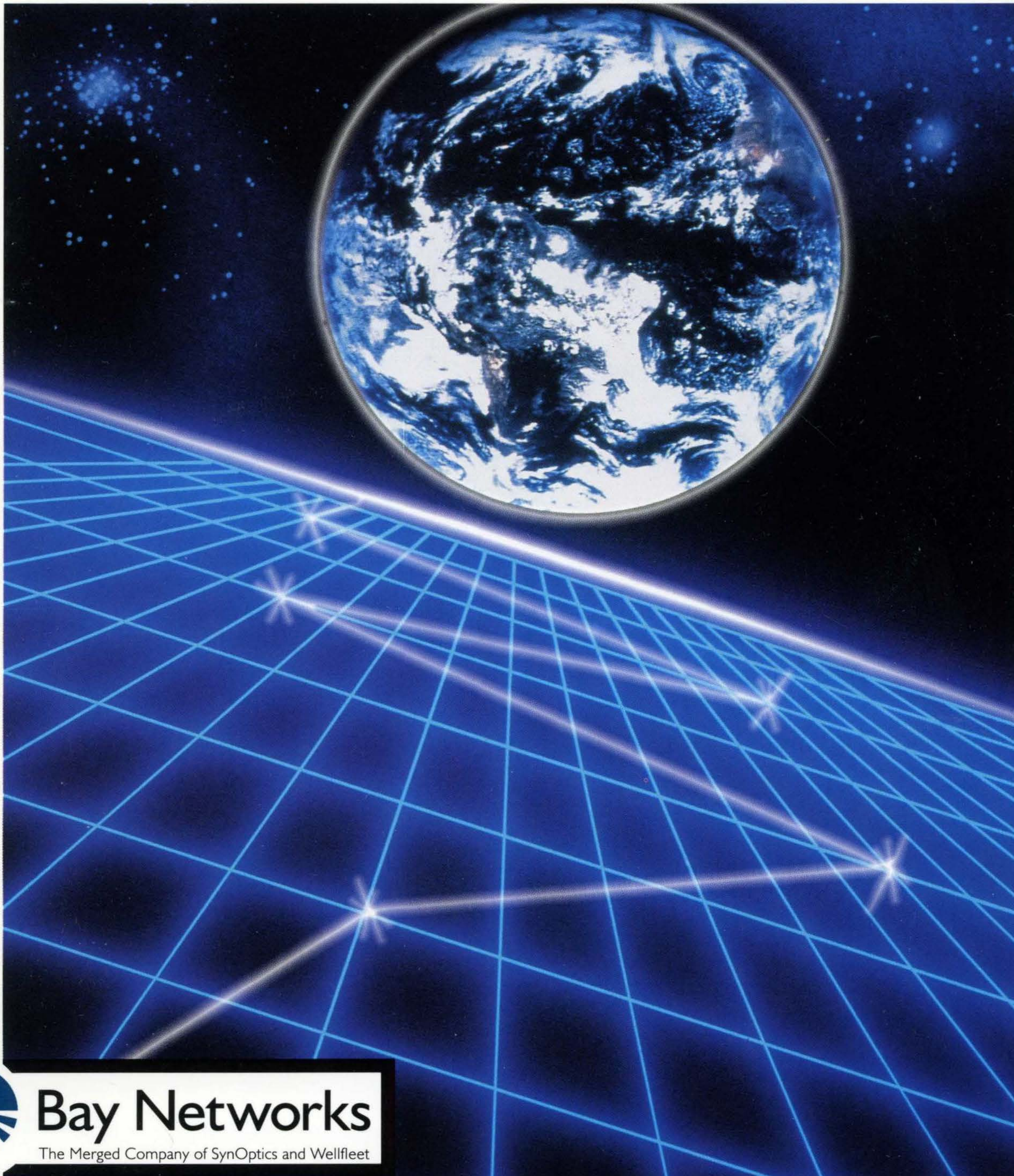

Bay Networks

The Merged Company of SynOptics and Wellfleet

Customizing Frame Relay Services

Part No. 110057 A

Customizing Frame Relay Services

Router Software Version 8.10
Site Manager Software Version 2.10

Part No. 110057 Rev. A
February 1995

Bay Networks
The Merged Company of SynOptics and Wellfleet

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About This Guide

If you are responsible for configuring and managing Wellfleet® routers, you need to read this guide. We assume that you have experience with LANs and WANs, frame relay, and network management tasks. We also assume that you have already configured at least one frame relay interface on the router using Site Manager.

This guide describes Bay Networks frame relay services and provides instructions for using Site Manager to configure frame relay parameters for your network.

Refer to this guide for

- An overview of the frame relay protocol (Chapter 1)
- A list of additional resources that describe frame relay (Chapter 1)
- Information about special features of our routers frame relay implementation (Chapter 2)
- Descriptions of frame relay parameters and instructions for editing those parameters (Chapter 3)

For information and instructions about the following topics, see *Configuring Wellfleet Routers*.

- Initially configuring and saving a WAN interface
- Retrieving a configuration file
- Rebooting the router with a configuration file

Before You Begin

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

- ❒ Create and save a configuration file that contains at least one frame relay 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

arrow character (➔)	Separates menu and option names in instructions. Example: Protocols➔AppleTalk identifies the AppleTalk option in the Protocols menu.
italic text	Indicates variable values in command syntax descriptions, new terms, file and directory names, and book titles.
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 you enter 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

ANSI	American National Standards Institute
ARP	Address Resolution Protocol
ATM	Asynchronous Transfer Mode
BECN	backward explicit congestion notification
BOFL	breath of life
CCITT	International Telegraph and Telephone Consultative Committee
C/R	Command/Response bit
CRC	cyclic redundancy check
DCE	data communications equipment
DE	Discard Eligibility
DTE	data terminal equipment
DLCI	data link connection identifier
dlcmi	data link control management interface
EA	Address Extension Bit
FECN	forward explicit congestion notification
IP	Internet Protocol
IPX	Internet Packet Exchange
LAN	local area network
LMI	Local Management Interface
PVC	permanent virtual circuit
VCs	virtual circuits
WAN	wide area network

Chapter 1
Frame Relay Overview

Frame relay is a high-speed, shared-bandwidth WAN protocol. Frame relay provides error detection, but not error recovery, and performs only basic processing on each packet, eliminating sequence numbers, window rotations, acknowledgments, and supervisory frames. This simplified processing allows frame relay networks to operate at high speeds with fewer delays.

Figure 1-1 illustrates a frame relay network.

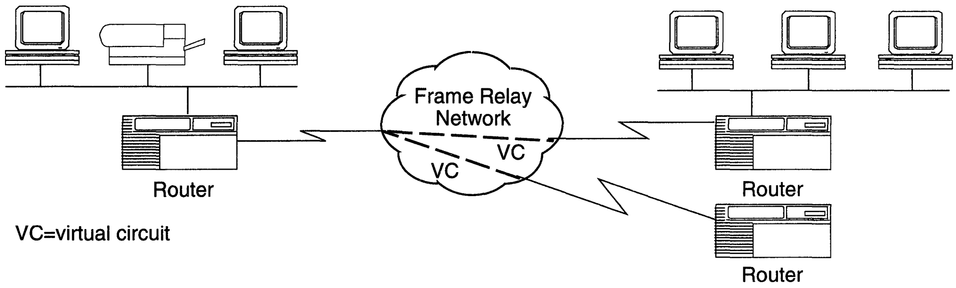

Figure 1-1. Frame Relay Network

Because frame relay performs only basic error checking, network end stations running intelligent protocols are responsible for resending packets that did not transmit correctly the first time. Therefore, implement frame relay networks using transmission lines with low error rates, for example, digital transmission media, so that the end stations do not become burdened with error-recovery functions.

The frame relay implementations are based on *permanent virtual circuits (PVCs)* that transmit data between each source and destination on the network. Since many PVCs can coexist, devices can share the bandwidth of the transmission line, sending data in multiple packets from the source to the destination.

Frame Relay Packets

Figure 1-2 illustrates the structure of a frame relay packet. The packet's header field includes the following components:

- **Data Link Connection Identifier (DLCI) -** The DLCI is the frame relay permanent virtual circuit (PVC) identification number. The frame relay network uses the DLCI to direct basic data flow.
- **Command/Response Bit (C/R) -** CCITT standards do not currently define the use of this bit.
- **Forward Explicit Congestion Notification (FECN)** and **Backward Explicit Congestion Notification (BECN)** - The FECN and BECN indicate congestion on the network. See Chapter 2 for information on how the router's frame relay software uses these bits.
- **Discard Eligibility (DE) -** The DE bit allows the router to mark specific frames as low priority (discard eligible), before transmission to the frame relay network.
- **Address Extension Bit (EA) -** The EA bit signals whether the next byte is part of the address.

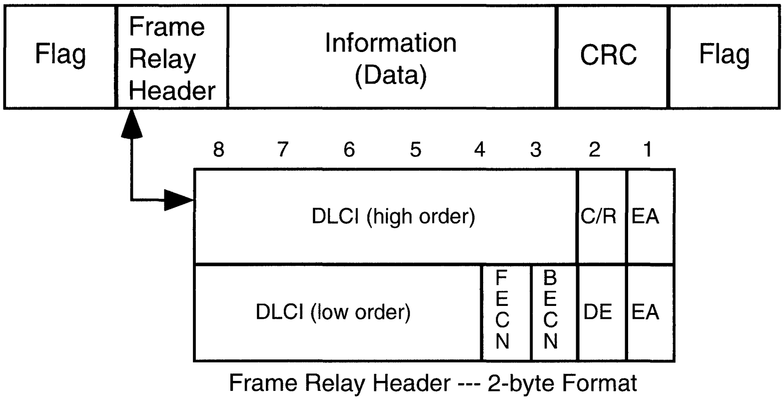

Figure 1-2. Frame Relay Header Format

Figure 1-2 depicts the frame relay header as a 2-byte structure. Frame relay can also format the header using 3 or 4 bytes, as shown in Figure 1-3. Note, however, that you must configure the frame relay interface on the router to use the same header length as the switched network to which it is connected (refer to the Address Length parameter description later in this manual).

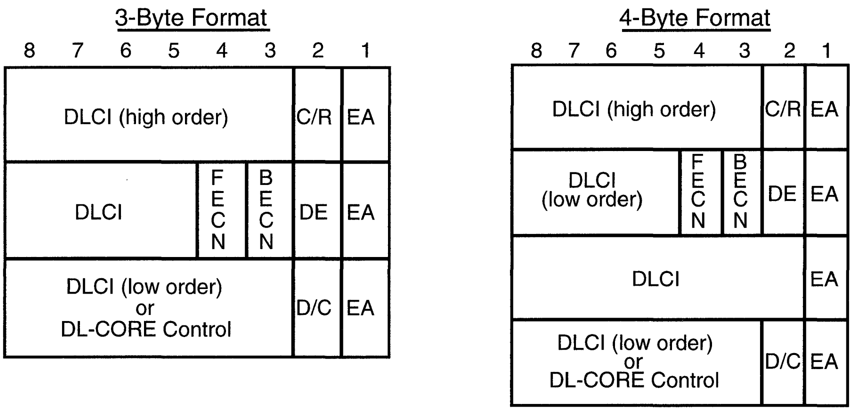

Figure 1-3. Formats for 3- and 4-Byte Headers

Management Protocols

Frame relay is an access protocol that runs between a router (DTE) and a switch (DCE). The router and the switch use the data link control management interface (DLCMI) to exchange information about the interface and the status of each PVC (Figure 1-4).

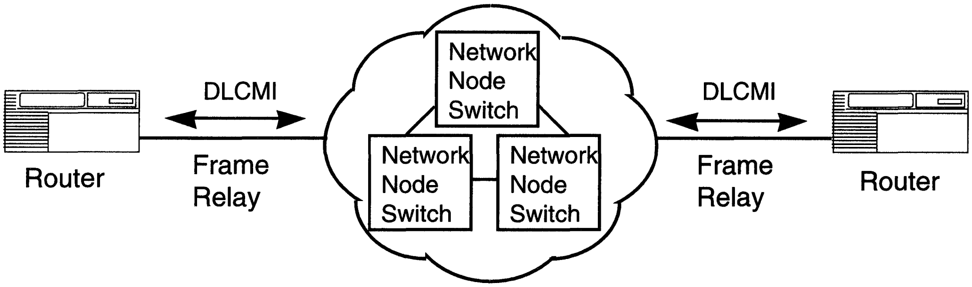

Figure 1-4. Conceptual Drawing of the DLCMI

The DLCMI supports three standard data link management specifications for this exchange of information: LMI, ANSI T1.617 Annex D, and CCITT Q.933 Annex A.

The networking industry first developed the LMI (Local Management Interface) specification. The LMI approach is asymmetric; the router sends a status-enquiry message to the network, signaling that the router's connection to the network is functioning. The network replies with a status response.

ANSI modified the LMI specification and incorporated it as Annex D to ANSI standard T1.617. The ANSI method is generally similar to the LMI approach.

The CCITT modified the ANSI standard and adopted it as Annex A to Q.933. The CCITT Annex A specification is similar to Annex D, but it uses an international numbering scheme.

Be sure to configure the frame relay interface on the router to use the same management protocol as the switched network to which it is connected. (You specify the management protocol in the Mgmnt Type parameter described later in this manual.) If no DLCMI function is available, set the DLCMI to None.

Frame Processing

When a frame enters a frame relay network, the network performs three simple steps to process the data:

1. Verifies the CRC; if an error is indicated, drops the frame.
2. Performs a table lookup for the DLCI; if the DLCI is invalid or unknown, drops the frame.
3. If the frame is valid, forwards it toward its destination.

For More Information about Frame Relay

For more information about the frame relay protocol, consult the following documents:

American National Standards Institute, T1.617-1991. *Integrated Services Digital Network (ISDN) - Digital Subscriber Signalling System No. 1 (DSS1) - Signalling Specification for Frame Relay Bearer Service.* Washington, D.C., June 1991.

— T1.617 Annex D-1991. *Additional Procedures for Permanent Virtual Connections (PVCs) Using Unnumbered Information Frames*. Washington, D.C., June 1991.

— T1.618-1991. *Integrated Services Digital Network (ISDN) - Core Aspects of Frame Protocol with Frame Relay Bearer Service.* Washington, D.C., June 1991.

Bradley, T., Brown, C., and Malis, A. *RFC 1490, Multiprotocol Interconnect over Frame Relay.* Menlo Park, California: Network Information Center (NIC), SRI International, January 1992.

Digital Equipment Corporation et al. *T1S1-Standards based Frame Relay Specification with Common Enhancements.* Document Number 001-208966, Revision 1.0, September 1990.

The following publications provide a less technical introduction to frame relay service:

Davidson, R. and Muller, N. *The Guide to SONET: Planning, Installing & Maintaining Broadband Networks.* New York: Telecom Library, Inc., 1991.

Goldstein, F. *ISDN in Perspective.* Reading, Massachusetts: Addison-Wesley Publishing Company, 1992.

Jennings, E., Jones, T., and Rehbehn, K. *The Buyer's Guide to Frame Relay Networking.* N.p.: Netrix Corporation.

Chapter 2
Implementation Notes

This chapter provides information about the Bay Networks implementation of frame relay.

RFC 1490

RFC 1490 defines the encapsulation method for sending data across a frame relay network. The router implements RFC 1490 for all protocols that it supports over a frame relay network.

Access Modes for Frame Relay Services

An access mode defines how the router views the PVC interface connection to the frame relay network. You can enable each frame relay PVC to function in one of three access modes: *group access, direct access,* and *hybrid access.* PVCs that are part of the same frame relay interface can use different modes. Read the next sections for a description of each access mode.

Group Access

In group access mode, upper-layer protocols treat each frame relay network interface as a single access point to the switched network. The upper-layer protocols use a single network address to send all traffic destined for the switched network to the frame relay network interface. Figure 2-1 illustrates group access (the default).

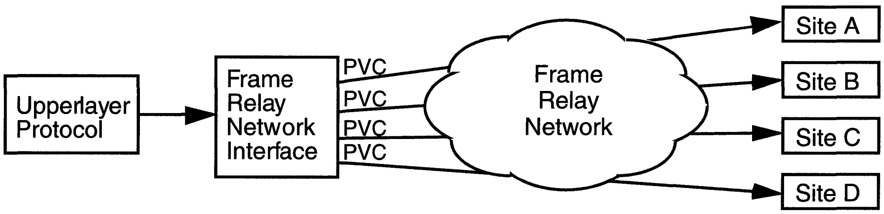

Figure 2-1. Using Group Access Mode

Group access supports all protocols, it simplifies network addressing, and it is the easiest of the three modes to configure, because you only need to define and associate a protocol with the frame relay interface. The DLCMI will dynamically configure PVCs; you do not need to explicitly configure them.

Use group access with the following network configurations:

- A bridged environment for only fully meshed configurations.

  Fully meshed means that there are paths, in this case, PVCs, between each node in the network. If a network is nonmeshed, connections do not exist between every node in the network.

- A bridged hub/spoke environment where the spokes do not need to communicate.

- A nonbridged environment for any configuration where all PVCs can support the same protocols.

In general, group access works best in either fully meshed or nonmeshed environments where there is no need for communication between unconnected systems.

There are, however, ways to configure upper-layer protocols such as IP or IPX to allow systems in nonmeshed networks to fully communicate. For more information about these upper-layer protocols, see the specific protocol manual.

Direct Access

In direct access mode, upper-layer protocols treat the frame relay network as a series of point-to-point connections. The upper-layer protocols view each PVC as an individual network interface.

Direct access mode is best suited to small, nonmeshed configurations; that is, configurations in which each protocol must run over a separate PVC. This mode is also good for spanning tree bridging.

If you use direct access mode, you must configure each PVC manually, which includes assigning protocols to run on each PVC. Figure 2-2 illustrates frame relay direct access.

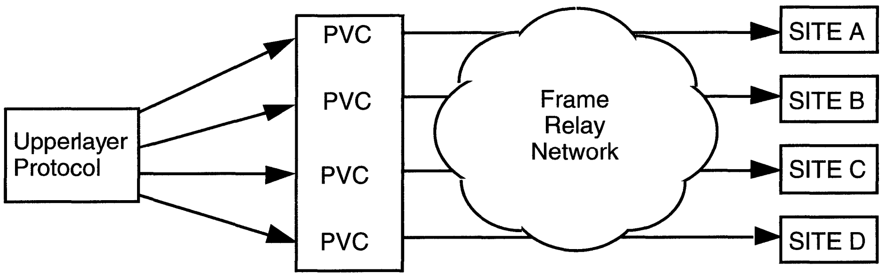

Figure 2-2. Using Direct Access Mode

Direct access mode supports all protocols. A direct access PVC may run several protocols simultaneously. It also enables you to dedicate a PVC to a particular protocol; but it is at the expense of configuration overhead, memory utilization, and wasted address space.

Hybrid Access

Hybrid access mode, as its name implies, combines characteristics of group and direct access modes. It works best for nonmeshed network configurations that use both bridging and routing over a single frame relay interface. This mode is also best for spanning tree bridging.

If your network combines bridging and routing over a single interface, you need to use PVCs in group mode for routing while simultaneously using the same PVCs for bridging. Since group mode does not allow for bridging in nonmeshed environments, you need to use hybrid access mode. This mode allows a PVC to behave as a direct access PVC for bridging while maintaining group access characteristics for routing protocols (see Figure 2-3). For hybrid access mode, configure all PVCs manually.

A hybrid access PVC uses group access for routing, therefore, all the routing protocols you select for the frame relay interface are available for the hybrid PVC. For bridging, the hybrid access circuit is separate from the other interface circuits, so it supports only bridging, spanning tree, source routing, and native mode LAN.

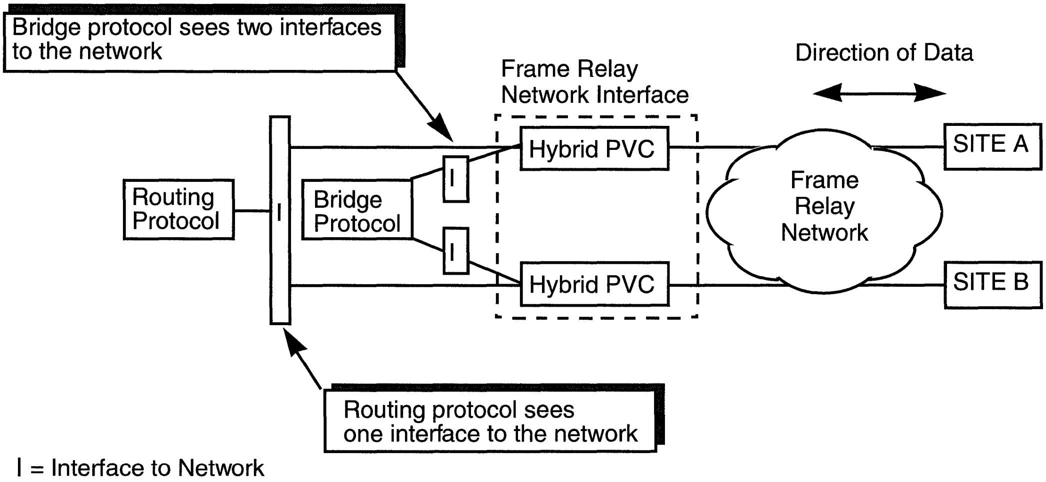

Figure 2-3. Hybrid Access Mode Configuration

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 5 routers, which only run group access mode, with Series 7 or higher routers, which can run in hybrid access mode, this combination may cause problems.

Using Hybrid Access for Transparent Bridging

In Figure 2-4, traffic is bridged between Site A and Site B. The bridge (Router 1) is running on the frame relay interface, and its configuration has the PVCs defined for group access mode.

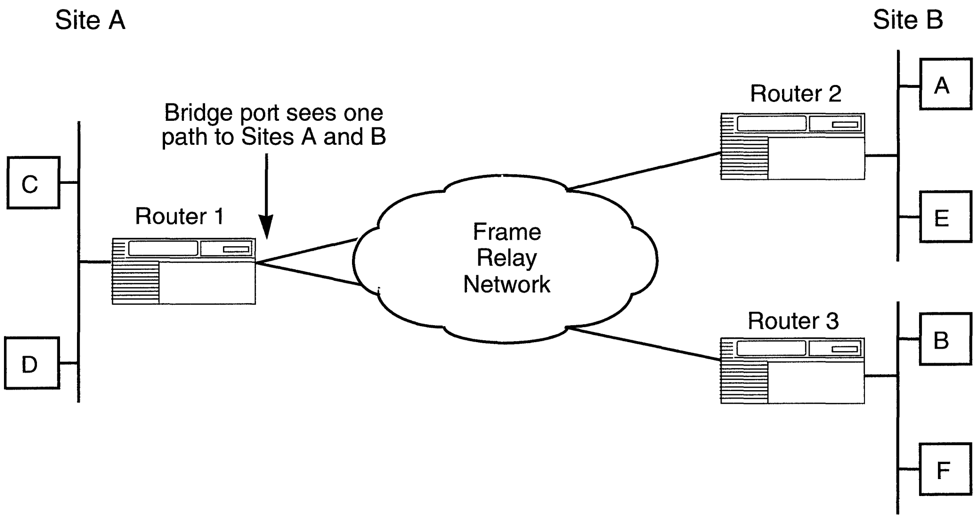

Figure 2-4. Example of a Bridged Network

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 frame relay 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 port from which it just received data, the bridge does not direct the data to Site B. In this example, you should use hybrid access mode.

If you define the PVCs in hybrid access mode (Figure 2-3), each PVC acts as a bridge port. This enables the bridge running on the frame relay 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 sends it out from all ports, including the port that has access to Site B. Therefore, data from Site A can reach Site B.

Using Hybrid Access for Routing

In hybrid access mode, routing protocols view the frame relay interface as group access PVCs, as described in "Group Access" in this chapter.

Protocol Prioritization

When you configure your router, you can prioritize the traffic sent across a synchronous line interface, using a process called *protocol prioritization*. The ability to prioritize traffic is important for an application that is time-sensitive and that requires a fast response.

For example, a user at Router A participating in a Telnet session with Router B requires a more immediate response than does a user at Router A performing a file transfer with Router B.

When you select frame relay on a circuit, the router enables protocol prioritization automatically. It does this because the DLCMI packets must have a higher priority than any other packets you are sending across the network.

For more information about protocol prioritization, see *Configuring Filter Options for Wellfleet Routers.*

Address Resolution

When you configure protocols for each frame relay interface, note that for most protocols, the router performs address resolution automatically. IP, AppleTalk®, and VINES® use the address resolution protocol (ARP).

If you want to reduce broadcast traffic associated with address resolution, you may configure Inverse ARP for IP; however, this is not required. You may also reduce broadcast traffic using static routing and adjacent host configurations at the protocol level. Refer to the appropriate protocol manual for more information about reducing broadcast traffic.

Table 2-1 on the next page shows how each protocol handles address resolution.

Table 2-1. How Protocols Handle Address Resolution

Protocol	Address Resolution	Action
Bridge (including source route)	Automatic	None
IP	Uses ARP or Inverse ARP	None for ARP Configure Inverse ARP
DECnet IV	Automatic	None
VINES	Uses ARP or Inverse ARP	None for ARP Configure Inverse ARP
IPX	Automatic	None
XNS	Automatic	None
AppleTalk	Uses AppleTalk ARP	None
Note: Protocols that support static routes and adjacent hosts may use these to reduce broadcast and address resolution traffic across the network.		

Source Routing

Source routing is the method by which a bridge sends data across two networks. The source routing bridge supports this method of routing over frame relay networks, using RFC 1490 standard frame relay data encapsulation or Bay Networks proprietary frame relay data encapsulation.

If you run source routing in a fully meshed environment, be sure to configure PVCs in group access mode. If you are running source routing in a non-meshed environment, the type of access mode you choose depends on your network. Follow the guidelines for bridging for each access mode to determine which mode is best for source routing, (refer to "Access Modes").

For details on how to configure source routing, refer to *Customizing Bridging Services.*

Multiline

Part of the router's frame relay service is a redundancy multiline feature. Redundancy, in this case, means that if there are two physical lines and one line fails, the other takes over the transmission. Multiline indicates that if both lines are up, the router uses both lines simultaneously. Two or more physical lines must be available for a multiline configuration.

The multiline feature lets you group several lines that back up each other to ensure that information makes it across the network. Figure 2-5 shows a network with two physical lines across the frame relay network.

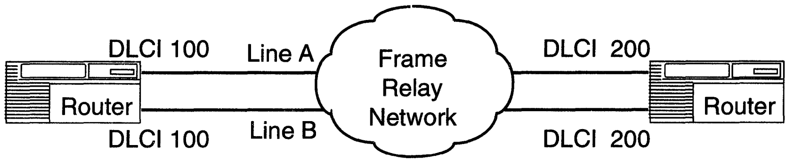

Figure 2-5. Multiline Network

In this example, when the router receives traffic destined for the network, it alternates randomly between Line A or Line B to transmit the data. The router uses both lines, simultaneously, to balance the traffic on each path. If one of these connections goes down, the router uses the remaining line.

You can configure multiline for group and direct access mode PVCs. The most significant part of configuring multiline is how you set a PVC's DLCI number. This number identifies each PVC, thereby identifying a path for the router to direct data to the network. For each frame relay PVC that you configure be certain that PVCs with the same destination have the same DLCI number.

Refer to "Grouping PVCs for Multiline," in Chapter 3, for instructions about grouping PVCs.

Note: If you use multiline, 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.

Congestion Control

Network congestion can degrade network performance. Congestion occurs when a node receives more frames than it can process, or attempts to send more frames than the transmission line can handle. The frame relay network informs the nodes of congestion conditions so that they can reduce the amount of traffic across the network.

To alert nodes of network congestion, the frame relay specification defines two bits in the frame relay packet header that the network sets when there is congestion: FECN (Forward Explicit Congestion Notation) and BECN (Backward Explicit Congestion Notation).

If the network detects congestion, it alerts the router in the same direction as the received frame by changing the frame's FECN bit from 0 to 1. For nodes in the opposite direction of the received frame, it changes the frame's BECN bit from 0 to 1 (see Figure 2-6).

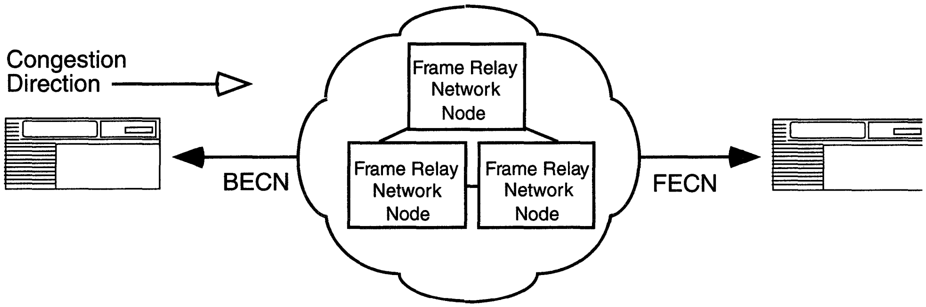

Figure 2-6. Detecting and Controlling Network Congestion

If you enable the congestion control feature, you can specify the number of FECN/BECN bits the router receives in a given time period before it stops transmitting frames. While frames are going across the network, the frame relay interface checks received packets for FECN and BECN bits set to 1. If the interface receives the number of bits during the designated time period that you configure, frame relay drops all traffic destined for the PVC where there is congestion. When the interface no longer receives these congestion notifications, the router resumes transmission.

For example, suppose you set the congestion timer to 0.50 seconds and the congestion count to 3. In this case, if an interface receives 3 FECNs or BECNs within the 0.50 seconds, the node stops sending frames (although it continues to receive frames for this PVC). If the interface receives no FECNs or BECNs during the next 0.50 seconds, the router resumes transmission.

Configuring Synchronous Lines for Frame Relay

If you enable frame relay on a circuit, note that Site Manager automatically sets the following synchronous line parameters:

Parameter	Value
BOFL	Disable
Promiscuous	Enable
Service	Transparent
WAN Protocol	Frame Relay

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

Chapter 3
Editing Frame Relay Parameters

Once you configure a circuit to support frame relay, you can use the Configuration Manager to edit frame relay parameters.

Note: You must have already configured frame relay on the router in order to access and edit the frame relay parameters. If you have *not* yet configured frame relay, see *Configuring Wellfleet Routers* for instructions.

For each frame relay parameter, this chapter provides information about Wellfleetdefault settings, valid parameter options, the parameter function, instructions for setting the parameter, and the Management Information Base (MIB) object ID.

The Technician Interface allows you to modify parameters by issuing **set** and **commit** commands with the MIB object ID. This process is equivalent to modifying parameters using Site Manager. For more information about using the Technician Interface to access the MIB, refer to *Using Technician Interface Software*.

You begin from the Configuration Manager window (Figure 3-1); the first window Site Manager displays when you enter the Configuration Manager.

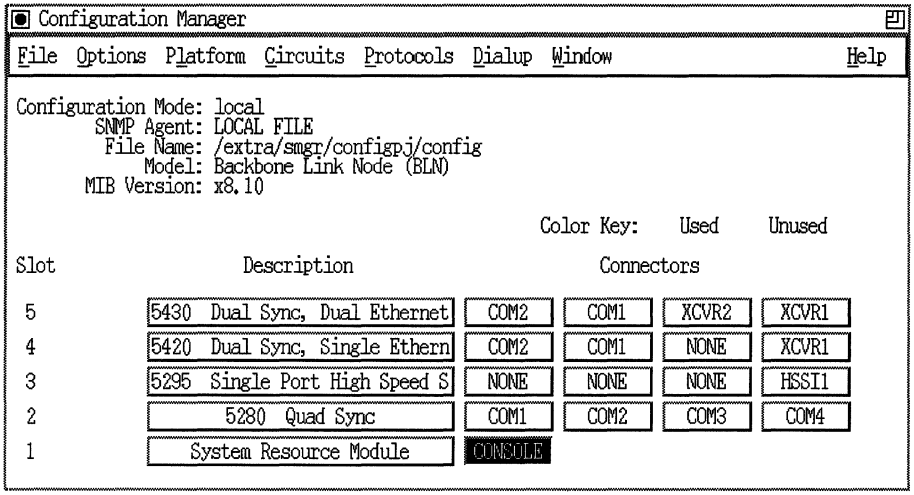

Figure 3-1. Configuration Manager Window

Editing Frame Relay DLCMI Parameters

To edit the frame relay DLCMI parameters, complete the following steps:

1. Select Protocols→Frame Relay→Interfaces from the Configuration Manager window (Figure 3-1). The Frame Relay Interface List window appears (Figure 3-2).

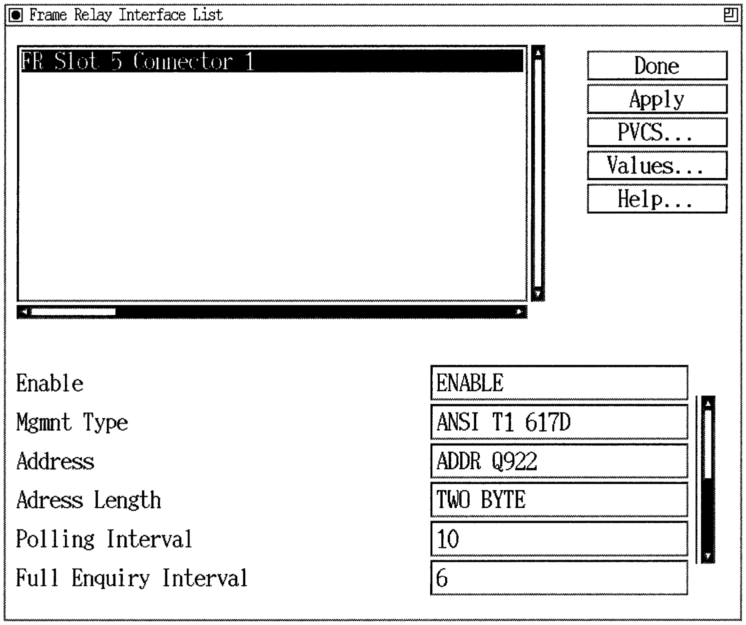

Figure 3-2. Frame Relay Interface List Window

2. Select the interface you want to edit on the Frame Relay Interface List window.
3. Configure the parameters on this screen, referring to the descriptions following this procedure for guidelines.
4. When you finish editing parameters, click on the Apply button.
5. When you finish editing all interfaces, click on the Done button.

Frame Relay DLCMI Parameter Descriptions

Use the following descriptions as guidelines when you configure the parameters on the Frame Relay Interface List window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables frame relay service on this interface.
Instructions:	Set to Disable if you want to disable frame relay service on this interface without deleting it.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.2

Parameter:	**Mgmnt Type**
Default:	ANSI TI.617D
Options:	DLCMI None | Rev 1 LMI | ANSI T1.617D | CCITT Annex A | LMI Switch | Annex D Switch | Annex A Switch
Function:	Specifies the management protocol that either the router and the frame relay network or routers connected back-to-back use to communicate status information. **DLCMI None** provides no management interface between the router and the frame relay network. In the absence of management support, you must configure all PVCs manually.

Rev 1 LMI provides user-side management services as specified by revision 1 of the local management interface standard.

ANSI TI.617D provides user-side management services as specified in Annex D to ANSI standard TI.617-1991.

CCITT Annex A provides user-side management services as specified by the CCITT.

LMI Switch offers limited management services for the DCE side of the connection as specified by revision 1 of the local management interface standard.

Annex D Switch provides limited management services for the DCE side of the connection as specified in Annex D to ANSI standard TI.617-1991.

Annex A Switch provides limited management services for the DCE side of the connection as specified by the CCITT.

Instructions: Select the management protocol for the frame relay network.

Note that the LMI Switch, Annex D Switch, and Annex A Switch options are primarily for troubleshooting.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.9.1.1.6

Note: If you are connecting two routers back to back, use one of the DTE parameter options (Rev 1 LMI, ANSI T1.617D, CCITT Annex A) for the router acting as a DTE, and one of the DCE options (LMI Switch, Annex D Switch, Annex A Switch) for the router acting as the DCE. Be aware, however, that although you can configure the router for the DCE side of a connection, the router cannot act as a full switch, and it does not perform all functions of bidirectional signaling.

Parameter:	**Address**
Default:	Addr Q922
Options:	ADDR Q922 | ADDR Q922 November 90 | ADDR Q922 MARCH 90 | ADDR Q921
Function:	Specifies the DLCI addressing type. ADDR Q922 selects addressing as specified in the final version of the Q.922 standard. Q.922 provides for FECN, BECN, DE, and EA. While most Q.922 addresses are included within a 2-octet field, the standard allows for 3- and 4-octet address fields. The November draft of ADDR Q922 differs from Addr Q922 in dropping the D/C bit from the "extended" (3- and 4-byte) forms. The March draft of ADDR Q922 differs from Addr Q922 in defining an 11-bit DLCI and dropping the DE bit from the second octet of the address field. ADDR Q921 differs from ADDR Q922 MARCH 90 in that it does not use FECNs or BECNs.
Instructions:	Select the addressing type for the frame relay network.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.8

Parameter:	**Address Length**
Default:	2-Byte
Options:	2-byte | 3-byte | 4-byte
Function:	Specifies the length of the frame relay address field.
Instructions:	Select the address length for the address field. This must match what the network specifies.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.9

Note: The length of this field determines the range of valid numbers for the DLCI ID set in the PVC List screen. See the DLCI parameter description for more details.

Parameter:	**Polling Interval**
Default:	10 seconds
Options:	5 to 30 seconds
Function:	Specifies the interval between Status Enquiry messages transmitted by the router. Status Enquiry messages cause a network response in the form of a Link Integrity Verification message or Full Status message. Successful completion of the request/response "handshake" verifies the status of the router/frame relay network link.
Instructions:	We recommend that you accept the default value, 10 seconds. If the default value does not match what the network requests, enter a value in the range of 5 to 30 seconds that is appropriate for your network.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.10

Note: Polling Interval is nonfunctional if you set Mgmnt Type to DLCMI None.

Parameter:	**Full Inquiry Interval**
Default:	6
Options:	1 to 255 polling intervals
Function:	Specifies the interval between Full Status Inquiry messages transmitted by the router. Full Status Inquiry messages cause a network response in the form of a Full Status Report message, which lists all PVCs, the PVC status (active or inactive), and whether the PVC is new or previously established. This field works in conjunction with the Polling Interval field. The default, 6, tells the router to send a Full Status Inquiry every 6 polling intervals. For example, with a Polling Interval of 10 and a Full Inquiry Interval of 6, the router transmits a Full Status Inquiry every 60 seconds; with a Polling Interval of 20 and a Full Inquiry Interval of 30, the router transmits a Full Status Inquiry every 10 minutes (600 seconds).
Instructions:	Enter a value in the range of 1 to 255, according to what the network dictates.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.11

Note: Full Inquiry Interval is nonfunctional if you set Mgmnt Type to DLCMI None.

Parameter: **Error Threshold**

Default: 3

Options: Any value

Function: The router uses the value in this field to establish a criterion that evaluates the quality of the router/ frame relay network connection. The value in this field works with the value in the Monitored Events parameter to check the network connection.

Specifically, Error Threshold determines the number of faulty status messages required to bring the connection down. The Monitored Events parameter specifies the number of status message exchanges. For more details, see the description of the Monitored Events parameter.

If you accept the default values for both Error Threshold and Monitored Events, 3 status exchange errors out of a sequence of 4 attempted exchanges will bring the connection down. With Error Threshold set to 5 and Monitored Events set to 10, 5 status exchange errors during a continuous sequence of 10 attempted exchanges will bring the connection down.

After the network clears the connection, status exchanges continue, and the router monitors line integrity. When the number of consecutive, successful status exchanges is equal to the Error Threshold value, the router restores the frame relay connection.

Instructions: Enter the number of faulty status exchanges that will bring the connection down.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.9.1.1.12

Note: Error Threshold and Monitored Events are nonfunctional if you set Mgmnt Type to DLCMI None.

Parameter: **Monitored Events**

Default: 4

Options: Any value

Function: The router uses the value in this field to establish a criterion that evaluates the quality of the router/ frame relay network connection. The value in this field works with the value in the Error Threshold parameter to check the network connection. Refer to the description of the Error Threshold parameter for more information.

Instructions: Enter the number of consecutive status exchanges to monitor.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.9.1.1.13

Parameter: **Multicast**

Default: Enable

Options: Enable | Disable

Function: Enables or disables support for frame relay multicast service.

Instructions: Set to Enable if your frame relay subscription service provides multicast service, and if this frame relay interface should receive multicast messages.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.9.1.1.16

Parameter:	**Congestion Control**
Default:	Disable
Options:	Enable | Disable
Function:	Enables or disables congestion control on this interface.
Instructions:	Set to Enable to activate congestion control. This value tells the router to drop all outbound traffic destined for a PVC where congestion is occurring until the congestion clears. The setting you select for this parameter affects all PVCs that you do not individually configure.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.22

Parameter:	**Congestion Timer**
Default:	1 second
Options:	0.5 to 5 seconds, in 0.5-second intervals
Function:	Sets the length of time during which the router counts congestion notifications. This is also the length of time during which the interface must not receive congestion notifications before it resumes transmitting.
Instructions:	Specify the length of the congestion timer. The greater the interval, the slower the router may be to detect congestion, resulting in long transmission delays once the congestion has cleared. A greater interval, however, may be less likely to stop transmission for an intermittent congestion condition. The setting you select for this parameter affects all PVCs that you do not individually configure.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.23

Parameter:	**Congestion Counter**
Default:	20
Options:	1 to 500 notifications
Function:	Sets the number of congestion notifications that the router receives during the Congestion Timer period before the router stops transmitting.
Instructions:	Specify the congestion count. The smaller the number, the more quickly the router will detect congestion and stop transmitting. The setting you select for this parameter affects all PVCs that you do not individually configure.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.24

Configuring PVCs

By default, you can configure frame relay PVCs to operate in group access mode. Group access mode (refer to Chapter 2) is self configuring as long as you are running a user-side management protocol–for example, Rev 1 LMI.

If you do not want PVCs to run according to the group access defaults, you must configure PVCs manually. The following list includes situations that require you to manually configure PVCs.

- Group access mode without the defaults
- Group access mode without a management protocol
- A frame relay topology as a group of point-to-point connections (direct access mode)
- Bridged traffic in hybrid mode

The next sections describe how to add PVCs, edit PVC parameters, group PVCs to run in multipath mode, and delete PVCs.

Adding PVCs

To add a PVC, complete the following steps:

1. From the Configuration Manager window (Figure 3-1), select Protocols→Frame Relay→Interfaces to display the Frame Relay Interface List window (Figure 3-2).
2. Click on the PVCs button to display the Frame Relay PVC List window (Figure 3-3).

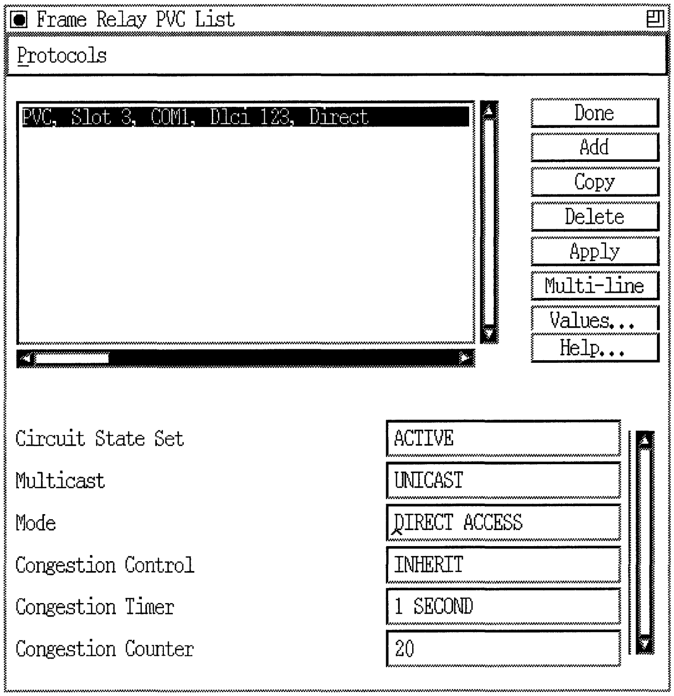

Figure 3-3. Frame Relay PVC List Window

3. To copy an existing PVC configuration, select that PVC and click the Copy button.

   If you are running PVCs in direct or hybrid access mode, the copy function duplicates all the PVC information including all the protocols for the PVC, but the function does not configure the protocols. You must reconfigure each protocol in the newly copied configuration.

If you want to start with the default configuration, click the Add button. (Whether you use Copy or Add, you can always change the configuration of the PVC later.) The Frame Relay Virtual Circuit window appears (Figure 3-4).

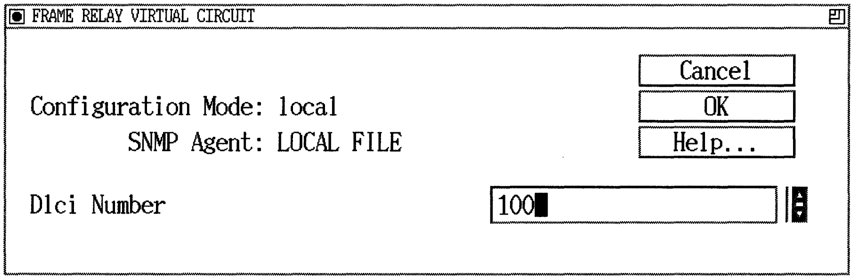

Figure 3-4. Frame Relay Virtual Circuit Window

4. Enter the DLCI number, in decimal format, that you want to use for the PVC (refer to the parameter description after this procedure for valid entries). This value must match the DLCI number the switch provider assigns.
5. Click on the OK button to return to the Frame Relay PVC List window (Figure 3-3).
6. If you want to change the configuration of the PVC you just added, complete the procedure described in "Editing PVC Configuration Parameters."

Parameter:	**DLCI Number**
Default:	None
Options:	Valid range changes based on the frame relay address length as follows:

Address Length	Range
2 Byte	16-1007
3 Byte	1024-64511
4 Byte	131072-8257535

Function:	This number is the PVC identification number that the frame relay network uses to direct data.
Instructions:	Enter a decimal number within the valid range.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.2.1.5

Editing PVC Configuration Parameters

To change the PVC configuration parameters, complete the next steps. (If you have just completed the procedure described in the section "Adding PVCs," skip to Step 3.)

1. From the Configuration Manager window (Figure 3-1), select Protocols→Frame Relay→Interfaces to display the Frame Relay Interface List window (Figure 3-2).
2. Click on the PVCs button to display the Frame Relay PVC List window (Figure 3-3).
3. Select the PVC you want to configure by clicking on the entry.
4. Assign values to the configuration parameters, referring to the descriptions following this procedure for guidelines.
5. Click on the Apply button to save your changes.

   If you configure the PVC to run in hybrid or direct access mode, once you apply the change, the Configuration Manager automatically displays the Select Protocols window (Figure 3-5) and places a Protocols button in the top-left corner of the window.

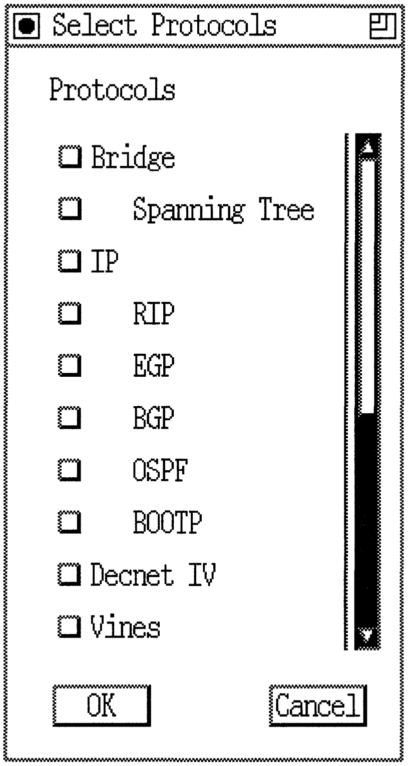

Figure 3-5. Select Protocols Window

Note: To see the complete list of protocols, scroll through the entire Select Protocols screen.

6. Select a protocol or protocols to be carried on this PVC and click on the OK button.

   To display a list of existing protocols for that PVC as well as to add other protocols to the PVC, click on the Protocols button at the top left corner of the Frame Relay PVC List window (Figure 3-3).

7. For each protocol you select, the Configuration Manager displays a protocol-specific configuration window, requesting required

information. Fill in the necessary information. If you need help to complete any screens, consult the appropriate protocol section of *Configuring Wellfleet Routers*.

8. When you finish choosing protocols, the Configuration Manager returns you to the Frame Relay PVC List window (Figure 3-3).

Note: If you configure the PVC for hybrid mode, Site Manager lists only Bridge, Spanning Tree, Source Routing, and Native Mode LAN on the Select Protocols window. We strongly recommend that you enable spanning tree on all hybrid access PVCs so that the router detects loops in the network.

9. Click on the Apply button to complete the modification of this PVC.

PVC Configuration Parameter Descriptions

Use the following descriptions as guidelines when you configure the parameters on the Frame Relay PVC List window.

Parameter:	**Circuit State Set**
Default:	Invalid
Options:	Invalid | Active | Inactive
Function:	Specifies the state of the PVC.
Instructions:	Set to Active to indicate that the PVC is available for use. Set to Inactive to indicate that the PVC is configured, but not available for use. Use the Inactive state when you purchase a PVC from your switch provider, and there is a delay prior to your provider actually activating the PVC. Choose Invalid if the PVC is configured, but the switch is unaware of it.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.2.1.7

Parameter:	**Multicast**
Default:	Unicast
Options:	Unicast | Multicast
Function:	Indicates if this PVC is multicast or unicast.
Instructions:	Set to unicast or multicast according to PVC type, as the frame relay switch provider instructs.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.2.1.19

Parameter:	**Mode**
Default:	Group Access
Options:	Group Access | Direct Access | Hybrid Access
Function:	Specifies the network access mode. See Chapter 2 for a description of each mode.
Instructions:	Specify the mode for the PVC.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.2.1.24

Parameter:	**Congestion Control**
Default:	Inherit
Options:	Disable | Enable | Inherit
Function:	Enables or disables congestion control on this interface.
Instructions:	Set to Enable to activate congestion control. This value tells the router to drop all traffic destined for a congested PVC until the congestion clears. Set to Inherit if you want the Congestion Control setting for this PVC to match the setting you specify for Congestion Control under the DLCMI parameters.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.2.1.25

Parameter:	**Congestion Timer**
Default:	1 second
Options:	0.5 to 5 seconds, in 0.5-second intervals
Function:	Sets the length of time during which the router counts congestion notifications. This is also the length of time during which the interface must not receive congestion notifications before it resumes transmitting.
Instructions:	Specify the length of the congestion timer. The greater the interval, the slower the router may be to detect congestion, resulting in long transmission delays once the congestion clears. A greater interval, however, may be less likely to stop transmission for an intermittent congestion condition. The setting you select for this parameter affects all PVCs that you do not individually configure. Note, however, that if you set the Congestion Control parameter to Inherit, the PVC uses the DLCMI parameter for congestion control, not the value in this field.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.2.1.27

Parameter:	**Congestion Counter**
Default:	20
Options:	1 to 500 notifications
Function:	Sets the number of congestion notifications that the router receives during the Congestion Timer period before it stops transmitting.
Instructions:	Specify the congestion count. The smaller the number, the more quickly the router detects congestion and stops transmitting. Note, however, that if you set the Congestion Control parameter to Inherit, the PVC uses the DLCMI parameter for congestion control, not the value in this field.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.2.1.28

Grouping PVCs for Multiline

You can configure two or more PVCs to run in multiline mode (see Chapter 2, "Implementation Notes"). You must configure PVCs that you group for multiline so that they are on different router connectors, have the same DLCI numbers, and use either direct or group access mode.

To group PVCs, complete the following steps:

1. From the Configuration Manager window (Figure 3-1), select Protocols→Frame Relay→Interfaces to display the Frame Relay Interface List window (Figure 3-2).
2. Click on the PVCs button to display the Frame Relay PVC List window (Figure 3-3).
3. Select one of the PVCs you want to run in multiline mode.

4. Click on the Multiline button to display the window in Figure 3-6. This window displays all PVCs that you can group with the previously selected PVCs.

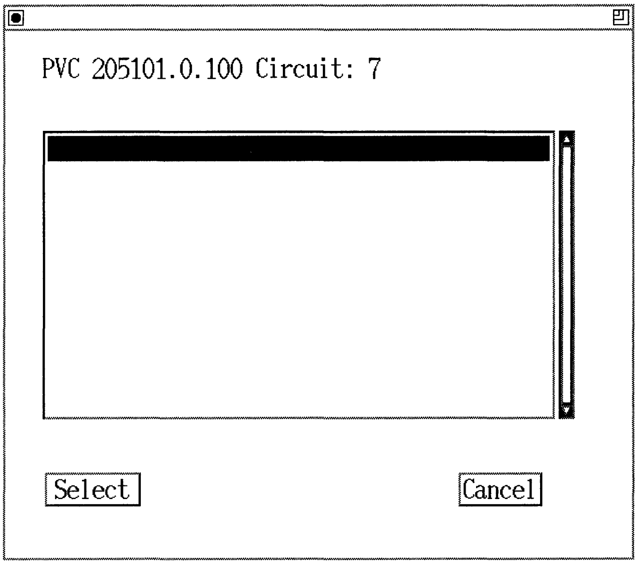

Figure 3-6. Multiline Window

5. Select another PVC that you want to group with the PVC you select on the previous screen.
6. Click on the Select button to return to the Frame Relay PVC List window.
7. Repeat this procedure until you configure all PVCs that you want to run in multiline mode.

Deleting PVCs

To delete a PVC, complete the following steps:

1. From the Configuration Manager window (Figure 3-1), select Protocols→Frame Relay→Interfaces to display the Frame Relay Interface List window (Figure 3-2).
2. Click on the PVCs button to display the Frame Relay 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 OK to delete the PVC.

After you delete a PVC, it may reappear on the list of active PVCs if the switch provider does not delete it. As soon as the switch provider removes the PVC, Site Manager dynamically deletes the PVC from the list.

If the switch provider deletes a PVC that you manually configure, the circuit state is set to Invalid, and the PVC remains unused until you delete it from the interface.

Deleting Frame Relay from the Router

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

1. From the Configuration Manager window (Figure 3-1), select Protocols→Frame Relay→Delete Frame Relay. A window prompts:

   ```
   Do you REALLY want to delete Frame Relay?
   ```

2. Click on the OK button.

   Site Manager returns you to the Configuration Manager window. Frame relay is no longer operating on the router.

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