Bay Networks

The Merged Company of SynOptics and Wellfleet

Customizing ATM Services

Part No. 110054 A

Customizing ATM Services

Router Software Version 8.10
Site Manager Software Version 2.10

Part No. 110054 Rev. A
February 1995

Bay Networks

The Merged Company of SynOptics and Wellfleet

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

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About This Guide

If you are responsible for configuring and managing Wellfleet® routers, read this guide. It describes ATM DXI and ATM FRE2 services and provides instructions for using Site Manager to configure ATM DXI and ATM FRE2 parameters for your network.

Refer to this guide for

❑ A general overview of Asynchronous Transfer Mode (ATM) technology (see Chapter 1, "ATM Overview")

❑ A list of additional reading resources that describe ATM (also in Chapter 1)

❑ Specific features of ATM DXI and ATM FRE2 and how we implement them (see Chapter 2, "ATM DXI Overview and Implementation," and Chapter 4, "ATM FRE2 Overview and Implementation")

❑ Descriptions of ATM DXI and ATM FRE2 parameters and how to edit them (see Chapter 3, "Editing ATM DXI Parameters" and Chapter 5, "Editing ATM FRE2 Parameters")

Before You Begin

Before using this guide, you must complete the following procedures:

❑ Create and save a configuration file that contains at least one ATM or ATM DXI interface.

❑ Retrieve the configuration file in local, remote, or dynamic mode.

Refer to *Configuring Wellfleet Routers* for instructions.

How to Get Help

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

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

Conventions

angle brackets (< >)	Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command. Example: if command syntax is **ping** *<ip_address>*, you enter **ping 192.32.10.12**
arrow character (➔)	Separates menu and option names in instructions. Example: Protocols➔AppleTalk identifies the AppleTalk option in the Protocols menu.
brackets ([ ])	Indicate optional elements. You can choose none, one, or all of the options.
user entry text	Denotes text that you need to enter. Example: Start up the Windows environment by entering the following after the prompt: **win**
command text	Denotes command names in text. Example: Use the **xmodem** command.
italic text	Indicates variable values in command syntax descriptions, new terms, file and directory names, and book titles.
`screen text`	Indicates data that appears on the screen. Example: `Set Wellfleet Trap Monitor Filters`
ellipsis points	Horizontal (. . .) and vertical (⋮) ellipsis points indicate omitted information.
quotation marks (" ")	Indicate the title of a chapter or section within a book.
vertical line (|)	Indicates that you enter only one of the parts of the command. The vertical line separates choices. Do not type the vertical line when entering the command.

Example: If the command syntax is

show at routes \| nets, you enter either

show at routes or **show at nets**, but not both.

Acronyms

AAL	ATM Adaptation Layer
ATM	Asynchronous Transfer Mode
ARP	Address Resolution Protocol
ATM	Asynchronous Transfer Mode
CSU	Channel Service Unit
DSU	Data Service Unit
DXI	Data Exchange Interface
ILI	intelligent link interface
IP	Internet Protocol
MAC	Media Access Control
OSI	Open Systems Interconnection
OSPF	Open Shortest Path First
PDU	protocol data unit
PVC	permanent virtual circuit
RIP	Routing Information Protocol
SAP	service access point
SDU	service data unit
SMDS	Switched Multimegabit Data Services
SNAP	Subnetwork Access Protocol
SNMP	Simple Network Management Protocol
SRM	system resource modules
SVC	switched virtual circuit
UNI	User to Network Interface
VCI	Virtual Channel Identifier
VCL	Virtual Channel Link
VPC	Virtual Path Connection
VPI	Virtual Path Identifier

Chapter 1
ATM Overview

Asynchronous Transfer Mode (ATM) is a connection-oriented, cell-based technology that relays traffic across a Broadband Integrated Services Digital Network (B-ISDN). It is a cost-effective way of transmitting voice, video, and data across a network.

ATM Cell

An ATM cell is a short, fixed-length packet of 53 bytes. It consists of a five-byte header containing address information, and a fixed 48-byte information field. Figure 1-1 shows a diagram of an ATM cell.

5-byte header	48-byte information field
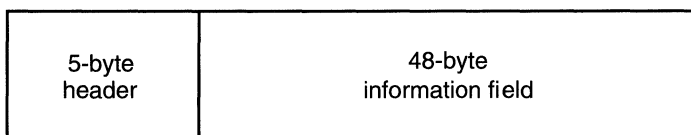
Figure 1-1. ATM Cell

Using a fixed-length cell size allows you to predict network delays, making ATM suitable for carrying real-time information (for example, voice and video) as well as data.

ATM allows the network to operate at a much higher rate than typical packet-switching systems (for example, X.25), because it provides no error protection or flow control. Instead, ATM relies on the source and destination devices to perform error-recovery functions such as re-transmission of lost packets.

Cell Header

After dividing the data into 48-byte segments for transmission, the end device (that is, the ATM Data Service Unit/Channel Service Unit [DSU/CSU] or native ATM device) attaches the required header information (Figure 1-2).
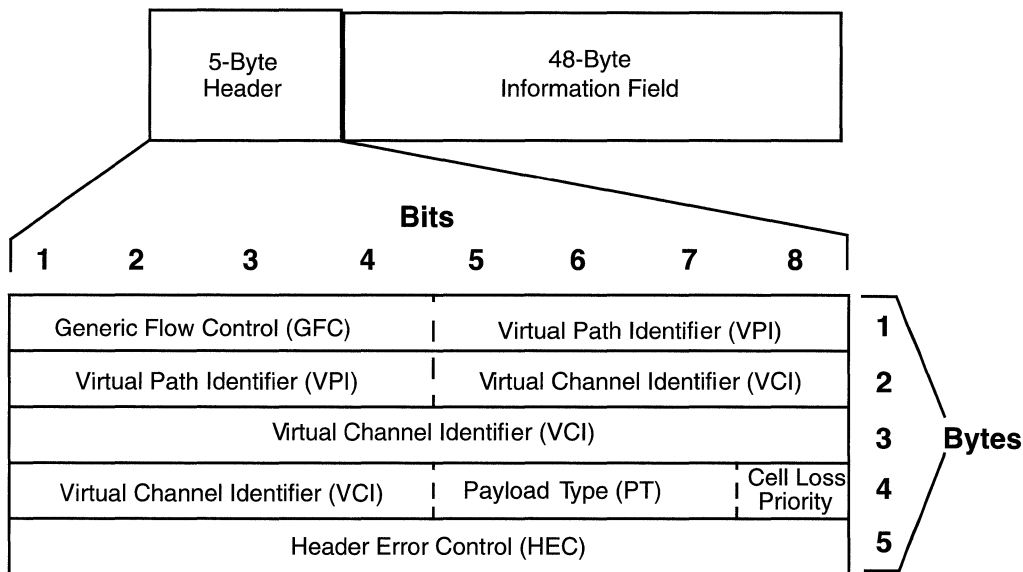
Figure 1-2. ATM Cell Header

The fields in each ATM cell header provide all of the information necessary for networking. These fields include the following:

❑ **Generic Flow Controller (GFC)**: The first four bits of the cell header contain the GFC. The GFC controls traffic flow onto the ATM network by controlling the user-network interface (UNI).

❑ **Virtual Path Identifier (VPI)**: The next eight (8) bits of the cell header (that is, the last half of byte one and the first half of byte two) contain the VPI. The VPI specifies a virtual path on the physical ATM link. Refer to the "Data Transmission" section, later in this chapter, for additional information on virtual paths.

❑ **Virtual Channel Identifier (VCI)**: The next 16 bits of the cell header (that is, the last half of byte two, all of byte three, and the first half of byte four) contain the VCI. The VCI specifies a virtual channel within the virtual path on the physical ATM link. Refer to the "Data Transmission" section, later in this chapter, for additional information on virtual channels.

❑ **Payload Type (PT)**: The next three (3) bits (that is, bits five through seven of byte four) indicate the type of information the cell is carrying (for example, user data or management information).

❑ **Cell Loss Priority (CLP)**: The last bit of byte four indicates the priority of the cell and whether the network can discard it under heavy traffic conditions. Setting the bit to 1 indicates the network may discard the cell if necessary.

❑ **Header Error Control (HEC)**: The last byte of the header field contains the HEC. Its primary function is to guard against misdelivery of cells due to header or single bit errors. However, the HEC does not gauge the quality of data in the information field.

Cell Information Field

Following the 5-byte cell header is a 48-byte information field containing user data. The ATM Adaptation Layer (AAL) organizes the data in this field. Refer to the following section, "ATM Layers," for additional information about the AAL.

ATM Layers

The B-ISDN protocol model, on which ATM is based, consists of four layers. Each layer communicates only with the layer directly above it or directly below it. Figure 1-3 shows the B-ISDN ATM protocol reference model.

Higher Protocol Layer	
Convergence Sublayer ------------------------------------ Segmentation & Reassembly Sublayer	ATM Adaptation Layer
ATM Layer	
Transmission Convergence Sublayer ------------------------------------ Physical Medium Dependent Sublayer	Physical Layer
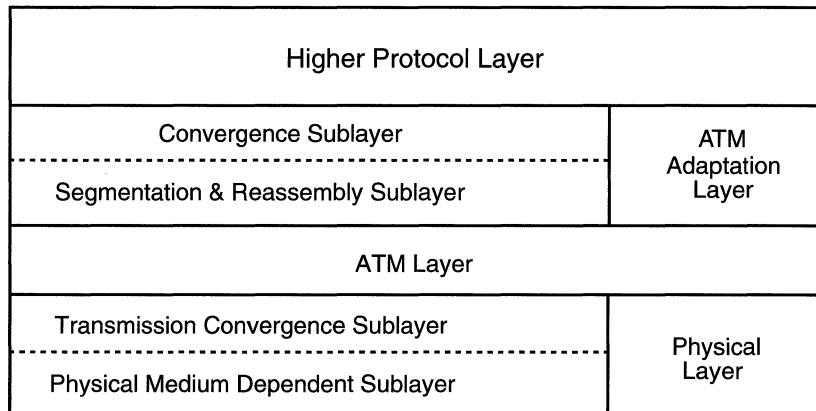
Figure 1-3. B-ISDN ATM Protocol Reference Model

The following layers relate directly to how our routers support ATM DXI and ATM FRE2:

❑ ATM Layer

❑ ATM Adaptation Layer (AAL)

The *ATM Layer* defines how information transmits between two nodes. It is concerned with the format and size of the cells and the contents of the headers. The addresses of the cells are of local significance only between the two nodes.

The *ATM Adaption Layer (AAL)* converts higher-layer protocol data into formats that are compatible with the requirements of the ATM layer, enabling ATM to handle different types of information all within the same format.

The AAL is divided into two sublayers: the *Convergence Sublayer (CS)* and the *Segmentation and Reassembly (SAR) Sublayer.* These two sublayers convert variable-length messages into 48-byte segments, while ensuring the integrity of the data.

The CCITT has defined different types of AALs to handle different kinds of traffic. Wellfleet routers support AAL 3/4 and AAL 5. The next two sections describe the AAL process.

AAL 3/4

In the AAL 3/4 process, a CS header and trailer envelop the data from the higher layer protocols, creating a CS protocol data unit (PDU). AAL 3/4 divides the PDU into 44-octet segments. Each segment is encapsulated with a segmentation and reassembly (SAR) header and trailer, creating a 48-octet SAR PDU. This 48-octet SAR PDU is the payload of the ATM cell (Figure 1-4).
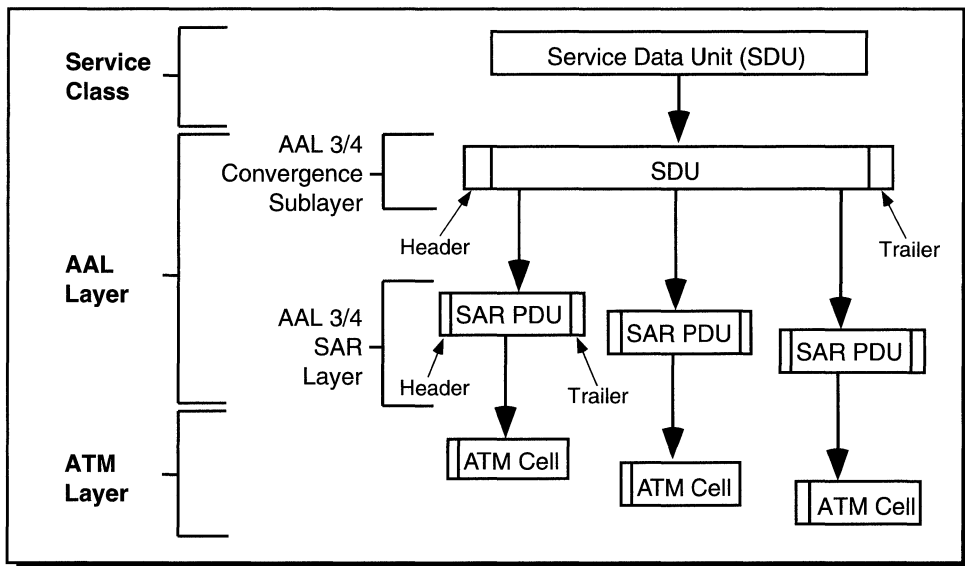
Figure 1-4. ATM Adaption Layer 3/4

AAL 5

In AAL 5, only a trailer attaches to the data from the higher layer protocols to create a CS Protocol Data Unit (PDU). AAL 5 divides the PDU into a 48-octet SAR PDU, however, it does not add an SAR header and trailer. This 48-octet SAR PDU becomes the payload of the ATM cell (Figure 1-5).
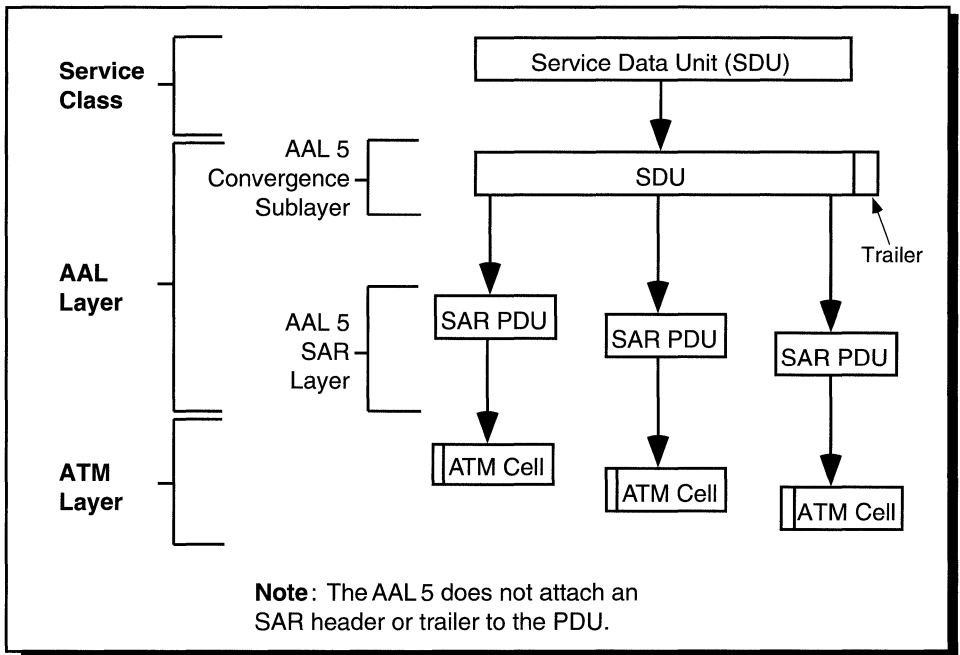
Figure 1-5. ATM Adaption Layer 5

Data Transmission

Data transmission (also called *cell switching*) through the ATM network relies on the establishment of logical connections between ATM entities. ATM is a *connection-oriented* service. This means that an ATM entity cannot transmit information until it establishes a connection with a receiving entity. These connections consist of *virtual channels*, *virtual paths*, and *transmission paths*.

A *virtual channel* is a logical connection between two communicating ATM entities. Each virtual channel may carry a different protocol or traffic type. The virtual channel transports cells that have a common identifier. The identifier is called the virtual channel identifier (VCI) and is part of the cell header. You can establish virtual channels permanently or set them up dynamically, allowing the network to adjust itself to the traffic demand.

A *virtual path* is a set of virtual channels between a common source and destination. The virtual channels in a virtual path logically associate to a common identifier. This identifier is called the virtual path identifier (VPI) and is part of the cell header. You can base cell switching on only the VPI, or on a combination of the VPI and VCI.

Virtual paths enable you to separate network transport functions into those related to an individual logical connection (virtual channel) and those related to a group of logical connections (virtual path).

A *transmission path* is a physical connection that comprises several virtual paths, each virtual path containing several virtual channels. The transmission path may support multiple virtual paths across a single connection to the network.

Figure 1-6 shows the relationships between the virtual channel, the virtual path, and the transmission path.

Transmission Path

VP = Virtual Path
VC = Virtual Channel
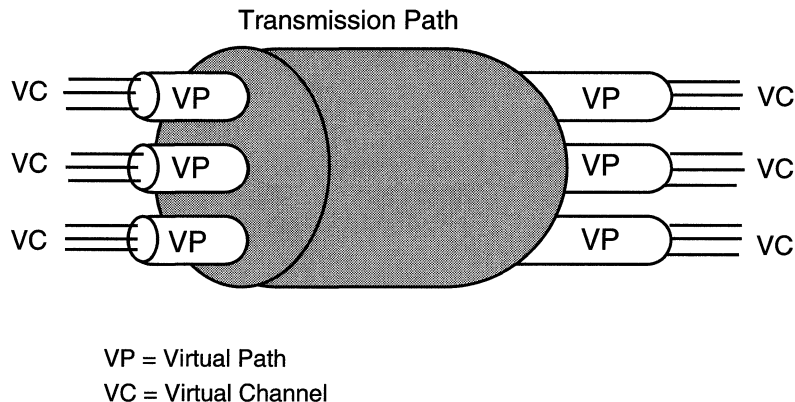
Figure 1-6. ATM Transmission Components

Virtual channels and virtual paths allow you to establish either permanent virtual connections (PVCs) or switched virtual connections (SVCs). Once you establish a PVC, you can transfer information over it at any time. Switched virtual circuits only activate (through signalling and network switching) when there is information ready for transmission.

ATM DXI and ATM FRE2

You can access an ATM network using either ATM DXI (Data Exchange Interface) or ATM FRE2 (Fast Routing Engine 2). However, each method provides access in a different way.

ATM DXI allows you to connect a synchronous interface to an ATM network through an ATM DSU/CSU. When the router transfers data to the DSU/CSU, the DSU/CSU converts variable-length packets into uniform 53-byte cells for transmission over the ATM network.

For additional information about ATM DXI and how to customize your ATM DXI interface, refer to Chapters 2 and 3.

ATM FRE2 refers to the Intelligent Link Interface (ILI) combination of an ATM link module and its FRE2 counterpart. ATM FRE2 allows the router to connect to an ATM network directly. The router converts variable-length packets into uniform, 53-byte cells for transmission over the ATM network.

For additional information about ATM FRE2 or how to customize your ATM FRE2 interface, refer to Chapters 4 and 5.

For More Information

For more information about ATM, refer to the following documents:

American National Standards Institute, Draft Standard. *Broadband ISDN ATM Aspects: ATM Layer Functionality and Specification.* May 1992.

Bellcore Document SR-NWT-001763, Issue 1. *Preliminary Report on Broadband ISDN Transfer Protocols.* December 1990.

_, FA-NWT-001109. *Broadband ISDN Transport Network Elements Framework Generic Criteria.* December 1990.

_, FA-NWT-001110. *Broadband ISDN Switching System Framework Generic Criteria.* December 1990.

Bradley, T., Brown, C., and Malis, A. *Multiprotocol Encapsulation over Frame Relay.* RFC 1294, Network Information Center (NIC) SRI International, Menlo Park, California, January 1992.

De Prycker, M. *Asynchronous Transfer Mode: Solution for Broadband ISDN.* Ellis Horwood Limited, 1991.

Handel, R. and Huber, M. *Integrated Broadband Networks: An Introduction to ATM-Based Networks.* Reading, Massachusetts: Addison-Wesley Publishing Company, 1991.

Chapter 2
ATM DXI Overview and Implementation

Before you customize ATM DXI for your router, you need to review the following topics:

❏ An overview of the various kinds of support that a router running ATM DXI provides

❏ Notes describing how we implement special ATM DXI features

ATM Data Exchange Interface (DXI) Overview

ATM DXI allows a link module with a synchronous interface (that is, HSSI, V.35, and RS-449) to connect to an ATM network through an ATM DSU/CSU. When the router transfers data to the DSU/CSU, the DSU/CSU converts variable-length packets into uniform 53-byte cells for transmission over the ATM network (Figure 2-1).
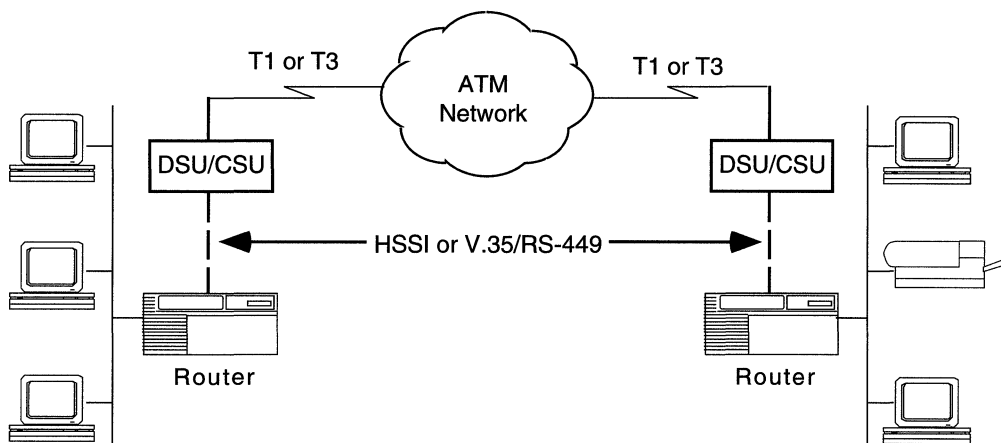
Figure 2-1. ATM DXI

A router running ATM DXI provides the following support:

❑ Routing of IP, IPX, XNS, DECnet Phase IV, AppleTalk, and VINES traffic over the ATM network

❑ MAC-level transparent bridging over the ATM network

❑ Multiprotocol encapsulation functions defined in RFC 1294 and RFC 1483 that enable concurrent bridging and multiprotocol routing support on the same PVC

❑ A Convergence Sublayer (CS) function compatible with AAL 3/4 and AAL 5 as defined in Section 1 of CCITT's *B-ISDN Protocol Reference Model (PRM)*

❑ Error checking

❏ ATM DXI Link Management Interface (LMI), including SNMP Proxy support. This is a proprietary version of the LMI and is only available when using the Mode 2 Proprietary DXI encapsulation with a Digital Link DSU/CSU.

❏ Broadcasting and multicasting support

❏ ARP and Inverse ARP support

The DSU/CSU supports the following layers:

❏ Segmentation and Reassembly (SAR) sublayer of the AAL

❏ ATM layer defined in the B-ISDN PRM

❏ Physical layer interface to the ATM network through DS1 and DS3

Multiprotocol Encapsulation

The multiprotocol encapsulation function enables the router to multiplex and demultiplex bridged or routed data packets. For transmission, this function adds a header between two and eight octets in length to the PDU to allow decoding, which determines the proper Service Access Point (SAP). When receiving packets, this function evaluates the header to determine if the PDU is a valid routed or bridged packet. If it is valid, this function then strips the header from the packet and passes it to the appropriate SAP for routing or bridging.

AAL Sublayer Support

The CS in the router logically connects to the SAR in the DSU/CSU using a common interface defined by the ATM DXI protocol. The ATM DXI protocol interface transfers PDUs between the CS and the SAR. Figure 2-2 shows the functional division of the AAL sublayers between the router and the DSU/CSU.

Bridge/Router

Upper Layer Protocols
Multiprotocol Encapsulation
Convergence Sublayer
ATM DXI

ATM DXI

DSU/CSU

AAL

ATM DXI
SAR Sublayer
ATM Layer
Physical Layer
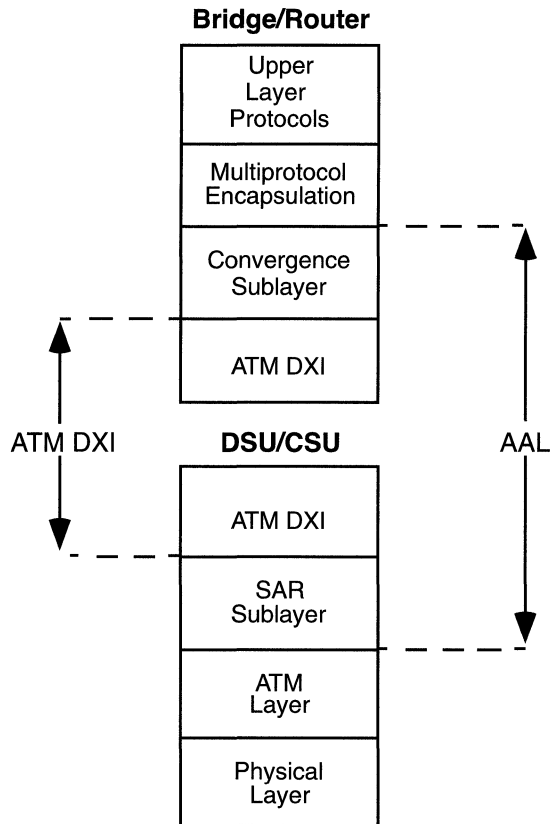
Figure 2-2. AAL Layer Division between Bridge/Router and DSU/CSU

ATM DXI Error Checking

The ATM DXI verifies that the VPI/VCI is valid with respect to the PVCs configured for the ATM circuit. It also verifies the header format as defined by the value of the DXI mode parameter. Refer to the "ATM DXI Modes of Operation" section, later in this chapter, for details. ATM DXI also verifies that the BTag field in the CS_PDU header is equal to the ETag field in the CS_PDU trailer and ensures that the frame size is valid. If the packet contains an invalid header, the router drops the packet, updates the appropriate MIB statistic, and logs the appropriate event.

ATM DXI LMI Support

The router supports a proprietary version of the ATM DXI Local Management Interface (LMI). This proprietary version of the LMI was a precursor to the standardized ATM Forum version.

LMI uses an SNMP-like protocol to query network management statistics maintained on the DSU/CSU MIB. The DSU/CSU may also send asynchronous events in the form of trap messages to the router.

Simulated Multicast Packet Support

The ATM DXI interface supports multicast packets, enabling the router to take advantage of multicast functionality, if it is available from the ATM network. ATM multicasting reserves selected network-assigned VPIs/VCIs as multicast addresses. The ATM network maps multiple recipients to a single VPI/VCI and delivers copies of all ATM cells to each member of the address group. As a cell passes through the ATM network, the network manipulates the cell to reveal the actual source to the cell recipient.

If no multicast address is available for the protocol (because the network interface has direct PVC Access, you have not set up the service yet, or the VPI/VCI has not been entered in the Adjacent Host Table), ATM DXI simulates a broadcast packet by forwarding a copy of the message to each known PVC.

Simulated multicasting is generally used in certain address resolution techniques and for applications that require the delivery of identical information to multiple recipients.

ARP and Inverse ARP Support

ATM DXI supports the ARP protocol, enabling the router to dynamically resolve IP network layer protocol-to-VPI/VCI address mappings. ATM DXI learns the PVC address by detecting the PVC that received the ARP response.

ATM DXI also supports the Inverse ARP protocol. However, you can only use Inverse ARP if both the local and remote router support it.

Bay Networks uses proprietary methods for ARP and Inverse ARP. These methods are not compatible with non-Bay Networks equipment (that is, equipment using the specifications in RFC 1577).

ATM DXI Implementation Notes

This section describes special features regarding how we implement ATM DXI.

Configuring Synchronous Lines for ATM DXI

If you enable ATM DXI on a circuit, Site Manager automatically sets synchronous line parameters as follows:

Parameter	Value
BOFL	Disable
Promiscuous	Enable
Service	Transparent
WAN Protocol	ATM DXI

For more information regarding these parameters, refer to the *Configuring Wellfleet Routers* manual.

ATM DXI Modes of Operation

The ATM Forum's ATM DXI specification defines three modes of operation. Each mode specifies a different set of operations and data transfer between the DTE, the router, the DCE, and the DSU/CSU. The combination of the router link module and the DSU/CSU provide a User to Network Interface (UNI) to the ATM network.

The modes of operation include

❏ **Mode 1A:** Using this mode, the DTE encapsulates the DTE service data unit (SDU) into a DXI frame and transmits it to the DCE. This mode operates with AAL 5 only. No AAL 5 functions are performed by the DTE; the DCE performs the AAL 5 and ATM layer functions.

❏ **Mode 1B:** This mode serves the same purpose as 1a, but it offers additional support for AAL 3/4 for at least one VPI/VCI.

❏ **Mode 2:** This mode allows the DTE to perform the AAL 3/4 CPCS encapsulation for the DTE SDU, then puts this PDU into an ATM DXI frame. The DSU/CSU then modifies the frame to support either AAL 3/4 or AAL 5.

   The DSU/CSU performs AAL functions based on whether the virtual channel connection is set for AAL 3/4 or AAL 5.

In addition to the three modes described by the ATM Forum, our implementation of the ATM DXI specification defines a fourth mode of operation: *Mode 2 Proprietary.*

❏ **Mode 2 Proprietary:** This mode is a proprietary version of Mode 2 used prior to the development of ATM Forum's standard Mode 2. This version of Mode 2 has some DXI header differences from the standard Mode 2 and it only handles AAL 3/4.

Note: Use this mode if your configuration uses pre-ATM Forum DXI DSU/CSU devices (for example, a Digital Link DL3200).

Figure 2-3 illustrates how each mode handles data transfer from the router to the DSU/CSU.
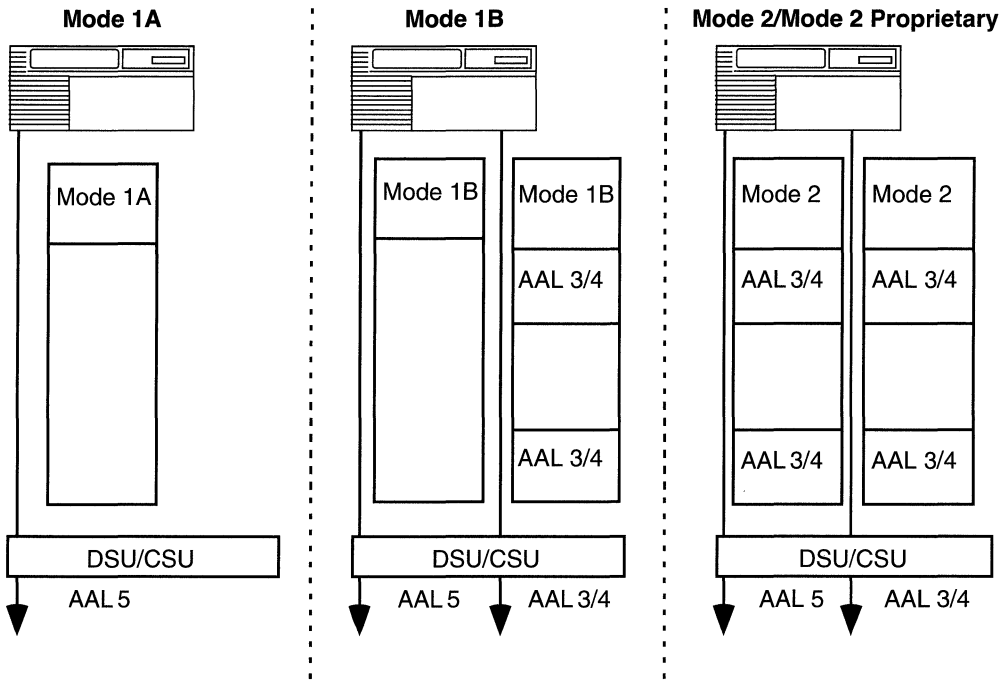
Figure 2-3. DXI Modes of Operation

To select a mode for your router, configure the DXI Mode parameter (refer to the section "ATM Interface Parameter Descriptions" in Chapter 3 for details).

Access Modes for ATM DXI Services

You can enable each ATM PVC to function in one of three access modes: *group access*, *direct access*, and *hybrid access*. Within the same ATM physical interface you can configure PVCs to use different modes. The following sections describe the access modes.

Group Access

In group access mode, upper-layer protocols treat each ATM network interface as a single access point to the switched network. They use a single network address to send all traffic destined for the switched network to the ATM network interface. Figure 2-4 shows a conceptual drawing of group access mode (the default).
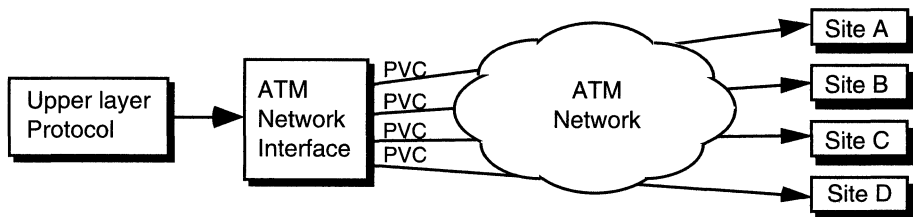
Figure 2-4. Using Group Access

Group access supports the following protocols: IP, IPX, XNS, DECnet Phase IV, AppleTalk, VINES, and transparent bridging. Of the three modes, group access uses network addressing most efficiently and is the easiest to configure. Although you need to configure each PVC manually for group access mode, you need only define and associate protocols with the ATM network interface. All the group access mode PVCs that you configure for a given ATM interface carry the protocol or protocols that you select and configure to run on that interface.

Note: When you configure group access mode, be aware that the PVCs all use the AAL type that you set for the ATM DXI interface (that is, the value of the CS_PDU parameter set in the ATM Interface List screen).

In a bridged environment, use group access only for fully meshed configurations, or in hub/spoke environments in which the spokes need not communicate. In a nonbridged environment, you can use group access in any configuration that does not require protocols residing on separate PVCs (that is, where all PVCs accept the same protocols).

Group access works best in either fully meshed environments or nonmeshed environments where systems not directly connected to each other have no need to communicate. There are, however, ways to configure upper-layer protocols, such as IP or IPX, to allow systems in nonmeshed networks to fully communicate. See the appropriate documentation for these upper-layer protocols for more information.

Direct Access

In direct access mode, upper-layer protocols treat the ATM network as a series of point-to-point connections (Figure 2-5). The upper-layer protocols view each PVC as an individual network interface. You can, therefore, configure each direct mode PVC individually. This is helpful if you have different network sites using different types of data encapsulation.
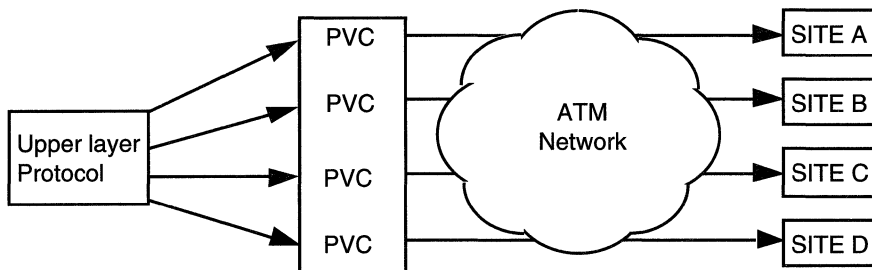
Figure 2-5. Direct Access

Direct access supports the following protocols: IP, IPX, XNS, DECnet Phase IV, AppleTalk, VINES, and bridging. If you use direct access mode, you must configure each PVC manually and assign protocols to run on each PVC. This mode allows you to dedicate a PVC to a particular protocol, but at the expense of some configuration overhead, memory, and address space.

Direct access mode is best suited to small non-mesh configurations, or configurations in which protocols must reside on separate PVCs.

Note: Be aware that the maximum number of PVCs you can configure in direct access mode varies, depending on the configuration of the router, the number of protocols running on the circuits, and the number of routing entries.

Hybrid Access

Hybrid access mode combines characteristics of group and direct access modes. It works best for nonmeshed network configurations that use both bridging and routing over a single ATM DXI interface. This mode is also best for spanning tree bridging.

Normally, if your network combines bridging and routing over the same interface, you need PVCs in group mode for routing, while at the same time you need bridging to operate over these same PVCs. Since group mode does not allow for bridging in nonmeshed environments, you must use hybrid access mode. In this mode, a PVC behaves like a direct access PVC for bridging while maintaining group access characteristics for routing protocols (Figure 2-6).

For hybrid access mode, you must configure all PVCs manually and assign bridging protocols to run on each PVC. Hybrid access supports all protocols that are available for the ATM interface: IP, IPX, XNS, DECnet Phase IV, AppleTalk, VINES, and bridge. Note, however, when you select hybrid access mode for a PVC, Site Manager provides only three protocol options: Bridge, Spanning Tree, and Native Mode LAN (NML). These protocols, as well as the protocols that are on the ATM interface, can run on the PVC.

Bridge protocol sees two interfaces to the network

ATM Network Interface

Direction of Data

Hybrid PVC

SITE A

Routing Protocol

Bridge Protocol

ATM Network

Hybrid PVC

SITE B

Routing protocol sees one interface to the network

I = Interface to Network
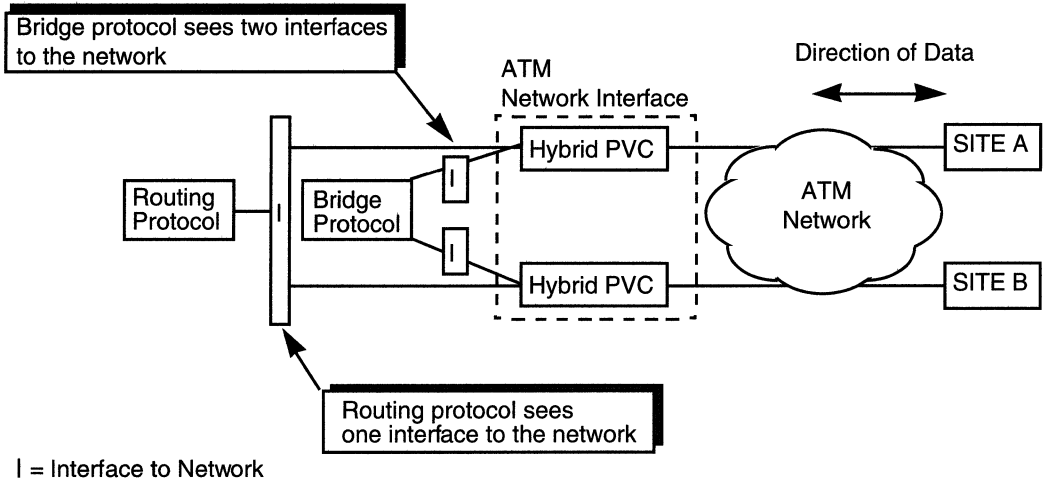
Figure 2-6. Hybrid Access Mode Configuration

Before you configure hybrid access on your router, carefully evaluate the types of routers you are connecting in your network. For example, if your network combines Series 7 routers running in group access bridge mode, with Series 7 or greater routers running in hybrid access mode, this may cause broadcasting or spanning tree problems. If you plan to configure such a network, contact the Bay Networks Help desk.

Using Hybrid Access for Transparent Bridging

In Figure 2-7, traffic bridges between Site A and Site B. The bridge (Router 1) runs on the ATM DXI network interface, and its configuration has the PVCs defined for group access mode.
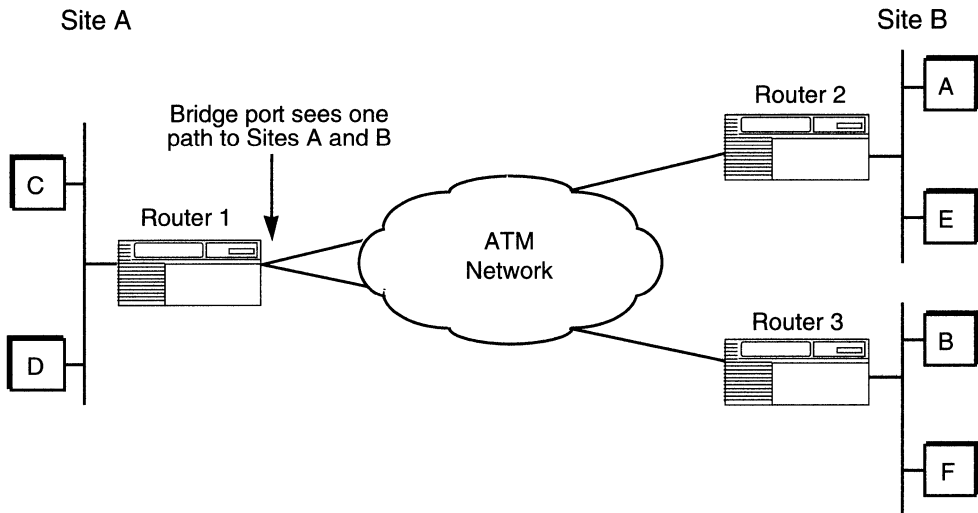
Figure 2-7. Example of a Bridged Network

In this example, the bridge receives data from Site A. If the bridge does not recognize the destination address, it tries to direct traffic through another bridge port. However, with group access mode configured, the ATM bridge port views the paths to Site A and Site B as the same path. Because the bridge does not send out data on the same bridge port from which it just received data, the bridge does not direct the data to Site B. In this example, you need to use hybrid access mode.

If you define the PVCs in hybrid access mode (Figure 2-6), each PVC acts as a bridge port. This enables the bridge running on the ATM interface to view the traffic from Site A as arriving on a different port than that of Site B. When the bridge sends out data, it now has access to all of its ports, including the port that accesses Site B. Therefore, data from Site A can reach Site B.

Using Hybrid Access for Routing

In hybrid access mode, routing protocols view the ATM network interface in terms of group access PVCs, as described in the "Group Access" section, earlier in this chapter.

Multipath Support

Our implementation of ATM DXI provides a redundancy multipath feature. This means, for example, that if there are two physical lines and one line fails, the other takes over the task of transmission (redundancy). If both lines are up, the router uses both lines simultaneously (multipath).

The multipath feature lets you group several lines that back up one another to ensure that information makes it across the network. Figure 2-8 shows a network with two physical links across the ATM network.
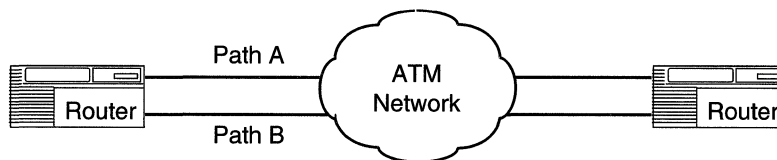
Figure 2-8. Multipath Network

In this example, when the router receives traffic destined for the network, it alternately chooses Path A or Path B, at random, to transmit the data. The router uses both lines, simultaneously, to balance the load. If one of these connections goes down, the router uses the remaining path.

You can configure multipath for group and direct access mode PVCs. The most significant part of configuring multipath is how you set a PVC's VPI/VCI pair. This number identifies each PVC, thereby identifying a path for the router to direct data out to the network.

See "Setting PVCs for Multipath Mode," in Chapter 3, for instructions on setting multiple PVCs to run in multipath mode.

Note: If you use multipath mode, packets traveling on the two paths may arrive at their destination out of sequence. Some protocols may not tolerate packets arriving out of sequence, and as a result, you may experience poor performance or failures.

Chapter 3
Editing ATM DXI Parameters

Once you configure a circuit to support ATM DXI, you can use the Configuration Manager tool to edit ATM DXI parameters.

Note: You must first configure ATM DXI on the router to edit ATM DXI parameters. If you have *not yet* configured ATM DXI, or if you want to add additional ATM DXI interfaces, see *Configuring Wellfleet Routers* for instructions.

For each ATM DXI parameter, this chapter describes

❏ The default setting

❏ All valid setting options

❏ The parameter function

❏ Instructions for setting the parameter

Begin from the Configuration Manager window (Figure 3-1), the first window that appears when you enter the Configuration Manager tool.

```
┌─────────────────────────────────────────────────────────────────────────────┐
│ ▣ Configuration Manager ▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓ ▣ │
│ File  Options  Platform  Circuits  Protocols  Dialup  Window          Help    │
│                                    ┌─────────────────┐                         │
│                                    │ Global Protocols ▷│                        │
│ Configuration Mode: local          ├─────────────────┤──────────────┐          │
│         SNMP Agent: LOCAL FILE     │ ATM DXI         ▷│ Interfaces...│          │
│          File Name: /extra/smgr/mark/atm.cfg          ├──────────────┤          │
│             Model: Backbone Link Node (BLN)          │ Delete ATM DXI│          │
│        MIB Version: x8.10                             └──────────────┘          │
│                                                                               │
│                                          Color Key:    Used      Unused        │
│                                                                               │
│ Slot              Description                      Connectors                  │
│                                                                               │
│  5          ┌─────────────────┐   ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐         │
│             │   5300  Quad Sync│   │ COM1 │ │ COM2 │ │ COM3 │ │ COM4 │         │
│             └─────────────────┘   └──────┘ └──────┘ └──────┘ └──────┘         │
│  4          ┌─────────────────┐   ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐         │
│             │      Empty Slot  │   │ NONE │ │ NONE │ │ NONE │ │ NONE │         │
│             └─────────────────┘   └──────┘ └──────┘ └──────┘ └──────┘         │
│  3          ┌─────────────────┐   ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐         │
│             │      Empty Slot  │   │ NONE │ │ NONE │ │ NONE │ │ NONE │         │
│             └─────────────────┘   └──────┘ └──────┘ └──────┘ └──────┘         │
│  2          ┌─────────────────┐   ┌──────┐ ┌──────┐ ┌──────┐ ┌──────┐         │
│             │      Empty Slot  │   │ NONE │ │ NONE │ │ NONE │ │ NONE │         │
│             └─────────────────┘   └──────┘ └──────┘ └──────┘ └──────┘         │
│  1          ┌─────────────────┐   ┌─────────┐                                 │
│             │ System Resource Module│ CONSOLE │                               │
│             └─────────────────┘   └─────────┘                                 │
└─────────────────────────────────────────────────────────────────────────────┘
```

Figure 3-1. Configuration Manager Window

Editing ATM Interface Parameters

The ATM Interface parameters define the ATM interface to the
physical line. You edit the parameters from the ATM Interface List
window (see Figure 3-2). To access this window, use the following
procedure:

1. Select Protocols→ATM DXI→Interfaces from the Configuration
    Manager window (Figure 3-1). Site Manager displays the ATM DXI
    Interface List window (Figure 3-2).
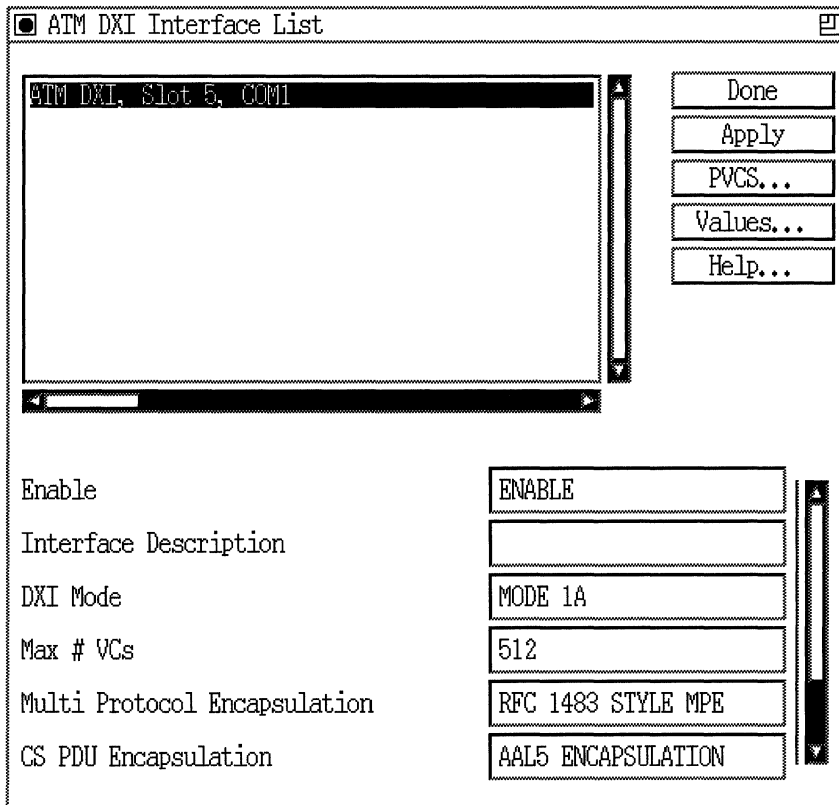
Figure 3-2. ATM DXI Interface List Window

2. From the ATM DXI Interface List window, select the interface you want to edit.

3. Configure the parameters on the screen. Refer to the descriptions following this procedure for guidelines.

4. When you finish editing the parameters, click on the Apply button.

5. If you have not yet added PVCs to the interface, click on the PVCS button. Go to "Configuring PVCs," later in this chapter.

6. Follow steps 2 through 5 to edit any additional interfaces.

7. When you finish editing all interfaces, click on the Done button to return to the Configuration Manager window.

ATM Interface Parameter Descriptions

Use the following guidelines to set the parameters on the ATM DXI Interface List window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables ATM DXI on the selected interface.
Instructions:	Set to Disable if you want to disable the ATM DXI for the selected interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.2

Parameter:	**Interface Description**
Default:	None
Range:	1 to 100 alphanumeric characters
Function:	Provides a description of the selected ATM interface.
Instructions:	Enter text to describe the destination or the purpose of the interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.7

Parameter:	**DXI Mode**
Default:	Mode 1A
Options:	Mode 1A	Mode 1B	Mode 2	Mode 2 Proprietary
Function:	Identifies the ATM DXI mode of operation for this interface, based on the ATM Forum's ATM DXI specification. Each mode relates to a different set of operations and functionality between the router and DSU/CSU.
Instructions:	Enter the desired mode of operation. See "ATM DXI Modes of Operation" in Chapter 2 for a detailed description of each mode.
	The DXI header size is different for Modes 1a and 1b than for Mode 2 and Mode 2 Proprietary. This difference affects the value that you set for the VPI and VCI parameters. For allowable VPI and VCI entries for each mode, refer to "ATM DXI Virtual Circuit Parameter Descriptions" later in this chapter.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.18

Parameter:	**Max # VCs**
Default:	512
Range:	1 to 512
Function:	Specifies the maximum number of virtual channels (VCs) allowed on the selected interface. This value is for permanent virtual connections (PVCs) only.
Instructions:	Accept the default, 512, or enter a different value between 1 and 512, inclusive.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.5

Parameter:	**Multiprotocol Encapsulation**
Default:	RFC 1483 Style MPE
Options:	RFC 1483 Style MPE | RFC 1294 Style MPE | No MPE
Function:	Determines whether the outbound packets on the selected interface are encapsulated with a multiprotocol header per RFC 1294 or RFC 1483. All group or hybrid access mode PVCs configured for the selected interface use the value you set for this field.
Instructions:	We recommend selecting RFC 1483.
	If you are running a version of the ATM DXI prior to Version 8.00, select RFC 1294 for backward compatibility.
	If you select No MPE, the router interprets this as virtual channel-based multiplexing, which is not supported for bridging.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.2.1.11

Parameter: **CS PDU Encapsulation**

Default: AAL 5 Encapsulation

Options: AAL 5 Encapsulation | AAL 3/4 Encapsulation | No Encapsulation

Function: Determines whether the outbound packets on the grouped virtual channels use the AAL 3/4 CS_PDU encapsulation or the AAL 5 CS_PDU encapsulation. The encapsulating method is based on the ATM Forum's ATM DXI specification. All group and hybrid access mode PVCs configured for the selected interface use the value you set for this field.

Instructions: Choose either AAL 3/4 or AAL 5 according to the desired encapsulation method. No Encapsulation is a proprietary value. Select this value when you do not want CS PDU encapsulation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.5.2.1.12

Parameter: **Multicast**

Default: Disable

Options: Enable | Disable

Function: Indicates whether the selected ATM interface supports multicast packets.

Instructions: Accept the default, Disable, if you do not want the interface to accept multicast packets. Set to Enable if you want the selected interface to accept multicast packets.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.5.2.1.13

Parameter: **LMI Enable**

Default: Disable

Options: Enable | Disable

Function: Specifies whether our proprietary version of the Local Management Interface (LMI) is enabled for the selected interface. This LMI is not compatible with the ATM Forum standard LMI, and is only for use with DXI Mode 2 Proprietary.

Instructions: Accept the default, Enable, if you want LMI enabled for the interface. Set to Disable if you do not want LMI available for the interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.5.2.1.15

Note: If you disable LMI, the DSU/CSU cannot report traps to the router and the router cannot retrieve statistical information from the DSU/CSU.

Configuring PVCs

You must manually configure all ATM PVCs for each interface. This section describes how to

❏ Add or copy PVCs

❏ Edit PVC configuration parameters

Adding or Copying PVCs

Note: Whether you Add or Copy a PVC, you can always change the configuration of the PVC later. When you run PVCs in direct or hybrid access mode, the copy function copies all of the existing PVC-specific information to the new PVC. However, this function does not copy the protocols that you have selected and configured for that PVC. **You must select and configure any desired protocols for the newly copied PVC**.

To add a PVC, complete the following steps:

1. From the Configuration Manager window (Figure 3-1), select Protocols→ATM DXI→Interfaces to display the ATM Interface List window (refer to Figure 3-2).

2. Click on the PVCS button to display the ATM DXI PVC List window (Figure 3-3).
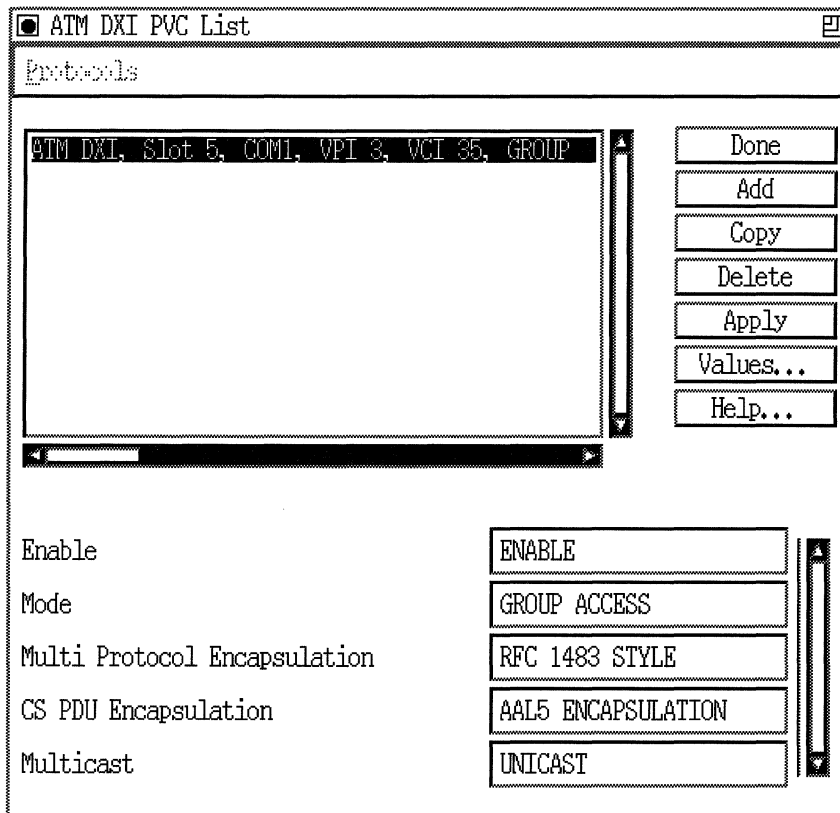
Figure 3-3. ATM DXI PVC List Window

3. Click on the Add button. Site Manager displays the ATM DXI
    Virtual Circuit parameters window (Figure 3-4).

```
┌────────────────────────────────────────────────────────────┐
│ ■ ATM DXI VIRTUAL CIRCUIT                                 🞄│
│ ┌────────────────────────────────────────────────────────┐ │
│ │                                    ┌──────────────┐      │ │
│ │                                    │   Cancel     │      │ │
│ │   Configuration Mode: local        ├──────────────┤      │ │
│ │           SNMP Agent: LOCAL FILE    │     OK       │      │ │
│ │                                    ├──────────────┤      │ │
│ │                                    │   Values...  │      │ │
│ │                                    ├──────────────┤      │ │
│ │                                    │    Help...   │      │ │
│ │                                    └──────────────┘      │ │
│ │                                                          │ │
│ │   VPI Number              ┌──────────────────┐   ┌─┐     │ │
│ │                           │ 3                │   │▲│     │ │
│ │                           └──────────────────┘   │ │     │ │
│ │   VCI Number              ┌──────────────────┐   │ │     │ │
│ │                           │ 35█              │   │▼│     │ │
│ │                           └──────────────────┘   └─┘     │ │
│ └────────────────────────────────────────────────────────┘ │
└────────────────────────────────────────────────────────────┘
```
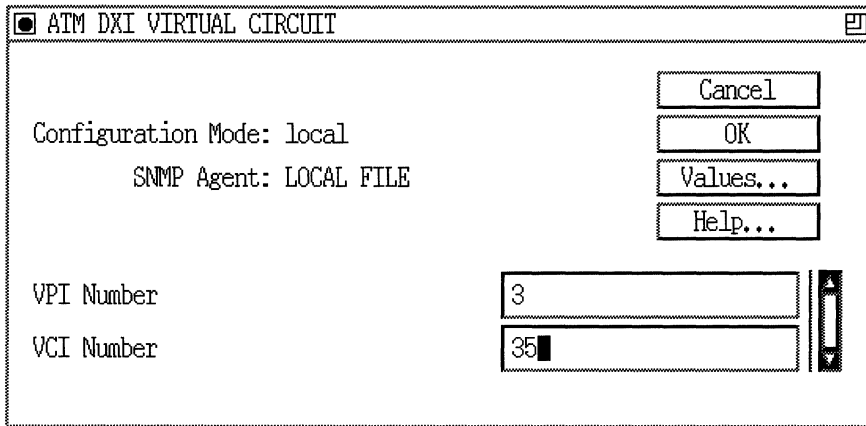
Figure 3-4. ATM DXI Virtual Circuit Window

4. Enter the VPI and VCI numbers that you want to use for the PVC.
    Refer to the following section, "ATM DXI Virtual Circuit Parameter
    Descriptions," for guidelines.

5. Click on the OK button. Site Manager returns you to the ATM DXI
    PVC List window (Figure 3-3). The window displays the default
    parameter values for this PVC.

6. Complete the procedure described in the next section, "Editing PVC
    Configuration Parameters," if you want to change the default
    configuration of the PVC.

To copy an existing PVC, complete the following steps:

Note: If you have just completed the procedure to add a PVC, skip to
    step 3.

1. From the Configuration Manager window (refer to Figure 3-1),
    select Protocols→ATM DXI→Interfaces to display the ATM DXI
    Interface List window (refer to Figure 3-2).

2. Click on the PVCS button to display the ATM DXI PVC List window (Figure 3-3).

3. Select the PVC that you want to copy.

4. Click on the Copy button. Site Manager displays the ATM DXI Virtual Circuit Parameters window (refer to Figure 3-4).

5. Enter the VPI and VCI number that you want to use for the PVC. Refer to the following section, "ATM DXI Virtual Circuit Parameter Descriptions," for guidelines.

6. Click on the OK button. Site Manager returns you to the ATM DXI PVC List window (refer to Figure 3-3).

Note: When running PVCs in direct or hybrid access mode, the copy function copies all of the existing PVC-specific information to the new PVC. However, this function does not copy the protocols that you have selected and configured for that PVC. **You must select and configure any desired protocols for the newly copied PVC**.

Complete the procedure described in the section, "Editing PVC Configuration Parameters," if you want to change the configuration of the PVC.

ATM DXI Virtual Circuit Parameter Descriptions

Use the following descriptions as guidelines when you configure the parameters on the ATM Virtual Circuit window.

Note: ATM DXI does not allow duplicate VPI/VCI pairs on the same ATM physical interface (that is, on the same link module). However, duplicate VPI/VCI pairs can exist on different physical interfaces (that is, on different link modules).

Parameter:	**VPI Number**
Default:	None
Range:	0 to 255
Function:	Identifies the virtual path of the PVC.
Instructions:	If you have selected Mode 1A or 1B for the DXI Mode value, enter a value from 0 to 15. If you chose Mode 2 or 2 Proprietary, enter a value from 0 to 255.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.3

Parameter:	**VCI Number**
Default:	None
Range:	32 to 65535
Function:	Identifies the virtual channel of the PVC.
Instructions:	If you have selected Mode 1A or 1B for the DXI Mode value, enter the a value from 32 to 63. If you chose Mode 2 or 2 Proprietary, enter a value from 32 to 65535.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.4

Editing PVC Configuration Parameters

To edit PVC configuration parameters, complete the following procedure:

Note: If you have just completed the procedure to add or copy a PVC, skip to step 4.

1. From the Configuration Manager window (Figure 3-1), select Protocols→ATM DXI→Interfaces to display the ATM Interface List window (refer to Figure 3-2).

2. Select the ATM DXI interface that contains the desired PVC.

3. Click on the PVCS button to display the ATM DXI PVC List window (refer to Figure 3-3).

4. Select the PVC you want to configure.

5. Assign values to the configuration parameters (refer to the "ATM PVC Parameter Descriptions" section following this procedure for guidelines).

6. Click on the Apply button to save your changes. If you configure the PVC to run in direct or hybrid access mode, the Configuration Manager adds a Protocol menu option in the top left corner of the ATM DXI PVC List window. The Configuration Manager then displays a Select Protocols Window (Figure 3-5).

Note: If you configure the PVC to operate in hybrid mode, only Bridge, Spanning Tree, and Native Mode LAN appear as options in the Select Protocols window. We strongly recommend that you enable Spanning Tree on all hybrid access PVCs to detect loops in the network.
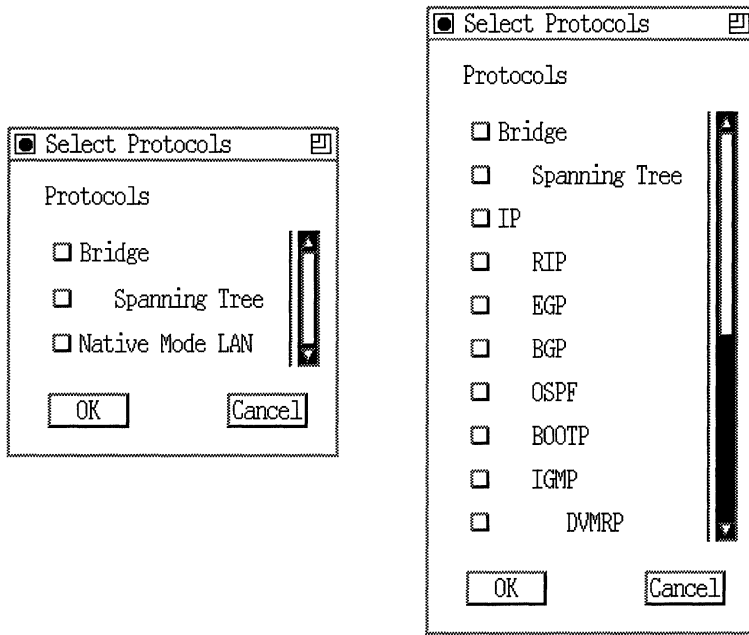
Figure 3-5. Select Protocols Window (Hybrid and Direct Access)

7. Select a protocol or protocols you want this PVC to carry, and click on the OK button.

    For each protocol you select, the Configuration Manager displays a protocol-specific window prompting for required information. If you need assistance in responding to any queries, consult the relevant protocol section of *Configuring Wellfleet Routers*.

    When you complete the protocol selection, the Configuration Manager returns you to the ATM DXI PVC List window (refer to Figure 3-3).

Note: If you select the bridge protocol for a hybrid or direct mode PVC, the Configuration Manager automatically sets the Multiprotocol Encapsulation parameter to Enable.

ATM PVC Parameter Descriptions

Use the following descriptions as guidelines when you configure the parameters on the ATM DXI PVC List window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable	Disable
Function:	Specifies whether this PVC is enabled for the selected interface.
Instructions:	Set to Disable if you do not want this PVC enabled.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.14

Parameter:	**Mode**
Default:	Group Access
Options:	Group Access	Hybrid Access	Direct Access
Function:	Specifies the role of the PVC.
Instructions:	Accept the default, group access, if you want the PVC to be part of a group of PVCs. Set to hybrid access if you want the PVC to be part of a group of PVCs used for routing, and to direct access for bridging. Set to direct access if you want the PVC to be used for bridging or routing to different networks. For more information about the three modes, see "ATM DXI Implementation Notes" in Chapter 2.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.9

Parameter:	**Multiprotocol Encapsulation**
Default:	RFC 1483 Style MPE
Options:	RFC 1294 Style MPE	MPE_Null	RFC 1483 Style MPE	
Function:	Determines whether the outbound packets on the selected interface are encapsulated with a multiprotocol header per RFC 1294 or RFC 1483. All direct access mode PVCs configured for the selected interface use the value of this field.
Instructions:	We recommend selecting RFC 1483.
	If you are running a of the ATM DXI prior to Version 8.00, select RFC 1294 for backward compatibility.
	If you select MPE_Null, the router interprets this as virtual channel-based multiplexing, which is not supported for bridging.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.12

Parameter:	**CS PDU Encapsulation**
Default:	AAL 5 Encapsulation
Options:	AAL 5 Encapsulation	AAL 3/4 Encapsulation	No Encapsulation
Function:	Determines whether the outbound packets on the grouped virtual channels use the AAL 3/4 CS PDU encapsulation or the AAL 5 CS PDU encapsulation. The encapsulating method is based on the ATM Forum's ATM DXI specification.
Instructions:	Choose either AAL 3/4 or AAL 5 according to the desired encapsulation method. No Encapsulation is a proprietary value. Select this value when you do not want CS PDU encapsulation.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.13

Parameter:	**Multicast**
Default:	Unicast
Options:	Unicast	Multicast
Function:	Indicates whether this PVC is multicast or unicast.
Instructions:	Set to unicast or multicast, according to the PVC type.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.5.14.1.16

Editing and Enabling Protocols for Group Access PVCs

After you add at least one PVC that functions in group access mode (default), you can enable bridging/routing protocols on the ATM DXI circuit using the following procedure:

1. From the Configuration Manager window (Figure 3-1), click on the ATM circuit to which you want to add bridging/routing protocols. Site Manager displays the Edit Connector window (Figure 3-6).
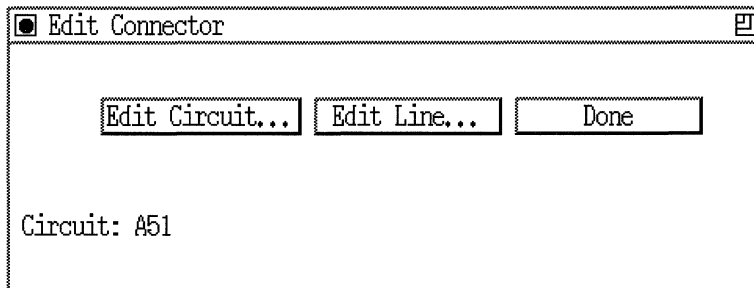
Figure 3-6. Edit Connector Window

2. Click on the Edit Circuit button to display the Circuit Definition window (Figure 3-7).
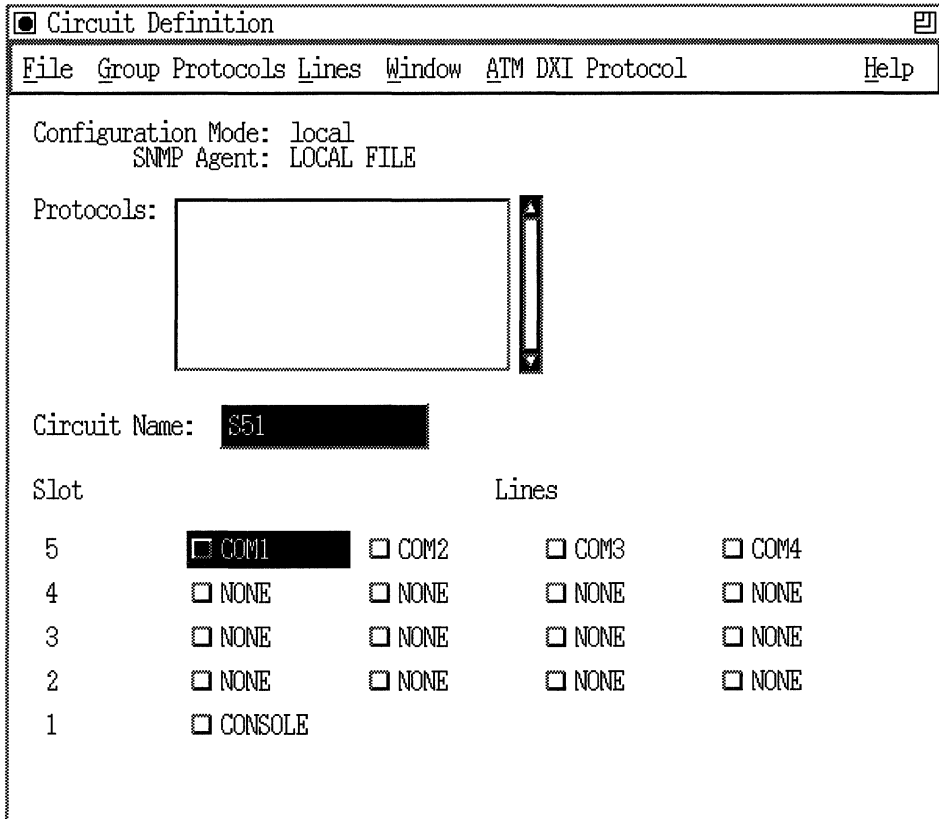
```
┌────────────────────────────────────────────────────────────────────┐
│● Circuit Definition                                               回 │
├────────────────────────────────────────────────────────────────────┤
│ File  Group Protocols Lines  Window  ATM DXI Protocol        Help   │
│                                                                      │
│  Configuration Mode:  local                                          │
│         SNMP Agent:  LOCAL FILE                                       │
│                                                                      │
│  Protocols:  ┌──────────────────────┐ ▲                             │
│              │                      │ │                             │
│              │                      │ │                             │
│              │                      │ │                             │
│              │                      │ │                             │
│              │                      │ ▼                             │
│              └──────────────────────┘                               │
│                                                                      │
│  Circuit Name:  █S51      █                                         │
│                                                                      │
│  Slot                              Lines                            │
│                                                                      │
│    5        █ COM1 █     ☐ COM2     ☐ COM3      ☐ COM4              │
│    4        ☐ NONE       ☐ NONE     ☐ NONE      ☐ NONE              │
│    3        ☐ NONE       ☐ NONE     ☐ NONE      ☐ NONE              │
│    2        ☐ NONE       ☐ NONE     ☐ NONE      ☐ NONE              │
│    1        ☐ CONSOLE                                               │
│                                                                      │
└────────────────────────────────────────────────────────────────────┘
```

Figure 3-7. Circuit Definition Window

3. Select Group Protocols→Add/Delete. The Configuration Manager displays the Select Protocols window (Figure 3-8).
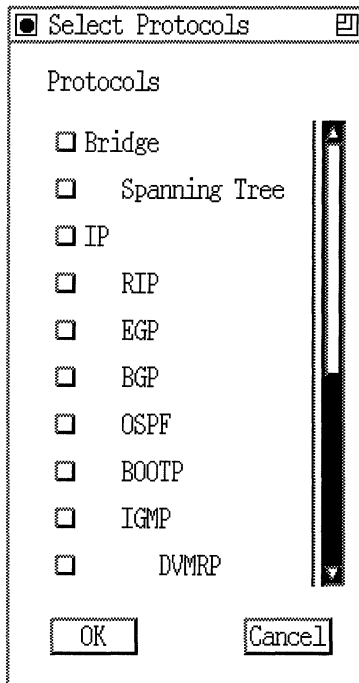
Figure 3-8. Select Protocols Window (Group Access)

4. Select the bridging/routing protocols you want to enable on that circuit.

    For each protocol you select, the Configuration Manager displays a protocol-specific window prompting for required information. If you need assistance in responding to any queries, consult the relevant protocol section of *Configuring Wellfleet Routers*.

    When you complete the protocol section, Configuration Manager returns you to the Circuit Definition window.

Editing and Enabling Protocols for Direct or Hybrid Access PVCs

After you configure a PVC to operate in hybrid or direct access mode, you can edit or enable additional protocols for that PVC. To edit an existing protocol, use the following procedure:

1. From the Configuration Manager window (Figure 3-1), select Protocols→ATM DXI →Interfaces to display the ATM Interface List window (Figure 3-2).

2. Click on the PVCS button to display the ATM DXI PVC List window (Figure 3-3).

3. Select the hybrid or direct PVC you want to configure.

4. Click on the Protocols menu option in the ATM DXI PVC List window. Site Manager displays a list of the existing protocols on that PVC (Figure 3-9).
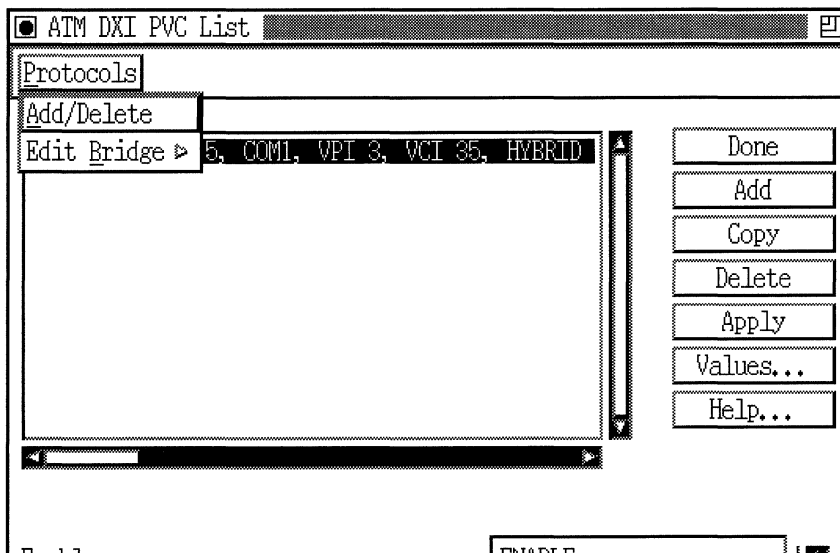
Figure 3-9. Protocols Menu (Top Level)

5. Select a protocol that you want to edit.

The Configuration Manager displays the requested protocol-specific window. If you need assistance in editing a specific protocol, consult the relevant protocol section of the *Configuring Wellfleet Routers* manual.

Note: Site Manager provides a menu structure for some protocols to assist you in locating specific configuration parameters. For example, when editing the Bridge protocol that also uses Spanning Tree, you can bypass the upper-level bridging parameters and edit the Spanning Tree parameters directly (Figure 3-10).
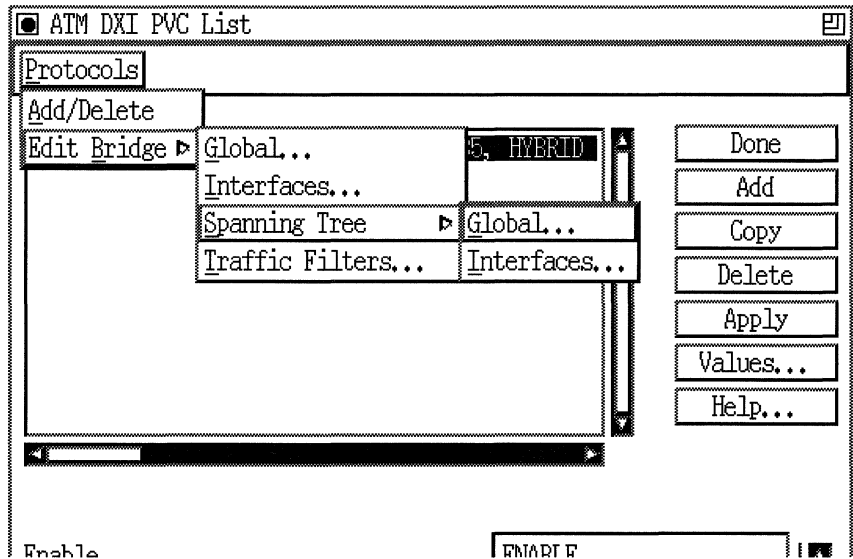
Figure 3-10. Protocols Menu (Various Levels)

To enable or disable a protocol on an existing PVC, use the following procedure:

1. From the Configuration Manager window (Figure 3-1), select Protocols→ATM DXI→Interfaces to display the ATM Interface List window (Figure 3-2).

2. Click on the PVCS button to display the ATM DXI PVC List window (Figure 3-3).

3. Select the hybrid or direct PVC you want to configure.

4. Select Protocols→Add/Delete. The Configuration Manager displays the Select Protocols window (Figure 3-11).
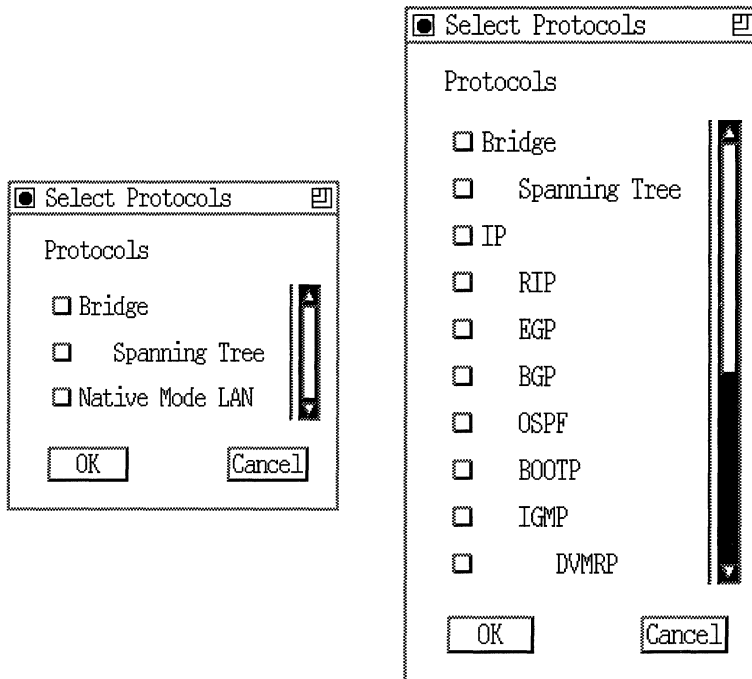
Select Protocols	
Protocols	
☐ Bridge	
☐ Spanning Tree	
☐ Native Mode LAN	
OK	Cancel

Select Protocols	
Protocols	
☐ Bridge	
☐ Spanning Tree	
☐ IP	
☐ RIP	
☐ EGP	
☐ BGP	
☐ OSPF	
☐ BOOTP	
☐ IGMP	
☐ DVMRP	
OK	Cancel

Figure 3-11. Select Protocols Window (Hybrid and Direct Access)

5. Select the bridging/routing protocol(s) that you want for that circuit.

   For each protocol you select, the Configuration Manager displays a protocol-specific window prompting for required information. If you need assistance in responding to any queries, consult the relevant protocol section of *Configuring Wellfleet Routers*.

6. When you complete the protocol section, Configuration Manager returns you to the ATM DXI PVC List window.

Setting PVCs for Multipath Mode

You can set two or more PVCs to run in multipath mode, as described in "ATM DXI Implementation Notes" in Chapter 2. When setting PVCs for multipath mode, keep the following in mind:

❑ The PVCs must have the same VCI and VPI numbers.

❑ You can only set PVCs that use direct access mode to operate in multipath mode.

To set PVCs to use multipath mode, complete the following steps:

1. From the Configuration Manager window (Figure 3-1), select Protocols→ATM DXI→Interfaces to display the ATM Interface List window (Figure 3-2).

2. Click on the PVCS button to display the ATM DXI PVC List window (Figure 3-3).

3. Select the initial PVC you want to run in multipath mode.

4. Click on the Multipath button on the ATM DXI PVC List window (Figure 3-12).

   The Configuration Manager displays the Multipath Selection window (Figure 3-13). This window displays all PVCs that you may set for multipath mode along with the initial PVC.

```
┌─────────────────────────────────────────────────────────────────┐
│ ◉ ATM DXI PVC List                                           ⊟   │
│ ┌───────────────────────────────────────────────────────────┐   │
│ │ Protocols                                                 │   │
│ └───────────────────────────────────────────────────────────┘   │
│                                                                   │
│  ┌──────────────────────────────────────────┐▲   ┌──────────┐   │
│  │ ATM DXI, Slot 4, COM2, VPI 3, VCI 35, DIRECT│   │   Done   │   │
│  │                                            │   ├──────────┤   │
│  │                                            │   │   Add    │   │
│  │                                            │   ├──────────┤   │
│  │                                            │   │   Copy   │   │
│  │                                            │   ├──────────┤   │
│  │                                            │   │  Delete  │   │
│  │                                            │   ├──────────┤   │
│  │                                            │   │  Apply   │   │
│  │                                            │   ├──────────┤   │
│  │                                            │▼  │ MultiPath│   │
│  ├──────────────────────────────────────────┤   ├──────────┤   │
│  │◀                                         ▶│   │ Values...│   │
│  └──────────────────────────────────────────┘   ├──────────┤   │
│                                                  │  Help... │   │
│                                                  └──────────┘   │
│                                                                   │
│  Enable                       ┌──────────────────────────┐▲     │
│                               │ ENABLE                   │       │
│  Mode                         ├──────────────────────────┤       │
│                               │ DIRECT ACCESS            │       │
│  Multi Protocol Encapsulation ├──────────────────────────┤       │
│                               │ RFC 1483 STYLE           │       │
│  CS PDU Encapsulation         ├──────────────────────────┤       │
│                               │ AAL5 ENCAPSULATION       │       │
│  Multicast                    ├──────────────────────────┤▼     │
│                               │ UNICAST                  │       │
│                               └──────────────────────────┘       │
└─────────────────────────────────────────────────────────────────┘
```
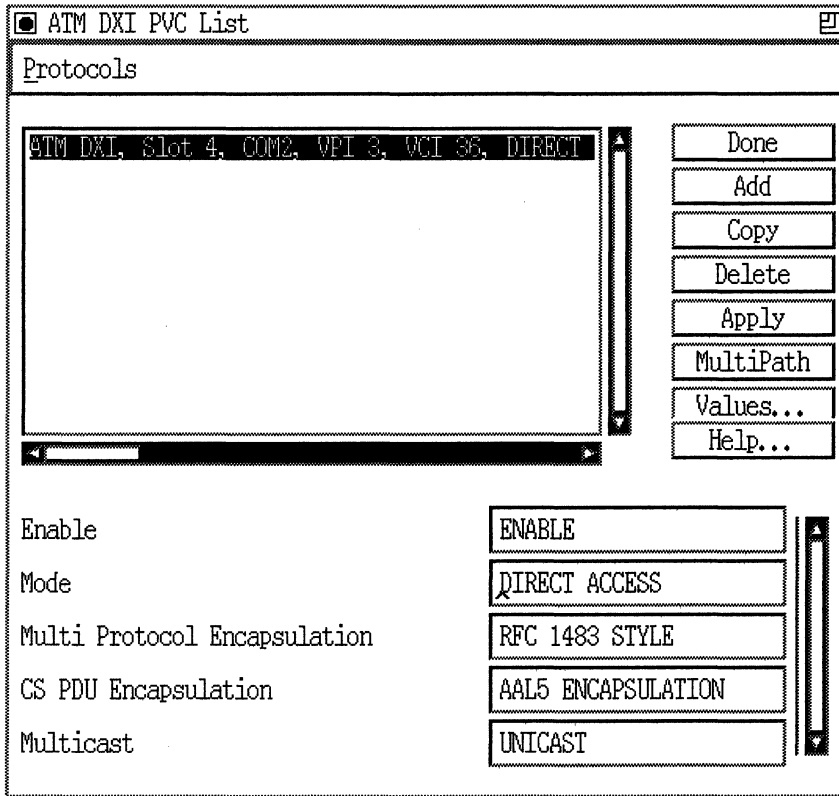
Figure 3-12. Multipath Button
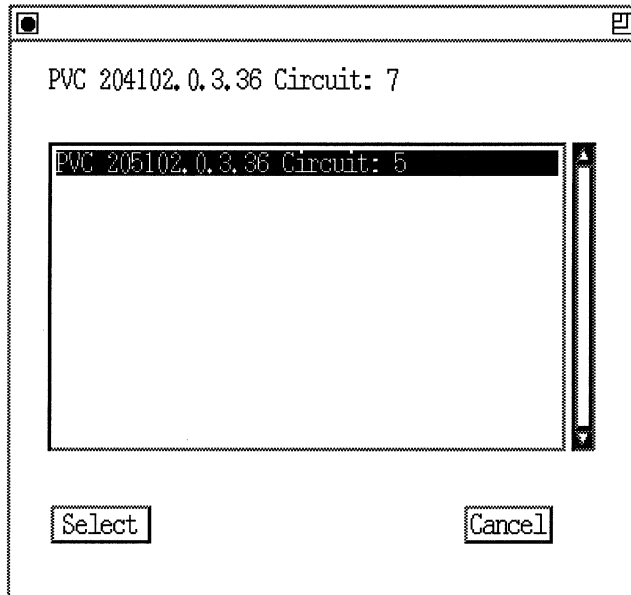
Figure 3-13. Multipath Selection Window

5. Select a PVC that you want to group with the initial PVC.

6. Click on the Select button to return to the ATM DXI PVC List window (Figure 3-12).

7. Repeat this procedure until you select all of the PVCs that you want to run in multipath mode.

Deleting PVCs

To delete a PVC, complete the following steps:

1. From the Configuration Manager window (Figure 3-1), select Protocols→ATM DXI→Interfaces to display the ATM Interface List window (Figure 3-2).

2. Click on the PVCS button to display the ATM DXI PVC List window (Figure 3-3).

3. Select the PVC you want to delete.

4. Click on the Delete button. Site Manager asks you to confirm the deletion.

5. Click on the OK button to delete the PVC.

Deleting ATM DXI from the Router

To delete ATM from all circuits on which it is currently configured, complete the following steps:

1. From the Configuration Manager window, select Protocols→ATM DXI→Delete ATM. A window pops up and prompts:

   Do you REALLY want to delete ATM?

2. Click on the OK button.

Site Manager returns you to the Configuration Manager window (Figure 3-1). ATM DXI is no longer operating on the router.

Chapter 4
ATM FRE2 Overview and Implementation

Before you customize ATM FRE2 on your router, you should review the following topics:

□   An overview of the various kinds of support that a router running ATM FRE2 provides

□   Notes describing how we implement special ATM FRE2 features

ATM FRE2 Overview

ATM FRE2 refers to the Intelligent Link Interface (ILI) combination of an ATM link module and its FRE2 counterpart. ATM FRE2 allows the router to connect to an ATM network directly. The router converts variable-length packets into uniform, 53-byte cells for transmission over the ATM network (Figure 4-1).
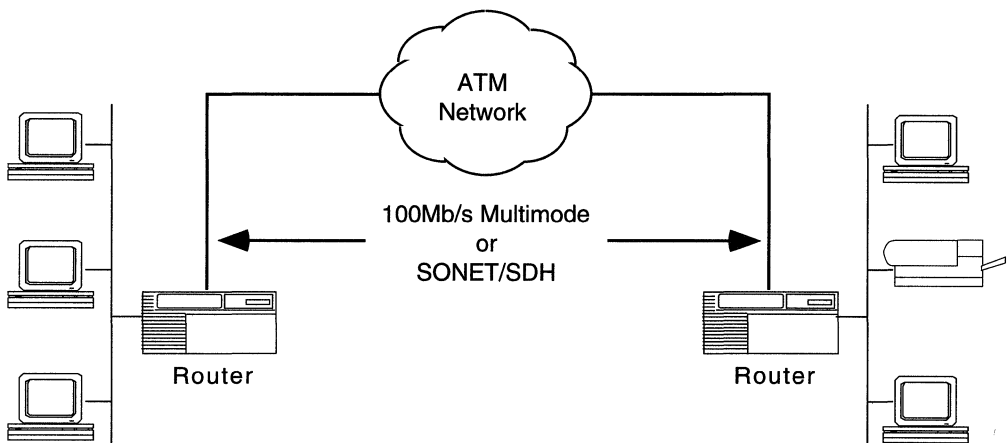
Figure 4-1. ATM FRE2

ATM FRE2 runs over a 100 Mb/s multimode fiber or a Synchronous Optical Network/Synchronous Digital Hierarchy (SONET/SDH) ATM physical interface installed in the router.

A router running ATM FRE2 provides the following support:

❐ Routing of IP, IPX, XNS, DECnet Phase IV, AppleTalk, and VINES traffic over the ATM network

❐ MAC-level transparent bridging over the ATM network

❐ Multiprotocol encapsulation functions defined in RFC 1294 (RFC 1490) and RFC 1483 that enable concurrent bridging and multiprotocol routing support on the same VCL

- A Convergence Sublayer (CS) function compatible with AAL 3/4 and AAL 5 as defined in Section 1 of CCITT's *B-ISDN Protocol Reference Model* (PRM)

- Error checking

- Broadcasting and simulated multicasting support

- ARP and Inverse ARP support

- The Segmentation and Reassembly (SAR) sublayer of the AAL

- The ATM layer defined in the B-ISDN reference model

Multiprotocol Encapsulation

The multiprotocol encapsulation function enables the router to multiplex and demultiplex bridged or routed data packets. For transmission, this function adds a header between two and eight octets in length to the PDU to allow decoding, which determines the proper Service Access Point (SAP). When receiving packets, this function evaluates the header to determine if the PDU is a valid routed or bridged packet. If it is valid, this function then strips the header from the packet and passes it to the appropriate SAP for routing or bridging.

ATM FRE2 allows you to use either a single encapsulation type (RFC 1483, RFC 1294, or Null), or any combination of RFC 1483 and Null encapsulation, for all channels.

Note: You cannot combine RFC 1294 with any other encapsulation choice in group access mode.

ATM FRE2 Error Checking

ATM FRE2 verifies that the VPI/VCI is valid with respect to the VCLs configured for the ATM circuit. It also verifies the header format.

ATM FRE2 also verifies that the BTag field in the CS_PDU header is equal to the ETag field in the CS_PDU trailer and ensures that the frame size is valid. If the packet contains an invalid header, the router drops the packet, updates the appropriate MIB statistic, and logs the appropriate event.

Simulated Multicast Packet Support

The ATM FRE2 interface supports multicast packets, enabling the router to take advantage of multicast functionality. ATM multicasting reserves selected network-assigned VPIs/VCIs as multicast addresses. The ATM network maps multiple recipients to a single VPI/VCI and delivers copies of all ATM cells to each member of the address group. As the cell passes through the ATM network, the network manipulates the cell to reveal the actual source to the cell recipient.

If no multicast address is available for the protocol (because the network interface has direct VCL Access, you have not set up the service yet, or the VPI/VCI has not been entered in the Adjacent Host Table), ATM FRE2 simulates a broadcast packet by forwarding a copy of the message to each known VCL.

Simulated multicasting is generally used in certain address resolution techniques and for applications that require the delivery of identical information to multiple recipients.

ARP and Inverse ARP Support

ATM FRE2 supports the ARP protocol, enabling the router to dynamically resolve IP network layer protocol-to-VPI/VCI address mappings. ATM FRE2 learns the VCL address by detecting the VCL that delivered the ARP response.

ATM FRE2 also supports the Inverse ARP protocol. However, you can only use Inverse ARP if both the local and remote router support it.

Bay Networks uses proprietary methods for ARP and Inverse ARP. These methods are not compatible with non-Bay Networks equipment (that is, equipment using the specifications in RFC 1577).

Note: When using IP over an ATM VCL, you must configure static adjacencies to non-Bay Networks equipment. Refer to the *Customizing IP Services* manual for additional information.

ATM FRE2 Implementation Notes

This section describes special features regarding how we implement ATM FRE2.

Access Modes for ATM FRE2 Services

You can enable each ATM VCL to function in one of three access modes: *group access*, *direct access*, and *hybrid access*. The following sections describe each of these access modes.

Group Access

In group access mode, upper-layer protocols treat each ATM network interface as a single access point (for all group access mode VCLs) to the switched network. They use a single network address to send all traffic destined for the switched network to the ATM network interface. Figure 4-2 shows a conceptual drawing of group access mode (default).

Note: In addition to group access mode VCLs, an ATM FRE2 interface can also contain direct and hybrid access mode VCLs.
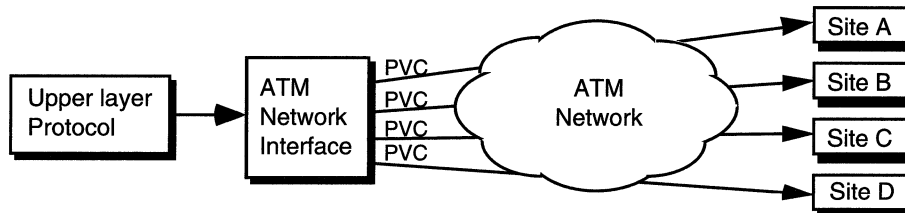
Figure 4-2. Using Group Access

Group access supports the following protocols: IP, IPX, XNS, DECnet
Phase IV, AppleTalk, VINES, and transparent bridging. Of the three
modes, group access uses network addressing most efficiently, and is
the easiest to configure. Although you need to configure each VCL
manually for group access mode, you need only define and associate
protocols with the ATM network interface. All the group access mode
VCLs that you configure for a given ATM interface carry the protocol or
protocols that you select and configure to run on that interface.

Note: When you configure group access mode, be aware that the VCLs
all use the data encapsulation type that you set for the ATM
interface (that is, the value of the data encapsulation parameter
set in the ATM Service Record List window). Refer to "Using the
ATM Service Record" in Chapter 5.

Group access works best in either fully meshed environments or
nonmeshed environments where systems not directly connected to
each other have no need to communicate. In a nonbridged
environment, you can use group access in any configuration in which
protocols do not need to be separated by a VCL, that is, all VCLs accept
the same protocols.

There are, however, ways to configure upper-layer protocols, such as IP
or IPX, to allow systems in nonmeshed networks to fully communicate.
See the appropriate documentation for these upper-layer protocols for
more information.

Direct Access

In direct access mode, upper-layer protocols treat the ATM network as a series of point-to-point connections. The upper-layer protocols view each VCL as an individual network interface. You can, therefore, configure each direct mode VCL individually. This is helpful if you have different network sites using different types of data encapsulation. (See Figure 4-3.)
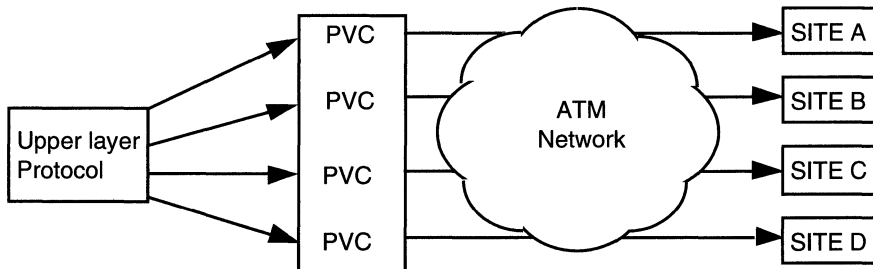
Figure 4-3. Direct Access

Direct access supports the following protocols: IP, IPX, XNS, DECnet Phase IV, AppleTalk, VINES, and bridging. If you use direct access mode, you must configure each VCL manually and assign protocols to run on each VCL. This mode allows you to dedicate a VCL to a particular protocol, but at the expense of some configuration overhead, memory, and address space.

Direct access mode is best suited to small nonmesh configurations, or configurations in which protocols must reside on separate VCLs.

Note: Be aware that the maximum number of VCLs you can configure in direct access mode varies, depending on the configuration of the router, the number of protocols running on the circuits, and the number of routing entries.

Hybrid Access

Hybrid access mode combines characteristics of group and direct access modes. It works best for nonmeshed network configurations that use both bridging and routing over a single ATM FRE2 interface. This mode is also best for spanning tree bridging.

If your network combines bridging and routing over the same interface, you need to use VCLs in group mode for routing, while at the same time allow bridging to operate over these same VCLs. Since group mode does not allow for bridging in nonmeshed environments, you use hybrid access mode. This mode allows a VCL to behave like a direct access VCL for bridging while maintaining group access characteristics for routing protocols (Figure 4-4).

For hybrid access mode, you must configure all VCLs manually and assign bridging protocols to run on each VCL. Hybrid access supports all protocols that are available for the ATM interface: IP, IPX, XNS, DECnet Phase IV, AppleTalk, VINES, and bridge. Note, however, when you select hybrid access mode for a VCL, Site Manager provides only three protocol options: Bridge, Spanning Tree, and Native Mode LAN (NML). These protocols, as well as the protocols that are on the ATM interface, can run on the VCL.

Bridge protocol sees two interfaces
to the network

ATM
Network Interface

Direction of Data

Hybrid PVC

SITE A

Routing
Protocol

Bridge
Protocol

I

ATM
Network

I

Hybrid PVC

SITE B

Routing protocol sees
one interface to the network

I = Interface to Network
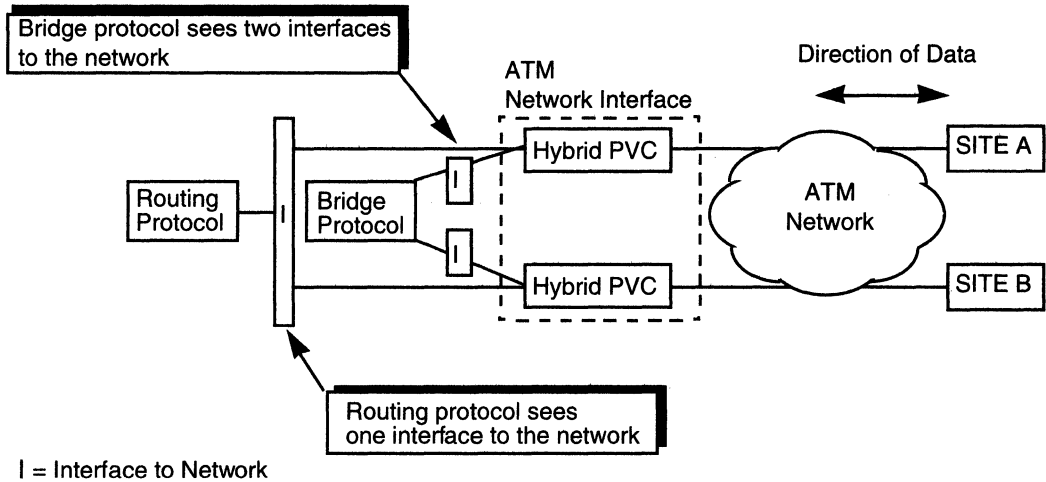
Figure 4-4. Hybrid Access Mode Configuration

Before you configure hybrid access on your router, carefully evaluate
the types of routers you are connecting in your network. Series 5
routers do not support ATM FRE2 interfaces. You must use ATM DXI
when connecting to Series 5 routers.

Using Hybrid Access for Transparent Bridging

In Figure 4-5, traffic bridges between Site A and Site B. The bridge (Router 1) is running on the ATM network interface, and its configuration has the VCLs defined for group access mode.
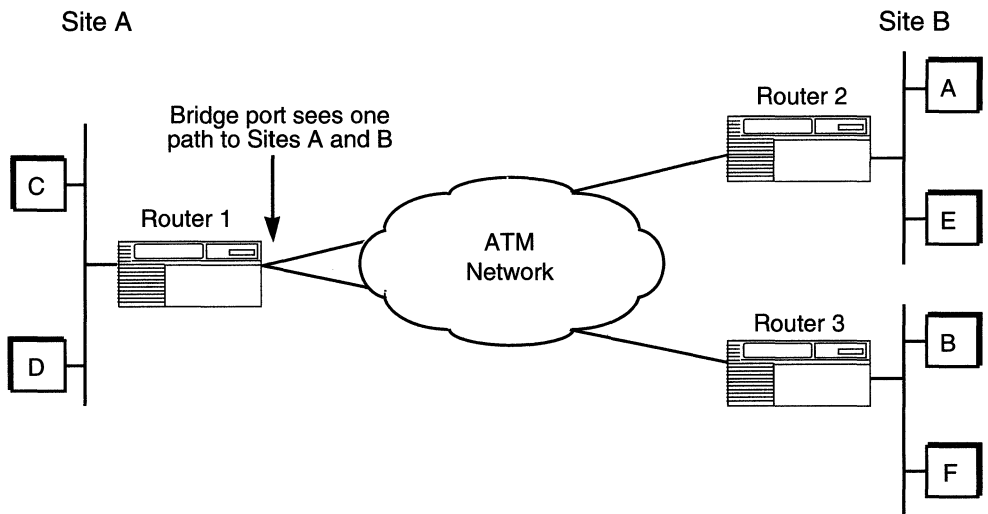
Figure 4-5. Example of a Bridged Network

In this example, the bridge receives data from Site A. If the bridge does not recognize the destination address, it tries to direct traffic through another bridge port. However, with group access mode configured, the ATM bridge port views the paths to Site A and Site B as the same path. Because the bridge does not send out data on the same bridge port from which it just received data, the bridge does not direct the data to Site B. In this example, you need to use hybrid access mode.

If you define the VCLs in hybrid access mode (Figure 4-4), each VCL acts as a bridge port. This enables the bridge running on the ATM interface to view the traffic from Site A as arriving on a different port than that of Site B. When the bridge sends out data, it now has access to all its ports, including the port that accesses Site B. Therefore, data from Site A can reach Site B.

Using Hybrid Access for Routing

In hybrid access mode, routing protocols view the ATM network interface in terms of group access VCLs, as described in the "Group Access" section earlier in this chapter.

ATM Traffic Parameters

The ATM UNI specification defines several traffic parameters. These parameters help to prioritize and control the traffic on each VCL.

How you assign your ATM traffic parameters depends on the characteristics (for example, maximum cell rate, average cell rate, burst size) of the individual connections that you want to set up.

You may change your ATM traffic parameters several times before deciding on a particular set. This section explains the different traffic parameters and provides some basic guidelines for you to use when customizing traffic parameters on an ATM VCL.

Peak Cell Rate

The Peak Cell Rate (PCR) is the upper traffic rate limit for an individual VCL. When setting the PCR, keep the following in mind:

□ Each VCL can have its own unique PCR.

□ The PCR cannot exceed the maximum rate for the physical media (for example, 100 Mb/s for 100 Mb/s multimode fiber or 155 Mb/s for SONET/SDH).

□ The PCR specifies the desired rate for the attached physical media (in this case, either 100 Mb/s multimode fiber or SONET/SDH). It does not specify the rate for the ATM network as a whole. In other words, you can specify a full 155 Mb/s for each VCL on a SONET/SDH connection. However, if your VCL ultimately connects to a lower speed link (for example, a T1, E1, or T3), your PCR is limited to the maximum rate of that media.

Sustainable Cell Rate

The SCR is the upper bound on the conforming average rate of an individual VCL. In this definition, *average rate* is the number of cells transmitted over the link divided by the duration of the connection. The *duration of the connection* equals the total amount of time it takes from connection setup to connection release.

By using the SCR, you can define future cell flow of a VCL in greater detail than by just using the PCR. Specifying the SCR controls the rate over time — not at a specific instant of time — and can help you more efficiently use your network resources. In other words, the SCR allows sufficient bandwidth for operation, but does not allow a bandwidth as high as the PCR.

When setting the SCR, keep the following in mind:

☐ The SCR is essentially a future average. By setting the SCR you are specifying the cell rate, over time, to which you want the VCL to conform.

☐ To be useful, the SCR must not exceed the PCR.

☐ If you know the user average rate, set the SCR about 10% higher than this value.

Maximum Burst Size

The MBS is the maximum length of a cell stream allowed on a particular VCL. In other words, the MBS specifies the maximum number of sequential cells allowed on a VCL before the VCL must relinquish bandwidth to other VCLs. This burst occurs at or close to the peak cell rate.

When setting the MBS, we suggest that you select a value larger than the largest packet your VCL can transmit (that is, the Maximum AAL CPCS Transmit SDU size). For example, if your VCL accepts packets that are less than 4608 bytes long (default), set your MBS value between 95 and 100 cells.

As a guideline, use the formula below to determine your MBS value:

$$\frac{Maximum\ Packet\ Size\ (in\ bytes)}{48\ bytes/cell} = MBS\ value\ (in\ cells)$$

for example:

$$\frac{4608\ bytes\ (default)}{48\ bytes/cell} = 96\ cells$$
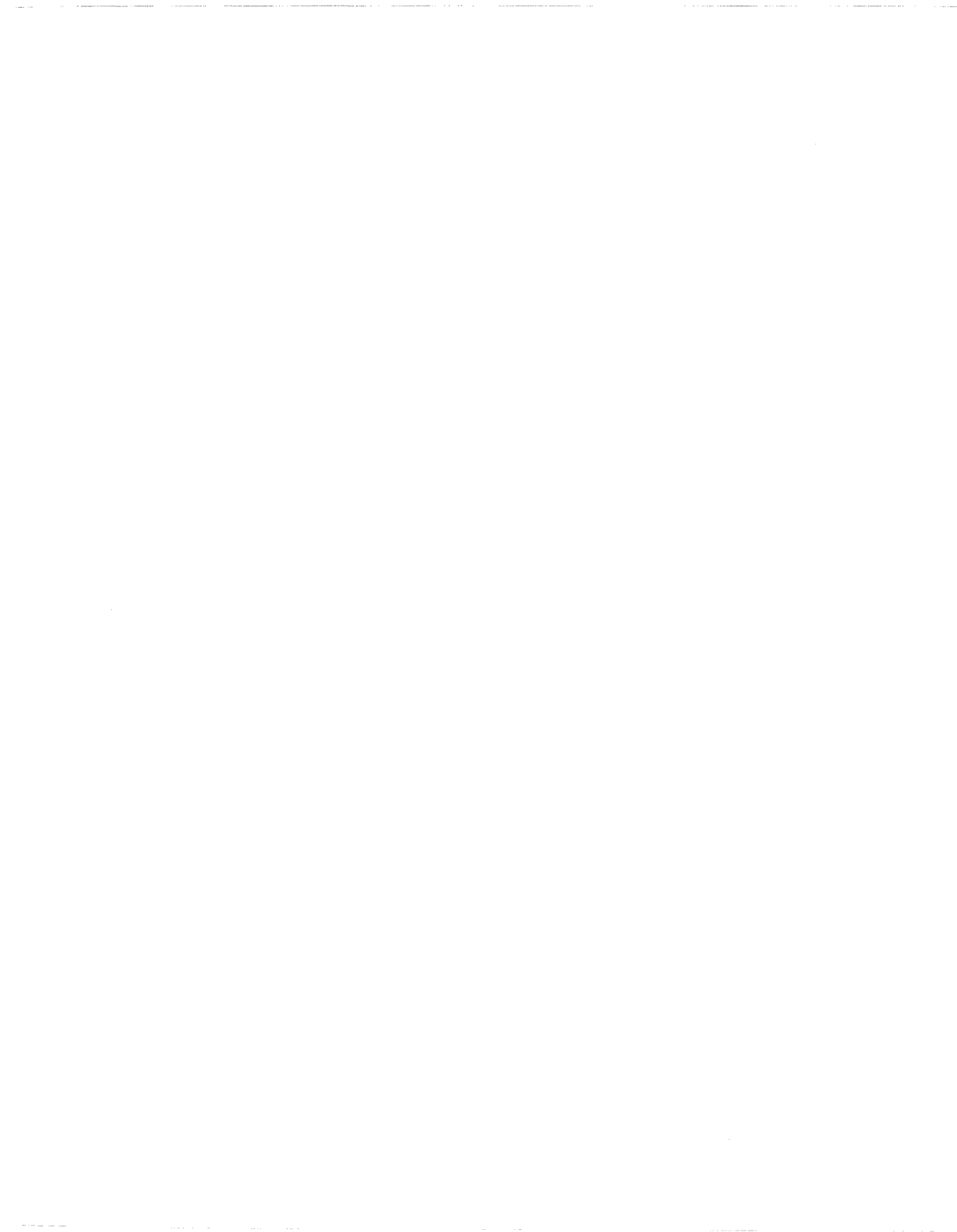
Chapter 5
Editing ATM FRE2 Parameters

Once you configure a circuit to support the ATM FRE2, you can use the Configuration Manager tool to edit ATM FRE2 parameters.

Note: You must first configure ATM FRE2 on the router in order to edit ATM FRE2 parameters. If you have *not yet* configured the ATM FRE2, or if you want to add additional ATM FRE2 interfaces, see *Configuring Wellfleet Routers* for instructions.

For each ATM FRE2 parameter, this chapter describes

❑ The default setting

❑ All valid setting options

❑ The parameter function

❑ Instructions for setting the parameter

Begin from the Configuration Manager window (Figure 5-1), the first window that appears when you enter the Configuration Manager tool.

```
┌─────────────────────────────────────────────────────────────────────────────┐
│ ◉ Configuration Manager ▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓▓ 回 │
│ ┌───────────────────────────────────────────────────────────────────────────┐ │
│ │ File  Options  Platform  Circuits  Protocols  Dialup  Window        Help  │ │
│ │                                   ┌──────────────────────┐                │ │
│ │ Configuration Mode: local         │ Global Protocols ▷   │                │ │
│ │        SNMP Agent: LOCAL FILE      │ ATM            ▷ ┌───────────────────┐│ │
│ │         File Name: /extra/smgr/mark/new.tst          │ Interfaces...     ││ │
│ │             Model: Backbone Link Node (BLN)          │ Service Records...││ │
│ │       MIB Version: x8.10                             │ Delete ATM        ││ │
│ │                                                      └───────────────────┘│ │
│ │                                         Color Key:    Used      Unused    │ │
│ │                                                                            │ │
│ │ Slot             Description                    Connectors                 │ │
│ │                                                                            │ │
│ │  5     [74022 ATM FRE2, 100Mbps Multim]  [NONE] [NONE] [NONE] [ ATM1 ]     │ │
│ │  4     [74023 ATM FRE2,OC-3 Multimode ]  [NONE] [NONE] [NONE] [ ATM1 ]     │ │
│ │  3     [74024 ATM FRE2,OC-3 Singlemode]  [NONE] [NONE] [NONE] [ ATM1 ]     │ │
│ │  2     [      Empty Slot              ]  [NONE] [NONE] [NONE] [NONE ]      │ │
│ │  1     [   System Resource Module     ]  [CONSOLE]                         │ │
│ └───────────────────────────────────────────────────────────────────────────┘ │
└─────────────────────────────────────────────────────────────────────────────┘
```

Figure 5-1. Configuration Manager Window

Editing ATM Interface Parameters

The ATM interface parameters define the ATM interface to the
physical line. You edit the parameters from the ATM Interface List
window (see Figure 5-2). To access this window, use the following
procedure:

1. Select Protocols→ATM→Interfaces from the Configuration
    Manager window (Figure 5-1). Site Manager displays the ATM
    Interface List window (Figure 5-2).
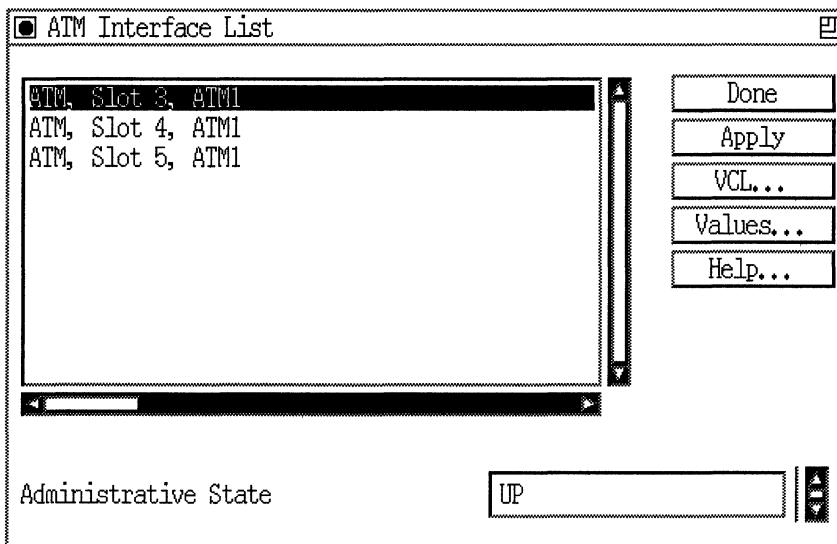
Figure 5-2. ATM Interface List Window

2. On the ATM Interface List window, select the interface you want to edit.

3. Configure the Administrative State parameter (refer to the description following this procedure for guidelines).

4. When you finish editing, click on the Apply button to save any changes.

5. If you want to add, copy, or edit VCLs (Virtual Channel Links) to the interface, click on the VCL button. Go to "Configuring VCLs," later in this chapter.

6. Follow steps 2 through 5 to edit any additional interfaces.

7. When you finish editing all interfaces, click on the Done button to return to the Configuration Manager window.

ATM Interface Parameter Descriptions

Use the following description when setting the Administrative State parameter in the ATM Interface List window.

Parameter:	**Administrative State**
Default:	Up
Options:	Up	Down
Function:	Specifies the desired administrative state of the interface. The Up and Down states indicate that the traffic flow is enabled or disabled respectively for the interface.
Instructions:	Accept the default, Up, if you want to enable traffic flow over this VCL.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.1.1.3

Configuring VCLs

You must manually configure all ATM VCLs for each interface. This section describes how to

❏ Add or copy VCLs

❏ Edit VCL configuration parameters

Adding or Copying VCLs

Note: Whether you Add or Copy a VCL, you can always change the configuration of the VCL later. When running VCLs in direct or hybrid access mode, the copy function copies all of the existing VCL-specific information to the new VCL. However, this function does not copy the protocols that you have selected and configured for that VCL. **You must select and configure any desired protocols for the newly copied VCL.**

To add a VCL, complete the following steps:

1. From the Configuration Manager window (Figure 5-1), select Protocols→ATM→Interfaces to display the ATM Interface List window (refer to Figure 5-2).

2. Click on the VCL button to display the ATM Virtual Channel Link window (Figure 5-3).
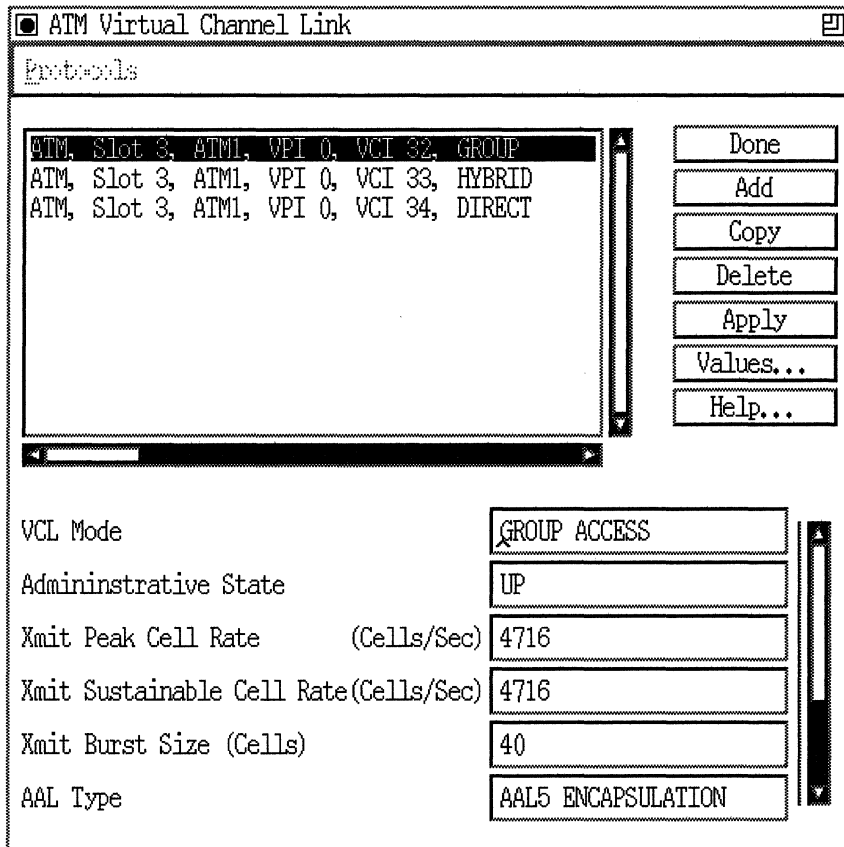
Figure 5-3. ATM Virtual Channel Link Window

3.   Click on the Add button. Site Manager displays the ATM Virtual
     Channel Link Parameters window (Figure 5-4).

```
┌─────────────────────────────────────────────────────────────────┐
│ ■ ATM Virtual Channel Link Parameters                         ◱ │
├─────────────────────────────────────────────────────────────────┤
│                                                                  │
│                                              ┌──────────┐        │
│                                              │  Cancel  │        │
│       Configuration Mode: local              ├──────────┤        │
│                                              │    OK    │        │
│              SNMP Agent: LOCAL FILE          ├──────────┤        │
│                                              │ Values...│        │
│                                              ├──────────┤        │
│                                              │  Help... │        │
│                                              └──────────┘        │
│                                                                  │
│       VPI Number                    ┌──────────────────┐  ┌──┐   │
│                                     │ 0                │  │▲ │   │
│       VCI Number                    ├──────────────────┤  ├──┤   │
│                                     │ 32█              │  │▼ │   │
│                                     └──────────────────┘  └──┘   │
│                                                                  │
└─────────────────────────────────────────────────────────────────┘
```

Figure 5-4. ATM Virtual Channel Link Parameters Window

4. Enter the VPI and VCI number that you want to use for the VCL. Refer to the following section, "ATM Virtual Channel Link Parameter Descriptions," for guidelines.

5. Click on the OK button. Site Manager returns you to the ATM Virtual Channel Link window (Figure 5-3). The window displays the default parameter values for this VCL.

6. Complete the procedure described in the section, "Editing VCL Configuration Parameters," if you want to change the default configuration of the VCL.

To copy an existing VCL, complete the following steps:

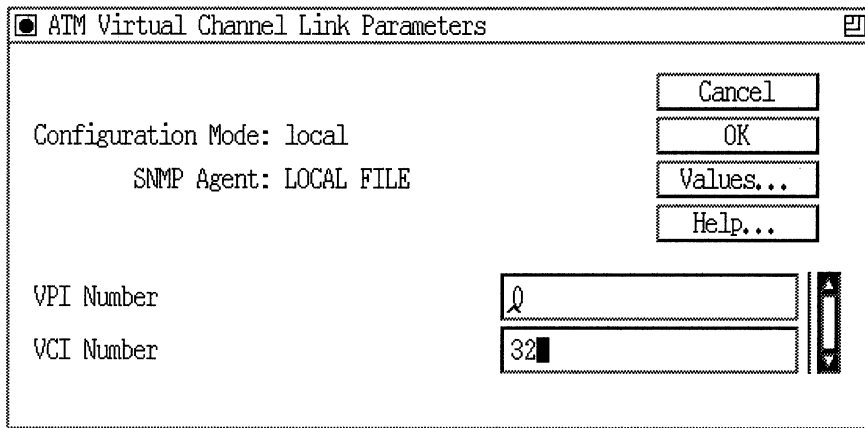**Note:** If you have just completed the procedure to add a VCL, skip to step 3.

1. From the Configuration Manager window (refer to Figure 5-1), select Protocols→ATM→Interfaces to display the ATM Interface List window (refer to Figure 5-2).

2. Click on the VCL button to display the ATM Virtual Channel Link window (Figure 5-3).

3. Select the VCL that you want to copy.

4. Click on the Copy button. Site Manager displays the ATM Virtual Channel Link Parameters window (refer to Figure 5-4).

5. Enter the VPI and VCI number that you want to use for the VCL. Refer to the following section, "ATM Virtual Channel Link Parameter Descriptions," for guidelines.

6. Click on the OK button. Site Manager returns you to the ATM Virtual Channel Link window (refer to Figure 5-3).

Note: When running VCLs in direct or hybrid access mode, the copy function copies all of the existing VCL-specific information to the new VCL. However, this function does not copy the protocols that you have selected and configured for that VCL. **You must select and configure any desired protocols for the newly copied VCL.**

7. Complete the procedure described in the section, "Editing VCL Configuration Parameters," if you want to change the configuration of the VCL.

ATM Virtual Channel Link Parameter Descriptions

Use the following guidelines when setting the parameters in the ATM Virtual Channel Link Parameters window.

Note: ATM FRE2 does not allow duplicate VPI/VCI pairs on the same ATM physical interface (that is, on the same link module). However, duplicate VPI/VCI pairs can exist on different physical interfaces (that is, different link modules).

Parameter:	**VPI Number**
Default:	None
Range:	0 to 255
Function:	Identifies the virtual path of the VCL.
Instructions:	Enter a VPI value between 0 and 255. The VPI (virtual path identifier) is part of the cell header. The header can contain a maximum of 8 VPI bits for a UNI (User to Network Interface) connection. This bit range allows for path identifiers between 0 and 255.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.3

Parameter: **VCI Number**

Default: None

Options: 32 to 65535

Function: Identifies the virtual channel of the VCL.

Instructions: Enter a VCI value between 32 and 65535. The VCI (virtual channel identifier) is part of the cell header. The header can contain a maximum of 16 VCI bits. This bit range allows for path identifiers between 0 and 65535.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.5.1.4

Note: Following the recommendation of the ATM Forum, the first five (5) VCI bits of the VCL (that is, identifiers between 0 and 31) are reserved for added functionality.

Editing VCL Configuration Parameters

To edit VCL configuration parameters, complete the following procedure:

Note: If you have just completed the procedure to add or copy a VCL, skip to step 4.

1. From the Configuration Manager window (Figure 5-1), select Protocols→ATM→Interfaces to display the ATM Interface List window (refer to Figure 5-2).

2. Select the ATM interface that contains the desired VCL.

3. Click on the VCL button to display the ATM Virtual Channel Link window (refer to Figure 5-3).

4. Select the VCL you want to configure.

5. Assign values to the configuration parameters (refer to the "ATM VCL Parameter Descriptions" section following this procedure, for guidelines).

6. Click on the Apply button to save your changes. If you configure the VCL to run in direct or hybrid access mode, the Configuration Manager adds a Protocol menu option in the top left corner of the ATM Virtual Channel Link window. The Configuration Manager then displays a Select Protocols window (Figure 5-5).

Note: If you configure the VCL to operate in hybrid mode, only Bridge, Spanning Tree, and Native Mode LAN appear as options in the Select Protocols window. We strongly recommend that you enable Spanning Tree on all hybrid access VCLs to detect loops in the network.
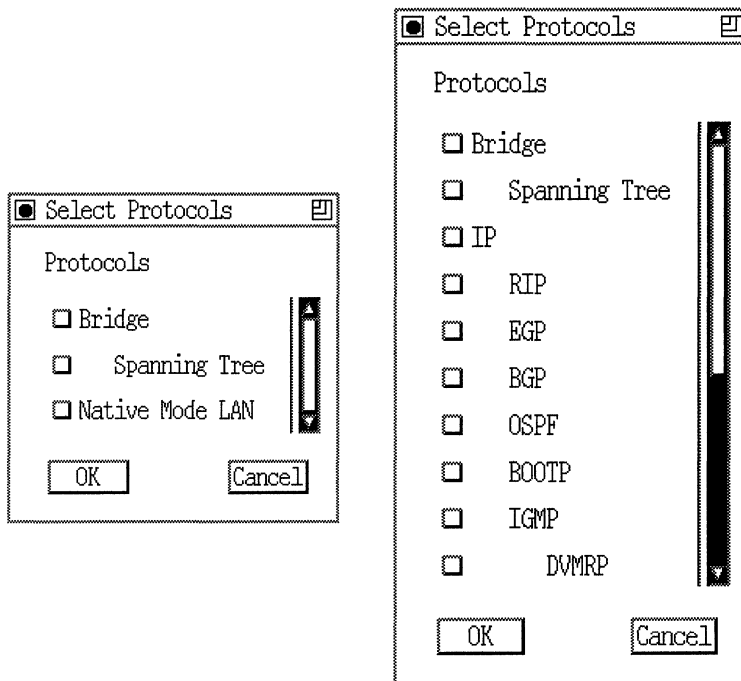
Figure 5-5. Select Protocols Window (Hybrid and Direct Access)

7. Select a protocol or protocols you want this VCL to carry, and click on the OK button.

For each protocol you select, the Configuration Manager displays a protocol-specific window prompting for required information. If you need assistance in responding to any queries, consult the relevant protocol section of the *Configuring Wellfleet Routers* manual.

When you complete the protocol selection, the Configuration Manager returns you to the ATM Virtual Channel Link window (refer to Figure 5-3).

Note: If you select the bridge protocol for a hybrid or direct mode VCL, the Configuration Manager automatically sets the MultiProtocol Encapsulation parameter to RFC 1483.

ATM VCL Parameter Descriptions

Use the following guidelines when you set the parameters on the ATM Virtual Channel Link window.

Parameter:	**VCL Mode**
Default:	Group Access
Options:	Group Access | Hybrid Access | Direct Access
Function:	Specifies the role of the VCL.
Instructions:	Accept the default, group access, if you want the VCL to be part of a group of VCLs. Set to hybrid access if you want the VCL to be part of a group of VCLs used for routing, and to direct access for bridging. Set to direct access if you want the VCL to be used for bridging or routing to different networks. For more information about the three modes, see "ATM FRE2 Implementation Notes" in Chapter 4.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.25

Parameter:	**Administrative State**
Default:	Up
Options:	Up | Down
Function:	Specifies the desired administrative state of the VCL. The Up state indicates that traffic flow is enabled on this VCL. The Down state indicates that traffic flow is disabled on this VCL.
Instructions:	Accept the default, Up, if you want traffic to flow on this VCL. Set the state to Down if you do not want traffic to flow on this VCL.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.5

Parameter:	**Transmit Peak Cell Rate**
Default:	4716
Range:	1 to 235849 (100 Mb/s multimode fiber optic cable); 1 to 365566 (SONET/SDH)
Function:	Specifies the upper traffic limit, in cells/second, that the ATM connection can submit.
Instructions:	How you set the peak cell rate depends on:
	— The optical transmission rate of your ATM device (235894 cells/sec [100 Mbps] maximum for 100 Mb/s fiber, 365566 cells/sec [155 Mbps] maximum for SONET/SDH)
	— The amount of traffic you expect on a particular VCL
	— What rate you desire for each VCL
	After you determine the transmission rate of your ATM device, you can set peak cell rates within the ranges mentioned above.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.8

Parameter:	**Transmit Sustainable Cell Rate**
Default:	4716
Range:	1 to 235849 (100 Mb/s multimode fiber optic cable); 1 to 365566 (SONET/SDH)
Function:	Specifies the upper limit of the ATM connection conforming average rate. The *average rate* equals the total number of cells transmitted divided by the *duration of the connection*.
Instructions:	By using the SCR, you can define the future cell flow of a VCL in greater detail than by just using the PCR.
	Specifying the SCR controls the rate over time — not at a specific instant of time — and can help you more efficiently use your network resources. When setting the SCR, keep the following in mind:
	— The SCR is essentially a future average. By setting the SCR you are specifying the cell rate, over time, to which you want the VCL to conform.
	— To be useful, the SCR must not exceed the PCR.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.9

Parameter:	**Transmit Burst Size**
Default:	40
Range:	1 to 65535
Function:	The MBS is the maximum length of a cell stream on a given VCL. In other words, the MBS specifies the maximum number of sequential cells allowed on a VCL, at the peak cell rate, before the VCL must relinquish bandwidth to other VCLs.
Instructions:	We recommend a conservative value to start.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.10

Parameter:	**AAL Type**
Default:	AAL 5
Options:	AAL 3/4 | AAL 5
Function:	Specifies the type of AAL used on the VCL.
Instructions:	Accept the default, AAL 5, if you want AAL 5 on this VCL. Set the AAL type to AAL 3/4 to use that AAL type.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.16

Parameter:	**Maximum AAL CPCS Transmit SDU Size**
Default:	4608
Range:	1 to 65535
Function:	Specifies the maximum AAL CPCS SDU size, in bytes, that this VCC supports in the transmit direction.
Instructions:	Enter an octet value that represents the maximum packet size you intend this VCL to transmit. We suggest that you accept the default value of 4608 bytes. Most packets fall well within this limit.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.17

Parameter:	**Maximum AAL CPCS Receive SDU Size**
Default:	4608
Range:	1 to 65535
Function:	Specifies the maximum AAL CPCS SDU size, in bytes, that this VCC supports in the receive direction.
Instructions:	Enter an octet value that represents the maximum packet size you intend this VCL to receive. We suggest that you accept the default value of 4608 bytes. Most packets fall well within this limit.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.5.1.18

Parameter: **Data Encapsulation Type**

Default: RFC 1483

Options: RFC 1483 | RFC 1294 | Null

Function: Specifies the type of data encapsulation used over both AAL 3/4 and AAL 5 SSCS layers.

Instructions: You can use this parameter to select

— RFC 1483, RFC 1294, or Null data encapsulation for each individual direct or hybrid access mode VCL

— RFC 1483 or Null data encapsulation for a group access mode VCL

We recommend selecting RFC 1483. If you select Null, the router interprets this as virtual channel-based multiplexing, which is not supported for bridging.

MIB Object ID: 1.3.6.1.4.1.18.3.4.23.1.5.1.19

Note: You must use the ATM Service Record to initially assign a data encapsulation type to a group access mode VCL. Refer to "Using the ATM Service Record," later in this chapter.

Assigning Data Encapsulation

ATM FRE2 allows for various data encapsulation types —
RFC 1483, RFC 1294, and Null — for each different access mode. How
you assign a data encapsulation type in Site Manager varies,
depending on the access mode you select for each VCL. Refer to the
following table when selecting and assigning a data encapsulation type
for any VCL.

Table 5-1.   Assigning Data Encapsulation

Data Encapsulation Method	Where to Assign Data Encapsulation		
	Group Mode	Direct Mode	Hybrid Mode
RFC 1483	Service Record	VCL List Window	VCL List Window
RFC 1294	Service Record	VCL List Window	VCL List Window
Null	VCL List Window	VCL List Window	VCL List Window

Using the ATM Service Record

The ATM service record contains the Data Encapsulation Type parameter that applies to all group access mode VCLs. When you add or copy a group access mode VCL, keep the following in mind:

❏ The ATM Service Record List window provides the option of using either RFC 1483 or RFC 1294 data encapsulation.

Note: The ATM Service Record List window initially contains a data encapsulation type of RFC 1483.

❏ When you add a VCL, the VCL reads and uses whatever data encapsulation type parameter resides in the ATM service record.

❏ When you change the data encapsulation type parameter you globally assign a new data encapsulation type to all group access mode VCLs on that interface.

Warning: Changing the data encapsulation type in the ATM Service Record List window changes the data encapsulation type for all group access mode VCLs. For example, if you change the ATM service record list data encapsulation type from RFC 1483 to RFC 1294, all group access mode VCLs change to RFC 1294. **Site Manager does not ask you to verify this change.**

❏ If you change the data encapsulation value in the ATM Service Record List window, all subsequent group access mode VCLs that you **add** use the new value.

❏ Using the ATM service record data encapsulation type of RFC 1483 allows for an additional group mode VCL option — you can individually assign Null data encapsulation to any group access mode VCLs by using the Data Encapsulation Type parameter in the VCL List window.

❑ When you copy a group access mode VCL, the new VCL uses the data encapsulation type from the existing VCL.

To assign a group access mode data encapsulation type use the following procedure:

1. From the Configuration Manager window (Figure 5-1), select Protocols➔ATM➔Service Record to display the ATM Service Record List window (Figure 5-6).

```
┌─────────────────────────────────────────────────────────────────────┐
│ ▣ ATM Service Records List                                       ▣  │
│ ┌───────────────────────────────────────────┐  ┌─────────────────┐ │
│ │ ATM, Slot 3, Circuit 3              ▲     │  │      Done       │ │
│ │ ATM, Slot 4, Circuit 2                    │  └─────────────────┘ │
│ │ ATM, Slot 5, Circuit 1                    │  ┌─────────────────┐ │
│ │                                           │  │     Apply       │ │
│ │                                           │  └─────────────────┘ │
│ │                                           │  ┌─────────────────┐ │
│ │                                           │  │    Values...    │ │
│ │                                           │  └─────────────────┘ │
│ │                                           │  ┌─────────────────┐ │
│ │                                      ▼    │  │     Help...     │ │
│ │ ◄                              ►          │  └─────────────────┘ │
│ └───────────────────────────────────────────┘                      │
│                                                                     │
│  Data Encapsulation Type          │RFC 1483               │   ▲▼   │
└─────────────────────────────────────────────────────────────────────┘
```
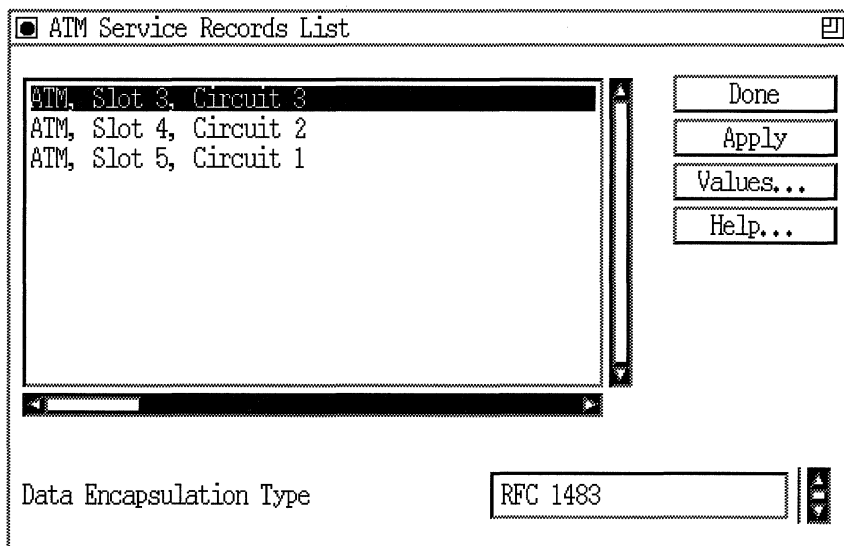
Figure 5-6. ATM Service Record List Window

2. Select the data encapsulation type you want the group mode VCLs on this interface to use (refer to the "Service Record Parameter Description" section following this procedure, for guidelines).

3. Click on the OK button. Site Manager returns you to the Configuration Manager window.

Service Record Parameter Description

Use the following guideline when setting the Data Encapsulation Type parameter in the Service Record window.

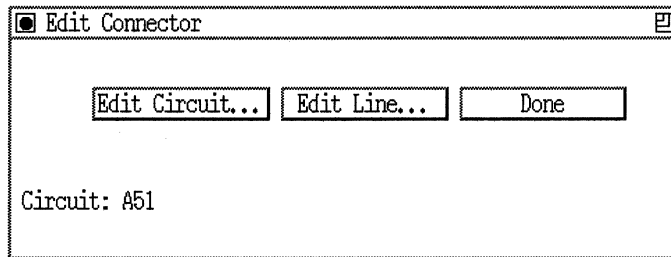|	
Parameter:	**Data Encapsulation Type**
Default:	RFC 1483
Options:	RFC 1483	RFC 1294
Function:	Specifies the type of data encapsulation used over both AAL 3/4 and AAL 5 SSCS layers.
Instructions:	You can use this parameter to select RFC 1483 or RFC 1294 data encapsulation for group access mode VCLs.
	We recommend selecting RFC 1483.
	Using RFC 1483 allows you to assign Null data encapsulation to individual group access mode VCLs on this interface. If you select RFC 1294, the router assigns this data encapsulation type to all group access mode VCLs. You cannot combine RFC 1294 and any other data encapsulation within group access mode.
MIB Object ID:	1.3.6.1.4.1.18.3.4.23.1.2.1.5

Note: You must use the Data Encapsulation Type parameter in the VCL List window to assign a data encapsulation type to a direct or hybrid access mode VCL or to assign Null data encapsulation to a group access mode VCL. Refer to "Editing VCL Configuration Parameters," earlier in this chapter.

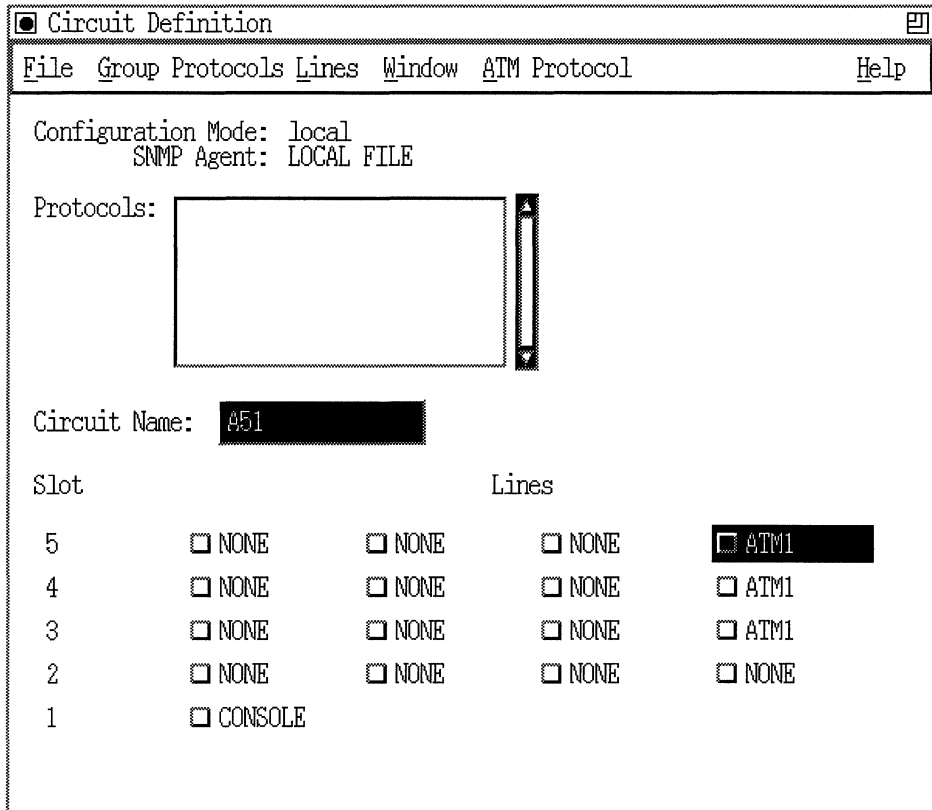# Editing and Enabling Protocols for Group Access VCLs

After you add at least one VCL that functions in group access mode (default), you can enable bridging/routing protocols on the ATM circuit using the following procedure:

1. From the Configuration Manager window (refer to Figure 5-1), click on the ATM circuit to which you want to add bridging/routing protocols. Site Manager displays the Edit Connector window (Figure 5-7).
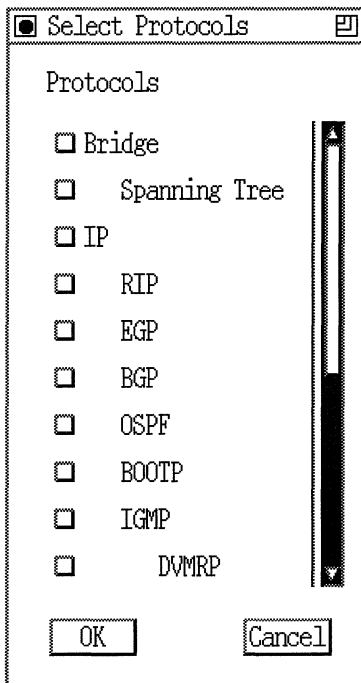
```
┌──────────────────────────────────────────────────────────────┐
│ ▣ Edit Connector                                          凹  │
├──────────────────────────────────────────────────────────────┤
│                                                                │
│        ┌──────────────┐ ┌──────────────┐ ┌──────────────┐      │
│        │ Edit Circuit...│ │ Edit Line... │ │    Done      │      │
│        └──────────────┘ └──────────────┘ └──────────────┘      │
│                                                                │
│                                                                │
│  Circuit: A51                                                  │
│                                                                │
└──────────────────────────────────────────────────────────────┘
```

Figure 5-7. Edit Connector Window

2. Click on the Edit Circuit button to display the Circuit Definition window (Figure 5-8).

```
┌─────────────────────────────────────────────────────────────────────┐
│ ▣ Circuit Definition                                              ▣   │
├─────────────────────────────────────────────────────────────────────┤
│ File  Group Protocols Lines  Window  ATM Protocol            Help    │
│                                                                       │
│  Configuration Mode:  local                                           │
│          SNMP Agent:  LOCAL FILE                                      │
│                                                                       │
│  Protocols:  ┌──────────────────────┐ ▲                               │
│              │                      │ ║                               │
│              │                      │ ║                               │
│              │                      │ ║                               │
│              │                      │ ║                               │
│              └──────────────────────┘ ▼                               │
│                                                                       │
│  Circuit Name:  ████A51███████████████                                │
│                                                                       │
│  Slot                              Lines                              │
│                                                                       │
│   5          ☐ NONE     ☐ NONE      ☐ NONE      ███☐ ATM1████         │
│   4          ☐ NONE     ☐ NONE      ☐ NONE      ☐ ATM1               │
│   3          ☐ NONE     ☐ NONE      ☐ NONE      ☐ ATM1               │
│   2          ☐ NONE     ☐ NONE      ☐ NONE      ☐ NONE               │
│   1          ☐ CONSOLE                                                │
│                                                                       │
└─────────────────────────────────────────────────────────────────────┘
```

Figure 5-8. Circuit Definition Window

3. Select Group Protocols→Add/Delete. The Configuration Manager displays the Select Protocols window (Figure 5-9).

```
┌────────────────────────────────────┐
│ ⬤ Select Protocols        ⧉        │
│ ┌──────────────────────────────────┤
│  Protocols                         │
│                                  ▲ │
│   ☐ Bridge                       █ │
│                                  █ │
│   ☐    Spanning Tree             █ │
│                                  █ │
│   ☐ IP                           █ │
│                                  █ │
│   ☐    RIP                       █ │
│                                  █ │
│   ☐    EGP                       █ │
│                                  █ │
│   ☐    BGP                       █ │
│                                  █ │
│   ☐    OSPF                      █ │
│                                  █ │
│   ☐    BOOTP                     █ │
│                                  █ │
│   ☐    IGMP                      █ │
│                                  █ │
│   ☐       DVMRP                  ▼ │
│                                    │
│  ┌─────────┐      ┌─────────┐      │
│  │   OK    │      │ Cancel  │      │
│  └─────────┘      └─────────┘      │
└────────────────────────────────────┘
```

Figure 5-9. Select Protocols Window (Group Access)

4. Select the bridging/routing protocol(s) that you want for that
    circuit.

    For each protocol you select, the Configuration Manager displays a
    protocol-specific window prompting for required information. If you
    need assistance in responding to any queries, consult the relevant
    protocol section of *Configuring Wellfleet Routers*.

    When you complete the protocol section, Configuration Manager
    returns you to the Circuit Definition window.

Editing and Enabling Protocols for Direct or Hybrid Access VCLs

After you configure a VCL to operate in hybrid or direct access mode, you can edit or enable additional protocols for that VCL.

To edit an existing protocol, use the following procedure:

1. From the Configuration Manager window (refer to Figure 5-1), select Protocols→ATM→Interfaces to display the ATM Interface List window (refer to Figure 5-2).

2. Click on the VCL button to display the ATM Virtual Channel Link window (Figure 5-10).

3. Select the hybrid or direct VCL you want to configure.

4. Click on the Protocols menu option in the ATM VCL List window. Site Manager displays a list of the existing protocols on that VCL (Figure 5-9).
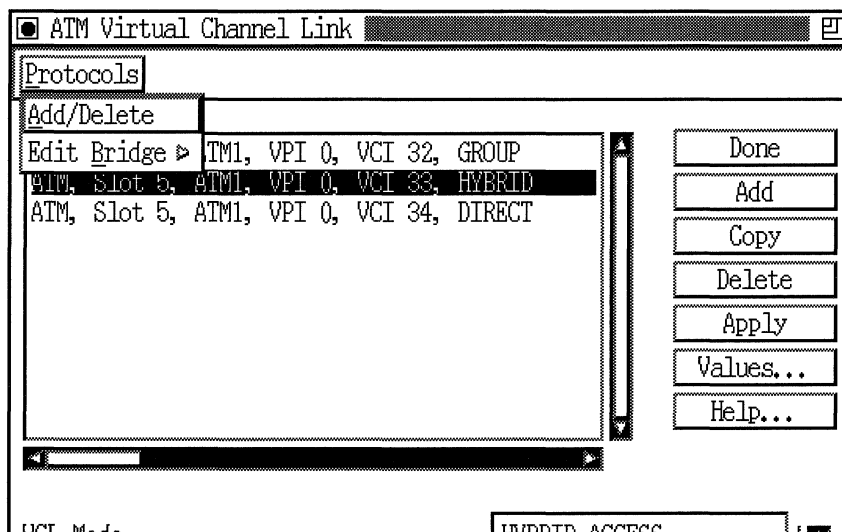
Figure 5-10. Protocols Menu (Top Level)

5. Select a protocol that you want to edit. The Configuration Manager displays the requested protocol-specific window. If you need assistance in editing a specific protocol, consult the relevant protocol section of the *Configuring Wellfleet Routers* manual.

Note: Site Manager provides a menu structure for some protocols to assist you in locating specific configuration parameters. For example, when editing the Bridge protocol that also uses Spanning Tree, you can bypass the upper-level bridging parameters and edit the Spanning Tree parameters directly (Figure 5-11).
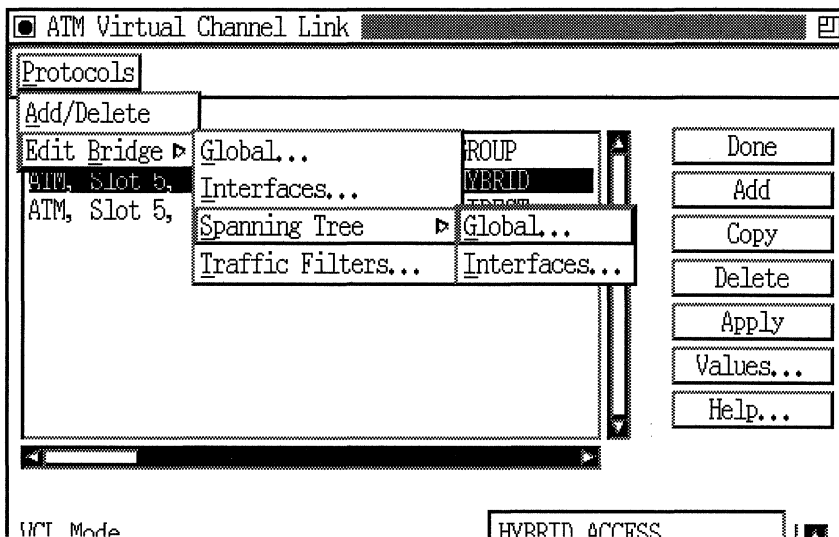
Figure 5-11. Protocols Menu (Various Levels)

To enable or disable a protocol on an existing VCL, use the following procedure:

1. From the Configuration Manager window (refer to Figure 5-1), select Protocols→ATM→Interfaces to display the ATM Interface List window (refer to Figure 5-2).

2. Click on the VCL button to display the ATM Virtual Channel Link window (Figure 5-11).

3. Select the hybrid or direct VCL you want to configure.

4. Select Protocols→Add/Delete. The Configuration Manager displays the Select Protocols window (Figure 5-12).
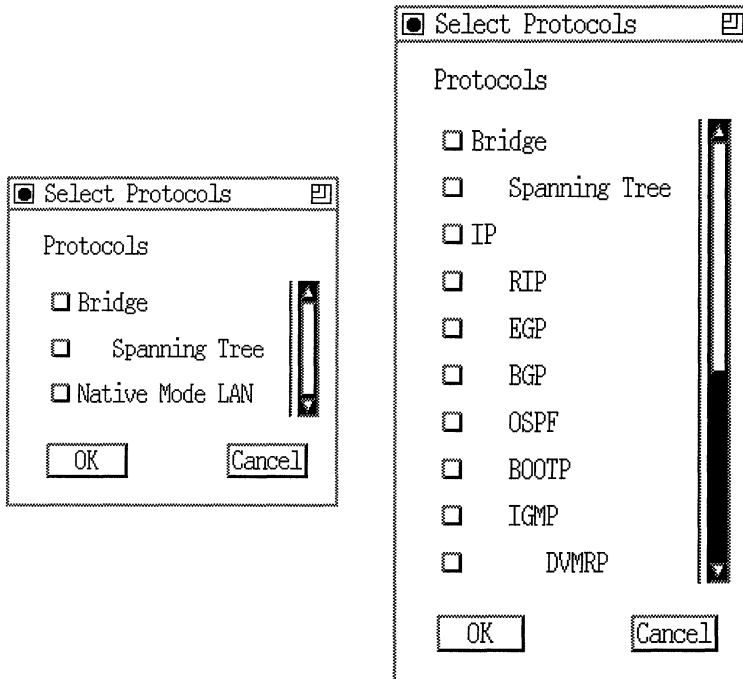
Figure 5-12. Select Protocols Window (Hybrid and Direct Access)

5. Select the bridging/routing protocol(s) that you want for that circuit.

For each protocol you select, the Configuration Manager displays a protocol-specific window prompting for required information. If you need assistance in responding to any queries, consult the relevant protocol section of *Configuring Wellfleet Routers*.

6. When you complete the protocol section, Configuration Manager returns you to the ATM Virtual Channel Link window.

Deleting VCLs

To delete a VCL, complete the following steps:

1. From the Configuration Manager window (refer to Figure 5-1), select Protocols→ATM→Interfaces to display the ATM Interface List window (Figure 5-2).

2. Click on the VCL button to display the ATM Virtual Channel Link window (Figure 5-3).

3. Select the VCL you want to delete.

4. Click on the Delete button. Site Manager asks you to confirm the deletion.

5. Click on the OK button to delete the VCL.

Deleting ATM from the Router

To delete ATM from all circuits on which it is currently configured, complete the following steps:

1. From the Configuration Manager window, select Protocols→ATM→Delete ATM. A window pops up and prompts:

   Do you REALLY want to delete ATM?

2. Click on the OK button. Site Manager returns you to the Configuration Manager window (Figure 5-1). ATM is no longer operating on the router.

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