Configuring Frame Relay Services

Router Software Version 10.0
Site Manager Software Version 4.0

Software Version BNX 6.0
Site Manager Software Version BNX 6.0

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Bay Networks

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About This Guide

If you are responsible for configuring and managing Bay Networks routers or BNX platforms, read this guide to discover how to customize Bay Networks router software for Frame Relay.

Configuring Frame Relay Services offers

- An overview of the Frame Relay protocol (Chapter 1)
- Implementation notes that may affect how you configure Frame Relay (Chapter 2)
- Instructions on enabling Frame Relay on the router (Chapter 3)
- Instructions on editing the Frame Relay interface and PVC parameters (Chapter 4)

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- The *System Suite* includes IP routing, 802.1 Transparent Bridge, Source Route Bridge, Translation Bridge, SNMP Agent, Bay Networks HDLC, PPP, OSPF, EGP, BGP, and basic DLSw.
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Written for system and network managers, this guide describes how to configure the Bay Networks implementation of Frame Relay interfaces to suit your environment.

We assume that you have experience with LANs and WANs, Frame Relay, and network management tasks.

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Conventions

This section describes the conventions used in this guide.

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.
bold text	Indicates text that you need to enter and command names in text. Example: Use the **dinfo** command.
brackets ([ ])	Indicate optional elements. You can choose none, one, or all of the options.

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.
`screen text`	Indicates data that appears on the screen. Example: `Set Bay Networks Trap Monitor Filters`
ellipsis points	Horizontal (. . .) and vertical (⋮) ellipsis points indicate omitted information.
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.

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Acronyms

ANSI	American National Standards Institute
ARP	Address Resolution Protocol
ATM	Asynchronous Transfer Mode
BECN	Backward Explicit Congestion Notification
BOFL	Breath of Life (message)
C/R	Command/Response bit
CRC	Cyclic Redundancy Check
DCE	data communications equipment
DE	Discard Eligibility
DLCI	data link connection identifier
DLCMI	data link control management interface
DTE	data terminal equipment
EA	Extended Address Bit
FECN	Forward Explicit Congestion Notification
IP	Internet Protocol
IPX	Internet Packet Exchange
ITU-T	International Telecommunications Union–Telecommunication Standardization Sector
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, packet-switching WAN protocol that enables the interconnection of geographically dispersed LANs. Frame Relay is usually offered by a public network provider; however, private organizations can own and manage their own Frame Relay networks as well.

Frame Relay is a connection-oriented protocol, which means that it relies on an existing end-to-end path between devices connected across the network. It implements these connections using *permanent virtual circuits (PVCs).*

A PVC is a logical path that the network provides to connect two devices. This path between the source and destination point is a dedicated connection, so the PVC is always available to the connected devices. Since many PVCs can coexist, devices can share the bandwidth of the transmission line.

Figure 1-1 illustrates a Frame Relay network.

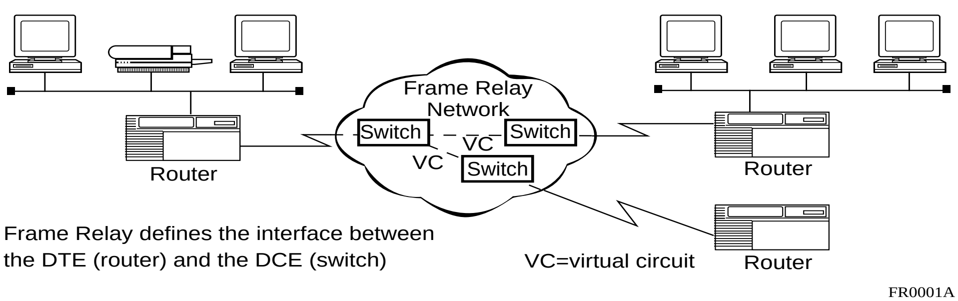

Figure 1-1. Frame Relay Network

Frame Relay assumes that networks use transmission lines with low error rates such as digital transmission media. Consequently, Frame Relay provides only basic error detection with no error recovery. This minimizes the processing required for each packet, allowing Frame Relay networks to operate at higher speeds with fewer network delays.

Because Frame Relay performs only basic error checking, endstations running upper-layer protocols such as Internet Protocol (IP) are responsible for resending packets that did not transmit correctly the first time.

Frame Relay Packets

Figure 1-2 illustrates the structure of a Frame Relay packet. The packet's header field includes the following:

- **Data Link Connection Identifier (DLCI)**

  The DLCI is the permanent virtual circuit (PVC) identification number. The Frame Relay network uses the DLCI to direct basic data flow.

- **Command/Response bit (C/R)**

  ITU-T (formerly CCITT) standards do not use 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 transmitting them to the Frame Relay network.

- **Extended Address bit (EA)**

  The EA bit signals whether the next byte is part of the address. This bit indicates the last byte of the DLCI.

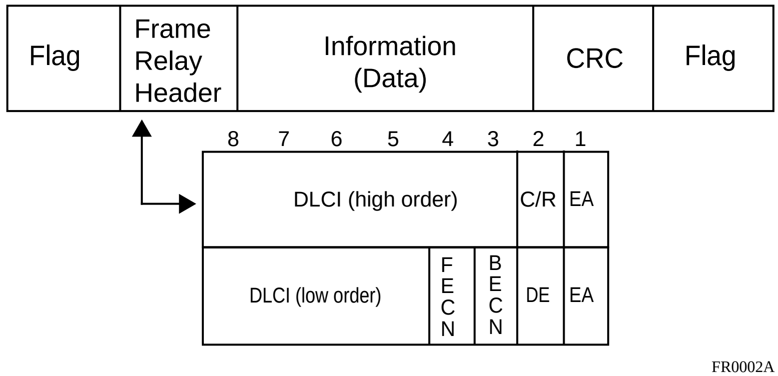

Figure 1-2. Frame Relay Header, 2-Byte Format

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.

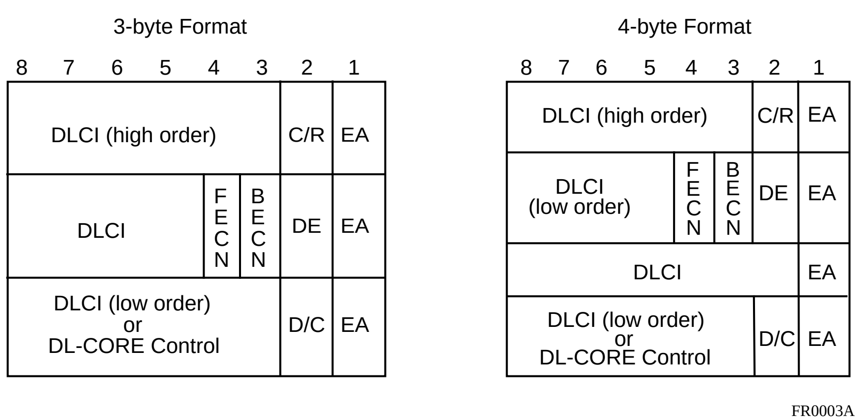

Figure 1-3. Frame Relay Header, 3- and 4-Byte Formats

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).

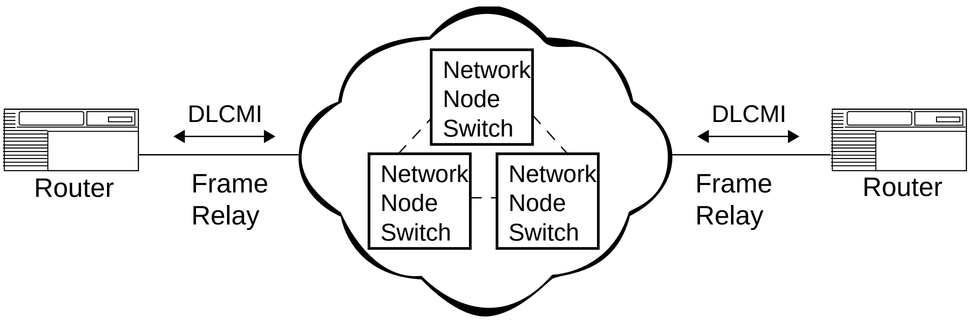

Figure 1-4. Conceptual Drawing of the DLCMI

The DLCMI supports three standard data link management specifications: LMI, ANSI T1.617 Annex D, and CCITT (now ITU-T) Q.933 Annex A.

- The networking industry first developed the Local Management Interface (LMI) 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 (now ITU-T) 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. See Chapter 4 for information about configuring Frame Relay.

Frame Processing

When a frame enters a Frame Relay network, the network performs three steps to process the data:

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

For More Information about Frame Relay

For more information about Frame Relay, 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:

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.

Access Modes for Frame Relay

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,* or *hybrid access.* PVCs that are part of the same Frame Relay interface can use different modes. This section describes each access mode.

To understand the access modes, you need to know whether the network is fully meshed or non-fully meshed (Figure 2-1).

- In a *fully meshed* network, PVCs exist between each pair of nodes in the network.
- In a *non-fully meshed* network, PVCs exist only between nodes that need to communicate.

The type of network configuration determines the best access mode for your application.

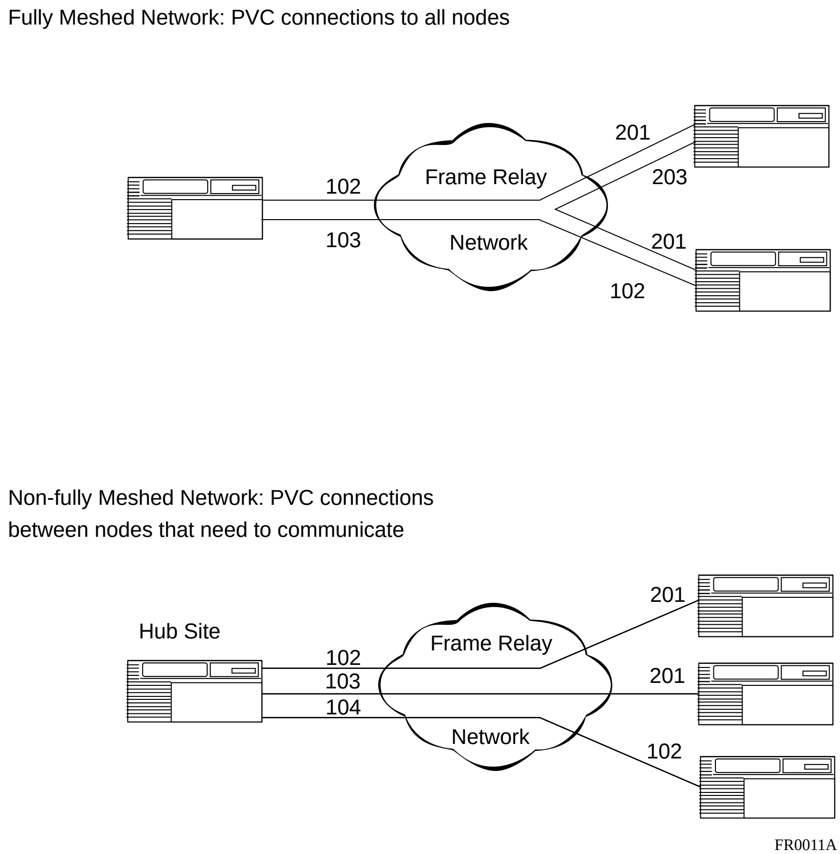

Figure 2-1. Fully Meshed and Non-fully Meshed Networks

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. When you configure each router, you assign only one network address, for example an IP or IPX address, to the Frame Relay interface, not to each PVC. Figure 2-2 illustrates group access (the default).

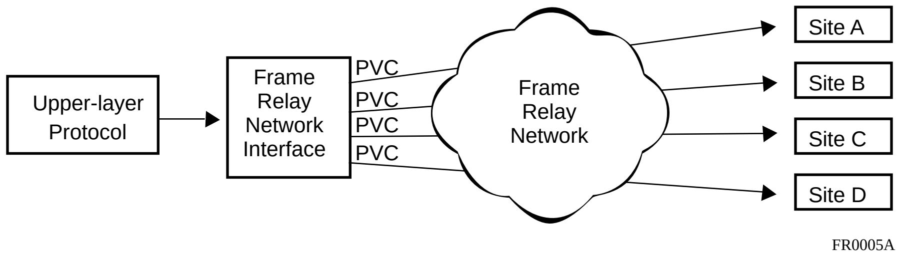

Figure 2-2. Group Access Mode Configuration

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

Use group access mode with the following network configurations:

- A routed environment for any network where all PVCs can support the same protocols
- A bridged environment for fully meshed networks
- A bridged hub and spoke environment where the spokes do not need to communicate with each other

In general, group access mode works best for fully meshed networks; however, it can also be used for non-fully meshed networks, for example, hub and spoke networks. In these types of networks, the remote site may only be able to communicate with the hub.

There are ways to configure upper-layer protocols such as IP or IPX to allow nodes in non-fully meshed 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, non-fully meshed configurations. Specifically, you can use direct access mode for 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 2-3 illustrates Frame Relay direct access mode.

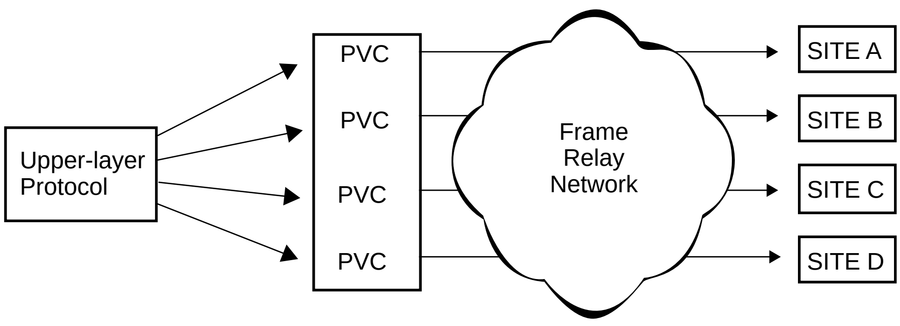

Figure 2-3. Direct Access Mode Configuration

Direct access mode supports all protocols. A direct access PVC may run several protocols simultaneously, or you can dedicate a PVC to a particular protocol. Note, however, that dedicating a PVC to a particular protocol creates configuration overhead, increased memory use, and additional address space.

Hybrid Access

Hybrid access mode, as its name implies, combines characteristics of group and direct access modes. It works only for non-fully meshed 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 access mode for routing while simultaneously using the same PVCs for bridging. Since group access mode does not allow for bridging in non-fully meshed environments, you need to use hybrid access mode.

This mode allows a PVC to function as a direct access PVC for bridging while maintaining group access characteristics for routing protocols (Figure 2-4). You must manually configure any PVC that requires hybrid access mode.

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.

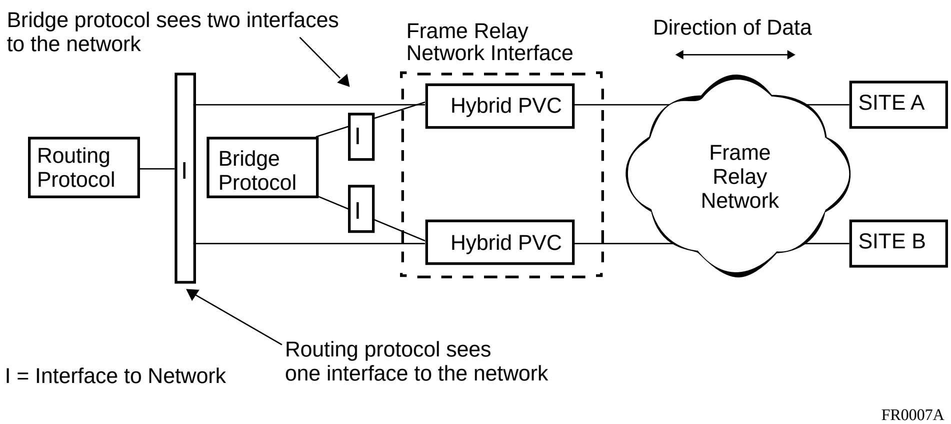

Figure 2-4. Hybrid Access Mode Configuration

Before you configure hybrid access on your router, evaluate the types of routers 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 2-5, 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.

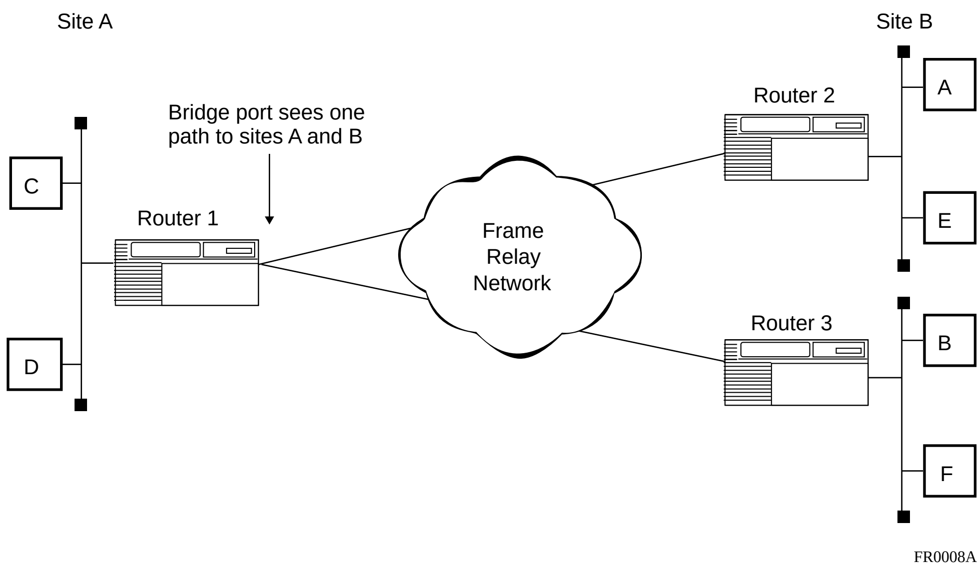

Figure 2-5. Example of a Bridged Network

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 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 2-4), each PVC acts as a separate 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.

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.

Protocol Prioritization

When you configure a router, you can set priorities for 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.

Note: *Protocol prioritization is not supported by BNX software.*

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 Traffic Filters and Protocol Prioritization.*

Address Resolution

Address resolution maps a remote network address such as an IP address to a local DLCI number. For most protocols that you configure for a Frame Relay interface, the router performs address resolution automatically. However, IP, AppleTalk, and VINES use the address resolution protocol (ARP). ARP dynamically generates an ARP table of addresses and DLCI numbers by sending messages back and forth to each network node to gather address information. This process increases broadcast traffic across the network.

To reduce broadcast traffic for all protocols, you can configure static routes and adjacent hosts at the protocol level. This eliminates the need for the router to perform address resolution. To reduce traffic associated specifically with IP and VINES address resolution, you can configure the address resolution protocol Inverse ARP. Refer to the appropriate protocol manual for more information about static routes, adjacent hosts, and Inverse ARP.

Table 2-1 lists how the router handles address resolution for each protocol and whether or not you can reduce broadcast traffic by modifying the address resolution configuration.

Table 2-1. How Protocols Handle Address Resolution

Protocol	How Router Performs Address Resolution	Configuration Requirements
Bridge including source route	Automatic	None
IP	ARP or Inverse ARP	None for ARP Configure Inverse ARP
DECnet IV	Automatic	None
VINES	ARP or Inverse ARP	None for ARP Configure Inverse ARP
IPX	Automatic	None

(continued)

Table 2-1. How Protocols Handle Address Resolution *(continued)*

Protocol	How Router Performs Address Resolution	Configuration Requirements
XNS	Automatic	None
AppleTalk	AppleTalk ARP	None

Data Compression over Frame Relay

You can configure the Bay Networks proprietary data compression protocol, WCP, over wide area networks running Frame Relay.

Enabling compression improves bandwidth efficiency by eliminating redundant strings in data streams. This, in turn, improves network response times and yields line-cost savings.

For a complete discussion of data compression, see *Configuring Data Compression Services*.

Source Routing

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

If you enable source routing in a fully meshed environment, be sure to configure PVCs in group access mode. If you enable source routing in a non-fully meshed environment, the type of access mode you choose depends on your network. To determine which access mode is best for source routing, refer to "Access Modes for Frame Relay."

To configure source routing, refer to *Configuring Bridging Services*.

Multiline

Frame Relay provides a redundancy multiline feature. The multiline feature lets you group two or more physical lines that back each other up in case of a failure. This ensures that information arrives at its destination on the network. In addition, if both lines are up, the router uses both lines simultaneously. Two or more physical lines must be available for a multiline configuration. Figure 2-6 illustrates a multiline configuration.

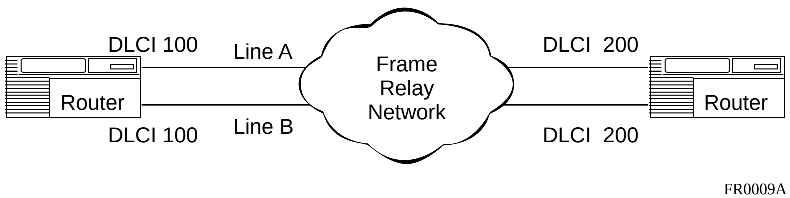

Figure 2-6. Multiline Network

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

You can configure multiline for group access mode and direct access mode PVCs. The most important 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.

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

Refer to Chapter 4 for instructions about grouping PVCs for multiline.

Traffic Distribution between Data Paths

To distribute traffic between multiline data paths, you can use one of two methods:

- Random
- Address-based

Random Distribution

Random distribution means that as the router sends out each packet, it alternates between the lines. This option determines which line the packet uses based on a randomly assigned number. For each outbound packet, the router generates a random number, and this number designates the line to use.

Random balancing evenly distributes traffic and lets the router use the two lines efficiently. Because packets travel on different paths, they arrive at the destination out of sequence, and the upper-layer protocols, for example, IP and OSI, have to resequence the information. Some protocols cannot tolerate packets arriving out of sequence, so be sure this option is appropriate for your application.

Address-based Distribution

Address-based distribution, as the name implies, determines the data path for outbound traffic based on the source and destination address in each packet. For any given address pair, the same path is always used.

The router determines whether to route or bridge the packet, and then uses the appropriate address. It uses the routing-level addresses for routing traffic, and the MAC-level addresses for bridging traffic.

Address-based distribution ensures that all outbound traffic travels on the same path, and that the packets arrive in sequence. For protocols that cannot receive packets out of sequence, use this method. Note, however, that this option does not always distribute the traffic evenly across each line.

Congestion Control

Network congestion can degrade network performance. Congestion occurs when a node receives more frames than it can process, or sends 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.

In the Frame Relay packet header, there are two bits that the network sets to alert nodes of network congestion. These bits, as defined by the Frame Relay specification, are the FECN (Forward Explicit Congestion Notation) bit and the BECN (Backward Explicit Congestion Notation) bit.

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 (Figure 2-7).

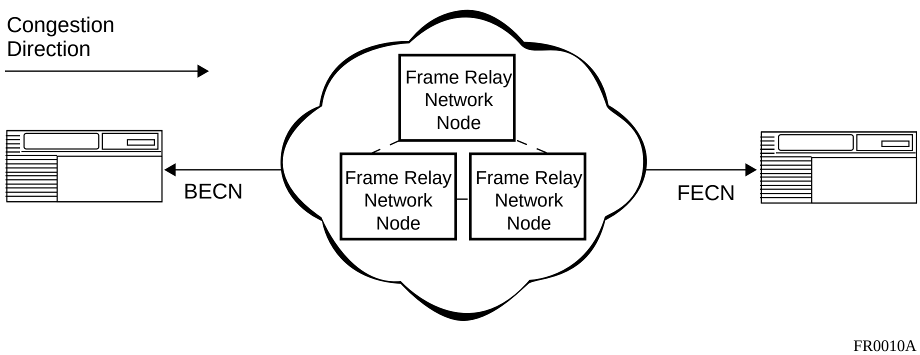

Figure 2-7. Detecting and Controlling Network Congestion

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 specified number of bits during the designated time period, 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 0.5 seconds and the congestion count to 3. In this case, if an interface receives 3 FECNs or BECNs within 0.5 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 0.5 seconds, the router resumes transmission. Refer to Chapter 4 for instructions on configuring the congestion parameters.

Configuring Synchronous Lines for Frame Relay

If you enable Frame Relay on a circuit, Site Manager automatically sets the following synchronous line parameters (Table 2-2):

Table 2-2. Synchronous Line Parameters for Frame Relay

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

For more information on these parameters, refer to *Configuring Routers* or *Configuring Customer Access and Trunks (BNX Software)*, depending on the type of installed software.

Chapter 3
Enabling Frame Relay

This chapter describes how to enable Frame Relay. It assumes you have read *Configuring Routers* or *Configuring Customer Access and Trunks (BNX Software)*, depending on the type of installed software that you have

1. Opened a configuration file
2. Specified router hardware if this is a local mode configuration file
3. Selected the link or net module connector on which you are enabling Frame Relay

When you enable Frame Relay service, you do not have to configure any Frame Relay parameters. The Configuration Manager supplies default values for all Frame Relay parameters. To edit these default values, refer to Chapter 4.

Enabling Frame Relay on an Interface

To enable Frame Relay on an interface, complete the following steps:

1. **From the Configuration Manager window, select a link or net module connector that requires a WAN circuit (Figure 3-1).**

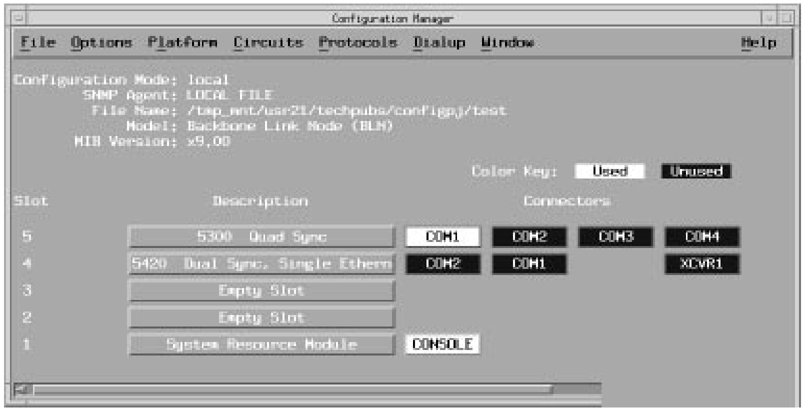

Figure 3-1. Configuration Manager Window

The Configuration Manager displays the WAN Protocols menu (Figure 3-2).

Figure 3-2. WAN Protocols Menu

2. **Select Frame Relay.**

   When running routing software, protocol prioritization is enabled automatically when you select Frame Relay. For detailed information on protocol prioritization, refer to *Configuring Traffic Filters and Protocol Prioritization.*

3. **Click on OK to enable Frame Relay.**

   The Configuration Manager displays the Select Protocols window. Go to the appropriate protocol-specific guide for information on enabling the protocols you want to run on this interface.

Chapter 4
Editing Frame Relay Parameters

Once you configure a circuit with Frame Relay, you can use the Configuration Manager to edit Frame Relay parameters.

Note: *You must first configure Frame Relay on the router before you can access and edit the Frame Relay parameters. If you have not yet configured Frame Relay, for instructions see* Configuring Routers *or* Configuring Customer Access and Trunks (BNX Software), *depending on the type of installed software.*

Using the MIB Object ID

For each parameter, this chapter includes default settings, valid parameter options, 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*.

Caution: *The Technician Interface does not verify that the value you enter for a parameter is valid. Entering an invalid value can corrupt your configuration.*

Editing Frame Relay DLCMI Parameters

To edit Frame Relay DLCMI parameters, begin at the Configuration Manager window (Figure 4-1); this is the first window that appears when you open a configuration file.

Figure 4-1. Configuration Manager Window

From the Configuration Manager, complete the following steps:

1. **Select Protocols→Frame Relay→Interfaces from the Configuration Manager window (Figure 4-1).**

   The Frame Relay Interface List window appears (Figure 4-2).

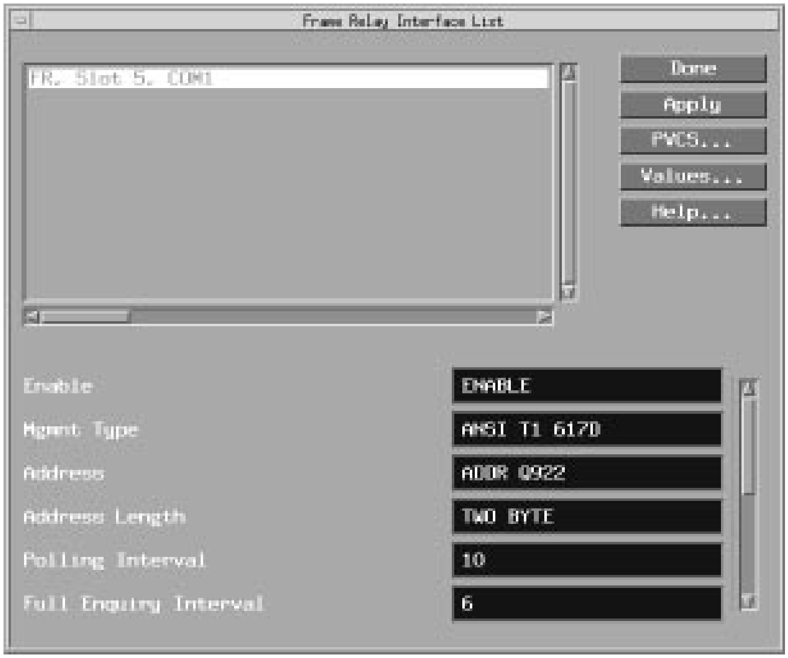

Figure 4-2. Frame Relay Interface List Window

2. **Select the interface that you want to edit from the scroll list.**
3. **Modify the parameters, referring to the descriptions that follow this procedure.**
4. **When you finish editing parameters, click on Apply.**
5. **When you finish editing all interfaces, click on Done.**

Frame Relay Interface Parameters

Use the following descriptions as guidelines when you edit 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 port.
Instructions:	Set to Disable if you want to disable Frame Relay service on this interface without deleting it. Set to Enable to re-enable Frame Relay service, if you previously disabled it.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.2

Parameter:	**Mgmnt Type**
Default:	ANSI T1.617D
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 the router and the Frame Relay network use to communicate status information. Routers connected back to back also use a management protocol to exchange 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 T1.617D** provides user-side management services as specified in Annex D to ANSI standard T1.617-1991.

CCITT Annex A provides user-side management services as specified by the ITU-T (formerly 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 T1.617-1991.

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

Instructions: Select the management protocol for the Frame Relay network. 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

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. Although you can configure the router for the DCE side of a connection, the router cannot act as a full switch, and it will not perform complete 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 bits. 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 interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.8

Parameter:	**Address Length**
Default:	Two Byte
Options:	Two Byte | Three Byte | Four 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 number set in the Frame Relay PVC List window. See the DLCI Number parameter description for more details.*

Parameter:	**Polling Interval**
Default:	10 seconds
Range:	5 to 30 seconds
Function:	Specifies the interval between Status Inquiry messages that the router transmits. Status Inquiry 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 that is appropriate for your network in the range of 5 to 30 seconds. Polling Interval does not function if you set the Mgmnt Type parameter to DLCMI None.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.10

Parameter:	**Full Enquiry Interval**
Default:	6
Range:	1 to 255 polling intervals
Function:	Specifies the interval between Full Status Inquiry messages that the router transmits. Full Status Inquiry messages cause the network to send 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 parameter works with the Polling Interval parameter. The default value, 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 Enquiry Interval of 6, the router transmits a Full Status Inquiry every 60 seconds; with a Polling Interval of 20 and a Full Enquiry Interval of 30, the router transmits a Full Status Inquiry every 10 minutes (600 seconds).
Instructions:	Enter a value between 1 and 255, according to what the network dictates. Full Enquiry Interval does not function if you set the Mgmnt Type parameter to DLCMI None.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.11

Parameter: **Error Threshold**

Default: 3

Range: 0 to 2,147,483,647

Function: Together with the value of the Monitored Events parameter, establishes a criterion used to evaluate the quality of the router/Frame Relay network connection.

The Error Threshold parameter determines the number of faulty status messages required to bring the connection down. The Monitored Events parameter specifies the number of status message exchanges.

If you accept the default values for both Error Threshold and Monitored Events, three status exchange errors in a sequence of four attempted exchanges will bring the connection down. With Error Threshold set to 5 and Monitored Events set to 10, five status exchange errors in a continuous sequence of ten 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
Range:	0 to 2,147,483,647
Function:	Together with the value of the Error Threshold parameter, establishes a criterion used to evaluate the quality of the router/Frame Relay network connection. Refer to the description of the Error Threshold parameter for more information.
Instructions:	Enter the number of consecutive status exchanges you want the router to monitor.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.9.1.1.13

Parameter:	**Multicast**
Default:	Disable
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 value of 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

Range: 0.5 to 5 seconds, in 0.5-second intervals

Function: Specifies the length of time during which the router counts congestion notifications. If the router receives the number of congestion notifications set by the Congestion Counter parameter, the router stops transmitting data. The router resumes transmission once it stops receiving congestion notifications.

Instructions: Set the length of time the router should count congestion notifications from the network. If you set this parameter for a long time period, the router may be less likely to stop transmission for an intermittent congestion condition. However, the router may be slow to detect congestion, resulting in long transmission delays once the congestion has cleared. The value of 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 notifications

Range: 1 to 500 notifications

Function: Indicates the maximum number of congestion notifications that the router can receive during the Congestion Timer period before it stops transmitting. If the router reaches the value set by this parameter, it determines the line is congested and stops transmitting.

Instructions: Specify the congestion count. The smaller the number, the more quickly the router detects congestion and stops transmitting. The value of 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, Frame Relay PVCs operate in group access mode. Group access mode is self-configuring as long as you are running a user-side management protocol — for example, Rev 1 LMI. Refer to Chapter 2 for more information about group access mode.

If you do not want PVCs to use group access defaults, you must configure them 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 configured as a group of point-to-point connections (direct access mode)
- Bridged traffic in hybrid mode

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

Adding PVCs

To add a PVC or copy an existing PVC, complete the following steps:

1. **Begin at the Configuration Manager window (Figure 4-1).**
2. **Select Protocols→Frame Relay→Interfaces to display the Frame Relay Interface List window (Figure 4-2).**
3. **Click on PVCs to display the Frame Relay PVC List window (Figure 4-3).**

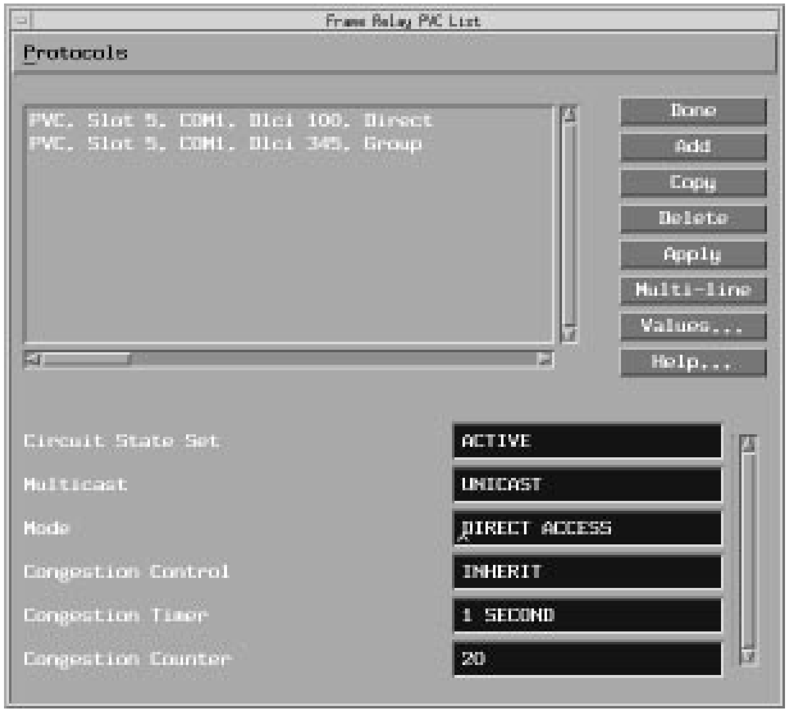

Figure 4-3. Frame Relay PVC List Window

4. **To start with the default PVC configuration, click on Add. To copy an existing PVC configuration, select that PVC and click on Copy.**

   If you are copying a group mode PVC, the Frame Relay Virtual Circuit window appears as shown in Figure 4-4. If you are copying a direct or hybrid mode PVC, the Frame Relay Virtual Circuit window appears as shown in Figure 4-5. Whether you use Copy or Add, you can always change the configuration of the PVC later.

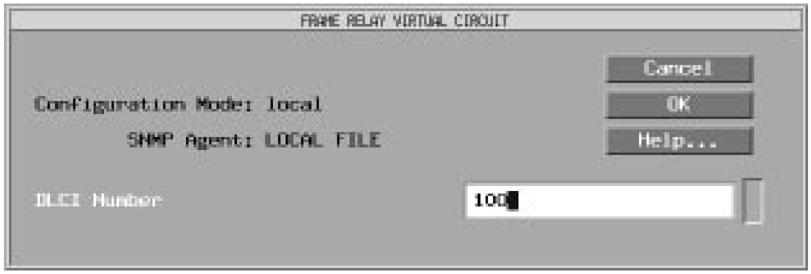

Figure 4-4. Frame Relay Virtual Circuit Window (Group Mode)

Figure 4-5. Frame Relay Virtual Circuit Window (Direct/Hybrid Mode)

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

5. **Enter the DLCI number, in decimal format, for the PVC.**

   Refer to the parameter description after this procedure for guidelines. This value must match the DLCI number the Frame Relay switch provider assigns.

6. **Select a value for the Enable Multi-line parameter. (Refer to Chapter 2 for information about multiline.)**

7. **Click on OK to return to the Frame Relay PVC List window (Figure 4-3).**

8. **To change the configuration of the PVC you just added, complete the procedure described in "Editing PVC Configuration Parameters" on page 4-15.**

Parameter: **DLCI Number**

Default: None

Options: The Frame Relay switch provider assigns DLC I numbers. These assigned numbers are valid options.

Valid DLCI numbers vary based on the Frame Relay address length. The DLCI numbers that the switch provider assigns are generally in the following ranges:

Address Length	DLCI Number
2 byte	16 to 1007
3 byte	1024 to 64511
4 byte	131072 to 8257535

Function: Specifies the PVC identification number that the Frame Relay network uses to direct data. If you are running IP over Frame Relay, the router uses this number as the MAC address for an adjacent host. Refer to *Configuring IP Services* for more information about adjacent hosts.

Instructions: Enter the decimal number that the Frame Relay provider assigns.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.9.2.1.4

Parameter:	**Enable Multi-line**
Default:	No
Options:	Yes | No
Function:	Allows you to enable the multiline feature for this PVC. You can then make this PVC part of a multiline group. See "Grouping PVCs for Multiline" on page 4-21 for more information about the multiline feature.
Instructions:	Select Yes if you want this PVC to be part of a multiline group.
MIB Object ID:	None

Editing PVC Configuration Parameters

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

1. **Begin at the Configuration Manager window (Figure 4-1).**
2. **Select Protocols→Frame Relay→Interfaces to display the Frame Relay Interface List window (Figure 4-2).**
3. **Click on PVCs to display the Frame Relay PVC List window (Figure 4-3).**
4. **Select the PVC you want to modify by clicking on it in the list.**
5. **Edit the configuration parameters you need to change, referring to the descriptions following this procedure.**
6. **Click on Apply to save your changes.**

PVC Configuration Parameters

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

Parameter:	**Circuit State Set**
Default:	Active
Options:	Invalid | Active | Inactive
Function:	Specifies the state of the PVC.
Instructions:	Set to Active to indicate to a Frame Relay switch that the PVC is available for use. Set to Inactive to indicate that the PVC is configured, but not available for use, for example, before your switch provider actually activates 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 whether 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 | Hybrid Access | Direct 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 in the Frame Relay Interface List window.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.9.2.1.25

Parameter: **Congestion Timer**

Default: 1 second

Range: 0.5 to 5 seconds, in 0.5-second intervals

Function: Specifies the length of time during which the router counts congestion notifications. If the router receives the number of congestion notifications set by the Congestion Counter parameter, the router stops transmitting data. The router resumes transmission once it stops receiving congestion notifications.

Instructions: Set the length of time the router should count congestion notifications from the network. If you set this parameter for a long time period, the router may be less likely to stop transmission for an intermittent congestion condition. However, the router may be slow to detect congestion, resulting in long transmission delays once the congestion has cleared.

The value of 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 of this parameter.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.9.2.1.27

Parameter: **Congestion Counter**

Default: 20 notifications

Range: 1 to 500 notifications

Function: Sets the maximum number of congestion notifications that the router can receive 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 of this parameter.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.9.2.1.28

Selecting Protocols for Direct or Hybrid Mode PVCs

If you set the Mode parameter in the Frame Relay PVC List window to direct or hybrid access and then click on Apply, the Configuration Manager displays the Select Protocols window (Figure 4-6). Also, the Configuration Manager adds a Protocols button in the top-left corner of the window (Figure 4-3).

Figure 4-6. Select Protocols Window

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

To select protocols for direct access and hybrid access PVCs, follow these steps:

1. **Click on Protocols→Add/Delete in the Frame Relay PVC List window (Figure 4-3).**

   The Configuration Manager displays the Select Protocols window with the currently enabled protocols for that PVC selected. You can also choose other protocols from this list to add to the PVC.

2. **Select one or more protocols to be carried on this PVC and click on OK.**

   For hybrid access PVCs, the Configuration Manager lists only those protocols shown in Figure 4-7. We strongly recommend that you enable spanning tree on all hybrid access PVCs so that the router detects loops in the network.

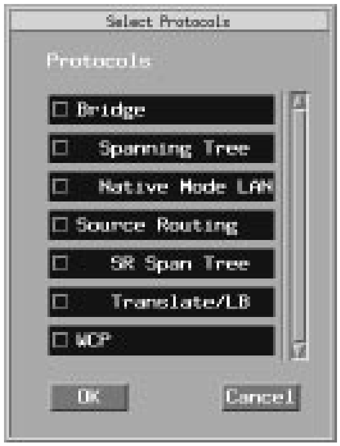

Figure 4-7. Protocols Menu for Hybrid Access PVCs

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

3. **Fill in the necessary information in the protocol configuration window. Consult the appropriate protocol manual for help.**

   When you finish configuring protocols, the Configuration Manager returns you to the Frame Relay PVC List window (Figure 4-3).

4. **Click on Apply to complete the modification of this PVC.**

Grouping PVCs for Multiline

You can configure two or more PVCs to run in multiline mode (refer to Chapter 2 for more information). PVCs that you group for multiline must

- Be on different router connectors
- Have the same DLCI numbers
- Use either direct or group access mode

To group PVCs, complete the following steps:

1. **Begin at the Configuration Manager window (Figure 4-1).**
2. **Select Protocols→Frame Relay→Interfaces to display the Frame Relay Interface List window (Figure 4-2).**
3. **Click on PVCs to display the Frame Relay PVC List window (Figure 4-3).**
4. **Select one of the PVCs you want to run in multiline mode.**
5. **Click on Multi-line to display the window in Figure 4-8. This window displays all PVCs that you can group with the previously selected PVC.**

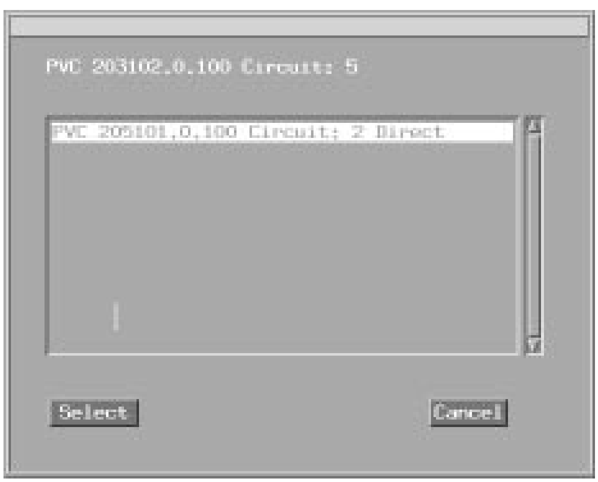

Figure 4-8. Multiline Window

6. **Select a PVC from the scroll list that you want to group with the first PVC you selected.**
7. **Click on Select to return to the Frame Relay PVC List window.**

   The Configuration Manager displays the window in Figure 4-9.

Figure 4-9. Data Path Chooser Window

8. **Enter the traffic distribution method, referring to the parameter description.**
9. **Repeat this procedure until you group all the PVCs that you want to configure in a multiline group.**

Data Path Chooser Parameter

Parameter:	**Data Path Chooser**
Default:	None
Options:	Random | Address Based
Function:	Specifies how the multiline circuit distributes traffic over its data paths.
Instructions:	Select Random to send data alternately over the two paths. This method ensures even distribution among the lines, but the packets arrive out of sequence. Select Address Based if the traffic between the same source and destination address pair is always going over the same data path. This method ensures the data arrives in sequence.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.1.1.23

Deleting PVCs

To delete a PVC, complete the following steps:

1. **From the Configuration Manager window (Figure 4-1), select Protocols→Frame Relay→Interfaces.**

   The Configuration Manager displays the Frame Relay Interface List window (Figure 4-2).

2. **Click on PVCs to display the Frame Relay PVC List window (Figure 4-3).**
3. **Select the PVC you want to delete.**
4. **Click on Delete.**

   The Configuration 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, the Configuration Manager dynamically deletes the PVC from the list.

If the switch provider deletes a PVC that you manually configured, 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 4-1), select Protocols→Frame Relay→Delete Frame Relay.**

   A window prompts

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

2. **Click on OK.**

The Configuration Manager returns you to the Configuration Manager window. Frame Relay is no longer operating on the router.

Appendix A
Configuration Examples

This appendix provides examples for configuring AppleTalk, DECnet, IP, IPX, and OSPF over a Frame Relay network. It lists the parameters that you modify to accommodate the following:

- A non-fully meshed Frame Relay network using group access mode
- A fully meshed Frame Relay network using group access mode
- A non-fully and fully meshed network using direct access mode

We assume that you are familiar with the configuration procedures for Frame Relay interfaces. Refer to Chapter 4 for more information about configuration.

Non-Fully Meshed Configuration

Figure A-1 shows the Frame Relay portion of the network as a non-fully meshed configuration using group access mode PVCs and one direct access mode PVC.

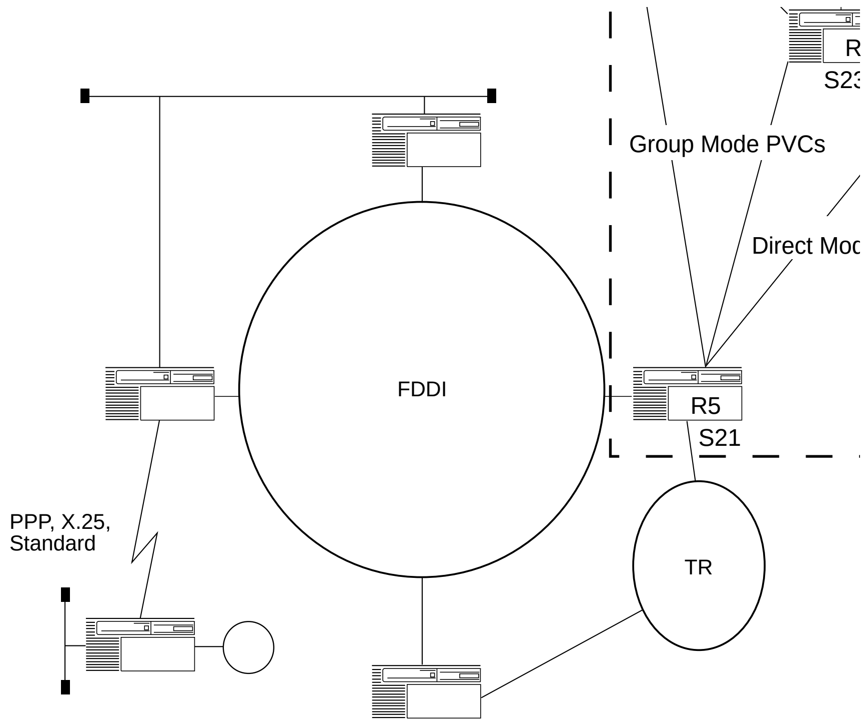

Figure A-1. Non-Fully Meshed Frame Relay Network

For this type of configuration, accept all the default values for the Frame Relay parameters no matter which protocol you configure over Frame Relay.

Fully Meshed Configuration

Figure A-2 shows the Frame Relay portion of the network as a fully meshed configuration using group access mode PVCs and one direct access mode PVC.

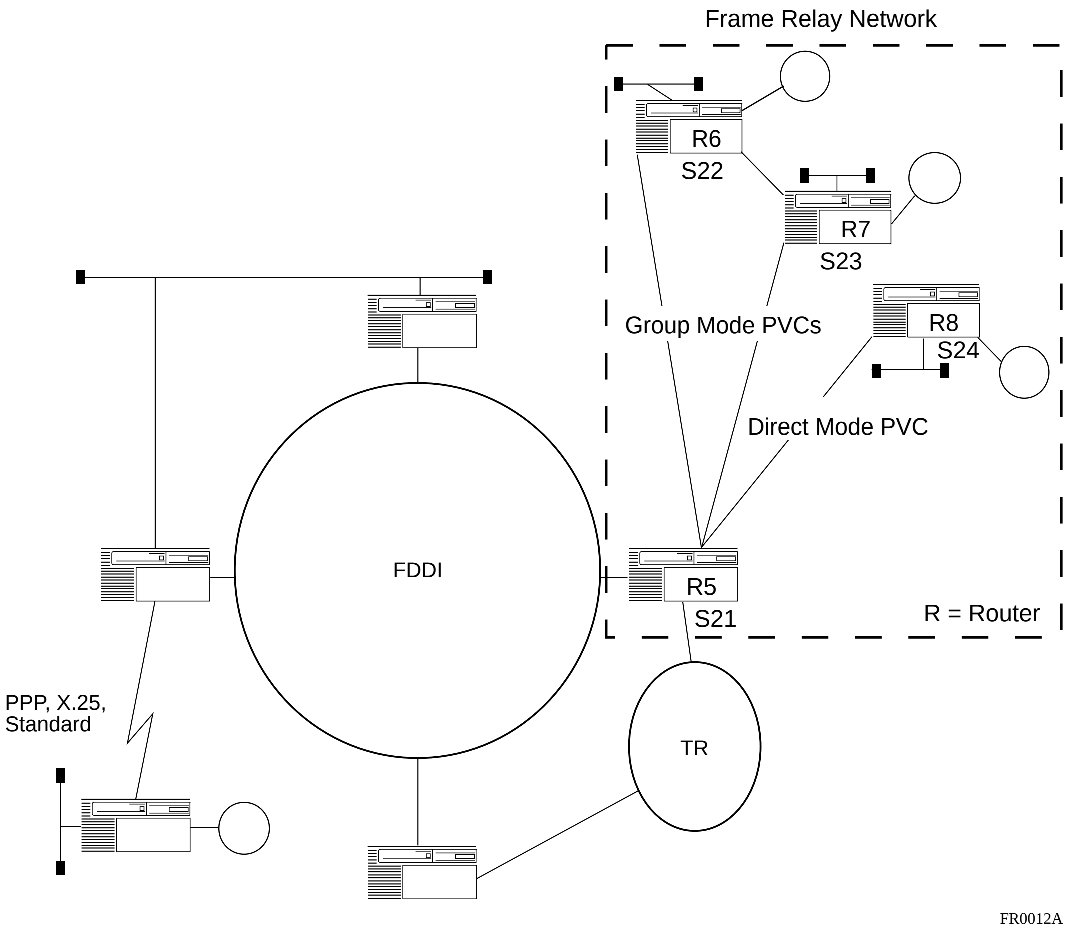

Figure A-2. Fully Meshed Frame Relay Network

For this type of configuration, accept all the default values for the Frame Relay parameters no matter which protocol you configure over Frame Relay.

Configuring Protocols for Each Type of Network

For AppleTalk, DECnet, IP, IPX, and OSPF, you must modify a few parameters for the non-fully meshed and fully meshed networks previously illustrated.

Select and edit these protocols after you configure a synchronous (COM) interface for Frame Relay. Refer to *Configuring Routers* or *Configuring Customer Access and Trunks (BNX Software)*, depending on the type of installed software, for more information about setting up an interface.

The following tables list configuration changes for each protocol running over the Frame Relay networks. These changes apply only to Routers 5, 6, and 7. Refer to the appropriate protocol manual for information about each protocol.

Note: *The tables list only parameters whose default settings you need to change.*

AppleTalk Configuration

Tables A-1 and A-2 list the AppleTalk parameters that you must edit for each interface.

Table A-1. AppleTalk Parameters for Routers 5, 6, and 7

Values for Seed Router Only			
Parameter Name	**S21**	**S22**	**S23**
Enable	Enable	Enable	Enable
Network Start	100	100	100
Network End	100	100	100
Default Zone	FR (case sensitive)	FR (case sensitive)	FR (case sensitive)
Values for Non-Seed Router only			
Parameter Name	**S21**	**S22**	**S23**
Enable	Enable	Enable	Enable

Table A-2. IP Adjacent Hosts for Routers 6 and 7 (Non-Fully Meshed Only)

Parameter Name	S22	S23
IP Address	66.66.66.7	66.66.66.6
Next Hop Interface Address	66.66.66.8	66.66.66.7
Next Hop Interface Mask	255.255.255.0	255.255.255.0
MAC Address	DLCI Number of adjacent host	DLCI Number of adjacent host
Host Encapsulation	SNAP	SNAP

Note: *You do not configure adjacent hosts for a fully meshed network.*

DECnet Configuration

Table A-3 lists the DECnet parameters that you must edit for each interface.

Table A-3. DECnet Parameters for Routers 5, 6, and 7

Parameter Name	S21	S22	S23
Area ID	2	2	2
Node ID	1	2	3

IP Configuration

Table A-4 lists the IP parameters that you must edit for each interface.

Table A-4. IP Parameters for Routers 5, 6, and 7

Parameter Name	S21	S22	S23
IP Address	66.66.66.5	66.66.66.6	66.66.66.7
Subnet Mask	255.255.255.0	255.255.255.0	255.255.255.0
RIP Parameter			
Poised Reverse	Actual	Poisoned	Poisoned

For non-fully meshed configurations only: Changing the hub router's (Router 5) Poisoned Reverse parameter from **poisoned** to **actual** allows you to configure adjacent hosts for each spoke router (Routers 6 and 7). By configuring adjacent hosts, one spoke router can ping the other spoke router through the hub router. Only the hub router's RIP interface changes; the RIP interface for each end node remains the same. Refer to *Configuring IP Services* for more information about RIP interfaces.

IPX Configuration

Table A-5 lists the IPX parameters that you must edit for each interface.

Table A-5. IPX Parameters for Routers 5, 6, and 7

Parameter Name	S21	S22	S23
Network Address (hex)	a12345	a12345	a12345

OSPF Configuration

Table A-6 lists the OSPF parameters that you must edit for each interface.

Table A-6. OSPF Parameters for Routers 5, 6, and 7

Parameter Name	S21	S22	S23
OSPF Area	4.0.0.0	4.0.0.0	4.0.0.0
Type	Point-to-Multipoint	Point-to-Multipoint	Point-to-Multipoint
AS Boundary Router[1]	Yes	Yes	Yes

[1] Changing the AS Boundary Router parameter to **Yes** enables the router to recognize any interfaces that are not configured for OSPF.

➡ **Note:** *Adjacent hosts are unnecessary for OSPF.*

Configuring the Group Mode PVCs

Once you have configured the protocols, your next step is to configure the parameters for the two group mode PVCs. Refer to Chapter 4 for instructions on adding PVCs.

Table A-7 lists the Frame Relay interface parameter that you must set for group mode PVCs.

Table A-7. Interface Parameter for Routers 5, 6, and 7

Parameter Name	S21, S22, and S23
Mgmnt Type	Select the management protocol supplied by your Frame Relay provider.

After setting the management protocol, go to the Frame Relay PVC List window (refer to Figure 4-3) to see a listing of PVCs.

Table A-8 lists the Frame Relay Virtual Circuit parameter that you must configure.

Table A-8. Virtual Circuit Parameter for Routers 5, 6, and 7

Parameter Name	S21, S22, and S23
DLCI Number	Enter the number supplied by your Frame Relay provider.

Once you enter the DLCI Number, you can exit from the Frame Relay Virtual Circuit window. The router automatically configures these PVCs in group mode, the default access mode.

Configuring the Direct Mode PVC

In both Frame Relay network illustrations, there is a direct mode PVC connecting Router 5 and Router 8.

The synchronous interface for Router 5 is already configured for Frame Relay. Your next step is to configure the PVC connecting Routers 5 and 8 for direct access mode and then configure the protocols for the PVC.

Refer to Chapter 4 for instructions on adding PVCs.

Table A-9 lists the Frame Relay interface parameter that you must set for direct mode PVCs.

Table A-9. Interface Parameter for Routers 5 and 8

Parameter Name	S21 and S24
Mgmnt Type	Select the management protocol supplied by your Frame Relay provider.

After setting the management protocol, go to the Frame Relay PVC List window (refer to Figure 4-3) to see a listing of PVCs. If you are running in dynamic mode and the switch is connected, Site Manager automatically displays a list of PVCs. In this case, highlight the PVC that you want to set for direct access. If you are working in local mode, you add the PVCs manually and then configure direct access. This example assumes that you have to add the PVC to the list.

Table A-10 lists the Frame Relay Virtual Circuit parameter that you must configure for the direct mode PVC.

Table A-10. Virtual Circuit Parameter for Routers 5 and 8

Parameter Name	S21 and S24
DLCI Number	Enter the number supplied by your Frame Relay provider.

To configure the PVC between Router 5 and Router 8 as a direct mode PVC, change the following Frame Relay PVC List parameter (Table A-11).

Table A-11. Frame Relay PVC List Parameter for Routers 5 and 8

Parameter Name	S21	S24
Mode	Direct Access	Direct Access

Once you add the direct mode PVC, Site Manager prompts you to select protocols for that PVC. Tables A-12 through A-16 list the parameters for AppleTalk, DECnet, IP with RIP, IPX, and OSPF running over the direct mode PVC.

AppleTalk Configuration

Table A-12 lists the AppleTalk parameters that you must edit for each interface.

Table A-12. AppleTalk Parameters for Routers 5 and 8

Values for Seed Router Only		
Parameter Name	**S21**	**S24**
Enable	Enable	Enable
Network Start	200	200
Network End	200	200
Default Zone	FR_Direct (case sensitive)	FR_Direct (case sensitive)
Values for Non-Seed Router Only		
Parameter Name	**S21**	**S24**
Enable	Enable	Not applicable

DECnet Configuration

Table A-13 lists the DECnet parameters that you must edit for each interface.

Table A-13. DECnet Parameters for Routers 5 and 8

Parameter Name	S21	S24
Area ID	3	3
Node ID	1	1

IP Configuration

Table A-14 lists the IP parameters that you must edit for each interface.

Table A-14. IP Parameters for Routers 5 and 8

Parameter Name	S21	S24
IP Address	191.33.50.5	191.33.50.8
Subnet Mask	255.255.255.0	255.255.255.0

IPX Configuration

Table A-15 lists the IPX parameters that you must edit for each interface.

Table A-15. IPX Parameters for Routers 5 and 8

Parameter Name	S21	S24
Network Address (hex)	b12345	b12345

OSPF Configuration

Table A-16 lists the OSPF parameters that you must edit for each interface.

Table A-16. OSPF Parameters for Routers 5 and 8

Parameter Name	S21	S24
OSPF Area	4.0.0.0	4.0.0.0
AS Boundary Router	Yes	Yes

Appendix B
Frame Relay Default Settings

This appendix lists the default parameter settings for Frame Relay. Use the Configuration Manager to edit any of the default settings listed here.

Table B-1. Frame Relay Interface Parameters

Parameter	Default
Enable	Enable
Mgmnt Type	ANSI T1.617D
Address	Addr Q922
Address Length	Two Byte
Polling Interval	10 seconds
Full Enquiry Interval	6
Error Threshold	3
Monitored Events	4
Multicast	Disable
Congestion Control	Disable
Congestion Timer	1 second
Congestion Counter	20 notifications

Table B-2. Frame Relay PVC Parameters

Parameter	Default
DLCI Number	None
Enable Multi-line	No
Circuit State Set	Active
Multicast	Unicast
Mode	Group Access
Congestion Control	Inherit
Congestion Timer	1 second
Congestion Counter	20 notifications
Data Path Chooser	None

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