Configuring X.25 Services

Router Software Version 11.01
Site Manager Software Version 5.01

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Bay Networks

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About This Guide

If you are responsible for configuring and managing Bay Networks® routers, read this guide to learn how to customize Bay Networks router software for X.25 services.

Configuring X.25 Services offers

- An overview of Bay Networks X.25 services (Chapter 1)
- Implementation notes that may affect how you configure X.25 services (Chapter 2)
- Directions for enabling X.25 (Chapter 3)
- Descriptions of X.25 parameters and instructions for editing those parameters (Chapter 4)
- Descriptions of IPEX parameters and instructions for editing those parameters (Chapter 5)
- Descriptions of QLLC parameters and instructions for editing those parameters (Chapter 6)
- A sample IPEX configuration (Appendix A)
- Examples of QLLC configurations (Appendix B)
- Default parameter settings (Appendix C)
- IPEX diagnostic codes (Appendix D)

Before You Begin

Before using this guide, you must complete the following procedures. For a new router:

- Install the router (refer to the installation manual that came with your router).
- Connect the router to the network and create a pilot configuration file (refer to *Quick-Starting Routers and BayStream Platforms*, *Connecting Bay Stack AN and ANH Systems to a Network*, or *Connecting ASN Platforms to a Network)*.

Make sure that you are running the latest version of Bay Networks Site Manager and router software. For instructions, refer to *Upgrading Routers from Version 7–10.xx to Version 11.0*.

Conventions

angle brackets (< >)	Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command. Example: if command syntax is **ping** *<ip_address>*, you enter **ping 192.32.10.12**
bold text	Indicates text that you need to enter, command names, and buttons in menu paths. Example: Enter **wfsm &**
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`
separator (>)	Separates menu and option names in instructions and internal pin-to-pin wire connections. Example: Protocols > AppleTalk identifies the AppleTalk option in the Protocols menu. Example: Pin 7 > 19 > 20

vertical line (|)	Indicates that you enter only one of the parts of the command. The vertical line separates choices. Do not type the vertical line when entering the command. Example: If the command syntax is **show at routes | nets**, you enter either **show at routes** or **show at nets**, but not both.

Acronyms

APPN	Advanced Peer-to-Peer Networking
BFE	Blacker front-end encryption
BOFL	Breath of Life (message)
CPU	central processing unit
CUG	closed user group
CUGOA	closed user group with outgoing access
DCE	data circuit-terminating equipment
DDN	Defense Data Network
DLSw	Data Link Switching
DOD	Department of Defense
DP	data path
DTE	data terminal equipment
FEP	front-end processor
FDDI	Fiber Distributed Data Interface
FTP	File Transfer Protocol
HDLC	high-level data link control
IEEE	Institute of Electrical Engineers
IP	Internet Protocol
IPEX	IP Encapsulation of X.25
ISO	International Organization for Standardization
ITU-T	International Telecommunications Union–Telecommunication Standardization Sector (formerly CCITT)
LAN	local area network
LAP	Link Access Procedure
LAPB	Link Access Procedure Balanced
LCN	logical channel number
LLC	Logical Link Control
MAC	media access control

MCT1	Multichannel T1
MIB	Management Information Base
MTU	maximum transmission unit
NCP	Network Control Program
NPSI	NCP Packet Switching Interface
NUI	Network User Identification
OSI	Open Systems Interconnection
OSPF	Open Shortest Path First
PAD	packet assembler/disassembler
PDN	Public Data Network
PDU	protocol data unit
PLP	Packet Level Procedure
PPP	Point-to-Point Protocol
QLLC	Qualified Logical Link Control
PSN	packet-switching network
RIP	Routing Information Protocol
RPOA	recognized private operating agencies
SAP	service access point
SDLC	Synchronous Data Link Control
SNA	Systems Network Architecture
SNAP	Subnetwork Access Protocol
SNPA	Subnetwork Point of Attachment
SVC	switched virtual circuit
TCP/IP	Transmission Control Protocol/Internet Protocol
VC	virtual circuit
VTAM	Virtual Telecommunication Access Method

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The message section is monitored by Bay Networks engineers, who provide assistance wherever possible. Customers and resellers holding Bay Networks service contracts also have access to special libraries for advanced levels of support documentation and software. To take advantage of CompuServe's recently enhanced menu options, the Bay Networks Forum has been re-engineered to allow links to our Web sites and FTP sites.

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Valbonne, France	(33) 92-968-968	(33) 92-966-998
Sydney, Australia	(612) 9927-8800	(612) 9927-8811
Tokyo, Japan	(81) 3-5402-0180	(81) 3-5402-0173

Chapter 1
X.25 Overview

The X.25 Protocol transports LAN traffic to packet-switching networks (PSNs). X.25 allows many different kinds of equipment to communicate across networks at a relatively low cost.

Common carriers, mainly the telephone companies, designed X.25. An agency of the United Nations, the International Telecommunications Union-Telecommunications sector (ITU-T, formerly CCITT), administers the X.25 Protocol. X.25 is a global standard, and is the dominant communications protocol in use around the world today.

X.25 Interface

X.25 defines the interaction across PSNs between data terminal equipment (DTE) and data circuit-terminating equipment (DCE). DTEs include devices such as terminals, hosts, and routers; DCEs include devices such as modems, packet switches, and other ports.

Figure 1-1 shows an X.25 network. A DTE (in this case, Router A) connects to a DCE in the PSN. The PSN connects to another DCE and, finally, to another DTE (Router B).

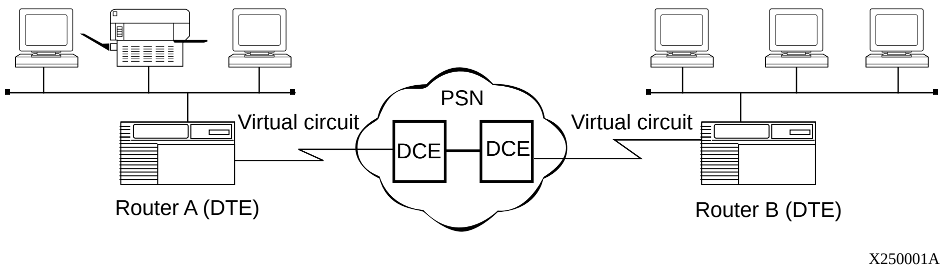

Figure 1-1. X.25 Network

To begin communication, one DTE device (for example, a router) calls another DTE to request a data exchange session. The called DTE can accept or refuse the connection. If the called DTE accepts the connection, the two systems begin full-duplex data transfer. Either side can terminate the connection at any time. Because public data networks (PDNs), the most commonly used type of PSN, typically use error-prone analog lines, the X.25 Protocol provides extensive error checking, recovery, and packet sequencing.

A DTE can be a device that does not itself implement X.25. In this case, the DTE connects to a DCE through a packet assembler/disassembler (PAD), which is a device that translates data into packet form.

X.25 and the OSI Model

The Open Systems Interconnection (OSI) Basic Reference Model combines a nonproprietary structured computer system architecture with a set of common communication protocols. It comprises seven layers. Each layer provides specific functions or services and follows the corresponding OSI communications protocols to perform those services.

The X.25 Protocol focuses on three of the seven layers in the OSI model: the physical layer, the data link layer, and the network, or packet, layer. As you read the following sections, refer to Figure 1-2, which illustrates the correspondence between X.25 and the OSI model. Figure 1-2 conforms to the typical rendering of the OSI model, which depicts the physical layer at the bottom of the protocol stack, and refers to succeeding layers as representing higher-level protocols.

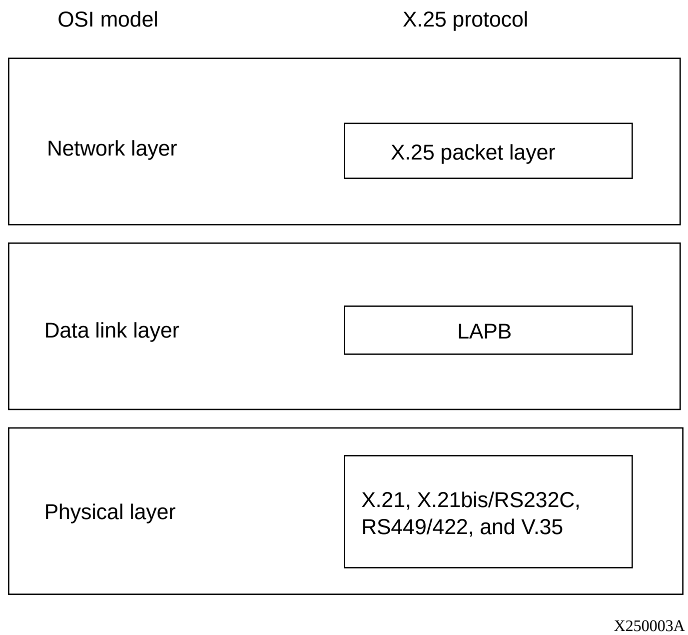

Figure 1-2. OSI/X.25 Correspondence

Physical Layer

The physical layer transmits bits across the physical connection or modem interface. Bay Networks supports all of the standard media for X.25 transmission: X.21, X.21bis/RS232C, RS449/422, and V.35.

Data Link Layer

The data link layer defines the link access procedures for transferring frames of data accurately and reliably across the access lines between the DTE and the DCE.

Link Access Procedure Balanced Protocol

X.25 uses the Link Access Procedure Balanced (LAPB) protocol at the data link layer to

- Initialize the link between the DTE and the local DCE device
- Frame X.25 data packets before transmitting them to the DCE

LAPB is a version of high-level data link control (HDLC), which is an OSI standard.

Figure 1-3 shows a LAPB frame. The LAPB Information field contains the X.25 data packet. When an X.25 packet reaches the destination router, the LAPB protocol strips away the LAPB frame and delivers the packet to the network layer for further processing.

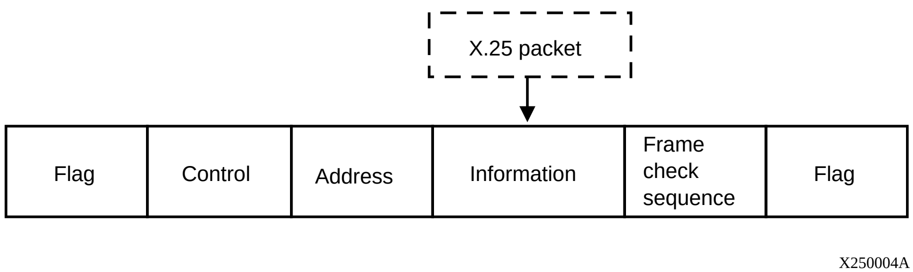

Figure 1-3. LAPB Frame

LAPB Implementation on Bay Networks Routers

The implementation of the LAPB protocol on the AN® and ASN™ routers, and on BN® and LN® routers with an Octal Sync link module, differs from that on other Bay Networks routers. On the AN and ASN routers and BN and LN® routers with Octal Sync, LAPB is implemented in software in routers that use the QUICC 68360 driver. On the other routers, LAPB is implemented in the hardware using the MK5025 chip.

➡ **Note:** The different LAPB implementations result in two different LAPB management information bases (MIBs). This means that if you copy an existing configuration from a Bay Networks router that uses the MK5025 chip to the AN or ASN, or the BN or LN with octal sync, the configuration may not work because the location of the LAPB MIB is different.

Although detailed discussion of the LAPB MIB is beyond the scope of this guide, when you configure X.25, you automatically set up LAPB for all routers.

Network Layer

The network, or packet, layer establishes the virtual circuit and provides procedures for call establishment, data transfer, flow control, error recovery, and call clearing. The router uses the network layer to determine destination X.121 addresses and to specify which user-configurable X.25 facilities the network layer supports. (See "Determining the X.121 Destination" later in this chapter, for more information about X.121 addresses.) The X.25 Protocol defines *how* the DTE and its respective DCE communicate and exchange data.

The X.25 network transmits data over *virtual circuits* (VCs) between each source and destination on the network. Because as many as 128 VCs can exist on the same physical link at the same time, multiple devices can share the bandwidth of the transmission line, sending data in multiple packets from the source to the destination.

X.25 Service Types

The Bay Networks router transmits data across five types of X.25 network services.

- Public Data Network (PDN)

  The X.25 PDN service provides end-to-end connectivity between the router and a remote DTE that supports Internet RFC 1356 X.25 services. The Bay Networks router supports Internet RFC 1356 for IP, OSI, DECnet, IPX, and XNS.

- Defense Data Network (DDN)

  The X.25 DDN service provides end-to-end connectivity between a router and a remote DTE that supports X.25 DDN Standard Service. IP uses DDN service to transmit IP datagrams. OSI uses DDN service to send OSI protocol data units (PDUs) over the X.25 network. No other protocols use DDN services.

  You can implement an X.25 DDN network as a Blacker front-end encryption (BFE) network. BFE is an external, standalone encryption device that you connect to your router to establish X.25 DDN networks.

- Point-to-Point Service

  Point-to-Point service is proprietary to Bay Networks, so Bay Networks routers must be at both ends of the connection. AppleTalk, transparent and spanning tree bridging, DECnet, IP, VINES, XNS, IPX, and OSI can use Point-to-Point X.25 service to transmit datagrams over the X.25 network.

- IP Encapsulation of X.25 (IPEX)

  IPEX allows two X.25 systems to exchange data by tunneling over a TCP/IP network.

- Qualified Logical Link Control (QLLC)

  QLLC transfers IBM Systems Network Architecture (SNA) traffic over an X.25 network.

The type of traffic that the router forwards depends upon the type of network layer service enabled on each of the router's network interfaces. For example, if you configure an interface for DDN services, you cannot configure any other type of service. You can, however, configure an interface to run PDN IPEX, QLLC, and Point-to-Point services together.

How X.25 Services Work

End users on a LAN use the services of the Bay Networks router to access X.25 networks. The router acts as a DTE device; it encapsulates user data in X.25 format and transmits it across the network.

To demonstrate how Bay Networks X.25 services work, the following sections explain how Router A, which is configured for X.25 PDN services, routes data from IP endstation 1.1.1.2 over the X.25 network to IP endstation 3.1.1.2. Refer to Figure 1-4 as you read the next sections.

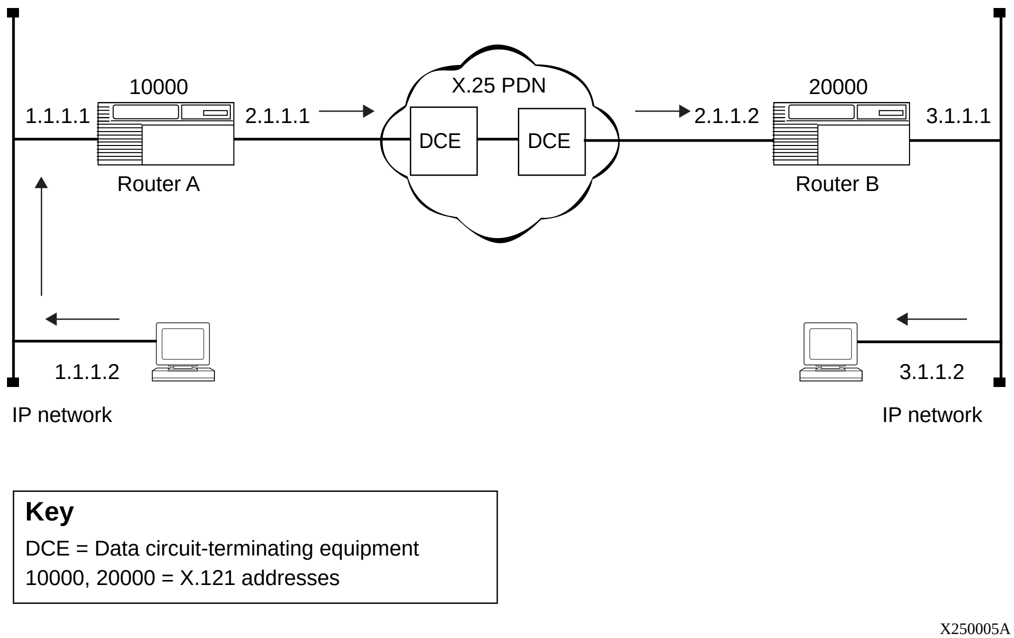

Figure 1-4. Sample X.25 Configuration

Determining the X.121 Destination

Each interface connecting to the X.25 network has an X.121 address, which consists of 1 to 15 decimal digits. For example, in Figure 1-4 the X.121 network addresses for Routers A and B are 10000 and 20000, respectively. Router A communicates with Router B over the X.25 network by setting up virtual circuits that connect the two X.25 interfaces.

Data transmission begins when

1. Router A receives an IP datagram from IP endstation 1.1.1.2 that is destined for endstation 3.1.1.2.
2. Router A checks its IP routing table to determine the next hop on the datagram's path (in this example, IP address 2.1.1.2).

3. When Router A determines that the next hop is located across the X.25 network, it checks to see which destination X.121 address maps to the next hop's IP address via the IP adjacent host table (in this example, X.121 address 20000).

4. To transmit the datagram across the network, the router now establishes a virtual connection between itself and destination X.121 address 20000.

   Router A begins by selecting an unused virtual circuit. The router assigns the circuit a 12-bit virtual circuit number (Figure 1-5), which it chooses from a user-specified range of virtual circuit numbers. The virtual circuit number identifies the logical channel portion of the circuit that connects the router and its DCE.

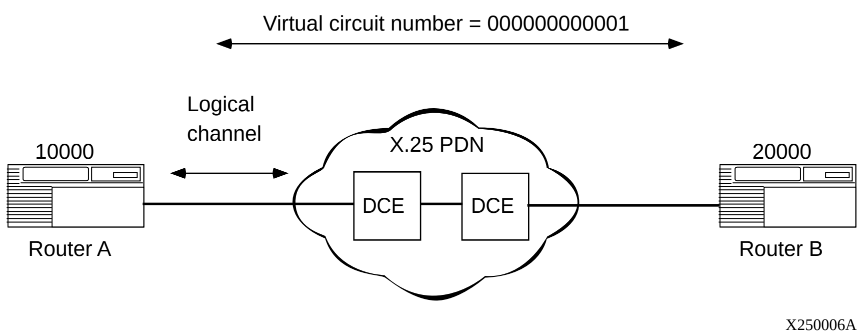

Figure 1-5. Virtual Circuit Connecting Bay Networks Routers

   The logical channel consists of a 4-bit logical channel group number concatenated with an 8-bit logical channel number. The logical channel number identifies this circuit as the one that will carry all data transmitted between the router and the destination DTE, when the connection to the destination X.121 address is established.

Establishing a Virtual Circuit

After Router A determines the destination X.121 address, the two routers establish a virtual circuit as follows:

1. Router A uses the services of the packet layer protocol to generate a call request packet that it sends to Router B.

Along with various optional X.25 facilities, the call request packet specifies the outgoing logical channel number, Router A's X.121 address, and Router B's X.121 address (Figure 1-6).

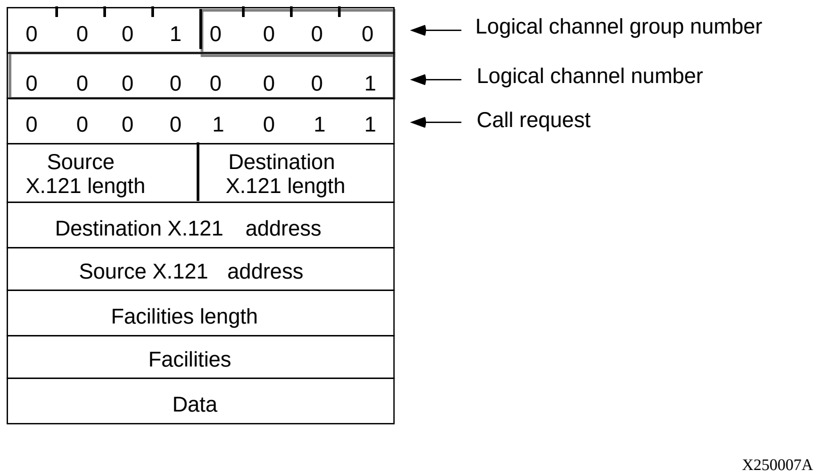

Figure 1-6. X.25 Call Request Packet Format

2. When the local DCE receives Router A's call request, the DCE forwards it across the X.25 network, where it is eventually routed to Router B.
3. Router B checks the called address for a match to its configured X.121 address. It also checks the calling address for a match to the remote X.121 address configured in the service record.
4. If it finds both matches, it accepts the call, and responds with a call accept packet that establishes the virtual connection between the two routers.

When the virtual circuit is established, the router can transmit and receive data (Figure 1-7).

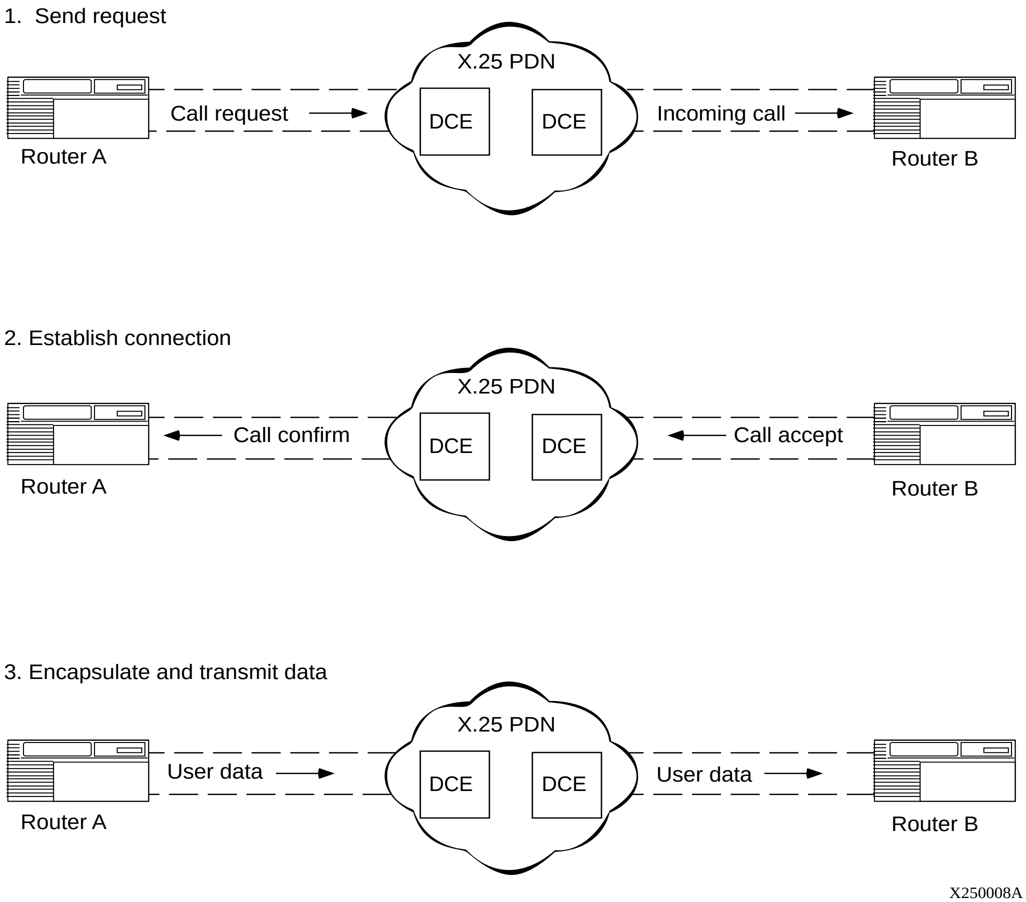

Figure 1-7. Setting Up an X.25 Call Connection

Transmitting Data

After Router B establishes the circuit, data travels between endstations 1.1.1.2 and 3.1.1.2 as follows:

1. Router A begins processing the packets it receives from IP endstation 1.1.1.2 across the X.25 network to Router B.
2. Router B removes the X.25 packet headers and trailers and forwards only the IP data to IP endstation 3.1.1.2 (Figure 1-8).

3. IP endstation 3.1.1.2 transmits data to endstation 1.1.1.2.

   Note that other IP endstations (for example, 1.1.1.3) can use the virtual circuit to transmit data in the direction of endstation 3.1.1.2 until the call is cleared.

   The call request and call accept packets specify the logical channel numbers (LCNs) assigned to the virtual connections between each router and its corresponding DCE. As a result, subsequent X.25 data packets contain only the logical channel numbers, rather than the complete X.121 destination addresses.

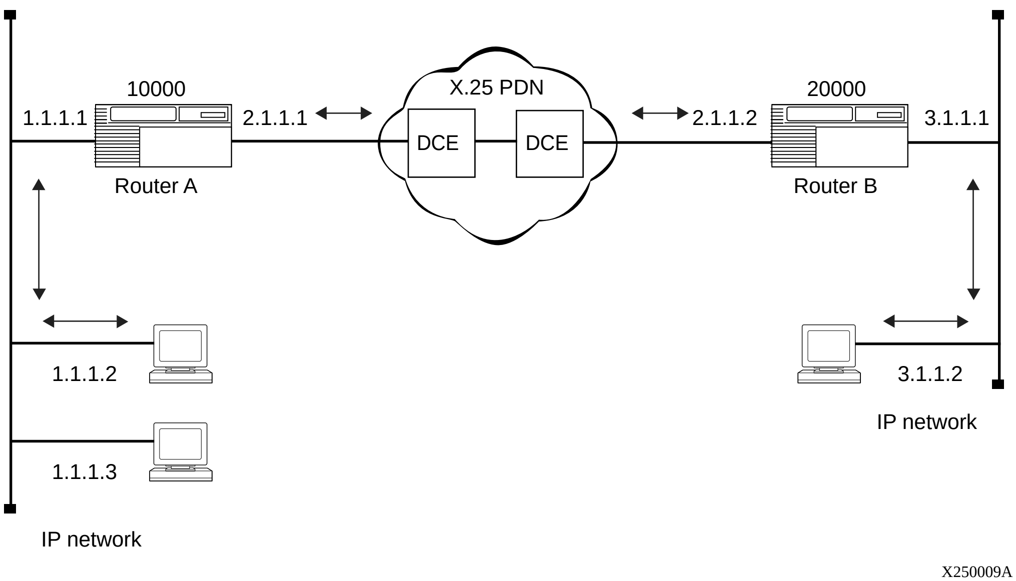

Figure 1-8. Routing IP Traffic across the X.25 Network

IPEX

Bay Networks X.25 services include tunneling over TCP/IP Internet (IPEX). IPEX lets you send and receive messages between two X.25 systems via a TCP/IP network. The tunneling maps TCP sockets to X.25 virtual circuits.

IPEX works with X.25 switched virtual circuits (SVCs), as well as with TCP/IP protocols over all interface types that Bay Networks routers support.

Note: In this document, the acronym IPEX refers to both the Bay Networks router when configured to provide X.25 tunneling service, and to the software that implements the tunneling, depending on the context.

IPEX supports

- TCP/IP over FDDI, Ethernet, and Token Ring LAN media
- X.25 over synchronous interfaces (6 MB/s maximum)

How IPEX Works

Tunneling support attaches an X.25 DTE or DCE to the IPEX router, which converts X.25 data to TCP and uses TCP/IP to carry the X.25 data to another, remote IPEX router, which converts it back to X.25. Figure 1-9 illustrates this conversion.

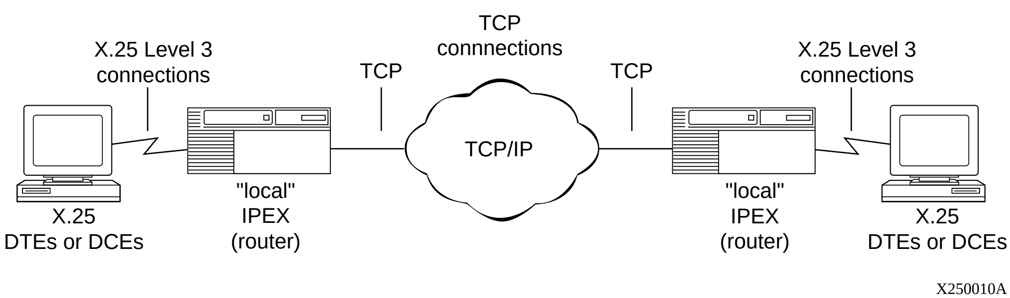

Figure 1-9. Sample Network Topology with TCP/IP Tunneling and IPEX

The sample configuration shows X.25 DTEs or DCEs connected to Bay Networks routers by standard X.25 lines, interfaces, and software, and a network of routers interconnected by standard TCP/IP lines and interfaces. You can connect the DTEs or DCEs to the router using any synchronous or Multichannel T1 (MCT1) port type.

Levels of Tunneling

Figure 1-10 shows the levels of tunneling within the IPEX router.

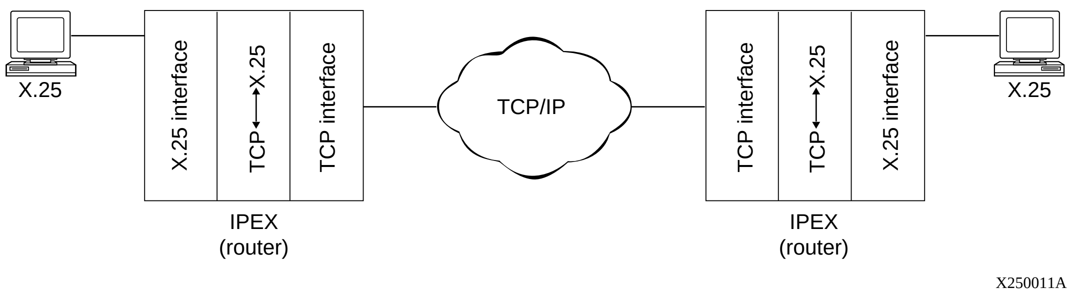

Figure 1-10. Levels of Tunneling with IPEX

When communicating with an X.25 DTE, the Bay Networks IPEX router acts as an X.25 DCE. Conversely, when communicating with an X.25 DCE, the Bay Networks IPEX router acts as an X.25 DTE. The IPEX router provides X.25 SVC support. You define the connection between two X.25 systems during configuration. When either a DCE or DTE initiates a call, the router establishes a TCP connection. SVCs must have an X.121 address for the router to make the TCP connection.

IPEX Network Interfaces

Bay Networks routers that support IPEX services use the following protocols:

- X.25 Packet Layer Protocol (PLP)
- Transmission Control Protocol (TCP)
- Internet Protocol (IP)

X.25 PLP Interface

The X.25 PLP interface corresponds to OSI Layer 3. On an X.25 PLP interface, you can create and configure multiple SVCs.

On an X.25 interface, you can configure IPEX service and another type of X.25 service: PDN, Point-to-Point, or QLLC. IPEX uses the X.25 flow-control mechanisms to detect any congestion in the X.25 connection.

IPEX uses the X.25 PLP client interface to

- Open and close X.25 connections
- Send data to the X.25 module for transmission
- Process received data delivered from the X.25 module
- Control the flow of data across the client interface
- Ensure data integrity

TCP Interface

IPEX appears to TCP as a client. As such, IPEX specifies the *socket* for the local TCP interface (consisting of its IP address and TCP port number) and another socket for the remote TCP interface to establish a connection.

For SVCs using IPEX, when the local X.25 DCE or DTE requests an X.25 end-to-end switched connection, the local router contacts the remote IPEX router to establish a unique TCP connection for that X.25 connection.

Because a large number of TCP connections may be active concurrently to support many tunneling sessions, IPEX service uses a large range of TCP port numbers to create separate sockets for the individual tunneling sessions. However, IPEX service does not use any port numbers that are reserved for the standard TCP/IP protocols, UNIX system services, or other TCP client services provided in the software. The port numbers reserved for IPEX service range from 12,304 through 16,399.

IPEX uses the TCP client interface to

- Open, close, and check the status of TCP connections
- Send data to the TCP module for transmission
- Process received data delivered from the TCP module
- Control the flow of data across the client interface
- Ensure data integrity across the IP network

IPEX Facility Support

IPEX handles only the following X.25 PLP facilities:

- **Default Packet Size and Default Window Size:** The IPEX router examines the packet and window size in the X.25 call from the client terminal. When the router has validated and accepted these parameters, it sets up the optimal flow control queues at the X.25 client interface, as well as the optimal receive and transmit windows at the TCP client interface.
- **Flow Control Parameter Negotiation:** The IPEX router can support the largest packet size defined in the X.25 standard. Therefore, it always accepts the proposed window and packet size parameters in the X.25 call packet from the client terminal after they are validated, without negotiating a smaller window or packet size.

Sequence of Connections with IPEX

Figure 1-11 illustrates the sequence of calls and connections in X.25 TCP/IP tunneling.

1. When the local IPEX router receives an incoming X.25 call request from a client X.25 terminal, the local IPEX router sends a TCP connection request to the IPEX router serving the remote X.25 terminal.
2. The remote IPEX router then sends a call request to the remote X.25 terminal. That terminal then responds with an X.25 call accepted packet.
3. The remote IPEX router accepts the TCP connection.
4. The local IPEX router accepts the local X.25 connection.

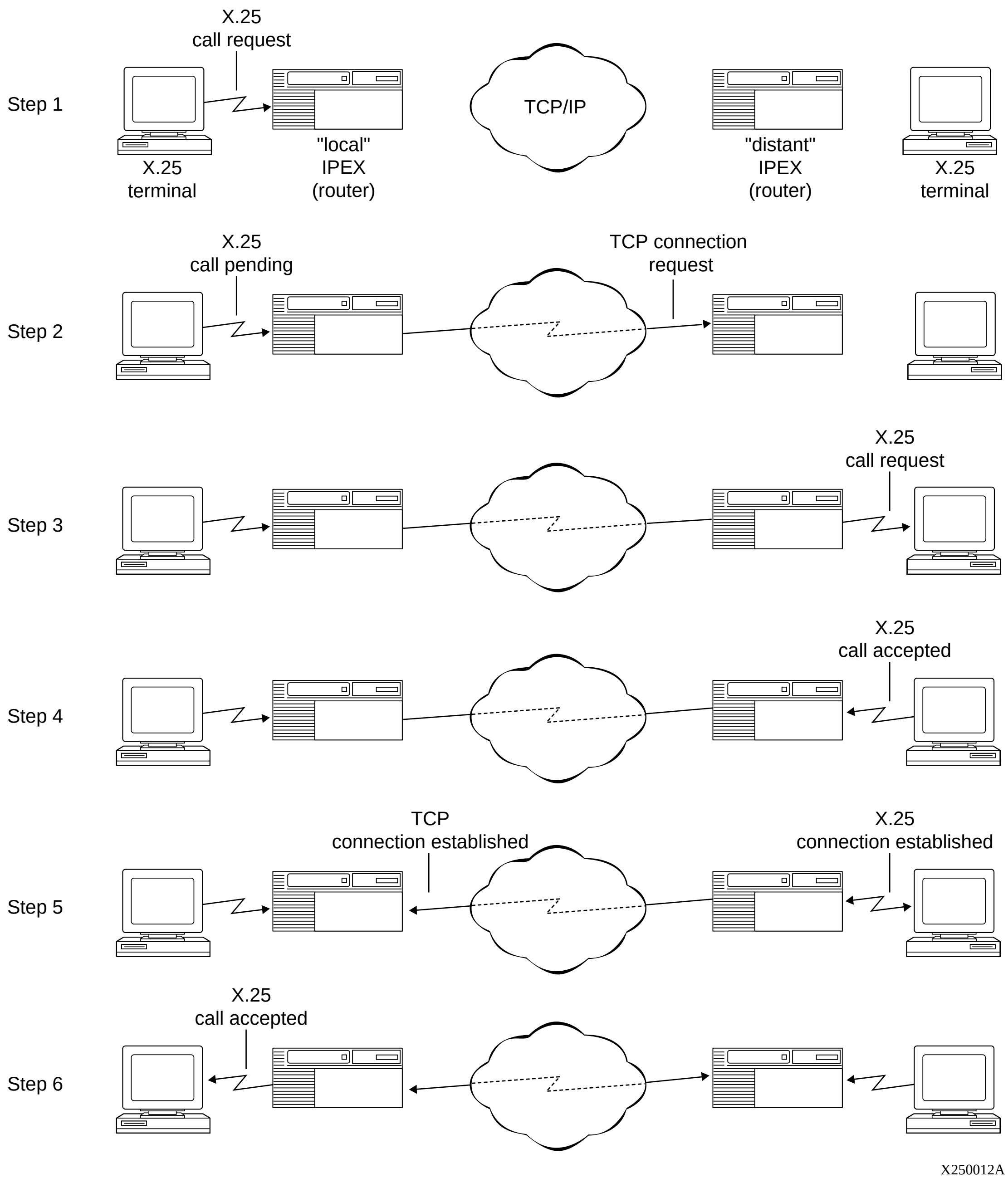

Figure 1-11. How IPEX Establishes Connections

IPEX Mapping

For each established SVC connection that contains a specified X.25 called address (X.121 address), IPEX establishes a TCP connection from IPEX to a TCP/IP server. This connection consists of the IP address and the TCP port number of a remote TCP/IP peer that correspond to the X.25 called address. To enable X.25-to-TCP conversion you must configure the following information:

- The point of attachment (that is, the circuit interface) on the IPEX system at which the SVC establishes the connection.
- The SVC LCN range at the packet level.
- The X.25 called address of the incoming call request from the X.25 DTE/DCE to IPEX.
- The associated remote TCP socket (IP address and TCP port number) that identifies the destination of the TCP connection.

This mapping sets a path for forwarding data received on an X.25 virtual circuit to a specific remote TCP/IP peer.

Mapping Types

To configure IPEX, you must select either local or end-to-end mapping, which determines whether facilities, call user data, M-bit and Q-bit support terminate locally or are passed across the TCP/IP connection.

If you set the mapping type to local, IPEX ports can support different packet sizes at each end, but message size can be no longer than 4 KB.

If you configure end-to-end mapping, all IPEX ports must have the same packet and window size, or the M-bit support will not function properly. End-to-end mapping allows unlimited message size.

IPEX Connection Summary

To set up a reliable tunneling session, each side must successfully establish a connection. When one side receives a call request, the other side attempts to connect. If the connection attempt fails on the remote side, the local side will reject the call request it received because the tunneling session cannot be set up.

Figure 1-12 shows how IPEX mediates the interaction between the two protocol stacks as the data flows between the X.25 client terminals and the TCP-based hosts.

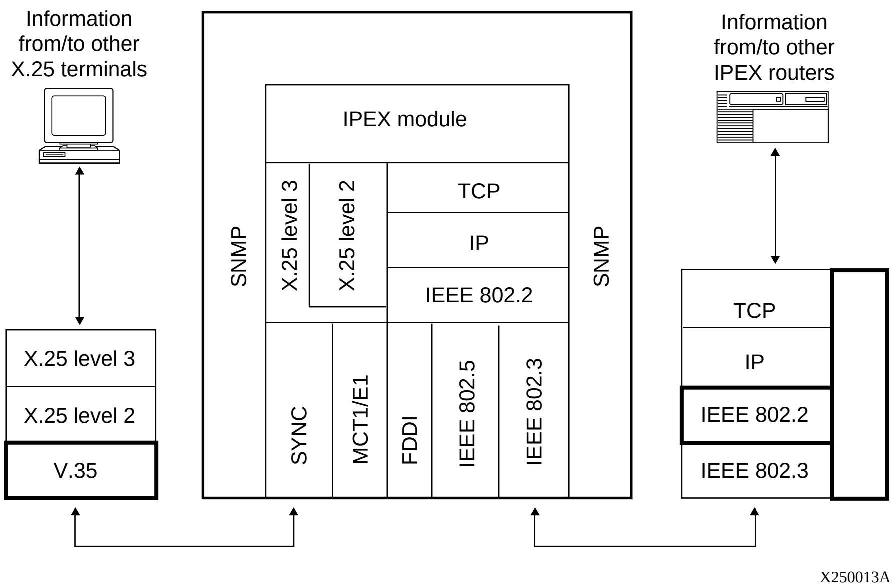

Figure 1-12. Role of the X.25 and TCP Protocol Stacks in IPEX

The TCP and X.25 communication stacks share the responsibility for maintaining a reliable and efficient data flow. That is, if data loss occurs because of a lack of software resources or intermittent transmission errors, the communication stack on that side must retransmit the lost data. In addition, both sides must independently maintain protocol flow control.

Data loss may also occur due to hardware or other catastrophic failures. You must implement redundancy in the network topology design and provide manual or automated intervention to handle these types of data communication failures.

IPEX Handling of Large Data Messages (M-bit)

X.25 is a message-based protocol, and TCP is an unstructured stream protocol. They differ in the way they send outgoing traffic from their clients and deliver incoming traffic to their clients.

How X.25 Handles Large Data Messages

When the X.25 client submits an X.25 message that is larger than an X.25 packet size, the X.25 protocol fragments the message. X.25 then transmits the sequence of packets containing these fragments. Within each packet, X.25 includes a flag (M-bit) that indicates the fragmentation and helps the receiver reassemble the message.

How TCP Handles Large Data Messages

TCP, on the other hand, does not have a flag to mark fragmentation of messages that are bigger than the TCP maximum transmission unit (MTU) size. The portion of a message that does not fit into one TCP data segment is sent in a subsequent data segment. Without a flag or any indication of the size of the message, the TCP client has no way of determining the boundary of a message; that is, whether the complete message is contained within one or in several data segments. Hence, once IPEX receives the X.25 user data and translates it to a TCP data segment, the message boundary is lost.

To minimize changes in the existing host applications, IPEX maintains the X.25 message boundary. IPEX structures the application information into message blocks before encapsulating it in TCP data segments.

Q-bit Support

IPEX service includes support for the Qualified Data bit (Q-bit), which is transported generically through the network. A Q-bit value of 1 indicates that the frame is a control frame, and a value of 0 indicates that it is a data frame.

QLLC

Bay Networks X.25 services include Qualified Logical Link Control (QLLC), a protocol that transfers IBM SNA data over an X.25 network. QLLC carries both logical link control information and SNA data across an X.25 network.

For example, with QLLC support, a Bay Networks router can send and receive X.25 packets from an IBM host running IBM's X.25 NCP Packet Switching Interface (NPSI) and downstream QLLC compatible SNA endstations. It can also work with other topologies, several of which are illustrated in Appendix B, "QLLC Configuration Examples."

QLLC and DLSw

You must run DLSw when you use QLLC. The router transmits the SNA data contained within QLLC packets over SDLC or LLC (token ring, Ethernet, Frame Relay) data links that use DLSw services.

QLLC works with all media that X.25 supports. You can establish as many as 128 simultaneous QLLC VCs on a physical link.

To configure DLSw, refer to *Configuring DLSw Services*.

NPSI

IBM's NCP Packet Switching Interface (NPSI) software allows SNA hosts to attach to X.25 networks, and to support virtual circuits for both incoming and outgoing calls. NPSI makes X.25 virtual circuits appear to SNA hosts as point-to-point (SDLC) links.

How QLLC Works

The interfaces that you configure for QLLC conversion are the serial interfaces of the X.25 network that connect to the remote devices with which you want your local SNA devices to communicate.

Sequence of Connections with QLLC

When an X.25 attached device -- for example, a 3174 -- wants to send data to an IBM host, the 3174 sends an X.25 call request packet. The IBM host running NPSI receives the call request, and establishes a QLLC session with the 3174.

QLLC Mapping

The QLLC software matches the MAC address that DLSw recognizes to the X.121 address that X.25 recognizes. It also translates the data into a format that the receiving X.25 device can comprehend.

To use QLLC, you must assign a virtual MAC address to the X.25 device, and map that MAC address to the device's X.121 address. You must also assign a virtual X.121 address to the DLSw device, and map that address to the DLSw device's MAC address. This mapping sets a path for forwarding data between an X.25 VC to and a specific remote DLSw device. QLLC requires one mapping entry for each VC.

Appendix B, "QLLC Configuration Examples," shows examples of QLLC network topologies.

Adjacent and Partner Devices

Bay Networks QLLC uses the terms *adjacent* and *partner* to describe the X.121 and MAC addresses that map to each other. These terms are relative to the interface that runs the QLLC/X.25 software.

The Adjacent X.121 DTE/DCE device connects to the interface that is running the QLLC/X.25 software, either directly or indirectly. It maps to that device's Adjacent MAC address.

The Partner X.121 DTE/DCE device connects through the DLSw network. It maps to that device's Partner MAC Address.

In Figure B-1, for example, Router A connects to the SNA mainframe through the X.25 network, so the mainframe is an adjacent device. The PC, the 3174 control unit, and the AS400 are partner devices because they connect through the DLSw network, and not through the X.25 network.

In Figure B-4 of Appendix B, Router A connects to the SNA mainframe through a token ring network, so it is a partner device. Router A connects to the PC through the X.25 network, so the PC is an adjacent device. The mainframe is an adjacent device for Router B, because they connect through the X.25 network. The PC is a partner device for Router B.

Coordinating X.25 and DLSw Parameters

In addition to setting QLLC parameters, you must coordinate X.25 packet size parameters with the SNA frame size to ensure that they are compatible.

Chapter 2
Implementation Notes

This chapter describes special features of the Bay Networks X.25 implementation, including

- Data compression
- Load sharing
- Clocking sources for routers set back-to-back
- Max Window Size and Max Packet Length parameters
- Flow control negotiation
- Configuring LAPB for an AN or ASN
- Configuring synchronous lines
- DDN default service record
- RFC 1356
- PTOP encapsulation

X.25 Data Compression

Bay Networks data compression software enables you to reduce line costs and improve response times over X.25 networks.

Our data compression eliminates redundancies in data streams. When you use compression on your network, bandwidth efficiency improves, enabling you to transmit more data over a given amount of network bandwidth.

To use data compression with X.25, you must set the X.25 service record parameter, Enable Compression, to Enable. See Chapter 4 for information about how to access this parameter.

For a complete discussion of data compression, descriptions of compression parameters, and instructions for configuring compression for an X.25 interface, see *Configuring Data Compression Services*.

Load Sharing

The Bay Networks implementation of X.25 on PDN networks includes load sharing across as many as four VCs, using a round-robin algorithm to distribute traffic. This feature improves performance by increasing the effective window size, that is, the number of packets that a DTE can transmit before it receives an acknowledgment.

To take advantage of multiple virtual connections and load sharing across them, you must set the Max Connections network service record parameter to a value greater than 1 (refer to Chapter 4).

IPEX and QLLC do not support load sharing.

Clocking Sources for Routers Set Back-to-Back

If two Bay Networks routers are operating back-to-back without a clocking source, you must configure internal clocking on both routers. Use a crossover cable to connect the ports.

The default clocking source for X.25 is external. When you configure X.25 and LAPB on an existing network, external clocking can cause unpredictable results on any internally clocked line. Clocking sources must be the same for each router that you connect back-to-back.

Packet-level Parameters: Max Window Size and Max Packet Length

When you configure X.25 packet-level parameters, make certain to set the Max Window Size and Max Packet Length parameters for peer routers to the same value if you also enable flow control. If you do not, the routers cannot perform network service-level negotiations.

For QLLC and IPEX, set Max Window Size and Max Packet Length parameters according to the values in the attached X.25 devices.

For example, if you set the Max Window Size for Router A to 7, set the Max Window Size for peer Router B to 7. Similarly, if you set the Max Packet Length for Router A to 512, set the Max Packet Length for peer Router B to 512.

Window size and packet length can affect packet throughput across the X.25 network. Setting either the Max Window Size or Max Packet Length parameter too low can cause the router to drop packets. You may want to configure these parameters at higher values than the default settings. Refer to Chapter 4 for information about how to access these parameters.

Flow-Control Negotiation

The Bay Networks implementation; of X.25 enables the router to negotiate flow control, which regulates the rate of data transfer among elements of a network to prevent congestion and overload. For flow-control negotiation to work properly, you must set the parameters in Tables 2-1 and 2-2 as shown.

Table 2-1. X.25 Packet-level Parameters

Parameter	Value
Flow Control Negotiation	On
Max Window Size	See the parameter descriptions for options
Max Packet Length	See the parameter descriptions for options
Acceptance Format	DEFEXT (specifies default Basic format)
Release Format	DEFEXT (specifies default Basic format)

Table 2-2. X.25 Service Record Parameters

Parameter	Value
Flow Facility	Negot (negotiate flow facility)
Window Size	See the parameter descriptions for options
Packet Size	See the parameter descriptions for options

Configuring LAPB for an AN or ASN

When you create a new X.25 line on a Bay Networks AN or ASN router, Site Manager automatically uses default values to configure LAPB. If you want to edit the LAPB parameters, you can access them through the Edit Line Parameters window after you have created the new X.25 line. For further information, refer to *Configuring Line Services*.

Configuring Synchronous Lines with X.25

Table 2-3 shows the default synchronous line configurations for an AN/ASN and a BN/VME router.

Table 2-3. Synchronous Line Parameter Defaults for X.25

Synchronous Line Parameter	AN/ASN X.25	BN/VME X.25
BOFL	Disable	Disable
MTU*	512	1600
Service	Transparent	LAPB
Transmit Window Size	1	7
Min Frame Spacing*	1	1
Local Addr	7	1†
Promiscuous	Enable	Disable
Remote Addr	7	3†
WAN Protocol	LAPB	X.25
Sync Polling‡	Enable	Disable

*. Set this parameter to the same value on both sides of the X.25 connection. The default is calculated to be 2 times the packet size times the window size. For nonsegmenting protocols (AppleTalk, DECnet), you may need to increase the MTU to a larger value.

†. The addresses are those of the BN/VME router configured as a DCE; they are reversed if the router is configured as a DTE.

‡. Set this parameter to Disable if the physical interface is not V.35.

If you want to edit the synchronous line parameters, you can access them through the Edit Line Parameters window after you have created the new X.25 line. For more information on these parameters, refer to *Configuring Line Services*.

DDN Default Service Record

When you configure the Service Type as DDN, you can automatically configure service records that use default parameter values for every DDN SVC on your network. This means that you do not have to individually configure DDN service records. To use the default DDN service record feature, set the Use Default Service Configuration packet-level parameter to ON.

You can also change the default values that apply when you set the Use Default Service Configuration parameter to ON. Refer to Chapter 4 for instructions.

If you want to configure specific DDN SVCs with nondefault values, you can configure them individually. If you set the Default DDN parameter to ON, the default values apply to all SVCs, but if you then edit an individual SVC, values that you assign to that SVC apply.

RFC 1356 Multiplexing

Bay Networks supports RFC 1356 multiplexing.

RFC 1356 defines a standard for multiprotocol encapsulation over X.25 networks. Bay Networks implements RFC 1356 for IP, OSI, IPX, DECnet, and XNS. This means you can use Bay Networks routers at one end of a connection, and equipment from another vendor (that also supports RFC 1356 for these protocols) at the other end of the connection.

Multiplexing enables you to send multiple protocols over a single virtual circuit. Bay Networks advises multiplexing when you configure multiple routing protocols on a PDN type of service.

You enable multiplexing by setting the Enable 1356 Multiplexing parameter. If you set this parameter to Enable, the router can use RFC 1356 Null Encapsulation to send multiple protocols over a single virtual circuit. If you set the value to Disable, the router uses RFC 1356 Normal Encapsulation for IP and OSI, and RFC 1356 SNAP Encapsulation for IPX DECnet and XNS, opening a separate virtual circuit for each protocol. The default setting is Disable. See Figures 2-1 and 2-2 for illustrations of Null and Normal Encapsulation.

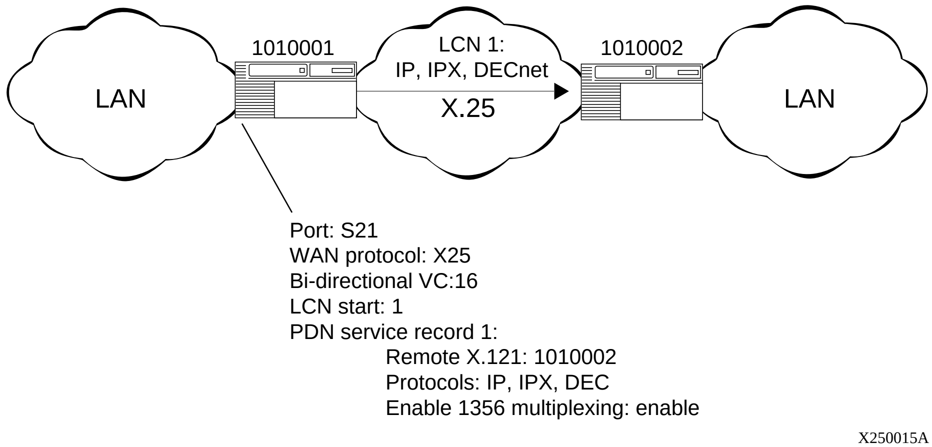

Figure 2-1. RFC 1356 Null Encapsulation

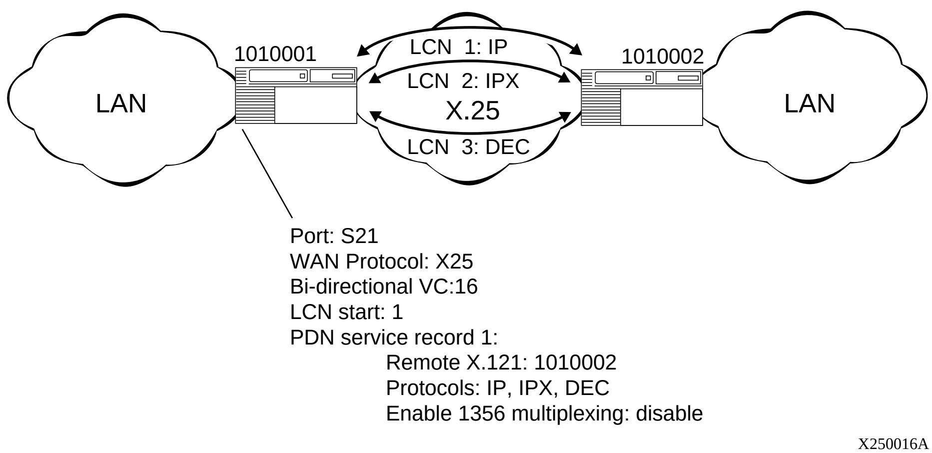

Figure 2-2. RFC 1356 Normal Encapsulation

PTOP Encapsulation

Bay Networks also has Point-to-Point Service (PTOP), a proprietary encapsulation method for LAN protocols. PTOP requires a Bay Networks router at both ends of a connection. You must use PTOP to encapsulate AppleTalk, Banyan VINES and Bridge traffic.

Chapter 3
Enabling X.25 Service

This chapter describes how to enable X.25 service. It assumes you have read *Configuring Routers* and

1. Opened a configuration file
2. Specified router hardware if this is a local mode configuration file

When you enable X.25 service, you must configure a subset of X.25 parameters. The Configuration Manager supplies default values for the remaining parameters. If you want to edit these default values, refer to Chapter 4, "Editing X.25 Parameters."

Enabling X.25 on an Interface

To enable X.25 service:

1. **Select the link or net module connector on which you are enabling X.25.**
2. **Select the X.25 Protocol.**
3. **Configure packet-level parameters.**
4. **Add X.25 service records.**
5. **Enable bridging and routing protocols.**
6. **Configure routing protocols over X.25 circuits.**

The following sections describe how to perform each of these steps.

Selecting a Connector

1. **In the main Configuration Manager window, click on the circuit (connector) you want to configure:**

   For example, if you selected the module 5300 Quad Sync, click on the connector COM1 to configure the first synchronous circuit. The Configuration Manager displays the Add Circuit window (Figure 3-1) with the selected circuit highlighted.

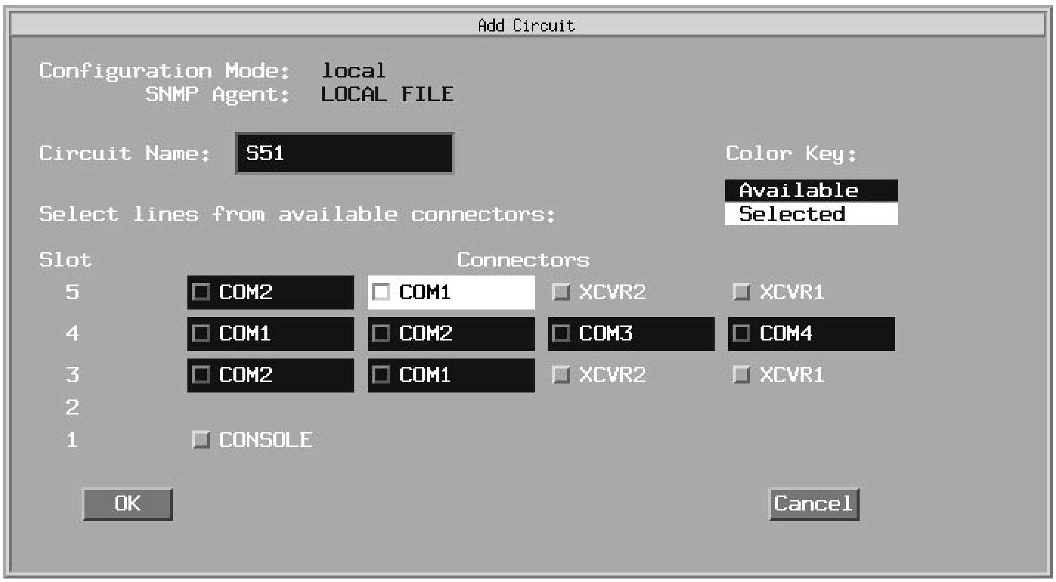

Figure 3-1. Add Circuit Window

2. **Click on OK to accept the values shown.**

   The WAN Protocols window appears (Figure 3-2).

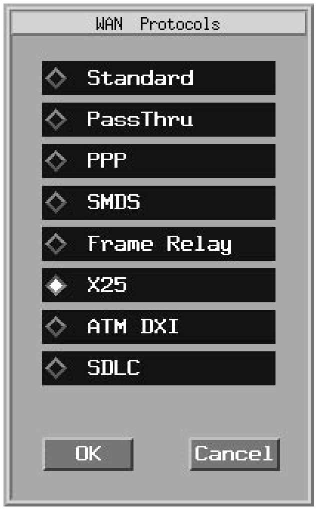

Figure 3-2. WAN Protocols Window

3. **Select X.25 from the WAN Protocols menu to display the X.25 Packet Config window (Figure 3-3).**

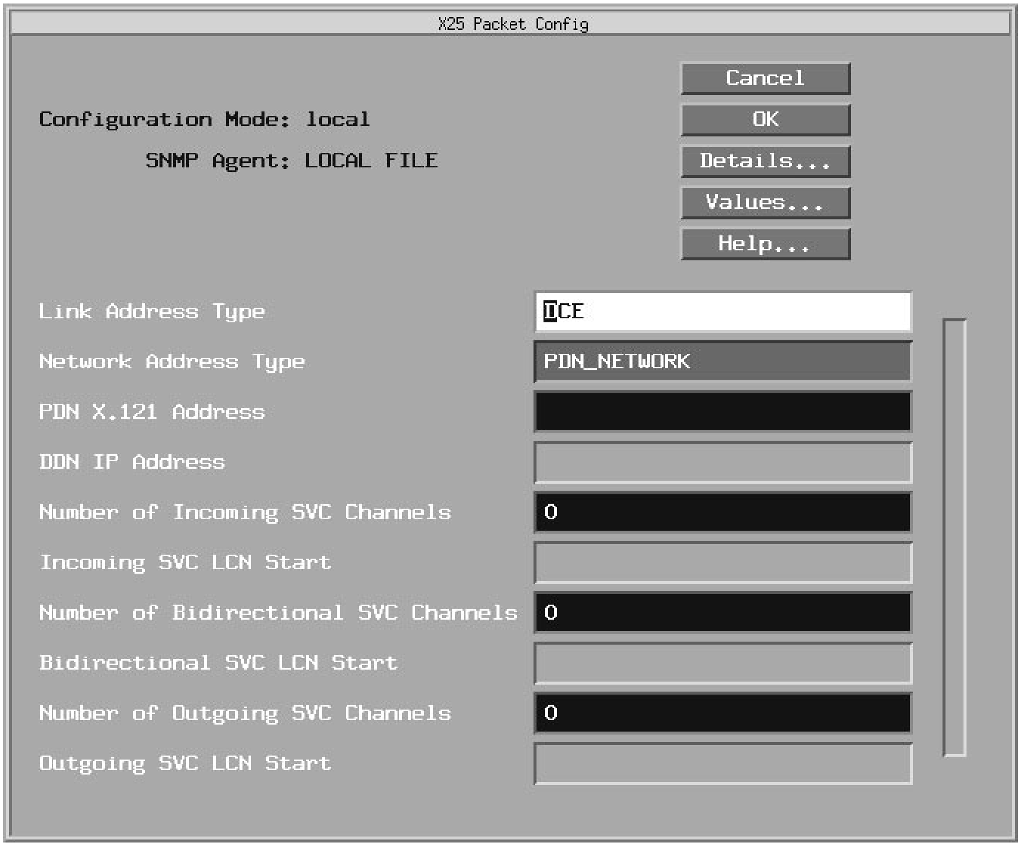

Figure 3-3. X.25 Packet Config Window

Configuring X.25 Packet-level Parameters

1. **Configure the packet-level parameters using the descriptions that follow as a guide.**
2. **When you are done, click on OK to display the X.25 Service Configuration window (Figure 3-4).**

You add X.25 service records from this window. Refer to “Adding X.25 Network Service Records,” later in this chapter, for instructions.

➡ **Note:** After you enable X.25 service on the router, you can edit the default settings for the rest of the X.25 parameters. See Chapter 4 for instructions.

X.25 Packet-level Parameter Descriptions

Use the following descriptions as guidelines when you set parameters in the X.25 Packet Config window.

At any time, you can get help or obtain a list of acceptable values for a parameter by clicking on the appropriate button on the upper right side of each window. To enter a value, you can either

- Type directly into the parameter field.
- Click on Values and then select a value from the list displayed (the default selection is highlighted).

Parameter:	**Link Address Type**
Default:	DCE
Options:	DCE | DTE
Function:	Specifies whether this interface provides logical DCE or DTE services.
Instructions:	Specify the service type as DCE or DTE. You must set one end of the link as a DCE and the other end as a DTE.

Parameter: **Network Address Type**

Default: PDN_Network

Options: PDN_Network | DDN_Network | BFE_Network

Function: Specifies the type of X.25 network to which the interface connects. The value of this parameter determines the format of the local X.121 address.

Instructions: Specify PDN_Network for a Public Data Network or a Point-to-Point connection. Specify DDN_Network for a Defense Data Network. Specify BFE_Network for a DDN that uses BFE encryption.

If you specify PDN_Network you must enter the local address in X.121 address format, that is, you must specify a value for the PDN X.121 Address parameter.

If you specify DDN_Network or BFE_Network, you must enter the local address in IP address format, that is, you must specify a value for the DDN IP Address parameter. The router will translate the address into X.121 format.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.50

Parameter: **PDN X.121 Address**

Default: None

Options: Any valid X.121 address

Function: Specifies the X.121 address assigned to this interface. The X.25 network service provider supplies the X.121 address.

Set this parameter only if you set the Network Address Type parameter to PDN_Network.

Instructions: Enter the appropriate X.121 address (up to 15 decimal digits).

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.52

Parameter:	**DDN IP Address**
Default:	None
Options:	Any valid IP address
Function:	Specifies the IP address assigned to this interface. The router translates the address into X.121 format and uses it as the local address. Set this parameter only if you set the Network Address Type parameter to DDN_Network or BFE_Network.
Instructions:	Enter the appropriate IP address.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.51

Note: The following parameters require you to specify logical channel number (LCN) value ranges for SVCs. Each SVC channel you configure on the router must have a unique LCN. There are three types of SVC channels: incoming, bidirectional, and outgoing. You must configure at least one SVC channel for X.25 to establish calls. The total number of channels you configure cannot exceed 512.

Parameter:	**Number of Incoming SVC Channels**
Default:	0
Options:	0 through 512
Function:	Specifies the number of logical channels that accept incoming calls only.
Instructions:	Enter the number of channels that you assign to incoming calls only on this interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.36

Parameter:	**Incoming SVC LCN Start**
Default:	0
Options:	0 through 4095
Function:	Specifies the lowest logical channel number that the router can assign to logical channels that accept incoming call requests only.
Instructions:	Enter a number greater than the highest number reserved for PVC channels, but small enough that the last SVC channel number will be less than 4095.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.37

Parameter:	**Number of Bidirectional SVC Channels**
Default:	0
Options:	0 through 512
Function:	Specifies the number of logical channels that both accept incoming calls and transmit outgoing calls.
Instructions:	Enter the number of logical channels that you assign to both accept and transmit calls on this interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.38

Parameter:	**Bidirectional SVC LCN Start**
Default:	0
Options:	0 through 4095
Function:	Specifies the lowest logical channel number that the router can assign to bidirectional logical channels.
Instructions:	Enter a number greater than the highest number reserved for incoming SVC channels, but small enough that the last SVC channel number will be less than 4095.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.39

Parameter:	**Number of Outgoing SVC Channels**
Default:	0
Options:	0 through 512
Function:	Specifies the number of logical channels that transmit outgoing calls only.
Instructions:	Enter the number of channels that you assign to outgoing calls only.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.40

Parameter:	**Outgoing SVC LCN Start**
Default:	0
Options:	0 through 4095
Function:	Specifies the lowest logical channel number that the router can assign to logical channels that transmit outgoing call requests only.
Instructions:	Enter a number greater than the highest number reserved for bidirectional SVC channels, but small enough that the last SVC channel number will be less than 4095.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.41

Parameter:	**Use Default Service Configuration**
Default:	OFF
Options:	ON	OFF
Function:	Creates default DDN service records for every DDN SVC on your network.
Instructions:	Select ON if you want to use default values for your DDN SVCs. Refer to configuration instructions in Chapter 4 if you want to set this parameter to ON and still individually configure some of your DDN SVCs.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.54

Adding X.25 Network Service Records

After you click on OK in the X.25 Packet Config window, the X.25 Service Configuration window appears (Figure 3-4). Complete the following steps to add X.25 network service records:

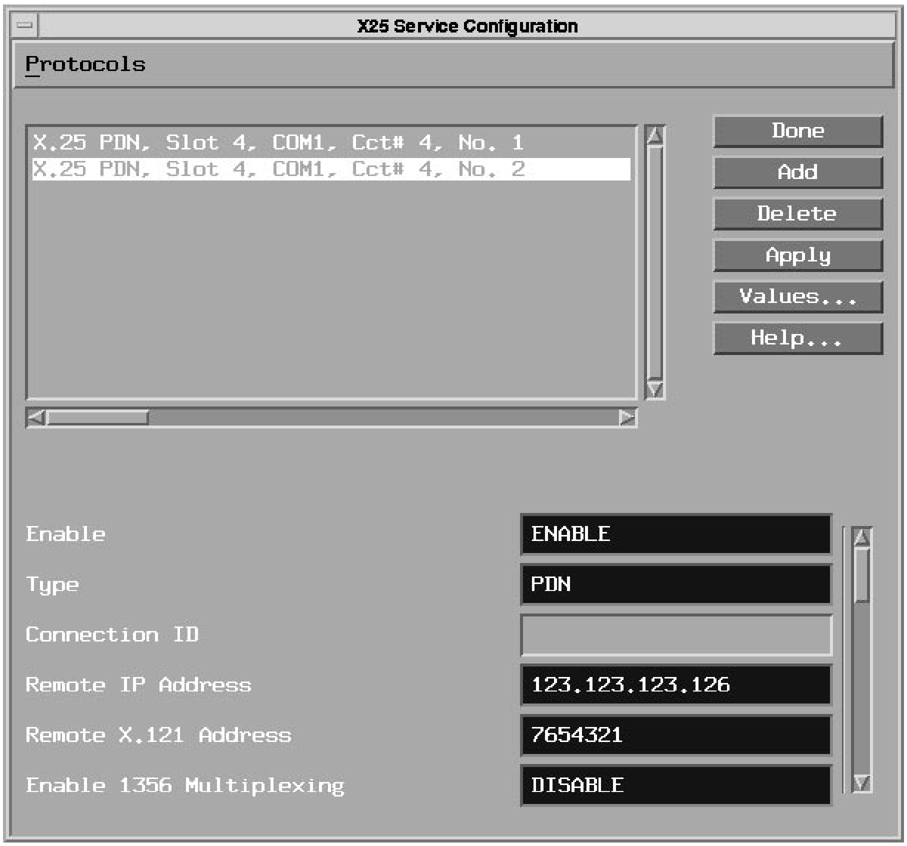

Figure 3-4. X.25 Service Configuration Window for a PDN Network

1. Click on Add to display the X.25 Service window (Figure 3-5).

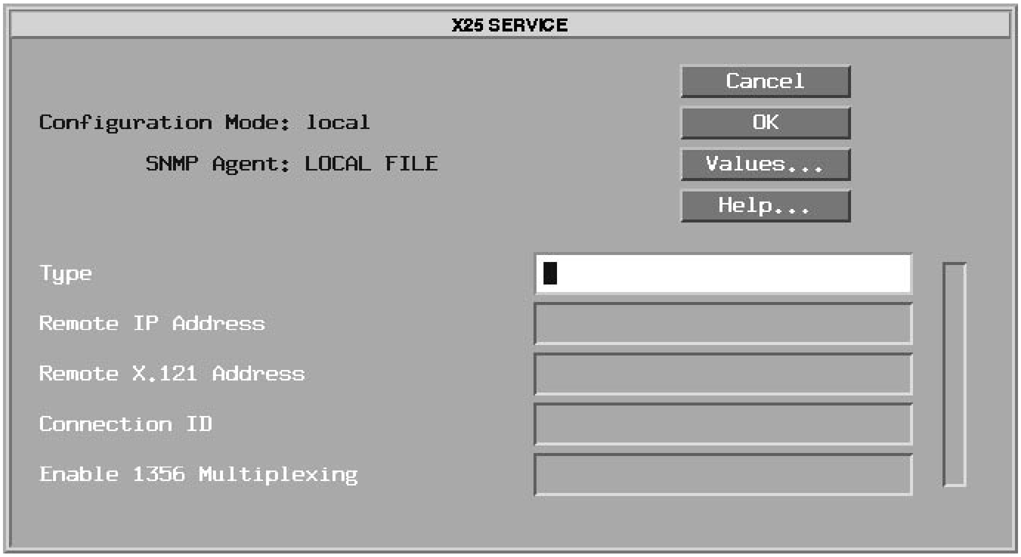

Figure 3-5. X.25 Service Window

2. **Configure the X.25 network service parameters using the descriptions that follow as a guide.**
3. **When you are done, click on OK.**

   The X.25 Service Configuration window appears. It now displays the record you just added. At this point you can

   - Add another network service record by repeating Steps 1 through 3.
   - Enable bridging and routing services on the X.25 circuit by following the instructions in the next section, "Enabling Bridging and Routing Services on an X.25 Circuit."
   - Edit the remaining X.25 network service parameters, for which the default values are currently in effect (refer to Chapter 4).

Note: If you selected IPEX in the Type parameter, the IPEX Mapping Table Configuration window appears when you click on OK in Step 3 above. See Chapter 5 for instructions on configuring IPEX mapping parameters. If you selected QLLC, the QLLC Mapping Table Configuration window appears. See Chapter 6 for instructions on configuring QLLC mapping parameters.

X.25 Network Service Record Parameter Descriptions

Use the following descriptions as guidelines when you configure the parameters in the X.25 Service window.

Parameter: **Type**

Default: None

Options: PDN | DDN | PTOP | IPEX | QLLC

Function: Specifies the type of X.25 service that this interface supplies.

- PDN for Public Data Network service
- DDN for Defense Data Network service
- PTOP for Point-to-Point network service
- IPEX for TCP/IP Tunneling over X.25
- QLLC for QLLC service

Instructions: Choose one of these network service types. If you specify IPEX or QLLC you must configure several IPEX or QLLC specific parameters (refer to Chapter 5 for IPEX and Chapter 6 for QLLC).

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.9

Parameter:	**Remote IP Address**
Default:	0.0.0.0
Options:	Any valid IP address
Function:	Specifies a destination IP address that is reachable over this X.25 interface. This parameter is not used with Point-to-Point service. You must specify a remote IP address if you plan to enable IP on this interface. For DDN services, the router translates the remote IP address you specify into an X.121 address so that it can route IP traffic over the network. For PDN services, the router uses the remote IP address you specify to define an adjacent host for the IP interface.
Instructions:	Enter a 32-bit destination IP address in dotted decimal notation. If you run OSI over DDN, you must also enter this IP address in the Subnetwork Point of Attachment (SNPA) field of the OSI External Address Adjacency Configuration window. To enter this value in the SNPA field, you must convert the IP address into X.121 format. Refer to *Configuring OSI Services* for more information.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.13

Parameter:	**Remote X.121 Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies a destination X.121 address. You must specify a destination X.121 address if you are configuring PDN or Point-to-Point services. If you are configuring DDN services, the router derives this address from the remote IP address.
Instructions:	Enter a destination X.121 address (up to 15 decimal digits) that is reachable over this X.25 interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.12

Parameter:	**Connection ID**
Default:	1
Options:	1 through 255
Function:	Identifies each circuit to its remote destination. You can have multiple Point-to-Point circuits configured to the same X.121 destination. Each of them requires a unique connection ID. Assign the same connection ID to both the local and remote configurations for each circuit. You use the Connection ID parameter with PTOP service only.
Instructions:	Assign a unique connection ID for each X.121 connection.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.11

Parameter:	**Enable 1356 Multiplexing**
Default:	Disable
Options:	Enable | Disable
Function:	If you set this parameter to Enable, the router can use RFC 1356 Null Encapsulation to send multiple protocols over a single virtual circuit. If you set the value to Disable, the router uses RFC 1356 Normal Encapsulation for IP and OSI, and RFC 1356 SNAP Encapsulation for any of the other protocols, opening a separate virtual circuit for each protocol. Bay Networks advises multiplexing only when you configure multiple routing protocols on a PDN type of service.
Instructions:	Select Enable if you want to multiplex traffic over a single virtual circuit. Otherwise, select Disable.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.34

Adding X.25 Network Service Records to a Previously Configured Interface

To add a new network service record to an existing X.25 interface, begin at the Configuration Manager window and

1. **Select Circuits > Edit Circuits to display the Circuit List window.**
2. **Select the X.25 interface to which you want to add network service records.**
3. **Click on Edit to display the Circuit Definition window.**
4. **Select X25 Protocol > Service.**

   The X.25 Service Configuration window appears (refer to Figure 3-4). It lists all network service records currently defined for the interface. Follow the instructions in the section, “Adding X.25 Network Service Records.”

Enabling Bridging and Routing Services on an X.25 Circuit

After you have added at least one network service record, you can enable bridging and routing protocols on an X.25 PTOP circuit, and routing protocols only on X.25 PDN and DDN circuits.

Note: If you configure multiple DDN or PDN network service records on the X.25 circuit, you need to enable routing protocols on that circuit only once. However, if you configure multiple PTOP network service records on the X.25 circuit, you must enable bridging/routing protocols for each PTOP network service record. This is because the router uses a different internal circuit for each PTOP record configured on the circuit.

To enable bridging and routing services:

1. **Select a network service record in the X.25 Service Configuration window (Figure 3-6).**
2. **Select Protocols > Add/Delete (Figure 3-6).**

   The Select Protocols window appears (Figure 3-7).
3. **Select the bridging/routing protocols you want to enable on the circuit, then click on OK.**

After you have selected the protocols, refer to the appropriate configuration guide for instructions on how to configure the parameters associated with these protocols.

When you have specified the protocol-specific parameters in all windows, the Configuration Manager redisplays the X.25 Service Configuration window.

4. **Enable additional bridging/routing protocols on the circuit by repeating Steps 1 through 3, or click on Done to exit the window.**

Configuring IP Interfaces over X.25 Circuits

The Configuration Manager allows you to configure multiple IP interfaces on a single X.25 PDN circuit. This means that a single X.25 circuit can respond to multiple IP addresses, each on a different subnet, at the same time.

This section leads you through the Configuration Manager windows that appear when you configure IP interfaces on a single X.25 circuit. To configure multiple IP addresses over X.25:

1. **From the X.25 Service Configuration window (Figure 3-6), select Protocols > Add/Delete.**

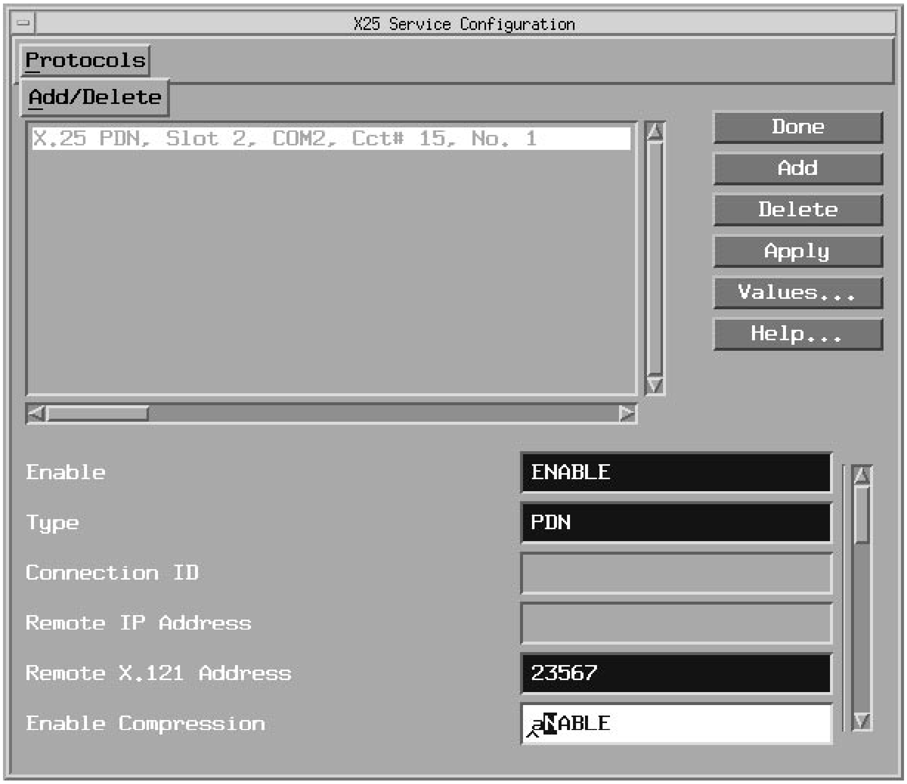

Figure 3-6. Selecting Protocols > Add/Delete

The Select Protocols window appears (Figure 3-7).

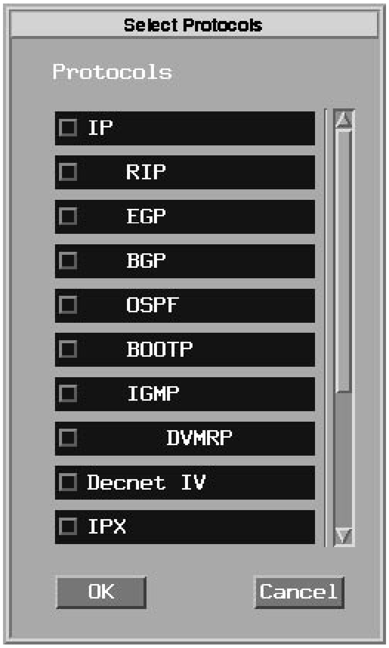

Figure 3-7. Select Protocols Windows

2. **From the Select Protocols window, select IP and click on OK to display the IP Configuration window (Figure 3-8).**

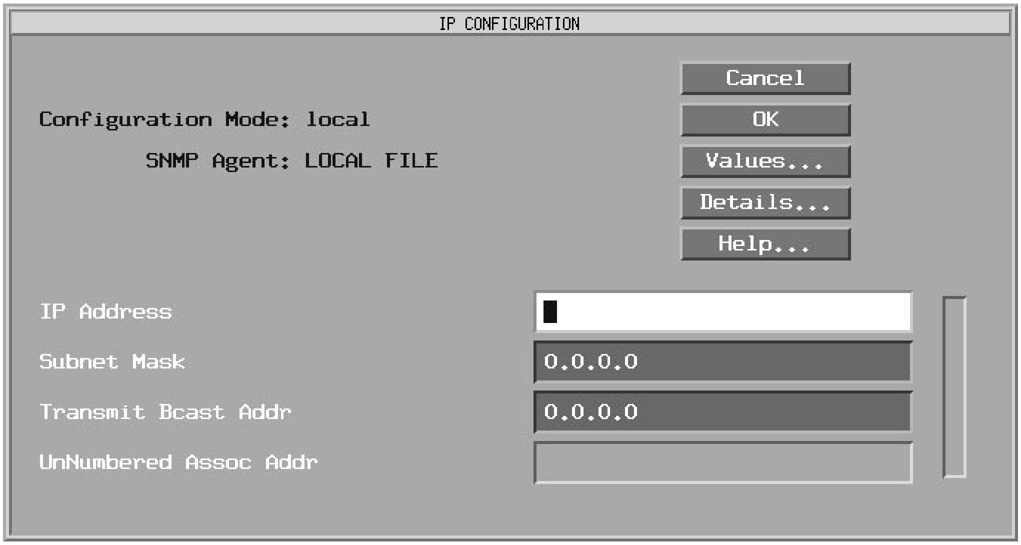

Figure 3-8. IP Configuration Window

3. **Configure the parameters using the descriptions that follow as a guide.**

   Note that you do not need to set the Unnumbered Assoc Addr parameter.

Parameter:	**IP Address**
Default:	None
Options:	Any valid IP address
Function:	Assigns a 32-bit IP address to the interface.
Instructions:	Enter the IP address of the interface in dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.4

Parameter:	**Subnet Mask**
Default:	0.0.0.0
Options:	The Configuration Manager automatically calculates an appropriate subnet mask, depending on the class of the network to which the interface connects. However, you can change the subnet mask with this parameter.
Function:	Specifies the network and subnetwork portion of the 32-bit IP address.
Instructions:	Accept the assigned subnet mask or enter another subnet mask in dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.6

Parameter:	**Transmit Bcast Addr**
Default:	0.0.0.0
Options:	0.0.0.0 or any valid IP broadcast address
Function:	Specifies the broadcast address that this IP subnet uses to broadcast packets. Accepting 0.0.0.0 for this parameter specifies that the IP router will use a broadcast address with a host portion of all 1s. Accepting 0.0.0.0 does not configure the router to use the address 0.0.0.0 to broadcast packets. For example, if you have IP address 123.1.1.1 and a subnet mask of 255.255.255.0, accepting the default value 0.0.0.0 configures the IP router to use the address 123.1.1.255 to broadcast packets. To set an explicit broadcast address of all 1s, enter 255.255.255.255 for this parameter.
Instructions:	Accept the default, 0.0.0.0, unless the calculated broadcast address (host portion) of all 1s is not adequate. In that case, enter the appropriate IP broadcast address in dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.8

4. **When you are finished configuring the parameters in the IP Configuration window, click on OK to display the Enter Adjacent Host window (Figure 3-9).**

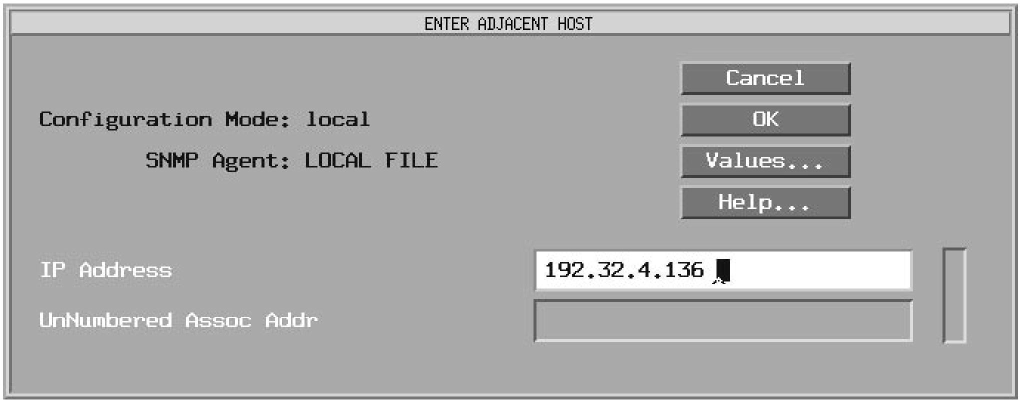

Figure 3-9. Enter Adjacent Host Window

5. **Enter the IP address of the adjacent host.**

You do not need to enter a value for the Unnumbered Assoc Addr parameter.

Parameter:	**IP Address**
Default:	None
Options:	The IP address of the remote X.25 interface which the X.25 call will terminate. This address must be on the same IP network as the local X.25 interface.
Function:	Assigns a 32-bit IP address to the interface.
Instructions:	Enter the IP address of the interface in dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.5.3.2.1.4.1.4

6. **Click on OK to return to the X.25 Service Configuration window (refer to Figure 3-6).**

7. **Select Protocols > Edit IP > Interfaces to display the IP Interfaces window (Figure 3-10).**

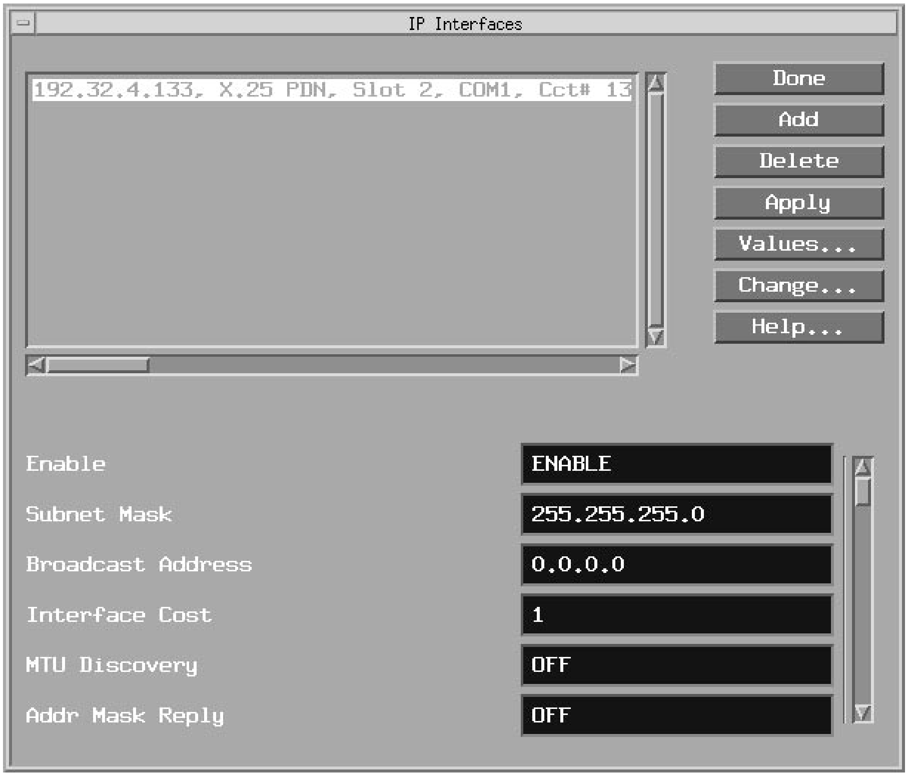

Figure 3-10. IP Interfaces Window

Note: For information on the parameters in the IP Interfaces window, refer to *Configuring IP Services*.

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8. **Click on Add to configure additional IP interfaces on the X.25 circuit.**

   The IP Configuration window appears (Figure 3-11).

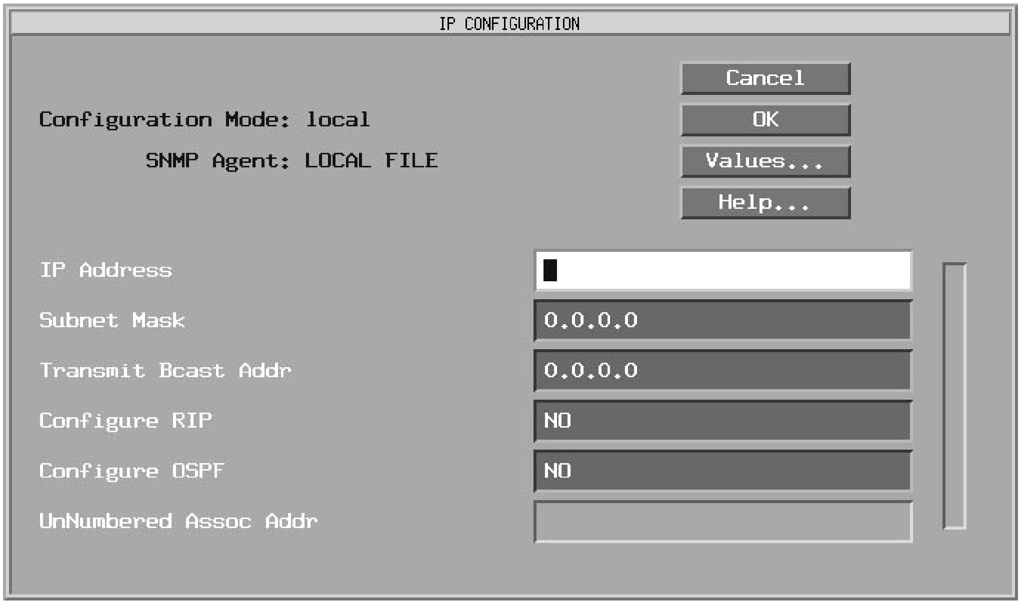


Figure 3-11. Adding an IP Interface to an X.25 Circuit

9. **Configure the parameters, using the descriptions that follow as a guide.**

   See Step 3 for descriptions of the IP Address, Subnet Mask, and Transmit Bcast Addr parameters.

   Note that you do not need to set the Unnumbered Assoc Addr parameter.

Parameter:	**Configure RIP**
Default:	None
Options:	YES | NO
Function:	Specifies whether the Routing Information Protocol (RIP) is configured on this interface.
Instructions:	Click on Values and select YES or NO.
MIB Object ID:	None

Parameter:	**Configure OSPF**
Default:	None
Options:	YES | NO
Function:	Specifies whether the Open Shortest Path First (OSPF) protocol is configured on this interface.
Instructions:	Click on Values and select YES or NO.
MIB Object ID:	None

For detailed information on RIP and OSPF, refer to *Configuring IP Services*.

10. **After you have specified the parameters in the IP Configuration window, click on OK.**

    The Enter Adjacent Host window appears (refer to Figure 3-9).

11. **Specify the IP address for the remote host, as previously described.**

    If you need to specify additional IP interfaces on the X.25 circuit, click on Add in the IP Interfaces window (refer to Figure 3-10) and continue adding IP interfaces until you are finished.

Chapter 4
Editing X.25 Parameters

After you enable X.25, you can edit all X.25 parameters from the Configuration Manager window (Figure 4-1). Refer to *Configuring Routers* for instructions on using Site Manager to access this window.

For each X.25 parameter, this chapter gives the default setting, valid parameter options, the parameter function, instructions for setting the parameter, and the MIB object ID.

The Technician Interface allows you to modify parameters by executing **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 the validity of the value you enter for a parameter. Entering an invalid value can corrupt your configuration.

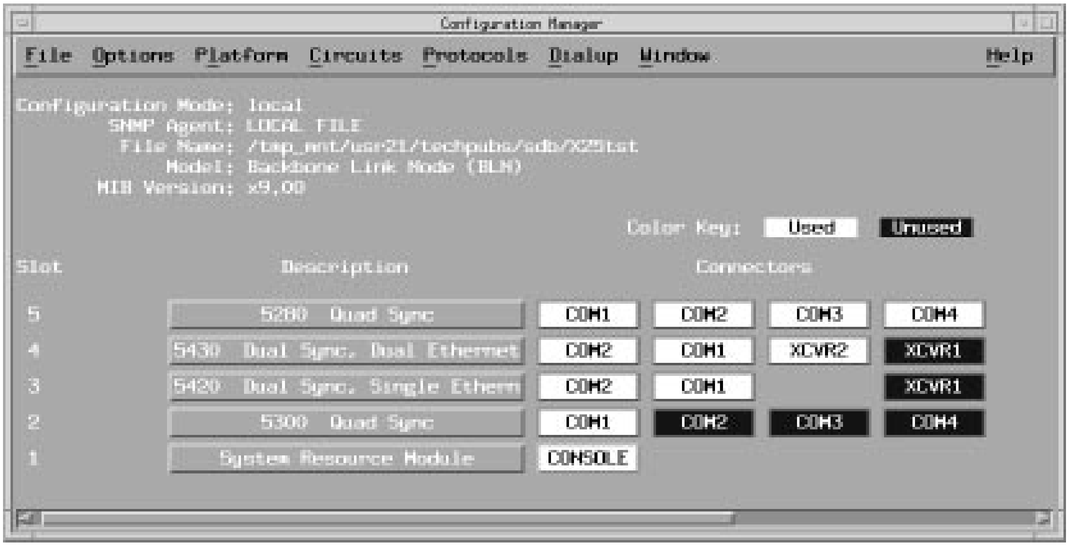


Figure 4-1. Configuration Manager Window

Editing the X.25 Global Parameter

The X.25 global parameter enables X.25 services for the entire router. To edit the X.25 global parameter, begin at the Configuration Manager window, shown in Figure 4-1, and

1. **Select Protocols > X25 > Global.**

   The Edit X.25 Global Parameters window appears (Figure 4-2).

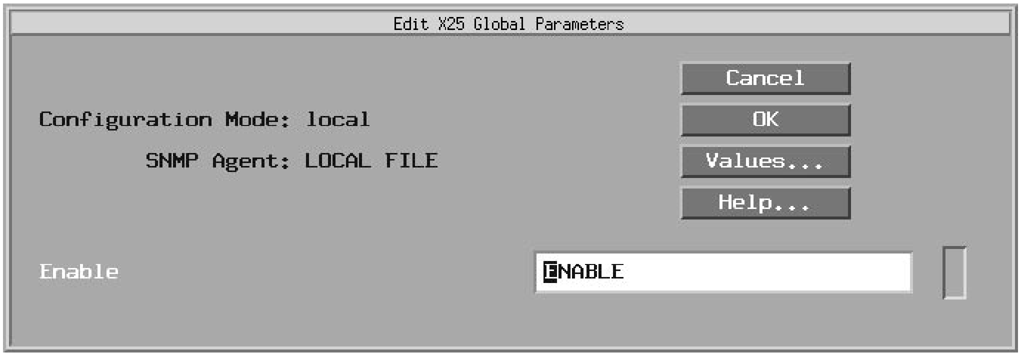


Figure 4-2. Edit X.25 Global Parameters Window

2. **Enable or disable X.25 services, using the Enable parameter as described in the following parameter description.**
3. **Click on OK to save your changes.**

X.25 Global Parameter Description

Use the following parameter description to edit the X.25 global parameter.

Parameter:	**Enable**
Default:	Enable
Options:	Enable	Disable
Function:	Globally enables or disables X.25 services.
Instructions:	Set to Disable if you want to disable X.25 services.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.1.2

Editing X.25 Packet-level Parameters

The X.25 packet-level parameters are specific to individual X.25 interfaces. To edit packet-level parameters for an existing interface, begin at the Configuration Manager window (refer to Figure 4-1) and

1. **Select Circuits > Edit Circuits to display the Circuit List window.**
2. **Select the X.25 interface that you want to edit; then click on Edit.**

   The Circuit Definition window appears.
3. **Select X25 Protocol > Packet.**

   The X.25 Packet Level Edit window appears (Figure 4-3).
4. **Edit the packet-level parameters that you want to change, using the parameter descriptions that follow as a guide.**
5. **Click on OK to exit the window.**

Note: When you reconfigure an interface in dynamic configuration mode, X.25 packet-level and LAPB service restart on that interface.

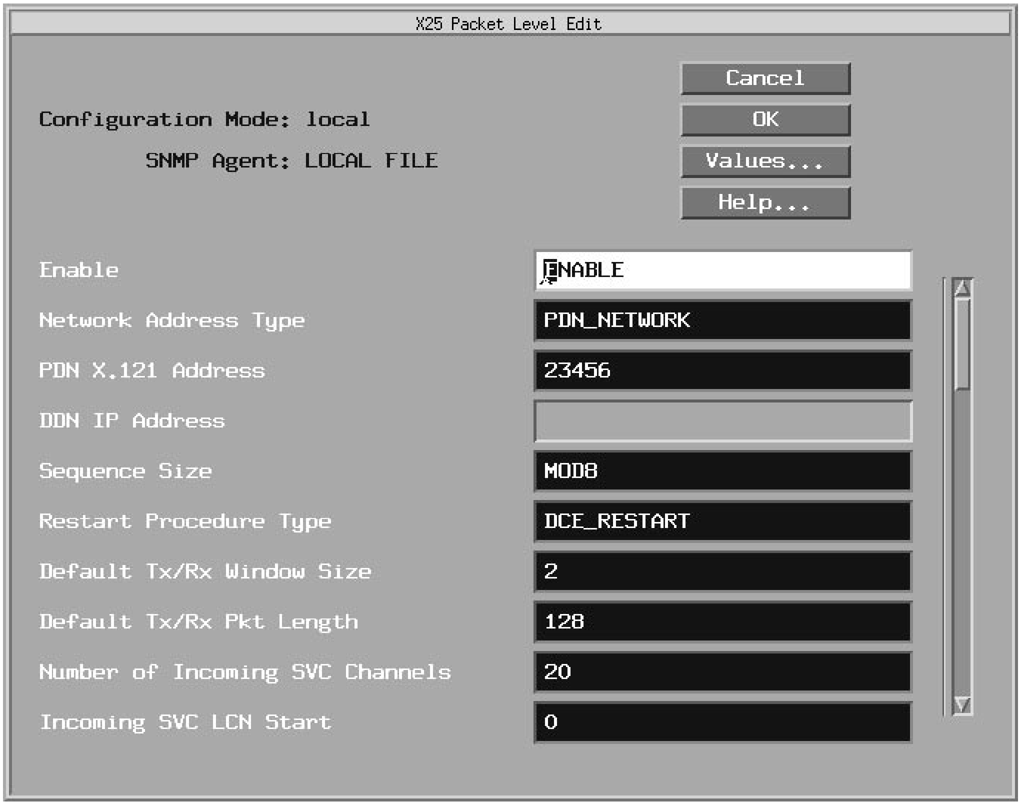


Figure 4-3. X.25 Packet Level Edit Window

X.25 Packet-level Parameter Descriptions

Use the following descriptions as guidelines when you edit the parameters in the X.25 Packet Level Edit window (refer to Figure 4-3). Because you may want to edit the parameters you set previously to enable X.25 services, this chapter repeats descriptions for those parameters and adds descriptions for the parameters for which the Configuration Manager supplies default values.

Caution: Line speed, packet size, and window size all affect packet throughput across the X.25 network. Setting any of these variables too low can cause the router to drop packets. Therefore, use caution when changing the default settings for the following X.25 parameters:

- Max Window Size
- Max Packet Length
- Window Size
- Packet Size

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables packet-level services for the interface.
Instructions:	Set to Disable to disable packet-level services.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.2

Parameter:	**Network Address Type**
Default:	PDN_Network
Options:	PDN_Network | DDN_Network | BFE_Network
Function:	Specifies the type of X.25 network to which the interface connects. The value of this parameter determines the format of the local X.121 address.
Instructions:	Do not set this parameter if you have a Point-to-Point connection. Specify PDN_Network for a Public Data Network. Specify DDN_Network for a Defense Data Network. Specify BFE_Network for a DDN network that uses BFE encryption. If you specify PDN_Network, you must enter the local address in X.121 address format, that is, you must specify a value for the PDN X.121 Address parameter. If you specify DDN_Network or BFE_Network, you must enter the local address in IP address format, that is, you must specify a value for the DDN IP Address parameter. The router translates the address into X.121 format.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.50

Parameter:	**PDN X.121 Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies the X.121 address assigned to this interface. The X.25 network service provider supplies the X.121 address. Set this parameter only if you set the Network Address Type parameter to PDN_Network.
Instructions:	Enter the appropriate X.121 address (up to 15 decimal digits).
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.52

Parameter:	**DDN IP Address**
Default:	None
Options:	Any valid IP address
Function:	Specifies the IP address assigned to this interface. The router translates the address into X.121 format and uses it as the local address. Set this parameter only if you set the Network Address Type parameter to DDN_Network or BFE_Network.
Instructions:	Enter the appropriate IP address.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.51

Parameter:	**Sequence Size**
Default:	MOD8
Options:	MOD8 | MOD128
Function:	Specifies the modulo of sequence numbering.
Instructions:	Set to the appropriate sequence size.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.10

Parameter:	**Restart Procedure Type**
Default:	DTE_Restart (for DTE) or DCE_Restart (for DCE)
Options:	DTE_Restart | DTE_Norestart | DTE_DXE | DCE_Restart
Function:	For each X.25 interface, this parameter specifies the device type (DTE or DCE) at the X.25 packet level. It also enables you to turn on restart procedures, which clear all virtual circuits and let you initialize a link. You can also use the restart procedures to recover from a network failure.
Instructions:	Select the value that matches your device type and determine whether you want to enable restart procedures. Select DTE_Restart if your interface is a DTE. Select DCE_Restart if your interface is a DCE. Select DTE_Norestart if you have a DTE interface but do not want to enable restart procedures. DTE_DXE is for a DTE/DTE environment, and it leaves the DTE unassigned, while still providing restart procedures.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.45

Parameter:	**Default Tx/Rx Window Size**
Default:	2
Options:	1 through 7 (for MOD8) or 1 through 127 (for MOD128)
Function:	Specifies a default window size for this packet layer. The value in this parameter applies only if the Flow Control Negotiation parameter is set to OFF in both the packet level and service record parameters.
Instructions:	To specify a window size other than 2, enter a value within the specified range.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.42

Parameter:	**Default Tx/Rx Pkt Length**
Default:	128
Options:	16 | 32 | 64 | 128 | 256 | 512 | 1024 | 2048 | 4096
Function:	Specifies a default packet size for this packet layer. The value in this parameter applies only if the Flow Control Negotiation parameter is set to OFF.
Instructions:	To specify a nonstandard default packet size, set to one of the available options.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.43

Note: The following parameters require you to specify logical channel number (LCN) value ranges for SVCs. Each SVC channel you configure on the router must have a unique LCN. There are three types of SVC channels: incoming, bidirectional, and outgoing. You must configure at least one SVC channel for X.25 to establish calls. The total number of channels you configure cannot exceed 512.

Parameter:	**Number of Incoming SVC Channels**
Default:	0
Options:	0 through 512
Function:	Specifies the number of logical channels that accept incoming calls only.
Instructions:	Enter the number of channels that you assign to incoming calls only on this interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.36

Parameter:	**Incoming SVC LCN Start**
Default:	0
Options:	1 through 4095
Function:	Specifies the lowest logical channel number that the router can assign to logical channels that accept incoming call requests only.
Instructions:	Enter a number greater than the highest number reserved for PVC channels, but small enough that the last SVC channel number will be less than 4095.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.37

Parameter:	**Number of Bidirectional SVC Channels**
Default:	0
Options:	0 through 512
Function:	Specifies the number of logical channels that both accept incoming calls and transmit outgoing calls.
Instructions:	Enter the number of logical channels that you assign to both accept and transmit calls on this interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.38

Parameter:	**Bidirectional SVC LCN Start**
Default:	0
Options:	1 through 4095
Function:	Specifies the lowest logical channel number that the router can assign to bidirectional logical channels.
Instructions:	Enter a number greater than the highest number reserved for Incoming SVC channels, but small enough that the last SVC will be less than 4095.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.39

Parameter:	**Number of Outgoing SVC Channels**
Default:	0
Options:	0 through 512
Function:	Specifies the number of logical channels that transmit outgoing calls only.
Instructions:	Enter the number of channels that you assign to outgoing calls only.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.40

Parameter:	**Outgoing SVC LCN Start**
Default:	0
Options:	1 through 4095
Function:	Specifies the lowest logical channel number that the router can assign to logical channels that transmit outgoing call requests only.
Instructions:	Enter a number greater than the highest number reserved for bidirectional SVC channels, but small enough that the last SVC channel number will be less than 4095.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.41

Parameter:	**Use Default Service Configuration**
Default:	OFF
Options:	ON | OFF
Function:	Creates default DDN service records for every DDN SVC on your network.
Instructions:	Select ON if you want to use default values for your DDN SVCs. Refer to configuration instructions in Chapter 4 if you want to set this parameter to ON and still individually configure some of your DDN SVCs.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.54

Parameter:	**T1 Timer**
Default:	60 seconds
Options:	1 through 999
Function:	Specifies how long the router waits to receive an acknowledgment of a transmitted command frame. Specifically, the T1 timer sets, in seconds, the timeout values for Restart, Reset, and Clear commands. The router uses this timer to set up data links.
Instructions:	We recommend that you accept the default value, 60.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.32

Caution: We recommend that you accept the default T1 Timer, T2 Timer, T3 Timer, and T4 Timer values. Reset these parameters with caution.

Parameter:	**T2 Timer**
Default:	180 seconds
Options:	1 through 999
Function:	Specifies the call-confirmation timeout value in seconds. The value for this timer is the amount of time the router has to respond to a call-confirmation condition. This timer represents the ITU-T (formerly CCITT) T11 timer for the DCE and the T21 timer for the DTE.
Instructions:	We recommend that you accept the default value, 180.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.33

Parameter:	**T3 Timer**
Default:	200 milliseconds
Options:	200 through 2000
Function:	Specifies the congestion or busy condition watchdog timeout value in milliseconds. The value for this timer is the length of time the router has to respond to a congestion or busy condition.
Instructions:	We recommend that you accept the default value, 200.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.34

Parameter:	**T4 Timer**
Default:	200 milliseconds
Options:	200 through 2000
Function:	Specifies the data packet transmission watchdog timeout value in milliseconds. The value for this timer is the length of time that the router has to respond to an acknowledgment frame. This is a Bay Networks proprietary internal timer.
Instructions:	We recommend that you accept the default value, 200.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.35

Parameter: Flow Control Negotiation

Default: OFF

Options: ON | OFF

Function: Enables the flow-control negotiation facility on this interface.

When you enable flow-control negotiation, the router can negotiate the maximum window size and packet length for virtual circuits on this interface on a per-call basis. It uses the Max Window Size and Max Packet Length parameter settings as a boundary check during negotiations. The receiving DTE may accept these values or reply with a counterproposal.

When you disable flow-control negotiation, the router uses the values specified by these parameters:

– Default Tx/Rx Window Size

– Default Tx/Rx Pkt Length

Configure the remote peer router to match these default values.

Instructions: To enable flow-control negotiation, set this parameter to ON. Then be sure to set the following parameters as shown in Table 4-1, or flow-control negotiation will not work.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.14

Table 4-1. Parameter Settings for Flow-Control Negotiation

Parameter	Value
X. 25 Packet-Level parameters	
Max Window Size/Max Packet Length	See parameter descriptions
Acceptance Format	DEFEXT
Release Format	DEFEXT
X. 25 Service Record parameters	
Flow Facility	Negot
Window Size/Packet Size	See parameter descriptions

Parameter: Max Window Size

Default: 2

Options: 1 through 7 (for MOD8) or 1 through 127 (for MOD128)

Function: Specifies the maximum window size allowed in the facilities field of outgoing and incoming call request packets generated by the router and transmitted on this interface.

Instructions: If you set the Sequence Size parameter to MOD8, accept the default, 2, or enter a value between 1 and 7. If you set the Sequence Size parameter to MOD128, enter a value between 1 and 127.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.11

Parameter: Max Packet Length

Default: 128

Options: 16 | 32 | 64 | 128 | 256 | 512 | 1024 | 2048 | 4096

Function: Specifies the maximum length, in bytes, of the information field of outgoing X.25 packets generated by the router and transmitted on this interface.

Instructions: Accept the default, 128, or set to one of the available options.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.12

Caution: Window size and packet length can affect packet throughput across the X.25 network. Setting either the Max Window Size or Max Packet Length parameter too low can cause the router to drop packets.

Also note that on peer routers, the values of the Max Window Size and Max Packet Length parameters must be the same. For example, if you set the Max Window Size for Router A to 7, then set the Max Window Size for peer Router B to 7.

Parameter: **Tx/Rx Throughput Class**

Default: THRCLASS19200

Options: THRCLASS75 | 150 | 300 | 600 | 1200 | 2400 | 4800 | 9600 | 19200 | 48000

Function: Specifies the default data throughput rate (amount of data in bits per second) for packets transmitted and received on this X.25 interface. This is the throughput value that the router first uses when bringing up the line.

If the router receives an incoming call requesting to negotiate a throughput rate different from this value, the router checks the Max Throughput Class parameter value to determine whether it can support the requested rate.

Instructions: To specify a nonstandard default data throughput rate, select one of the available options.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.44

Parameter: **Throughput Class Negotiation**

Default: OFF

Options: ON | OFF

Function: Permits the negotiation of throughput classes, allowing you to determine the amount of throughput you want to go through the switch.

When you enable this parameter, the router can negotiate the throughput rate for virtual circuits on this interface on a per-call basis. The receiving DTE may accept the proposed rate or reply with a counterproposal.

Instructions: If you want the router to accept calls with throughput negotiation, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.15

Parameter:	**Max Throughput Class**
Default:	19200
Options:	75 | 150 | 300 | 600 | 1200 | 2400 | 4800 | 9600 | 19200 | 48 K | 64 K
Function:	Specifies the maximum throughput rate (amount of data in bits per second) that this VC can send across the X.25 network. If the Throughput Class Negotiation parameter is set to ON, the default value (19200) is the maximum value allowed by this parameter.
Instructions:	Accept the default, 19200, or select one of the available options.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.13

Parameter:	**Network User Identification**
Default:	OFF
Options:	ON | OFF
Function:	Specifies whether this interface supports the Network User Identification (NUI) service facility. When you enable this parameter, the router can provide administrative and management information to the DCE on a per-call basis.
Instructions:	To enable NUI support, set this parameter to ON.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.16

Parameter:	**Incoming Calls Accept**
Default:	ON
Options:	ON | OFF
Function:	Specifies whether this interface accepts incoming calls. When you enable this parameter, the router can accept incoming call requests on this interface.
Instructions:	To disable incoming calls, set this parameter to OFF.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.17

Parameter: **Outgoing Calls Accept**

Default: ON

Options: ON | OFF

Function: Specifies whether this interface generates outgoing call requests.

When you enable this parameter, the router can initiate outgoing call requests on this interface.

Instructions: To disable outgoing calls, set this parameter to OFF.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.18

Parameter: **Fast Select Accept**

Default: OFF

Options: ON | OFF

Function: Enables the fast select accept facility on this interface.

When you enable this parameter, the router can accept incoming call requests with fast select facility on this interface.

Instructions: To enable the fast select accept facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.19

Parameter: **Reverse Charge Accept**

Default: OFF

Options: ON | OFF

Function: Enables or disables the reverse charge accept facility on this interface.

When you enable this parameter, the router can accept calls with the reverse charge facility.

Instructions: To enable the reverse charge accept facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.20

Note: When this parameter is set to ON, the router accepts calls with the reverse charge facility, but it does not maintain a record of the charges.

Parameter: **Fast Select**

Default: OFF

Options: ON | OFF

Function: Enables the fast select request facility on this interface.

When you enable this parameter, call request packets the router generates and transmits on this interface can contain up to 128 bytes of user data.

Instructions: To enable the fast select request facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.21

Parameter: **Reverse Charging**

Default: OFF

Options: ON | OFF

Function: Enables or disables the reverse charge request facility on this interface.

Packet network charges accrue whenever the router generates an outgoing call request packet. When you enable this parameter, these packet network charges are charged to the receiving DTE.

Instructions: To enable the reverse charge request facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.22

Parameter: **CUG Selection**

Default: Null

Options: Null | Basic (16) | Extended (32)

Function: Specifies the type of closed user group (CUG) facility that the interface supports.

Instructions: If you accept the default value, Null, no closed user groups are supported; if you set this parameter to Basic, the Basic facility is supported; if you set this parameter to Extended, the Extended facility is supported. Ensure that the value of this parameter matches the value of the network service record parameter CUG Facility Format.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.23

Parameter:	**CUG Outgoing Access**
Default:	Null
Options:	Null | CUGOA
Function:	Specifies whether or not this interface supports a closed user group (CUG) with outgoing access.
Instructions:	To enable CUG with outgoing access, set this parameter to CUGOA. If you enable this option, set the CUG Selection parameter to Extended. In addition, set the network service record parameter CUG Facility Type to OA.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.24

Parameter:	**CUG Bilateral Selection**
Default:	Null
Options:	Null | Bilateral
Function:	Specifies whether or not this interface supports a bilateral closed user group (CUG).
Instructions:	To enable CUG with bilateral facility support, set this parameter to Bilateral. If you enable this option, set the CUG Selection parameter to Extended. In addition, set the network service record parameter CUG Facility Type to Bilateral.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.25

Parameter:	**RPOA Selection**
Default:	OFF
Options:	ON | OFF
Function:	Enables the recognized private operating agencies (RPOA) selection facility on this interface. When you enable this parameter, the router can accept incoming calls with this facility; the router accepts both RPOA Basic format and Extended format.
Instructions:	To enable the RPOA facility, set this parameter to ON.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.26

Note: When this parameter is set to ON, the router accepts calls with the RPOA facility, but it does not validate them.

Parameter:	**Charging Information**
Default:	OFF
Options:	ON | OFF
Function:	Specifies whether this packet layer accepts incoming calls with charging information; however, the packet layer does not collect any charging information.
Instructions:	To enable the charging information facility, set this parameter to ON.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.27

Parameter:	**Transit Delay**
Default:	OFF
Options:	ON | OFF
Function:	Specifies whether this packet layer accepts incoming calls with transit delay. Note that the router does not send outgoing calls with transit delay.
Instructions:	To enable transit delay, set this parameter to ON.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.28

Parameter:	**Full Addressing**
Default:	ON
Options:	ON | OFF
Function:	Specifies whether the router includes a full local DTE address in all outgoing call requests transmitted on this interface.
Instructions:	To enable full addressing, set this parameter to ON.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.29

Parameter:	**Acceptance Format**
Default:	Basic (2)
Options:	Basic (2) | Allext (255) | Defext (128)
Function:	Specifies the call accept packet format as follows: – Basic is Basic call accept packet format. – ALLEXT is Extended call accept packet format. – DEFEXT specifies that when an incoming call does not include facilities, a default Basic call accept packet format is used.
Instructions:	Select the appropriate call accept packet format.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.30

Parameter:	**Release Format**
Default:	Basic (2)
Options:	Basic (2) | Allext (255) | Defext (128)
Function:	Specifies the format of the call clear packet as follows: – Basic is Basic call clear packet format. – ALLEXT is Extended call clear packet format. – DEFEXT specifies that when an incoming call does not include facilities, a default Basic call clear packet format is used.
Instructions:	Select the appropriate call clear packet format.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.31

Parameter:	**CCITT Conformance**
Default:	DXE1988
Options:	DXE1980 | DXE1984 | DXE1988 | FDSEL1980 | FDSEL1984 | FDSEL1988
Function:	Specifies the CCITT (now ITU-T) specification to which the router's operation conforms.
Instructions:	Select a CCITT conformance year that matches your network requirements. For example, if you are connecting to a DXE1980-compliant network, select DXE1980.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.46

Parameter:	**Network Standard**
Default:	None
Options:	None | ISO | DOD
Function:	Specifies the network standard with which your router complies. The value of this parameter is in addition to the ITU-T (formerly CCITT) specification with which your network conforms.
Instructions:	Select the appropriate network standard. Choose None if you want to use only the CCITT Conformance value. Select ISO if you are connecting to a network that complies with the International Organization for Standardization. Select DOD if you are connecting to a network that complies with Department of Defense specifications (DDN networks).
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.47

Parameter:	**Statistics Computation**
Default:	Disable
Options:	Enable | Disable
Function:	Specifies whether the router computes statistics and X.25 debug logging for the packet level and all the virtual circuits associated with this line instance. If you set this parameter to Disable, the router computes no statistics, which maximizes data throughput. If you set this parameter to Enable, the router computes statistics.
Instructions:	Set this parameter to Enable or Disable.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.49

Parameter:	**Client Response Timer**
Default:	120 seconds
Options:	1 through 999
Function:	Specifies the client application response timeout period in seconds to allow for extended delays that can occur negotiating with remote clients. This timer must have a value greater than that for the T3 Timer parameter, and less than the value for the T2 Timer parameter.
Instructions:	We recommend that you accept the default value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.57

Editing X.25 Network Service Records

To edit the parameters for an existing X.25 network service record, begin at the Configuration Manager window (refer to Figure 4-1) and

1. **Select Circuits > Edit Circuits.**

   The Circuit List window appears.

2. **Select an X.25 interface; then click on Edit.**

   The Circuit Definition window appears.

3. **Select X25 Protocol > Service.**

   The X.25 Service Configuration window appears (Figure 4-4). It lists all currently defined network service records.

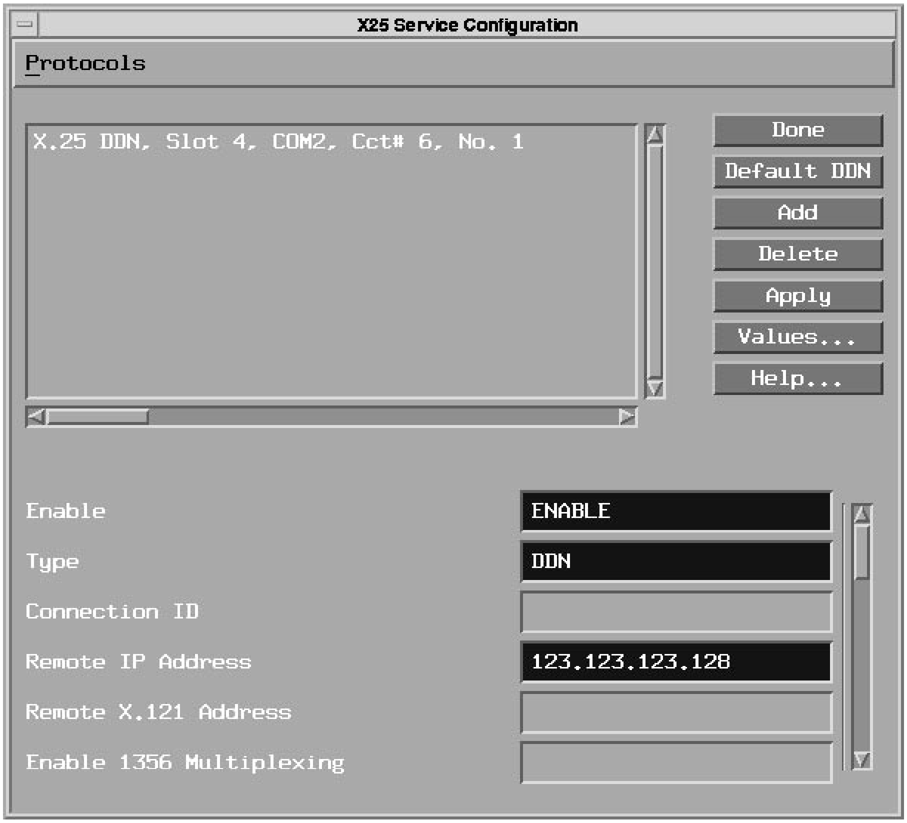


Figure 4-4. X.25 Service Configuration Window for a DDN Network

4. **Select the network service record you want to edit.**
5. **Edit the network service parameters that you want to change, using the parameter descriptions that follow as guidelines.**
6. **If you are configuring DDN Service Records and you want to change the default values for service record parameters, click on Default DDN, and edit service record parameters in the Default DDN Service window (Figure 4-5).**

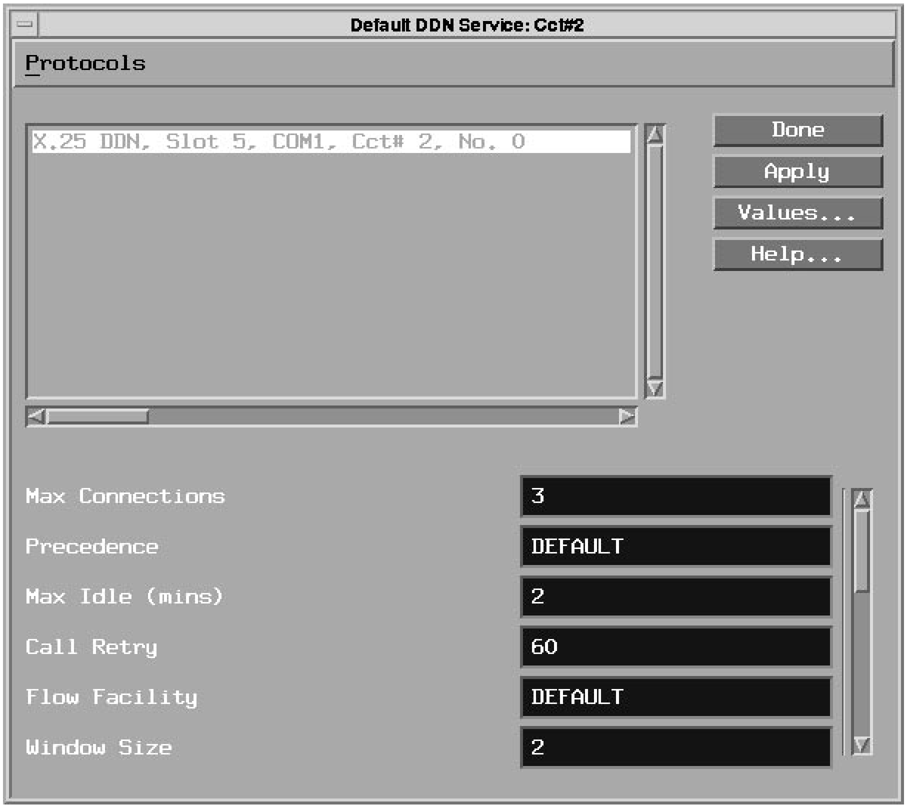


Figure 4-5. Default DDN Service Window

7. **Click on Apply to implement your changes.**

   The values that you have selected are the new default DDN service record parameter values. They apply to all DDN circuits, except those that you configure individually, following Steps 1 through 5 of this procedure.

8. **Click on Done.**

X.25 Network Service Record Parameter Descriptions

This section provides information on how to set all network service record parameters in the X.25 Service Configuration window (refer to Figure 4-4).

Parameter: **Enable**

Default: Enable

Options: Enable | Disable

Function: Enables or disables the network service record.

Instructions: Set this parameter to Disable only if you want to disable this service record.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.2

Parameter: **Type**

Default: None

Options: PDN | DDN | PTOP | IPEX | QLLC

Function: Specifies the type of X.25 service that this interface supplies.

- PDN for Public Data Network service
- DDN for Defense Data Network service
- PTOP for Point-to-Point network service
- IPEX for TCP/IP Tunneling over X.25
- QLLC for QLLC service

Instructions: Choose one of these network service types. If you specify IPEX or QLLC you must configure several IPEX or QLLC specific parameters (refer to Chapter 5 for IPEX and Chapter 6 for QLLC).

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.9

Parameter: **Connection ID**

Default: 1

Options: 1 through 255

Function: Identifies each circuit to its remote destination. You can have multiple Point-to-Point circuits configured to the same X.121 destination. Each of them requires a unique Connection ID. Assign the same connection ID to both the local and remote configurations for each circuit. You use the Type parameter with PTOP service only.

Instructions: Assign a unique connection ID for each X.121 connection.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.11

Parameter: **Remote IP Address**

Default: 0.0.0.0

Options: Any valid IP address

Function: Specifies a destination IP address that is reachable over this X.25 interface. This parameter is not used with Point-to-Point service.

You must specify a remote IP address if you plan to enable IP on this interface. For DDN services, the router translates the remote IP address you specify into an X.121 address so that it can route IP traffic over the network. For PDN services, the router uses the remote IP address you specify to define an adjacent host for the IP interface.

Instructions: Enter a 32-bit destination IP address in dotted decimal notation.

If you run OSI over DDN, you must also enter this IP address in the SNPA field of the OSI External Address Adjacency Configuration window. To enter this value in the SNPA field, you must convert the IP address into X.121 format. Refer to *Configuring OSI Services* for more information.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.13

Parameter:	**Remote X.121 Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies a destination X.121 address. You must specify a destination X.121 address if you are configuring PDN or Point-to-Point services. If you are configuring DDN services, the router derives this address from the remote IP address.
Instructions:	Enter a destination X.121 address (up to 15 decimal digits) that is reachable over this X.25 interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.12

Parameter:	**Enable 1356 Multiplexing**
Default:	Disable
Options:	Enable | Disable
Function:	If you set this parameter to Enable, the router can use RFC 1356 Null Encapsulation to send multiple protocols over a single virtual circuit. If you set the value to Disable, the router uses RFC 1356 Normal Encapsulation for IP and OSI, and RFC 1356 SNAP Encapsulation for any of the other protocols, opening a separate virtual circuit for each protocol. Bay Networks advises multiplexing only when you configure multiple routing protocols on a PDN type of service.
Instructions:	Select Enable if you want to multiplex traffic over a single virtual circuit. Otherwise, select Disable.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.34

Parameter:	**Enable Compression**
Default:	Disable
Options:	Enable | Disable
Function:	Enables data compression.
Instructions:	Set this parameter to Enable if you want the X.25 service to use compression for this connection. Otherwise, accept the default, Disable.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.33

Parameter:	**Broadcast**
Default:	OFF
Options:	ON | OFF
Function:	Indicates whether you want the X.25 service to send IP broadcast messages to the remote IP address.
Instructions:	Set this parameter to ON if you want the X.25 service to send broadcast messages to the IP address. Otherwise, accept the default, OFF.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.14

Parameter:	**Max Connections**
Default:	2
Options:	1 through 4
Function:	Specifies the maximum number of virtual circuits that the router can establish with the remote device specified in this record. Increasing the number of connections to the same destination may improve the rate of data throughput. To take advantage of multiple virtual connections and load sharing across them, set this parameter to a value greater than 1. This parameter has meaning only for PDN services.
Instructions:	Accept the default, 2, or enter a value within the specified range.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.15

Parameter:	**Precedence**
Default:	OFF
Options:	ON | OFF
Function:	Specifies the priority of IP packets that this X.25 interface transmits and that traverse the X.25 network. This parameter has meaning only for DDN services.
Instructions:	To enable IP packet prioritization, set Precedence to ON.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.16

Parameter:	**Max Idle (Mins)**
Default:	2, except QLLC default is 0
Options:	0 through 999
Function:	Specifies the maximum number of minutes that a virtual circuit can remain idle. Once the Max Idle timer expires, X.25 clears the circuit. Point-to-Point connections do not use this parameter. QLLC has a default of 0 for this parameter, which disables the parameter Use this parameter to minimize CPU and network overhead during periods of low datagram traffic.
Instructions:	Accept the default value, 2, or enter a timeout value within the specified range. To disable this parameter, enter a value of 0.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.17

Parameter:	**Call Retry**
Default:	60
Options:	10 through 999
Function:	Specifies the interval in seconds between call request packets the router sends to a specific destination. If a call attempt fails, the router waits the number of seconds this parameter specifies before sending another call request packet to the destination. If the router receives any IP datagrams for this destination, it drops them during this period.
Instructions:	Accept the default, 60, or enter a call retry interval within the specified range.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.18

Parameter:	**Flow Facility**
Default:	Default
Options:	Negot | Default
Function:	Enables or disables the X.25 flow-control facility on each virtual circuit. If you enable this parameter, calls the router transmits to the remote X.121 address in this service record will contain flow control. You must also enable the flow-control facility at the packet layer.
Instructions:	To enable flow-control facility negotiations, set this parameter to Negot.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.19

Parameter: Window Size

Default: 2

Options: 1 through 7 (for MOD8) or 1 through 127 (for MOD128)

Function: Specifies the window size that appears in the facilities field of outgoing call request packets to the X.121 address in this service record.

Instructions: Accept the default, 2, or enter a window size within the specified range.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.20

Note: Window size and packet size can affect packet throughput across the X.25 network. Setting the Window Size or Packet Size parameter too low could cause the router to drop packets.

Parameter: Packet Size

Default: 128

Options: 16 | 32 | 64 | 128 | 256 | 512 | 1024 | 2048 | 4096

Function: Specifies the packet size that appears in the facilities field of outgoing call request packets to the remote X.121 address in this service record.

Instructions: Accept the default, 128, or enter a packet size within the specified range.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.21

Note: Do not set this parameter to a value greater than you specify for the packet-level parameter Max Packet Length.

Parameter: **Fast Select Request**

Default: OFF

Options: ON | OFF

Function: Enables the fast select request facility on each virtual circuit.

When you enable this parameter, call request packets this router generates and sends to the remote X.121 address in this service record contain the fast select request facility.

Instructions: To enable the fast select request facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.22

Parameter: **Fast Select Accept**

Default: OFF

Options: ON | OFF

Function: Enables the fast select accept facility.

When you enable the fast select accept facility, the router can accept incoming fast select call requests from the remote X.121 address in this service record.

Instructions: To enable the fast select accept facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.23

Parameter: **Reverse Charge Request**

Default: OFF

Options: ON | OFF

Function: Enables or disables the reverse charge request facility.

Packet network charges accrue whenever the router generates an outgoing call request packet. When you enable Reverse Charge Request, these packet network charges accrue to the receiving DTE.

Instructions: To enable the reverse charge request facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.24

Parameter:	**Reverse Charge Accept**
Default:	OFF
Options:	ON | OFF
Function:	Enables or disables the reverse charge accept facility. When you enable this parameter, the router accepts network packet charges from incoming call request packets.
Instructions:	To enable the reverse charge accept facility, set this parameter to ON.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.25

Parameter:	**DDN BFE**
Default:	Disable
Options:	Disable | Enable
Function:	Enables or disables DDN Blacker front-end encryption (BFE) support.
Instructions:	To enable DDN BFE support, set this parameter to Enable.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.31

Parameter: **User Facility (hex)**

Default: None

Options: Any facility that needs to be included in the call request packet

Function: Allows you to add support for a facility Bay Networks does not transmit. To generate a call with such a facility, you must enter the appropriate facility code in this parameter. You must also set the associated parameter at the packet level to ON. Table 4-2 names the facilities, which are also the names of the packet-level parameters, and gives the corresponding facility codes.

Table 4-2. User Facilities and Codes

Facility/Packet-Level Parameter	Code
Throughput Class Negotiation	02
Network User Identification	C6
RPOA Selection	44
Transit Delay	49

Instructions: Specify a facility in hexadecimal form.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.29

Note: If you need to set this parameter back to nil after you have configured it, you must

1. **Select User Facility from the appropriate network service record (refer to "Editing X.25 Network Service Records" earlier in this chapter).**
2. **Overwrite the erroneous value by typing all spaces where you previously entered a hexadecimal value.**
3. **Click on Apply to implement your changes.**
4. **Click on Done to exit the X.25 Service Configuration window.**

Parameter:	**CUG Facility Format**
Default:	None
Options:	None | Basic | Extended
Function:	Specifies the closed user group (CUG) facility format that the interface can accept. The value of this parameter should match that of the X.25 packet-level parameter CUG Selection.
Instructions:	If you are not configuring a CUG for this interface, select None. To configure the Basic format, select Basic. To configure the extended format, select Extended.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.26

Parameter:	**CUG Facility Type**
Default:	Normal
Options:	Normal | OA | Bilateral
Function:	Defines the type of CUG facility that the interface will accept. This parameter works with the X.25 packet-level parameters CUG Outgoing Access and CUG Bilateral Selection.
Instructions:	Select Normal to enable routing between CUGs.
	Select OA to allow communication between CUGs with outgoing access. If you select OA, make sure that you set the packet-level parameter CUG Outgoing Access to CUGOA.
	Select Bilateral to allow communication between bilateral CUGs. If you select this option, make sure that you set the packet-level parameter CUG Bilateral Selection to Bilateral.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.27

Parameter:	**CUG Number**
Default:	0
Range:	0 through 9999
Function:	Identifies each CUG with a number so that information is routed to the correct CUG.
Instructions:	Enter a number for the closed user group.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.28

Deleting X.25 Network Service Records

To delete a network service record, begin at the X.25 Service Configuration window (refer to Figure 4-4) and

1. **Select the network service record that you want to delete.**
2. **Click on Delete.**

   The X.25 Service Configuration window no longer lists the network service record you deleted.
3. **Click on Done to save your changes and exit the window.**

Deleting X.25 from the Router

To delete X.25 from the router globally, begin at the Configuration Manager window (refer to Figure 4-1) and

1. **Select Protocols > X25 > Delete X.25.**

   A window pops up and prompts:

   ```
   Do you REALLY want to delete X.25?
   ```
2. **Click on OK.**

Site Manager returns you to the Configuration Manager window. X.25 is no longer configured on the router.

Chapter 5
Editing IPEX Parameters

This chapter describes how to configure

- IPEX global parameters, which seldom require attention. Check these parameters to make sure that IPEX is installed.
- IPEX mapping parameters, which you use to configure tunneling.

For each IPEX parameter, this chapter gives the default setting, valid parameter options, the parameter function, instructions for setting the parameter, and the MIB object ID.

The Technician Interface allows you to modify parameters by executing **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 the validity of the parameter values you enter. Entering an invalid value can corrupt your configuration.

Accessing IPEX Global Parameters

After you have configured a network interface circuit for X.25, you can edit the configuration record to enable IPEX service on it.

Access the IPEX global parameters from the Protocols menu in the Configuration Manager window (Figure 5-1).

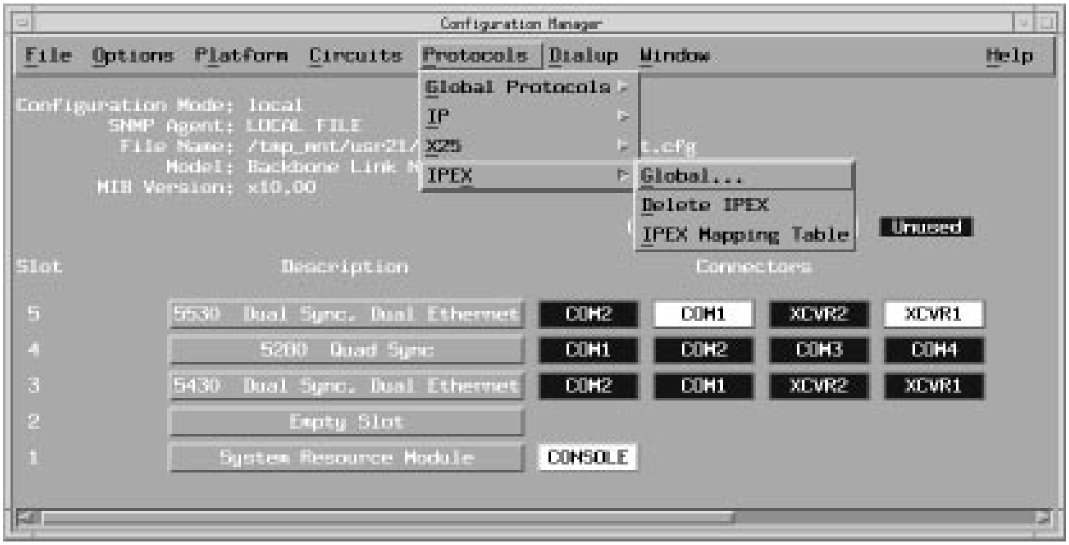


Figure 5-1. Configuration Manager Window Showing IPEX Protocols Menu

1. **From the Protocols menu in the Configuration Manager window, select IPEX > Global.**

   The Edit IPEX Global Parameters window appears (Figure 5-2).

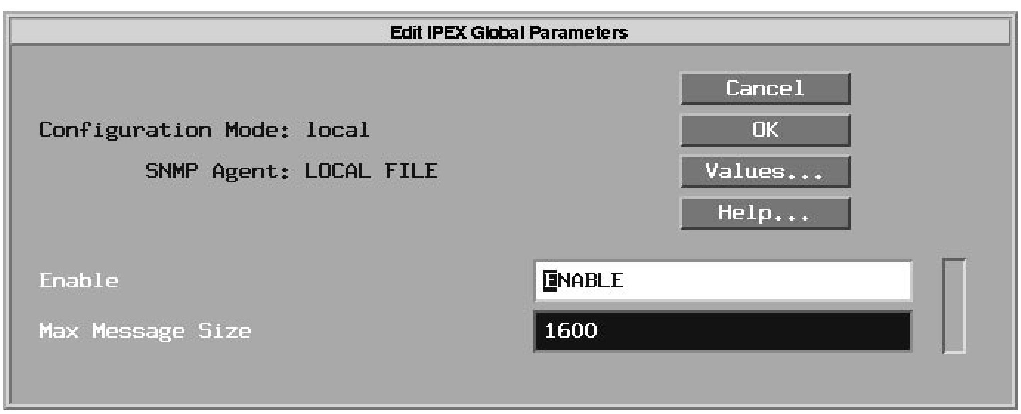


Figure 5-2. Edit IPEX Global Parameters Window

2. **In the Edit IPEX Global Parameters window, accept or change the default values and click on OK to return to the Configuration Manager main window.**

IPEX Global Parameter Descriptions

This section describes the IPEX global parameters you can modify from the Edit IPEX Global Parameters window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Globally enables or disables IPEX.
Instructions:	Select Enable (the default) to activate IPEX on all interfaces. Select Disable to deactivate IPEX on all interfaces. Selecting this option when the Configuration Manager is in dynamic mode terminates all active IPEX sessions.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.1.2

Note: When you create X.25 interfaces that use IPEX service, the service is globally enabled automatically.

Parameter:	**Max Message Size**
Default:	1600
Options:	16 through 4096 bytes
Function:	The maximum client message size that IPEX transports. The value for this parameter cannot be larger than that for the Client Queue Size parameter, and the software prevents you from assigning a value that is too large.
Instructions:	Accept the default, or assign a value equal or less than that for the client queue size.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.1.4

Configuring IPEX Mapping Entries

To set up the mapping between the X.25 and TCP interfaces

1. **Add an entry to the IPEX Mapping Table.**
2. **Configure the IPEX Mapping Parameters.**

Adding an IPEX Mapping Table Entry

To add an entry to the IPEX Mapping Table

1. **In the X.25 Service Configuration window (refer to Figure 4-4), click on Add.**

   The X.25 Service window appears (Figure 5-3).

Figure 5-3. X.25 Service Window

2. **Position your cursor in the Type parameter bar, click on the Values button, and select IPEX as the service type (Figure 5-4).**

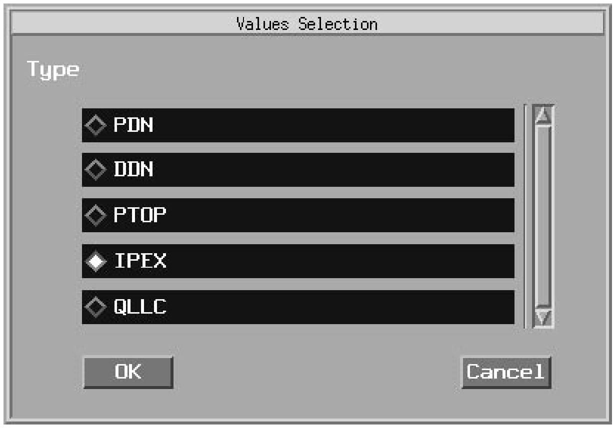


Figure 5-4. Values Selection Window

3. **Click on OK.**

   You return to the X.25 Service window, which now lists IPEX as the Type parameter entry. This is the only parameter you configure in the Service window.

4. **Click on OK.**

   The IPEX Mapping Table Configuration window appears (Figure 5-5).

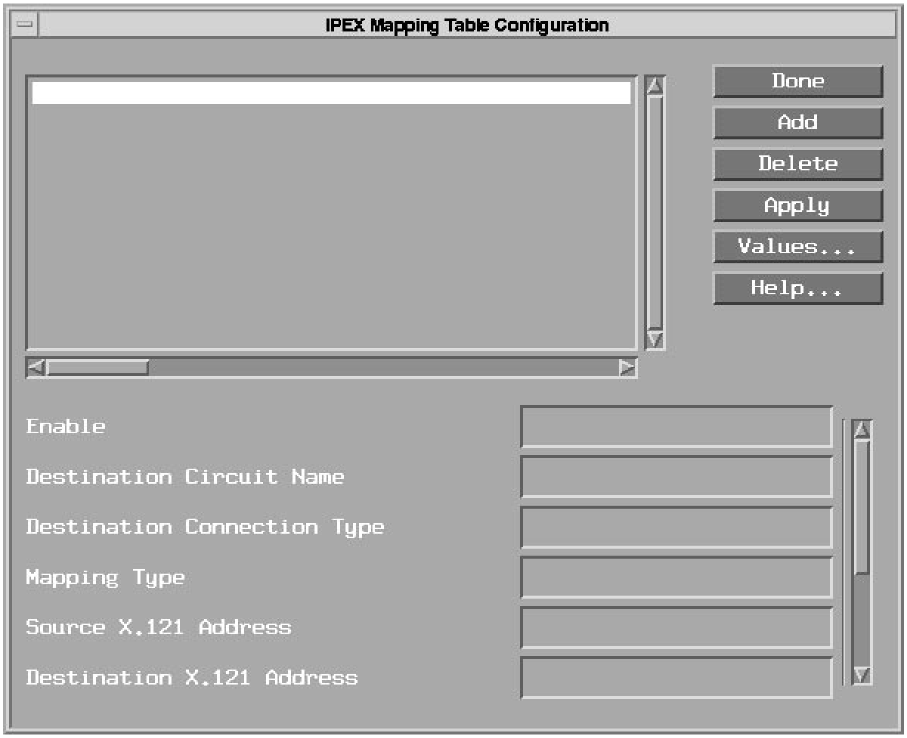


Figure 5-5. IPEX Mapping Table Configuration Window

5. **Click on Add.**

   The IPEX Mapping Type window appears (Figure 5-6).

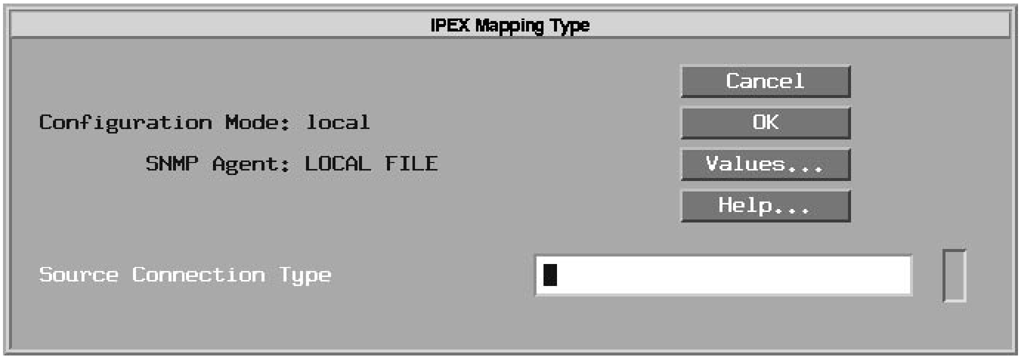


Figure 5-6. IPEX Mapping Type Window

6. **Click on the Values button and select a source connection type from the menu that appears (Figure 5-7), using the parameter description that follows as a guide.**

Parameter: **Source Connection Type**

Default: None

Options: SVC | TCP

Function: Specifies the type of connection at the sending end of the original message. SVC specifies an X.25 Level 3 connection. TCP is a Transmission Control Protocol connection.

Source connection type SVC sends to destination connection type TCP. Source connection type TCP sends to destination connection type SVC.

Instructions: Select SVC to specify an X.25 connection to a switched virtual circuit. Select TCP to specify a Transmission Control Protocol connection.

MIB Object ID: 1.3.6.1.4.18.3.5.15.2.1.4

Note: Either the source or the destination connection type (but not both) must be TCP.

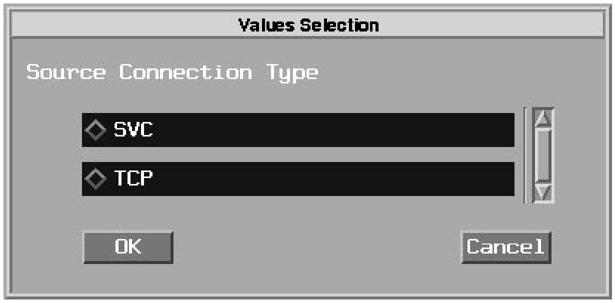


Figure 5-7. Values Selection Window

7. **After you select SVC or TCP, click on OK.**

   The IPEX Mapping Type window reappears and displays the connection type you have selected.

8. **Click on OK.**

   The IPEX Mapping Parameters window appears. If you selected SVC, Figure 5-8 appears. If you selected TCP, Figure 5-9 appears.

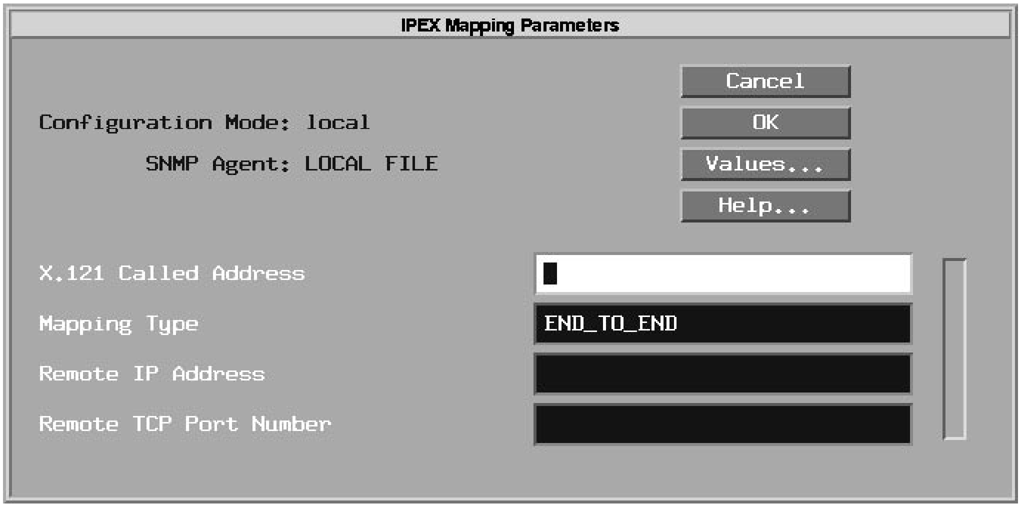


Figure 5-8. IPEX Mapping Parameters Window for SVC

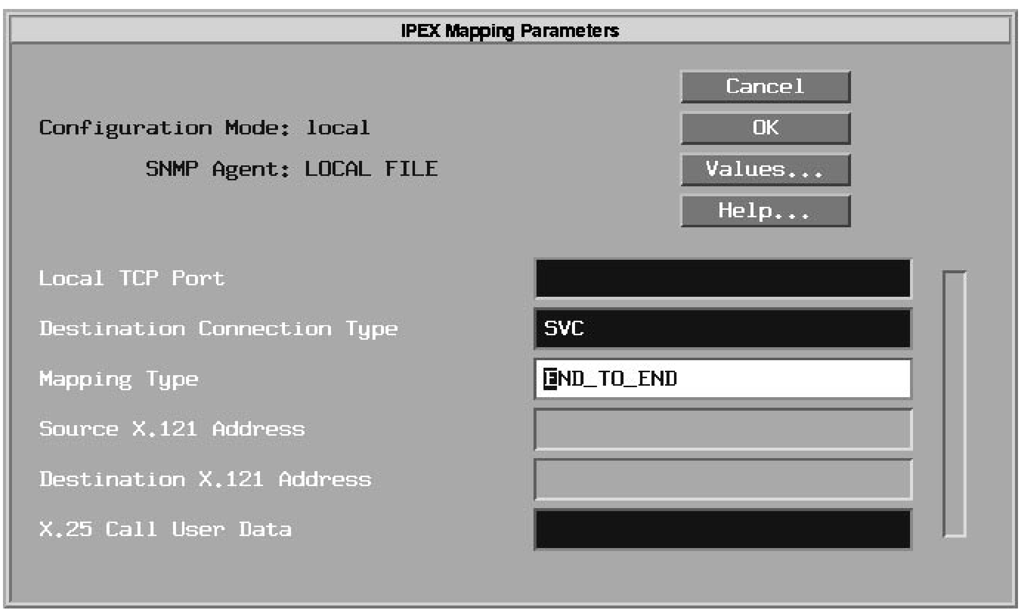


Figure 5-9. IPEX Mapping Parameters Window for TCP

In the IPEX Mapping Parameters windows, you define a new mapping entry by specifying source and destination X.121 addresses, a mapping type, local or remote port numbers, and other parameters, depending on whether the connection type is SVC or TCP.

IPEX Mapping Parameter Descriptions

This section describes the IPEX mapping parameters that you must configure in the IPEX Mapping Parameters windows. It also describes additional parameters that you can modify in the IPEX Mapping Table Configuration window. The order of the parameter descriptions is

- Mapping parameters for SVC connections
- Mapping parameters for TCP connections
- Additional mapping parameters

To set parameters, enter a value in the parameter field or select a value from the Values list.

Parameters for SVC Connections

Parameter:	**X.121 Called Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies the inbound X.121 called address that you map to the TCP connection. The port monitors the X.25 calls for this X.121 called address to initiate the connection.
Instructions:	Enter the called X.121 address (up to 15 decimal digits). The destination address depends on the network device to which this circuit is connected. Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.18.3.5.15.2.1.6

Parameter:	**Mapping Type**
Default:	End_to_End
Options:	Local | End_to_End
Function:	Specifies whether facilities, call user data, M-bit, and Q-bit support terminate locally or are passed end-to-end. X.25 parameters that you configure at the packet and service record level determine which facilities are supported. If you set this parameter to Local, IPEX ports can support different packet sizes at each end. You must also configure the Source X.121 Address parameter for an SVC source connection type, and both Source and Destination X.121 Address parameters for a TCP source connection type. If you configure End-to-End mapping, all IPEX ports must have the same packet and window size, because if you allow different packet sizes, the M-bit support does not function correctly.
Instructions:	Select Local or End_to_End.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.16

Parameter:	**Remote IP Address**
Default:	None
Options:	Any valid IP address
Function:	Specifies the remote IP address used to establish a TCP connection to the destination. You configure this parameter only when the source connection type is SVC.
Instructions:	Enter the IP address of the remote connection. Use dotted decimal notation (for example, 1.1.1.1). Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.12

Parameter:	**Remote TCP Port Number**
Default:	None
Options:	The TCP port number at the remote connection, a value between 12304 and 16399.
Function:	Specifies the remote TCP port number used to establish a TCP connection to the destination. The remote TCP port originates connections to the local TCP port. You configure this parameter only when the source connection type is SVC.
Instructions:	Enter the TCP port number for the remote connection.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.13

Parameters for TCP Connections

Parameter:	**Local TCP Port**
Default:	None
Options:	The local TCP port number, a value between 12304 and 16399.
Function:	Specifies the TCP port in the local IPEX connection. This port accepts inbound TCP connections from the remote TCP port. You configure this parameter when the Source Connection Type is TCP.
Instructions:	Enter the TCP port number.
MIB Object ID:	1.3.6.1.4.18.3.5.15.2.1.5

Parameter: Destination Connection Type

Default: SVC if the source connection type is TCP | TCP if the source connection type is SVC

Options: SVC | TCP

Function: Destination connection type TCP receives data from source connection type SVC. Destination connection type SVC receives data from source connection type TCP. SVC specifies an X.25 Level 3 connection. TCP is a Transmission Control Protocol connection. Site Manager configures this parameter automatically after you configure the Source Connection Type parameter.

Instructions: You cannot change the value of this parameter. If you want to make a change, delete the entry and create a new one.

1.3.6.1.4.1.18.3.5.15.2.1.8

Note: Either the source or the destination connection type (but not both) must be TCP.

Parameter: Mapping Type

Default: End_to_End

Options: Local | End_to_End

Function: Specifies whether facilities, call user data, M-bit, and Q-bit support terminate locally or are passed end-to-end. X.25 parameters that you configure at the packet and service record level determine which facilities are supported.

If you set this parameter to Local, IPEX ports can support different packet sizes at each end. You must also configure the Source X.121 Address parameter for an SVC source connection type, and both Source and Destination X.121 Address parameters for a TCP source connection type.

If you configure End-to-End mapping, all IPEX ports must have the same packet and window size, because if you allow different packet sizes, the M-bit support does not function correctly.

Instructions: Select Local or End_to_End.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.2.1.16

Parameter:	**Source X.121 Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies the calling X.121 address that will be inserted in the outbound X.25 call packet. You configure this parameter only with source connections of type TCP, and only when you set the Mapping Type parameter to Local.
Instructions:	Enter the calling X.121 address (up to 15 decimal digits). The source address is based on where the call originated. Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.9

Parameter:	**Destination X.121 Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies the called X.121 address that will be inserted in the outbound X.25 call packet. You configure this parameter only with source connections of type TCP, and only when you set the Mapping Type parameter to Local.
Instructions:	Enter the called X.121 address (up to 15 decimal digits). The destination address depends on the network device to which this circuit is connected. Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.10

Parameter:	**X.25 Call User Data**
Default:	None
Options:	Any valid call user data up to 128 bytes
Function:	Specifies the X.25 call user data field content inserted in the X.25 Call Request packet. You configure this parameter only when the source connection type is TCP and the mapping type is Local.
Instructions:	Enter the appropriate data in ASCII format.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.10

Additional Mapping Parameters

You can access the following parameters in the IPEX Mapping Table Configuration window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables a particular IPEX mapping entry on this interface.
Instructions:	Select Enable (the default) to activate this IPEX mapping entry. Select Disable only if you want to deactivate this mapping entry. When you select Disable, you eliminate all active IPEX sessions established with this mapping entry.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.2

Parameter:	**Destination Circuit Name**
Default:	TCP Circuit if the source connection type is SVC | The serial port configured for IPEX if the source connection type is TCP
Options:	TCP Circuit | The serial port configured for IPEX
Function:	Specifies the circuit that sends the tunneled message to the destination. Site Manager configures this parameter automatically after you configure the Source Connection Type parameter. If the source connection type is SVC, the Destination Circuit Name is TCP Circuit, and IP routing determines the appropriate circuit on the router. If the source connection type is TCP, the Destination Circuit Name is the serial port configured for IPEX.
Instructions:	You cannot change the value of this parameter. If you want to make a change, delete the entry and create a new one.

Parameter:	**Client Queue Size**
Default:	The larger of TCP Max Window Size or IPEX Max Message Size, usually 4096
Options:	16 through 8192 bytes
Function:	Specifies the size (in bytes) of the IPEX queues used for buffering data between TCP and X.25. The value of this parameter must be at least as large as that of the Maximum Message Size parameter, and the software prevents you from assigning a lower value.
Instructions:	Accept the default, or select a client queue size at least as large as the maximum message size.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.14

Parameter:	**Idle Session Timer**
Default:	120
Options:	0 through 86,400 seconds
Function:	Specifies the timeout period, in seconds, that an established TCP connection can be inactive before the router sends messages to the peer to verify that the peer is alive. If you set this parameter to zero, you disable the keepalive feature.
Instructions:	Accept the default, or adjust the timer if your network requires a shorter or longer idle time
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.18

Parameter:	**Keep Alive Retransmit Timer**
Default:	3 seconds
Options:	0 through 600
Function:	Specifies the interval, in seconds, at which the router will retransmit unacknowledged keepalive messages. If you set the Idle Session Timer to 0, this timer's value has no impact. If you set the Idle Session Timer to a value other than 0, and this timer is 0, the router does not send keepalive messages, and the TCP session terminates when the idle session timer expires. The time you set should be larger than the round-trip network delay, or retransmits will occur unnecessarily.
Instructions:	Accept the default or adjust to be longer than the round-trip network delay.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.19

Parameter:	**Keep Alive Retransmit Count**
Default:	5
Options:	0 through 99
Function:	Specifies the number of unacknowledged keepalive messages that the router retransmits before the TCP session terminates. If you set this parameter to 0, the router will send only one keepalive message.
Instructions:	Accept the default or adjust to meet requirements for the total time the router needs to detect that the peer connection has terminated. The total time is the sum of the Idle Session Timer and the Keep Alive Retransmit Timer times the Keep Alive Retransmit Count.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.20

Editing IPEX Mapping Table Entries

To change an IPEX mapping table entry:

1. **In the Configuration Manager window, select Protocols > IPEX > IPEX Mapping Table.**

   The IPEX Mapping Table Configuration window appears (refer to Figure 5-5).

2. **In the IPEX Mapping Table Configuration window, select the circuit for which you want to edit parameter values.**
3. **Edit the parameter values. Refer to "IPEX Mapping Parameter Descriptions," earlier in this chapter.**
4. **Click on Apply to save the new configuration.**
5. **Click on Done.**

   You return to the Configuration Manager window.

Editing LAPB Parameters

For a synchronous circuit, LAPB functions are implemented in hardware and firmware. To edit the LAPB parameters of a synchronous circuit, refer to the procedures for editing line parameters in *Configuring Line Services*.

Deleting IPEX Mapping Table Entries

To delete an entry from the IPEX Mapping Table:

1. **In the Configuration Manager window, select Protocols > IPEX > IPEX Mapping Table.**

   The IPEX Mapping Table Configuration window appears (refer to Figure 5-5).

2. **Select the entry that you want to delete.**
3. **Click on Delete.**

The system software deletes the entry you selected, and the entry disappears from the list of IPEX Mapping Table entries in the IPEX Mapping Table Configuration window.

Deleting IPEX from the Router

T o delete IPEX globally, begin at the Configuration Manager window, and

1. **Select IPEX > Global > Delete IPEX.**

   A window prompts:

   ```
   Do you REALLY want to delete IPEX?
   ```

2. **Click on OK.**

Site Manager returns you to the Configuration Manager window. IPEX is no longer configured on the router.

Chapter 6
Editing QLLC Parameters

This chapter describes how to configure QLLC parameters.

For each QLLC parameter, this chapter gives the default setting, valid parameter options, the parameter function, instructions for setting the parameter, and the MIB object ID.

The Technician Interface allows you to modify parameters by executing **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 the validity of the parameter values you enter. Entering an invalid value can corrupt your configuration.

Configuring QLLC

When you configure a network interface circuit for X.25, you can enable QLLC. You must

1. Add an X.25 Service Record and select QLLC as the service type.
2. Add an entry to the QLLC Mapping Table.
3. Configure the QLLC Mapping Parameters.
4. Configure DLSw over X.25 circuits.

   Refer to *Configuring DLSw Services.*

Adding a QLLC Mapping Table Entry

1. **In the X.25 Service Configuration window (refer to Figure 3-4), click on Add.**

   The X.25 Service window appears (Figure 6-1).

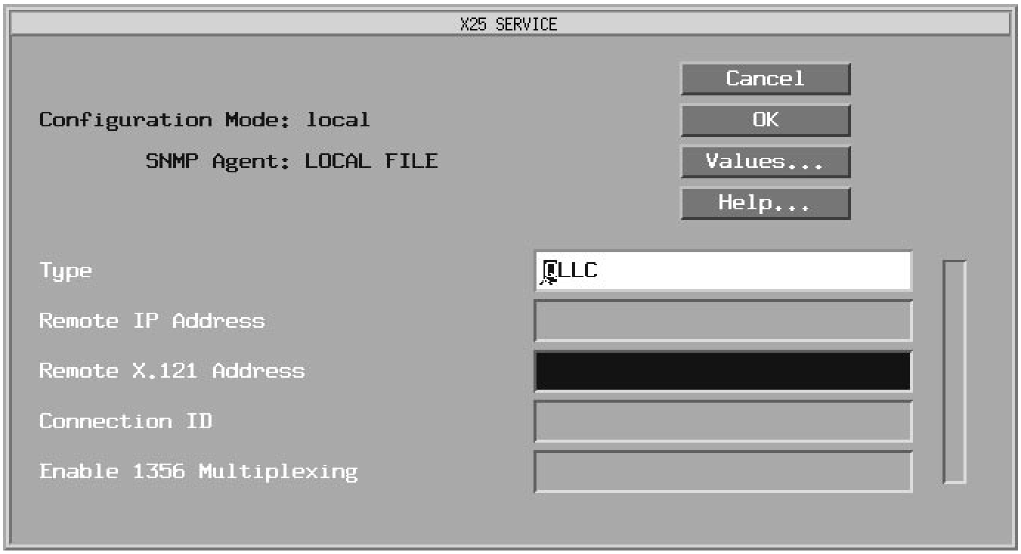


Figure 6-1. X.25 Service Window

2. **Position your cursor in the Type parameter bar, click on the Values button, and select QLLC as the service type (Figure 6-2).**

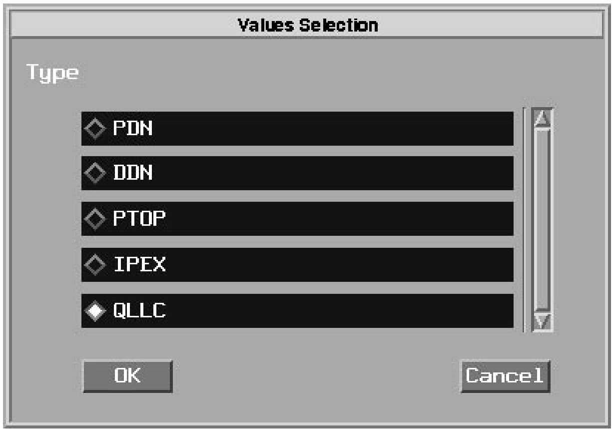


Figure 6-2. Values Selection Window

3. **Click on OK.**

   You return to the X.25 Service window, which now lists QLLC as the Type parameter entry.

4. **Enter a value for the Remote X.121 Address.**

   Refer to the parameter description below.

5. **Click on OK.**

   The QLLC Mapping Table Configuration window appears (Figure 6-3).

Parameter:	**Remote X.121 Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies a destination X.121 address. You must specify a destination X.121 address if you are configuring PDN or Point-to-Point services. If you are configuring DDN services, the router derives this address from the remote IP address.
Instructions:	Enter a destination X.121 address (up to 15 decimal digits) that is reachable over this X.25 interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.12

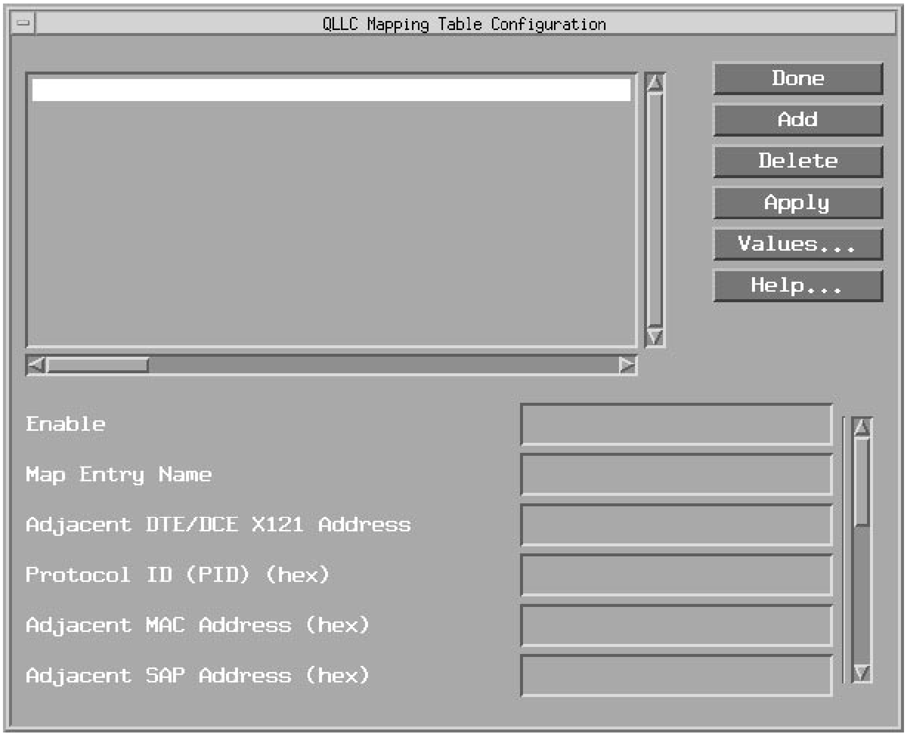


Figure 6-3. QLLC Mapping Table Configuration Window

6. **Click on Add.**

   The QLLC Mapping Parameters window appears (Figure 6-4).

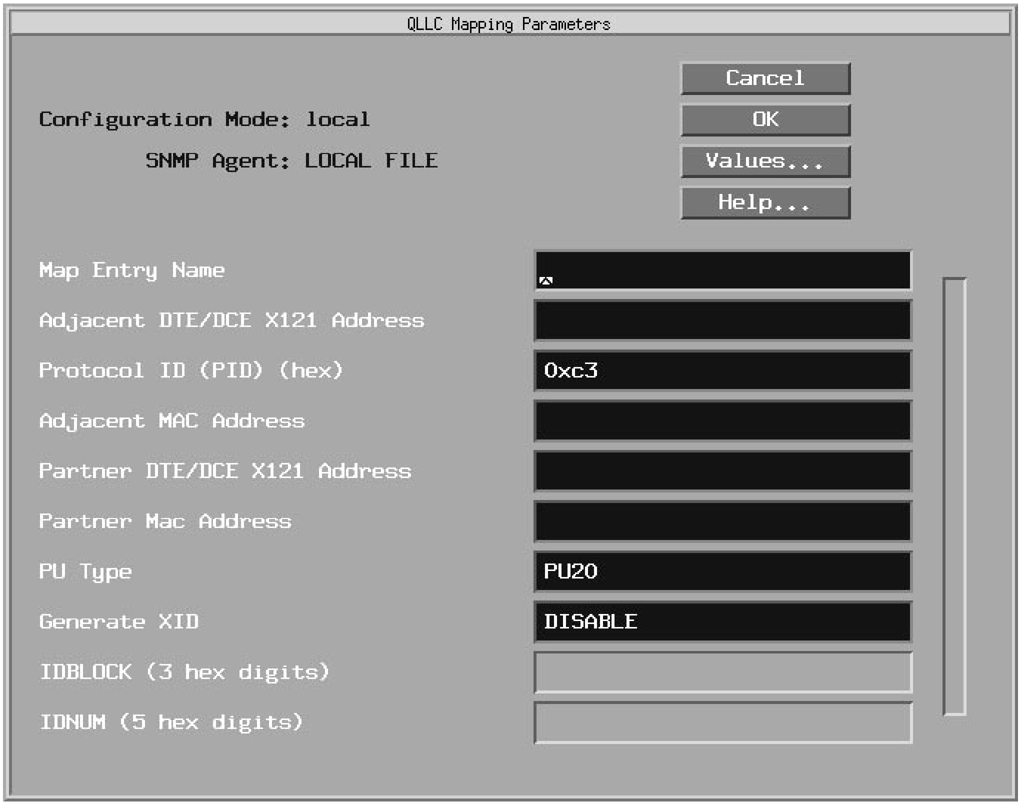


Figure 6-4. QLLC Mapping Parameters Window

In the QLLC Mapping Parameters window, you define a new mapping entry by specifying a Map Entry Name, Adjacent and Partner X.121 addresses, and Adjacent and Partner MAC addresses. All other QLLC parameters have default values.

QLLC Mapping Parameter Descriptions

This section describes the QLLC mapping parameters that you can configure in the QLLC Mapping Parameters window. It also describes additional parameters that you can modify in the QLLC Mapping Table Configuration window.

Note: Each mapping entry must have a unique combination of Adjacent X.121 Address, Partner X.121 Address, and Protocol ID.

To set parameters, enter a value in the parameter field or select a value from the Values list.

QLLC Mapping Parameters

You can access the following parameters in the QLLC Mapping Parameters window.

Parameter:	**Map Entry Name**
Default:	None
Options:	Any text string
Function:	Provides a name for the QLLC mapping entry.
Instructions:	Enter a text string that describes this mapping entry.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.18

Parameter:	**Adjacent DTE/DCE X.121 Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies the X.121 device that connects to the interface running the QLLC/X.25 software, either directly or indirectly. QLLC software maps the adjacent X.121 address to the adjacent MAC address.
Instructions:	Accept the value that the software automatically carries forward from the X.25 service record, or enter the appropriate X.121 address (up to 15 decimal digits). Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.7

Parameter:	**Protocol ID (PID) (hex)**
Default:	0xC3
Options:	A hexadecimal value from 0x01 through 0xFE
Function:	Specifies the protocol ID used in the first byte of the Call User Data of the X.25 Call Request packet.
Instructions:	Accept the default, or select another value within the range given. The PID must be set to the value of the adjacent X.25/QLLC device.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.8

Parameter:	**Adjacent MAC Address**
Default:	None
Options:	The MAC address assigned to this QLLC device. It must be unique within your DLSw network.
Function:	Specifies the MAC address assigned to the device that connects to the interface running the QLLC/X.25 software. QLLC software maps the adjacent MAC Address to the adjacent X.121 address.
Instructions:	Enter the adjacent MAC address. Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.11

Parameter:	**Partner DTE/DCE X.121 Address**
Default:	None
Options:	Any valid X.121 address
Function:	Specifies the X.121 address of the device that connects through the DLSw network. QLLC software maps the partner X.121 address to the partner MAC address.
Instructions:	Enter the partner X.121 address (up to 15 decimal digits). Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.6

Parameter:	**Partner MAC Address**
Default:	None
Options:	The MAC address assigned to this SNA device. It must be unique within your network.
Function:	Specifies the MAC address assigned to the device that connects through the DLSw network. The QLLC software maps the partner MAC address to the partner X.121 address.
Instructions:	Enter the MAC address. Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.9

Parameter:	**PU Type**
Default:	2.0
Options:	2.0 | 2.1
Function:	Identifies the type of the adjacent SNA node. This parameter, with the IDBLOCK and IDNUM parameters, determines the XID value.
Instructions:	Accept the default, or enter 2.1.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.15

Parameter:	**Generate XID**
Default:	Disable
Options:	Enable | Disable
Function:	Allows a non-NPSI host to establish a session with a QLLC endstation.
Instructions:	Set to Enable when a PU 2.0 QLLC device connects through DLSw to a non-X.25 host.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.16

Parameter:	**IDBLOCK**
Default:	None
Options:	017 | 061 | any other three-digit hexadecimal value
Function:	Specifies the block number that identifies incoming connection requests. This parameter, with the PU Type and IDNUM parameters, determines the XID value. The value in the IDBLOCK parameter must match the host IDBLOCK value.
Instructions:	Obtain the configured value at the host (from VTAM or other host operating system) for this device. In most cases, type 017 for a 3174 T2.0 node, or type 061 for a T2.0 node in fixed format. The following table lists the IDBLOCK values.
MIB Object ID:	NA

Device	IDBLOCK Num
NPSI	003
3770	004
3650/3680	005
6100/3790	006
NTO, 3767	007
S/34	00E
3774	011
3x74	017
3276	018
8775	019
S/1	021
S/38	022
5520	031
5280	032
PC/SRJE	03D
S/36	03E
4680	04D
APPC/PC	050
AS/400	056
6150	05C
OS/2 EE	05D
WSP	05E
PC/3270	061
RS/6000	071
Subarea	FFF

Parameter:	**IDNUM**
Default:	None
Options:	Any five-digit hexadecimal value from 00000 to FFFFF
Function:	Specifies the ID number that identifies incoming connection requests. This parameter, with the PU Type and IDBLOCK parameters, determines the XID value. This value must match the host IDNUM parameter value.
Instructions:	Obtain the configured value at the host (from VTAM or other host operating system) for this device. Type a five-digit hexadecimal value from 00000 to FFFFF.
MIB Object ID:	NA

Additional Mapping Parameters

You can access the following parameters in the QLLC Mapping Table Configuration window.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables a particular QLLC mapping entry on this interface.
Instructions:	Accept the default, Enable, to activate this QLLC mapping entry. Select Disable only if you want to deactivate this mapping entry. When you select Disable, you eliminate all active QLLC sessions established with this mapping entry.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.2

Parameter:	**Adjacent SAP Address**
Default:	0x04
Options:	A hexadecimal value from 0x01 through FE.
Function:	Specifies the SAP address associated with a communication subsystem on an adjacent device. If you have two data streams running between the same two endpoints, you must assign different SAP numbers to each of these streams.
Instructions:	Accept the default, or specify the SAP address associated with a specific communication subsystem. For example, the SAP associated with SNA is 0x04. You must include the 0x prefix.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.12

Parameter:	**Partner SAP Address**
Default:	0x04
Options:	A hexadecimal value from 0x01 through 0xFE
Function:	Specifies the SAP address associated with a communication subsystem on a partner device, If you have two data streams running between the same two endpoints, you must assign different SAP numbers to each of these streams.
Instructions:	Accept the default, or specify the SAP address associated with a specific communication subsystem. For example, the SAP associated with SNA is 0x04. You must include the 0x prefix.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.10

Parameter:	**Options**
Default:	Wait
Options:	Wait | Don’t Wait
Function:	Specifies when to forward an XID to the adjacent device.
Instructions:	Accept the default, Wait, if you are connecting to a device running PU 2.0 traffic. Choose Don’t Wait if you are connecting to a host running PU 2.1 traffic.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.8.1.13

Parameter: **Trace**

Default: Disable (0x0)

Hexadecimal Value	Decimal Value	Message/Event
0x0001	1	Enable QLLC logging
0x0002	2	Data frames/packets
0x0004	4	Flow control messages
0x0008	8	Client registration messages
0x0010	16	X.25 session establishment messages
0x0020	32	Test frames/packets
0x0040	64	XID frames/packets
0x0080	128	Set Mode frames/packets
0x0100	256	Disconnect frames/packets
0x0200	512	Configuration changes
0x0400	1024	Death of client (DLSw)
0x0800	2048	Data Path (DP) messages

Function: This object is a bitmask used to enable logging of internal QLLC messages and events. You can add values and enter the sum to enable multiple message groups.

Enabling this parameter has a small impact on router performance. You may want to disable this parameter after you are sure that the configuration works.

Instructions: Accept the default, Disable, or enable the type of debugging that you want on your network.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.14

Editing or Deleting QLLC Mapping Table Entries

To change a QLLC mapping table entry:

1. **In the Configuration Manager window, select Circuits > Edit Circuits.**

   The Circuit List window appears. Select the circuit you want to edit.

2. **Click on Edit.**

   The Circuit Definition window appears.

3. **Select X.25 Protocol > Service.**

   The X.25 Service Configuration window appears.

4. **Select QLLC.**

   The QLLC Mapping Table Configuration window appears.

5. **Select a mapping table entry and change the appropriate parameters. If you want to delete a mapping table entry, select it and click on Delete.**

6. **Click on Apply to save the new configuration.**

7. **Click on Done.**

   You return to the Configuration Manager window.

Appendix A
Sample IPEX Configuration

IPEX Mapping Example

This sample configuration for IPEX mapping parameters (Figure A-1) illustrates two X.25 terminals that use X.25 TCP/IP Tunneling.

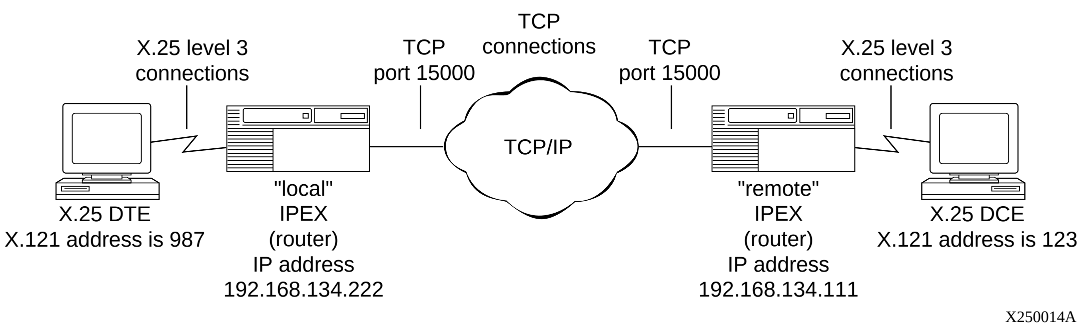


Figure A-1. Sample Configuration for Mapping Parameters

In this example, the calling X.25 terminal on the left (987) sends the called address (123) to the first IPEX router, establishing an SVC source connection with a TCP destination connection. The call is tunneled through the TCP/IP network to the second IPEX router, which establishes a source TCP connection with an SVC destination connection to the X.25 terminal on the right.

Figures A-2 through A-5 show the parameter settings for full duplex calls for this configuration. Figures A-2 and A-5 show the settings for 987 calling 123, and Figures A-4 and A-3 show the settings for 123 calling 987.

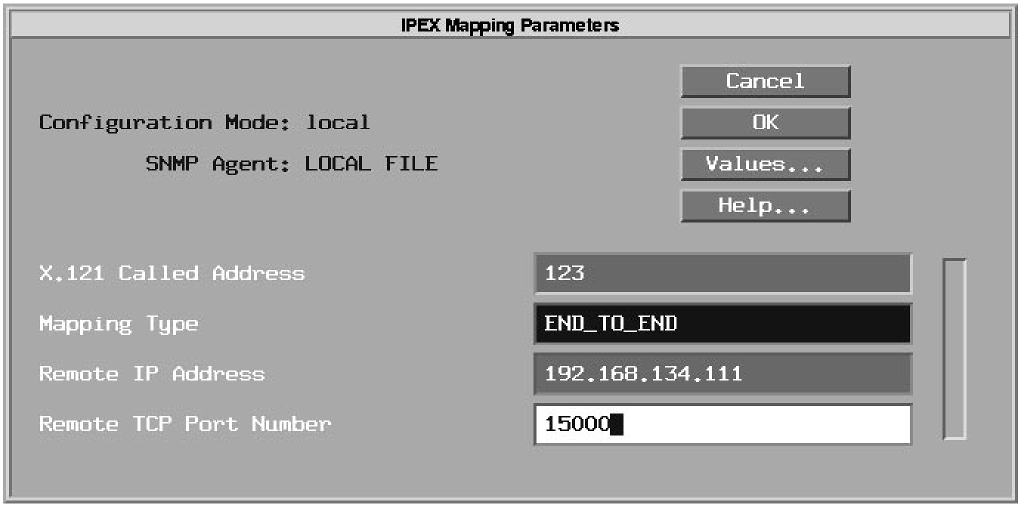


Figure A-2. IPEX Mapping Parameters for Local SVC Connection Type

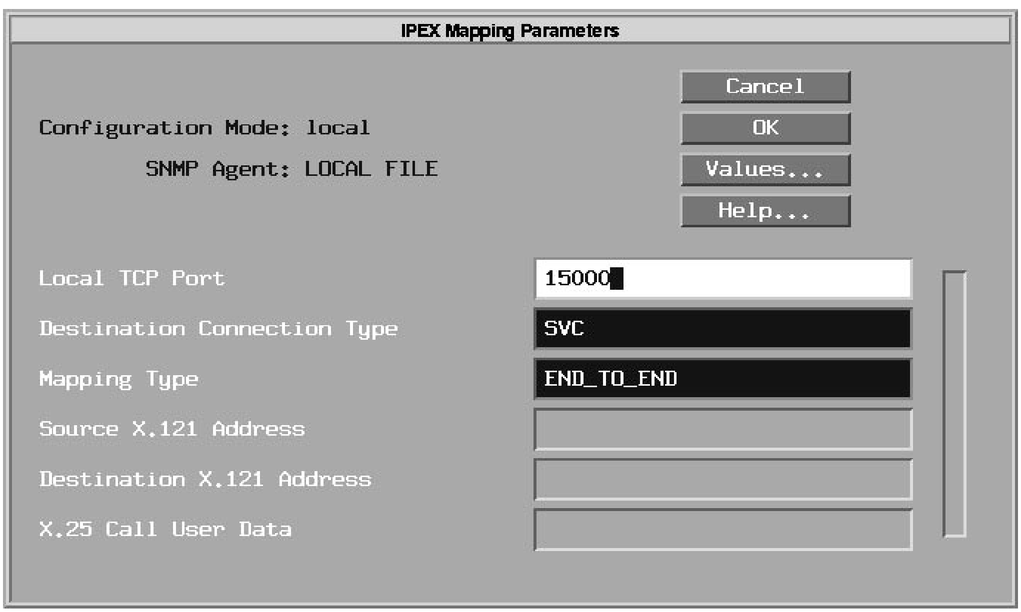


Figure A-3. IPEX Mapping Parameters for Local TCP Connection Type

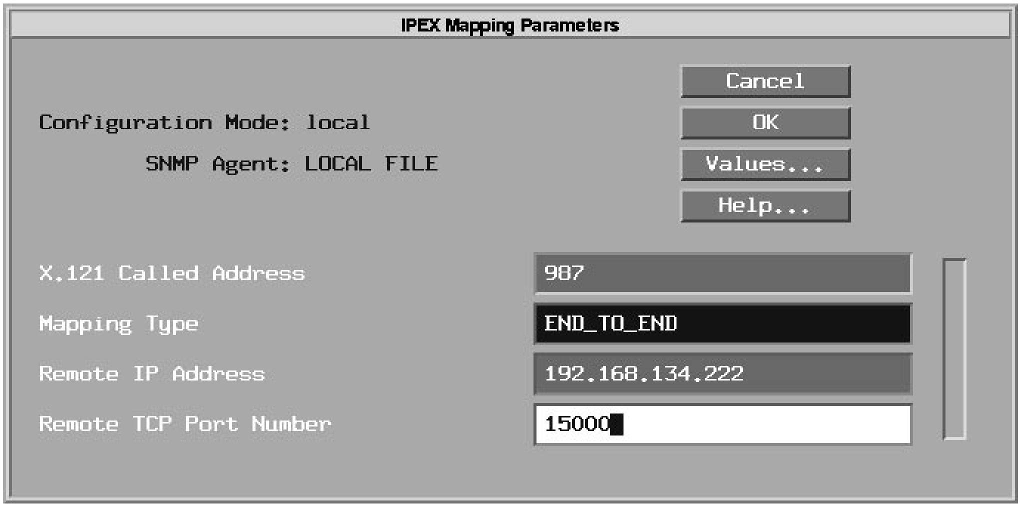


Figure A-4. IPEX Mapping Parameters for Remote SVC Connection Type

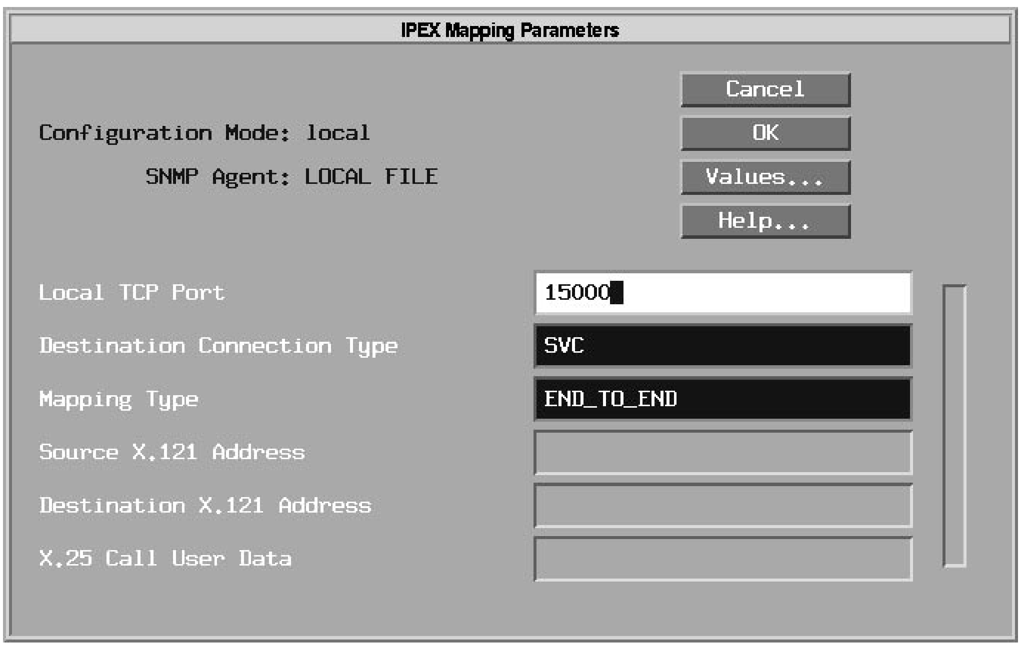


Figure A-5. IPEX Mapping Parameters for Remote TCP Connection Type

Appendix B
QLLC Configuration Examples

The sections that follow illustrate typical QLLC network topologies.

Sample Network Topologies

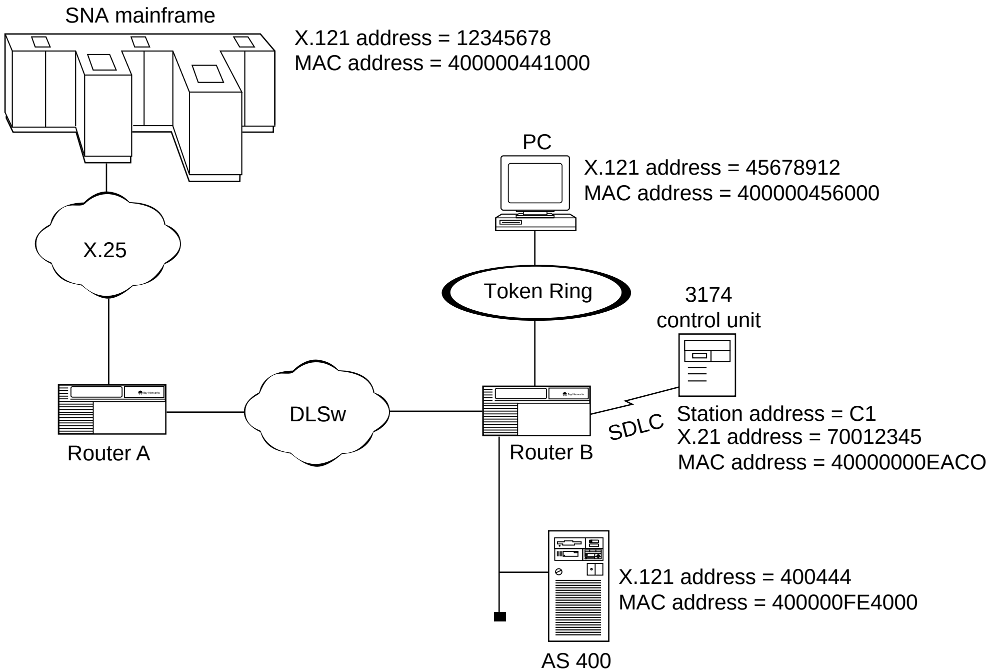
QLLC conversion supports the following network topologies:

- Upstream QLLC
- Downstream QLLC
- Endpoint QLLC
- Backbone QLLC

The following sections show examples of each.

Upstream QLLC Network

Figure B-1 shows support for upstream X.25 networks. The DLSw network connects to an upstream QLLC host through an X.25 network, and to SDLC- and LLC-attached SNA endstations. The endstations can be a PU2.0 devices, such as the AS 400, IBM 3174, PS/2, and IBM 5394. A QLLC host might be an AS 400 or an IBM mainframe running NPSI software.



Router B SDLC local device table

Address = C1 MAC address = 4000000EAC0

Router A mapping table

SNA mainframe parameters map to	PC parameters	AS 400 parameters	3174 control unit parameters
Adjacent DTE/DCE X.121 address =12345678 Adjacent MAC address = 400000441000	Partner DTE/DCE X.121 address = 45678912 Partner MAC address = 400000456000	Partner DTE/DCE X.121 address = 400444 Partner MAC address = 400000FE4000	Partner DTE/DCE X.121 address = 70012345 Partner MAC address = 40000000EACO

X250017A

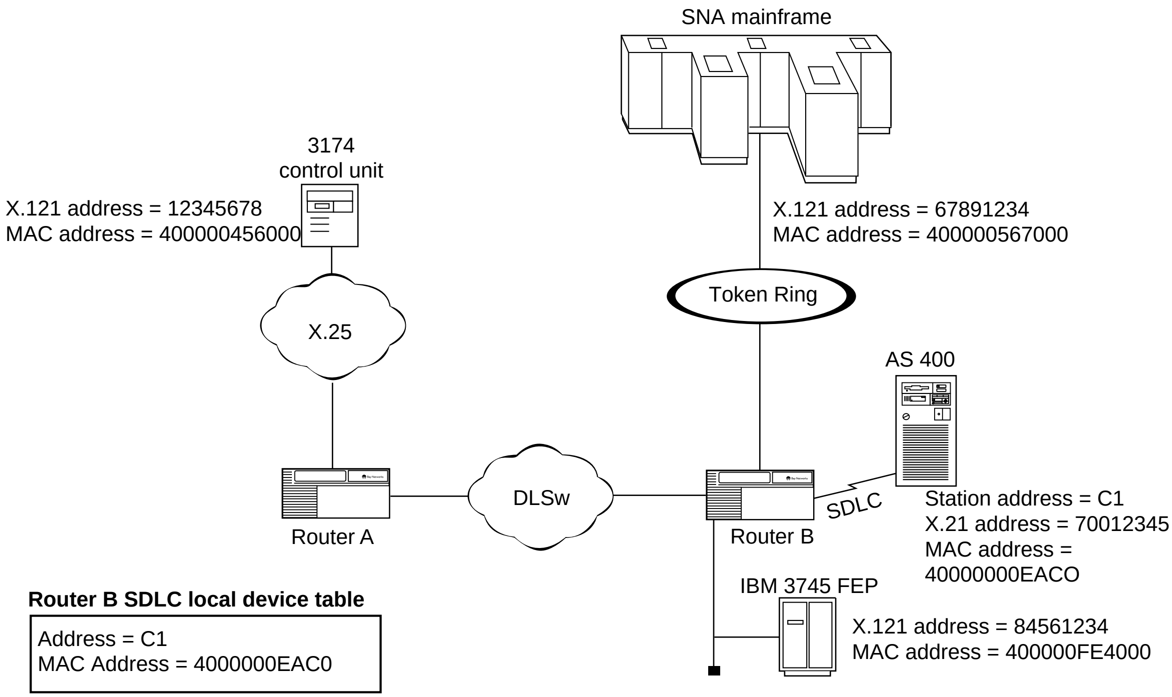
Figure B-1. Upstream QLLC Network

Downstream QLLC Network

Figure B-2 shows support for downstream QLLC devices. The DLSw network connects to upstream SDLC- or LLC-attached SNA hosts, and downstream QLLC-compatible attached SNA endstations. The endstation can be a PU2.0 device, such as an AS 400, IBM 3174, PS/2, or IBM 5394. The SNA host might be an AS 400 or an IBM mainframe.

Setting the Generate XID Parameter

Set the Generate XID parameter to Enable when you configure a secondary X.25 device to communicate with a non-X.25/QLLC primary device. This means that for the FEP, the AS 400, and the IBM 3745 in Figure B-2, set this parameter to Enable.



Router A mapping table

3174 control unit parameters map to	SNA mainframe parameters	AS 400 parameters	IBM 3745 parameters
Adjacent DTE/DCE X.121 address =12345678 Adjacent MAC address = 400000456000	Partner DTE/DCE X.121 address = 67891234 Partner MAC address = 4000005670000	Partner DTE/DCE X.121 address = 70012345 Partner MAC address = 40000000EACO	Partner DTE/DCE X.121 address = 84561234 Partner MAC address = 4000000FE4000

X250018A

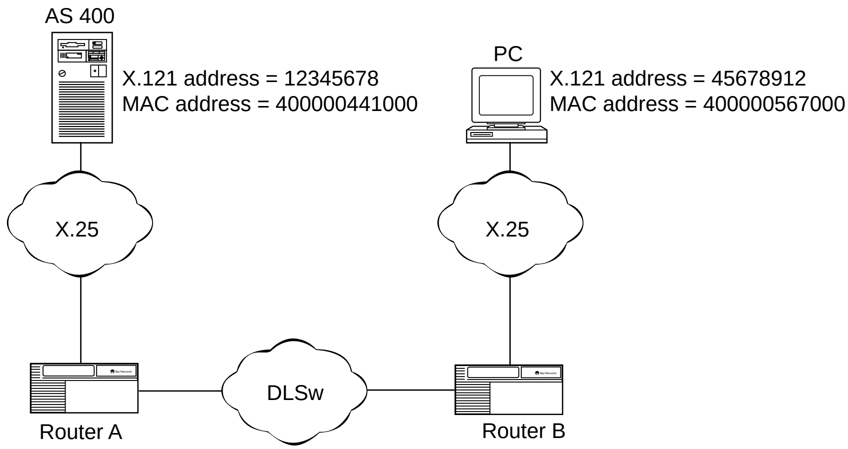
Figure B-2. Downstream QLLC Network

Endpoint QLLC Network

Figure B-3 shows support for a network that connects an upstream X.25-attached SNA endstation, and a downstream X.25-attached SNA endstation. The endstations can be an AS 400 and a PC supporting a hierarchical protocol such as SNA or a peer-to-peer protocol such as APPN.

Setting the Options Parameter

Set the Options parameter to Don't Wait when both endstations are X.25/QLLC devices.



Router A mapping table

AS 400 parameters map to	PC
Adjacent DTE/DCE X.121 address = 12345678 Adjacent MAC address = 400000441000	Partner DTE/DCE X.121 address = 45678912 Partner MAC address = 400000567000

Router B mapping table

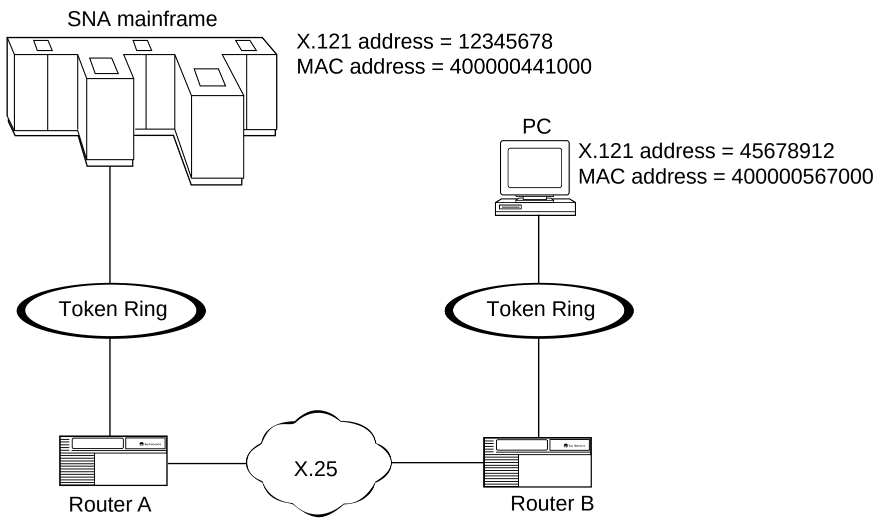
PC parameters map to	AS 400
Adjacent DTE/DCE X.121 address = 45678912 Adjacent MAC address = 400000567000	Partner DTE/DCE X.121 address = 12345678 Partner MAC address = 400000441000

X250020A

Figure B-3. Endpoint QLLC Network

Backbone QLLC Network

Figure B-4 shows support for an X.25 backbone. This X.25 network connects to an upstream SNA mainframe, and a downstream PC through an X.25 backbone network. Refer to Chapter 1 for definitions of Adjacent and Partner devices.



Router A mapping table

SNA mainframe parameters map to	PC
Adjacent DTE/DCE X.121 address = 45678912 Adjacent MAC address = 400000567000	Partner DTE/DCE X.121 address = 22345678 Partner MAC address = 400000441000

Router B mapping table

PC parameters map to	SNA mainframe
Adjacent DTE/DCE X.121 address =12345678 Adjacent MAC address = 400000441000	Partner DTE/DCE X.121 address = 45678912 Partner MAC address = 400000567000

X250021A

Figure B-4. X.25 Backbone QLLC Network

Appendix C
X.25 Default Parameter Settings

Tables B-1 through B-6 list X.25, IPEX, and QLLC parameters and their default values.

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Table C-1. X.25 Global Parameter

Parameter	Default
Enable	Enable

Table C-2. X.25 Packet-level Parameters

Parameter	Default
Enable	Enable
Link Address Type	DCE
Network Address Type	PDN_Network
PDN X.121 Address	None
DDN IP Address	None
Sequence Size	MOD8
Restart Procedure Type	DTE_Restart (for DTE) DCE_Restart (for DCE)

(continued)

Table C-2. X.25 Packet-level Parameters *(continued)*

Parameter	Default
Default Tx/Rx Window Size	2
Default Tx/Rx Pkt Length	128
Number of Incoming SVC Channels	0
Incoming SVC LCN Start	0
Number of Bidirectional SVC Channels	0
Bidirectional SVC LCN Start	0
Number of Outgoing SVC Channels	0
Outgoing SVC LCN Start	0
Use Default Service Configuration	OFF
T1 Timer	60 s
T2 Timer	180 s
T3 Timer	200 ms
T4 Timer	200 ms
Flow Control Negotiation	Off
Max Window Size	2
Max Packet Length	128
Tx/Rx Throughput Class	THRCLASS19200
Throughput Class Negotiation	Off
Max Throughput Class	19200

(continued)

Table C-2. X.25 Packet-level Parameters *(continued)*

Parameter	Default
Network User Identification	Off
Incoming Calls Accept	On
Outgoing Calls Accept	On
Fast Select Accept	Off
Reverse Charge Accept	Off
Fast Select	Off
Reverse Charging	Off
CUG Selection	Null
CUG Outgoing Access	Null
CUG Bilateral Selection	Null
RPOA Selection	Off
Charging Information	Off
Transit Delay	Off
Full Addressing	On
Acceptance Format	Basic (2)
Release Format	Basic (2)
CCITT Conformance	DXE1988
Network Standard	None
Statistics Computation	Disable
Client Response Timer	120

Table C-3. X.25 Network Service Record Parameters

Parameter	Default
Enable	Enable
Type	None
Connection ID	1
Remote IP Address	0.0.0.0
Remote X.121 Address	None
Enable 1356 Multiplexing	Disable
Enable Compression	Disable
Broadcast	Off
Max Connections	2
Precedence	Off
Max Idle (Mins)	2
Call Retry	60
Flow Facility	Default
Window Size	2
Packet Size	128
Fast Select Request	Off
Fast Select Accept	Off
Reverse Charge Request	Off
Reverse Charge Accept	Off
DDN BFE	Disable
User Facility (hex)	None
CUG Facility Format	None
CUG Facility Type	Normal
CUG Number	0

Table C-4. IPEX Global Parameters

Parameter	Default
Enable	Enable
Max Message Size	1600

Table C-5. IPEX Mapping Parameters

Parameters for SVC Connections	**Default**
X.121 Called Address	None
Mapping Type	End_to_End
Remote IP Address	None
Remote TCP Port Number	None
Parameters for TCP Connections	**Default**
Local TCP Port	None
Destination Connection Type	SVC if the source connection type is TCP | TCP if the source connection type is SVC
Mapping Type	End_to_End
Source X.121 Address	None
Destination X.121 Address	None
X.25 Call User Data	None
Additional Mapping Parameters	**Default**
Enable	Enable
Source Connection Type	None
Destination Circuit Name	TCP Circuit if the source connection type is SVC | The serial port configured for IPEX if the source connection type is TCP
Client Queue Size	Set to the larger of TCP Max Window Size or IPEX Max Message Size, usually 4096
Idle Session Timer	120 seconds
Keep Alive Retransmit Timer	3 seconds
Keep Alive Retransmit Count	5

Table C-6. QLLC Parameters

QLLC Mapping Parameters	Default
Map Entry Name	None
Adjacent DTE/DCE X.121 Address	None
Protocol ID (PID)	0xC3
Adjacent MAC Address	None
Partner DTE/DCE X.121 Address	None
Partner MAC Address	None
PU Type	2.0
Generate XID	Disable
ID Block	None
ID Num	None
Additional Parameters	**Default**
Enable	Enable
Adjacent SAP Address	0x04
Partner SAP Address	0x04
Options	Wait
Trace	Disable (0x0)

Appendix D
IPEX Cause and Diagnostic Codes

If IPEX receives a Disconnect Request from TCP or a Disconnect Indication from Packet Layer Protocol (PLP), IPEX forwards the packet with cause and diagnostic code transparently.

If IPEX detects an error, a Clear Request packet with IPEX specific cause and diagnostic code is generated and sent to PLP. The lists of IPEX cause and diagnostic codes follows:

IPEX Originated Cause Code in Disconnect Request Packet

IPEX_X25_CAUSE_OPERATIONAL	0x09

IPEX Originated Diagnostic Codes in Clear Request Packet

Error Condition	**IPEX Cause/Diagnostic Code**
TCP gate failed.	(0x09, 0x60)
IPEX session failed.	(0x09, 0x61)
IPEX mapping is disabled.	(0x09, 0x62)
IPEX cct is not up.	(0x09, 0x63)

IPEX Originated Diagnostic Codes Due to TCP Error

When IPEX detects a TCP error, it maps the TCP error status code into X.25 diagnostic code by adding 0x20 to TCP error status code.

The Mapping Table follows:

Error Condition	TCP Error	IPEX Cause/Diagnostic Code
Disconnect is per user request.	0x64	(0x09, 0x84)
Disconnect reason is unknown to TCP.	0x65	(0x09, 0x85)
Network management deleted/disabled all of TCP connection.	0x66	(0x09, 0x86)
The remote TCP disconnected.	Ox67	(0x09, 0x87)
TCP Paniced somewhere	Ox68	(0x09, 0x88)
IP registration failed.	Ox69	(0x09, 0x89)
Buffer could not be allocated.	Ox6a	(0x09, 0x8a)
GAME RPC call timeout with no response.	Ox6b	(0x09, 0x8b)
Another connection exists with the same socket definitions.	Ox6c	(0x09, 0x8c)
An unexpected disconnect of the timer gate for this connection occurred.	Ox6d	(0x09, 0x8d)
TCP quit because a maximum number of retries was reached on a (re)transmit without acknowledgment from the remote TCP system.	Ox6e	(0x09, 0x8e)
An unexpected disconnect of the client transmit gate for this connection occurred.	Ox6f	(0x09, 0x8f)
An unexpected disconnect of the client receive gate for this connection occurred.	Ox70	(0x09, 0x90)
The IP reassembly gate for the given interface disconnected.	Ox71	(0x09, 0x91)
TCP protocol error occurred.	Ox72	(0x09, 0x92)
Connection was Idle for too long.	Ox73	(0x09, 0x93)
Client was idle for too long.	Ox74	(0x09, 0x94)
Out of Sequence SYN received.	Ox75	(0x09, 0x95)
TCP function called from wrong gate.	Ox76	(0x09, 0x96)
Normal close.	Ox77	(0x09, 0x97
Client (Interface) Error.	Ox78	(0x09, 0x98)
No response to keep Alive.	Ox79	(0x09, 0x99)

X.25 Originated Cause and Diagnostic Codes Associated with Clear Request Packets

Error Condition	Cause Code	Diagnostic Code
Self-clearing of virtual circuits out of order. P4_frozen state, T2 expired. P4_wakeup.	 0x09	Maintenance action. 0x7a
Deregistration of PLP service user.	DTE originated 0x00	Maintenance action. 0x7a
Local_calling state receives call request (DCE).	Local procedure error 0x13	Call setup or call clearing problem. 0x40
Logical_channel_ready state receives CCALL,CCLR.	Local procedure error 0x13	Not applicable packet in state p1 (DTE). 0x14
Logical_channel_ready state receives CCALL,CCLR.	Local procedure error 0x13	Not applicable packet in state p2 (DCE). 0x15
P2_remote_calling state receives CALL, CCALL, CCLR, Invalid packet.	Local procedure error 0x13	Not applicable packet in state p3 (DTE). 0x16
P2_local_calling state receives CCLR, Invalid packet.	Local procedure error 0x13	Not applicable packet in state p3 (DCE). 0x16
Local_calling state receives CCLR, Invalid packet.	Local procedure error 0x13	Not applicable packet in state p2 (DCE). 0x15
P4 state receives CALL,CCALL,CCLR.	Local procedure error 0x13	Not applicable packet in state p4. 0x17

Error Condition	Cause Code	Diagnostic Code
P2_collision state receives CALL,CCLR, invalid.	Local procedure error 0x13	Not applicable packet in state p5. 0x18
P2_remote_clearing state receives CALL, CCALL, CCLR, invalid	Local procedure error 0x13	Not applicable packet in state p6 (DCE). 0x19
P2_remote_clearing state receives CALL, CCLR, CCALL invalid	Local procedure error 0x13	Not applicable packet in state p7 (DTE). 0x20
P2_local_calling state watch T2 expired.	Local procedure error 0x13	Call connected dog timer expired 0x31
P2_local_clearing state T1 expired.	Local procedure error 0x13	Clear confirm watch dog timer 1st expired 0x32
P2_SVC_setup state T1 expired.	Local procedure error 0x13	Reset confirm watch dog timer 2nd expired 0x33
Error in PLP2	Local procedure error 0x13	Unidentifiable packet. 0x21 (33)
Error in PLP2	Local procedure error 0x13	Too short packet. 0x26 (38)
Error in PLP2	Local procedure error 0x13	Too long packet 0x27 (39)
Error in PLP2	Local procedure error 0x13	Non-zero LCN. 0x29 (41)
Error in PLP2	Local procedure error 0x13	Not applicable packet in state px. 0x13 + px

Error Condition	Cause Code	Diagnostic Code
Error in PLP2	Local procedure error 0x13	Improper cause code from DTE. 0x51 (82)
Error in PLP2	Local procedure error 0x13	Not acceptable intermediate packet length. OX40 (64)
Error in PLP2	Local procedure error 0x13	Packet not conformant with requested facility 0x2a
Error in PLP2	Local procedure error 0x13	Non-zero address length field 0x4a
Error in PLP2	Unknown called address 0x0d	Null 0x00
Error in PLP2	Local procedure error 0x13	Invalid called DTE address 0x43
Error in PLP2	Local procedure error 0x13	Invalid calling DTE address 0x44
Error in PLP2	Invalid facility request 0x03	Unknown facility code. 0x41
Error in PLP2	Local procedure error 0x13	Duplicated facility code. 0x49
Error in PLP2	Invalid facility request. 0x03	Facility parameter not allowed. 0x42
Error in PLP2	Local procedure error 0x13	Exceeding facility length. 0x45

Error Condition	Cause Code	Diagnostic Code
Error in PLP2	Access barred. 0x0b	Not both way or one way incoming LC 0x46
Error in PLP2	Access barred. 0x0b	Null 0x00
Error in p1_local_restart.	Invalid facility 0x03	Not available facility service. 0x4d
Negotiation Error in call request packet in p1 state.	Local procedure error 0x13	Facility parameter not allowed. 0x42
p2_remote_calling state timer expired.	Out of order 0x09	Call setup or clearing problem 0x40
p2_local_calling state zt4 expired.	Local procedure error 0x13	Call setup or clearing problem. 0x40

X.25 Originated Cause and Diagnostic Codes Associated with Restart Packet

Error Condition	Cause Code	Diagnostic Code
Invalid event in state r1.	Local procedure error. 0x01	Packet type invalid for r1. 0x11 (17)
Invalid event in state r2.	Local procedure error. 0x01	Not applicable packet in state r2 (DCE) 0x12 (18)
Invalid event in state r3.	Local procedure error. 0x01	Not applicable packet in state r3 (DTE) 0x13 (19)
Local Restart state, watchdog timer expiration.	Local procedure error. 0x01	Confirmation watchdog timer first expiration. 0x34 (52)
Error in p1_local_restart.	Local procedure error. 0x01	Reject supported but not subscribed to. (0x21 (33)
Error in p1_local_restart.	Local procedure error. 0x01	Unidentifiable packet 0x26 (38) ??????
Error in p1_local_restart.	Local procedure error. 0x01	Too short packet 0x26 (38)
Error in p1_local_restart.	Local procedure error. 0x01	Too long packet. 0x27 (39)
Error in p1_local_restart.	Local procedure error. 0x01	Non-zero LCN 0x29 (41)
Invalid packet.	Local procedure error. 0x01	Not applicable packet in state r2. 0x12 (18)

Error Condition	Cause Code	Diagnostic Code
In P1 restart local/remote state receives Reset Ind.	Network Operational. 0x07	No additional information. 0x00
In P1 DTE_DXE_wait state receives error packet or T4 expired.	DTE originated. 0x00	No additional information. 0x00

X.25 Originated Cause and Diagnostic Codes Associated with Diagnostic Packets

Error Condition	Cause Code	Diagnostic Code
Local restart state, watchdog timer second expiration.	DTE originated 0x00	Confirmation watchdog timer second expiration 0x34 (52)
Invalid packet in p1.	DTE originated 0x00	Unidentifiable packet. 0x21 (40)
Invalid packet in p1.	DTE originated 0x00	Too short packet 0x26 (38)
Invalid packet in p1.	DTE originated 0x00	Invalid bits 5-8 (GFI) 0x28 (40)
Invalid packet in p1.	DTE originated 0x00	Invalid LCN 0x24 (40)
Invalid packet in p1.	DTE originated 0x00	Too long packet 0x27 (39)
P2_local_clearing state. Clear confirm watchdog timer second expired.	DTE originated 0x00	Clear confirm watchdog timer second expired. 0x32

X.25 Originated Cause and Diagnostic Codes Associated with Reset Packets

Error Condition	Cause Code	Diagnostic Code
Local Restart state	User defined 0xxx	User defined 0xxx
1. P3_local_reset state T1 expired. 2. P4_disabled-T1 expired	Local procedure error. 0x05	Confirmation watchdog timer first expiration 0x33 (51)
P3_flow_control_ready state received Reset Confirm	Local procedure error. 0x05	Not applicable packet in state d1 0x1b (27)
P3 _remote_reset state received Reset Confirm or invalid packet.	Local procedure error. 0x05	Not applicable packet in state d2 (DCE) 0x1c (28)
P3_local reset state received Reset Confirm	Local procedure error. 0x05	Not applicable packet in state d3 (DTE) 0x1d (29)
1. Error in p3_local_reset 2. Error in P4_disabled	Local procedure error. 0x05	Unidentifiable packet 0x21 (33)
1. Error in p3_local_reset 2. Error in p4_disabled.	Local procedure error. 0x05	Reject but not subscribed to 0x25 (37)
1. Error in p3_local_reset. 2. Error in p4_disabled.	Local procedure error. 0x05	Too short packet. 0x26 (38)
1. Error in p3_local_reset. 2. Error in p4_disabled.	Local procedure error. 0x05	Too long packet. 0x27 (39)
1. Error in p3_local_reset. 2. Error in p4_disabled.	Local procedure error. 0x05	Non-zero LCN 0x29 (41)

Error Condition	Cause Code	Diagnostic Code
Error in p3_local_reset.	Local procedure error. 0x05	Not applicable packet in state dx (DCE) 0x1b +dx
Error in p3_local_reset.	Local procedure error. 0x05	Not applicable packet in state dx (DCE) 0x1b +d?
1.Error in p3_local_reset. 2. Error in p4_disabled.	Local procedure error. 0x05	Forbidden packet on PVC. 0x23
Error in p3_local_reset.	Local procedure error. 0x05	Bad PS 0x01
Error in p3_local_reset.	Local procedure error. 0x05	Bad PR 0x02
Error in p3_local_reset.	Local procedure error. 0x05	Bad Q bit 0x53
Error in p3_local_reset.	Local procedure error. 0x05	Improper case code from DTE. 0x51
INTR in p5_remote_interrup state	Local procedure error. 0x05	Not applicable interrupt packet in this state. 0x2c
CINTR in p5_remote_interrup state	Local procedure error. 0x05	Not applicable interrupt confirm packet in this state 0x2b
CINTR in p5_remote_interrup state	Not usable PVC. 0x1d	Not used. 0x00

Error Condition	Cause Code	Diagnostic Code
Error in p4_disabled bad ps, pr, q bit, cause	Network disorder.	Not used. 0x00
Error in p4_disabled timer. Reset confirm. Watch dog timer second expired.	Not used. 0x00	Reset confirm. Watch dog second expired. 0x33

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