box appears.

9. Click **Yes** to proceed.

The install wizard copies the driver to the correct location and installs a default ATM ELAN connection. The system will display a final dialog box to show installation is finished.

10. Click **Finish** to complete the installation process. You do not need to reboot your PC.

To edit the properties of the driver, access the Network and Dialup Connections control panel. Two icons appear, an **ATM Connection** icon and an **ATM ELAN Connection** icon.

- If your site is using Classical IP, double-click the **ATM Connection** icon and edit the TCP/IP properties and specify an ARP server address.

- If your site is using LAN Emulation, double-click the **ATM ELAN Connection** icon to edit the TCP/IP properties and, if not using the default ELAN, change the ELAN name.

5.4.4 "Fat" Driver Installation in Windows 98 or 2000

On Windows 98 the operating system includes drivers for the Marconi adapters and automatically installs the default IDT77211 driver for the adapter. You do not need to install it manually from the Marconi distribution files.

However, if you are using MPOA or other features of the Marconi "fat" drivers, you must use the drivers provided by Marconi. Use the following procedure to remove the IDT77211 and install the Marconi "Fat" drivers:

1. In the Network Control Panel, delete the **IDT77211 Based PCI ATM Adapter** driver and all its bindings that were automatically configured by Windows 98.

2. In Windows Explorer or DOS, delete the `c:\windows\inf\netfore.inf` file.

3. Reboot the computer. Windows 98 auto-discovers the adapter as it starts up and prompts you for *ForeThought* installation files. Insert the *Marconi* software CD and specify the `\win95\patch` directory of the CD.

4. Proceed to select **Add** from the Adapters tab of the Network Control Panel. The Select Network Component Type dialog box appears.

5. Select **Adapters** and click **Add...**. The Select Network adapters dialog box appears, as shown in Figure 5.4.
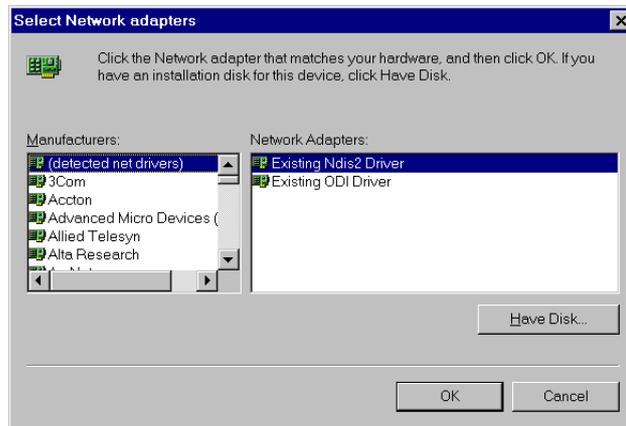
Figure 5.4 - Select Network Adapter Dialog Box

6. When the Select Network adapters dialog box appears, select **Have Disk...**. The Insert Disk dialog box appears, as shown in Figure 5.5.
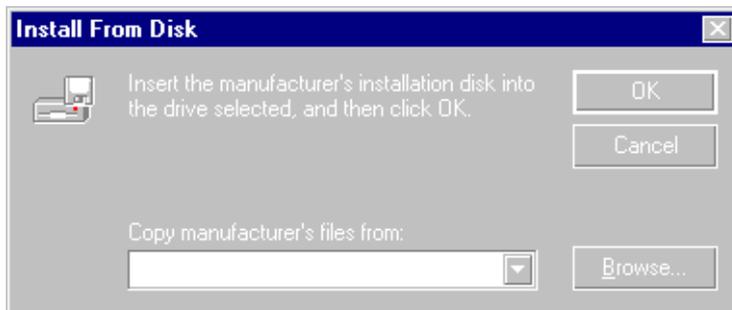
Figure 5.5 - Insert Disk Dialog Box

7. Change the default drive specification to indicate the path to the Marconi Windows 95/98 distribution files. If you are using the Marconi adapter software CD, this would be `e:\windows\win95\patch`, assuming your CD drive is `e:`.

8. Click the **OK** button. The Select OEM Option dialog box appears, as shown in Figure 5.6.
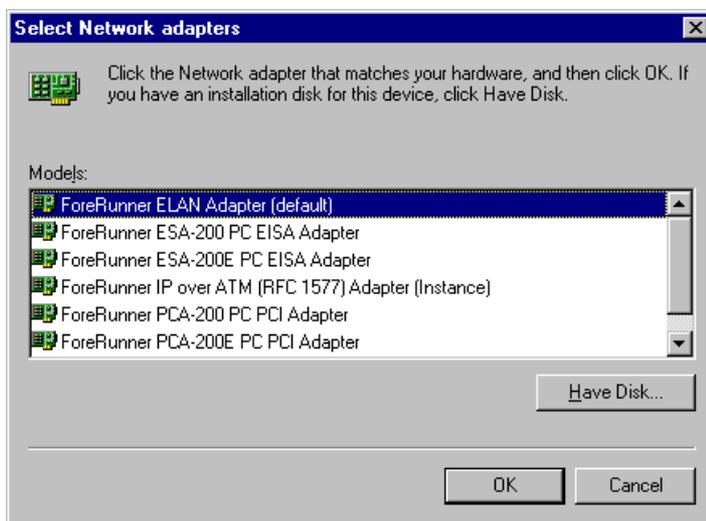
Figure 5.6 - Select OEM Option Dialog Box

9. Select the appropriate Marconi ATM adapter driver, matching the adapter hardware you have installed. Click the **OK** button. The Windows Setup dialog box

appears, with a progress bar showing the files being copied.

10. If necessary, configure the ATM driver as described in "Configuring the Marconi ATM Adapter Driver (If Necessary)" on page 5-15.

11. Install and configure one or more of the following:

    a. A *ForeRunner* ELAN Adapter driver for each ELAN to which you want to connect.

    b. A *ForeRunner* IP over ATM (RFC 1577) Adapter driver for each Classical IP LIS to which you want to connect.

    You can install up to four copies of each driver, as long as you remain within Windows 95/98 networking limitations.

12. Reboot the system.

5.4.5   Installing the Marconi ATM Adapter Driver in Windows 95

After installing the Marconi ATM adapter hardware, when you start up your PC, Windows 95 automatically discovers the new hardware and displays the New Hardware Found dialog box, shown in Figure 5.7.
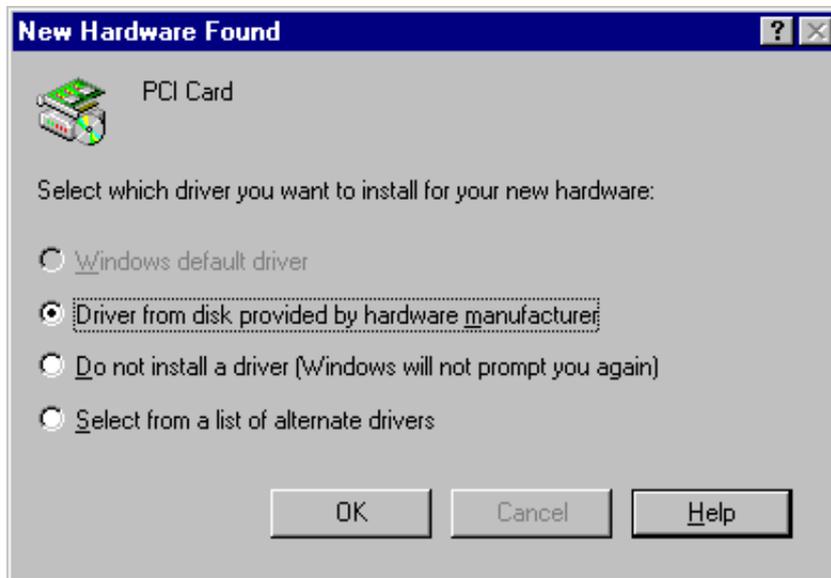
Figure 5.7 - New Hardware Found Dialog Box

This dialog box displays the type of the adapter and gives options for installing the driver.

Use the following procedure to install the ATM driver at this point:

1. Accept the default option, **Driver from disk provided by hardware manufacturer** and click **OK**. The Install from Disk dialog box appears, specifying the A: drive.

2. Change the path to indicate the location of the Marconi Windows 95/98 distribution files. If you are using the Marconi adapter software CD, this would be `e:\windows\win95\patch`, assuming your CD drive is `e:`.

3. Click **OK**. A progress bar appears, showing the files being copied to your hard drive.

4. A warning appears, reminding you that you must install an ELAN or CLIP driver. Click **OK** to proceed. Additional files are copied.

5. A prompt appears, asking you to load the Windows 95 or 98 CD-ROM. If you have installed Windows 95/98 already, you may be able to specify the directory containing the required files.

6. If you have installed additional adapters, you are prompted to install additional drivers.

7. Reboot the system.

8. After the system reboots, proceed to install the *ForeRunner* ELAN or CLIP adapter, as described in the following sections:

   - "Installing the Emulated LAN Adapter Driver" on page 5-20.
   - "Installing the IP Over ATM (RFC 1577) Driver" on page 5-28.

5.4.5.1 Manually Installing the Driver

You may have to install the Marconi ATM driver manually in the following situations:

- At some previous time, when the adapter card was discovered by Windows 95/98 at boot-up and the New Hardware Found dialog box appeared, the **Do not install a driver (Windows will not prompt you again)** option was chosen.

- Another adapter had been previously installed in the machine.

In these cases you must use the procedure in "Installing the ATM Driver Manually on Windows 95" on page 5-38.

5.4.6   Configuring the Marconi ATM Adapter Driver (If Necessary)

Windows 95/98/2000 installs the Marconi ATM driver using the default values. If these default values are not acceptable for your site, you must configure the driver using the following procedure. You must configure the driver if one of the following is true:

- You are not using ILMI.
- You want to change the default transmit or receive buffer and queue sizes (the default values, which are acceptable for most sites, are listed on page 5-18).

Contact your system administrator to determine if any of these conditions apply to you. Use the following procedure if you must configure the Marconi ATM Adapter driver:

1. Display the Network control panel (shown in Figure 5.8) by using the following procedure:

   a.   Click the **Start** button on the Taskbar.

   b.   Select **Settings**.

   c.   Select **Control Panel**. The Control Panel appears.

   d.   Double-click the **Network** icon.

   The Network control panel appears, as shown in Figure 5.8.

2. Select the **ForeRunner (xxx) ATM Adapter** in the list of installed network components and click the **Properties** button.
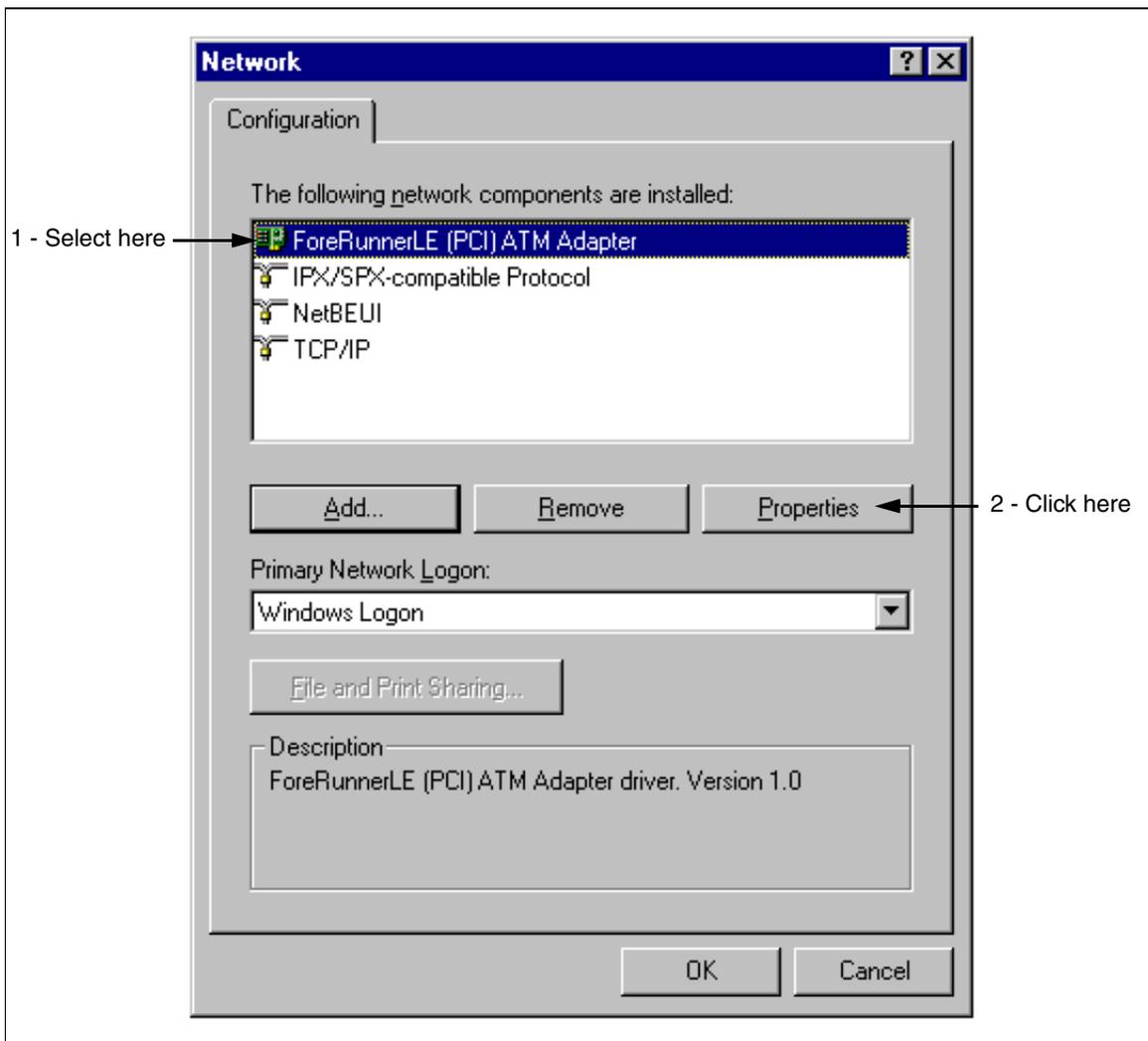
Figure 5.8 - Network Control Panel

3. The ForeRunner (xxx) ATM Adapter Properties dialog box appears, as shown in Figure 5.9. This dialog box contains six tabs. The only tabs you can edit are **Adapter Configuration** and **UNI Configuration**. Do not attempt to configure the driver through the **Driver Type**, **Bindings**, and **Advanced** tabs. Information configured through the **Advanced** tab is ignored by the driver.
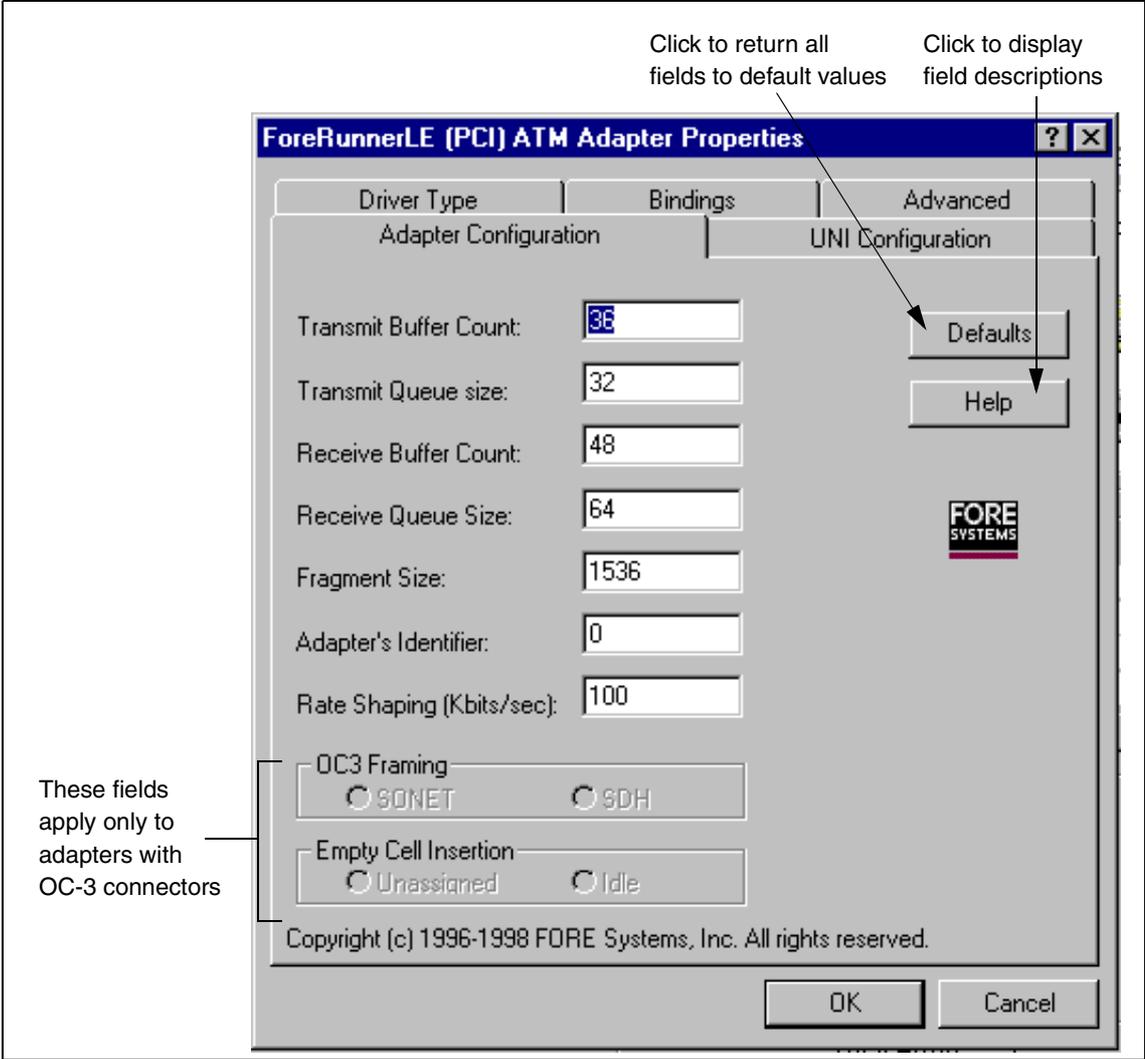
Figure 5.9 - ForeRunner Marconi ATM Adapter Configuration Tab

NOTE Any changes to values appearing in this dialog box take effect only when the system is rebooted.

4. Click the **Adapter Configuration** tab. The adapter configuration information appears, as shown in Figure 5.9.

   If you have installed multiple adapters - Note the number in the **Adapter's Identifier** field. You need this information when configuring the *ForeRunner* ELAN or IP over ATM driver or drivers associated with this physical adapter. (Zero indicates the first adapter.)

5. Modify the fields of the **Adapter Configuration** tab to conform to your system requirements (the default values are adequate for most installations).

6. Click on the **UNI Configuration** tab to display the UNI parameters for the adapter, as shown in Figure 5.10. By default, **ILMI Enabled** is selected and you cannot modify the local ATM address of the adapter. Select the **Disabled** radio button if you want to enter the local ATM address and UNI version of the adapter manually.

NOTE If you disable **ILMI** and the **UNI Version** parameter was set to **Auto UNI**, the **UNI Version** reverts to UNI 3.0 (because the driver can no longer use ILMI to determine the UNI version). You *must* use the same version of UNI as that used by the ATM switch to which the adapter is connected. Get the correct values from your system administrator.

   If you don't know the MAC address - If you aren't using ILMI and don't know the MAC address, you can specify mm for each two-byte portion of the MAC/ESI address. The adapter then automatically provides the address when it starts up.

   Refer to "How to Specify an ATM Address" on page 4-4 for information about the format of an ATM address.

7. Click the **OK** button to save the changes you have made.
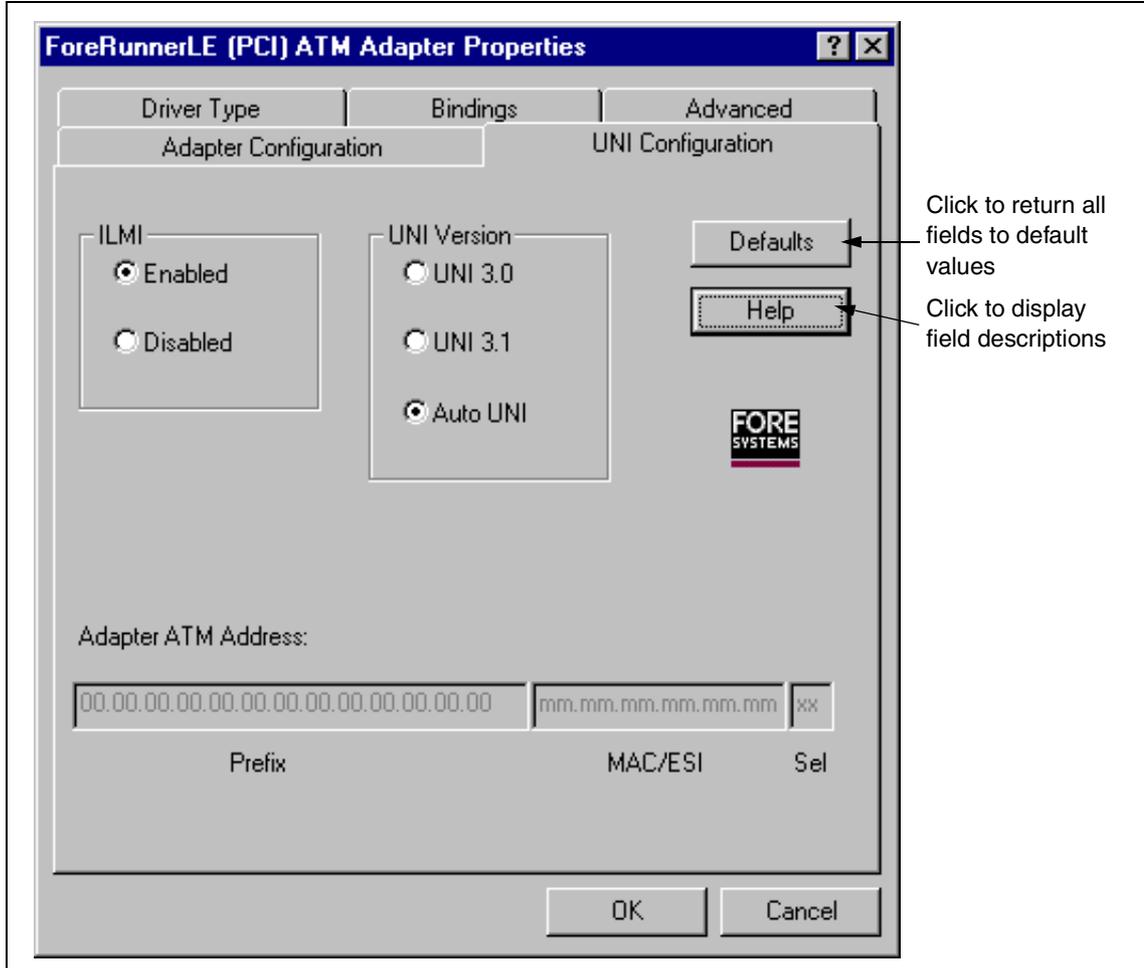
Figure 5.10 - UNI Configuration Tab

8. The Network control panel appears with the **ForeRunner ATM Adapter** driver in the list of installed network components.

9. Proceed to do either or both of the following:

    a. Install one or more *ForeRunner* Emulated LAN Adapter drivers using the procedure in "Installing the Emulated LAN Adapter Driver" on page 5-20.

    b. Install one or more *ForeRunner* IP Over ATM Adapter drivers using the procedure in "Installing the IP Over ATM (RFC 1577) Driver" on page 5-28.

5.4.7   Installing the Emulated LAN Adapter Driver

NOTE	You must repeat this procedure for each ELAN that you want to join. You can install a maximum of four ELAN adapter drivers.

Use the following procedure to install one or more *ForeRunner* Emulated LAN Adapter drivers on a Windows 95/98 system:

1.   In the Network control panel, click the **Add...** button. The Select Network Component Type dialog box appears, as shown in Figure 5.11.
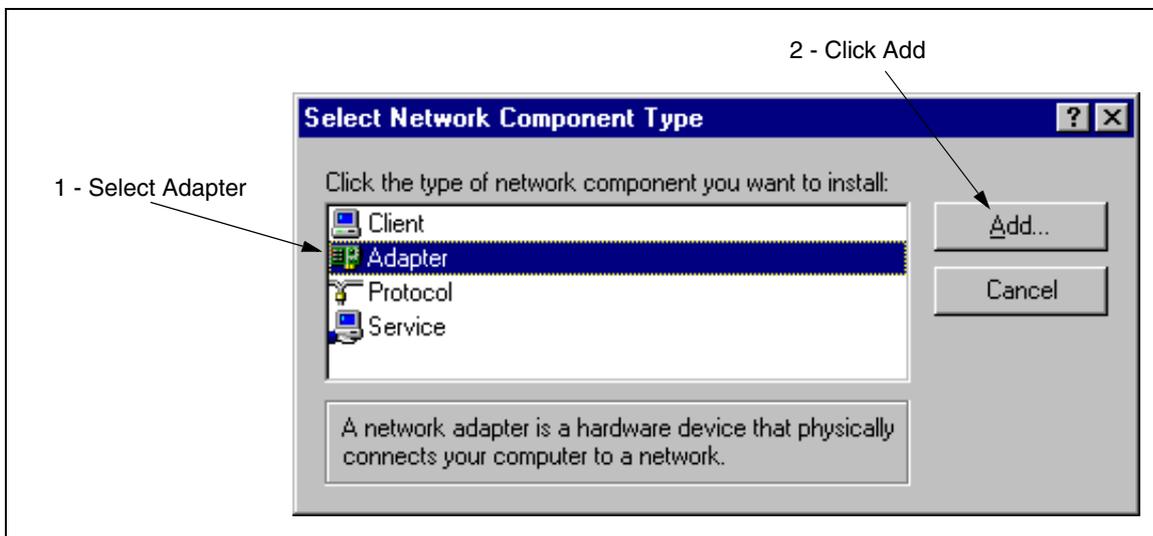
Figure 5.11 - Select Network Component Type Dialog Box

2. Select **Adapter**. Then, click the **Add** button. A progress bar is displayed as Windows 95/98 builds an adapter database. The Select Network adapters dialog box appears, as shown in Figure 5.12.

1 - Select FORE   2 - Select ELAN Adapter
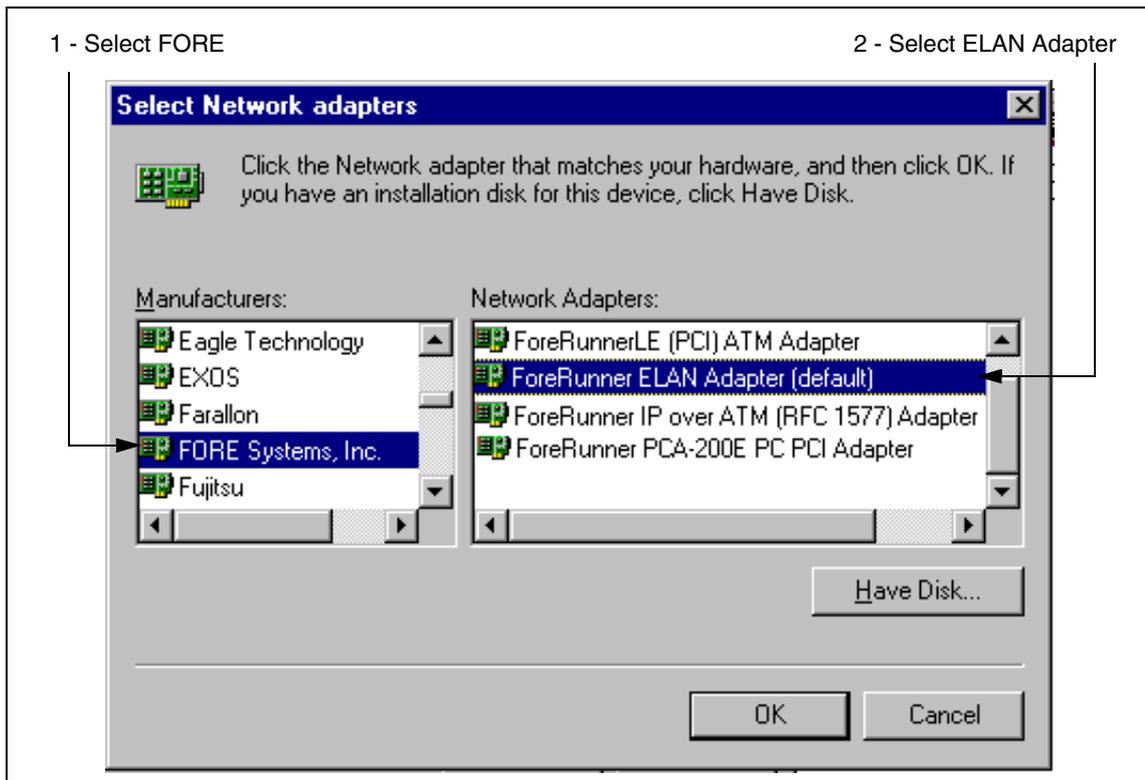
Figure 5.12 - Select Network Adapters Dialog Box

3. Select **Fore Systems, Inc.** and **ForeRunner ELAN Adapter**. The Network control panel appears with the ELAN driver in the list of installed network components, as shown in Figure 5.13.

4. If you are using all of the default values for the driver:

    -   Using the LANE services (the LES and LECS)

    -   Using the automatic ELAN name (in which the driver finds out which ELAN to join from the LECS)

    -   Using other default values (such as using Ethernet rather than Token Ring)

    You don't have to configure the ELAN driver. Skip ahead to step **8**.
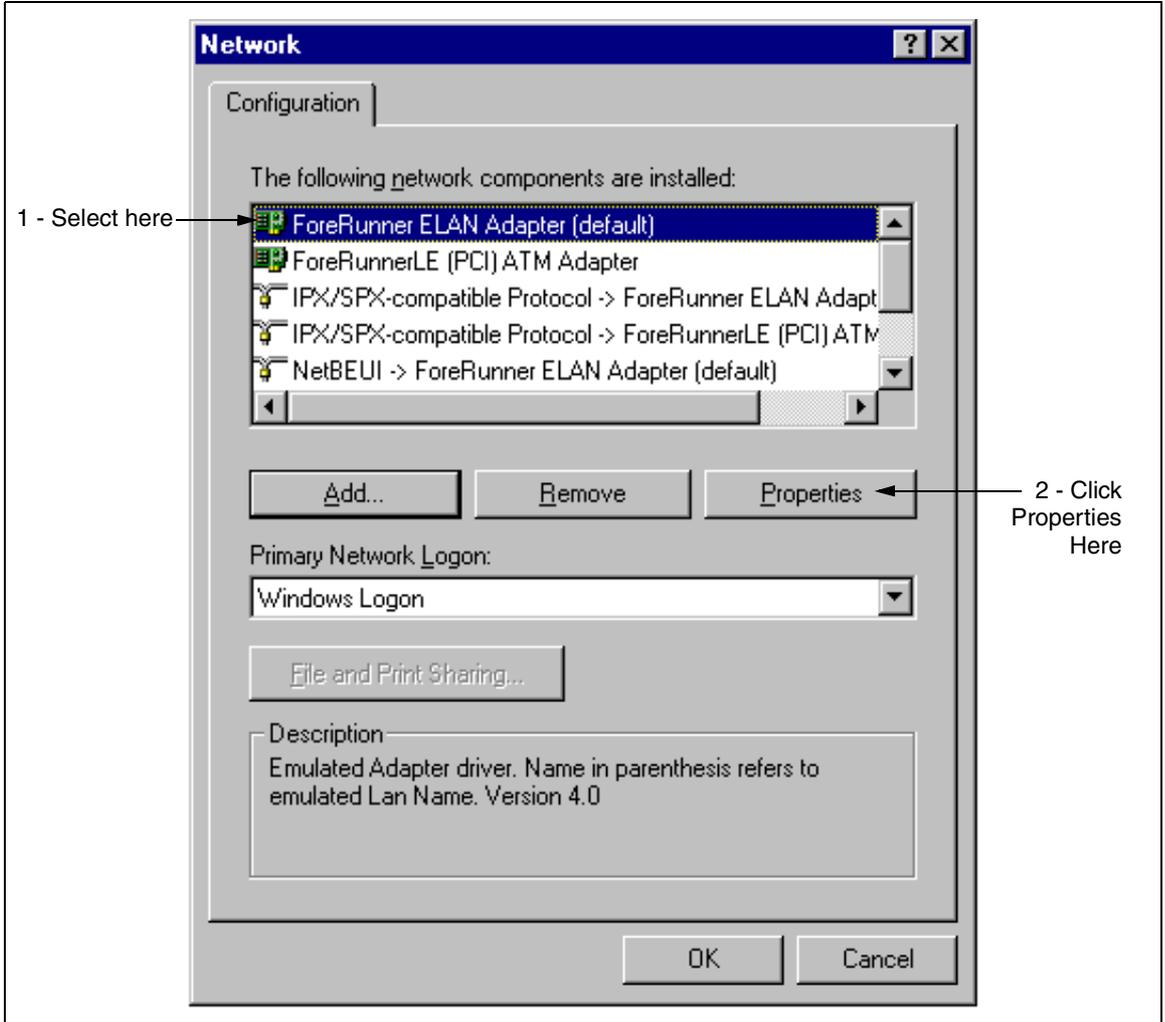
Figure 5.13 - Network Control Panel with ELAN Driver

5. Select **ForeRunner ELAN Adapter** and click **Properties**, as shown in Figure 5.13. The ForeRunner ELAN Adapter Properties dialog box appears, as shown in Figure 5.14. The only tabs you can edit are **Adapter Configuration** and **UNI Configuration**. Do not attempt to configure the driver through the **Driver Type**, **Bindings**, and **Advanced** tabs. Information configured through the **Advanced** tab is ignored by the driver.

6. Edit the fields on the **Basic ELAN Conf** tab as required.
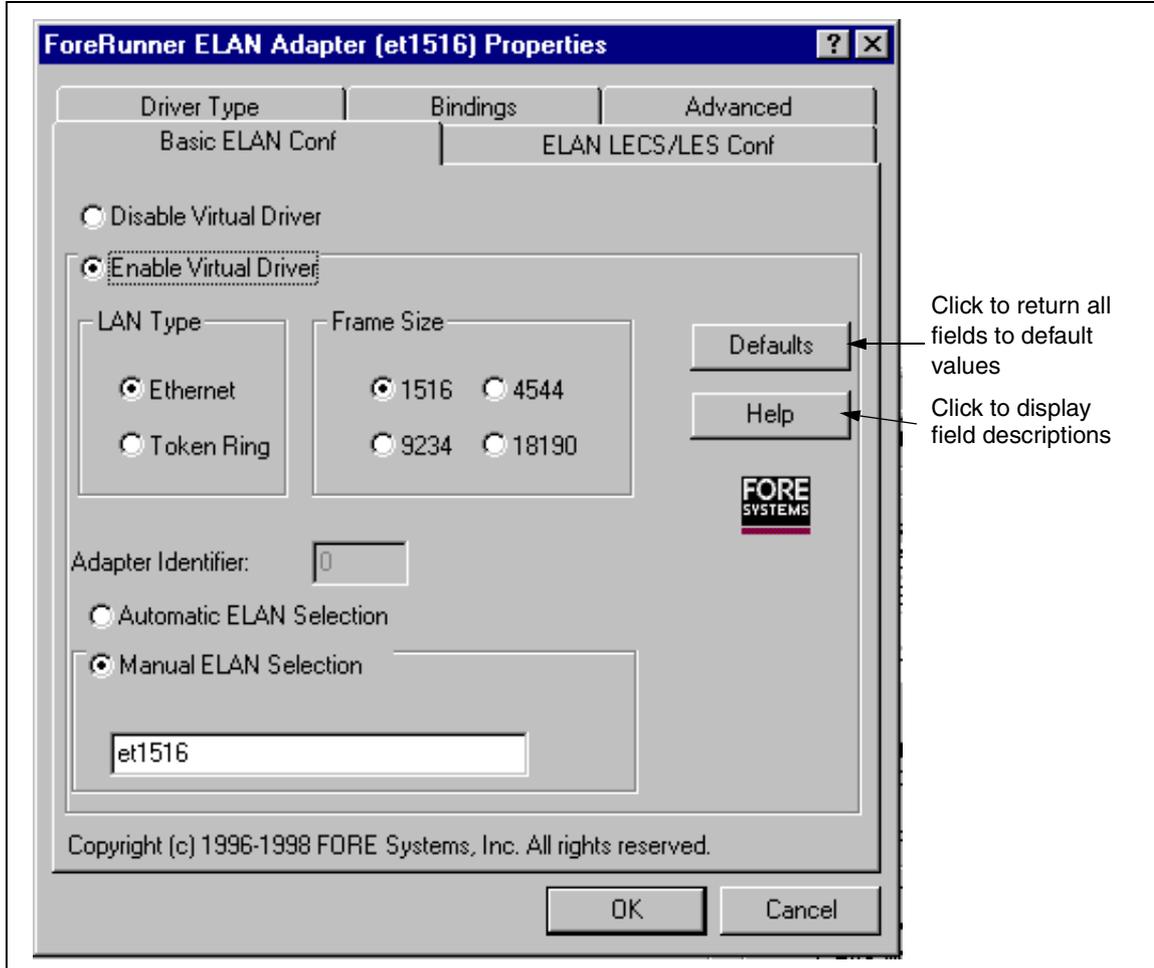
Figure 5.14 - Basic ELAN Conf Tab

a. If you want to disable this driver, so it does not start when the system is rebooted, select **Disable Virtual Driver.** When this option is selected, all parameters for the driver are grayed out and cannot be edited.

b. Select the type of ELAN to which this driver connects, **Ethernet** or **Token Ring**.

c. Select the appropriate **Frame Size**. *This value must match the frame size of the ELAN.*

    d.   If you have more than one Marconi adapter in this machine, you must specify the adapter you want to use in the **Adapter Identifier** box. This field is read-only if only one Marconi ATM adapter is installed.

        The adapter identifier for each adapter was assigned in step 8 of the previous procedure, "Installing the Marconi ATM Adapter Driver in Windows 95" on page 5-13.

    e.   If you are using an LECS, you can select **Automatic ELAN Selection** in order to use the default ELAN specified by the LECS. In this case you don't need to enter a value in the **Emulated LAN Name** field, and can proceed to step 7.

> **NOTE** ▶ If you use **Automatic ELAN Selection**, you must still specify the ELAN type and MTU size (or accept the default). If no ELAN has been specified on the LECS that matches these parameters, the Automatic ELAN Name feature does not work. Use the InFOREmation Center utility, described in "Using InFOREmation Center" on page 10-1, to determine the name of the ELAN that the driver has joined.
>
> This feature can only be used on one ELAN driver. For all other ELAN drivers, you must specify the ELAN name.

    f.   Enter the **Emulated LAN Name** that you want to join. Any valid alphanumeric name up to 32 characters long may be specified.

7. Click on the **ELAN LECS/LES Conf** tab to display the LECS and LES parameters for the adapter, as shown in Figure 5.15. By default, the **Yes** option in the **Use LECS** box and the **Enabled** option in the **Discover LECS** box are selected.

Click to return all fields to default values

Click to display field descriptions
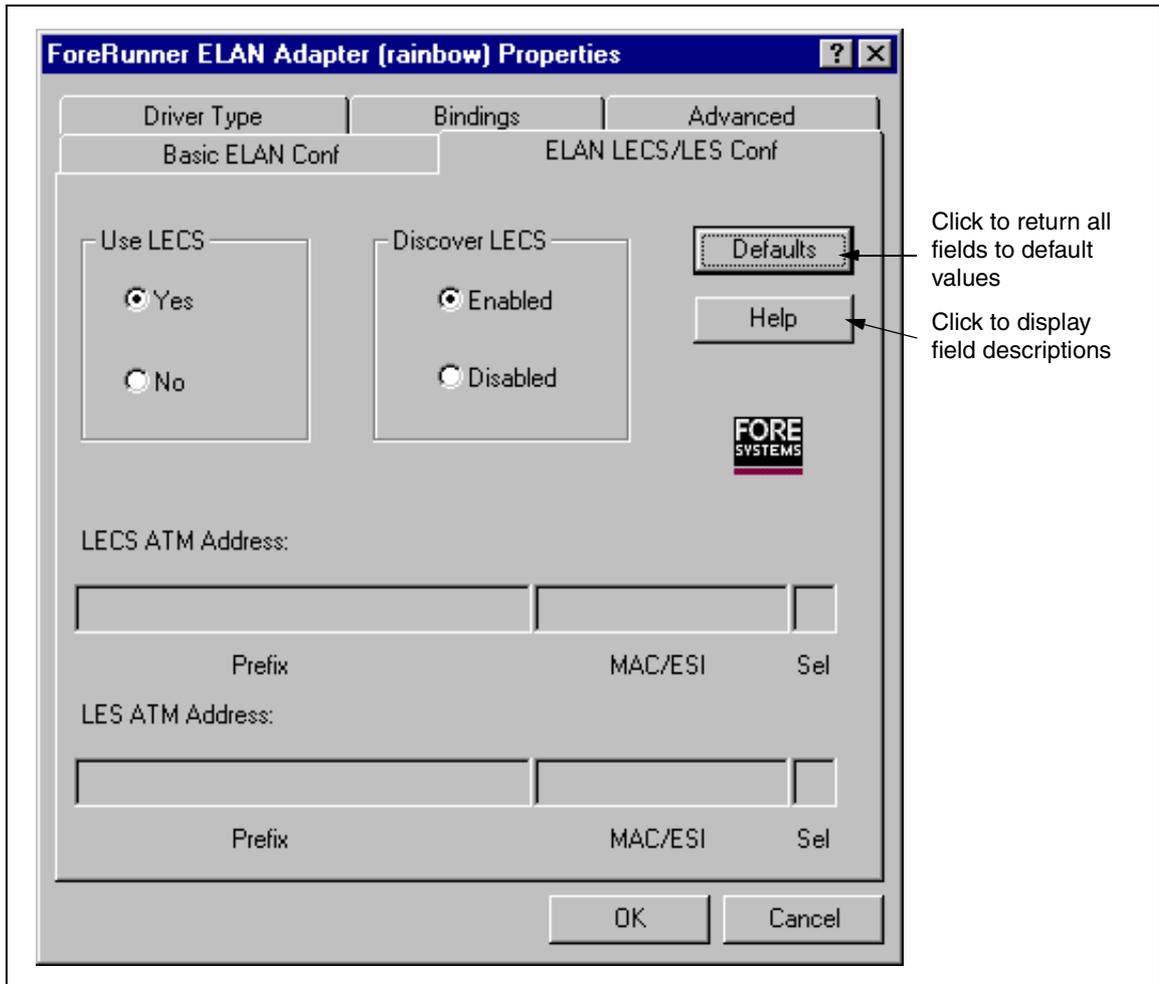
Figure 5.15 - ELAN LECS ⁄ LES Configuration Tab

a. Indicate whether or not you are using an LECS. If you are using the LECS, you don't have to specify the LES address or an ELAN name (if the Automatic ELAN Name has been configured in the LECS).

> **NOTE** LECS usage for all ELAN drivers is determined by the first ELAN driver that you install. All ELAN drivers must use the same LECS, whether you use the well-known address, PVC (0,17), or manually enter the address.

b. Indicate whether or not the driver should attempt to contact the LECS automatically. If you enable discovery of the LECS, you don't have to specify the LECS address.

c. The **LECS ATM Address** field contains the address for the LAN Emulation Configuration Server (LECS).

   If you are using an LECS but **Discover LECS** is disabled, you must specify the LECS address in this field.

d. The **LES ATM Address** field contains the address for the LAN Emulation Server (LES) associated with this ELAN.

   If the LECS is not configured - **LECS Use is Disabled** is displayed above the address field. You must specify the LES ATM address. Refer to "How to Specify an ATM Address" on page 4-4 for information about the format of an ATM address.

8. Click the **OK** button when you are finished configuring the *ForeRunner* ELAN adapter driver. The Network control panel appears, with the **ForeRunner ELAN Adapter** driver in the list of installed network components. A description of the adapter appears in the **Description** field when the ELAN adapter is selected.

Figure 5.16 shows an example of the Network control panel with the driver and an ELAN driver installed.

> **NOTE** If you change the name of the ELAN, the old name still appears in the installed network components list until you exit the Network control panel and re-enter it.
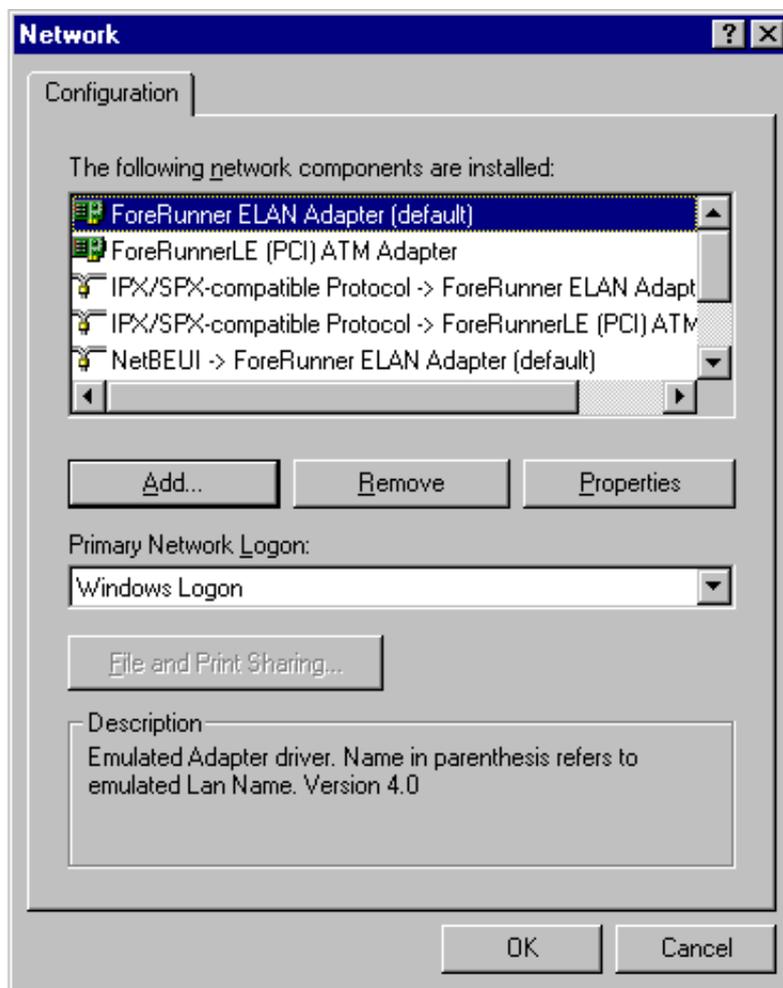
Figure 5.16 - Network Control Panel with an ELAN Driver Installed

9. Do one of the following:

    a. Return to the beginning of this procedure to install additional ELAN drivers.

    b. Proceed to "Installing the IP Over ATM (RFC 1577) Driver" on page 5-28 to install one or more Classical IP drivers.

    c. Proceed to "Binding Protocols to the ELAN and IP Over ATM Drivers" on page 5-35 if you have installed all ELAN and IP over ATM drivers.

5.4.8 Installing the IP Over ATM (RFC 1577) Driver

Use the following procedure to install one or more IP Over ATM (RFC 1577) drivers on a Windows 95/98 system. This driver can be used to connect to a Classical IP LIS.

> **NOTE** You must repeat this procedure for each LIS that you want to join. You can install a maximum of four IP Over ATM (RFC 1577) adapter drivers.

1. In the Network control panel, click the **Add** button. The Select Network Component Type dialog box appears, as shown in Figure 5.17.
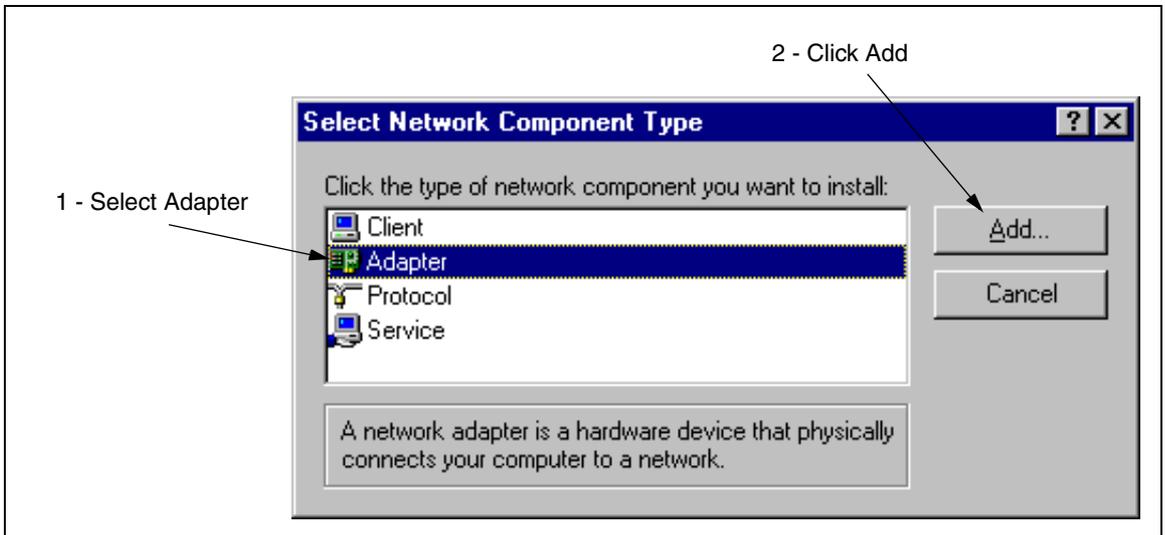
Figure 5.17 - Select Network Component Dialog Box

2. Select **Adapter** and click the **Add** button. If this is the first IP Over ATM or ELAN driver you've installed, a progress bar is displayed as Windows 95/98 builds an adapter database. The Select Network adapters dialog box appears, as shown in Figure 5.18.

3. Select **Fore Systems, Inc.** and **ForeRunner IP over ATM (RFC 1577) Adapter**, as shown in Figure 5.18.   Depending on what Marconi drivers you have installed previously, you may be prompted for Marconi driver files. Specify the path to the Marconi Windows 95/98 distribution files, and proceed. If you are using the Marconi adapter software CD, this would be `e:\windows\win95\patch`, assuming your CD drive is `e:`.

The Network control panel appears with the IP Over ATM driver in the list of installed network components, as shown in Figure 5.19.
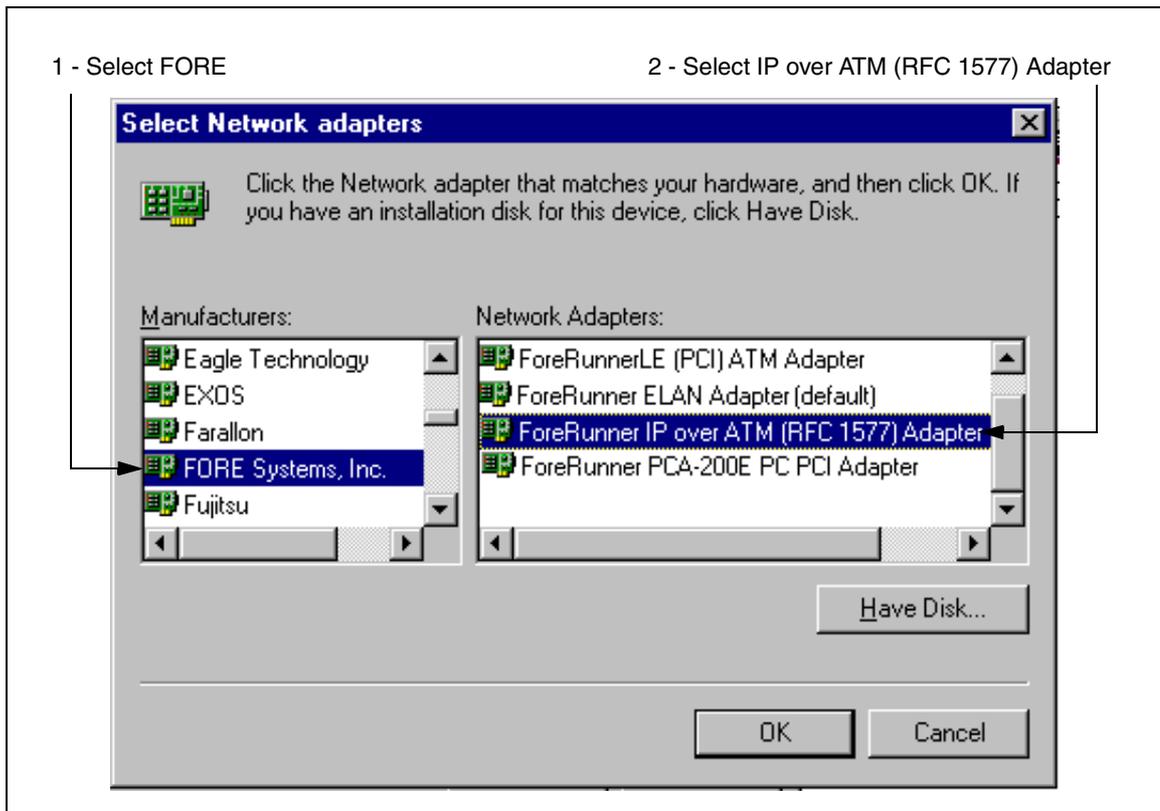
Figure 5.18 - Select Network Adapters Dialog Box

4. Select **ForeRunner IP over ATM (RFC 1577) Adapter** and click **Properties**, as shown in Figure 5.19. The ForeRunner IP over ATM (RFC 1577) Adapter Properties dialog box appears, as shown in Figure 5.20.
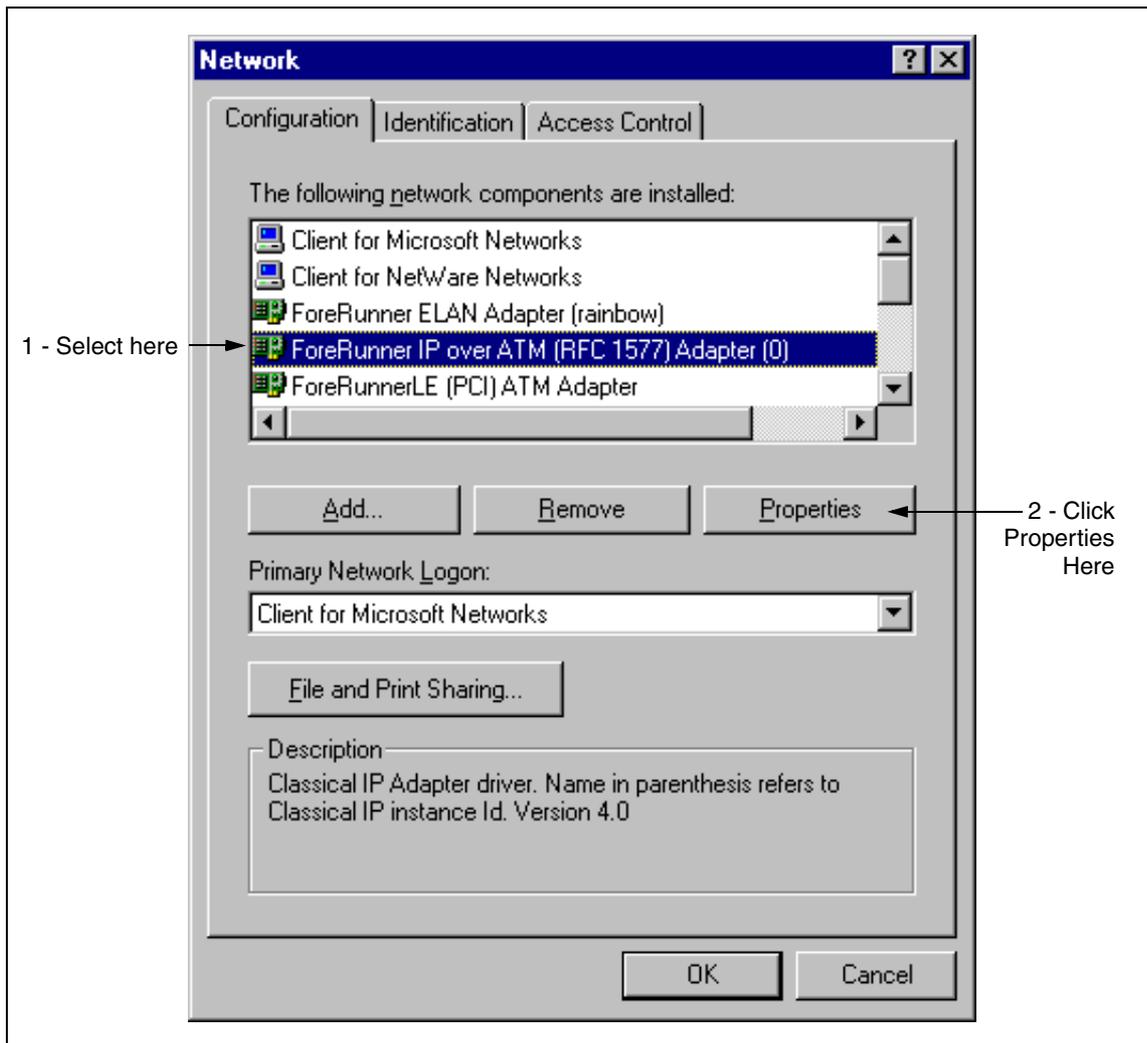
Figure 5.19 - Network Control Panel with IP Over ATM Driver

5. Edit the Adapter Configuration parameters as necessary for your site. The only tabs you can edit are the **Adapter Configuration**, **Configuration Params**, and **PVC Connections** tabs. Do not attempt to configure the driver through the **Driver Type**, **Bindings**, and **Advanced** tabs. Information configured through the **Advanced** tab is ignored by the driver.

By default, the driver is configured to use the Microsoft ARP server at the well-known address. If the Microsoft ARP server is not available, or your site is using a specific ARP server, you must specify the ATM address of the ARP Server that this driver uses to resolve addresses of other hosts. Get this address from your system administrator. You must also specify an identifier for this CLIP driver. For other parameters you can use the defaults unless directed otherwise by your system administrator.
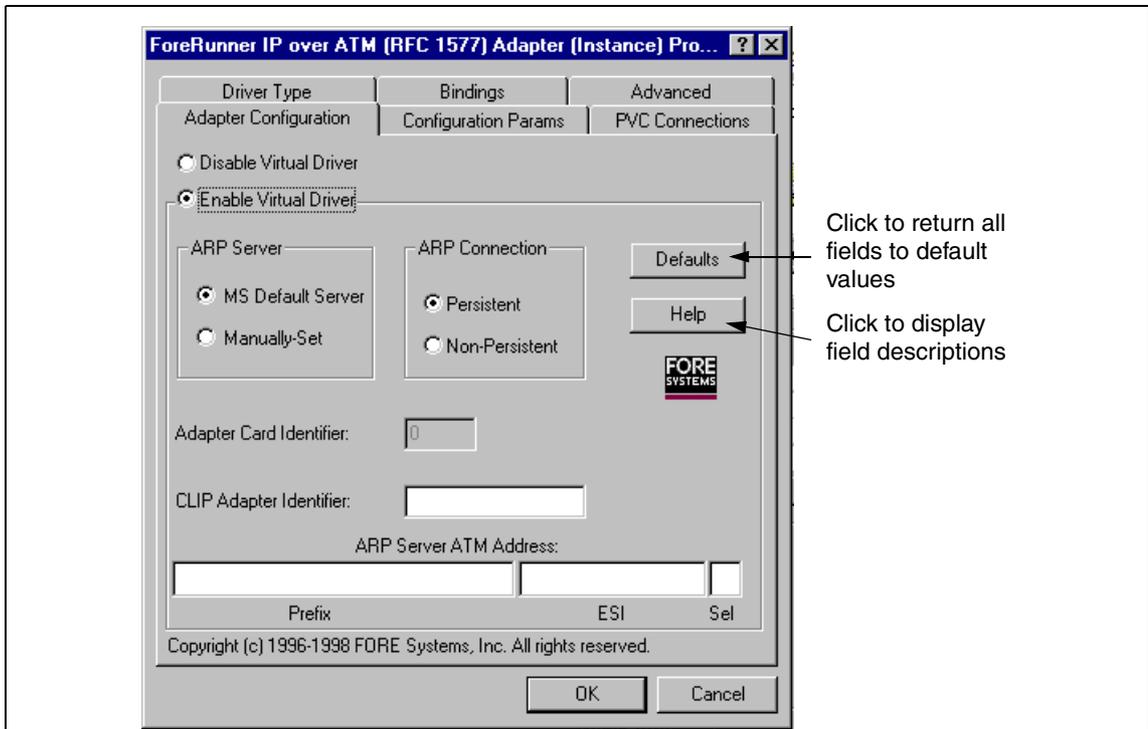
Figure 5.20 - Adapter Configuration Tab

6. Select the **Configuration Params** tab, shown in Figure 5.21.

7. Edit the configuration parameters as necessary for your site.
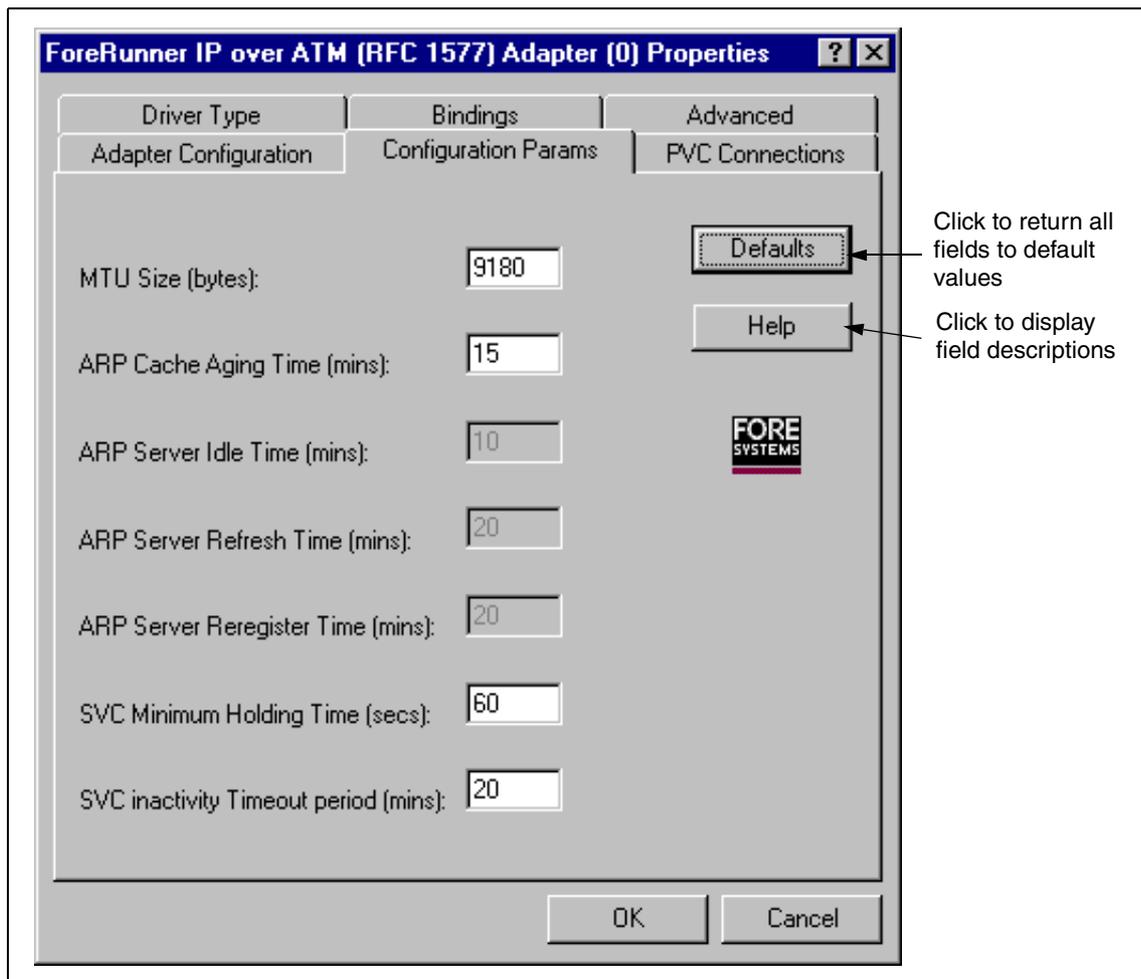
Figure 5.21 - Configuration Params Tab

8. If you must manually enter PVC connections for the driver, select the **PVC Connections** tab, shown in Figure 5.22. Contact your system administrator for any PVCs you may have to add.
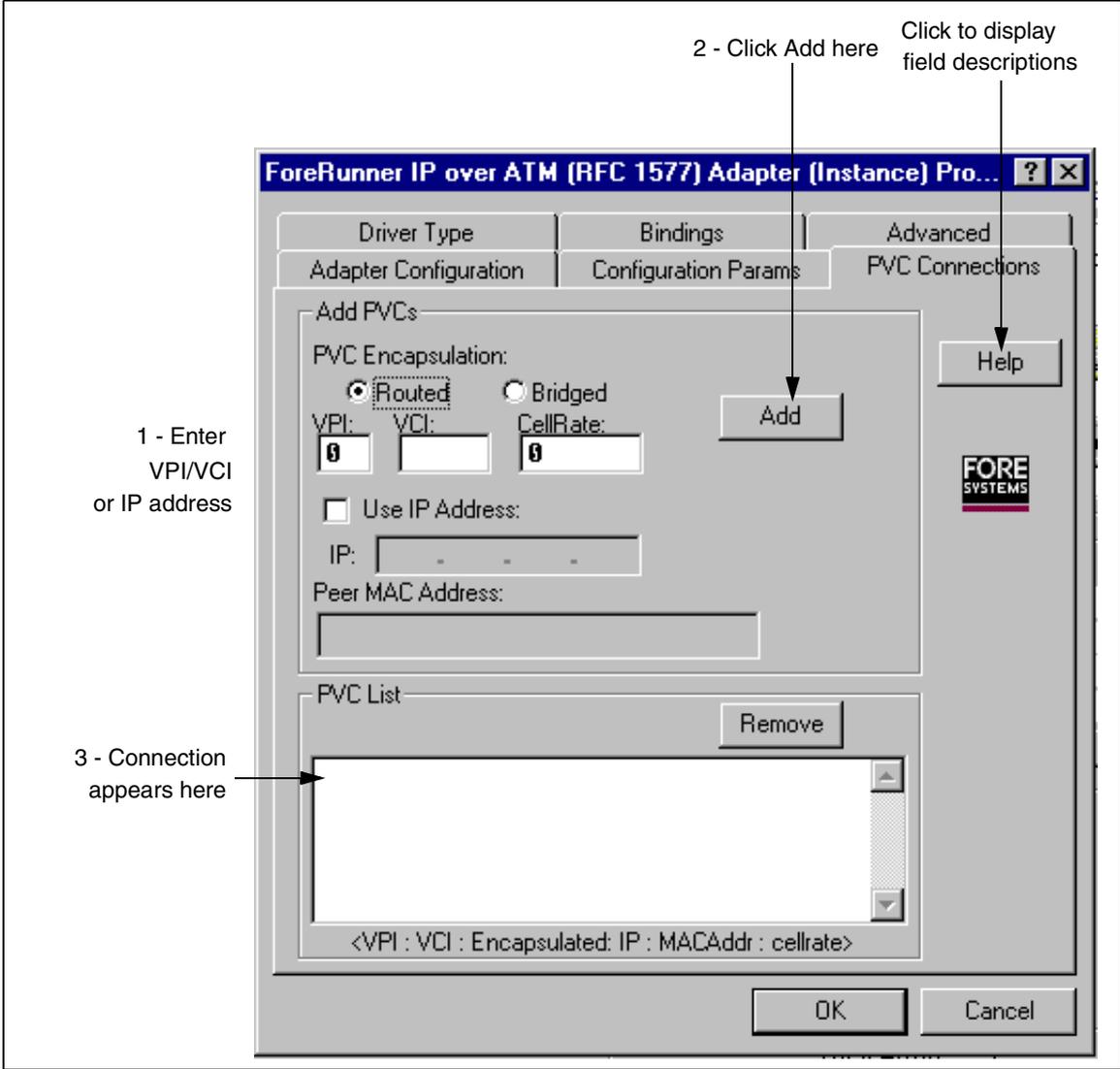
Figure 5.22 - PVC Connections Tab

    a. Enter the VCI for the PVC connection (the VPI is always zero) *or* check the **Use IP Address** option and specify the IP address of the destination host. Only VPI 0 is supported. Also, please note that VCI's 0 through 31 are reserved by the ATM Forum, and that the Marconi drivers support a limit of 1024 VCI's.

    b. Specify a CBR Maximum Cell Rate for the PVC if desired by entering a rate in the **CellRate** field. 0 indicates a UBR connection.

    c. You can accept the default encapsulation (**Routed**) or select **Bridged** encapsulation. If you select Bridged encapsulation, you must enter a MAC address of the peer machine.

    d. Click the **Add** button. The connection appears in the **PVC List**.

Repeat these steps for additional PVC connections.

Removing Connections from the List - To remove a connection from the list, highlight the connection by clicking on it in the list and click the **Remove** button.

9. Do one of the following:

    a. Return to the beginning of this procedure to install additional IP Over ATM drivers.

    b. Proceed to "Binding Protocols to the ELAN and IP Over ATM Drivers" on page 5-35 if you have installed all ELAN and IP over ATM drivers.

5.4.9 Binding Protocols to the ELAN and IP Over ATM Drivers

5.4.9.1 Binding Limitations in Windows 95/98

Windows 95/98 allows up to eight bindings per network protocol (IPX, NetBEUI, or TCP/IP). There is also a NetBios restriction of a combined total of eight protocol bindings using NetBEUI and TCP/IP. If you have a total of more than eight protocol bindings using NetBEUI and TCP/IP, your system may hang at boot-up. For example, if you have bound five drivers to TCP/IP, you can only perform three bindings to NetBEUI, because the total number of TCP/IP and NetBEUI bindings cannot exceed eight.

5.4.9.2 Binding the Protocols

Use the following procedure to complete the installation:

1. Bind any network protocols to the ELAN or IP Over ATM driver or drivers, as required by your site, and within Windows 95/98 networking limitations.

    To configure the bindings, select the binding in the list of installed network components in the Network control panel and click the **Properties** button. If you select the TCP/IP binding, the TCP/IP Properties dialog box is displayed, as shown in Figure 5.23.

    Contact your system administrator for any addresses (such as TCP/IP) you may need. If your site is using the Dynamic Host Configuration Protocol (DHCP), you do not need to specify a TCP/IP address.

    For specific instructions about Windows 95/98 network configuration, please consult your system administrator and the appropriate Windows 95/98 documentation.

NOTE

Keep the following notes in mind as you bind the protocols to the drivers:

• The IP Over ATM driver only binds to TCP/IP. The ELAN driver can bind to TCP/IP, NetBeui, or IPX/SPX.

• You must bind network protocols to each ELAN or IP Over ATM driver you have installed separately, and assign each ELAN a distinct address.

• If you are using automatic ELAN selection and TCP/IP, you must still get the appropriate TCP/IP address for your host on that ELAN.

2. Click the **OK** button. You are prompted to reboot the system. Click the **Restart Now** button. The *ForeRunner* adapter driver installation is now complete. When the PC reboots, the Marconi ATM, ELAN and IP over ATM drivers are loaded.
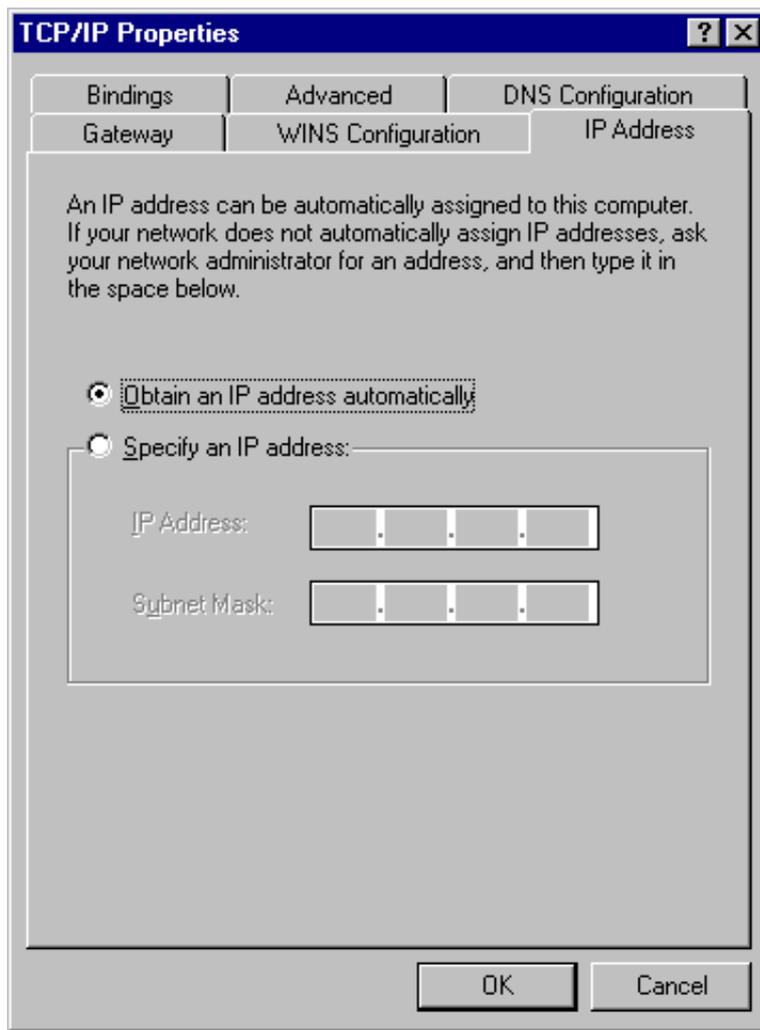
Figure 5.23 - TCP/IP Properties Dialog Box

3. If necessary, proceed to configure the MPOA and QoS parameters for your ELAN connections, as described in Chapter 9. Consult your system administrator to determine if you need to configure these parameters.

> **NOTE**
>
> If you reconfigure an already installed ELAN driver to join a different ELAN (for example by changing the ELAN name parameter or the LECS usage), the ELAN driver retains any QoS Preferences that had previously been defined for the driver in InFOREmation Center.
>
> If you want to create new QoS preferences for the reconfigured ELAN connection, you must manually delete the existing preferences. To do this, enter InFOREmation Center, switch to Advanced View, select the ELAN in the VLAN Information tab, select the **QoS Preferences** button, and delete each preference in the MPOA Properties dialog box.

4. If you are using Winsock2 applications designed for use with the Marconi Service Provider Interface (SPI), install the SPI as described in "Installing and Upgrading the Service Provider" on page D-7.

5.4.10 Installing the ATM Driver Manually on Windows 95

You must install the ATM driver manually (as opposed to installing it when Windows 95/98 discovers the adapter when booting up) if you select "Do not install driver at this time" when Windows 95/98 discovered the LE or PCA adapter when booting up.

Also, if you removed the LE or PCA ATM drivers and later want to re-install or upgrade them, or other ATM adapter drivers have been installed, occasionally Windows 95/98 may not recognize that the drivers had been removed and will automatically re-install the old drivers.

Use the following procedure to install the ATM driver manually:

1. Display the System Properties control panel by using the following procedure:

    a. Click the **Start** button on the Taskbar.

    b. Select **Settings**.

    c. Select **Control Panel**. The Control Panel appears.

    d. Double-click on the **System** icon.

    The System Properties control panel appears.

2. Select the **Device Manager** tab.

    The **Device Manager** information appears, as shown in Figure 5.24. A question mark appears next to the PCI card.

Remove and reboot
or select Properties
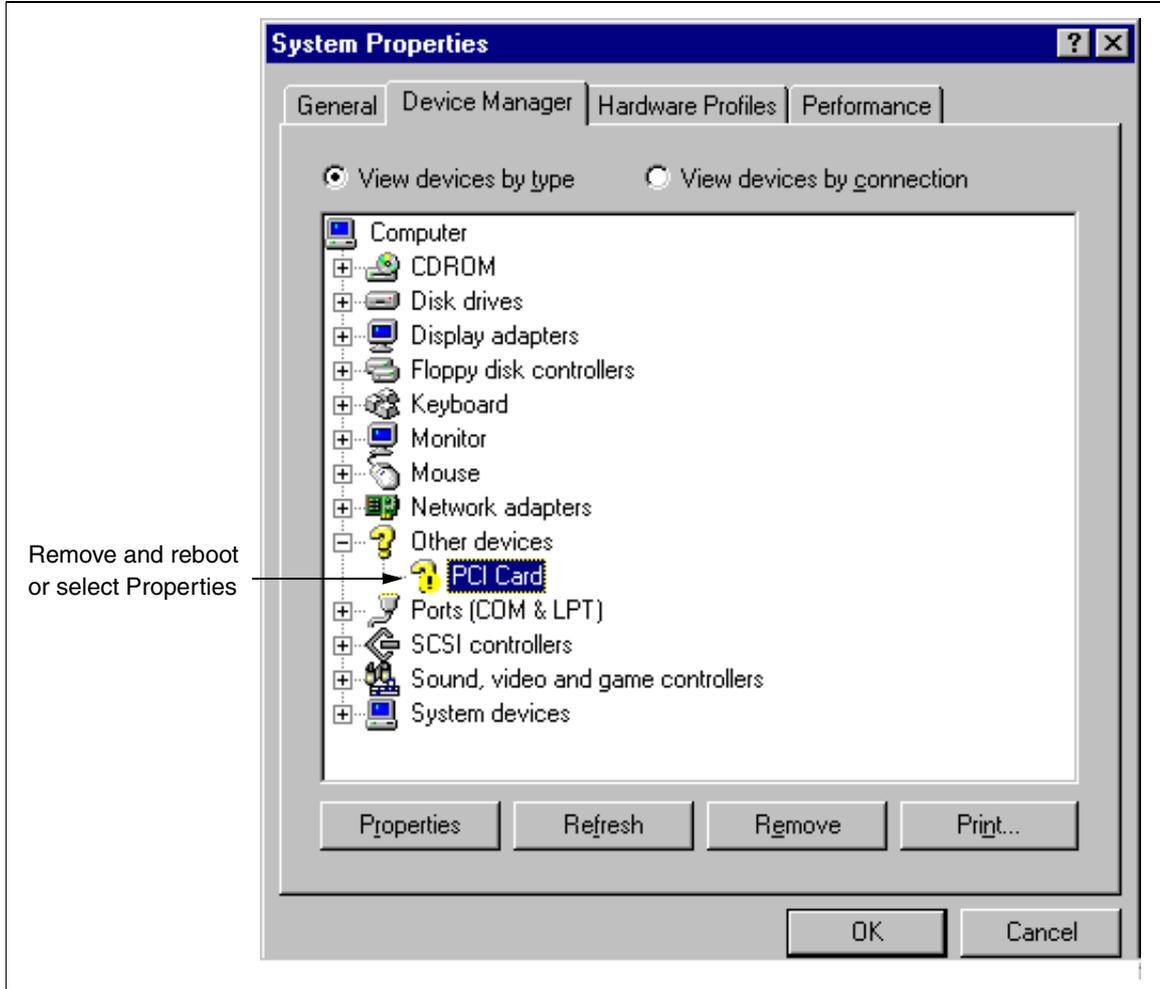
Figure 5.24 - Device Manager Tab

3. At this point, you have two options:

    a. You can remove the unknown card from the list by highlighting it and choosing the **Remove** button. You can then reboot the machine. Windows 95∕98 discovers the adapter and you can proceed to install the driver as described in "Installing the Marconi ATM Adapter Driver in Windows 95" on page 5-13.

    b. You can continue with the manual installation by proceeding to step 4.

4. Select the PCI card and click the **Properties** button.

   The PCI Card Properties dialog box appears.

5. Select the **Driver** tab. The Driver information appears, as shown in Figure 5.25.
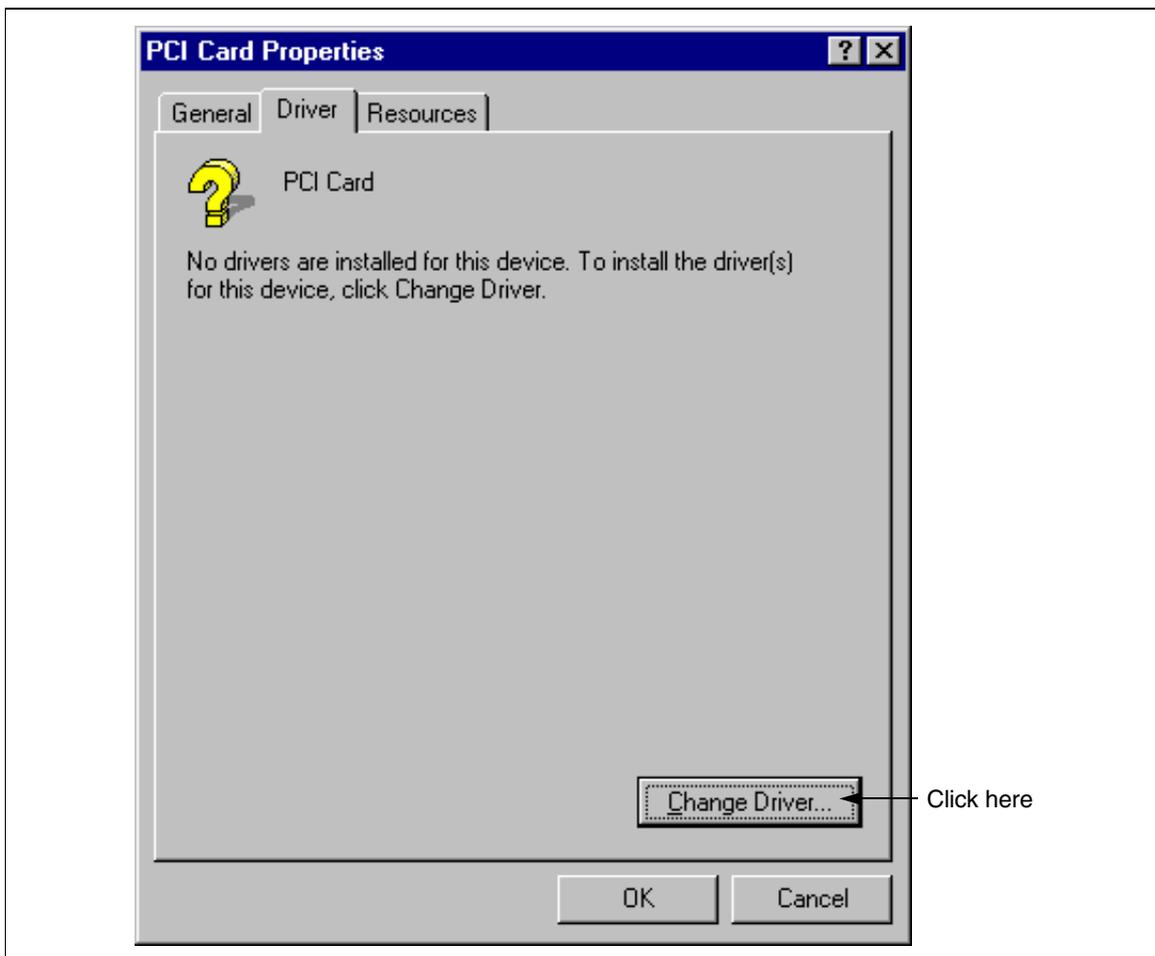
Figure 5.25 - PCI Card Driver Tab

6. Click the **Change Driver...** button, as shown in Figure 5.25. The Select Hardware Type dialog box appears, as shown in Figure 5.26.

Figure 5.26 - Select Hardware Type Dialog Box

7. Click **Network Adapters** and click the **OK** button. The Select Device dialog box appears.

8. Click the **Have Disk...** button. The Install from Disk dialog box appears.

9. Change the path to indicate the location of the Marconi Windows 95/98 distribution files. If you are using the Marconi adapter software CD, this would be `e:\windows\win95\patch`, assuming your CD drive is `e:`.

10. Press **ENTER**. The Select Device dialog box reappears, listing the driver for your adapter.

11. Click the **OK** button to install the driver. The driver now appears in the **Device Manager** tab of the System Properties dialog box. A prompt appears, asking if you want to restart the PC now to incorporate the changes.

12. Click the **Restart Now** button. The *ForeRunner* ATM adapter driver installation is now complete. You must proceed to install the ELAN driver, as described in "Installing the Emulated LAN Adapter Driver" on page 5-20.

5.5   Upgrading the Marconi Adapter Software

Refer to Chapter 8 for information on upgrading your Marconi drivers.

5.6   Installing the Marconi Service Provider Interface (SPI)

If you are using Winsock2 applications designed for use with the Marconi Service Provider Interface (SPI), install the SPI as described in "Installing and Upgrading the Service Provider" on page D-7.

CHAPTER 6 **Windows NT Installation**

This chapter describes how to install the Marconi ATM drivers on a Windows NT 4.0 operating system and gives requirements for the Marconi drivers. The installation process installs the drivers in the `\%system-root%\drivers` directory (usually `\system32\drivers`). The installation process also copies the Marconi statistics application, InFOREmation Center (described in Chapter 10) to the `\%system-root%` directory (usually `\system32`).

6.1   Procedures for All Marconi PC Adapters

These procedures can be used to install the Windows NT drivers for any of the Marconi PC adapters:

- LE, also referred to as the LE adapter
- PCA-200EPC, also referred to as the PCA adapter
- *ForeRunner*, also referred to as the HE adapter

During the installation, the model name for your adapter appears in the dialog boxes relating to the ATM adapter driver.

6.2   The Marconi ATM and LANE Drivers

You must install both a Marconi ATM driver and one or more of the following Marconi drivers:

- Emulated LAN (ELAN) driver to connect to an emulated LAN.
- IP over ATM (RFC 1577) (also referred to as Classical IP or CLIP) driver to connect to a CLIP Logical IP Subnet (LIS).

Contact your system administrator for information about the drivers you must install. An introduction to LAN Emulation and Classical IP is given in Chapter 1.

> **NOTE**   You must install the *ForeRunner* PCA, LE, or *ForeRunner* ATM Adapter driver prior to installing the ELAN or IP over ATM driver or drivers.

```
\windows\winnt\patch directory
(9 files and 1 subdirectory containing driver files):
```

```
\i386 directory
crdisk.bat
disk1
disk2
disk3
disk4
oemsetup.inf
oemsetup.inf.he
oemsetup.inf.le
oemsetup.inf.pca
```

This directory contains the following
26 files and 7 subdirectories:

```
\debug directory          foreinfo.hlp
\he directory             foreinfo.jar
\java directory           forelan.dll
\le directory             forelan.hlp
\pca directory            forelan.sys
\sys directory            foresee.exe
\winsock2 directory       foresnmp.dll
                          forestat.exe
foreadp.dll               foreuni.dll
foreadp.hlp               foreuni.hlp
foreclip.sys              forevir.dll
foreclp1.dll              forevir.hlp
foreclp1.hlp              forews2.dll
foreclp2.dll              forews2.exe
foreclp2.hlp              regutil.exe
foreclp3.dll              snmpinst.exe
foreclp3.hlp              unattend.txt
foreinfo.dll              upgrade.args
foreinfo.cpl              upgrade.exe
foreinfo.exe
```

Windows NT Installation

Figure 6.1 - Relevant Marconi Windows NT Installation Files

6.3   Installation Requirements

Requirements to ensure proper installation of the Marconi ATM drivers are:

- Approximately 1 MB of free disk space in the installation directory file system
- 16 M of RAM minimum (64M minimum for an HE622 adapter)
- Microsoft Windows NT version 4.0, server or workstation
- A PCI 2.0/2.1 specification compliant PC that appears on the Microsoft, Inc., Hardware Compatibility List
- Successful installation of the Marconi adapter card (see Chapter 3) (Note that you cannot install an LE and PCA or HE622 adapter together in the same PC.)
- The *ForeThought* 5.1 distribution files for Windows NT These files are available from Marconi's TAC or the Marconi driver software CD.

| NOTE | If you must install the files from a diskette, refer to "How to Create Installation Diskettes" on page 4-5 for information about creating a Windows NT installation diskette. |

6.3.1   Relevant Files

The relevant files for Windows NT driver installation are listed in Figure 6.1. The files in the Marconi distribution are compressed, and are uncompressed in the installation process. Do not copy the files and attempt to execute them directly.

6.4   Installing the Marconi Adapter Software

The installation of the Marconi ATM adapter software consists of three parts:

1.   Installing the *ForeRunner* ATM Adapter driver for each Marconi adapter that has been installed on your PC.

2.   Installing and configuring one or more of the following:

   a.   A *ForeRunner* ELAN Adapter driver for each ELAN to which you want to connect.

   b.   A *ForeRunner* IP over ATM (RFC 1577) Adapter driver for each Classical IP LIS to which you want to connect.

3.   Bind your network protocols to the ELAN or IP Over ATM drivers.

4.   If you are using Winsock2 applications designed for use with the Marconi Service Provider Interface (SPI), install the SPI as described in "Installing and Upgrading the Service Provider" on page D-7.

The following sections describe these procedures.
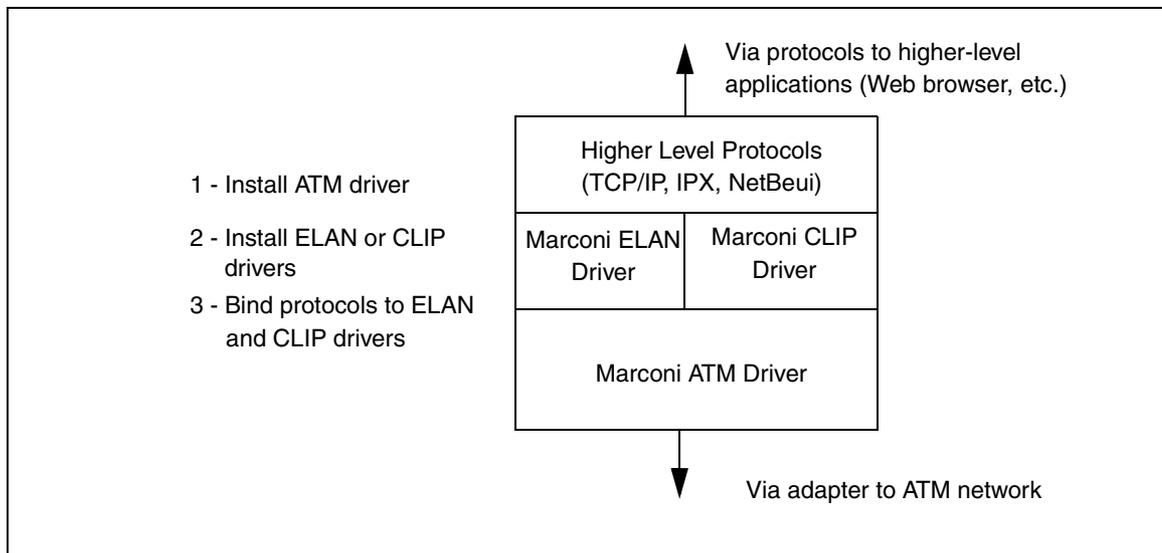
Figure 6.2 - Marconi Driver Configuration

6.4.1   Installing Drivers While Installing NT 4.0 Networking

If Windows NT 4.0 networking has ***not*** been installed, use the following procedure to install the Marconi drivers at the same time you install the Windows NT 4.0 networking component. This procedure involves using the Networking Wizard and installing Windows NT 4.0 networking files.

> **NOTE** ➤ This procedure requires your Microsoft Windows NT 4.0 Installation CD.

1. Display the Network control panel by using the following procedure:

    a. Click the **Start** button on the Taskbar.

    b. Select **Settings**.

    c. Select **Control Panel**. The Control Panel appears.

    d. Double-click on the **Network** icon.

    The prompt shown in Figure 6.3 appears, asking if you want to install Windows NT networking. Select **Yes**.
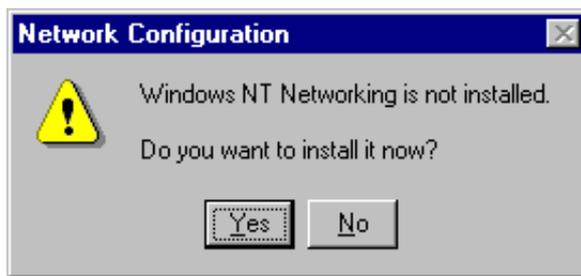
Figure 6.3 - Windows NT Prompt

2. The Network Setup Wizard appears.

3. Select **Next** to continue. The Adapter Search dialog box of the Wizard appears, as shown in Figure 6.4.
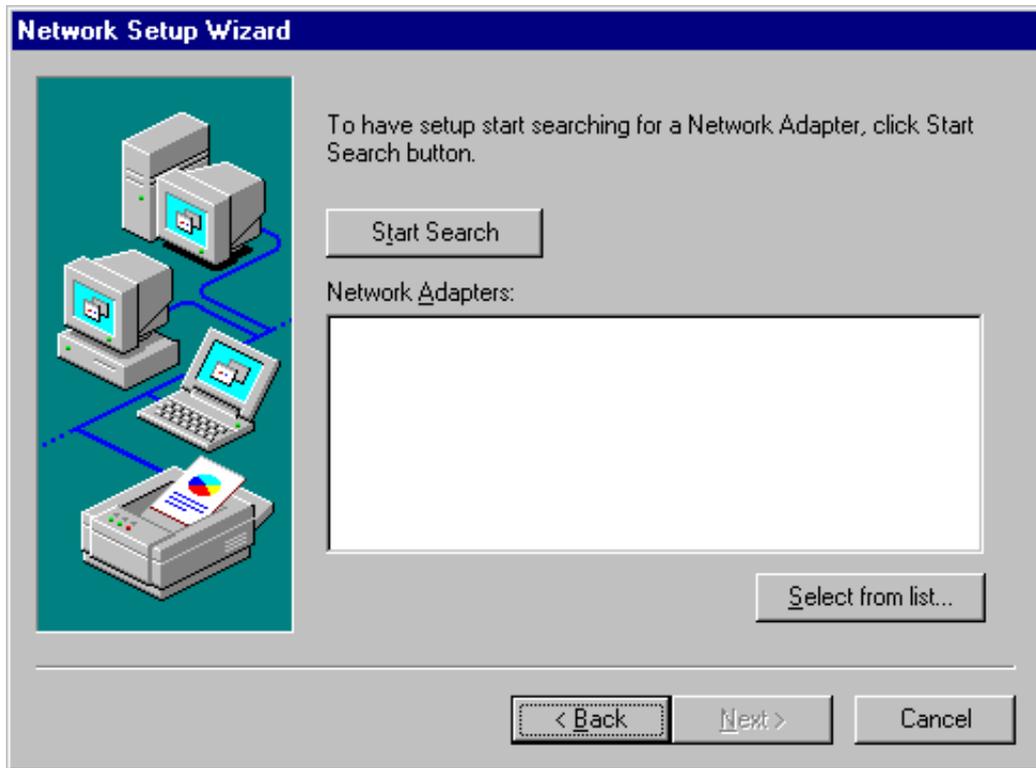
Figure 6.4 - Network Setup Wizard, Adapter Search

4. Click **Select from list...**. The Select Network Adapter dialog box is displayed.

5. Click the **Have Disk...** button. The Insert Disk dialog box appears.

6. Change the path to indicate the location of the Marconi Windows NT distribution files. If you are using the Marconi adapter software CD, this would be `e:\windows\winnt\patch`, assuming your CD drive is `e:`.

7. Press **Enter**. The Select OEM Device dialog box appears.

8. Select the **ForeRunner (xxx) ATM driver** that matches your adapter (PCA, HE622 or LE) and click **OK**. The driver appears in the **Network Adapters** list.

9. Return to step 4 and repeat the process to install one or more ELAN or IP Over ATM drivers.

10. Click **Next** to proceed. The Network Wizard Protocols dialog box appears.

11. Check any protocols required for your machine in addition to TCP/IP.

12. Click **Next** to proceed. The Network Wizard Network Services dialog box appears.

13. Click **Next** to proceed. The Network Wizard displays informational text.

14. Click **Next** to proceed. The Network Wizard prompts you for the Windows NT files, as shown in Figure 6.5.
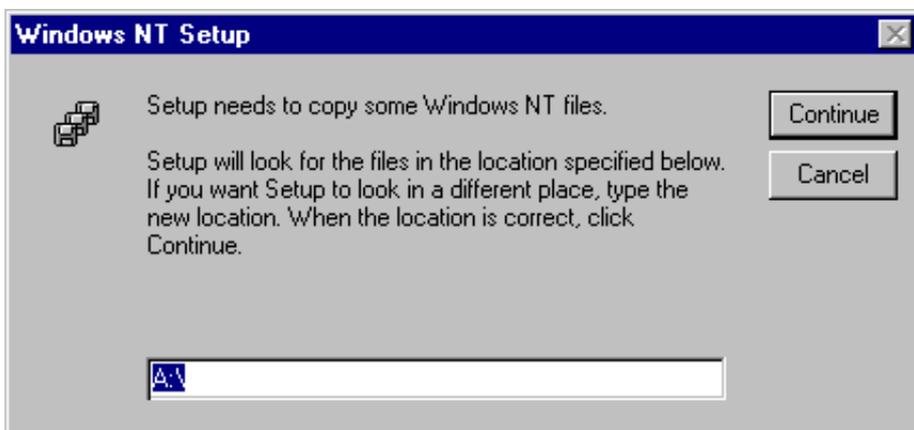
Figure 6.5 - Prompt for Windows NT Files

15. Although the prompt indicates that Setup needs Windows NT files, it actually needs the Marconi driver files. Change the path to the directory containing the Marconi Windows NT installation files. If you are using the Marconi adapter software CD, this would be `e:\windows\winnt\patch`, assuming your CD drive is `e:`. Click **Continue**. A second prompt appears, identical to that shown in Figure 6.5.

16. Setup now needs the Windows NT networking files. Insert the Windows NT distribution CD. Specify the directory containing the Windows NT distribution files and click **Continue**. The Windows NT Setup dialog box appears as files are copied.

> **NOTE**
>
> Be sure to change the path when you insert the Windows NT distribution CD.
>
> Incorrectly specifying the path (for example, specifying the path `D:\windows\winnt\patch`, used for the Marconi driver files, when the Windows NT CD is in the drive) will cause errors as Setup attempts to install the files.

17. The ForeRunner (xxx) ATM Driver dialog box appears. Edit the parameters as described in "Installing the Marconi ATM Adapter Driver" on page 6-10. Click **OK** when you are done editing the dialog box.

18. Additional dialog boxes for the ELAN and IP Over ATM drivers appear. Edit them as described in "Installing the Emulated LAN Adapter Driver" on page 6-18 and "Installing the IP Over ATM (Classical IP) Adapter Driver" on page 6-25.

19. Windows NT continues to install the networking components it needs. Depending on what Windows NT files have already been installed, a prompt may appear, asking you to insert the Microsoft Windows NT 4.0 software CD. Insert the CD and proceed.

20. As Windows NT installs the network bindings, it prompts you for TCP/IP bindings for the ELAN or IP Over ATM drivers. Specify the TCP/IP addresses for each driver and proceed.

21. When the final dialog box of the Network Wizard appears, click **Finish**. A prompt appears, asking you to reboot the system.

22. Click **Yes**.

Installation of the drivers is now complete. If you are using Winsock2 applications designed for use with the Marconi Service Provider Interface (SPI), install the SPI as described in "Installing and Upgrading the Service Provider" on page D-7.

6.4.2   Installing the Marconi ATM Adapter Driver

Use the following procedure to install the Marconi ATM Adapter driver on a Windows NT version 4.0 system.

NOTE If you are installing the drivers on a Windows NT 4.0 system that does not have the networking components installed, use the procedure in "Installing Drivers While Installing NT 4.0 Networking" on page 6-6.

1. Log on to the PC. You must have administrative privileges.

2. Display the Network control panel (shown in Figure 6.6) by using the following procedure:

    a. Click the **Start** button on the Taskbar.

    b. Select **Settings**.

    c. Select **Control Panel**. The Control Panel appears.

    d. Double-click on the **Network** icon.

    The Network control panel appears, as shown in Figure 6.6.

3. Select the **Adapters** tab and click **Add...**. The Select Network Adapter dialog box appears (see Figure 6.7).
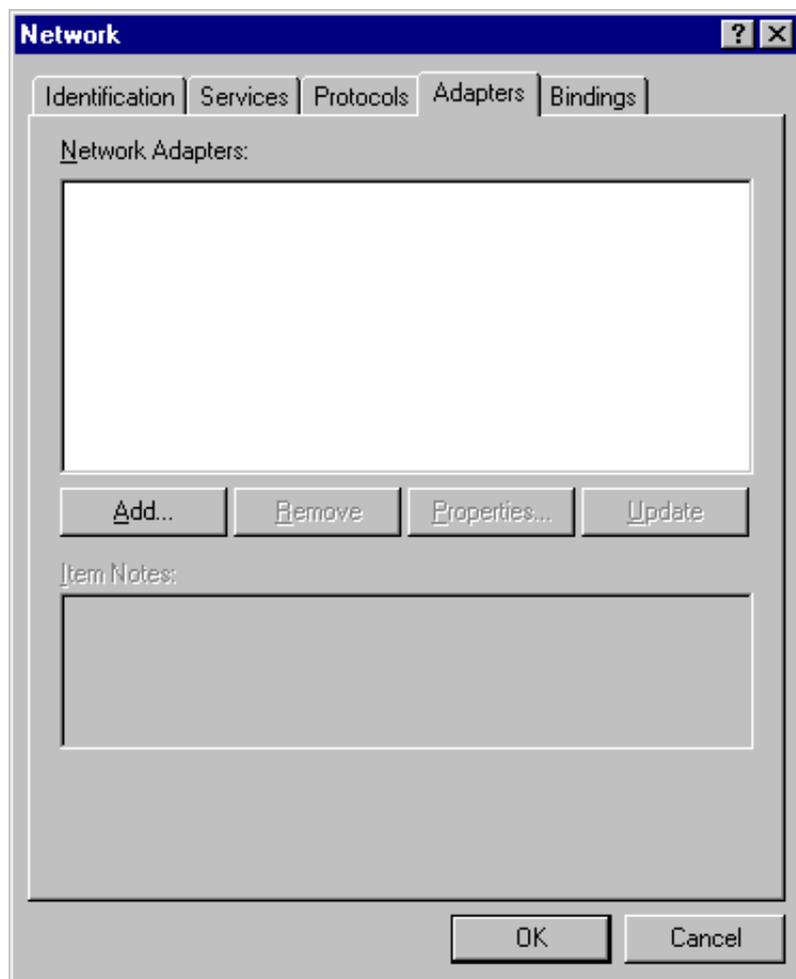
Figure 6.6 - Network Settings Control Panel

4. Select **Have Disk...** The Insert Disk dialog box appears, as shown in Figure 6.8.
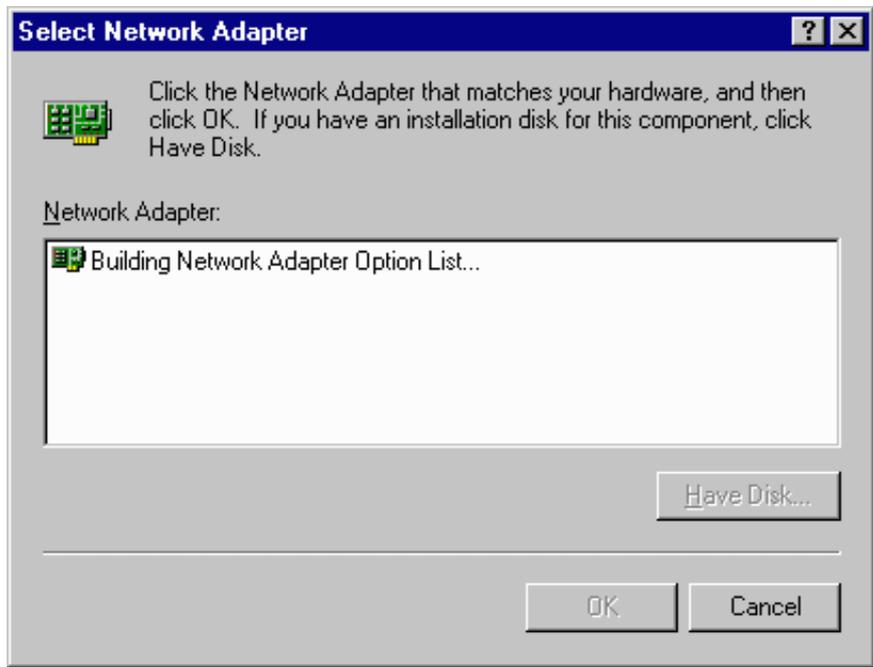
Figure 6.7 - Select Network Adapter Dialog Box
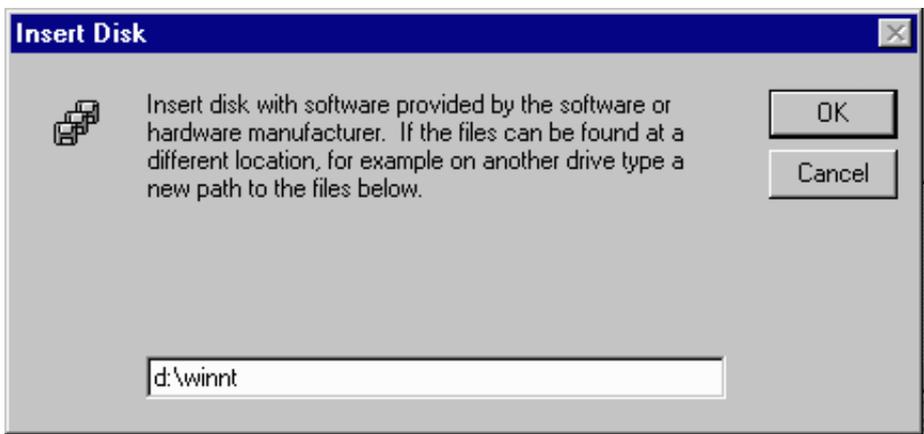
Figure 6.8 - Insert Disk Dialog Box

5. Change the default drive specification to indicate the path to the Marconi Windows NT distribution files. If you are using the Marconi adapter software CD, this would be `e:\windows\winnt\patch`, assuming your CD drive is `e:`.

6. Click the **OK** button. The Select OEM Option dialog box appears, as shown in Figure 6.9).
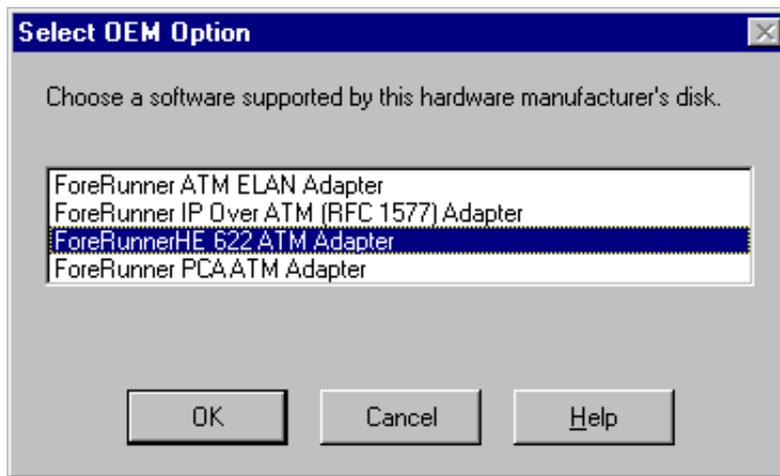
Figure 6.9 - Select OEM Option Dialog Box

7. Select the appropriate ATM driver for your adapter, PCA, HE 622, HE 155, or LE. In this example, **ForeRunnerHE 622 ATM Adapter** is selected. Click the **OK** button. The Windows NT Setup dialog box appears, with a progress bar showing the files being copied.

8. The ForeRunner (xxx) ATM Adapter dialog box appears after the files are copied. You can click **Cancel** to abort the entire installation process. Modify the fields to conform to your system requirements (the default values are adequate for most installations).

The dialog box for the HE adapter (shown in Figure 6.10) is different than the dialog box for the LE and PCA adapters (shown in Figure 6.11).

If your site is using ILMI - If you are using ILMI to determine the hosts ATM address and UNI version, and are using the default buffer values and other defaults, you can immediately click the **OK** button and proceed to step 15 on page 6-16.
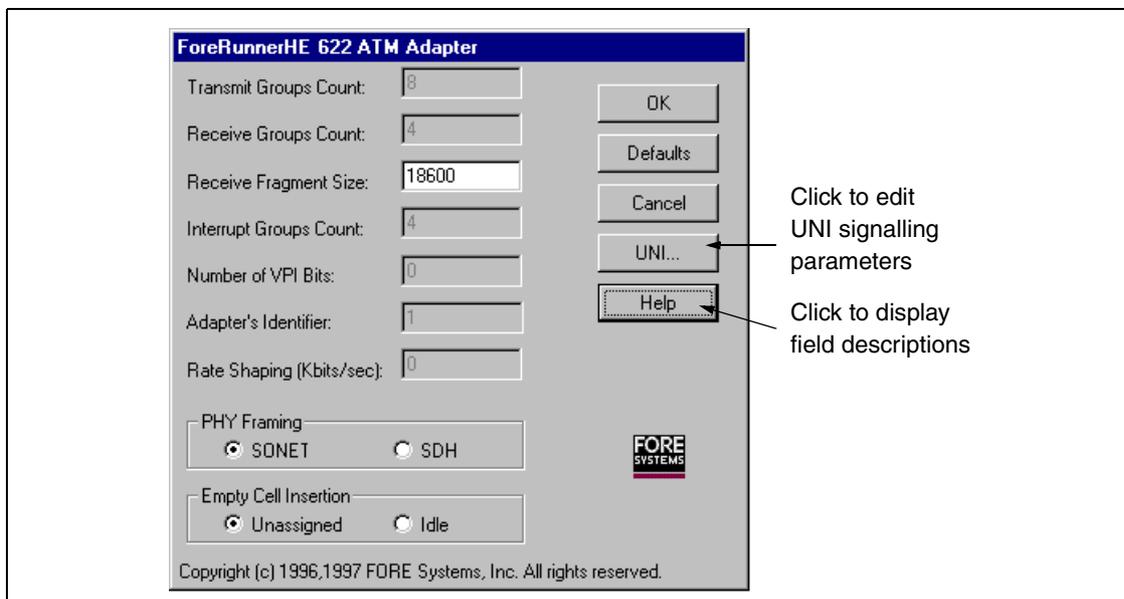
Figure 6.10 - ForeRunnerHE ATM Adapter Dialog Box
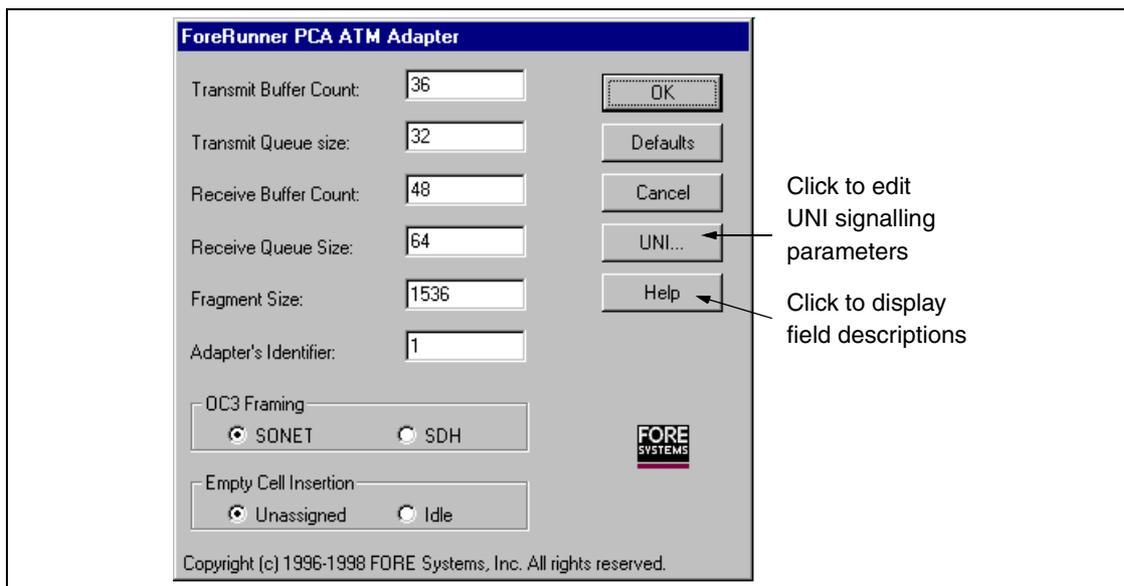
Figure 6.11 - ForeRunner PCA ATM Adapter Dialog Box (Same for LE Adapter Also)

HE/200E/LE ATM Adapters for the PC User's Manual

If you have installed multiple adapters - Note the number in the **Adapter's Identifier** field for this adapter. You need this information when defining the *ForeRunner* ELAN or IP Over ATM driver or drivers associated with this adapter.

> **NOTE** ▶
>
> Any changes to values appearing in this dialog box take effect only when the system is rebooted.

9. If you are not using ILMI or must edit the UNI signalling parameters for this adapter, click the **UNI...** button.

   Otherwise, click the **OK** button when you are done editing the parameters and proceed to step 14.

10. If you selected the **UNI...** button, the ATM UNI Signalling Configuration dialog box appears (see Figure 6.12). By default, **ILMI Enabled** is selected and you cannot modify the local ATM address of the adapter. Select the **Disabled** option if you want to manually enter the local ATM address of the adapter.
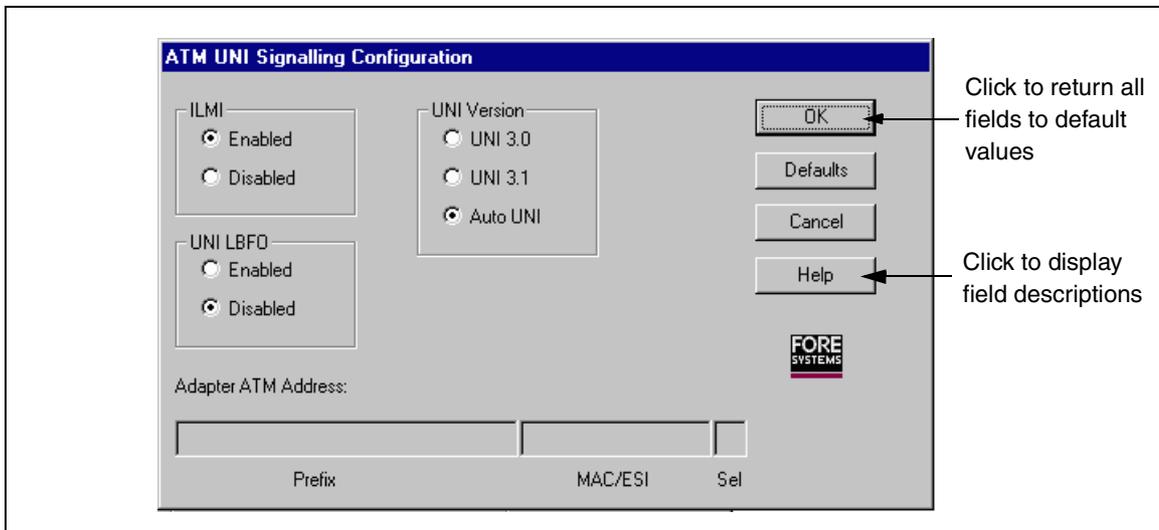
Figure 6.12 - ATM UNI Signalling Configuration Dialog Box

NOTE ▶ If you disable **ILMI** and the **UNI Version** parameter was set to **Auto UNI**, the **UNI Version** reverts to **UNI 3.0** (because the driver can no longer use ILMI to determine the UNI version). You *must* use the same version of UNI as that used by the ATM switch to which the adapter is connected. Get the correct values from your system administrator.

If you don't know the MAC address - If you aren't using ILMI and don't know the MAC address, you can specify `mm` for each two-byte portion of the MAC/ESI address. The adapter then automatically provides the address when it starts up.

Refer to "How to Specify an ATM Address" on page 4-4 for information about the format of an ATM address.

11. If you have multiple adapters in this host and want to use the Load-Balancing Failover feature, select the **Enabled** option in the **UNI LB/FO** area.

    With this option enabled, the driver configures all adapters in the host that have LB/FO enabled to balance the outgoing network traffic among them, and, in the event of the failure of an adapter, failover all network traffic to the remaining adapters.

    Note the following when enabling LB/FO:

    - All adapters in the host with LB/FO enabled must be on the same physical ATM network.
    - All adapters in the host with LB/FO enabled should be configured to use the same UNI version.
    - All adapters in the host with LB/FO enabled should be of the same speed. For example, all LE 155 adapters rather than a mix of LE 155s and LE 25s.

12. Click the **OK** button to return to the ForeRunner ATM Adapter dialog box.

13. Click the **OK** button.

14. A warning message appears, explaining that you must install the ELAN or IP Over ATM adapter driver. Click the **OK** button to continue.

15. The Network Settings control panel appears with the **ForeRunner (*adapter-model*) ATM Adapter** driver in the list of **Installed Adapter Cards**, as shown in Figure 6.13.

16. Proceed to do either or both of the following:

   a. Install one or more *ForeRunner* Emulated LAN Adapter drivers using the procedure in "Installing the Emulated LAN Adapter Driver" on page 6-18.

   b. Install one or more *ForeRunner* IP Over ATM Adapter drivers using the procedure in "Installing the IP Over ATM (Classical IP) Adapter Driver" on page 6-25.
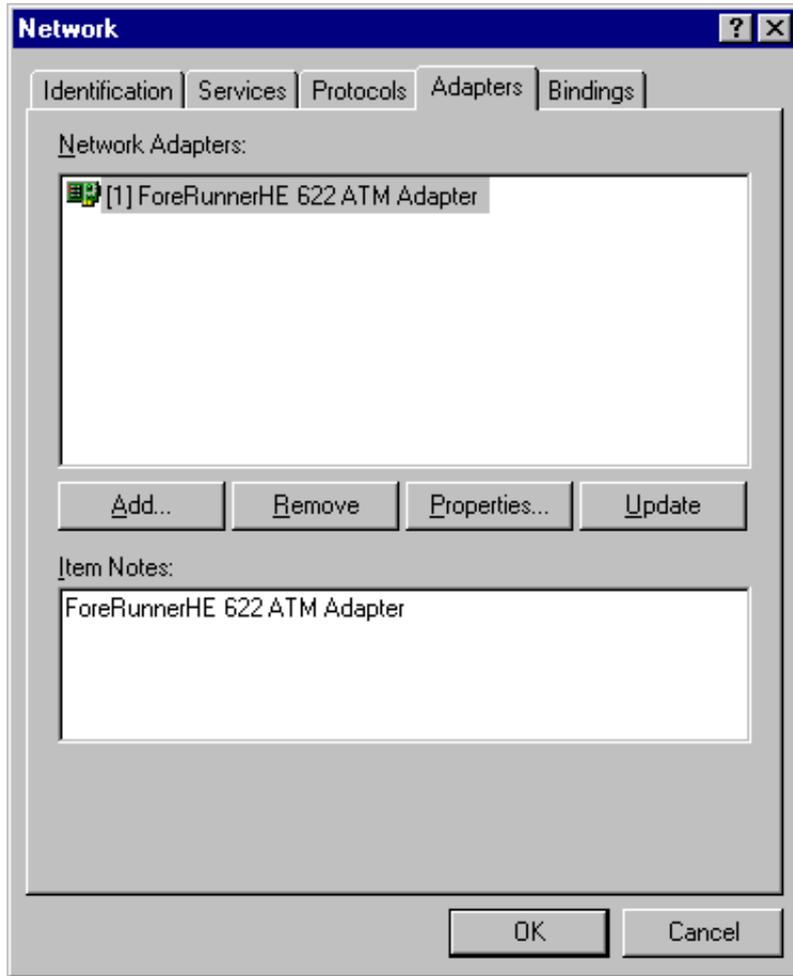
Figure 6.13 - Network Control Panel with ATM Driver Installed

6.4.3 Installing the Emulated LAN Adapter Driver

6.4.3.1 Connecting to Multiple ELANs

You may want to join more than one ELAN, for example, Engineering and Marketing. If so, then the following procedure must be repeated once for each ELAN that you want to join. You can connect to a combined total of 16 ELANs and LISs.

6.4.3.2 Installing the ELAN Driver

Use the following procedure to install the *ForeRunner* Emulated LAN Adapter driver on an existing Windows NT system:

1. Select the **Adapter** tab and click **Add**. The Select Network Adapter dialog box appears.

2. Select **Have Disk...**. The Insert Disk dialog box appears.

3. Change the drive specification to indicate the path to the Marconi Windows NT distribution files. If you are using the Marconi adapter software CD, this would be `e:\windows\winnt\patch`, assuming your CD drive is `e:`.

4. Click the **OK** button. The Select OEM Option dialog box appears, as shown previously in Figure 6.9.

5. Select **ForeRunner ATM ELAN Adapter** and click the **OK** button. The Windows NT Setup dialog box with a progress bar appears and the required files are copied.

6. The ForeRunner Emulated LAN Adapter dialog box appears (see Figure 6.14) after the files are copied.

Click to return all
fields to default
values

ForeRunner Emulated LAN Adapter

○ Disable Virtual Driver

◉ Enable Virtual Driver

LAN Type
◉ Ethernet
○ Token Ring

Adapter Identifier: |1

○ Automatic ELAN Selection
◉ Manual ELAN Selection
Emulated LAN Name:
|et1516

Frame Size
◉ 1516
○ 4544
○ 9234
○ 18190

OK   Cancel
Defaults▾
Advanced...
Help

FORE SYSTEMS

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Click to edit
LECS and LES
parameters

Click to display
field descriptions

Figure 6.14 - Emulated LAN Adapter Dialog Box

If your site is using the LECS - If you are using the LECS and other default values (LECS auto-discovery, automatic ELAN selection, Ethernet LAN Type with a Frame Size of 1516), you can click the **OK** button and proceed immediately to step **8** on page 6-23.

Otherwise, edit the parameters as needed:

       a.   If you want to disable this driver, so it does not start when the system is rebooted, select **Disable Virtual Driver**. When this option is selected, all parameters for the driver are grayed out and cannot be edited.

b. Select the media type of the ELAN to which this driver connects, either **Ethernet** or **Token Ring**.

c. Select the appropriate **Frame Size**. *This value must match the frame size of the ELAN.*

d. If you have more than one Marconi adapter in your system, and you want to associate this ELAN with an adapter other than the first, you must specify a value in the **Adapter Identifier** box. This field is read-only if only one Marconi ATM adapter is installed in your system.

The adapter identifier for each adapter was assigned in step **8** on page 6-13 of the previous procedure.

e. If you are using an LECS, you can select **Automatic ELAN Selection** in order to use the default ELAN specified by the LECS. In this case you don't need to enter a value in the **Emulated LAN Name** field, and can proceed to step **8**.

f. Enter the **Emulated LAN Name** that you want to join. Any valid alphanumeric name up to 32 characters long may be specified.

NOTE ▶ If the Automatic ELAN Name feature has been configured on the LECS (and you are using the LECS), you do not have to specify an ELAN name. The host will join the ELAN indicated by the LECS. You must still specify the ELAN type and MTU size (or accept the default). If no ELAN has been specified on the LECS that matches these parameters, the Automatic ELAN Name feature will not work. Use the InFOREmation Center utility, described in Chapter 10, to determine the name of the ELAN that the driver has joined.

This feature can only be used on one ELAN driver. For all other ELAN drivers, you must specify the ELAN name.

g. If you must configure the ATM address of the LECS or LES, click the **Advanced** button.

h. If you do not need to configure the advanced parameters, proceed to step **8**.

7. If you clicked the **Advanced** button, the ATM Forum LAN Emulation Configuration dialog box appears (see Figure 6.15). By default, the **Yes** radio button in the **Use LECS** box and the **Enabled** option in the **Discover LECS** box are selected.

> **NOTE** LECS usage for all ELAN drivers is determined by the first ELAN driver that you install. All ELAN drivers must use the same LECS, whether you use the well-known address, PVC (0,17), or manually enter the address.

If you aren't using the LECS - Under **Use LECS** select the **No** option. You must then specify the LES address in the **LES ATM Address** field.

If you aren't using auto-discovery for the LECS - Under **Discover LECS** select the **Disabled** option and enter the LECS address in the **LECS ATM Address** field.

Refer to "How to Specify an ATM Address" on page 4-4 for information about the format of an ATM address.

Click **OK** when you are done editing the fields on this dialog box. The ForeRunner Emulated LAN Adapter dialog box reappears.

Windows NT Installation
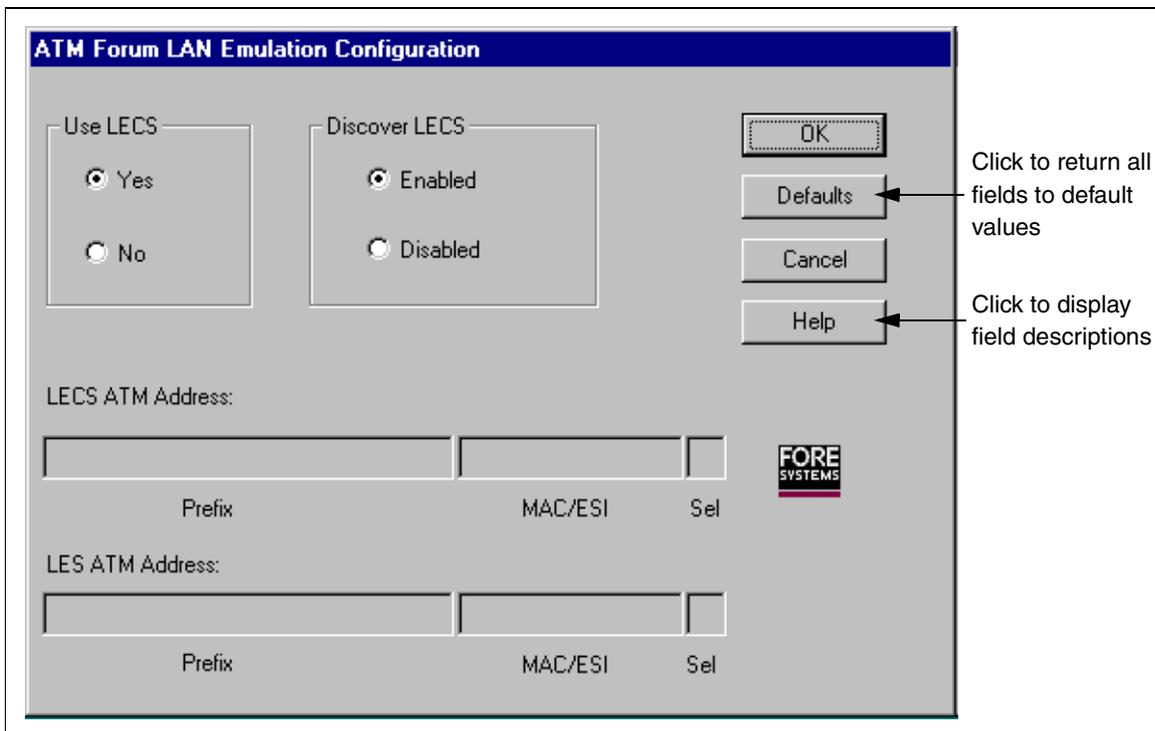
Figure 6.15 - ATM Forum LAN Emulation Configuration Dialog Box

8.   Click **OK** when you are finished configuring the *ForeRunner* ELAN adapter driver. If you are using the Automatic ELAN Selection feature, a warning appears, indicating that you must set the TCP/IP address and other parameters appropriately for the ELAN driver. Click **OK**.

The Network Settings control panel appears, with the **ForeRunner ELAN Adapter** driver in the list of **Installed Adapter Cards**, including the unit number. A description of the adapter appears in the **Description** field. Figure 6.16 shows an example of the Network Settings control panel with the Marconi ATM driver and an ELAN drivers installed. The name of the ELAN associated with each ELAN driver appear in parentheses.
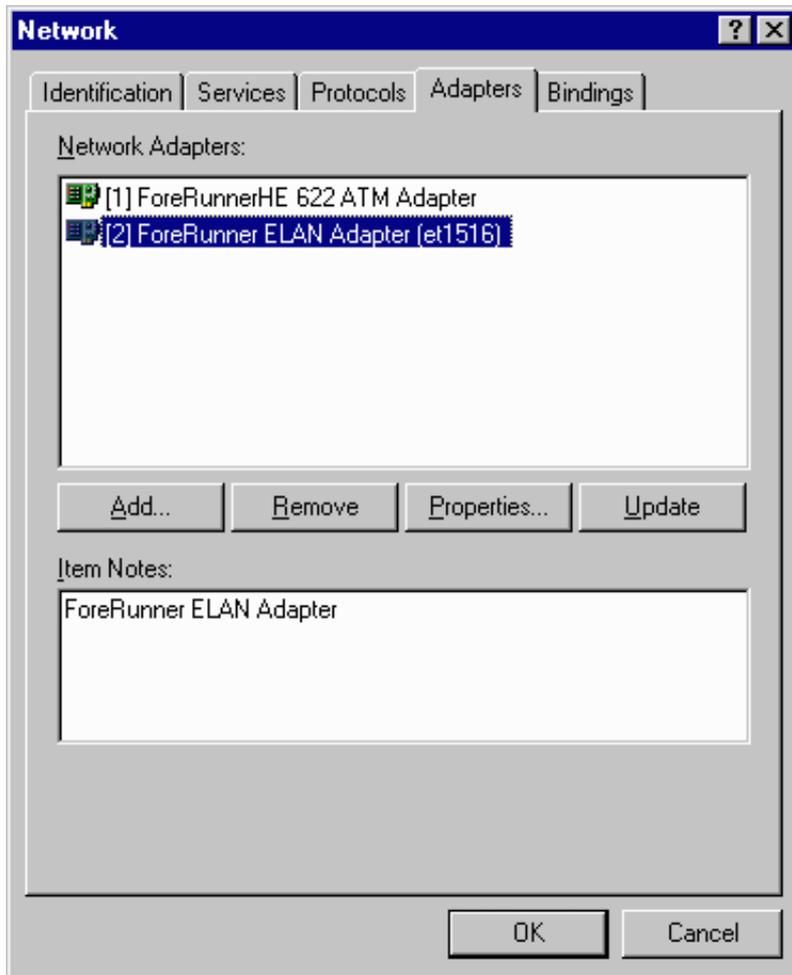
Figure 6.16 - Network Settings with ELAN Driver Installed

9. Do one of the following:

a. Return to the beginning of this procedure to install additional ELAN drivers.

b. Proceed to "Installing the IP Over ATM (Classical IP) Adapter Driver" on page 6-25 to install one or more Classical IP drivers.

c. Proceed to "Binding Protocols to the ELAN and IP Over ATM Drivers" on page 6-31 if you have installed all ELAN and IP over ATM drivers.

6.4.4 Installing the IP Over ATM (Classical IP) Adapter Driver

6.4.4.1 Connecting to Multiple LISs

You may want to join more than one LIS, for example, **Engineering** and **Marketing**. If so, then the following procedure must be repeated once for each LIS that you want to join. You can connect to a combined total of 16 ELANs and LISs.

6.4.4.2 Installing the IP Over ATM Driver

Use the following procedure to install the *ForeRunner* IP Over ATM Adapter driver on an existing Windows NT system:

1. Select the **Adapters** tab and click **Add...**. The Select Network Adapter dialog box appears.

2. Select **Have Disk...** The Insert Disk dialog box appears.

3. Change the drive specification to indicate the path to the Marconi Windows NT distribution files. If you are using the Marconi adapter software CD, this would be `e:\windows\winnt\patch`, assuming your CD drive is `e:`.

4. Click the **OK** button. The Select OEM Option dialog box appears.

5. Select **ForeRunner IP Over ATM (RFC 1577) Adapter** and click the **OK** button. The Windows NT Setup dialog box with a progress bar appears and the required files are copied.

6. The IP Over ATM Adapter Configuration dialog box appears (see Figure 6.17) after the files are copied.

   Edit the Adapter Configuration dialog box as necessary for your site By default, the driver is configured to use the Microsoft ARP server at the well-known address. If the Microsoft ARP server is not available, or your site is using a specific ARP server, you must specify the ATM address of the ARP Server that this driver uses to resolve addresses of other hosts. Get this address from your system administrator. You must also specify an identifier for this CLIP driver. For other parameters you can use the defaults unless directed otherwise by your system administrator.

IP Over ATM Adapter Configuration

○ Disable Virtual Driver

● Enable Virtual Driver

ARP Server
- ● MS Default Server
- ○ Manually-Set

ARP Connection
- ● Persistent
- ○ Non-Persistent

[OK]   [Cancel]

[Defaults]

[Advanced...]

[PVC Setup...]

[Help]

Adapter Card Identifier: [1]

CLIP Adapter Identifier: [   ]

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ARP Server ATM Address:

| 00000000.00000000.00000000.00 | 000000.000000 | 00 |
| Prefix | ESI | Sel |

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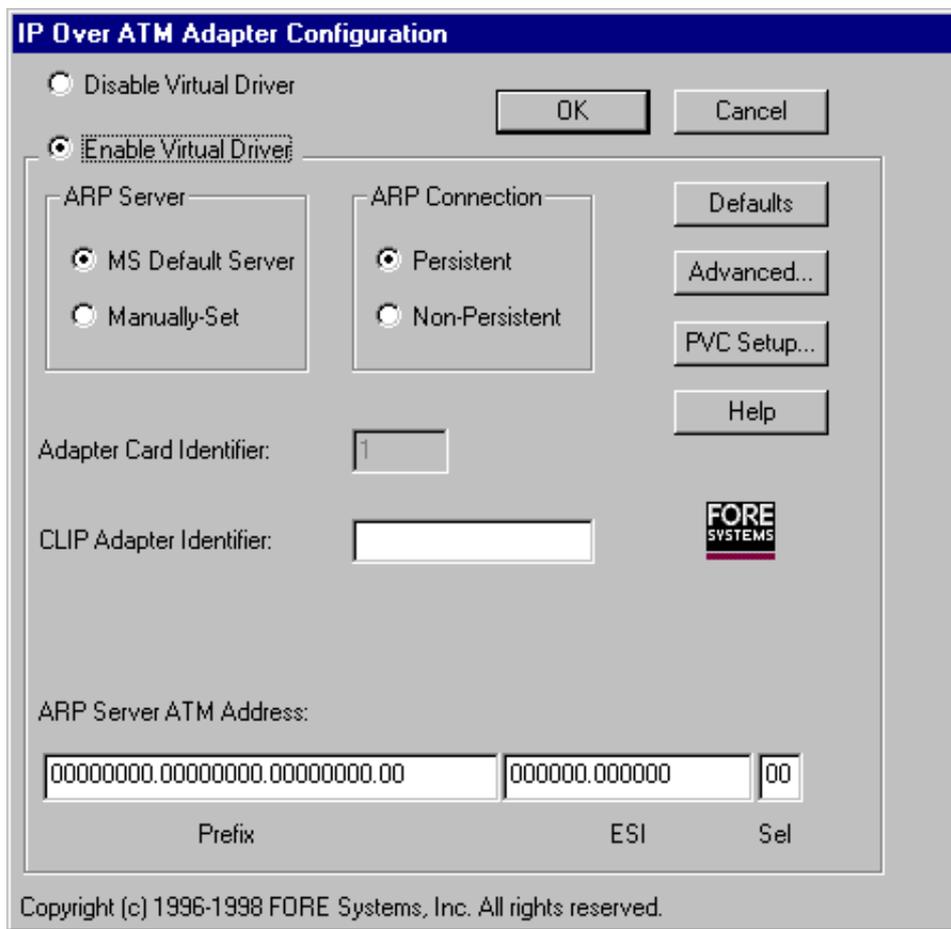
Figure 6.17 - IP Over ATM Adapter Configuration Dialog Box

a. If you want to disable this driver, so it does not start when the system is rebooted, select **Disable Virtual Driver**. When this option is selected, all parameters for the driver are grayed out and cannot be edited.

b. Select whether you want the connection to the ARP Server to be **Persistent**, in which the connection is maintained continuously, or **Non-Persistent**, in which the connection is created only when needed.

c. If you have more than one Marconi adapter in your system, and you want to associate this ELAN with an adapter other than the first, you must specify a value in the **Adapter Card Identifier** box. This field is read-only if only one Marconi ATM adapter is installed in your system.

   The adapter identifier for each adapter was assigned in step 8 on page 6-13 of the previous procedure.

d. In the **CLIP Adapter Identifier** field you can assign a name or number to this driver. The name can contain any valid alphanumeric character and be up to 32 characters long.

e. You ***must*** specify the ATM address of the ARP Server that this driver uses to resolve addresses of other hosts. Get this address from your system administrator. For other parameters you can use the defaults unless directed otherwise by your system administrator.

f. If you must configure the MTU size (the default is set to 9180, the recommended size for Classical IP LIS's) or change the default values for time-out parameters (how long entries are kept in the ARP cache, how long before the idle connections are dropped, etc.), click the **Advanced** button.

g. If you must manually configure PVC connections to other hosts on the LIS, click the **PVC Setup** button.

h. If you do not need to configure the advanced parameters or PVCs, proceed to step 9.

7. If you chose the **Advanced** button, the IP Over ATM Adapter Configuration Parameters dialog box appears, as shown in Figure 6.18. Edit the configuration parameters as necessary for your site.
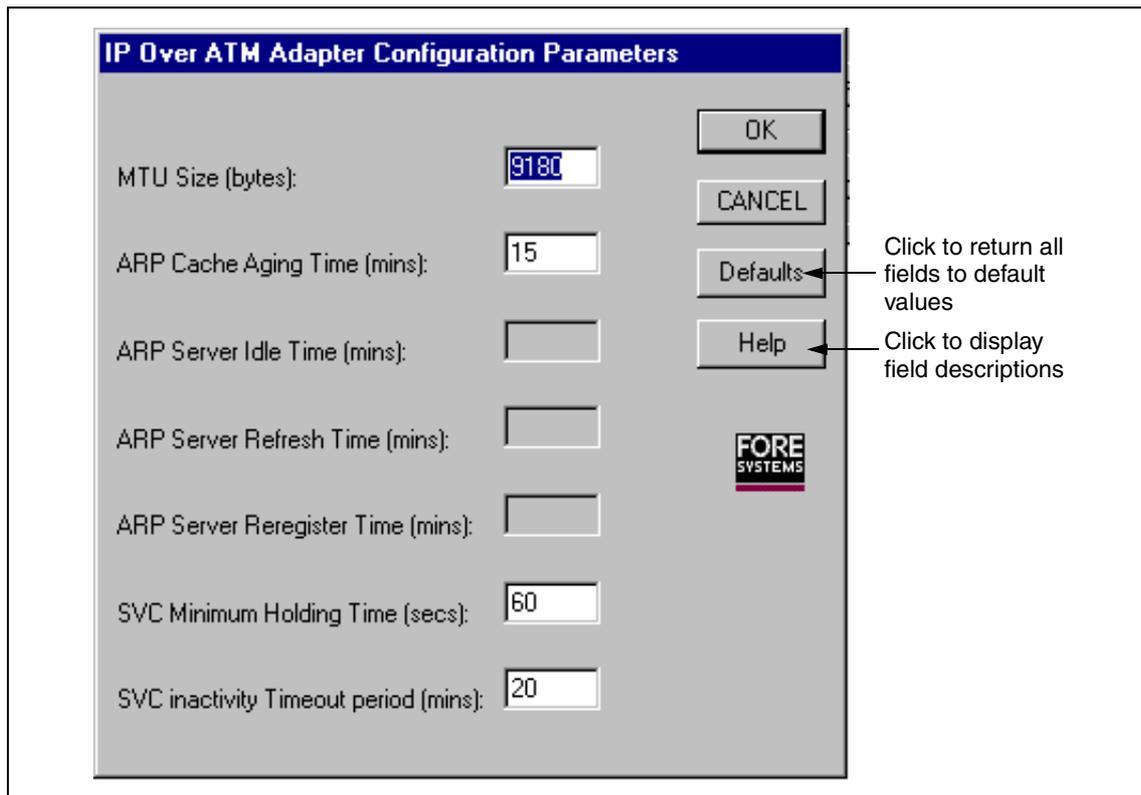
Figure 6.18 - IP Over ATM Adapter Configuration Parameters Tab

8. If you must manually enter PVC connections for the driver, click the **PVC Setup...** button. The IP Over ATM Adapter PVC Connections dialog box is displayed, as shown in Figure 6.19. Contact your system administrator for any PVCs you may have to add.
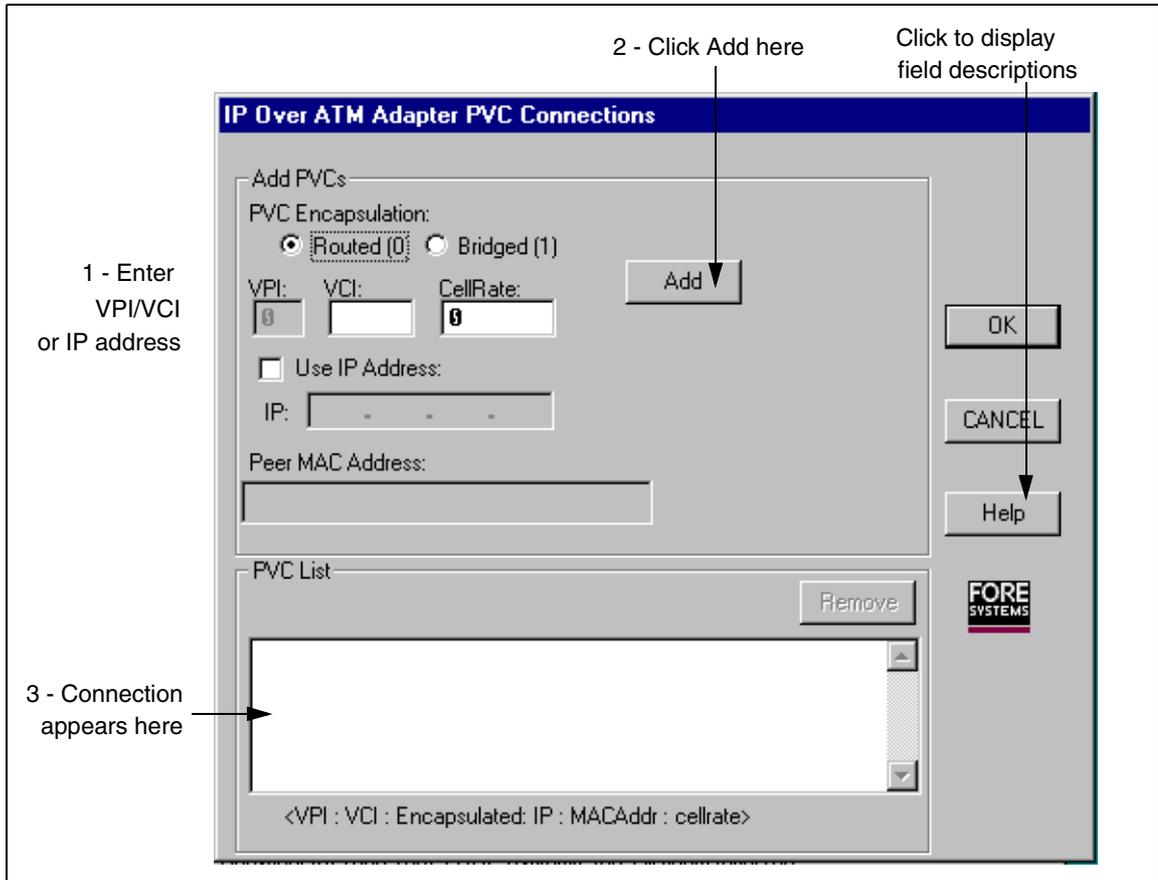
Figure 6.19 - IP Over ATM Adapter PVC Connections Dialog Box

a. Enter a unique VCI for the PVC connection (the VPI is always zero). You can also check the **Use IP Address** option and specify the IP address of the destination host. Only VPI 0 is supported. Also, please note that VCI's 0 through 31 are reserved by the ATM Forum. The valid VCI range is 32-1023.

b. Specify a CBR Maximum Cell Rate for the PVC if desired by entering a rate in the **CellRate** field. 0 indicates a UBR connection. The valid Cell Rate range is 0-353207.

c. You can accept the default encapsulation (**Routed**) or select **Bridged** encapsulation. If you select Bridged encapsulation, you must enter a MAC address of the peer machine.

d. Click the **Add** button. The connection appears in the **PVC List**.

Repeat these steps for additional PVC connections.

Removing Connections from the List - To remove a connection from the list, highlight the connection by clicking on it in the list and click the **Remove** button.

9. Click **OK** to return to the IP Over ATM Adapter Configuration dialog box. Click **OK** again. The Network control panel appears with the IP Over ATM driver in the Network Adapters list, as shown in Figure 6.20.
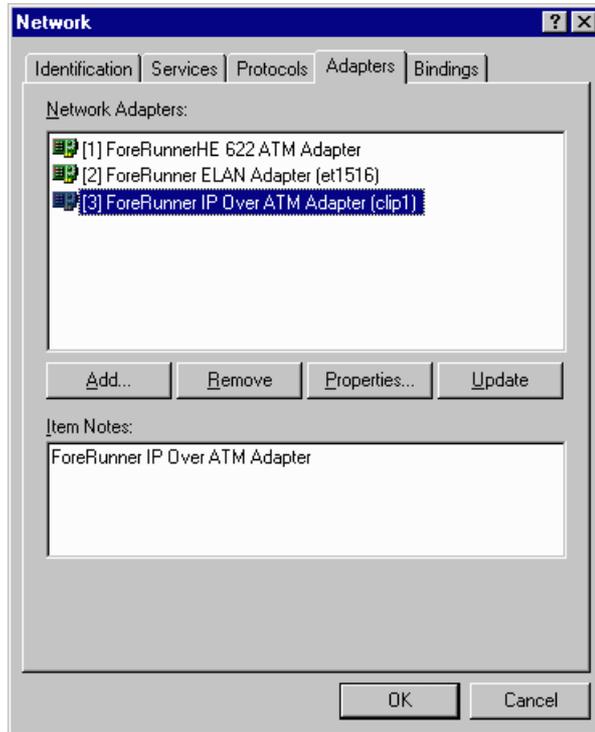
Figure 6.20 - Network Control Panel with IP Over ATM Driver Installed

10. Do one of the following:

   a. Return to the beginning of this procedure to install additional IP Over ATM (RFC 1577) drivers.

   b. Proceed to "Binding Protocols to the ELAN and IP Over ATM Drivers" on page 6-31 if you have installed all ELAN and IP over ATM drivers.

6.4.5   Binding Protocols to the ELAN and IP Over ATM Drivers

Use the following procedure to complete the installation:

1. After installing all ELAN and IP Over ATM drivers, click **Close** in the Network control panel to complete the installation. Progress bars are displayed.

2. Additional dialog boxes appear, depending on the installed network software. The dialog boxes may be different than those shown in the following steps.

> **NOTE** The IP Over ATM driver only binds to TCP/IP. The ELAN driver can bind to TCP/IP, NetBeui, or IPX/SPX.

3. The TCP/IP Configuration dialog box appears (see Figure 6.21) if TCP/IP network software is installed. If not, skip ahead to step 8.

4. In the TCP/IP Configuration dialog box, select the **IP Address** tab, scroll through the **Adapter** card list, and select the Marconi ELAN and IP Over ATM drivers. If you have multiple adapters installed, the adapter identifier number is included in the brackets adjacent to the adapter name (it is shown as 5 in Figure 6.21). This identifier was assigned to the adapter in step 7 of the previous procedure, "Installing the Marconi ATM Adapter Driver" on page 6-10.

> **NOTE** If you are using automatic ELAN selection and TCP/IP, you must still get the appropriate TCP/IP address for your host on that ELAN.

5. Fill in the appropriate fields for *each* ELAN or IP Over ATM driver with your particular network parameters. For specific instructions about Windows NT network configuration, please consult your system administrator and the appropriate Windows NT documentation.
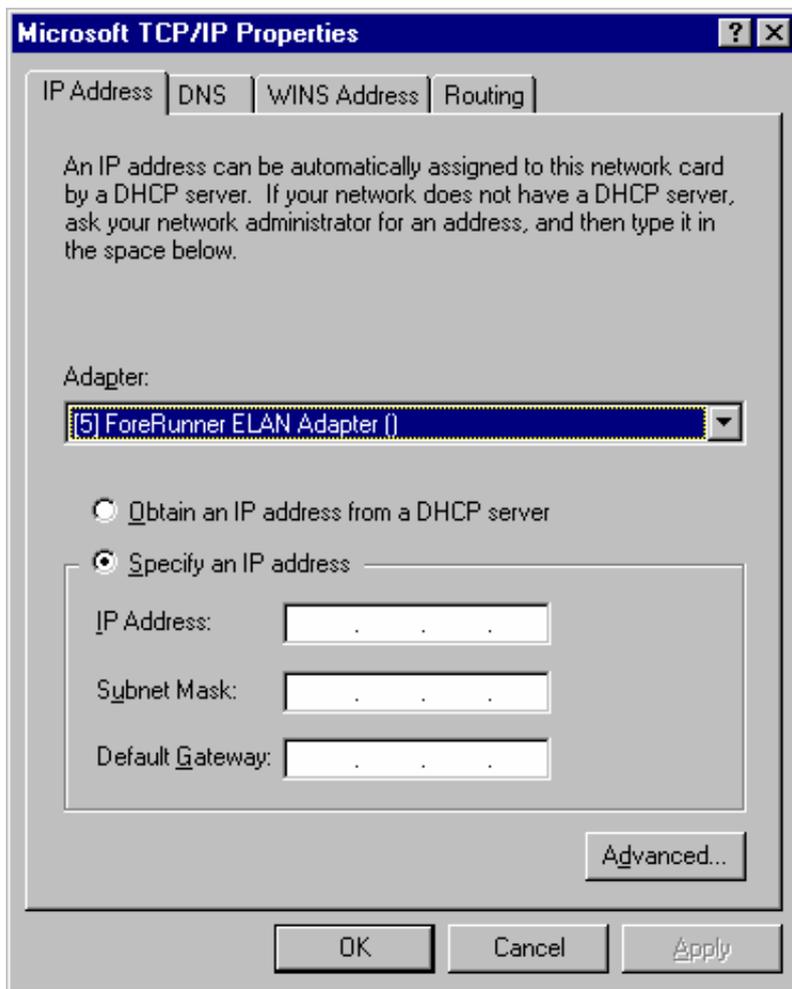
Figure 6.21 - TCP ⁄ IP Configuration

6. In the TCP/IP Configuration dialog box, select the **DNS** tab. (DNS is the Domain Name Server).

7. Fill in the parameters appropriate for your network configuration. For specific instructions on Windows NT network configuration, please consult your system administrator and the appropriate Windows NT documentation. When finished, click the **OK** button.

8. If you do not have Novell NetWare access software installed, or have only installed the IP Over ATM driver skip ahead to step 9.

   If the network software for accessing Novell NetWare is installed on your PC, a dialog box similar to that shown in Figure 6.22 appears. **Auto Detect** is the default option for **Frame Type** and is acceptable for ELAN adapter driver configuration. Click **OK**. The Network control panel appears.
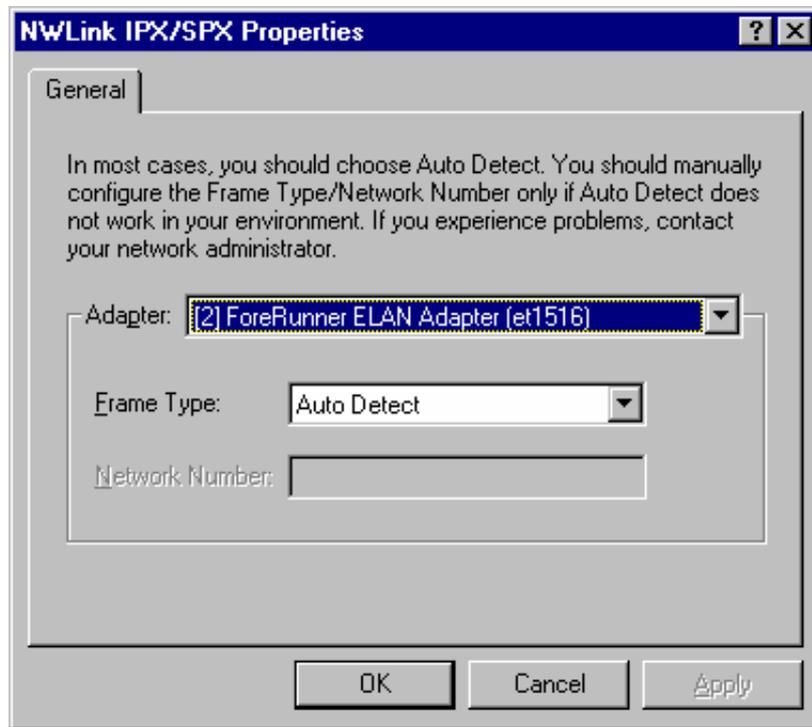
Figure 6.22 - IPX Protocol Configuration

9. Click the **OK** button on the Network control panel. The Network Settings Change message appears, asking if you want to restart the PC so the latest changes can take effect.

    Click the **Yes** button. The *ForeRunner* adapter driver installation is now complete. When the PC reboots, the Marconi ATM, ELAN, and IP Over ATM drivers are loaded.

10. If necessary, proceed to configure the MPOA and QoS parameters for your ELAN connections, as described in Chapter 9. Consult your system administrator to determine if you need to configure these parameters.

    NOTE ▶ If you reconfigure an already installed ELAN driver to join a different ELAN (for example by changing the ELAN name parameter or the LECS usage), the ELAN driver retains any QoS Preferences that had previously been defined for the driver in InFOREmation Center.

    If you want to create new QoS preferences for the reconfigured ELAN connection, you must manually delete the existing preferences. To do this, enter InFOREmation Center, switch to the Advanced View, select the ELAN in the VLAN Information tab, select the **QoS Preferences** button, and delete each preference in the MPOA Properties dialog box.

11. If you are using Winsock2 applications designed for use with the Marconi Service Provider Interface (SPI), install the SPI as described in "Installing and Upgrading the Service Provider" on page D-7.

6.5   Installing the SNMP Agent

The *ForeThought* driver for Windows NT includes support for an SNMP agent. The agent allows MIB variables to be read by any SNMP network management system.

NOTE ▶ To use the SNMP agent, you must have installed the *ForeThought* 5.0.2 (or later) adapter driver.

To install the SNMP agent for the Marconi driver:

1. Install the Windows NT SNMP Service.
2. Open a DOS window.
3. In DOS, go to the Marconi distribution directory corresponding to your CPU type. For example, `\winnt\patch\i386\`.
4. Issue the following command:

   `snmpinst`

This command makes appropriate registry changes to support the Marconi SNMP agent.

**Windows NT
Installation**

6.5.1   Starting and Stopping the Agent

To start the agent, issue the following command:

net start snmp

To stop the agent, issue the following command:

net stop snmp

6.5.2   Removing the Agent

To remove the SNMP agent, in a DOS window, go to the distribution directory corresponding to your CPU type, and issue the following command:

snmpinst -uninstall

This command removes the agent from the registry.

6.5.3   Accessing the MIBs

The MIB variables supported by the agent can be read by any SNMP network management system. However, all the values in the Marconi MIBs supported by the agent are read-only.

The MIB files that are supported by the agent can be found in the `\windows\winnt\mibs` directory of the driver distribution file structure. They are:

- `fore-adapter.mib`
- `fore-sonet.mib`
- `fore-lane.mib`

6.6   Upgrading the Marconi Adapter Software

Refer to Chapter 8 for information on upgrading your Marconi drivers.

6.7   Installing the Marconi Service Provider Interface (SPI)

If you are using Winsock2 applications designed for use with the Marconi Service Provider Interface (SPI), install the SPI as described in "Installing and Upgrading the Service Provider" on page D-7.

6.8   Screen Savers and Network Performance

Some Windows screen savers use a substantial percentage of the CPU utilization. Consequently, screen savers can degrade network performance. Marconi recommends setting the screen saver to "none" or "blank" on server machines.

**Windows NT
Installation**

CHAPTER 7   NetWare Driver Installation

This chapter describes how to install the *ForeThought* 4.1.7 ATM and LANE drivers on a NetWare operating system and gives requirements for the Marconi drivers, such as required values for NetWare start-up parameters and required NetWare files. Separate procedures and requirements for a NetWare 4.11 and 5.0 operating systems are given.

NOTE   These drivers do not support MPOA.

7.1   The Marconi ATM and LANE Drivers

You must install both a Marconi ATM driver and one or more Marconi LAN Emulation (LANE) drivers to successfully connect your NetWare server with an emulated LAN (ELAN).

You must install the appropriate ATM driver for your Marconi adapter:

FOREFPHE.LAN	ATM driver for the HE 155 and 622 adapter. You must install this driver to run your *HE* adapter with the NetWare operating system.
FOREFP2E.LAN	ATM driver for the PCA-200EPC adapter. You must install this driver to run your PCA-200EPC adapter with the NetWare operating system.

You must install one or more of the following LAN Emulation drivers, one for each ELAN to which you want to connect your host via your Marconi adapter:

FOREVETH.LAN	Virtual Ethernet driver. To upper level protocols, this driver appears to be a conventional Ethernet driver.
FOREVTOK.LAN	Virtual Token Ring driver. To upper level protocols, this driver appears to be a conventional Token Ring driver.

You can install a total of 16 FOREVETH or FOREVTOK drivers, allowing you to connect to up to 16 ELANs simultaneously through your Marconi adapter.

After loading the ATM driver and FOREVETH or FOREVTOK drivers, you must bind your higher-level protocols to the FOREVETH and FOREVTOK drivers, as if they were Ethernet or Token Ring drivers.

7.2   The Marconi Driver Files

The relevant Marconi driver files are included in the `\windows\netware\ft4.1.7` directory of the *ForeThought* 5.1 distribution and are listed in Table 7.1. The same software CD is used for installation on NetWare 4.11 or 5.0.

NOTE ▶ If you must install the files from a diskette, refer to "How to Create Installation Diskettes" on page 4-5 for information about creating a NetWare installation diskette.

Table 7.1 - NetWare Installation Files

NetWare Driver Files		
`!fsi2001.cfg`	`foreilmi.nlm`	`foreveth.lan`
`!fsi2002.cfg`	`foreinst.nlm`	`foreveth.ldi`
`!fsi2003.cfg`	`forelec.nlm`	`forevtok.lan`
`forecon.nlm`	`foremux.nlm`	`forevtok.ldi`
`forefp2e.lan`	`foreosp.nlm`	`install.ncf`
`forefp2e.ldi`	`foreprsr.nlm`	`install3.dat`
`forefphe.lan`	`foresig.nlm`	`install4.dat`
`forefphe.ldi`	`foreunld.ncf`	

7.3   Installation Requirements

7.3.1   System Requirements

The following are requirements to ensure proper installation of the Marconi driver software on NetWare 4.11 or 5.0 installations.

- Novell NetWare 4.11 or 5.0
- 1 MB of disk space in the installation directory file system
- 16 MB of RAM (minimum)
- A PCI compliant PC that appears on the Novell NetWare Hardware Compatibility List
- Successful installation of the Marconi adapter hardware (see Chapter 2)
- *ForeThought* 4.1.7 distribution files

7.3.2   Required NetWare NLMs

The following NetWare NLMs are required to install the Marconi drivers on NetWare 4.11, or 5.0:

- CLIB
- NWSNUT.NLM
- ETHERTSM.NLM
- TOKENTSM.NLM
- MSM.NLM
- NBI.NLM
- PARSER.NLM

You must get the latest versions of these files from the Novell NetWare sites on the Internet. Refer to the following website for the latest updates:

http://support.novell.com/misc/patlst.htm

**NetWare   Driver
Installation**

7.3.3   Required NetWare Start-up Parameters

7.3.3.1   Set Minimum Packet Receive Buffers

You must include the following NetWare start-up parameter in the server's STARTUP.NCF file:

```
set minimum packet receive buffers=<n>
```

In this parameter, you must enter a value for the variable *<n>* depending on the type and number of adapters you have installed:

- For PCA adapters, enter 600 for your first adapter card, and include an additional 100 for each additional physical PCA adapter you have installed in the machine.

- For HE adapters, enter 3000 for your first adapter card, and include an additional 1000 for each additional physical HE adapter you have installed in the machine.

For example, if you have installed one PCA adapter, include the following line in the NetWare start-up parameters:

```
set minimum packet receive buffers=600
```

If you have installed two PCA adapters, include the following line:

```
set minimum packet receive buffers=700
```

NOTE   If you have additional adapters from other manufacturers installed, consult their documentation and add any required buffer space to that required by the Marconi adapters.

You can add this line, with the appropriate value, when you install NetWare:

1. During the initial NetWare install, select **Custom Install** rather than the **Simple Install**.

2. At the Special Startup Commands prompt, enter the **set minimum packet receive buffers=<n>** parameter.

7.3.3.2 Set Maximum Physical Receive Packet Size

You must include the following NetWare start-up parameter in the server's `STARTUP.NCF` file:

```
set maximum physical receive packet size=<value>
```

You must assign a value depending on the largest MTU size used by the ELANs to which the host is connected. Use Table 7.2 to determine the appropriate value for your machine.

Table 7.2 - Recommended Maximum Physical Receive Packet Sizes

If Your MTU Size is...	Set the Maximum Physical Receive Packet Size to...
1514	1584
4542	4608
9232	9312
18188	18240

7.4 Installation Options

There are three methods of installing the driver:

- A manual installation for users with extensive experience with NetWare software. Manual installation on a existing server can be performed by simply copying the files listed in Table 7.3 from the distribution to the server's `SYS:\SYSTEM` directory, or a directory of your choice. This can be accomplished from a client system logged into the Administrator's account on the server.

- An installation using the NetWare installation application, as described in the procedure on page 7-6.

- An installation using `foreinst.nlm`, as described in the procedure on page 7-18.

NetWare Driver Installation

7.5   Using the NetWare Installation Application

The following sections provide the procedures for installing and upgrading the Marconi drivers on a NetWare 4.11 server.

7.5.1   Overview of Installation

The installation process using the installation application involves four steps. You ***must*** perform each step:

1.   Install the appropriate Marconi driver for your adapter:

   -   `FOREFPHE` for an *HE* adapter

   -   `FOREFP2E` for a PCA-200EPC adapter

2.   Install the `FOREVETH` virtual Ethernet driver or `FOREVTOK` virtual Token Ring driver.

3.   Edit the `AUTOEXEC.NCF` file. You must also modify your `STARTUP.NCF` file as described in "Required NetWare NLMs" on page 7-3.

4.   Restart the server.

The complete procedure for each step is given below.

7.5.2   Files Added

Table 7.3 lists the files that are copied to the SYS:\SYSTEM directory by the installation or upgrade procedure.

Table 7.3 - Files Added by Installation

File	Contents
forecon.nlm	Marconi ATM console
forefxxx.lan	Marconi ATM adapter driver
forefxxx.ldi	Driver installation file
foreilmi.nlm	Marconi ILMI module
forelec.nlm	Marconi LAN Emulation Client module
foremux.nlm	Marconi adapter multiplexor
foreosp.nlm	Marconi portability module
foreprsr.nlm	Marconi parser module
foresig.nlm	Marconi UNI signalling module
foreunld.fcf	Marconi Driver Unload Script
foreveth.lan	Marconi Virtual Ethernet driver
foreveth.ldi	Marconi Virtual Ethernet driver installation file
forevtok.lan	Marconi Virtual Token Ring driver
forevtok.ldi	Marconi Virtual Token Ring driver installation file

**NetWare   Driver
Installation**

7.5.3   Step One: Install the Marconi ATM Driver

Use the following procedure to load the ATM driver. You must repeat this procedure for each adapter you are installing.

1. Bring up the server with no LAN drivers loaded. Also make sure that the NLMs listed on page 7-7 are not loaded.

    a. Use the **MODULES** command to verify which NLMs are loaded.

    b. Use the **UNLOAD** command to unload those NLMs listed on page 7-7.

2. At the server prompt, type the following command:

    load install (for NetWare 4.11)

    load nwconfig (for NetWare 5.0)

    The NetWare Installation Options menu appears (see Figure 7.1).

3. Select the Driver options menu. The Driver Options menu appears.

4. Select Configure network drivers. The Additional Driver Actions menu appears.


```
NetWare Server Installation  4.1                NetWare Loadable Module

                         Installation Options
    ┌──────────────────────────────────────────────────────────────┐
    │ Driver options     (load/unload disk and network drivers)     │
    │ Disk options       (configure/mirror/test disk partitions)    │
    │ Volume options     (configure/mount/dismount volumes)         │
    │ License option     (install the server license)               │
    │ Copy files option  (install NetWare system files)             │
    │ Directory options  (install NetWare Directory Services)       │
    │ NCF files options  (create/edit server startup files)         │
    │ Product options    (other optional installation items)        │
    │ Server options     (install/upgrade this server)              │
    │ Exit                                                           │
    └──────────────────────────────────────────────────────────────┘




 Use the arrow keys to highlight an option, then press <Enter>.
```

Figure 7.1 - NetWare 4.11 Installation Options Menu

5. Choose **Select a driver**.

6. Insert the *ForeThought* software CD into the CD-ROM drive.

7. Press the **Insert** key to install a new driver. The installation application displays the drive and directory path (**A:**) that is searched to find the new driver files (see Figure 7.2).
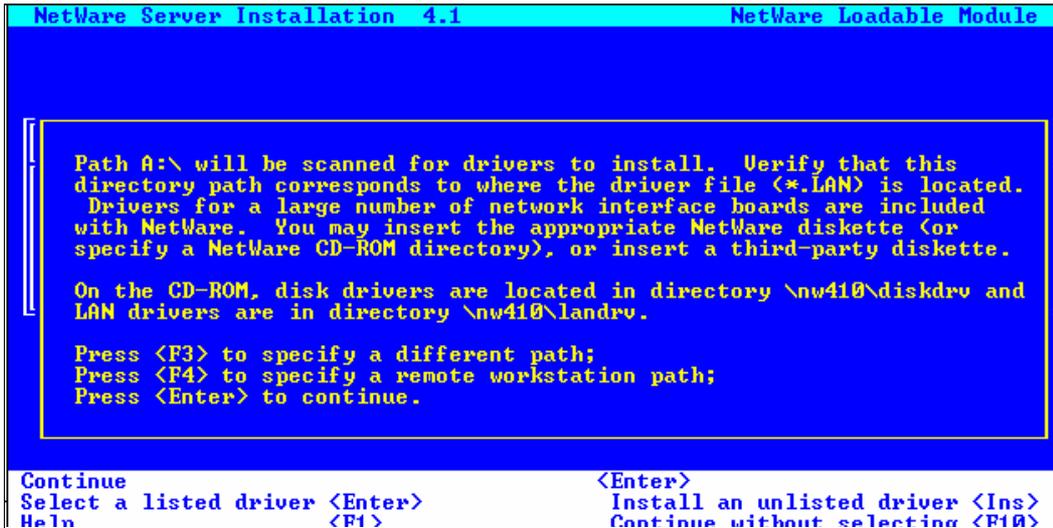
Figure 7.2 - NetWare Driver Search Path Screen

8. Change the path to indicate the path to the \netware\patch directory of the *ForeThought* file distribution. For example:

g:\netware\patch

In this example, the CD-ROM drive is indicated by **g:**. Be sure to indicate the correct path for your CD-ROM drive.

9. Press **Enter**. The following message appears:

Scanning for available drivers...

10. As soon as the files are read, a new window appears with a list of drivers that you can install (see Figure 7.3).

- FOREFPHE for a *HE* adapter
- FOREFP2E for a PCA-200EPC adapter

Select the appropriate driver and press **Enter**.
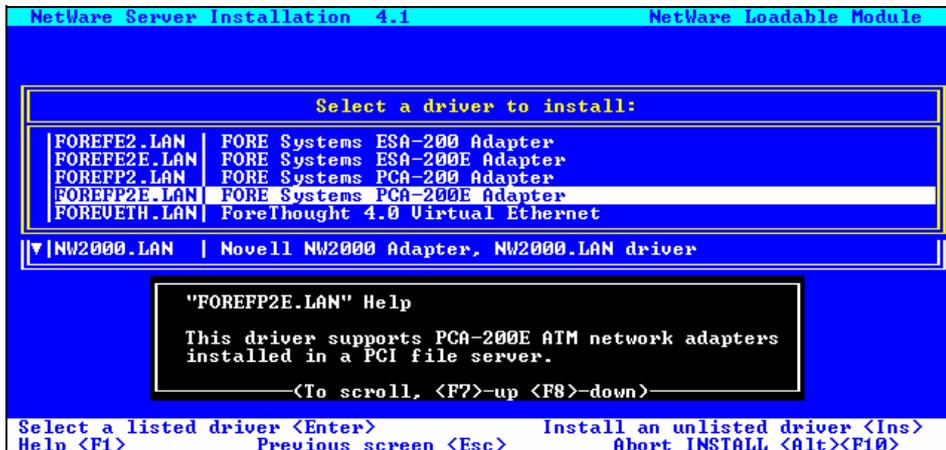
Figure 7.3 - NetWare Driver Selection Screen

11. The installation application asks whether to copy the driver. Respond with **Yes**.

    If older versions of the files exist in the SYS:\SYSTEM directory, the installation application asks if you want to save or overwrite the older files. Choose the appropriate action for your requirements. The installation application prompts for confirmation.

12. Once the installation application copies all files to the server SYS:\SYSTEM partition, the installation application displays two windows (see Figure 7.4):

    - FOREFxxx_x Parameters

    - Board FOREFxxx_x (Driver FOREFxxx Actions).

13. You can accept the default value for the Bus Slot field (the default value is blank) in the section FOREFxxx_x Parameters. This field determines which physical board uses this driver.

    How slot numbers are assigned - NetWare associates the driver that is loaded first with the first matching physical board in the lowest numbered slot.

14. In the section `Board FOREFxxx_x (Driver FOREFxxx Actions)`, choose
    Save parameters and load driver (see Figure 7.4).
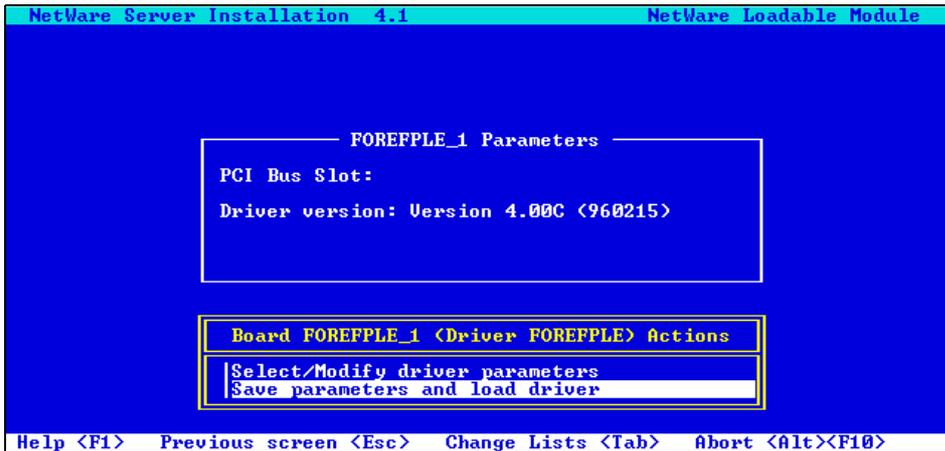
Figure 7.4 - NetWare Driver Actions Screen

15. The next window that appears has a message, `Network address to bind IPX`. Press **Esc** to indicate you do not want to bind IPX.

16. Press **Enter** to confirm that you don't want to bind IPX.

17. A prompt appears, asking if you want to install an additional driver. Select **Yes** and proceed:

    a. If you must install additional drivers for additional adapter cards, return to step 9.

    b. If you have installed drivers for all your adapter cards, proceed immediately to "Step Two: Install the FOREVETH or FOREVTOK Driver".

**NetWare Driver
Installation**

7.5.4   Step Two: Install the FOREVETH or FOREVTOK Driver

Use the following procedure to load the FOREVETH Virtual Ethernet driver or FOREVTOK Virtual Token Ring driver. You must repeat this procedure for each ELAN to which you are connecting.

1. In the NetWare Driver Selection screen (see Figure 7.3), select the driver that you want to install, either `FOREVETH.LAN` (for a Virtual Ethernet ELAN connection) or `FOREVTOK.LAN` (for a Virtual Token-Ring ELAN connection), and press **Enter**.

2. The installation application asks whether to copy the driver. Respond with **Yes**. Confirm your choice by pressing **Enter**.

   If older versions of the files exist in the `SYS:\SYSTEM` directory, the installation application asks if you want to save or overwrite the older files. Choose the appropriate action for your requirements. The installation application prompts for confirmation.

3. After the files are copied, the screen displaying the FOREVETH or FOREVTOK protocols and parameters appears (see Figure 7.5).

4. Do not specify any values in the `FOREVxxx_x Protocols` window. The ELAN driver always binds with the IPX protocol.
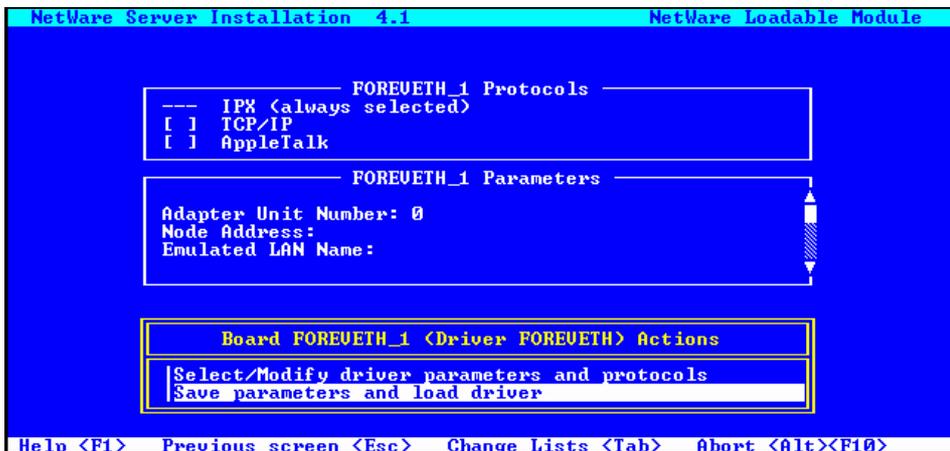
Figure 7.5 - LAN Emulation Driver Actions Screen

5. Specify values in the `FOREVxxx_x Parameters` fields:

   a. **Adapter Unit Number** - This parameter specifies which Marconi ATM driver the FOREVxxx driver uses to connect to the ELAN.

      If you have installed only one adapter driver, you do not have to specify an adapter unit number (and can accept the default unit number of zero).

      If you have installed more than one adapter - You must specify the adapter unit number. Specify **0** (zero) to associate this ELAN driver with the first adapter driver that is loaded, one for the second, two for the third, etc. For additional information, refer to "How the ELAN Drivers are Associated with Adapters" on page 7-35.

   b. **Node Address** - You should not enter a value in this field unless you are prepared to administer local addresses. The default value is the node address on the board.

   c. **Emulated LAN Name** - Specify the name of the ELAN you want to join. This name is case sensitive.

      Leaving this field blank - If you do not specify this parameter, the LEC attempts to use the Automatic ELAN selection feature. The success of this attempt depends on whether contact can be made with the LECS to get the list of ELAN names associated with this LEC and on the configuration of the LECS and the matching rules defined in the LECS configuration file. You must still specify the ELAN type and MTU size (or accept the default). If no ELAN has been specified on the LECS that matches these parameters, the Automatic ELAN Name feature will not work. Use the `FORECON` NLM, described in "Viewing ATM Statistics in NetWare" on page 11-1, to determine the name of the ELAN that the driver has joined.

      This feature can only be used with one ELAN driver.

      Specifying a LES failover sequence - If the LECS has been configured to support failovers in the event of the failure of a LES, you can specify a failover sequence when you specify the ELAN name. To do this, specify the ELAN name, a vertical bar, and a range corresponding to the backup ELANs you want this LEC to contact if one or more LESs fail. For example, if the ELAN name is `test`, and a total of five ELANs for `test` have been configured, and you want to attempt each of the five in the event of multiple LES failures, specify the following in the `Emulated LAN Name` field:

      test|1-5

6. In the section `Board FOREVxxx_x (Driver FOREVxxx Actions),` choose `Save parameters and load driver` (see Figure 7.5).

7. The installation application asks if you want to bind IPX. Press **Enter** to confirm and continue.

8. Repeat step 1 through step 7 for each ELAN you want to join.

> **NOTE** You can install a maximum of 16 ELAN drivers. Each ELAN must be distinguished by a different Emulated LAN Name parameter.

9. Exit the installation program and eject the Marconi software CD.

7.5.5   Step Three: Edit the AUTOEXEC.NCF File

When you install the Marconi ATM driver and the FOREVETH Virtual Ethernet or FOREV-TOK Virtual Token-Ring driver, the installation application automatically edits the AUTOEXEC.NCF file based on the information you entered. If you are using the LANE services and default frame-type for your ELANs, you do not have to edit the AUTOEXEC.NCF. How-ever, in many cases you may want to edit the AUTOEXEC.NCF file. Possible reasons to edit the file include:

• You aren't using ILMI and must manually specify the LEC address.

• You aren't using the well-known address or the PVC (0,17) address of the LECS and must manually specify the ATM address of the LECS.

• You aren't using a LECS and must manually specify the ATM address of the LES.

• You want to bind additional frame types to the ELAN driver. (The default frame-type is 802.2 for Ethernet and TOKEN_SNAP for Token Ring.)

• You want to modify any other default information specified by the installation process.

To add this information manually, you must edit the AUTOEXEC.NCF file to add parameters to the LOAD FOREVETH or LOAD FOREVTOK command. The parameters for the LOAD FORE-VETH and LOAD FOREVTOK statements are described in the following sections:

In the `AUTOEXEC.NCF`:

- There must be one `LOAD FOREFxxx` statement for each Marconi ATM adapter you have installed.

- There must be one `LOAD FOREVETH` or `LOAD FOREVTOK` statement for each ELAN to which you are connecting. You can also include additional `LOAD FORE-VETH` or `LOAD FOREVTOK` statements to bind additional frame types to the driver.

A portion of a sample `AUTOEXEC.NCF` file is shown in Figure 7.7. The lines that begin with # are informational and need not be entered when modifying the `AUTOEXEC.NCF` file.

NOTE

The following notes apply to the `AUTOEXEC.NCF` file:

- The ELAN name is case sensitive.

- LOAD parameters for the LAN drivers that are misspelled or which contain values that are not in the allowed range are ignored by the LOAD command. No warning or error indication is displayed when parameters are ignored.

- The sample `AUTOEXEC.NCF` file uses the `BEDROCK.CFG` configuration file. A sample `BEDROCK.CFG` file is shown in Figure 7.6.

```
NAME=BEDROCK_8022
LECS-ADDRESS=47.0005.80.ffe100.0000.f215.0f5b.002048102aef.0a
ELAN-NAME=BEDROCK|0-3
```

Figure 7.6 - Sample BEDROCK.CFG File

```
# load the adapter driver for your Marconi ATM adapter (in this example,
# a HE adapter has been installed)
LOAD FOREFPHE
#
# load the virtual ethernet interface using the 'BEDROCK' ELAN
# configuration file, BEDROCK.CFG
#
LOAD FOREVETH @BEDROCK
#
# load a second frame type for the BEDROCK ELAN.
#
LOAD FOREVETH FRAME=ETHERNET_II NAME=BEDROCK_II
#
# bind the protocols to the ELAN
#
BIND IPX BEDROCK_8022 NET=4
BIND IP BEDROCK_II ADDR=198.29.15.7
#
# load the virtual token-ring interface
#(NOTE THAT THIS COMMAND MUST BE ENTERED ON ONE LINE)
LOAD FOREVTOK LES-ADDRESS=47000580FFE1000000F21A00FE00123456789ABC
 FRAME=TOKEN-RING_SNAP MTU-FRAME-SIZE=9234 ELAN-NAME=DUEY NAME=VTOK
#
# bind the protocols:
#
bind ipx vtok net=0222
bind ip vtok addr=169.144.221.23 mask=ff.ff.ff.0
```

Figure 7.7 - Sample Portion of AUTOEXEC.NCF File

7.5.6   Step Four: Restart the Server

After you have edited the AUTOEXEC.NCF file, restart the server to load the new drivers and parameters. Restarting the server loads all the parameters previously loaded in the AUTOEXEC.NCF file. The new drivers are automatically loaded when the server is restarted.

7.5.7   Upgrading the Drivers

The procedure for upgrading an already-installed Marconi HE or PCA driver is identical to the initial installation process, with the exception that you do not have to edit the AUTOEXEC.NCF file. The paths, bindings, and other interactions between the Marconi and NetWare software have already been established in the AUTOEXEC.NCF file.

Use the following procedure to upgrade the adapter software:

1. Perform "Step One: Install the Marconi ATM Driver" on page 7-8.
2. Perform "Step Two: Install the FOREVETH or FOREVTOK Driver" on page 7-12.
3. Bring the server down.
4. Restart the server.

Restarting the server loads all the parameters previously loaded in the AUTOEXEC.NCF file. The new drivers are automatically loaded when the server is restarted.

**NetWare   Driver
Installation**

7.6   Using FOREINST.NLM

The following procedures detail methods of installing or upgrading the software using the
FOREINST.NLM module.

7.6.1   Installing the Marconi ATM Driver with FOREINST

Use the following procedure to install the Marconi ATM software with the FOREINST mod-
ule:

1.   Start the NetWare server.

2.   Insert the Marconi software CD into the CD-ROM drive.

> **NOTE** If you must install the drivers from a diskette, refer
> to the README.TXT file on the CD for information
> about creating a NetWare installation diskette.

3.   From the NetWare console prompt, add a search path to indicate the directory con-
     taining the drivers corresponding to your adapter:

search add g:\netware\patch

In this example, the CD-ROM drive is indicated by **g:**. Be sure to indicate the cor-
rect path for your CD-ROM drive.

4.   From the NetWare console prompt, type:

load foreinst

The *ForeThought* Installation screen (see Figure 7.8) appears.

Figure 7.8 - *ForeThought* Installation Screen

5. Press **Enter** to begin installation. The installation application copies the Marconi software to the `SYS:\SYSTEM` directory.

6. The installation application asks if you want to save or overwrite any older copies of Marconi driver files. Choose the appropriate action for your requirements. The installation application prompts for confirmation. After the files have been copied, a message indicates that the process is complete.

7. Press **Esc** to exit the installation application.

8. Eject the Marconi software CD from the CD-ROM drive.

9. If you have not previously installed *ForeThought* software, you must:

    a. Modify the `AUTOEXEC.NCF` file to load the appropriate adapter driver for your adapter:

        -   `FOREFPHE` for a *HE* adapter

        -   `FOREFP2E` for a PCA-200EPC adapter

    b. Modify the `AUTOEXEC.NCF` file to load one or more ELAN drivers (`FOREVETH` or `FOREVTOK`).

    c. Modify your `STARTUP.NCF` file as described in "Required NetWare Start-up Parameters" on page 7-4.

NetWare Driver Installation

Sample lines to add for a Marconi adapter driver are shown in Figure 7.10, and additional information about editing the AUTOEXEC.NCF file is given in "Step Three: Edit the AUTOEXEC.NCF File" on page 7-14. The lines that begin with # are informational only, and are ignored by NetWare. Refer to "LOAD Parameters for Marconi Drivers and Modules" on page 7-24 for additional information about the `LOAD` statements.

Specifying a LES failover sequence - If the LECS has been configured to support failovers in the event of the failure of a LES, you can specify a failover sequence when you specify the ELAN name. To do this, specify the ELAN name, a vertical bar, and a range corresponding to the backup ELANs you want this LEC to contact if one or more LESs fail. For example, if the ELAN name is `test`, and a total of five ELANs for `test` have been configured, and you want to attempt each of the five in the event of multiple LES failures, specify the following in the `Emulated LAN Name` field:

test|1-5

Using the Automatic ELAN Name Feature - If the Automatic ELAN Name feature has been configured on the LECS (and you are using the LECS), you do not have to specify an ELAN name. The host will join the ELAN indicated by the LECS. You must still specify the ELAN type and MTU size (or accept the default). If no ELAN has been specified on the LECS that matches these parameters, the Automatic ELAN Name feature will not work. Use the `FORECON` NLM, described in "Viewing ATM Statistics in NetWare" on page 11-1, to determine the name of the ELAN that the driver has joined.

This feature can only be used on one ELAN driver. For all other ELAN drivers, you must specify the ELAN name.

10. Restart the server to load the drivers.

NOTE ▶ Figure 7.10 shows the driver being loaded for an HE adapter connecting to a virtual Ethernet ELAN or virtual Token Ring ELAN. When you edit your `AUTOEXEC.NCF` file, you must specify the driver for your specific adapter (as listed in step 9 on page 7-19) and specify the correct ELAN driver, either `FOREVETH` or `FOREVTOK`.

NOTE ▶

The sample AUTOEXEC.NCF file uses the BEDROCK.CFG file to specify configuration for a ELAN driver. A sample BEDROCK.CFG file is shown in Figure 7.9.

```
UNIT=2
NAME=BEDROCK_8022
LECS-ADDRESS=47.0005.80.ffe100.0000.f215.0f5b.002048102aef.0a
ELAN-NAME=BEDROCK
FRAME=ETHERNET_802.2
```

Figure 7.9 - Sample BEDROCK.CFG File for a Virtual Ethernet Driver

NOTE ▶

The ELAN name is case sensitive.

**NetWare   Driver
Installation**

```
# load the adapter driver for your Marconi adapter (this
# example shows the driver for the HE adapter)
#
LOAD FOREFPHE
#
# load the virtual ethernet interface using the 'BEDROCK'
# ELAN configuration file, BEDROCK.CFG
#
LOAD FOREVETH @BEDROCK
#
# load a second frame type for the BEDROCK ELAN.
#
LOAD FOREVETH FRAME=ETHERNET_II NAME=BEDROCK_II
#
# bind the protocols to the ELAN
#
BIND IPX BEDROCK_8022 NET=4
BIND IP BEDROCK_II ADDR=198.29.15.7
#
# load the virtual token-ring interface
#(NOTE THAT THIS COMMAND MUST BE ENTERED ON ONE LINE)
LOAD FOREVTOK LES-ADDRESS=47000580FFE1000000F21A00FE00123456789ABC
 FRAME=TOKEN-RING_SNAP MTU-FRAME-SIZE=9234
 ELAN-NAME=DUEY NAME=VTOK
#
# bind the protocols:
#
bind ipx vtok net=0222
bind ip vtok addr=169.144.221.23 mask=ff.ff.ff.0
```

Figure 7.10 - Sample Portion of AUTOEXEC.NCF File

7.6.2   Upgrading the Drivers Using FOREINST

You can either use the **load foreinst** command to upgrade the drivers, as described in "Installing the Marconi ATM Driver with FOREINST" on page 7-18, or use the following procedure to copy the files:

1. Log into the Supervisor account on the server from a client on the network.

2. Copy the files from the \windows\netware\ft4.1.7 directory of the *ForeThought* software distribution to the server's SYS:SYSTEM partition.

> **NOTE** If you have moved the adapter to a new slot, you must re-configure the driver to specify the correct slot and edit the AUTOEXEC.NCF file to specify the correct slot.

Use the following procedure to run the new Marconi drivers:

1. Bring the server down.

2. Restart the server. If the installation is successful, messages similar to those shown in Figure 7.11 appear on the server console. The messages indicate which drivers you installed. In this example they show the driver for na HE driver and the virtual Ethernet ELAN driver, FOREVETH.

```
Loading Module FOREFPHE.LAN
ForeRunnerHE ATM Adapter Driver
Version 4.1.7 February 9, 1997
Copyright (c) 1997 FORE Systems, Inc. as an unpublished work. All rights
                            reserved.
Loading Module FOREVETH.LAN
ForeThought 4.10 Virtual Ethernet Driver
Version 4.10 February 9, 1997
Copyright (c) 1997 FORE Systems, Inc. as an unpublished work. All rights
reserved.
```

Figure 7.11 - Driver Start-up Messages

These messages are followed by other driver and system messages. The messages appear in the order that the drivers and modules are loaded.

3. The message may only appear briefly. To be sure the driver was correctly installed, enter the command **CONFIG** on a command line on the server. A message with the current version appears.

7.7   LOAD Parameters for Marconi Drivers and Modules

This section documents the LOAD and configuration parameters used by the following Marconi drivers and modules:

- Adapter Driver (`FOREFxxx.LAN`)
- Adapter Multiplexor (`FOREMUX.NLM`)
- UNI 3.0/3.1 Signalling (`FORESIG.NLM`)
- ILMI Services (`FOREILMI.NLM`)
- Operating System Portability (`FOREOSP.NLM`)
- LAN Emulation Client (`FORELEC.NLM`)
- Virtual Ethernet Driver (`FOREVETH.LAN`)
- Virtual Token Ring Driver (`FOREVTOK.LAN`)

NOTE

In the following sections, parameters appear in upper case for clarity. In practice, they are not case sensitive.

LOAD parameters for the LAN drivers that are misspelled or which contain values that are not in the allowed range are ignored by the LOAD command. No warning or error indication is displayed when parameters are ignored.

7.7.1   Marconi Adapter Driver (FOREFxxx.LAN)

The adapter driver can be loaded more than once to support multiple adapter cards. The adapter driver has the following LOAD line parameters:

SLOT=<number>	(Optional) Specifies the slot in which the Marconi adapter card resides.
NAME=<name>	(Optional) Specifies the name of the adapter driver. The default name is the name of the adapter driver file (e.g., FOREFPHE in the case of a HE adapter driver.).
OC3-FRAMING= <SONET,SDH>	(Optional; applies to OC-3 adapters only) Specifies the type of framing used for this adapter, SONET or SDH. The default is SONET.
EMPTY-CELL= <IDLE, UNASSIGNED>	(Optional; applies to OC-3 adapters only) Specifies whether empty cells are marked as idle or unassigned. The default is unassigned.

Loading the adapter driver automatically loads several other components:

- FOREMUX, the adapter multiplexing layer
- FOREOSP, the Operating System Portability module
- FOREPRSR, the parser

7.7.1.1 Example

The following is an example of the LOAD command for the driver:

```
LOAD FOREFPHE NAME=ATMDRIVER SLOT=1
```

NetWare Driver Installation

7.7.2   Adapter Multiplexor (FOREMUX.NLM)

The adapter multiplexor, FOREMUX.NLM, allows the adapter driver to support multiple adapter cards and allows the network stack to support adapter cards of different types (e.g., adapters simultaneously). This module is loaded automatically when other modules are loaded. The adapter multiplexor supports the following LOAD line parameter:

TRACE=<level> (Optional) Specifies the level and type of tracing to perform. For the tracing information to appear, the FOREOSP TRACE_LEVEL parameter must be set to the appropriate level, usually DEBUG. TRACE output goes to the console. Each bit in the TRACE level is used for different tracing. The bits are defined as follows:

0x00000001 - Driver registration

0x00000002 - Driver flow control

0x00000004 - VC activation / deactivation

0x00000020 - Adapter information calls (IOCTLs)

0x00000080 - Multiplexor initialization /de-initialization

0x00000100 - Adapter open / close

The types of tracing above can be "OR'd" together to obtain information about several areas. For example, if you want information about driver registration and driver flow control, set **TRACE=0x3** (bits 1 and 2 "OR'd" together).

7.7.2.1   Example

The following is an example of a LOAD command for the FOREMUX.NLM:

LOAD FOREMUX TRACE=0x00000004

7.7.3   UNI Signalling (FORESIG.NLM)

The UNI Signalling module, FORESIG.NLM, performs signalling tasks in accordance with the UNI 3.0 or 3.1 specification. This module is loaded automatically when other modules are loaded. The signalling module has the following LOAD line parameter:

UNI= **<AUTO,3.0,3.1>**	(Optional) Specifies the version of the UNI protocol that the adapter uses. **AUTO** indicates that the adapter will use ILMI to determine the version used by the network and use that version. Otherwise, you can specify version **3.0** or **3.1**. The default is **AUTO**.

NOTE ▶ If you aren't using ILMI you must specify the UNI version as 3.0 or 3.1. Otherwise, the driver can't determine what version it should use. You ***must*** use the same version of UNI as that used by the ATM switch to which the adapter is connected. Get the correct values from your system administrator.

TRACE=<level>	(Optional) Specifies the type of tracing to perform. For the tracing information to appear, the FOREOSP TRACE_LEVEL parameter must be set to the appropriate level, usually DEBUG. TRACE output goes to the console. Each bit in the level value is used for different tracing. The bits are defined as follows:

0x00000040 - UNI signalling debugging

0x01000000 - SSCOP data input/output

0x02000000 - SSCOP signalling processing

0x04000000 - SSCOP timeout events

0x08000000 - SSCOP events

0x10000000 - SSCOP signalling interface calls

0x20000000 - SSCOP statistics information

0x40000000 - SSCOP message information

The types of tracing above can be "OR'd" together to obtain information about several areas. For example, if you want information about UNI signalling and SSCOP signalling interface calls, set **TRACE=0x10000040**.

7.7.3.1 Example

The following is an example of a LOAD command for the `FORESIG.NLM`:

LOAD FORESIG TRACE=0x00000040

7.7.4   ILMI (FOREILMI.NLM)

The ILMI module, `FOREILMI.NLM`, implements the UNI 3.0/3.1 Interim Local Management Interface. It establishes the 20-byte ATM address of the server's adapter on the switch. This module is loaded automatically when other modules are loaded. The ILMI module supports the following `LOAD` line parameter:

TRACE=<level> (Optional) Specifies the level and type of tracing to perform. For the tracing information to appear, the `FOREOSP TRACE_LEVEL` parameter must be set to the appropriate level, usually `DEBUG`. `TRACE` output goes to the console. Each bit in the level value is used for different tracing. The bits are defined as follows:

0x00000001 - General ILMI debugging information

0x80000000 - ILMI packet input/output tracing

7.7.4.1 Example

The following is an example of a LOAD command for the `FOREILMI.NLM`:

LOAD FOREILMI TRACE=0x00000001

7.7.5 Operating System Portability (FOREOSP.NLM)

The Operating System Portability Module, `FOREOSP.NLM`, implements NetWare-specific functions that the other modules need. This module is loaded automatically when other modules are loaded. The `FOREOSP` module supports the following `LOAD` line parameters:

TRACE=<level>	(Optional) Specifies the level and type of tracing to perform. For the tracing information to appear, the `FOREOSP` `TRACE_LEVEL` parameter must be set to the appropriate level, usually `DEBUG`. `TRACE` output goes to the console. Each bit in the level value is used for different tracing. The bits are defined as follows:
	0x00000100 - Debug general timeouts
	0x00000200 - Debug buffer allocations
TRACE_LEVEL= <WARNING | NOTICE | INFO | DEBUG>	(Optional) Specifies the level of tracing for all NLMs in the *ForeThought* stack. The default is **NOTICE**. **INFO** and **DEBUG** are progressively more verbose, and **WARNING** is less verbose.

7.7.5.1 Example

The following is an example of a LOAD command for the `FOREOSP.NLM`:

```
LOAD FOREOSP TRACE_LEVEL=DEBUG TRACE=0x00000100
```

7.7.6 LAN Emulation Client (FORELEC.NLM)

The LAN Emulation Client, `FORELEC.NLM`, implements the ATM Forum's LAN Emulation Client Specification 1.0. This module is loaded automatically when other modules are loaded. This component currently has no `LOAD` line parameters.

7.7.6.1 Example

The following is an example of a LOAD command for the `FORELEC.NLM`:

```
LOAD FORELEC
```

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7.7.7   Virtual Ethernet Driver (FOREVETH.LAN)

The Virtual Ethernet Driver, FOREVETH.LAN, implements an ATM-as-Ethernet device driver. To NetWare, the module appears to be an Ethernet driver. The FOREVETH module can be loaded multiple times for multiple ELANs. This module automatically loads the FORELEC.NLM, FOREILMI.NLM, and FORESIG.NLM modules if they are not yet loaded. It is likely the administrator will want to specify all parameters in a configuration file (.CFG). The FOREVETH module supports the following LOAD line parameters:

UNIT= *<unit number>*	(Optional) Specifies the ATM adapter driver to use for establishing connections to the Virtual Ethernet network. The FOREMUX.NLM module prints the assigned UNIT number as the adapter drivers (e.g., FOREFPHE.LAN) are loaded. The default is zero (0).
NODE=_<address>_	(Optional) Specifies the MAC address for the adapter on the ELAN. The default address for the first ELAN is the hardware address of the adapter card. Subsequent ELANs use an address generated by the LAN Emulation Client (LEC). The NODE address is a 6-byte address and is specified as 12 hexadecimal characters.
NAME=_<name>_	(Optional) Specifies the board name (used in protocol binding) of this instance of the LEC. If not specified, the default is the name of the module, FOREVETH. You may want to assign the same name as the ELAN name to this parameter.
ATM-ADDRESS= *<address>*	(Optional) Specifies the ATM address for this LEC. The default is to discover this information via ILMI. If you specify this parameter, ILMI is disabled for this LEC. Refer to "How to Specify an ATM Address" on page 4-4.

ELAN-NAME= **<*name*>[I<*range*>]**	(Optional) Specifies the ELAN to which this LEC belongs. This value is case-sensitive.

If you don't specify this parameter, the LEC attempts to join the first available ELAN (the default ELAN). This attempt depends on whether contact can be made with the LECS to get the list of ELAN names associated with the ATM-ADDRESS parameter and on the configuration of the LECS and the matching rules defined in the LECS configuration file.

The |<*range*> is an optional part of the ELAN-NAME parameter that allows you to specify a range of failover ELANs for this ELAN. The range must consist of a number, followed by a hyphen, followed by a higher number. The numbers correspond to the failover ELANs defined on the LECS. For example:

```
ELAN-NAME=TEST|0-4
```

In the event that the primary ELAN, TEST|0, fails, the LEC attempts to connect to the first backup, TEST|1. In the event of successive failures, it attempts to contact the backup ELANs in order. The LEC switches back to the primary, TEST|0, when TEST|0 returns to service.

FRAME= **<*frame-type*>**	(Optional) Specifies the frame type to use on the ELAN. Possible values are **ETHERNET_802.2**, **ETHERNET_SNAP**, and **ETHERNET_802.3**. The default frame type is **ethernet_802.2**. Refer to "NetWare Driver LOAD Parameters" on page 7-37 for the list of valid frame types. For example:

```
FRAME=ETHERNET_802.3
```

MTU-FRAME- **SIZE=<*number*>**	Specifies the size of the frames on the ELAN. The default (and currently the only supported value) is **1516** for Ethernet (1514 bytes being Ethernet's maximum frame size, plus 2 bytes required by LAN Emulation).

LECS-ADDRESS= *<address>* (Optional) Specifies the ATM address of the LECS. If this address is not specified, the LEC attempts to automatically contact the LECS via the well-known address or PVC 0,17. If there is no LECS or the auto-discovery fails, then you must manually specify the `LES-ADDRESS`. Refer to "How to Specify an ATM Address" on page 4-4.

LES-ADDRESS=*<address>* (Optional) Specifies the ATM address of the LAN Emulation Server. The default is to determine this address dynamically through the LECS. Refer to "How to Specify an ATM Address" on page 4-4.

TRACE=*<level>* (Optional) Specifies the type of tracing to perform. For the tracing information to appear, the `FOREOSP TRACE_LEVEL` parameter must be set to the appropriate level, usually `DEBUG`. `TRACE` output goes to the console. Each bit in the level value is used for different tracing. The bits are defined as follows:

0x00000001 - Virtual Ethernet Initialization

7.7.8   Virtual Token Ring Driver (FOREVTOK.LAN)

The Virtual Token Ring driver, FOREVTOK.LAN, implements an ATM-as-Token Ring device driver. To NetWare, the module appears to be a Token Ring driver. The FOREVTOK module can be loaded multiple times for multiple ELANs. This module automatically loads the FORELEC.NLM, FOREILMI.NLM and FORESIG.NLM modules if they are not yet loaded. You can use a configuration file (.CFG) to specify all parameters for the driver. The FOREVTOK module supports the following LOAD line parameters:

UNIT=<*unit number*>	(Optional) Specifies the Marconi ATM adapter driver to use for establishing connections to the Virtual Token Ring network. The FOREMUX.NLM module prints the assigned UNIT number as the adapter drivers (e.g., FOREPLE.LAN) are loaded. The default is zero (0).
NODE=<*address*>	(Optional) Specifies the MAC address for the adapter on the ELAN. The default address for the first ELAN is the hardware address of the adapter card. Subsequent ELANs use an address generated by the LAN Emulation Client (LEC). The NODE address is a 6 byte address and is specified as 12 hexadecimal characters.
NAME=<*name*>	(Optional) Specifies the board name (used in protocol binding) of this instance of the LEC. If not specified, the default is the name of the module, FOREVTOK. You may want to assign the same name as the ELAN name to this parameter to simplify debugging.
ATM-ADDRESS= <*address*>	(Optional) Specifies the ATM address for this LEC. The default is to discover this information via ILMI. If you specify this parameter, this driver automatically disables ILMI. Refer to "How to Specify an ATM Address" on page 4-4.

ELAN-NAME= **<*name*>[|<*range*>]**	(Optional) Specifies the ELAN to which this driver belongs. This value is case-sensitive.
	If you don't specify this parameter, a list of available ELANs is displayed (if the driver successfully contact the LECS to get the list). This attempt depends on whether contact can be made with the LECS to get the list of ELAN names associated with the `ATM-ADDRESS` parameter and on the configuration of the LECS and the matching rules defined in the LECS configuration file.
	The `|<range>` is an optional part of the `ELAN-NAME` parameter that allows you to specify a range of failover ELANs for this ELAN. The range must consist of a number, followed by a hyphen, followed by a higher number. The numbers correspond to the failover ELANs defined on the LECS. For example:

```
ELAN-NAME=TEST|0-4
```

In the event that the primary ELAN, TEST|0, fails, the LEC attempts to connect to the first backup, TEST|1. In the event of successive failures, it attempts to contact the backup ELANs in order. The LEC switches back to the primary, TEST|0, when TEST|0 returns to service.

FRAME= **<*frame-type*>**	(Optional) Specifies the frame type to use on the ELAN. Possible types are **token-ring_snap** or **token-ring** (although IP cannot bind with **token-ring**). The default frame type is **token-ring**. For example:

```
FRAME=TOKEN-RING_SNAP
```

MTU-FRAME- **SIZE=<*number*>**	Specifies the size of the frames on the ELAN. Supported sizes are 1516, 4544, 9234, or 18190. The default is **4544**.
LECS-ADDRESS= **<*address*>**	(Optional) Specifies the ATM address of the LECS. If this address is not specified, the LEC attempts to use the LECS autodiscovery (via the well-known address or PVC 0,17). If there is no LECS or the auto-discovery fails, then you must specify `LES-ADDRESS`. Refer to "How to Specify an ATM Address" on page 4-4.

LES-ADDRESS=<*address*> (Optional) Specifies the ATM address of the LAN Emulation Server. You must specify this address if there is no LECS or the auto-discovery fails. The default is to determine this address dynamically through the LECS. Refer to "How to Specify an ATM Address" on page 4-4.

TRACE=<*level*> (Optional) Specifies the type of tracing to perform. For the tracing information to appear, the `FOREOSP TRACE_LEVEL` parameter must be set to the appropriate level, usually `DEBUG`. `TRACE` output goes to the console. Each bit in the level value is used for different tracing. The bits are defined as follows:

0x00000001 - Virtual Token Ring Initialization

7.7.8.1 How the ELAN Drivers are Associated with Adapters

If you have multiple adapters connecting to multiple ELANs, you must know how to determine which adapter card uses which FOREVETH or FOREVTOK driver. The `Adapter Unit Number` parameter, which you specify when you install the FOREVETH or FOREVTOK driver, determines which driver (and that driver's associated adapter card) uses the FOREVETH or FOREVTOK driver. The adapter unit numbers are assigned to drivers in the following manner:

1.   When the NetWare server starts up, the drivers are loaded in the order their `LOAD` commands appear in the `AUTOEXEC.NCF` file.

2.   The first driver that is loaded uses the first matching physical board (for example, an HE adapter for a `FOREFPHE` driver) in the lowest numbered slot. This first driver is assigned unit number 0. (If you specify a `SLOT` parameter for the driver, the driver is associated with the board in the specified slot.)

3.   The next driver that is loaded uses the next available matching physical card and is assigned unit number 1.

4.   The FOREVETH or FOREVTOK driver with the `UNIT=0` parameter is associated with the driver that was assigned unit number 0.

5.   The FOREVETH or FOREVTOK driver with the `UNIT=1` parameter is associated with the driver that was assigned unit number 1.

6.   The process is repeated for each driver loaded in `AUTOEXEC.NCF`.

Refer to "LOAD Parameters for Marconi Drivers and Modules" on page 7-24 for more information about the LOAD commands for the drivers.

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> **NOTE** One physical adapter card can connect to up to 16 ELANs. You must load a FOREVETH or FOREVTOK driver for each ELAN.

7.7.8.2 Example

The following is an example of a command using a configuration file to load the FOREVETH driver. The contents of DEV.CFG are shown in Figure 7.12.

LOAD FOREVETH @DEV.CFG.

```
UNIT=2
NAME=dev
ELAN-NAME=dev|0-3
ATM-ADDRESS=47.0005.80.FFE100.00000.F215.0F5B.002048102AEF.0A
```

Figure 7.12 - Sample DEV.CFG File

7.7.9   Setting Up the Trace Options

To use the trace options that are available with the different Marconi modules, you must first unload the module, using the UNLOAD command, and then load the module using the TRACE= parameter.

You can add the LOAD command with the TRACE parameters to the AUTOEXEC.NCF file. For example:

```
LOAD FOREOSP TRACE_LEVEL=DEBUG
LOAD FOREMUX TRACE=0X000000FF
LOAD FOREFPHE
LOAD FOREVETH @FRED
```

7.8   NetWare Driver LOAD Parameters

Table 7.4 lists commonly used NetWare parameters.These parameters can be used in an
AUTOEXEC.NCF file or issued from the command line. For additional details about these and
other parameters, refer to the LOAD LAN driver section of the *Novell System Administration*
manual.

Table 7.4 - Ethernet ⁄ Token-Ring LAN Emulation Parameters

Parameter	Default	Supported Values	Optional
FRAME (Ethernet)	Ethernet_802.2	Ethernet_802.2 Ethernet_802.3 Ethernet_Snap Ethernet_II	Yes
FRAME (Token-Ring)	Token-Ring	Token-Ring Token-Ring_Snap	Yes
NAME	None	Any unique 17-character name	Yes
NODE	Board value	Any 12-digit hexadecimal number	Yes
SLOT	None	17 through 32	No

Command syntax for these parameters is as follows:

FRAME=ETHERNET_II

More than one parameter may be used in the same command line as long as the commands
are separated by one or more spaces. For example:

FRAME=ETHERNET_II SLOT=17

7.9   Finding the MAC Address

For many configurations, you need to know the Ethernet MAC address of the host PC (in which the Marconi adapter has been installed).

 Use the following procedure to determine the MAC address:

1. Enter the following command at a console prompt (this example shows the command for an HE adapter):

   LOAD FOREFPHE

2. Enter the following command at a console prompt:

   CONFIG

   This displays information including the node address, which is the default MAC address for Ethernet.

7.10 Multiple Configuration Files

Configuration files can be copied from one server to another just as any file can be moved between NetWare server systems. The configuration file is a simple text file containing the same text that the system operator might type at the server command line prompt. The only difference is that the file is accessed from a command line. Using a configuration file instead of typing the data simplifies the system operator's task of bringing up the server and putting it into operation.

A single server may have as many different configuration files for the drivers as required. The server could have a file for each different configuration that the operator wants to support. For example, an operator might create files ATMTCPIP.CFG with all the necessary parameters to load the driver for TCP/IP support and ATMIPX.CFG with all the necessary parameters for IPX support. For a FOREFPHE driver, the operator could issue the following command to use either of these configuration files:

LOAD FOREFPHE @ATMTCPIP

NOTE The .CFG extension is optional.

NetWare Driver Installation

CHAPTER 8   Upgrading the Marconi Adapter Drivers

This chapter describes how to upgrade the Marconi drivers on a Windows 95/98 or Windows NT operating system. To load new drivers, or reconfigure drivers, refer to the installation chapters, Chapter 5 for Windows 95/98 and Chapter 6 for Windows NT.

8.1   Upgrading the Marconi Adapter Software

CAUTION

When upgrading the Marconi drivers on Windows 95 or NT, always use the Upgrade utility provided by Marconi, as described in this procedure. Attempting to upgrade the drivers by deleting old drivers manually may lead to problems with your Windows 95 or NT system.

Use the following procedure to upgrade previously installed *ForeThought* ATM software on your Windows 95 or NT workstation:

1. Insert the *ForeRunner* software CD in the CD-ROM drive.

2. Display the Run dialog box by clicking the **Start** button and selecting **Run...**.

3. Specify the directory path appropriate for your operating system, where `D:` indicates your CD-ROM drive, as shown in Figure 8.1:

   - `D:\WINDOWS\WIN95\PATCH\UPGRADE.EXE` for Windows 95.

   - `D:\WINDOWS\WINNT\PATCH\I386\UPGRADE.EXE` for Windows NT on an Intel-based machine.

   - `A:\UPGRADE.EXE` if you are upgrading from diskettes you created from the *ForeThought* 5.1 distribution files.

   If you are upgrading from files you downloaded from the Marconi website, specify the directory containing the files.

Figure 8.1 - Running the UPGRADE.EXE File

4. Click the **OK** button. The *ForeThought* Upgrade dialog box appears, as shown in Figure 8.2. (These examples show a PCA-200EPC adapter upgrade. The procedure is the same for a LE or HE adapter.)
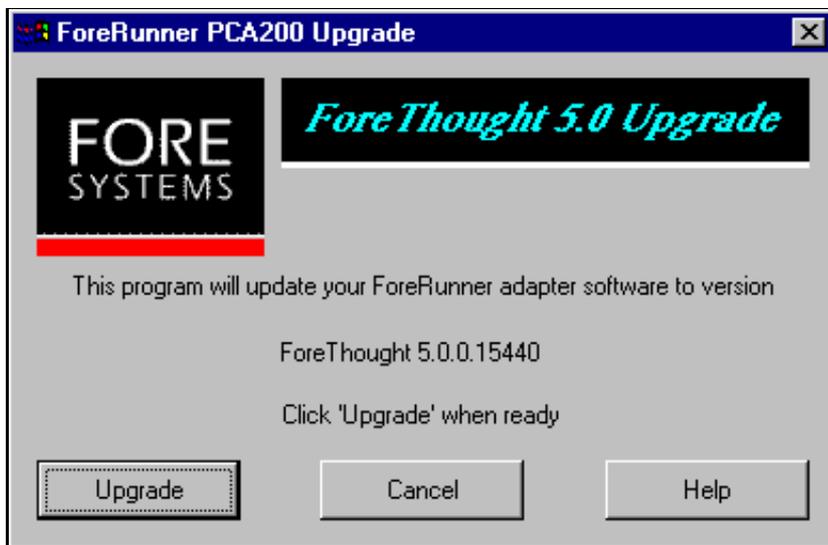
Figure 8.2 - *ForeThought* 5.0 Upgrade Dialog Box

5. Click the **Upgrade** button.

A progress bar appears, showing the files being upgraded from the media.
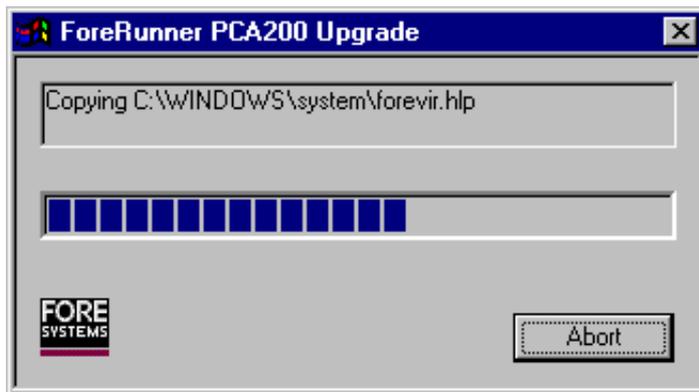
Figure 8.3 - ForeThought 5.0 Upgrade Progress Dialog Box

6.   After the files are copied from the CD, a prompt appears, asking if you want to restart the computer in order to implement the new files. Click **Yes**.
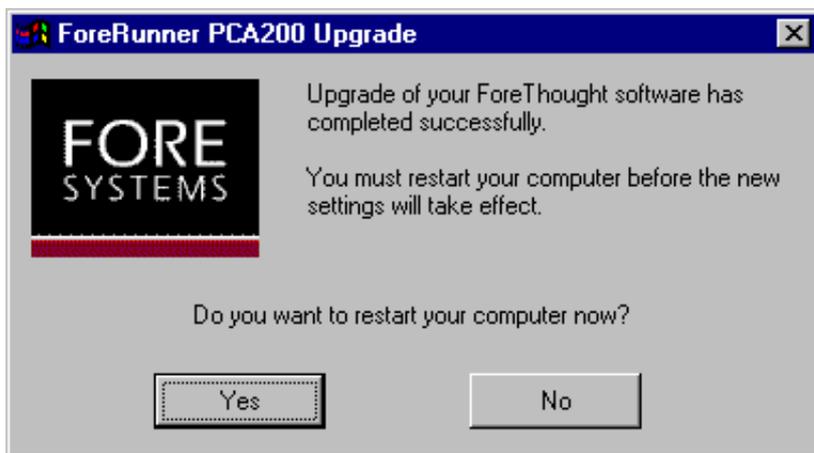
Figure 8.4 - Restart Prompt

After the computer restarts, the upgrade process is complete.

8.2   Additional Upgrade Options

When running `UPGRADE.EXE` in DOS you can use the following syntax:

`UPGRADE [FORCE]  [NOSWAP│QUIET│AUTO]`

FORCE	This option specifies that the files will be upgraded even if the source files are not newer than the destination files.
NOSWAP	Indicates that you want to upgrade only files from the current source disk.
QUIET	Specifies that no dialogs are displayed during the upgrade process and you are upgrading only files from the current source disk.
AUTO	Specifies that no dialogs are displayed and the system automatically restarts after the files are upgraded.

CHAPTER 9 — Configuring MPOA and Quality of Service Parameters

ForeThought 5.0 and greater allows you to configure flow specifications for the connections established by the ELAN driver. The flow specifications determine:

- The LANE VC settings (Quality of Service (QoS) preferences and LANE VC threshold) for connections within the ELAN to which your driver is connected.
- The MPOA shortcut threshold for connections to hosts that are not on the ELAN to which your driver is connected (but are accessible via one or more routers).

This chapter includes the following sections:

- Section 9.1, "MPOA and LANE VC Parameters," describes these parameters.
- Section 9.2, "Example of a Flow Specification," gives an example of how these parameters work.
- Section 9.3, "Adding or Editing the MPOA & LANE VC Parameters," describes how to configure these parameters.

Marconi recommends that you configure these parameters only under the direction of your system administrator. Editing these parameters requires a knowledge of MPOA LANE networking and ATM QoS.

9.1 MPOA and LANE VC Parameters

These parameters allow you greater control over individual traffic flows established by your driver. The MPOA and LANE VC parameters consist of three parts:

- Flow descriptors, indicating the traffic flow or flows to which the parameters apply.
- LANE VC specifications, indicating the QoS and the LANE VC threshold. These specifications apply to connections within the host's ELAN.
- The MPOA shortcut threshold for the traffic. This specification applies to routed connections outside the host's ELAN.

9.1.1 Using Predefined MPOA and LANE VC Parameters

The LECS, if configured to do so, can provide a list of MPOA and LANE VC parameters for the MPOA Client (MPC) when the client starts up and establishes its ELAN connections. Check with your system administrator to determine if you can use the preferences supplied by the LECS. In most cases, you need to configure QoS preferences only if your site is using a LECS that is not MPOA-aware (from an earlier *ForeThought* release or from a third-party vendor). The MPOA and LANE VC parameters supplied by the LECS cannot be edited.

9.1.2 LANE Virtual Circuit Parameters

9.1.2.1 Virtual Circuit Type

This parameter determines the QoS for the VC. QoS parameters specify required bandwidth and variation in cell arrival times of an ATM connection. Different applications require different levels of QoS. With *ForeThought* 5.0 and greater, you can define a preference for a specific network connection, defining how the traffic for that connection is handled. Possible QoS types are constant bit rate (CBR), variable bit rate (VBR), unknown bit rate (UBR), or shared. After choosing the QoS type, you must specify the traffic parameters for the connection.

The QoS preferences apply only to destinations within the host's ELAN. They do not apply to MPOA shortcuts.

9.1.2.2 LANE Virtual Circuit Threshold

This parameter, specified as a rate in cells per second, determines the point at which the driver creates a direct connection with a destination, rather than using the Broadcast and Unknown Server (BUS). By avoiding the creation of direct connections for infrequent traffic (such as SNMP polls), the overhead of switch CPU and circuit resources can be reduced.

The LANE virtual circuit threshold applies only to destinations within the host's ELAN.

When the amount of traffic sent by the driver on this connection reaches this threshold, the driver will create a VC for the LANE traffic. Below this threshold, the driver uses the BUS to handle the traffic for this connection.

9.1.3   MPOA Shortcut Threshold

This parameter, specified as a rate in packets per second, determines the point at which the driver attempts to create an MPOA shortcut to handle traffic for a particular traffic flow to a destination outside the host's ELAN (and must therefore be routed). The shortcut avoids any routers in the network, creating a direct connection with the destination.

MPOA shortcuts apply only to destinations outside the host's ELAN and do not have QoS parameters applied to them.

When the amount of traffic sent by the driver on this connection reaches this threshold, the driver will attempt to create the shortcut. The driver tears down idle shortcuts when traffic on the shortcut drops below a threshold set by the LECS.

9.1.4   Specifying Flow Descriptors

You specify traffic flows to which the MPOA and LANE VC parameters apply by indicating the following:

- • The destination IP address. This can include trailing wildcards, specifying which of the IP address bytes are significant.
- • The protocol used by the application, such as TCP, SNMP, etc.
- • The destination port number used by the connection.
- • The source port number used by the connection. Note that in many cases you should not specify a source port, because the networking application itself will specify which port it will use.

Configuring MPOA and QoS Parameters

9.2   Example of a Flow Specification

Figure 9.1 shows a simplified view of an MPOA network with three hosts operating on two ELANs. A Powerhub 7000 is routing traffic between the ELANs. The network administrator has the following goals for Host1:

- All FTP traffic generated by this host on the *engineering* ELAN should be specified as CBR traffic with a peak cell rate of 75000 cells⁄second.

- To avoid router traffic generated when this host establishes FTP sessions with hosts on the *marketing* ELAN, an MPOA shortcut should be established when traffic on routed connections to *marketing* reaches 10000 packets⁄second.
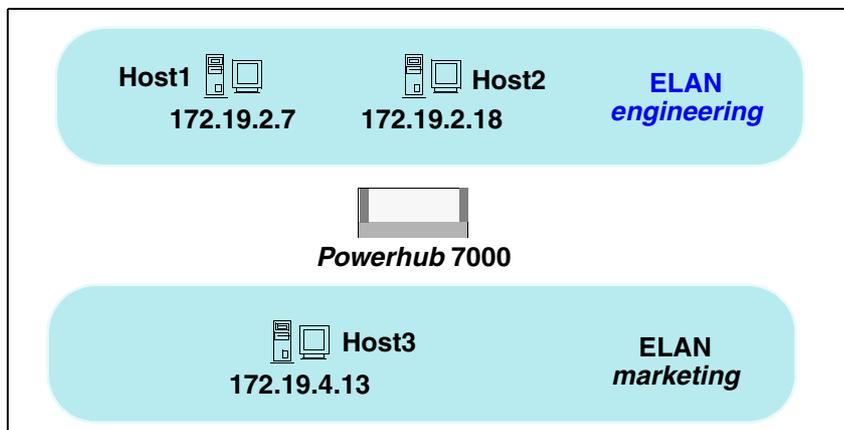
Figure 9.1 - Example Configuration of an MPOA Network

The network administrator can implement these goals by running the InFOREmation Center utility on Host1 and adding a flow specification. (The complete procedure for adding a flow specification is given in "Adding or Editing the MPOA & LANE VC Parameters" on page 9-7.)

The administrator sets the following parameters in the **Flow Specification** area of the Add Flow Specification dialog box, shown in Figure 9.2:

- Sets the **IP Destination** for the flow specification to `172.19.2.*`. This applys the flow specification to all subnets to which Host1 might communicate.

- Sets the **Protocol** to **TCP**. This is the protocol that FTP uses.

- Sets the **Destination Port** to **ftp**. Note that his specifies port 21, the port used by FTP.

- Sets the **Source Port** to **Any**. The FTP server will determine which source port it will use, and it cannot be determined in advance. Note that if you did specify a source port, and the FTP connection was established using a different port, this flow specification would not be applied to the connection and the QoS would not be established.

In the **LANE VC Specification** area of the dialog box, specify a **VC Type** as **CBR** with a **Peak Rate** of 31000 kbits per second.

NOTE

InFOREmation Center can display and accept rates as either *cells per second* or *kilobits per second.* The measurement used is controlled by checking or unchecking the **Options**>**Use Cell Measurements** menu option.

When you enter QoS rates, be sure you are entering appropriate values for the measurement option you are using.

This is the QoS that will be used for all connections that match the flow specification. Note that the QoS applies only to destinations within the host's subnet.

In the **MPOA Shortcuts** area of the dialog box, specify an **MPOA Shortcut Threshold** of 10000.
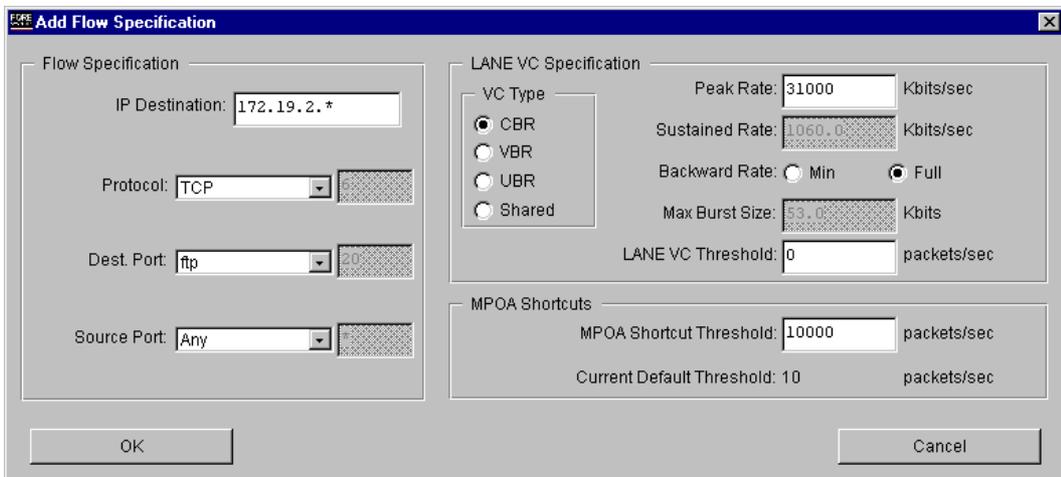
Figure 9.2 - Add Flow Specification Example

After clicking **OK** and exiting the InFOREmation Center utility, the flow specification has the following effect:

- When Host1 FTPs to Host2, a CBR connection is established with a peak cell rate of 75000 cells/second. Also, this connection is immediately established over a LANE VC rather than a connection via the BUS, because the LANE VC Threshold is set to 0 (the default) for the connection.

- When Host1 FTPs to Host3, the connection is initially routed through the Powerhub 7000. When the data flow on the routed connection from Host1 to Host3 reaches 10000 packets/second, an MPOA shortcut is established directly from Host1 to Host3, avoiding the router. No QoS is applied to the connection.
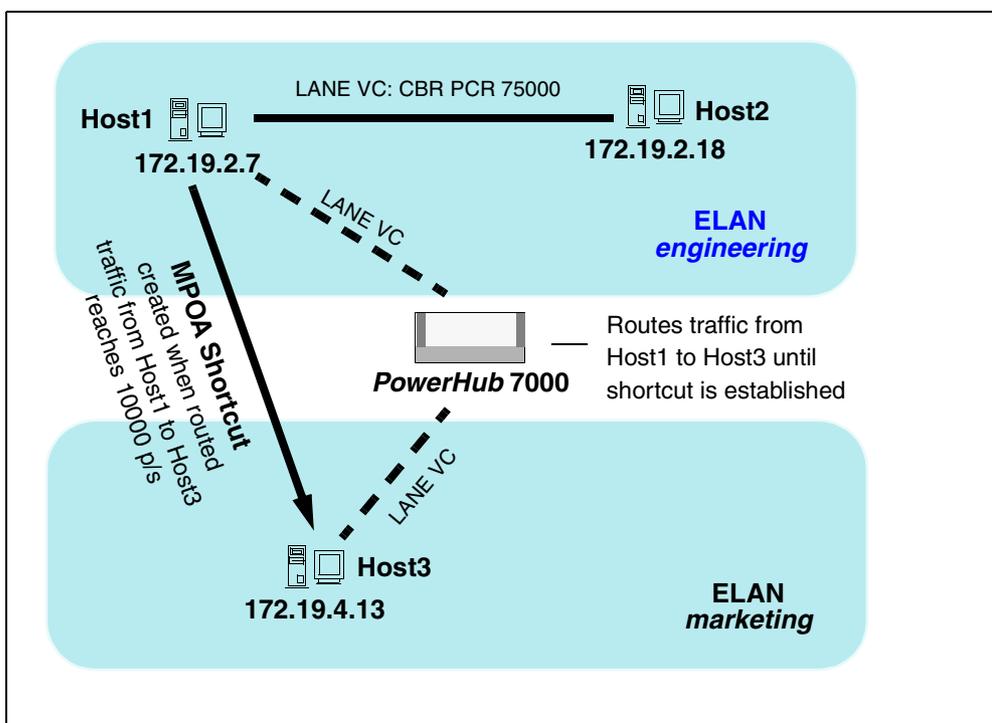
Figure 9.3 - Result of Flow Specification

9.3   Adding or Editing the MPOA & LANE VC Parameters

Use the following procedure to add new MPOA parameters or edit existing parameters. For an example of how the flow specifications work, see "Example of a Flow Specification" on page 9-4.

    1.   Open the InFOREmation Center utility by double-clicking on the Marconi icon in the Windows Control Panel.

        The InFOREmation Center utility appears, showing the summary view, as shown in Figure 9.4.
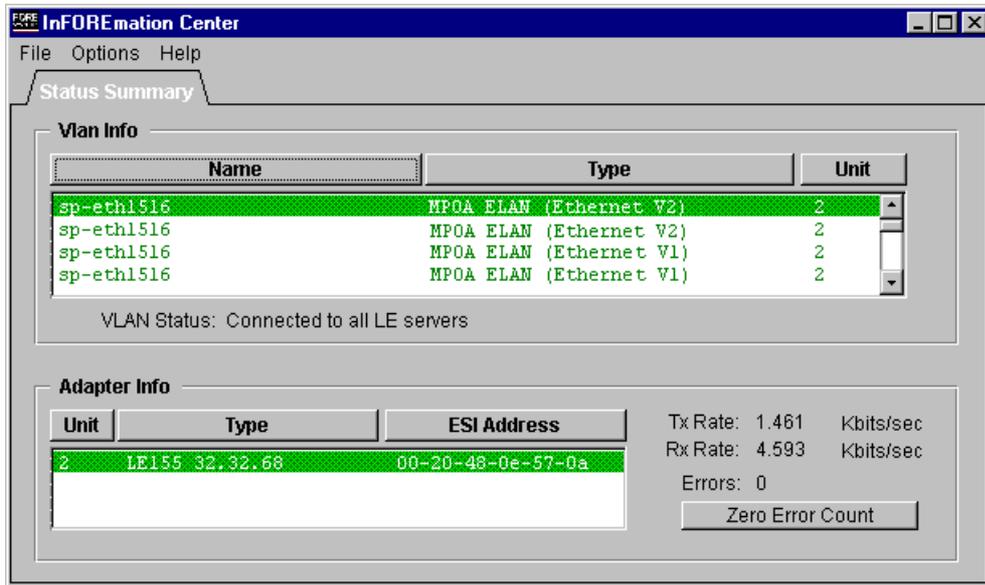
Figure 9.4 - InFOREmation Center Summary View

2. Select the **Advanced View** option of the **Options** menu.

    The detailed view of the InFOREmation Center appears, showing the VLAN Information tab, as shown in Figure 9.5.
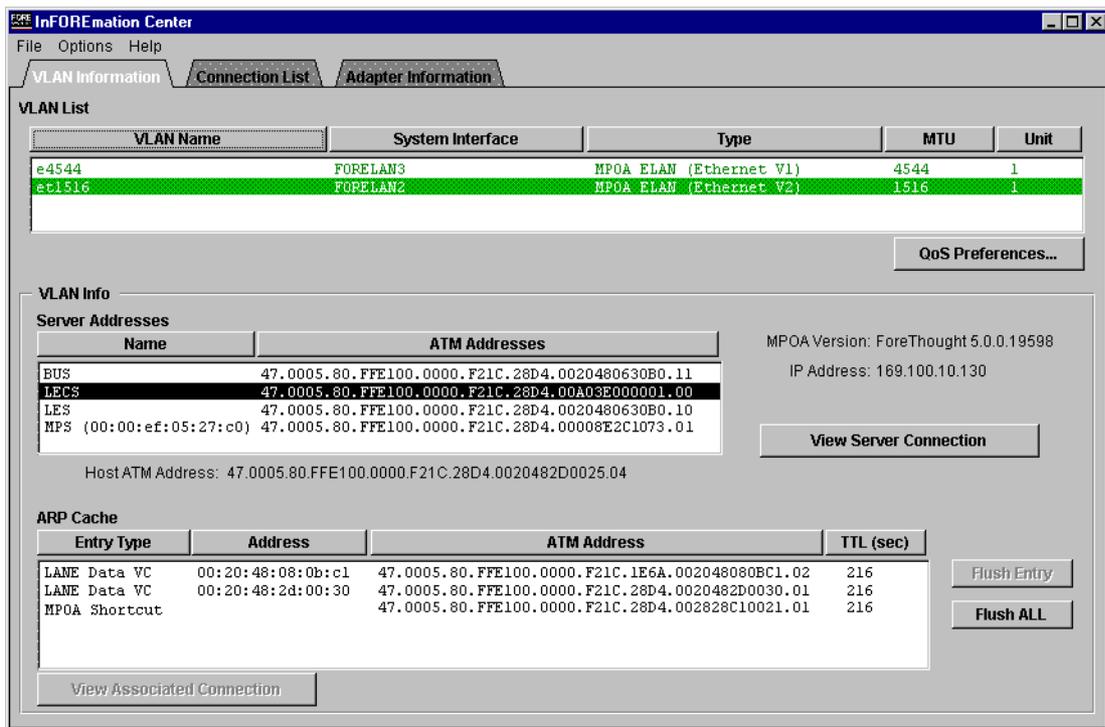
Figure 9.5 - VLAN Information Tab

3. In the VLAN List, highlight the MPOA ELAN interface for which you want to configure QoS Preferences. You must select an MPOA ELAN.

4. Select the **QoS Preferences** button.

    The **MPOA Properties** dialog box appears, as shown in Figure 9.6.

These preferences are manually added and edited.

These preferences are supplied by the driver and the LECS.
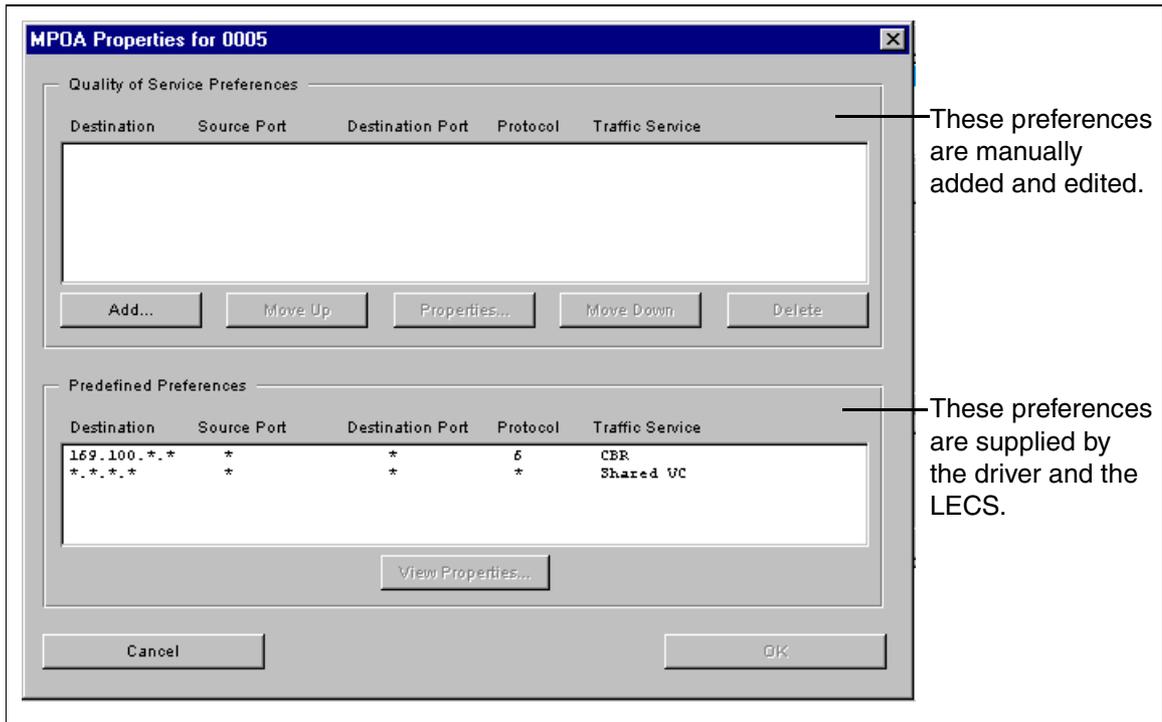
Figure 9.6 - MPOA Properties Dialog Box

This dialog box shows two sets of QoS preferences. The preferences in the upper list are user-defined and edited. The lower list displays predefined preferences provided by the LECS and the driver and cannot be edited. The predefined preferences can be viewed by selecting a preference and selecting the **View Properties** button. User-defined QoS preferences supersede those predefined by the LECS and driver.

**Configuring MPOA
and QoS Parameters**

5. To edit the properties of an existing QoS preference in the upper list, highlight the preference and select the **Properties...** button. To add a new QoS preference, select the **Add...** button.

   The Add Flow Specification dialog box appears, as shown in Figure 9.7.
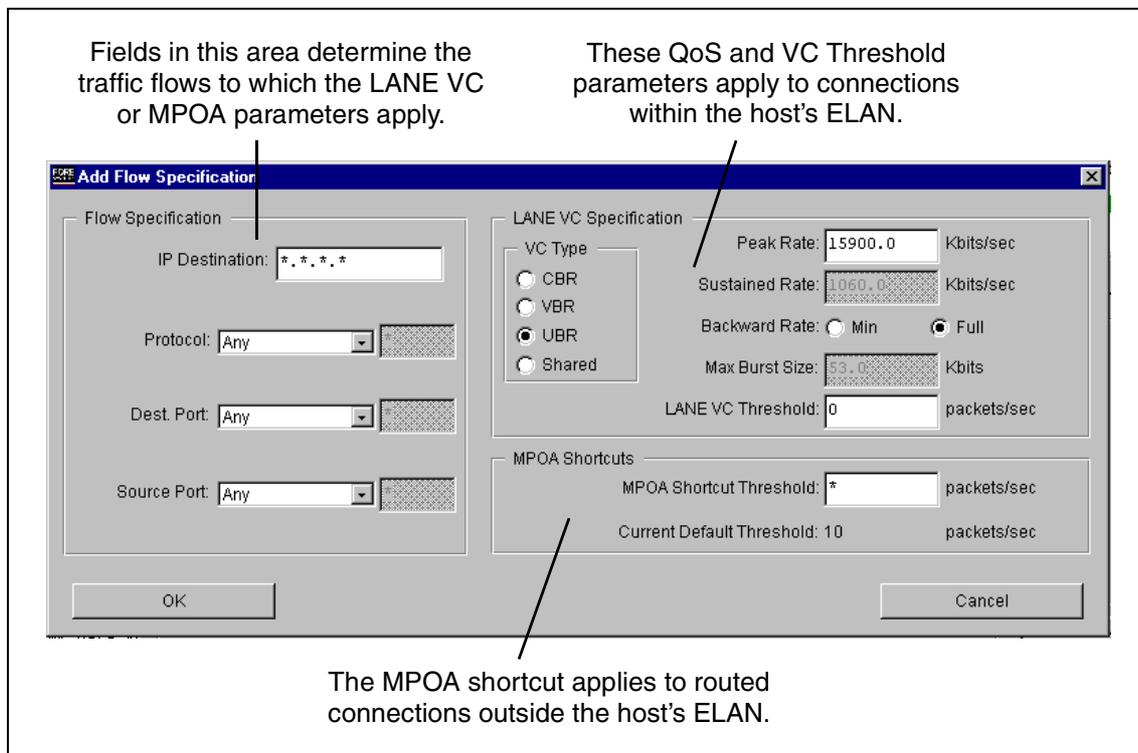
Figure 9.7 - Add Flow Specification Dialog Box

6. Edit the **Flow Specification** fields. Together, these fields determine which traffic is controlled by this Flow Specification.

   a. Specify the destination IP address or a host name (if your host has established a connection to a Domain Name Server). You can use trailing wildcards when specifying an IP address. For example, `145.235.5.*`, `145.*.*.*`, and `*.*.*.*` are valid addresses. `145.*.5.3` is not a valid address.

b. Specify a value in the **Protocol** field. You can select a protocol from the pull-down list or you can also select **user-specified** from the list and enter a value in the adjacent field.

c. Specify the **Destination Port** and **Source Port**. You can select a well-known port from the pull-down list or you can select **user-specified** from the list and enter a port ID in the adjacent field.

d. Specify the **Source Port**. You can select a well-known port from the pull-down list or you can select **user-specified** from the list and enter a port ID in the adjacent field. Note that most applications will not need a specified source port.

7. Edit the **LANE VC Specification** fields. These fields determine the QoS for the connection and the LANE VC Threshold.

a. Specify the type of service desired for the intra-ELAN connection: **CBR**, **VBR**, **UBR**, or **Shared**. MPOA shortcuts are always UBR.

b. Specify the required traffic shaping parameters:

- **Peak Rate** when using CBR or UBR.

- **Peak Rate**, **Sustained Rate**, and **Max Burst Size** when using VBR.

c. Specify the backward peak rate:

- **Min**, setting the backward peak rate equal to the forward peak rate on non-UBR connections.

- **Full**, setting the backward peak rate equal to the UBR line rate.

d. Specify the **LANE VC Threshold** (described in "LANE Virtual Circuit Threshold" on page 9-2).

> **NOTE**
> The PCA-200EPC adapter does not support CBR when the Maximum Transmit Rate is set to less than 1385. The PCA adapter will establish a UBR connection for the traffic.

8. In the MPOA Shortcuts fields, specify the **MPOA Shortcut Threshold** (described in "MPOA Shortcut Threshold" on page 9-3).

9. Click the **OK** button. The **MPOA Properties** dialog box reappears. If you added a new QoS preference, it now appears in the list.

10. You can re-arrange the order of preferences in the list by using the **Move Up** and **Move Down** buttons. A preference higher in the list has priority over a preference lower in the list. For example, if the flow specification of the first preference of the list applies to all flows to destination address `123.11.22.3` using TCP, and the second preference applies to all destinations using TCP, a connection to `123.11.22.3` using TCP will use the first preference in the list that matches it.

    Note that the user-defined QoS preferences in the upper list have priority over the predefined preferences in the lower list.

11. After arranging the list in the desired order, click the **OK** button.

12. Exit InFOREmation Center. The new QoS preferences and virtual circuit thresholds will take effect immediately.

NOTE ▶ If you reconfigure an already installed ELAN driver to join a different ELAN (for example by changing the ELAN name parameter or the LECS usage), the ELAN driver retains any QoS Preferences that had previously been defined for the driver.

If you want to create new QoS preferences for the reconfigured ELAN connection, you must manually delete the existing preferences. To do this in InFOREmation Center, select the ELAN in the VLAN Information tab, select the **QoS Preferences** button, and delete each preference in the **MPOA Properties** dialog box.

CHAPTER 10   Using InFOREmation Center

The InFOREmation Center application provides performance monitoring and debugging tools that allow you to view a number of ATM parameters and statistics. With the InFOREmation Center application, you can display the following information:

- Information about each LAN Emulation ELAN and Classical IP LIS to which the currently installed drivers are connected
- The list of connections used by the drivers
- Information about each Marconi adapter currently installed in your machine
- AAL traffic and transmission error statistics
- MPOA parameters for MPOA ELAN connections

You can also perform the following configuration through the InFOREmation Center:

- Configure MPOA and QoS parameters. This is described in Chapter 9, "Configuring MPOA and Quality of Service Parameters" on page 9-1.
- Configure Classical IP PVCs.

The InFOREmation Center is automatically installed when you install the *ForeThought* 5.1 adapter drivers on Windows 95 or Windows NT.

10.1 InFOREmation Center Requirements

10.1.1 Display Recommendations

Marconi recommends that when running Information Center your display is set to at least 640x480 resolution and a 16 color display. A resolution of 800x600 and 256 colors or better is highly recommended.

10.1.2 Font Requirements

InFOREmation Center requires that your Windows NT or Windows 95 machine have TrueType fonts. These are the default fonts for Windows, but it is possible to remove them or fail to load them when upgrading Windows. InFOREmation Center will not display correctly without them.

InFOREmation Center is designed to use the following fonts:

- Arial (normal, italic, and bold)
- Courier (normal, italic, and bold)
- Times New Roman (normal, italic, and bold)

Your machine must have at least one TrueType font installed, and Marconi recommends that the above fonts are installed.

10.1.3 CPU Usage

The InFOREmation Center consumes CPU resources. In general, Marconi recommends that you exit the InFOREmation Center when its use is not required.

10.2 Starting InFOREmation Center

To start InFOREmation Center, double-click on the **FORE Systems** icon in the Windows control panel, as shown in Figure 10.1. A start-up window appears while the application loads, and then the InFOREmation Center appears, showing the Summary View, as shown in Figure 10.2.
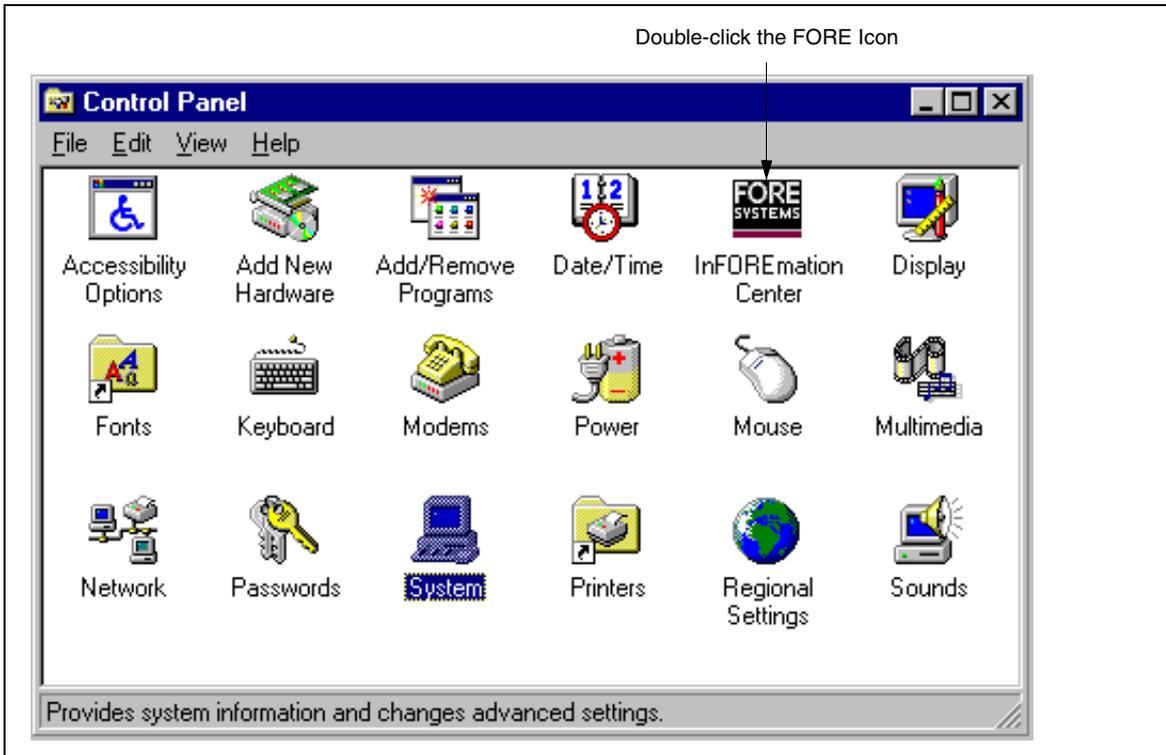
Figure 10.1 - Starting the InFOREmation Center

The InFOREmation Center utility appears, showing the summary view, as shown in Figure 10.2.

10.3 InFOREmation Center - Summary View

The summary view shows the following information:

- A list of all VLANs to which the adapter is connected.
- The status of each VLAN, given by color (see "VLAN Status Colors" on page 10-10).
- A list of all Marconi adapters installed in the host.
- The status of each adapter, given by color (see "Adapter Status Colors" on page 10-17).
- The current transmit and receive rates of the adapter in cells/sec or Kb/sec. See "Setting Cell Measurements" on page 10-25 for information on changing the units used in InFOREmation Center.
- The number of errors encountered by the adapter in the period since the driver was started or the error count was reset to zero with the **Zero Error Count** button.
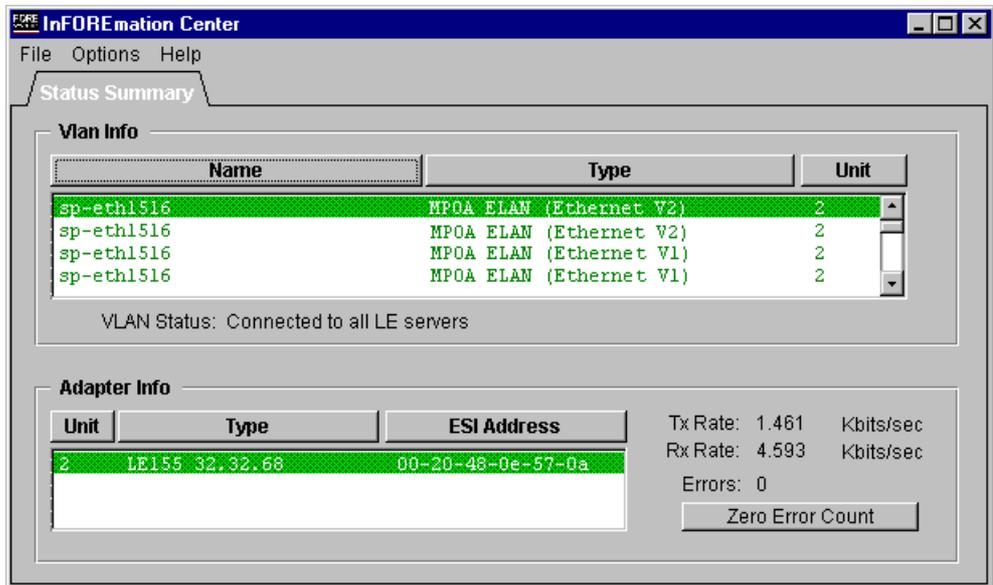
Figure 10.2 - InFOREmation Center Summary View

10.4 Menus in InFOREmation Center

The menus presented by the InFOREmation Center are:

File   Allows you to Exit the InFOREmation Center.

Options   Allows you to refresh the VLAN and Adapter information, set the automatic refresh interval, view more detailed adapter and VLAN information, and toggle the units used in InFOREmation Center between *cells per second* (cells ⁄ sec) and *kilobits per second* (Kb ⁄ sec).

Help   Displays on-line help and version information for InFOREmation Center.

10.5 On-line Help in InFOREmation Center

On-line help is available for InFOREmation Center. To display the on-line help, select the `Contents` option of the Help menu. The InFOREmation Center Help window appears, as shown in Figure 10.3. You can display help about each field and table displayed in InFOREmation Center.
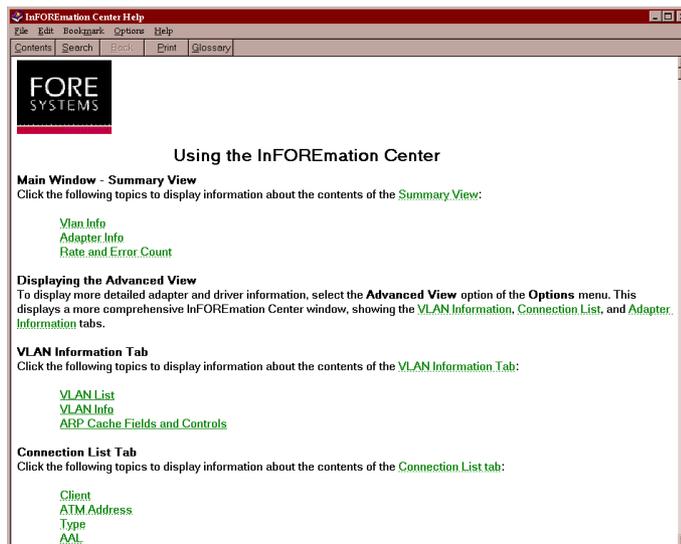
Figure 10.3 - InFOREmation Center Help Window

10.6 Copying Fields in InFOREmation Center

You can copy the contents of fields in InFOREmation Center and paste them into other applications. To copy an address, click on the field and press **Ctrl**+**C**. In the application in which you want to paste the address, press **Ctrl**+**V**. The entire contents of the InFOREmation Center field is pasted into the application.

Only selectable fields can be copied.

10.7 InFOREmation Center - Advanced View

To view more detailed information about the installed adapters and VLAN connections maintained by the adapters, select the Option>Advanced View menu option.

The detailed view of the InFOREmation Center appears, showing the VLAN Information tab, as shown in Figure 10.4.

10.8 Using the VLAN Information Tab

Figure 10.4 shows the VLAN Information window. It provides a wide range of information about current ATM connections through installed Classical IP and Emulated LAN drivers.
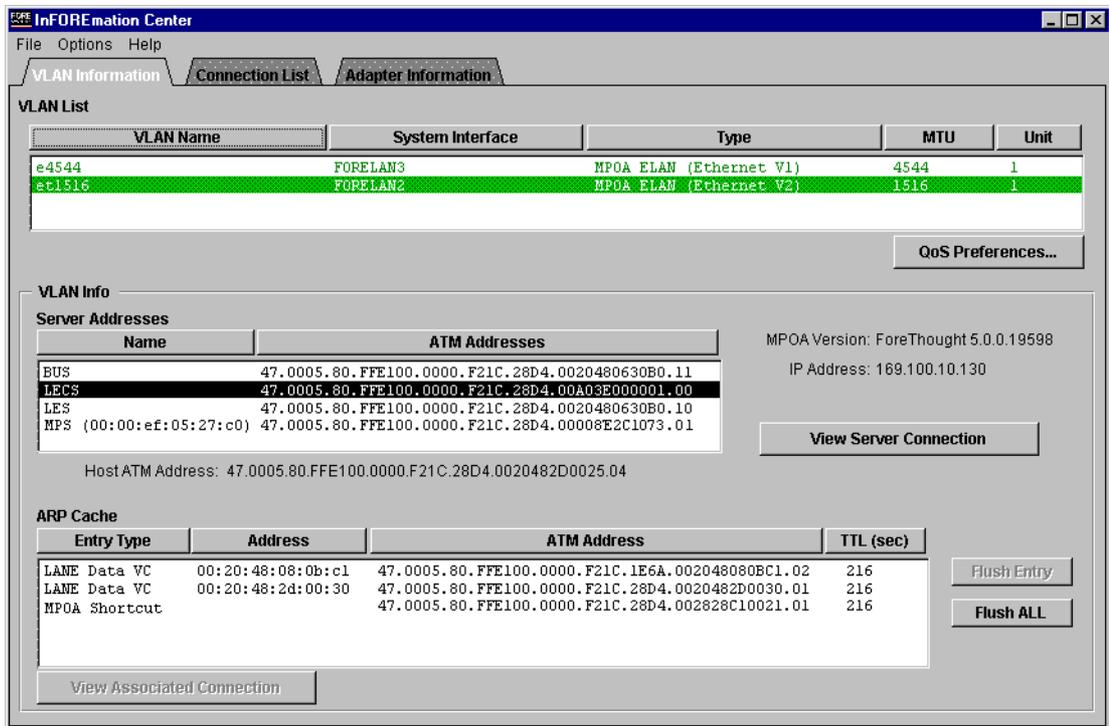
Figure 10.4 - The VLAN Information Window

From the VLAN Information window, you can:

- View the list of ELANs and Classical IP LISs to which this host is connected.
- View information about the VLAN, including related ATM addresses and status.
- Configure and view MPOA parameters.
- View and delete ARP Cache entries for a VLAN connection.
- View and delete CLIP PVC entries for a Classical IP connection.

Table 10.1 lists references to information on the VLAN Information Window.

Table 10.1 - Using the VLAN Information Window

For a description of...	Refer to...
The VLAN List	"The Marconi VLAN List" on page 10-9
The ARP Cache	"ARP Cache Table" on page 10-10
The VLAN Information	"VLAN Information Table" on page 10-12
Configuring MPOA Parameters	Chapter 9, "Configuring MPOA and Quality of Service Parameters" on page 9-1

10.8.1 Sorting the Lists

All lists in the VLAN Information window are sortable by the list heading. For example, clicking on **Name** will re-sort the entries by name, **Type** sorts by type, etc. To reverse the order of the sort, click on the list heading again.

10.8.2 The Marconi VLAN List

This list displays information about the ELANs or CLIP LISs to which the host is connected. You can double-click on a VLAN in the list to display the status of the VLAN.

VLAN Name	System Interface	Type	MTU	Unit
e4544	FORELAN3	MPOA ELAN (Ethernet V1)	4544	1
et1516	FORELAN2	MPOA ELAN (Ethernet V2)	1516	1

QoS Preferences...

Figure 10.5 - VLAN List Portion of VLAN Information Window

VLAN Name	VLAN of which the driver interface is a member.
System Interface	System-specific name assigned to the selected driver.
Type	Type and version of VLAN, either Classical IP or an Ethernet or Token Ring MPOA ELAN.
MTU	Maximum Transmission Unit in bytes. This is the largest packet data unit size that can be transmitted over the VLAN.
Unit	Unit number of the Marconi adapter over which this connection is running.

Selecting an ELAN's line entry in the VLAN List displays all information pertaining to it across all windows in the VLAN Information screen.

10.8.2.1 QoS Preferences Button

The **QoS Preferences...** button allows you to view and configure the MPOA traffic flow parameters for the highlighted ELAN. For a complete description of these parameters and how to configure them, refer to Chapter 9, "Configuring MPOA and Quality of Service Parameters".

10.8.2.2 VLAN Status Colors

The VLANs are color-coded to correspond with their individual connectivity state:

Green	Indicates full connectivity. For ELAN connections, the host is connected to the LES and BUS. For Classical IP connections, the host is connected to the ARP server.
Yellow	Indicates partial connectivity. For ELAN connections, the host has the LES address but is not connected. For Classical IP connections, the host has the ARP server address but is not connected.
Red	Indicates no connectivity.
Gray	Indicates that the driver is disabled.
Black	Indicates that the state is unknown.

10.8.3 ARP Cache Table

This table displays the ARP Cache for the VLAN selected in the VLAN list.

- For ELAN connections, this table lists MAC and ATM Addresses for other LECs on the selected ELAN which with this host has communicated.
- For MPOA ELANs, it also lists current MPOA shortcuts established by the driver.
- For Classical IP connections, this table lists IP addresses for other hosts in the LIS.

Figure 10.6 - ARP Cache Portion of VLAN Information Window

Entry Type	Indicates the type of entry.
Address	The MAC or IP address of other hosts on the specified VLAN.
ATM Address	The ATM address of other hosts maintained in the cache.

| **TTL (sec)** | "Time to Live" or the amount of time, in seconds, allotted for a connection. If no data traffic moves across the cache entry in the allotted time, the cache entry is automatically removed from the ARP Cache. |

If you select an entry in the ARP Cache table and there is a corresponding entry highlighted in the Connection List, you can use the **View Associated Connection** button to view the connection in the Connection List.

> **NOTE** Canonical address format is typically used in Ethernet and is also known as least significant bit (LSB) first. Noncanonical is typically used in Token Ring and is also known as most significant bit (MSB) first. Because Token Ring and Ethernet LANs transmit MAC addresses in opposite bit order, Token Ring and Ethernet MAC addresses are shown in opposite bit order.

10.8.3.1 Flush Entry and Flush All Buttons

The **Flush Entry** button deletes a highlighted entry from the ARP Cache, and is active only after an ARP Cache entry has been highlighted. The **Flush All** button deletes all entries from the ARP cache (but does not delete Classical IP PVCs).

10.8.3.2 Delete PVC Button

The **Delete PVC** button deletes a highlighted PVC connection from the ARP Cache, and is active only after a PVC ARP Cache entry has been highlighted.

10.8.3.3 View Associated Connection

You can highlight an entry in the ARP Cache and then click the **View Associated Connection** button to view the connection in the Connection Tab.

10.8.4 VLAN Information Table

This table displays general information about the selected VLAN. The information displayed varies depending on whether the VLAN is a LAN Emulation ELAN or a Classical IP LIS.

Figure 10.7 - VLAN Information Portion of VLAN Information Window (MPOA ELAN)

10.8.4.1 If the Connection is an ELAN

The Server Addresses table provides the ATM addresses of the ELAN's LANE service components as well as the host itself.

LECS	Displays the address of the LAN Emulation Configuration Server.
LES	Displays the address of the LAN Emulation Server.
BUS	Displays the address of the Broadcast and Unknown Server.
Host ATM Address	Displays the address of the LAN Emulation Client (i.e., this machine.)

10.8.4.2 If the Connection is an MPOA ELAN

The Server Addresses table may also include an entry for the MPOA Server for the MPOA ELAN, as shown in Figure 10.7. The entry shows the MAC address of the MPS. The MPS will appear only if shortcuts are being used.

10.8.4.3 If the Connection is a Classical IP LIS

The ATM Addresses table lists the address of the ARP server associated with the LIS and the ATM address of the host.
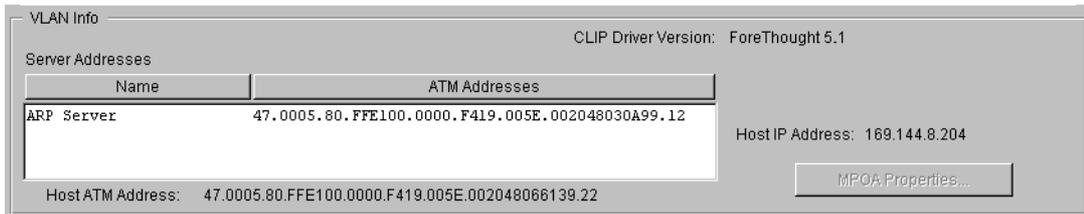
Figure 10.8 - VLAN Information Portion of VLAN Information Window (Classical IP ELAN)

10.8.4.4 MPOA/CLIP Driver Version Field

This field indicates the driver version number and build number. For the current release, the version is to `5.1`.

10.8.4.5 View Server Connection Button

You can highlight an entry in the Server Addresses list and there is a current connection to that server, then click the **View Server Connection** button to view the connection in the Connection Tab.

10.9 Using the Connection List Tab

This table displays the ATM addresses of all connections currently maintained by this host.

Figure 10.9 - Connection List Tab

Client	Displays the ELAN on which the connection resides. Also indicates if the connection is to one of the LANE Services (LECS, LES, or BUS), or to the ARP Server.
ATM Address	Displays the ATM Address of the connection
Type	Indicates connection types. SVC for switched virtual circuit, for example.
AAL	Indicates the ATM Adaptation Layer type. This field always displays 5.
VPI	Indicates the Virtual Path Identifier.

VCI   Indicates the Virtual Channel Identifier.

Unit   Indicates the adapter that this connection is using.

10.9.1 Add Classical IP PVC... Button

This button displays the **Add PVC** dialog box, allowing you to add a PVC connection manually to a host in a Classical IP LIS.

This button appears only if an IP Over ATM driver has been installed.

10.9.2 Delete PVC Button

This button deletes the selected connection if it is a user-specified Classical IP PVC connection manually. You cannot delete signalling PVCs.

This button appears only if an IP Over ATM driver has been installed.

10.9.3 Delete User PVCs Button

This button deletes all user-specified Classical IP PVC connections. You cannot delete signalling PVCs.

This button appears only if an IP Over ATM driver has been installed.

10.9.4 Selected Connection Fields

The **Selected Connection** fields at the bottom of the window show the Quality of Service preferences and age for the highlighted connection.

```
┌─ Selected Connection ──────────────────────────┐
│         VC Type:  UBR                           │
│      Max Tx Rate:  146249.77      Kbits/sec     │
│      Max Rx Rate:  146249.77      Kbits/sec     │
│   Connection Age:  6 hrs, 11 min, 0 sec         │
│        Interface:  FOREATM1                      │
└────────────────────────────────────────────────┘
```

10.10Using the Adapter Information Tab

The Adapter Information window, shown in Figure 10.10, displays general adapter information and data statistics for the adapter connection. The display is opened by clicking the `Adapter   Info` button on the VLAN Information window, or selecting the Windows>Adapter Info menu option.
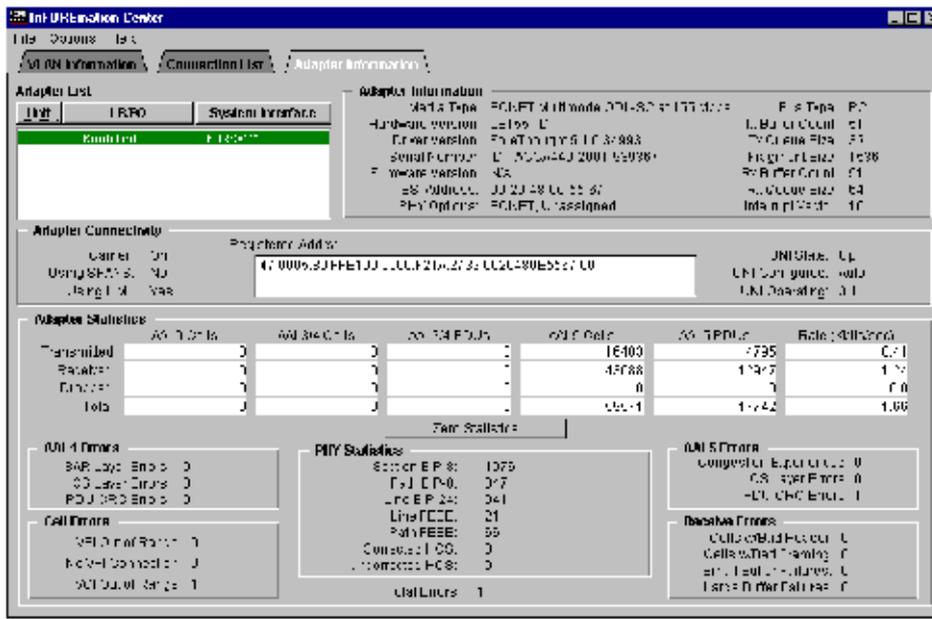
Figure 10.10 - Adapter Information Window

Refer to Table 10.2 for references to information on the Adapter Information Window.

Table 10.2 - Viewing the Adapter Information Window

For a description of...	Refer to...
Adapter information	"Adapter List Table" on page 10-17
	"Adapter Information Table" on page 10-18
Connectivity information	"Adapter Connectivity Table" on page 10-21
Statistical information	"Adapter Statistics Table" on page 10-22

10.10.1 Adapter List Table

This table lists the Marconi adapters currently installed in the machine, the LB/FO status for the adapter, and their corresponding unit numbers and status.
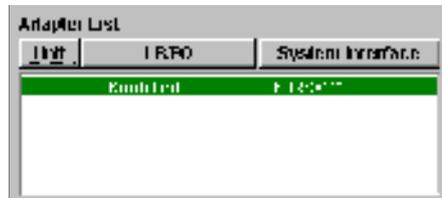
Figure 10.11 - Adapter List Portion of Adapter Information Window

10.10.1.1 Adapter Status Colors

The adapters are color-coded to correspond with their individual connectivity state:

Green	Indicates that carrier is detected and UNI signalling is operating.
Yellow	Indicates that carrier is detected but UNI signalling is not operating.
Red	Indicates no carrier.

10.10.1.2 LB/FO Status

The LB/FO column indicates whether the adapter is enabled for load-balancing and failover.

10.10.2 Adapter Information Table

This table displays general information about the adapter specified in the Adapter List field.

Figure 10.12 - Adapter Information Portion of Adapter Information Window

Media Type	Indicates the physical media or cable type that connects the adapter to the switch. Several types exist.
Hardware Version	Indicates the adapter card's name and model and the bus type used by the adapter (PCI).
Driver Version	Indicates the driver version number and build number. For the current release, the version is to `5.0`.
Serial Number	Indicates the adapter card's encoded serial number. This number is also stencilled on its face.
Firmware Version	Indicates the firmware version number of the firmware running on the adapter. This field applies only to PCA-200EPC adapters.
ESI Address	Indicates the End Service Identifier of the adapter. This value is factory-set for the adapter.

PHY Options   Indicates the Framing Type and Empty Cell Insertion options, if an OC3 adapter is used. The field string has four possibilities: **SONET, Unassigned**; **SONET, Idle**; **SDH, Unassigned**; or **SDH, Idle**.

SONET and **SDH** indicate the possible framing types.

Unassigned indicates that the adapter inserts unassigned cells when the cells are empty. This is the ATM Forum and ANSI standard.

Idle indicates that the adapter inserts idle cells when the cells are empty. This is the ITU-T standard.

Typically, **SONET, Unassigned** is used in the United States and **SDH, Idle** is used in Europe.

Tx Buffer Count   The number of transmit buffers which are allocated by the driver when it is loaded. The number of buffers can significantly impact the resources the driver consumes in the system. While more transmit buffers allows more send operations to be performed at one time, potentially increasing system performance, they also consume more system resources.

This value can be set when the ATM driver is configured through the Network control panel.

Tx Queue Size   The number of transmit queue descriptors associated with the transmit buffers.

This value can be set when the ATM driver is configured through the Network control panel.

Fragment Size	The size of each internal transmit buffer fragment generated by the driver; for *ForeRunnerLE* cards it also is the size of the receive buffer fragments (which are set to 2048 if the parameter is set to <= 2048, 4096 if the parameter is set to <= 4096 or otherwise to 8192).
	This parameter can change for Token Ring environments, where a larger fragment size might be used in the environment or in specific application environments (such as a higher fragment size for user API applications). The default (and minimum) value is 1536.
	This value can be set when the ATM driver is configured through the Network control panel, but users should not have to alter this parameter.
Rx Buffer Count	The number of receive buffers which are allocated by the driver when it is loaded. The number of buffers can significantly impact the resources the driver consumes in the system. While more receive buffers allows more receive operations to be performed at one time, potentially increasing system performance, they also consume more system resources.
	This value can be set when the ATM driver is configured through the Network control panel.
Rx Queue Size	The number of receive queue descriptors associated with the receive buffers.
	This value is set when the ATM driver can be configured through the Network control panel. However, setting this parameter too high can prevent the driver from loading due to insufficient system resources
Interrupt Vector (IRQ)	Indicates the interrupt request (IRQ) used by this adapter.

10.10.3 Adapter Connectivity Table

This table displays general host connectivity information including the machine's connection status, its ATM address, and the configuration method.
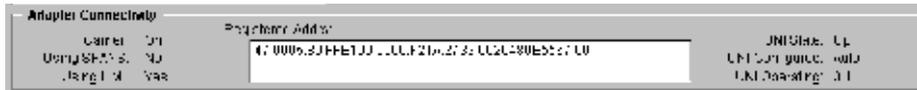
Figure 10.13 - Adapter Connectivity Portion of Adapter Information Window

Carrier **On** indicates that the host is successfully communicating with the network and is physically installed. **Off** indicates that the host is not communicating with the network and that the physical connection should be checked.

Using SPANS This field does not apply to the Marconi PC adapters.

Using ILMI **Yes** indicates that the host is configured to use ILMI. **No** means that it is not.

Registered Address The ATM address of the host. If ILMI has not found it, the field will read **Unknown (attempting to register)** until it is located. If LB/FO is in use, this field shows multiple addresses. The first address is the primary, followed by any secondary addresses registered for the selected adapter.

UNI State **Up** indicates that UNI is operating and has established a connection with the switch. **Down** indicates it has not.

UNI Configured Indicates what version of UNI the adapter driver was configured to use, **3.0**, **3.1** or **Auto** to indicate that ILMI should automatically determine the UNI version to use.

UNI Operating Either **3.0** or **3.1** if the UNI version is known; **Auto** if ILMI is currently determining which version to use.

10.10.4 Adapter Statistics Table

This table displays statistical information for ATM traffic and transmission errors.

Figure 10.14 - Adapter Statistics Portion of Adapter Information Window

The statistical information includes cells and packet data units (PDUs):

- Transmitted
- Received
- Dropped
- Throughput (Kb/s)

PHY Statistics are also provided for adapters with an OC3 interface.

Error statistics are broken down into three categories:

- AAL5
- Dropped Cell
- Receive

AAL5 Errors:

- Congestion Experienced — Traffic Overflow
- PDU CRC Errors — Data Error Checking
- CS Layer Protocol Errors — PDU errors

Dropped Cell Errors:

- VPI Out of Range Drops
- No Connection for VPI Drops
- VCI Out of Range Drops

Receive Errors:

- Cells Received with Bad Header
- Cells Received with Bad Framing
- Small Buffer Allocation Failures
- Large Buffer Allocation Failures

10.10.4.1 Zero Statistics Button

To return the cumulative statistics to zero, select the **Zero Statistics** button.

10.11 Using the Refresh and Measurement Options

The InFOREmation Center's Refresh Options allow you to set refresh intervals, implement immediate data refreshes, and clear statistical information at any time. These options are accessed through the `Options` menu. The Use Cell Measurements option allows you to change the units in which rates are displayed.

10.11.1 Setting Refresh Intervals

The Set Refresh Interval dialog, shown in Figure 10.15, allows you to determine how often the application automatically polls the driver to update its displayed information, as well as the automatic refreshes that take place when you select list items in the windows.

To set the Refresh Intervals:

1. Select the Options>Set Refresh Interval... menu option. The Set Refresh Intervals dialog box is displayed, as shown in Figure 10.15.
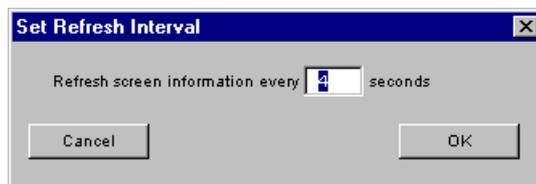
Figure 10.15 - Set Refresh Interval Dialog Box

2. Change the interval as desired. The interval cannot be set to zero. Marconi recommends that you specify an interval greater than 30 seconds to prevent frequent screen repainting and possible strain on CPU usage.

3. Click **OK** to implement the settings or `Cancel` to withdraw the changes and revert back to the original settings.

10.11.2 Refresh VLAN/Adapter Info Now

The **Refresh Now** menu option immediately update the display, as opposed to waiting for the refresh interval as described in the previous section.

10.11.3 Setting Cell Measurements

The **Use Cell Measurements** option allows you to control whether the units used in InFOREmation Center to display and input traffic rates are *kilobits* and *kilobits per second* (kbits/sec) or *cells* and *cells per second* (cells/sec).

When the **Use Cell Measurements** option is checked, the cell is the unit of measurement. When it is not checked, the kilobit is the unit of rate measurement.

10.12 Adding a Classical IP PVC

You can use the InFOREmation Center utility to add a PVC connection via an IP Over ATM (RFC 1577). In this manually configured connection, you must specify the VPI and VCI of the connection, specify the IP address of the destination host, or, if the host has established a connection to a Domain Name Server, specify a host name. If selecting a bridged connection, you must specify a peer MAC address.

You can specify the Maximum transmission rate for the connection.
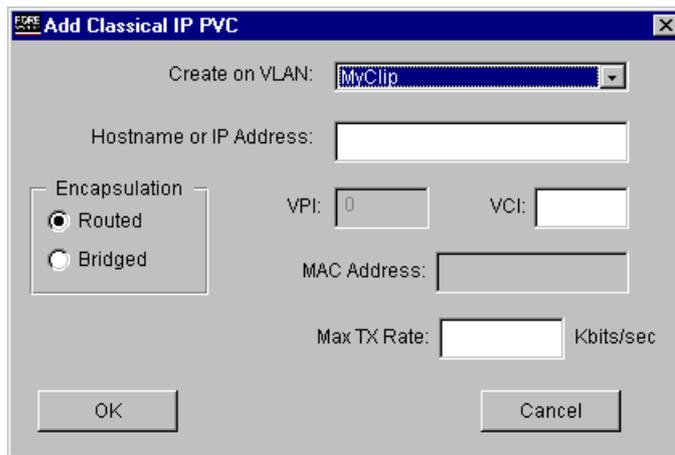
Figure 10.16 - Add Classical IP PVC Dialog Box

CHAPTER 11   Viewing ATM Statistics in NetWare

11.1 Introduction

The *ForeThought* ATM Console program for NetWare, FORECON.NLM, provides performance monitoring and debugging tools that allow you to view and log a number of ATM parameters and statistics. With the ATM Console, you can display the following information:

- Adapter information, such as AAL statistics and driver revision information
- ELAN information, such as addresses of the LANE services and current connections within the ELAN

You can also log this information to a text file.

By default, the ATM Console displays statistics about the number of cells and PDUs transmitted and received by the adapter, as shown in Figure 11.1. These statistics are constantly updated while the program is running, even if you are looking at other information.
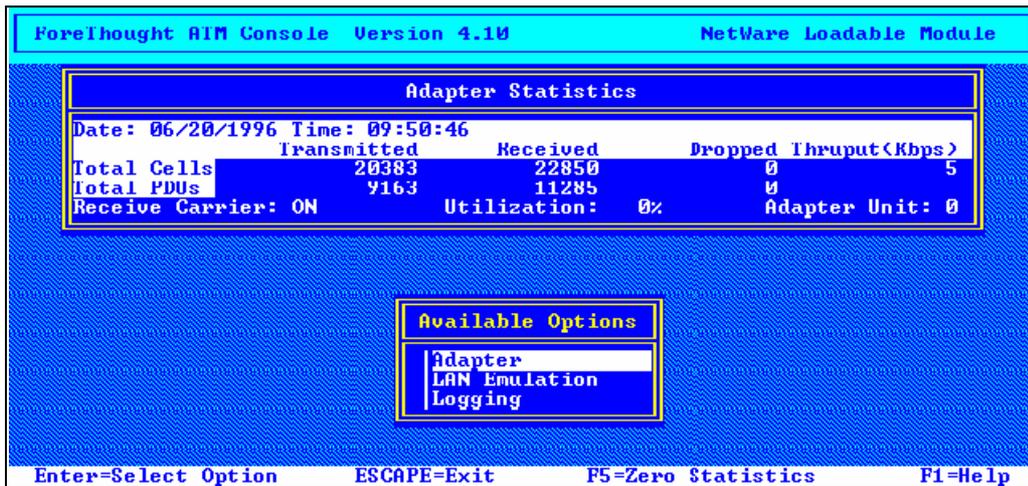
Figure 11.1 - ATM Console Main Window

11.1.1 Required NetWare Files

The ATM Console has the following NetWare file requirements:

- `CLIB` version 4.10 (dated 11/3/94 or later).
- `NWSNUT.NLM` version 4.11 (dated 10/17/94 or later).

11.1.2 Starting the ATM Console

Use the following NetWare console command to start the ATM Console:

```
load forecon
```

11.1.3 Navigating in the ATM Console

Use the following guidelines to navigate among the windows and menus of the ATM Console:

Selecting Menu Items	Select menu items by highlighting the item in the menu with the arrow keys and pressing **Enter**.
Exiting a Menu Level	To go back a menu level or to exit ATM Console while at the main menu level press **Esc**.
Displaying Online Help	To display online help, press **<F1>**.
Exiting ATM Console	To exit the ATM Console from any menu or submenu press **<Alt+F10>**.
Browsing NLM Consoles	To return to the NetWare system console, or a display console of any loaded NLMs, press **<Alt+Esc>**. Pressing this key combination repeatedly cycles through the system console and all other display consoles of loaded NLMs.
Displaying Currently Loaded NLMs	To display a list of loaded NLMs (from which you can choose one), press **<CTRL+ESC>**.
Unloading ATM Console	To unload the ATM Console from the NetWare system console, use the command **UNLOAD FORECON** at the system console prompt or press **<ESCAPE>**.

11.2 Default Statistics

By default, the ATM Console displays statistics about the number of cells transmitted and received by the adapter, as shown in Figure 11.3. These statistics are constantly updated while the program is running, even if you are looking at other information.
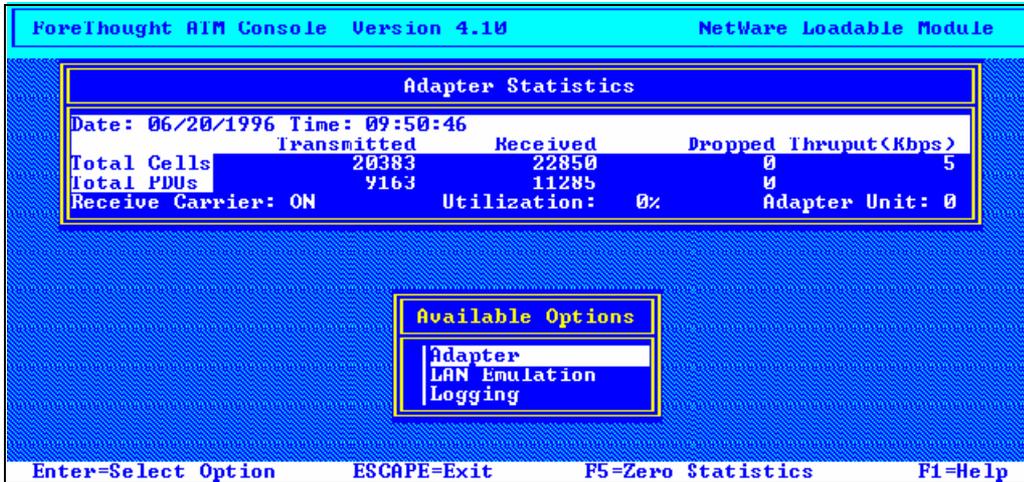
Figure 11.2 - ATM Console Main Window

The default statistics are:

- Total cells and PDUs transmitted, received and dropped
- Carrier status for the adapter
- Utilization percentage for the SERVER
- Unit number of the adapter

You can press **<F5>** to return the cumulative statistics to zero.

> **NOTE**
>
> If multiple Marconi adapters are installed in the Netware server, the ATM Console only displays information pertaining to the currently selected adapter. To display information about connections maintained by a different adapter, first change the selected adapter, as described in "Displaying Information for Different Adapters" on page 11-10.

11.3 Displaying ATM Adapter Information

11.3.1 Displaying Standard AAL Statistics

To display AAL statistics for the driver, firmware, and adapter:

1.   Select the Available Options>Adapter menu option.

2.   Select the Adapter>Show AAL Statistics menu option.

The AAL Statistics table displays the current date and time, and when the statistics were last zeroed.

```
┌─────────────────────────────────────────────────────────────────────────┐
│ ForeThought AIM Console   Version 4.10          NetWare Loadable Module   │
├─────────────────────────────────────────────────────────────────────────┤
│                              AAL Statistics                               │
│  Date: 06/06/1996 Time: 11:25:46                                          │
│     AAL        Transmitted        Received       Dropped Thruput(Kbps)    │
│     0   Cells            0               0            0              0     │
│    3/4  Cells            0               0            0              0     │
│    3/4  PDUs             0               0            0                    │
│     5   Cells        18139           11643            0              6     │
│     5   PDUs          5563            6072            0                    │
│  Total Cells         18139           11643            0              6     │
│  Total PDUs           5563            6072            0                    │
│  Receive Carrier: ON                               Adapter Unit: 0        │
│                                                                           │
│ ESC=Adapter Menu   F5=Zero Statistics  F10=Show Error Statistics   F1=Help│
└─────────────────────────────────────────────────────────────────────────┘
```

Figure 11.3 - AAL Statistics

The AAL standard statistics are:

- Cells transmitted, received, and dropped for AAL0
- Cells transmitted, received, and dropped for AAL3/4
- PDUs transmitted, received, and dropped for AAL3/4
- Cells transmitted, received, and dropped for AAL5
- PDUs transmitted, received, and dropped for AAL5
- Total cells (AAL0, AAL3/4, and AAL5) transmitted, received, and dropped
- Total PDUs (AAL3/4 and AAL5) transmitted, received, and dropped
- Cell throughput for AAL0, AAL3/4, and AAL5

11.3.2 Displaying Error AAL Statistics

To display AAL error statistics for the driver, firmware, and adapter:

1. Select the Available Options>Adapter menu option.

2. Select the Adapter>Show Error Statistics menu option.

The ATM Console Statistics window always displays the current date and time, as well as the date and time the statistics were last zeroed.

```
 ForeThought ATM Console   Version 4.10              NetWare Loadable Module

                          AAL Error Statistics

 Date: 06/20/1996 Time: 10:02:30              Last Zeroed: 06/20/1996 10:02:26
 Cells Rcvd Bad Header CRC          0  Cell Drops:VCI Out of Range          0
 Cells Rcvd Bad Framing             0  Cell Drops:VCI No Connect           50
 Rcv Alloc Failure Small b1         0  A3 Payload CRC Error Count           0
 Rcv Alloc Failure Large b1         0  A3 SAR or CS Layer Errors            0
 Rcv Alloc Failure Small b2         0  A3 CS Layer Protocol Errors          0
 Rcv Alloc Failure Large b2         0  A5 Congestion Experienced            0
 Rcv PDU Alloc Failures             0  A5 PDU CRC Errors                    0
 Cell Drops:UPI Out of Range        0  A5 CS Layer Protocol Errors          0
 Cell Drops:UPI No Connect          0



 ESC=Adapter Menu   F5=Zero Statistics   F10=Show Regular Statistics   F1=Help
```

Figure 11.4 - AAL Error Statistics

Cells Rcvd Bad Header CRC	Indicates the number of cells the adapter has received with a bad header Cyclic Redundancy Check (CRC) field.
Cells Rcvd Bad Framing	Indicates the number of cells the adapter has received with bad framing.
Rcv Alloc Failure...	Indicates the number of receive allocation failures that have occurred for each of the buffers used by the adapter driver.
Rcv PDU Alloc Failures	Indicates the number of Protocol Data Unit (PDU) receive allocation failures that have occurred.

Cell Drops: VPI Out Of Range	Indicates the number of cells the adapter has dropped because the Virtual Path Identifier (VPI) was out of range.
Cell Drops: VPI No Connect	Indicates the number of cells the adapter has dropped because there was no connection for the VPI.
Cell Drops: VCI Out of Range	Indicates the number of cells the adapter has dropped because the Virtual Channel Identifier (VCI) was out of range.
Cell Drops: VCI No Connect	Indicates the number of cells the adapter has dropped because there was no connection for the VCI.
A3 Payload CRC Error Count	Indicates the number of AAL3 payload CRC errors.
A3 SAR or CS Layer Errors	Indicates the number of AAL3 Segmentation and Reassembly (SAR) or Convergence Sublayer (CS) protocol errors that have occurred.
A3 CS Layer Protocol Errors	Indicates the number of AAL3 CS protocol errors.
A5 Congestion Experienced	Indicates the number of AAL5 cells that have experienced congestion.
A5 PDU CRC errors	Indicates the number of AAL5 cells that have had PDU CRC errors.
A5 CS Layer Protocol Errors	Indicates the number of AAL5 cells that have had CS layer protocol errors.

11.3.3 Switching Between Standard and Error Statistics

You can switch between the standard AAL statistics, shown in Figure 11.3 and the AAL error statistics, shown in Figure 11.4, by pressing **F10**.

11.3.4 Displaying Revision Information

To display revision information for the driver, firmware, and adapter:

1. Select the Available Options>Adapter menu option.
2. Select the Adapter>Revision Information menu option.

The Driver/Firmware/Adapter Revision Information table is displayed, as shown in Figure 11.5.

Figure 11.5 - Revision Information Screen

11.3.4.1 Information in the Table

This table shows the following information:

Card Type	The type of Marconi adapter currently selected. This value depends on what type of Marconi adapters you have installed in this machine. In this example, a PCA-200EPC adapter is shown.
Serial Number	The serial number of this *ForeRunner* adapter card.
Hardware Version	The hardware version of this *ForeRunner* adapter card.
Driver Version	The version number of this *ForeRunner* driver.

Firmware Version	The version number of this *ForeRunner* firmware, if this is a PCA adapter. The HE adapters do not use firmware.
MON960 Version	The i960 monitor version used by this adapter, if this is a PCA adapter. The HE adapters do not have an i960 monitor.
Media Type	The type of media this adapter is using to connect to the switch.
OC3 Framing	The type of OC3 cell framing used by this adapter, either SONET or SDH. This field appears only if the selected adapter is an OC3 adapter.
Empty Cell	Indicates how an OC3 adapter handles empty cells. This field appears only if the selected adapter is an OC3 adapter.
	UNASSIGNED indicates that the adapter inserts unassigned cells when the cells are empty. This is the ATM Forum and ANSI standard.
	NULL indicates that the adapter inserts idle cells when the cells are empty. This is the ITU-T standard.
	Typically, SONET framing with Unassigned cell insertion is used in the United States and SDH framing with Null cell insertion is used in Europe.
MAC Address	The Media Access Control (MAC) address that this driver is emulating.
LAN Emulation	The type of LAN emulation this driver is using.
Interrupt Vector	The interrupt vector of this adapter.
Bus Type	The type of bus in which this adapter is installed.

11.3.5 Displaying Connection Information

To display connection information for the adapter:

1. Select the Available Options>Adapter menu option.

2. Select the Adapter>Connection Information menu option.

The `Connection Information Table` is displayed, as shown in Figure 11.6.


```
 ForeThought AIM Console   Version 4.10              NetWare Loadable Module


                            Connection Information

   Use Ilmi                      YES
   ATM Address                   47.0005.80.FFE100.0000.F41A.2235.002048080041.00
   UNI  Configured Version       3.1
   UNI  Operating  Version       3.1










 ESCAPE=Previous Menu    Alt+F10=Exit                              F1=Help
```

Figure 11.6 - Connection Information Screen

11.3.5.1 Information in the Table

This table shows the following information:

Use ILMI	Indicates whether the driver is using ILMI to determine signalling information.
ATM Address	Indicates the ATM address of this adapter.
UNI Configured Version	Indicates the version of UNI that this driver is configured to use.
UNI Operating Version	Indicates the version of UNI that the driver is actually using.

11.3.6 Displaying Information for Different Adapters

You can display statistics for each Marconi adapter in your PC if you have multiple adapters installed.

NOTE

If multiple Marconi adapters are installed in the Netware server, the ATM Console only displays information pertaining to the currently selected adapter.

Use the following procedure to select the adapter for which statistics are displayed:

1. Select the Available Options>Adapter menu option.
2. Select the Adapter>Change Adapter menu option.
3. Select the adapter for which you want to display statistics.

11.3.7 Changing the Statistics Update Interval

Use the following procedure to change the statistics update interval:

1. Select the Available Options>Adapter menu option.
2. Select the Adapter>Change Update Interval menu option.
3. Specify a new update interval in seconds.
4. Press **Enter** and **Esc** when finished and **Enter** to confirm your changes.

11.4 Displaying LAN Emulation Information

To display LAN Emulation information, select the Available Options>LAN Emulation menu option. A list of available ELANs is displayed. Select the ELAN for which you want to display information. The `LAN Emulation Information` Table is displayed, as shown in Figure 11.7.

Figure 11.7 - LAN Emulation Table

> **NOTE**
>
> The LAN Emulation Information table displays information for the selected adapter ***only***. If multiple Marconi adapters are installed on the Netware server, and the ELAN that you selected is not accessed via the currently selected adapter, the LAN Emulation Information indicates that the ELAN has not started.
>
> To display LAN Emulation Information about connections maintained by a different adapter, first change the selected adapter, as described in "Displaying Information for Different Adapters" on page 11-10.

11.4.1 Refreshing the Table

The information in this table is dynamic. However, the update process may not occur during a typical viewing. To refresh the information, return to the main menu and re-select this information.

11.4.2 Information in the Table

The following LAN Emulation information is given in the LAN Emulation Information table:

Actual ELAN Name	The name of the ELAN to which this driver is connected.
Configured ELAN Name	The name of the ELAN to which this driver is connected, as configured in the LOAD parameter for this driver. If a name was not specified, this value is `<NULL>` and the Automatic ELAN Name specified by the LECS is used. (The name of this ELAN appears in the `Actual ELAN Name` field).
ELAN State	The state of the selected ELAN.
ELAN Type	Type of LAN being emulated, Ethernet or Token Ring.
Max MTU size	The largest MTU size that can be used by this ELAN.
ATM Address	ATM address assigned to this NetWare server. The selector byte of this address differentiates the server's address on this ELAN from this server's ATM address on other ELANs to which it is connected.
LECS Address	ATM address of the LECS associated with the selected ELAN.
LES Address	ATM address of the LES associated with the selected ELAN.
BUS Address	ATM address of the BUS associated with the selected ELAN.

11.4.3 Displaying the ARP Cache

To display the ARP cache for the selected ELAN driver:

1. Select the Available Options>LAN Emulation option.

2. A list of available ELANs is displayed. Select the ELAN for which you want to display information.

3. Select the LAN Emulation Options>Addressing and ARP Cache option.

The LAN Emulation Address and ARP Cache table is displayed, as shown in Figure 11.8.

Figure 11.8 - ARP Cache Screen

The following ARP Cache information is given in the LAN Emulation Address and ARP Cache table.

ATM Address	20-octet ATM address of a host with which this host has communicated via the ELAN. If the cache entry is unresolved, the message `-----unresolved-----` appears in this field.
MAC Address	6-octet Media Access Control (MAC) address being emulated by the host with the above ATM address.
TTL	The Time To Live is the time (in milliseconds) for which an idle table entry remains valid.

NOTE ▶ Because Token Ring and Ethernet LANs transmit MAC addresses in opposite bit order, Token Ring MAC addresses are shown in opposite bit order compared to Ethernet MAC addresses.

11.4.4 Displaying Connection Information

To display connection information:

1. Select the Available Options>LAN Emulation option.

2. A list of available ELANs is displayed. Select the ELAN for which you want to display information.

3. Select the LAN Emulation>Connection Table option.

The Incoming/Outgoing Connection table is displayed, as shown in Figure 11.9.

```
ForeThought ATM Console   Version 4.10              NetWare Loadable Module

                     Incoming/Outgoing Connection Table

ELAN Name: rainbow
   UPCI    AAL                 ATM Address                      Type    TTL
    83      5    47.0005.80.FFE100.0000.F415.0F5B.00204808114A.08   SVC    860
    84      5    47.0005.80.FFE100.0000.F41A.2235.002048071351.00   SVC      0

  ESCAPE=Previous Menu    Alt+F10=Exit                            F1=Help
```

Figure 11.9 - Incoming/Outgoing Connection Table Screen

11.4.4.1 Refreshing the Table

The information in this table is dynamic, however, the update process may not occur during a typical viewing. To refresh the information, go to the main menu and re-select this information.

11.4.4.2 Information in the Table

This window is a scrollable list with the transmit connection table followed by the receive connection table. The following connection information is given in the Incoming/Outgoing Connection table.

ELAN Name	The name of the selected ELAN.
VPCI	Virtual Path Channel Identifier, a combination of the VPI (Virtual Path Identifier) and the VCI (Virtual Channel Identifier). (For the *ForeThought* 4.1 release, only VPI 0 is used, so the value in this field always indicates the VCI.)
AAL	ATM Adaptation Layer type used by the connection. (For the *ForeThought* 4.1 release, this value is always AAL5.)
ATM Address	20-octet ATM address, consisting of 13 octets supplied by the switch, six octets supplied by the adapter, and one selector octet supplied by the Virtual Ethernet or Virtual Token-Ring driver.
Type	Connection type used by the driver. (For the *ForeThought* 4.1 release this value is always SVC, Switched Virtual Circuit).
TTL	Time, in milliseconds, for which an idle table entry remains valid. (TTL stands for Time To Live.)

11.4.5 Displaying Information for Different ELANs

You can display statistics for each ELAN for which you have a driver installed.

Use the following procedure to select the adapter for which statistics are displayed:

1. Select Available Options>LAN Emulation.
2. Select LAN Emulation>Change ELAN.
3. Select the ELAN for which you want to display statistics.

11.5 Logging Information to a Text File

The ATM Console allows you to log information to a text file. You can control the properties of the log file and start and stop the logging at your discretion. Depending on the parameters you set, the log file can contain some or all of the following information:

- AAL Statistics
- LAN Emulation Address Resolution Cache
- Incoming/Outgoing Connection Table
- Driver/Firmware/Adapter Revision Information Table

This is the same information that is displayed on the different screens in the ATM Console. The data written to the log file is independent of that shown in the screen. If you change the data shown on the screen, the data that is logged is unaffected. A sample log entry is shown in Figure 11.10 and Figure 11.11.

NOTE If the server crashes, the log file is still intact.

11.5.1 Starting the Log

Use the following procedure to start logging information to a file:

1. Select Available Options>Logging.
2. Select Logging>Start Logging.
3. Specify a file name for the log file. The log file must be on a NetWare partition. If the file already exists, a prompt asks if the file should be replaced or if data should be appended to the file.

11.5.2 Stopping the Log Prematurely

Use the following procedure to stop logging information to the log file:

1. Select Available Options>Logging.
2. Select Logging>Stop Logging.

A message appears if logging is not in progress. Otherwise, all logging is stopped and you can examine the log file with a text editor. Logging can be restarted by selecting Main Menu>Logging>Start Logging.

```
Log Entry for 01/17/1996 at 14:11:04
----------------------------------
----------------------------------


AAL Statistics for Adapter Unit 0
--------------
                              AAL 3/4      AAL 5       Total

 Cells Transmitted                 0       69480       69480
 Cells Received                    0       67670       67670
 Cells Dropped                     0           0           0
 Cell  Payload CRC Errors          0
 Cell  Protocol Errors             0
 Cell  Congestion Experienced              0
 PDUs Transmitted                  0       42697       42697
 PDUs Received                     0       44387       44387
 PDUs Dropped                      0           0           0
 PDU  Protocol Errors              0           0           0
 PDU  CRC Errors                           0
 VPI OutRange/NoConnect 0 / 0
 VCI OutRange/NoConnect 0 / 31581
 RecvBuffs Alloc Fail   0
 Receive Carrier       ON RecvDescr Alloc Fail   0
LAN Emulation and Address Resolution Cache for ELAN bambam:
------------------------------------------------------------------
ELAN State:   Connected
ELAN Type:    Ethernet
Max MTU Size: 1516 Bytes
ATM Address:  47.0005.80.FFE100.0000.F21A.0352.00204811323F.00
LECS Address: 47.0079.00.000000.0000.0000.0000.00A03E000001.00
LES Address:  47.0005.80.FFE100.0000.F21A.0352.0020481A0352.08
BUS Address:  47.0005.80.FFE100.0000.F21A.0352.0020481A0352.09
              ATM Address                        MAC Address       TTL
47.0005.80.FFE100.0000.F21A.0352.002048112FF1.00  00-20-48-11-2F-F1      0
47.0005.80.FFE100.0000.F21A.0352.00204811323A.00  00-20-48-11-32-3A   2000
```

Figure 11.10 - Sample NetWare Log (Part One of Two)

```
Connection Table for ELAN: bambam
----------------------------------------------------------------

   VPCI    AAL                  ATM Address                      Type     TTL
      61    5  47.0005.80.FFE100.0000.F21A.0352.002048112FF1.00  SVC       0
      41    5  47.0005.80.FFE100.0000.F21A.0352.00204811323A.00  SVC      2000


Driver/Firmware/Adapter Revision Information:
--------------------------------------------
 Card Type        PCA-200EPC
 Driver Version    4.1
 Serial Number     12863
 Hardware Version  PCA-200E Revision C
 Firmware Version  2.4.2
 Mon960 Version    30.0.0
 Media Type        SONET UTP5 at 155 Mbps
 MAC Address       00-20-48-11-32-3F
 OC3 Framing       Sonet
 Empty Cell        Unassigned
 ATM Address       47.0005.80.FFE100.0000.F21A.0352.00204811323F.00
 LAN Emulation     ATM Forum LAN Emulation Ethernet
 Interrupt Vector  5
 Bus Type          PCI
Connectivity Information:
--------------------------------------------
 Use Ilmi              Yes
 ATM Address           47.0005.80.FFE100.0000.F21A.0352.00204811323F.00
 UNI Configured Version Auto
 UNI Operating Version  3.1
```

Figure 11.11 - Sample NetWare Log (Part Two of Two)

11.5.3 Changing Log Properties

Use the following procedure to change the properties of the log:

1. Select Available Options>Logging.

2. Select Logging>Change Log Properties. The Log Properties screen is displayed, as shown in Figure 11.12.

3. Specify what information to log and override default log file parameters as desired:

    a. `Log...` - Specify Yes or No to indicate whether each item should appear in the log.

    b. `Purge File Size` - Specify the size at which the log file is purged. The log file is purged when it reaches the user-defined size. When the log file is purged, it is deleted and then re-created. The default is 100 K.

    c. `Log Update Interval` - Specify the length of the interval between log file updates. The default is 120 seconds.

    d. `Stop Logging After` - Specify how long logging should continue. The default is 60 minutes.

4. Press **Esc** when finished and **Enter** to confirm the changes.
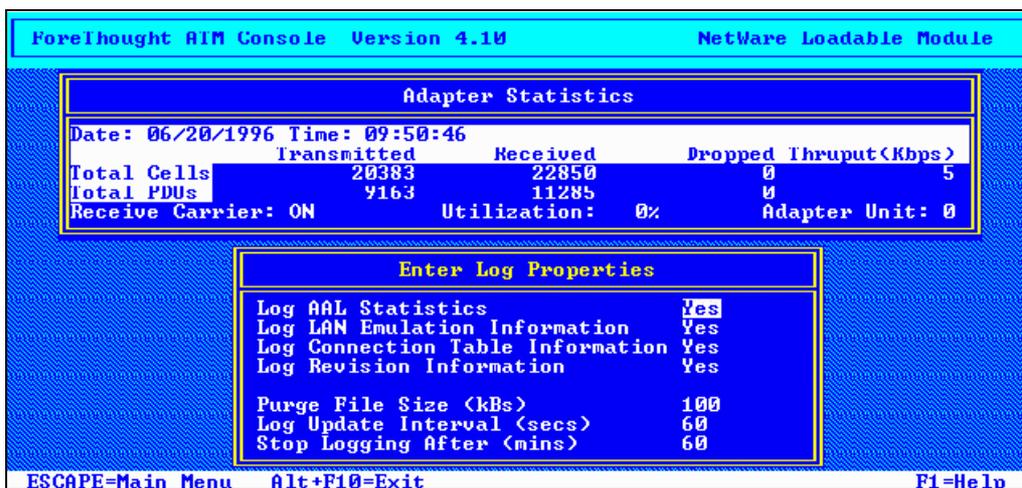
```
 ForeThought ATM Console  Version 4.10          NetWare Loadable Module

┌──────────────────────── Adapter Statistics ────────────────────────┐
 Date: 06/20/1996 Time: 09:50:46
               Transmitted        Received      Dropped Thruput(Kbps)
 Total Cells        20383          22850           0              5
 Total PDUs          9163          11285           0
 Receive Carrier: ON         Utilization:     0%      Adapter Unit: 0

       ┌──────────────── Enter Log Properties ────────────────┐
        Log AAL Statistics                            Yes
        Log LAN Emulation Information                 Yes
        Log Connection Table Information Yes
        Log Revision Information                      Yes

        Purge File Size (kBs)                         100
        Log Update Interval (secs)                    60
        Stop Logging After (mins)                     60

 ESCAPE=Main Menu    Alt+F10=Exit                           F1=Help
```

Figure 11.12 - Log Properties Screen

APPENDIX A   **LED Indicators**

This appendix shows the location of and gives a description of the LED indicators on the faceplate of the adapter adjacent to the cable connectors.

A.1 LED Locations

The figures below show the appearance of the end plate for ST, SC, and UTP connectors. Note that the LE 25 Mbps adapters are available with UTP connectors only. The LE 155 Mbps adapters are available with UTP or SC connectors only. The HE 622 Mbps adapters are available with SC connectors only.
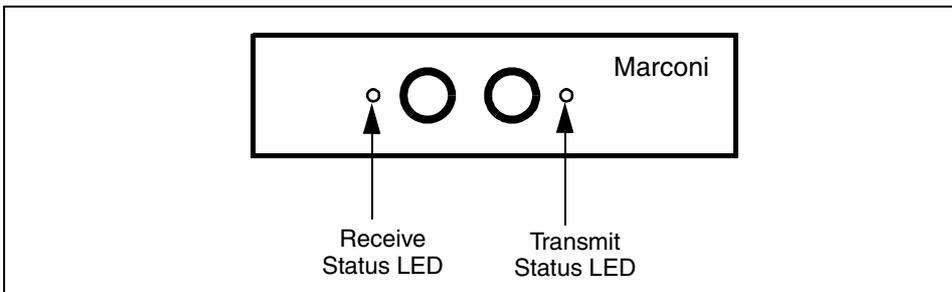
Figure A.1 - ST Connector End Plate Configuration
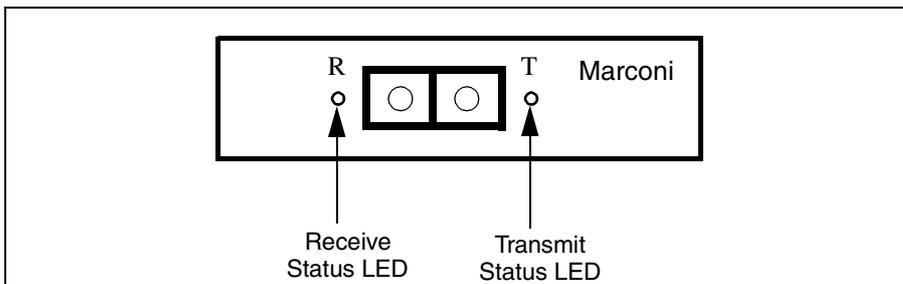
Figure A.2 - SC Connector End Plate Configuration
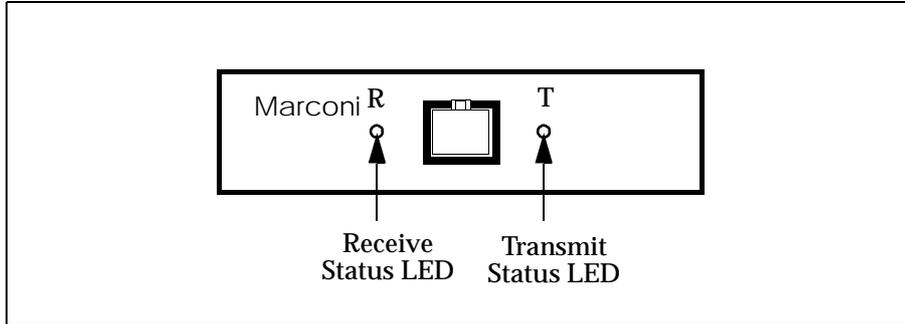
Figure A.3 - UTP Connector End Plate Configuration

A.2 LED Descriptions

The meanings of the LED indicators are described in Table A.2, "SC Connector End Plate Configuration," on page A-1 and Table A.2, "Receive LED," on page A-2.

Table A.1 - Transmit LED

LED Color	Meaning
green	Transmitting data
off	Idle
yellow	SONET alarm condition declared (indicates trouble with the receiving device)

Table A.2 - Receive LED

LED Color	Meaning
green	Receiving data
off	Idle
red	No carrier
yellow	No carrier (LE 155 and HE622)

APPENDIX B   Network Troubleshooting in Windows

B.1 Introduction

This appendix describes procedures for troubleshooting the Marconi driver in the Windows NT and Windows 95 environments.

B.2 Troubleshooting Questions

If your workstation is unable to communicate with another workstation, review the following sections to check for possible solutions.

B.2.1   Is There an Interrupt Conflict with the Adapter?

An interrupt conflict may exist if the adapter and another device (such as a mouse or sound card) are assigned the same IRQs.

How to check -

Run the PCI slot configuration utility for your PC and check the IRQ assignments.

Possible solutions -

To minimize potential conflicts, resources used by other devices cards or software can be manually entered into the PCI configuration database using the PCI slot configuration utility for your PC. Once entered, this data should be "locked" so another piece of software will not change the values stored for any PCI cards. When used properly, PCI configuration software automatically configures Marconi cards correctly.

B.2.2   Is the Adapter Receiving a Carrier Signal?

If the adapter is not receiving a carrier signal, it is physically disconnected from the network.

How to check -

There are two ways to check this. One method uses the InFOREmation Center utility:

1. Double-click on `InFOREmation Center` in the Control Panel.
2. Select `Adapter Information` in the `Window` menu.
3. The Adapter Connectivity portion of the window should include the message `Carrier: ON`.

The other method is to look at the faceplate of the adapter card in the machine:

-   The LE 25 and PCA-200EPC adapter receive LEDs will display a red light if no carrier is present.
-   The HE and LE 155 adapter receive LEDs will display a yellow light if no carrier is present.

Possible solution - If there is no carrier, plug in or replace your fiber/cable as appropriate. Check that the receive and transmit connectors are attached to the correct ports.

B.2.3   Is the Adapter Plugged into the Correct Port on Your Switch?

The media type used by the adapter (SONET, OC-3, UTP) must match that of the port into which it plugs in the switch.

How to check -

1. Double-click on `InFOREmation Center` in the Control Panel.
2. Select `Adapter Information` in the `Window` menu.
3. The `Media Type` parameter should match the type of port to which the adapter is connected on the switch.

Possible solution - Contact your system administrator for switch information, if appropriate.

B.2.4   Are the Adapter Drivers Loaded?

An instance of the *ForeRunner* ELAN driver must be loaded for each ELAN to which you are connecting, and an instance of the *ForeRunner* driver for each adapter card you have installed.

How to check -

1. Double-click on the `Network` control panel.

2. Make sure that at least one `ForeRunner ATM Adapter` and one `ForeRunner ELAN Adapter` driver appear in the `Installed Adapter Cards`.

Possible solution - If the required drivers are not loaded, add them as necessary, using the procedures in the driver installation chapter.

B.2.5   Is the Adapter Receiving and Transmitting Cells?

How to check -

1. Double-click on `InFOREmation Center` in the Control Panel.

2. In the AAL Statistics that are displayed, make sure there are AAL5 cells being transmitted and received.

Possible solution - If cells are not being transmitted or received, recheck that the adapter is plugged into the correct media type on the switch and that the correct Marconi drivers are loaded. If these are all correct, contact Marconi Technical Support.

B.2.6   Has the Adapter Connected to the Desired Emulated LAN?

This applies if you are using the Marconi ELAN driver to connect to an emulated Ethernet or Token Ring LAN.

How to check -

1. Double-click on `InFOREmation Center` in the Control Panel.

2. Check that the desired ELAN appears in the list of `Enabled FORE VLANs`. If it is not, you must install an ELAN driver for the desired ELAN.

3. Check the color of the ELAN in the list. If it is not green, contact your network administrator to determine why the ELAN is not available.

**Network
Troubleshooting in
Windows**

B.2.7 Has the Adapter Connected to the Desired Classical IP LIS?

This applies if you are using the Marconi IP Over ATM driver to connect to an emulated to a Logical IP Subnet (LIS), as defined by Classical IP (RFC 1577).

How to check -

1. Double-click on `InFOREmation Center` in the Control Panel.
2. Check that the desired LIS appears in the list of `Enabled FORE VLANs.` If it is, select it. If it is not, you must installed an IP Over ATM driver for the desired LIS.

B.2.8 Is There a Static NSAP route for the Adapter on the Switch?

If you're not using ILMI, the system administrator must set up a static NSAP route for the adapter on the switch.

How to check - Contact your system administrator for switch information.

Possible solution - Configure the switch as required.

B.2.9 Is the Adapter Using the Correct UNI Version?

The adapter driver must be using the same version of the UNI protocol as the switch to which it is connected, either UNI 3.1 or UNI 3.0. If you are using ILMI to determine the UNI version (which is the default driver setting), and ILMI is running, the adapter's UNI version should be correct. If you aren't using ILMI, the driver's default setting is UNI 3.1. If the switch is using UNI 3.0, you must manually specify that the driver use UNI 3.0 by specifying the UNI 3.0 option when configuring the driver.

How to check -

1. Double-click on `InFOREmation Center` in the Control Panel.
2. Click on the `Adapter Info...` button.
3. The `UNI Configured` field indicates which version of UNI the driver is config-ured to use. (If it indicates `Auto`, ILMI has determined the UNI version, which is indicated in the `UNI Operating` field.)
4. Contact you system administrator to compare this version with the version run-ning on the switch.

Possible solution - Configure the driver to use the correct UNI version, as described in the driver installation chapter.

B.3 For More Information

Table B.1 lists other places in this manual that may help you in troubleshooting.

Table B.1 - Information Sources

For Information About...	Refer To...
LAN Emulation	"Overview of LANE" on page 2-3
Classical IP	"Overview of Classical IP (Windows 95/98 and NT)" on page 2-17
The InFOREmation Center Application	"Using InFOREmation Center" on page 10-1
Adapter checklist	"Multiple Adapters Worksheet" on page 4-3 "Pre-Installation Checklist" on page 4-2
ATM addresses	"How to Specify an ATM Address" on page 4-4
Contacting Marconi Systems Technical Support	"Technical Support" on page iii of the Preface

B.4 Troubleshooting Checklist

Table B.2 provides a summary checklist of the troubleshooting questions.

Table B.2 - Summary of Troubleshooting Questions

Checklist Items	How to Check	Possible Solutions
Is adapter receiving carrier?	Start `InFOREmation Center`. Check if carrier is indicated.	Check hardware connections. Make sure transmit/receive connectors are in correct plugs.
Is adapter attached to correct media type on switch?	Start `InFOREmation Center`. Check media type of adapter and compare with media type on switch.	Contact system administrator and use compatible media.
Are the drivers loaded for the adapter?	Check `Network` control panel. Check if appropriate drivers (`ForeRunner ATM Adapter` and `ForeRunner ELAN Adapter`) are loaded.	Add the drivers as necessary.
Is adapter transmitting and receiving cells?	Start `InFOREmation Center`. Check AAL5 statistics.	Recheck first three items in checklist. Possible adapter hardware problem.
Is adapter connected to ELAN? (if using ELAN driver)	Start `InFOREmation Center`. Check `Enabled FORE VLANs` and `ELAN State` fields.	Change ELAN driver configuration, if necessary. Contact system administrator and check status of LANE services if necessary.
Is adapter connected to LIS? (if using IP Over ATM driver)	Start `InFOREmation Center`. Check `Enabled FORE VLANs`.	Change IP Over ATM driver configuration, if necessary. Contact system administrator and check status of ARP server if necessary.
Does adapter have NSAP route on switch (if ILMI is not being used)?	Contact system administrator to review switch configuration.	Edit switch configuration if necessary.

B.5 Collecting Diagnostic Information (Windows NT)

This section briefly describes key information that should be collected in the event of a Windows NT Operating Systems failure. This information does not apply to Windows 95. Providing the information described below is critical to the timely identification and diagnosis of any problems related to the ATM adapter software.

Windows NT Systems can totally fail in two different ways:

1. System Hang - A system hang results when a major problem within the Operating System or one of its kernel mode components goes undetected. The system ceases to be responsive, and fails to accomplish any useful work. Sometimes, but not always, the display is lost (rendering the system console screen totally black). As a result, system hangs are often referred to as *Black Screens.*

   There is little or no useful data that can be gathered after a system hang when the system is configured for ordinary use. However, once your system has been rebooted, be sure to collect the WinMSD information, as described in Section B.5.2, on your system.

2. System Halt - The Operating System displays a set of diagnostic information on the system console and halts its own execution. This information is displayed in white characters on a blue screen. As a result, Windows NT crashes are often referred to as *Blue Screens.*

   Unlike a system hang, there is much more information that can be gathered when a system halts. The following section describes the data that should be collected after the system halts.

B.5.1   Blue Screen Data

When the system halts, it is vital that as much information as possible be preserved from the system console display. The precise format of the information varies, depending on the type of crash and version of the operating system in use. Starting with Windows NT 3.5, it is possible to configure the system to save any blue screen diagnostic messages to a file automatically.

You can enable this option by checking the **Write debugging information file to:** *<file>* option in the Recovery dialog box. You can specify the path for the file. The Recovery dialog box is invoked by clicking the **Recovery...** button in the System dialog box, from the Control Panel program group.

> **NOTE** ➤ You have to be the administrator of the PC to use the above feature.

Ensure that the system is configured to capture any crash information that is generated.

B.5.2   Using WinMSD

In addition to the Blue Screen data you have collected above, you also need data about your system and its hardware. This information is displayed in detail by the `WINMSD` utility.

Once your system is restarted, wait for it to resume normal operation. Start any devices and services that were active at the time of the crash. Then run the `WINMSD` program (typically located in the `%SystemRoot%\system32` directory). Use `WINMSD` to create a report, and save this report to a file.

`WINMSD` can be invoked from the Taskbar by selecting Start>Run... and executing the following command:

```
WINMSD
```

B.6   Before Calling Support

Collect all the information described above and have it ready prior to calling Marconi Technical Support. They will request specific information from the `WINMSD` report, and from the blue screen data that you have collected. If you have access to the Internet, sending electronic mail to Marconi Technical Support with all the information you have collected is recommended.

APPENDIX C   Novell NetWare Network Troubleshooting

C.1 Introduction

This appendix describes procedures for troubleshooting a Marconi driver for an HE, LE or PCA adapter that is running in the NetWare Server Operating System environment. Messages produced by the Marconi modules are also included.

C.2 Troubleshooting Questions

If your workstation is unable to communicate with another workstation, review the following sections to check for possible solutions.

C.2.1   Is There an Interrupt Conflict with the Adapter?

An interrupt conflict may exist if the adapter and another device (such as a mouse or sound card) are assigned the same IRQs.

How to check -

Run the PCI slot configuration utility for your PC and check the IRQ assignments.

Possible solutions -

To minimize potential conflicts, resources used by other devices cards or software can be manually entered into the PCI configuration database using the PCI slot configuration utility for your PC. Once entered, this data should be "locked" so another piece of software will not change the values stored for any PCI cards. When used properly, PCI configuration software automatically configures Marconi cards correctly.

You can set the Marconi adapter interrupt to 5, 10, 11, or 12. The default value is 5.

C.2.2   Is the Adapter Receiving a Carrier Signal?

If the adapter is not receiving a carrier signal, it is physically disconnected from the network.

How to check -

There are two ways to check this. One method uses the FORECON utility:

1. Load the `FORECON.NLM` module.
2. Check that the main screen includes the message `Receive carrier: ON`.

The other method is to look at the faceplate of the adapter card in the machine. If the receive LED is red, the adapter is not receiving a carrier signal. (The faceplates and LEDs are described in Appendix A.)

Possible solution - If there is no carrier, plug in or replace your fiber/cable as appropriate. Check that the receive and transmit connectors are attached to the correct ports.

C.2.3   Is the Adapter Plugged into the Correct Port on Your Switch?

The media type used by the adapter (SONET, OC-3, UTP) must match that of the port into which it plugs in the switch.

How to check -

1. Load the `FORECON.NLM` module.
2. Select **Get Other Information**.
3. Select **Get Revision Information**.
4. The `Media Type` parameter should match the type of port to which the adapter is connected on the switch.

Possible solution - Contact your system administrator for switch information, if appropriate.

C.2.4   Are the Adapter Drivers Loaded?

An instance of the FOREVETH or FOREVTOK driver must be loaded for each ELAN to which you are connecting, and an instance of the FOREFxxx driver for each adapter card you have installed.

How to check -

1. At the NetWare console, type `modules`.

2. In the list of modules, make sure that you have FOREVETH or FOREVTOK and at least one ATM adapter driver loaded (e.g., FOREFPHE for the HE adapter, FOREFP2E for the PCA-200EPC adapter, etc.).

Possible solution - If the required modules are not loaded, load them as necessary, either manually or by adding the LOAD commands to the AUTOEXEC.NCF file and restarting the server.

C.2.5   Is the Adapter Receiving and Transmitting Cells?

How to check -

1. Load the FORECON.NLM module.

2. In the AAL Statistics that are displayed, make sure there are AAL5 cells being transmitted and received.

Possible solution - If cells are not being transmitted or received, recheck that the adapter is plugged into the correct media type on the switch and that the correct Marconi modules are loaded. If these are all correct, it is possible you have bad hardware. Contact Marconi Technical Support.

C.2.6   Has the Adapter Connected to the Desired ELAN?

How to check -

1. Load the `FORECON.NLM` module.

2. Select **`LAN Information`**.

3. If you receive an error message, then the FOREVETH or FOREVTOK driver is not loaded properly.

4. If you did not receive an error message, select the ELAN which you attempted to join. If you did not specify an ELAN, then select the first entry in the list, which is the default ELAN.

5. If the ATM address is `Not Available`, then ILMI might not be working.

6. If the LECS Address is `Not Available`, then the LECS is not operational, or an invalid LECS address was specified in the FOREVETH or FOREVTOK load command.

7. If the LES/BUS Address field is `Not Available`, then the LES/BUS is not operational, or an invalid LES address was specified in the FOREVETH or FOREVTOK load command.

Possible solution - Check that any unavailable addresses are specified correctly in the **`LOAD FOREVETH`** or **`LOAD FOREVTOK`** command in the `AUTOEXEC.NCF` file. If they are specified correctly, contact your system administrator or refer to the documentation for the platform on which the LANE Emulation services are running.

C.2.7   Is the Adapter Using the Correct Frame Type?

All hosts on the ELAN must have the same frame type.

How to check -

1. Load the `MONITOR.NLM` module.

2. Are you transmitting or receiving packets on the ELAN (FOREVETH or FOREVTOK)?

Possible solution - If your workstation is not transmitting or receiving packets, check the **`LOAD FOREVETH`** or **`LOAD  FOREVTOK`** command in the `AUTOEXEC.NCF` file. The `FRAME=` parameter must specify the same frame type as all other hosts on the ELAN.

C.2.8   Is the Adapter Using the Correct UNI Version?

The adapter driver must be using the same version of the UNI protocol as the switch to which it is connected, either UNI 3.1 or UNI 3.0. If you are using ILMI to determine the UNI version (which is the default driver setting), and ILMI is running, the adapter's UNI version should be correct. If you aren't using ILMI, the driver's default setting is UNI 3.1. If the switch is using UNI 3.0, you must manually specify that the driver use UNI 3.0 by specifying the `UNI=3.0` parameter with the `FORESIG` module.

How to check -

1. Load the `FORECON.NLM` module.
2. From the `Available Options` menu, select **Adapter**.
3. From the `Adapter` menu, select **Connection Information**.
4. The `UNI Configured` field indicates which version of UNI the driver is configured to use. (If it indicates `Auto`, ILMI has determined the UNI version, which is indicated in the `UNI Operating` field.)
5. Contact your system administrator to compare this version with the version running on the switch.

Possible solution - Edit the `AUTOEXEC.NCF` file to load the correct version of UNI.

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C.2.9   Is There a Static NSAP Route for the Adapter on the Switch?

If you're not using ILMI, the system administrator must set up a static NSAP route for the adapter on the switch.

How to check - Contact your system administrator for switch information.

Possible solution - Configure the switch as required.

Table C.1 - Summary of Troubleshooting Questions

Checklist Items	How to Check	Possible Solutions
Is adapter receiving carrier?	Load `FORECON.NLM`. Check if carrier is indicated.	Check hardware connections. Make sure transmit/receive connectors are in correct plugs.
Is adapter attached to correct media type on switch?	Load `FORECON.NLM`. Check media type of adapter and compare with media type on switch.	Contact system administrator and use compatible media.
Is `FOREVETH` loaded for the adapter?	Issue **`modules`** command. Check if appropriate modules (`FOREVxxx` and `FORExxx`) are loaded.	Edit `AUTOEXEC.NCF` to add appropriate **`LOAD`** commands.
Is adapter transmitting and receiving cells?	Load `FORECON.NLM`. Check AAL5 statistics.	Recheck first three items in checklist. Possible adapter hardware problem.
Is adapter connected to ELAN?	Load `FORECON.NLM`. Check `LAN Emulation Information`.	Edit `AUTOEXEC.NCF` if necessary. Contact system administrator and check status of LANE services if necessary.
Is adapter processing the correct frame type?	Load `MONITOR.NLM`. Check packet statistics.	Edit `FRAME=` parameter of `LOAD FOREVETH` command in `AUTOEXEC.NCF`.
Does adapter have NSAP route on switch (if ILMI is not being used)?	Contact system administrator to review switch configuration.	Edit switch configuration if necessary.

C.3 For More Information

Table C.2 lists other places in this manual that may help you in troubleshooting.

Table C.2 - Information Sources

For Information About...	Refer To...
Adapter checklist	"Pre-Installation Checklist" on page 4-2 "Multiple Adapters Worksheet" on page 4-3
ATM addresses	"How to Specify an ATM Address" on page 4-4
Contacting Marconi Systems Technical Support	"Technical Support" on page iii of Preface
FORECON utility	"Viewing ATM Statistics in NetWare" on page 11-1
FOREVETH parameters	"Step Three: Edit the AUTOEXEC.NCF File" on page 7-14 "LOAD Parameters for Marconi Drivers and Modules" on page 7-24
Marconi module parameters	"LOAD Parameters for Marconi Drivers and Modules" on page 7-24
LAN Emulation overview	"Overview of LANE" on page 2-3
Messages produced by the adapter	"Marconi Module Messages" on page C-8
Trace options	"Setting Up the Trace Options" on page 7-36

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C.4 Marconi Module Messages

C.4.1 FOREVETH and FOREVTOK Messages

The following messages (shown in boldface type) are produced by the ELAN drivers, FOREVETH and FOREVTOK. These are the messages produced when the `TRACE=` parameter on the `FOREOSP` module is set to the default value of `NOTICE`.

`FOREV`*xxx*`: MTU Frame Size is larger than Maximum Physical Receive Packet Size.`

The `STARTUP.NCF` file `SET MAXIMUM PHYSCIAL RECEIVE PACKET SIZE` parameter is not set correctly. Refer to "Required NetWare Start-up Parameters" on page 7-4.

`FOREVxxx: Specify the LECS-ADDRESS or LES-ADDRESS, not both.`

When loading the Virtual Ethernet adapter, you cannot specify both the `LECS-ADDRESS` and the `LES-ADDRESS` parameters. If you specify the `LECS-ADDRESS`, the LECS provides the system with the LES address, if it is aware of the ELAN that you are trying to configure.

You should specify the `LES-ADDRESS` parameter if you do not have a LECS to provide you with that information.

`FOREVxxx: Unable to start ILMI.`

The system attempted to start ILMI (to register the ATM address), but that attempt was unsuccessful. Make sure that the switch to which you are attached supports ILMI. In addition, make sure that you have successfully started one of the adapter drivers, FOREFP2 or FOREFP2E.

`FOREVxxx: Unable to get NSAP address with ILMI.`

The system attempted to retrieve this host's ATM address, but was not successful. Make sure that the switch to which you are attached supports ILMI.

`FOREVxxx: Unable to create LEC configuration.`

The system attempted to create a ELAN configuration but was unsuccessful. This problem can occur if you are low on memory, or if you provided an invalid UNIT= argument. UNIT numbers are displayed as the adapter drivers are loaded.

`FOREVxxx: '<`*elan-name*`>' is an invalid failover ELAN name.`

The name that you specified for the failover ELAN is invalid. The name must be of the form: `<`*elan-name*`>[|<`*range*`>].` For example, `accounting|1-2`.

`FOREVxxx: Unable to use automatic configuration.`

The LECS was unable to be contacted, or the LECS that you are using does not support the Marconi extensions to the LECS. This message is just a warning and the system attempts manual configuration.

`FOREVxxx: the ELAN-NAME parameter must be specified.`

Please specify the `ELAN-NAME` parameter. You see this message only if your LECS is not configured to return a default ELAN name for the client to join.

`FOREVxxx: Unable to add emulated LAN '<elan-name>'.`

The Virtual Ethernet driver was unable to add the specified ELAN. This problem can occur if the system is low on memory.

`FOREVxxx: Unable to search for LECS.`

This problem occurs if the system was unable to start the timer that waits for a response from the LECS. If you see this message, it is likely that the system is low on memory.

`FOREVxxx: Unable to create an LEC interface to '<elan-name>'.`

The Virtual Ethernet driver was unable to add the specified ELAN. This problem can occur if the system is low on memory.

C.4.2   Marconi ATM Driver Messages

The following messages are produced by the Marconi ATM driver. These messages are produced when the specified condition occurs and the `TRACE=` parameter on the `FOREOSP` module is set to the default value of `NOTICE`.

C.4.2.1 PCA Adapter Messages

The message prefix indicates which driver produced the message. In the following list, the driver has the `FOREFP2E` prefix, indicating that the message was produced by an PCA-200EPC driver. The possible prefixes are:

FOREFP2E	ATM driver for the PCA-200EPC adapter.
FOREFPHE	ATM driver for the HE adapter.

`FOREFP2E: Unable to find any ForeRunner adapters.`

The adapter driver that was loaded is not correct. You see this message if, for example, you have an PCA adapter and you attempted to load the driver for the HE adapter.

`FOREFP2E: Unable to parse command line.`

The parameters presented on the command line are incorrect.

`FOREFP2E: Using ForeRunner adapter in slot <slot-number>.`

You did not specify a slot number for the driver, so the driver is using the *ForeRunner* adapter it found in slot `<slot-number>`.

`FOREFP2E: slot <slot-number> is already being used.`

The driver for the adapter in this slot has already been loaded.

`FOREFP2E: Unable to register the HSM.`

The driver was unable to register its hardware options (IRQ, memory address, etc.) with the operating system. This error typically occurs if there is a resource conflict. For example, if the SCSI controller is using interrupt 10 and the PCA adapter is also assigned to interrupt 10, then this error is generated.

`FOREFP2E: Adapter memory allocation failed.`

The adapter was unable to allocate memory. You may need to increase your system memory resources.

`FOREFP2E: Unable to obtain PCI information.`

The driver attempted to search the configuration space for the adapter, but was unable to perform the search. Make sure that you are attempting to load the correct driver and that the adapter is properly seated in the computer.

```
FOREFP2E: Unable to map adapter RAM into NetWare.
```

The driver was unable to map the adapter's address space into NetWare. The system may have a resource conflict or be low on resources.

```
FOREFP2E: HSM hardware registration failed.
```

The driver was unable to register the hardware options. The driver multiplexor (`FOREMUX`) reports the specific hardware conflict.

```
FOREFP2E: Unable to register for EXIT function.
```

The driver was unable to register with the operating system for the EXIT command. The driver registers for this option so that it can properly reset the adapter when the system goes down. If you see this message, it is likely that the system is low on resources.

```
FOREFP2E: Unable to initialize adapter.
```

The driver was unable to reset and initialize the adapter. The driver was not able to reset the adapter. It is possible that the adapter is bad. It is also possible that the adapter is incompatible with your system. Try re-seating the adapter or moving the adapter to another slot.

```
FOREFP2E: Unable to load firmware.
```

The driver was unable to load the firmware file into memory. Be sure that the driver .LAN file was not corrupted. The system may also be low on memory resources.

```
FOREFP2E: Unable to download firmware.
```

The driver was unable to load the firmware file onto the adapter card. This message can only occur if the firmware has been corrupted. Check to make sure that the adapter driver is the correct one. You may want to attempt to load the latest adapter driver available from Marconi.

```
FOREFP2E: Unable to start firmware.
```

The driver was unable to start the firmware. The firmware image may have been corrupted, or the hardware has failed.

```
FOREFP2E: Firmware initialization failed.
```

The driver was unable to initialize the firmware. The firmware image may have been corrupted, or the hardware has failed.

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```
FOREFP2E: Unable to allocate adapter resources.
```

The driver was unable to allocate resources required to run. The system is probably low on memory resources.

```
FOREFP2E: Unable to initialize command queue.
```

The driver was unable to initialize the adapter's command queue. The system is probably low on memory resources.

```
FOREFP2E: Unable to initialize transmit queue.
```

The driver was unable to initialize the adapter's transmit queue. The system is probably low on memory resources.

```
FOREFP2E: Unable to register transmit queue lock.
```

The driver was unable to protect the transmit queue. The system is probably low on memory resources.

```
FOREFP2E: Unable to initialize receive queue.
```

The driver was unable to initialize the adapter's receive queue. The system is probably low on memory resources.

```
FOREFP2E: Unable to initialize large buffer queue.
```

The driver was unable to initialize the adapter's buffer resupply queue. The system is probably low on memory resources.

```
FOREFP2E: Unable to allocate initial receive buffers.
```

The driver was unable to initialize the adapter's receive buffers. The system is probably low on memory resources.

```
FOREFP2E: Unable to get adapter prom data.
```

The driver was unable to obtain important information from the adapter, such as the default node address (MAC address). The adapter may have a bad PROM.

```
FOREFP2E: Unsupported ATM TSM to HSM control function.
```

The driver received an unsupported call from the adapter multiplexor. Be sure that you are using compatible versions of Marconi's modules.

```
FOREFP2E: heartbeat stopped (0x<value>)!
```

The firmware's "heartbeat" stopped, indicating an internal firmware error. Please contact Marconi's Technical Support. Please provide them with the *<value>* listed in the error message.

```
FOREFP2E: received multi-fragment (<size>) packet.
```

The adapter received a packet that was too large to process. Be sure that all machines on the network are using the same packet (MTU) size.

C.4.2.2 LE Driver Messages

```
FOREFPLE: Unable to determine SLOT number.
```

The operating system was unable to determine the adapter slot number. Please try a different slot. If this error persists, you may have a bad adapter. If this message does recur, please contact Marconi's Technical Support, as described in "Technical Support" on page iii of the Preface.

```
FOREFPLE: Unable to find any ForeRunner FOREFPLE adapters
```

The HSM was unable to locate a LE adapter. Please try a different slot. If this error persists, you may have a bad adapter. If this message does recur, please contact Marconi's Technical Support, as described in "Technical Support" on page iii of the Preface.

```
FOREFPLE: Unable to parse command line.
```

The parameters presented on the command line are incorrect.

```
FOREFPLE: slot <slot-number> is already being used.
```

The driver for the adapter in this slot has already been loaded.

```
FOREFPLE: Unable to register the HSM.
```

The driver was unable to register its hardware options (IRQ, memory address, etc.) with the operating system. This error typically occurs if there is a resource conflict. For example, if the SCSI controller is using interrupt 10 and the HE adapter is also assigned to interrupt 10, then this error is generated.

```
FOREFPLE: Adapter memory allocation failed.
```

The adapter was unable to allocate memory. You may need to increase your system memory resources. Please try to unload unnecessary NLMs to increase the amount of available memory.

```
FOREFPLE: PACKET SIZE must be at least 2048.
```

The driver must have buffers of at least 2K in size. Please change the `SET MINIMUM PHYSI-CAL RECEIVE PACKET SIZE` parameter to at least 2048 in your `STARTUP.NCF` file.

```
FOREFPLE: HSM hardware registration failed.
```

The driver was unable to register the hardware options. The driver multiplexor (FOREMUX) reports the specific hardware conflict.

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`FOREFPLE: Unable to register for EXIT function.`

The driver was unable to register with the operating system for the EXIT command. The driver registers for this option so that it can properly reset the adapter when the system goes down. If you see this message, it is likely that the system is low on resources.

`FOREFPLE: Unable to determine media type.`

The driver was unable to determine the type of adapter you installed. You may have a bad adapter. Please contact Marconi's Technical Support, as described in "Technical Support" on page iii of the Preface.

`FOREFPLE: Unable to locate Marconi adapter.`

The physical adapter does not have a Marconi hardware address. This software only works with the Marconi LE adapter.

`FOREFPLE: Unable to allocate large buffer pool.`

The adapter was unable to allocate the packet buffers required for receive data. NetWare may be low on resources. Please increase the `SET MINIMUM PACKET RECEIVE BUFFERS` parameter in your `STARTUP.NCF` file.

`FOREFPLE: Unable to allocate memory for queues.`

The adapter was unable to allocate the memory required for transmitting and receiving data. Your system may be low on memory resources. Please try unloading unnecessary NLMs to increase the amount of available memory.

`FOREFPLE: Unable to align queues.`

The memory used for transmitting and receiving data must meet strict memory boundary requirements. Your system may be low on memory resources. Please try unloading unnecessary NLMs to increase the amount of available memory.

`FOREFPLE: Warning: No carrier.`

No carrier was detected on the adapter card. Check your adapter's cable or fiber to ensure that it is correctly connected.

`FOREFPLE: Hardware failed to initialize raw cell queue (%x != %x)`

The adapter hardware did not properly initialize. You may have a bad adapter. Please contact Marconi's Technical Support, as described in "Technical Support" on page iii of the Preface.

C.4.2.3 HE Driver Messages

`FOREFPHE: Unable to parse command line.`

The driver was unable to parse the command line arguments. The most likely cause would be an incorrect command line parameter.

`FOREFPHE: No Adapters Available.`

The driver did not detect and ForeRunner HE adapter cards.

`FOREFPHE: Slot already occupied.`

The slot specified by the command line parameter "SLOT" is already in use.

`FOREFPHE: Failed to register with ATMTSM.`

The driver was unable to register its hardware options (IRQ, memory address, etc.) with the operating system. This error typically occurs if there is a resource conflict. For example, if the SCSI controller is using interrupt 10 and the HE adapter is also assigned to interrupt 10, then this error is generated.

`FOREFPHE: Failed to register hardware.`

The card driver failed to register its hardware options. The driver multiplexor, FOREMUX, reports the specific hardware conflict.

`FOREFPHE: Unable to allocate connection array.`

The card driver was unable to allocate memory for the VC connection array. This usually means that the system is low on resources. Please try to unload unnecessary NLMs to increase the amount of available memory.

`FOREFPHE: Failed to initialize the hardware.`

There was a problem initializing the card's hardware. The driver multiplexor, FOREMUX, reports the specific hardware conflict.

`FOREFPHE: Failed to initialize data structures.`

The data structures used by the card driver failed to initialize. This usually means the system is low on resources.

`FOREFPHE: Failed to start TSM interface.`

The card driver failed when it tried to inform the TSM to start sending packets.

`FOREFPHE: Unable to register for EXIT function.`

The driver was unable to register with the operating system for the EXIT command. The driver registers for this option so that it can properly reset the adapter when the system goes down. If you see this message, it is likely that the system is low on resources.

`FOREFPHE: Failed to stop TSM interface.`

The driver was unable to stop sending packets.

`FOREFPHE: Failed to deregister hardware.`

The driver was unable to deregister the hardware. This only occurs when trying to unload the driver.

`FOREFPHE: Unable to determine SLOT number.`

The driver found an HE adapter card, but was unable to determine its slot number. This is most likely the result of a problem with the hardware or Netware's setup.

`FOREFPHE: Unable to find any ForeRunner HE adapters.`

There are no HE adapters loaded in the machine.

`FOREFPHE: Failed to read PCI config space.`

The driver failed to read the PCI configuration space on the card. This is caused by a hardware error.

`FOREFPHE: Invalid Media type.`

The driver detected an unknown version of the HE adapter card. This is caused by a hardware error.

`FOREFPHE: Deregistering Driver failed.`

There was a problem unloading the driver.

`FOREFPHE: Adapter memory allocation failed.`

The adapter failed when it tried to allocate memory. This usually means that the system is low on resources. Please try to unload unnecessary NLMs to increase the amount of available memory.

`FOREFPHE: Couldn't allocate Receive Buffers.`

The adapter failed to allocate receive buffers. This usually means that the system is low on resources. Please try to unload unnecessary NLMs to increase the amount of available memory.

C.4.3   FOREMUX Messages

The following messages are produced by the FOREMUX module. These messages are produced when the specified condition occurs and the TRACE= parameter on the FOREOSPmodule is set to the default value of NOTICE.

FOREMUX: Unable to parse command line.

The adapter multiplexor did not understand some of the options presented on the command LOAD line.

FOREMUX: invalid register version.

The adapter multiplexor and adapter driver are incompatible. Use consistent versions of the software.

FOREMUX: Unable to allocate alloc resource tag.

The adapter multiplexor could not obtain necessary resources. The system is probably low on memory resources.

FOREMUX: Unable to allocate HSM's adapter handle.

The adapter multiplexor could not obtain necessary resources. The system is probably low on memory resources.

FOREMUX: Unable to allocate adapter configuration information.

The adapter multiplexor could not obtain necessary resources. The system is probably low on memory resources.

FOREMUX: Unable to allocate AES Resource Tag.

The adapter multiplexor could not obtain necessary resources. The system is probably low on memory resources.

FOREMUX: Unable to allocate MLID Resource Tag.

The adapter multiplexor could not obtain necessary resources. The system is probably low on memory resources.

FOREMUX: LSL Registration Failed.

The adapter multiplexor could not register the adapter driver with the Link Support Layer. It is likely that the system is low on memory resources.

FOREMUX: Unable to allocate buffers.

The adapter multiplexor could not obtain necessary system buffers. You must set the MINI-MUM PACKET RECEIVE BUFFERS parameter to at least 150 in your STARTUP.NCF file.

`FOREMUX: Invalid number of HSMs.`

The number of adapter drivers is limited to 16.

`FOREMUX: <board-name> assigned unit number <n>.`

The adapter driver, `<board-name>`, was assigned the unit number `<n>`. The unit number is used to indicate which physical adapter to use from the virtual adapter drivers.

`FOREMUX: Unable to allocate memory for HSM's firmware.`

The adapter multiplexor could not obtain necessary resources. The system is probably low on memory resources.

`FOREMUX: Unable to read HSM's custom firmware.`

The adapter multiplexor could not read the adapter's firmware. The disk drive may not be functioning properly, the driver file may be corrupted, or the system is low on memory resources.

`FOREMUX: Unable to allocate IO Registration Resource Tag.`

The adapter multiplexor could not obtain necessary resources. The system is probably low on memory resources.

`FOREMUX: RegisterHardwareOptions failed (0x<error-code>).`

The adapter multiplexor was unable to obtain the hardware options that were requested by the adapter driver. For example, the IRQ was already in use. Check your system interrupts and memory addresses to ensure that there is not a conflict.

`FOREMUX: Unable to allocate Interrupt Resource Tag.`

The adapter multiplexor could not obtain necessary resources. The system is probably low on memory resources.

`FOREMUX: Unable to set hardware interrupt.`

The adapter multiplexor was unable to use the interrupt requested by the adapter driver. Check your system interrupt settings to ensure that there is not a conflict.

C.4.4   FOREOSP Messages

The following messages are produced by the FOREOSP module. These messages are produced when the specified condition occurs and the TRACE= parameter on the FOREOSP module is set to the default value of NOTICE.

FOREOSP: Unable to parse command line.

The portability module was unable to parse the command LOAD line. Correct the LOAD line parameters.

FOREOSP: Trace level set to WARNING.

FOREOSP: Trace level set to NOTICE.

FOREOSP: Trace level set to INFO.

FOREOSP: Trace level set to DEBUG.

The portability has set the trace level according to the TRACE_LEVEL= parameter that was specified on the command line. These are informational messages and require no action.

FOREOSP: You can only load FOREOSP on a v.4.0 or later Server.

C.4.5   FOREILMI Message

The following message is produced by the FOREILMI module. These messages are produced when the specified condition occurs and the TRACE= parameter on the FOREOSP module is set to the default value of NOTICE.

FOREILMI: Unable to parse command line.

The ILMI module was unable to parse the command LOAD line. Correct the LOAD line parameters.

C.4.6   FORESIG Message

The following message is produced by the `FORESIG` module. This message is produced when the `TRACE=` parameter on the `FOREOSP` module is set to the default value of `NOTICE`.

```
FORESIG: Unable to parse command line.
```

The UNI Signalling module was unable to parse the command LOAD line. Correct the LOAD line parameters.

C.4.7   FORELEC Message

The following message is produced by the FORELEC module. This message is produced when it joins an ELAN via a LES, and then attempts to join via an LECS with the same adapter card.

```
FORELEC: WARNING! Cannot join elan via LECS if previously connected
via LES!
```

If a LEC joins an elan via the LES, a LEC on the same adapter cannot join a different elan via an LECS.

APPENDIX D   Using the Marconi ATM Service Provider with WinSock2

The Marconi ATM Service Provider is a protocol stack that complies with the Windows Sockets 2 (WinSock2) Service Provider Interface (SPI) specification. WinSock2 allows an application to use the familiar socket interface to achieve simultaneous access to any number of installed transport protocols, including ATM. The Marconi ATM Service Provider can be used for native ATM applications developed in WinSock 2.

WinSock2 requires either Windows NT 4.0 or Windows 95/98/2000 and can work only in a 32-bit environment.
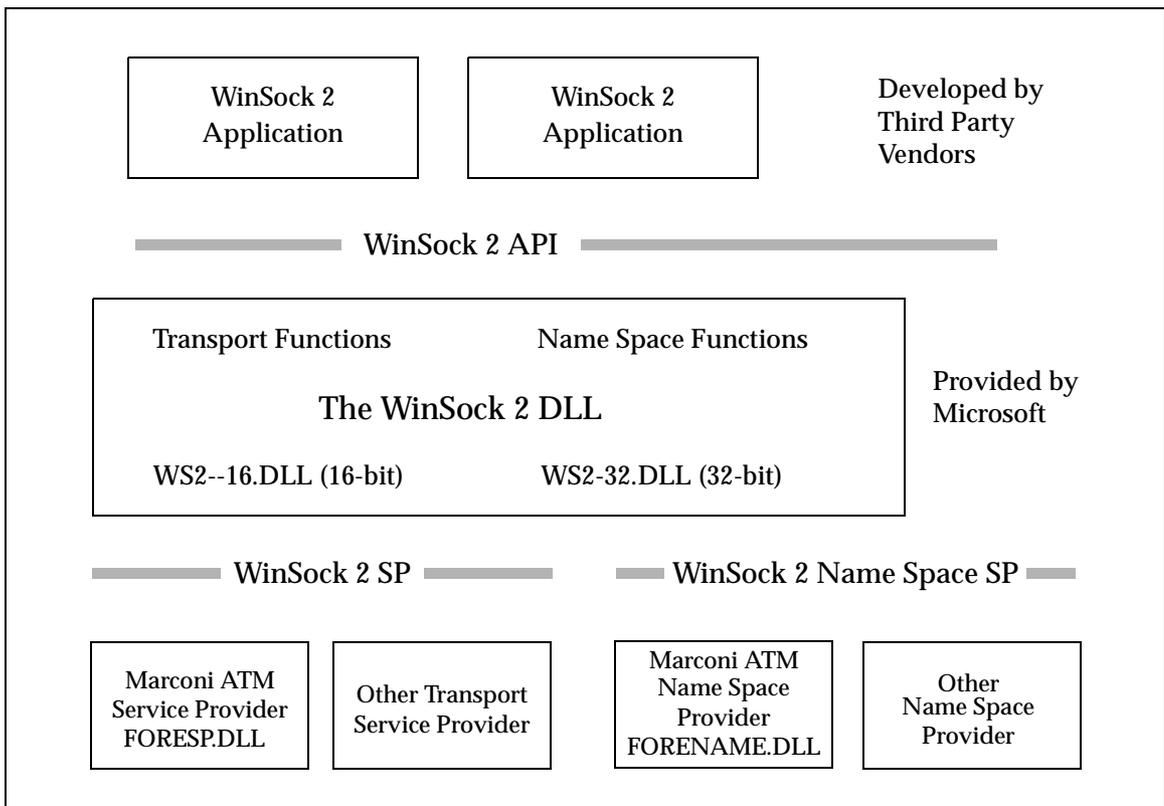
Figure D.1 - WinSock2

To allow WinSock2 to recognize the Marconi ATM Service Provider, you must install the Marconi ATM Service Provider with WinSock2. The installation process registers the Service Provider with the `WS2_32.DLL`. To do this use the installation program, as described in "Installing and Upgrading the Service Provider" on page D-7. After the installation, a developer deals only with WinSock2.

> **NOTE** ▶ The Service Provider works only with Marconi *ForeThought* 4.1 or later adapter drivers. Also, the ForeThought driver and WinSock SPI must be the same version in order to work properly together.

D.1 The Marconi Name Space Provider

In addition to the Service Provider, Marconi also provides a Name Space Provider. The Name Space Provider allows developers to use the name resolution and registration functions available in WinSock2 with the Marconi Service Provider. An ATM application developed with the Name Space Provider can reference an `ATMHOSTS` file in the `%windir%` directory, containing a list of ATM addresses and associated text names. An example `ATMHOSTS` file is included with the Marconi Service Provider software, and the sample application code can be referred to for an example of Name Space Provider usage.

> **NOTE** ▶ The `ATMHOSTS` file must not have a.TXT extension (or any extension). When you edit it, make sure that the editor does not add an extension.

The Name Space Provider can be installed and registered with WinSock at the same time as the Service Provider, as described in "Installing and Upgrading the Service Provider" on page D-7.

D.2 Getting Started: WinSock2 and the Service Provider

Because the Marconi ATM Service Provider is integrated as a behind-the-scenes component of the WinSock2 API, developers familiar with WinSock2 should be able to use the Service Provider without great difficulty. This document is intended to point out information that applies to ATM in general, using the ATM extensions to WinSock2, and the current status of the Marconi ATM Service Provider.

The following sections describe where to find further, comprehensive information on Windows Sockets 2, and provide required information for developing applications with the Marconi ATM Service Provider and Windows Sockets 2. Refer to "Brief Overview of ATM" on page D-12 for ATM concepts such as SVCs and PVCs.

D.2.1 Refer to the WinSock 2 Software Development Kit (SDK)

Intel and Microsoft provide the Windows Sockets 2 SDK to developers. As a WinSock2 developer, you should reference the documentation in the SDK. Also, there are numerous World Wide Web sites devoted to development in WinSock. Among these are:

- **http://www.stardust.com**
- **http://www.intel.com/ial/winsock2/index.htm**
- **http://www.sockets.com/**
- **http://www.winsock.com/wsresource/wsresrce.html**

Many published reference books are also devoted to development in WinSock.

NOTE

The WinSock 2 SDK runtime files are required only for Windows 95 and Windows 98. The Winsock 2 support is built in to Windows NT 4.0.

D.2.2   Summary of WinSock2 Features

WinSock2 expands the earlier WinSock interfaces and includes support for the following new features. This is a partial list of WinSock2 features. For the complete list and description of the WinSock2 API, refer to the WinSock2 specifications and the WinSock2 SDK.

- Multiple protocols including ATM. The WinSock2 architecture is designed so that the WinSock interface can be used for simultaneous access to up to four different installed protocol stacks.

- Quality of Service (QoS). WinSock2 provides mechanisms that allow applications to negotiate for the required quality of service, taking advantage of ATM's QoS capabilities.

- Multipoint and Multicast. WinSock2 allows applications to take advantage of ATM point-to-multipoint capabilities.

- Overlapped I/O. WinSock2 supports overlapped I/O and other features that can assist applications in performing Real-time Multimedia Communications.

D.2.3   ATM Extensions to the WinSock API

WinSock2 includes ATM-specific extensions needed to support the native ATM services specified in the ATM Forum's User Network Interface (UNI) 3.0 or 3.1 specification.

- A new address family, `AF_ATM`, and a corresponding sockaddr structure, `SOCKADDR_ATM`, are defined.

- ATM point-to-multipoint and point-to-point connection setup and teardown are supported in WinSock2.

- An ATM-specific QoS extension is also available.

For a complete description of the ATM extensions in WinSock2, refer to the *ATM-Specific Extensions* annex of the WinSock2 specifications.

D.2.4   CBR Support

CBR connections are supported on the LE and HE adapters. Limited CBR support is available on the PCA-200EPC adapter.

D.2.5   VBR Support

VBR connections are supported in a limited manner on all Marconi adapters. Connections specified through Winsock as VBR are implemented as non-real-time VBR connections. However, the adapters cannot guarantee that the traffic will not exceed the Sustained Cell Rate of the connection (causing the loss of cells in excess of the SCR). The chance of a violation increases with the traffic load on the adapter.

VBR connection setup is only supported using the Winsock Generic QoS mechanism. You must specify a QoS `flowspec` field with the `ServiceType` field set to `SERVICETYPE_CONTROLLEDLOAD` and then specify the flow specification parameters as appropriate.

VBR connection setup is not supported using the corresponding ATM setup IEs directly through the ProviderSpecific buffer. (Other IEs can be specified this way).

D.2.6   Maximum Supported Rate-shaped Streams

The Marconi adapters have the following limitations on the supported number of simultaneous rate-shaped streams:

- The PCA-200EPC adapter supports a total of three simultaneous rate shaped streams. Each stream can have a different rate. For example, one VBR stream and two CBR streams.

- The LE adapter supports a total of 1000 simultaneous rate shaped streams and a total of 16 different rates.

- The HE adapter supports a total of 4000 simultaneous rate shaped streams and a total of 32 different rates.

D.2.7   VPI, VCI, and Selector Byte Limitations

Please note the following limitations as you develop code using Winsock2 and the Marconi service provider:

- Only VPI 0 is supported.
- VCI's 0 through 31 are reserved by the ATM Forum and ITU for signalling.
- Winsock2 developers should use selector bytes greater than 0x32 for all development purposes.
- The Marconi drivers support a maximum of 1024 VCIs on the PCA-200EPC and LE adapters, and 4000 VCIs on the HE adapter.

D.2.8   Files Included with the Service Provider

The Marconi Service Provider files are available from the Marconi Systems FTP site. Relevant files include:

- `FORESP.DLL`, the DLL file for the Marconi Service Provider. There are different `FORESP.DLL` files for Windows 95 and Windows NT.
- `FORENAME.DLL`, the DLL file for the Marconi Name Service Provider.
- `WSATMDRV.VXD`, a driver file used in Windows 95.
- `WSATMDRV.SYS`, a driver file used in Windows NT.

These files are installed, upgraded, or deleted by the setup utility described in "Installing and Upgrading the Service Provider" on page D-7.

The `\WINSOCK2` directory also contains files for the Setup utility and sample files to aid in understanding the use of the Marconi ATM service and name providers with WinSock2.

D.3 Installing and Upgrading the Service Provider

Installation of the Marconi ATM service and name provider requires the following steps:

1. Check that you have the required WinSock2 files (described in "Required WinSock2 Files" on page D-7) in the correct directories on your machine. On Windows 95 you must install the Windows Sockets 2 SDK prior to installing running the setup utility to install the Marconi service provider.

2. Run the Setup utility, `forews2.exe` to install the service provider and register it with your WinSock 2 files. This file, and other files for the service provider are included on your *ForeThought* adapter software CD. Setup copies the relevant directories and files to the required locations on your hard drive and registers the service provider files with WinSock. The following sections describe these steps in detail.

To upgrade or un-install the service provider files, run the setup utility as described in "Running the Setup Utility" on page D-8.

D.3.1 Required WinSock2 Files

You must have the Windows Sockets 2 SDK (version 2.0) installed on your machine. This SDK is included with Windows NT 4.0 but not with Windows 95. You must also ensure that the Windows Sockets 2 DLL (`WS2_32.DLL`) is installed in the correct directory on your machine:

- On Windows 95 `WS2_32.DLL` must be installed at `%windir%\system` directory.

- On Windows NT 4.0 `WS2_32.DLL` is installed on `%SystemRoot%\system32` directory.

NOTE

The Marconi ATM SPI does *not* work with the Windows Sockets 2 SDK version 1.6.

D.3.2 Running the Setup Utility

> **NOTE** On Windows 95/98/2000, you must install the WinSock 2 runtime files prior to running the setup utility to install the Marconi ATM service provider.

To install, upgrade, or delete the Service Provider and Name Space Provider, use the following procedure:

1. Run `ws2setup.exe` from the directory in which the Marconi WinSock files reside.

    a. Click on the **Start** button.

    b. Select the **Run...** option.

    c. Specify the directory path to the `forews2.exe` file, in the directory containing the files downloaded from the Marconi FTP site or on the Marconi driver software CD. On the CD this file is located in the corresponding directory for the Windows 95 or Windows NT driver.
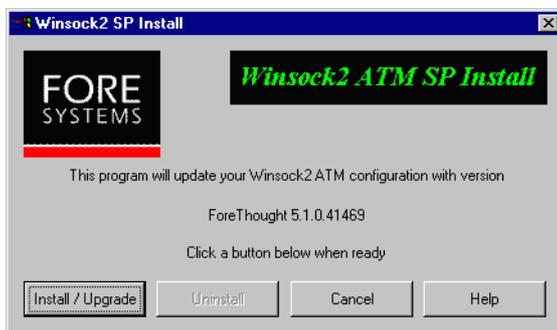
Figure D.2 - Winsock2 ATM SPI Installation

2. Click **Install/Upgrade** or **Uninstall** as desired. The installation utility updates the files on your PC accordingly.

3. When you have completed all steps, a message appears, indicating that the SPI has been installed, upgraded, or deleted. Click **Yes** to complete the installation by rebooting.

Figure D.3 - Update Complete

D.4   Using the Service Provider

D.4.1   Recognizing the Service Provider in Your Application

FORESP.DLL must be registered with WS2_32.DLL, as described in "Installing and Upgrading the Service Provider" on page D-7. After the registration, WS2_32.DLL relies on the parameters of the API socket creation functions (**socket()** and **WSASocket()**) to determine which Service Provider to utilize. In the case of the **socket()** function, the WS2_32.DLL finds the first entry in the set of installed WSAPROTOCOL_INFO structs that matches the values supplied in the tuple formed by the (*address family, socket type, protocol*) parameters. To preserve backwards compatibility, the WinSock2 DLL treats the value of zero for either *address family* or *socket* type as a wild card value. The value of zero for *protocol* is not considered a wild card value by the WinSock2 DLL unless such behavior is indicated for a particular protocol by having the PFL_MATCHES_PROTOCOL_ZERO flag set in the WSAPROTOCOL_INFO struct.

For the **WSASocket()** function, if NULL is supplied for *lpProtocolInfo,* the behavior is exactly as just described for **socket().** If a WSAPROTOCOL_INFO struct is referenced, however, the WinSock2 DLL does not perform any matching function but immediately relays the socket creation request to the transport Service Provider associated with the indicated WSAPROTOCOL_INFO struct.

If an application developer wants to find out what protocols are installed, use the function **WSAEnumProtocols()**. This function will return all installed protocols' WSAPROTOCOL_INFO struct. Use this structure to choose the protocol he or she needs. In this sense, the Service Provider is not completely hidden.

You must install and register a Service Provider, otherwise the Service Provider will not be available. When a particular Service Provider is not installed, if an application uses the tuple formed by the (*address family, socket type, protocol*) parameters to demand this type of service (in our case, ATM Service Provider), another Service Provider of the same type will be chosen if it is available. Otherwise, **WSASocket()** and **socket()** will return error indicating the requested type of service is not available. There is no WSAPROTOCOL_INFO struct about a Service Provider available to an application if that Service Provider is not registered with WS2_32.DLL.

D.4.2 Tracing Problems in the API and the Service Provider

When developing your application, you must be able to isolate problems among:

- • The client application under development
- • The WinSock2 DLL
- • The Marconi ATM Service Provider

You can trace problems with the WinSock2 debug/trace layer. It can be used to monitor, and to some extent control, all procedure calls across the WinSock2 API or the Service Provider. This layer is a DLL supported by a special version of the WinSock2 DLL. The debug/trace DLL (DT_DLL.DLL) and the special WinSock2 DLL for use with debug/trace are included with the WinSock2 SDK.

Please contact Marconi technical support for issues relating to the Marconi ATM Service Provider only. Contacting Marconi technical support is described in "Technical Support" on page iii.

D.4.3 Sample Programs

The Marconi service provider files include sample Winsock2 programs in the \SAMPLES directory.

D.5 Brief Overview of ATM

This section is a brief overview of some ATM concepts. Please refer to the many web sites and reference books available for a more thorough explanation of ATM networking.

Asynchronous Transfer Mode, or ATM, is a connection-based communication architecture based on the switching of small fixed length packets of data called *cells*. In ATM, all data is transferred in 53-byte cells. Each cell has a 5-byte header that identifies the cell's route through the network and 48-bytes containing user data. This user data in turn, carries any headers or trailers required by higher level protocols.

D.5.1 Virtual Channels and Virtual Paths

The set of mappings in the ATM network used to route cells from a source to a destination are generally referred to as virtual channels and virtual paths. Signalling can be used to create the virtual channels and virtual paths needed to establish a connection between two ATM endpoints. Virtual paths are used to establish connections among switches in an ATM network. Once the switch fabrics are connected via a virtual path, they can use this virtual path to route virtual channels.
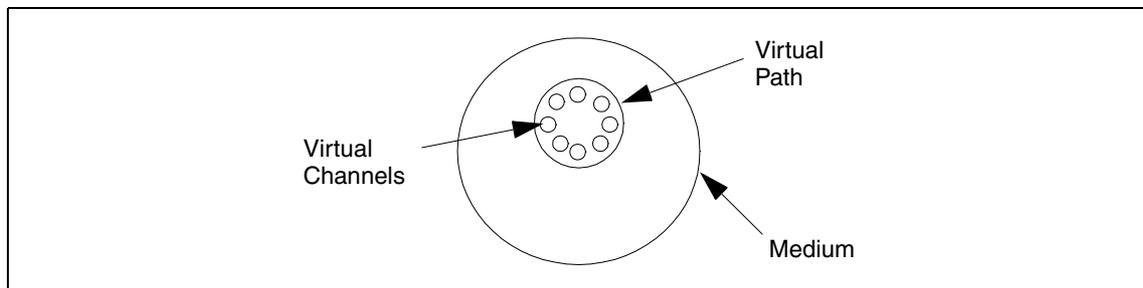
Figure D.4 - Virtual Channels and Paths

Each ATM cell contains a virtual path identifier (VPI) and a virtual channel identifier (VCI) as part of its five-byte ATM header. The VPI and VCI are used to route the cell through the ATM network.

Virtual channels "ride" inside of virtual paths. The combination of the two specifies a virtual connection. On a switch fabric, each virtual channel switches cells with a specific VPI and VCI received on a specific port to another port with a new VPI and a new VCI. Unlike through paths, virtual channels describe a single virtual connection between two endpoints connected to a switch fabric.

D.5.1.1 Switched and Permanent Virtual Channels

There are generally two types of virtual channels:

- Switched Virtual Channels (SVCs), which are established by network signalling, and last only for the duration of the information transfer.

- Permanent Virtual Channels (PVCs), which are established manually for dedicated long-term information transport between locations. PVCs may be required when signalling cannot be used. PVCs can be created from the WinSock API using `WSAIoctl(SIO_ASSOCIATE_PVC)`

The virtual channels are identified by the VPI and VCI.

| NOTE | In this release of the Marconi Service Provider, only VPI 0 (zero) is available. |

D.5.1.2 ATM Addresses

The ATM address is 20 bytes in length and is specified as 40 hexadecimal characters. Three address formats have been specified: DCC, ICD, and E.164. Marconi implements the ICD ATM format. Per the UNI specifications, all private networks should accept initial call setup messages containing ATM address with any of the approved formats and forward the calls as necessary.

The logical components of an ATM address are:

- The *NSAP* or *switch prefix*, consisting of the first 13 bytes, which is typically the same for all ports on a single switch. For example:

    47000580ffe1000000f2150f5b

- The *end system identifier (ESI),* consisting of bytes 14 through 19, which usually is the six-byte hardware MAC address of a particular adapter card. For example:

    002048102aef

- The *selector byte*, the last byte of the ATM address, serves the same purpose as a TCP port, which is to identify a service access point. For example:

    0a

The following is a sample of the entire ATM address:

    47000580ffe1000000f2150f5b002048102aef0a

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