

# SX.25 Administrator's Guide

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# Contents

**List of Figures** xi

**List of Tables** xiii

**About This Guide** xv

What This Guide Contains xv

Conventions Used in This Guide xvii

Related Documentation xvii

- 1. Understanding the SX.25 Application** 1
  - X.25 Network Fundamentals 2
  - How Packet-Switched Networks Work 2
    - Virtual Circuits 3
    - Logical Channels 3
    - Packet Types 3
    - Packet Sizes 4
  - SX.25 Software Components 4
    - SX.25 Functional Layers 6
    - Subnet IDs and DTE Addresses 6
    - The SX.25 Configuration File 6
    - Protocol Parameter Files 7
      - X.25 Parameter Files 7
      - LAPB Parameter Files 8
      - LLC2 Parameter Files 8
    - IP Network Connections 9
      - CCITT Addressing 9
      - DDN Addressing 10
    - PAD and PADD Connections 10

- About gx25adm Menus 10
  - Accessing Port Configuration Functions 11
  - Accessing Optional Features 12
  - Accessing Support Functions 12
- 2. Planning for SX.25 13**
  - Port Naming Conventions 13
  - Evaluating SX.25 Parameter Files 15
  - Collecting Information for Port Configurations 16
    - Additional Information for Custom Protocol Files 16
    - Additional Information for IP Connections 17
    - Additional Information for PAD and PADD Connections 18
- 3. Getting Started With gx25adm 19**
  - Starting the gx25adm Utility 19
    - From the Find Toolchest 20
    - From the Icon Catalog 20
    - From a Shell 20
  - Using the Primary Window 20
    - Primary Window Tabs 21
    - Primary Window Buttons 22
  - Using the File Menu 22
    - The New Option 23
    - The Open Option 23
    - The Save Option 23
    - The Save As Option 23
    - The Exit Option 23
  - Using the Edit Menu 24
    - The PAD Map/Xhosts Option 24
    - The IXE Map Option 25
    - The PADD Option 25
    - The Subnetworks Option 25
    - The Kernel Parameters Option 25

Using the Action Menu	26
The Network Option	26
The Create Kernel Option	26
Using gx25adm Help	27
Configuration Procedure at a Glance	27
<b>4. Configuring a Host for Basic Connections</b>	<b>31</b>
The Global Kernel Parameters Option	32
Procedure to Configure Global Kernel Parameters	32
About the Ports List	34
Port Selection Procedure	34
Using Port Configuration Windows	36
The Setup Menu	36
The Options Menu	36
The Run Time Stacks Menu	37
The Help Menu	37
Port Configuration Window Buttons	37
The Open Button	37
The Delete Button	38
The Assign Button	38
Link Procedure Buttons	38
The OK Button	38
The Cancel Button	38
WAN Port Configuration Procedure	39
Setting WAN Port Kernel Parameters	39
Kernel Parameter Settings For GIO Systems	40
Kernel Parameter Settings For ISC Systems	41
Kernel Parameter Settings For VSC Systems	42
Creating a WAN Port Configuration Record	43
LAN Port Configuration Procedure	47
Procedure to Rebuild the IRIX Kernel	51

- 5. **Configuring X.25 Options** 53
  - The IP/IXE Option 53
    - IP/IXE Configuration Procedure 54
    - IP/IXE Parameters 56
    - Removing the IP/IXE Service From a Port 58
  - The PVC Map Option 59
    - PVC Configuration Procedure 59
    - Removing a Permanent Virtual Circuit 62
  - Run Time Parameters Option 62
  - The IXE Map Option 64
    - IXE Map Configuration Procedure 64
    - IP/IXE Map Parameters 66
    - Changing the IXE Map 66
  - The PAD Map Option 66
    - PAD Map Configuration Procedure 67
      - General Parameters of the PAD Map 68
      - Facilities Parameters of the PAD Map 69
      - CUG and RPOA Parameters of the PAD Map 71
      - Aliases Parameters of the PAD Map 72
    - Changing the PAD Map 72
  - The PADD Listen Strings Option 73
    - Listen Strings Configuration Procedure 73
    - PADD Listen String Formats 74
    - Changing and Removing PADD Listen Strings 74
  - The Subnetwork Names Option 75
    - Subnetwork Names Configuration Procedure 75
    - Changing the Subnetwork Names List 77
- 6. **UUCP Configuration** 79
  - Configuring the XTY System 79

Files Associated with UUCP	79
Devices	80
Dialcodes	80
Permissions	81
Dialers	81
Systems	81
<b>7. Creating Customized Parameter Files</b>	<b>83</b>
Using Parameter Files as Templates	83
Template Tabs	83
The OK Button	84
The Save As Button	84
The Cancel Button	85
The Help Button	85
Creating an X.25 Parameter File	85
X.25 General Operating Parameters	86
Logical Channel Parameters	88
Packet- and Window- Size Parameters	90
Timer Parameters	92
Counter Parameters	95
Transit Delay Parameters	96
Throughput Class Parameters	96
Closed User Group Parameters	99
Subscription Option Parameters	100
Localization Parameters	101
D-Bit Control Parameters	103
Throughput Window and Packet Parameters	104
Creating a LAPB Parameter File	107
LAPB General Operating Parameters	108
LAPB Timer Parameters	110
LAPB Link-Level Parameters	112

- Creating an LLC2 Parameter File 113
  - LLC2 General Operating Parameters 114
  - LLC2 Timer Parameters 116
  - LLC2 XID Parameters 118
- 8. Troubleshooting 119**
  - STREAMS Trace Messages 119
    - X.25 PLP Driver 120
      - Trace Level 1 - Call Activity 120
      - Trace Level 2 - Clear Activity 120
      - Trace Level 3 - Reset Activity 120
      - Trace Level 4 - Restart Activity 121
      - Trace Level 5 - Interrupt Activity 121
      - Trace Level 6 - Data Activity 121
      - Example Trace Logging Output 121
    - LAPB Driver 122
      - Trace Level 1 - Setup and Disconnection Activity 122
      - Trace Level 2 - Reset Activity 122
      - Trace Level 3 - Error Activity 123
      - Trace Level 4 - Busy Activity 123
      - Example Trace Logging Output 123
    - LLC2 Driver 124
      - Trace Level 1 - Setup and Disconnection Activity 124
      - Trace Level 2 - Reset Activity 124
      - Trace Level 3 - Error Activity 124
      - Trace Level 4 - Busy Activity 125
      - Trace Level 5 - Type 1 Activity 125
      - Example Trace Logging Output 125
    - Tracing Summary 126
  - STREAMS Error Messages 126
  - Network Board-Loading (nload) Error Messages 127
  - Network Daemon (snetd) Error Messages 127



<b>A.</b>	<b>Address Formats</b>	131
	X.121 Addresses	131
	Internet Addresses	132
	<b>Glossary</b>	133
	<b>Index</b>	137



---

## List of Figures

<b>Figure 1-1</b>	SX.25 Protocol Layers	5
<b>Figure 1-2</b>	Overview of gx25adm Menus	11
<b>Figure 3-1</b>	Primary Window for gx25adm	21
<b>Figure 3-2</b>	File Menu	22
<b>Figure 3-3</b>	Edit Menu	24
<b>Figure 3-4</b>	Action Menu	26
<b>Figure 3-5</b>	The Port Configuration Process	28
<b>Figure 4-1</b>	The Kernel Configuration Screen	33
<b>Figure 4-2</b>	Sample Ports List	35
<b>Figure 4-3</b>	Kernel Parameters Option on the Setup Menu	39
<b>Figure 4-4</b>	Kernel Parameters for Ports on a GIO Bus	40
<b>Figure 4-5</b>	Kernel Parameters for Ports on an ISC Bus	41
<b>Figure 4-6</b>	Kernel Parameters for Ports on a VME Bus	42
<b>Figure 4-7</b>	The WAN Port Configuration Window	44
<b>Figure 4-8</b>	Tabs of X.25 Parameters	45
<b>Figure 4-9</b>	Tabs of LAPB Parameters	46
<b>Figure 4-10</b>	LAN Port Configuration Window	48
<b>Figure 4-11</b>	Tabs of X.25 Parameters	49
<b>Figure 4-12</b>	Tabs of LLC2 Parameters	50
<b>Figure 5-1</b>	IP/IXE Configuration Parameters	55
<b>Figure 5-2</b>	PVC Map Parameters	61
<b>Figure 5-3</b>	IXE Map of IP Hosts	64
<b>Figure 5-4</b>	IP/IXE Map Record	65
<b>Figure 5-5</b>	PAD Map Configuration Window	67
<b>Figure 5-6</b>	General Parameters in a PAD Map Record	68
<b>Figure 5-7</b>	Facilities Parameters in a PAD Map Record	70
<b>Figure 5-8</b>	CUG and RPOA Parameters in a PAD Map Record	71

<b>Figure 5-9</b>	Alias Parameters on a PAD Map Record	72
<b>Figure 5-10</b>	PADD Listen String Parameters	73
<b>Figure 5-11</b>	Subnetworks Configuration Window	76
<b>Figure 7-1</b>	Unlabeled Tabs on Template Windows	84
<b>Figure 7-2</b>	X.25 General Parameters	86
<b>Figure 7-3</b>	Logical Channel Parameters	88
<b>Figure 7-4</b>	Packet- and Window-Size Parameters	90
<b>Figure 7-5</b>	Timer Parameters	93
<b>Figure 7-6</b>	Counter Parameters	95
<b>Figure 7-7</b>	Transit Delay Parameters	96
<b>Figure 7-8</b>	Throughput Class Parameters	97
<b>Figure 7-9</b>	Closed User Group Parameters	99
<b>Figure 7-10</b>	Subscription Options Parameters	100
<b>Figure 7-11</b>	Localization Parameters	101
<b>Figure 7-12</b>	D-Bit Control Parameters	103
<b>Figure 7-13</b>	Throughput Window and Packet Parameters	105
<b>Figure 7-14</b>	LAPB General Parameters	108
<b>Figure 7-15</b>	LAPB Timer Parameters	110
<b>Figure 7-16</b>	LAPB Link-Level Parameters	112
<b>Figure 7-17</b>	LLC2 General Parameters	114
<b>Figure 7-18</b>	LLC2 Timer Parameters	116
<b>Figure 7-19</b>	LLC2 XID Parameters	118

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## List of Tables

<b>Table 2-1</b>	Port Numbering on Silicon Graphics Systems	14
<b>Table 8-1</b>	Tracing Levels	126
<b>Table A-1</b>	X.25 Network Address Formats	131



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## About This Guide

The *SX.25 Administrator's Guide* explains how to use gx25adm to configure X.25 network connections on a Silicon Graphics® host. The gx25adm utility is a graphical interface to SX.25, the Silicon Graphics implementation of the X.25 protocols specified by the International Consultative Committee for Telegraphy and Telephony (CCITT).

The audience for this guide is experienced X.25 network administrators. The guide describes gx25adm software components and briefly reviews X.25 network concepts to familiarize you with the SX.25 operating environment. It assumes that you will consult CCITT publications and service providers specifications to determine detailed configuration requirements of your site.

Most procedures in this guide assume that you are configuring an SX.25 host for the first time. If you are modifying an existing SX.25 configuration, you need to make slight adjustments when carrying out some instructions. For example, data entry fields that appear empty on unconfigured systems frequently contain data if the system is already configured, and it is not necessary to supply configuration data as instructed, except to make changes. Configured SX.25 hosts might also contain user-created files in addition to the factory-shipped files; any user-created files are displayed as selections in file lists.

### What This Guide Contains

This guide comprises eight chapters and one appendix. It covers these configuration topics:

Chapter 1, "Understanding the SX.25 Application"

Reviews X.25 network fundamentals, describes the software components that implement SX.25, and summaries gx25adm menus and their relationship to the underlying software. Read this chapter to identify the X.25 features that SX.25 offers and to preview the gx25adm configuration utility.

Chapter 2, "Planning for SX.25"

Explains SX.25 port-naming conventions and how to evaluate factory-shipped parameter files, which eliminate the need to specify protocol parameters individually. This chapter also contains an extensive list of the information that you should be prepared to supply during configuration procedures. Read the chapter before starting the configuration process to ensure that the process goes smoothly, particularly if SX.25 is new to the host.

Chapter 3, "Getting Started With gx25adm"

Explains how to start the gx25adm utility and describes the options available from the menus on the primary window. It also illustrates the steps in a typical port configuration procedure. Read this chapter for help with starting a gx25adm session.

Chapter 4, "Configuring a Host for Basic Connections"

Contains procedures for configuring WAN and LAN ports for basic X.25 connection services and for rebuilding the IRIX<sup>™</sup> operating system kernel, which is needed to put the ports into operation. Use this chapter as a tutorial until you become familiar with the port configuration process.

Chapter 5, "Configuring X.25 Options"

Contains procedures for configuring the optional features that SX.25 offers. Usually, the procedures in this chapter are performed after Chapter 4 procedures.

Chapter 6, "UUCP Configuration"

Explains how to modify UUCP configuration files to implement UUCP over the basic connection service. Use the information in this chapter after you configure the basic connection service (Chapter 4).

Chapter 7, "Creating Customized Parameter Files"

Contains procedures for creating customized protocol parameter files. Use this chapter in conjunction with Chapter 4 only if you determine that SX.25 factory-shipped parameter files are not suitable for your network service.

Chapter 8, "Troubleshooting"

Explains SX.25 error messages and identifies the likely source of the message. Use this chapter to monitor SX.25 and detect problems with its operation.



### Appendix A, "Address Formats"

Explains formats for constructing X.121 addresses and Internet Addresses.

## Conventions Used in This Guide

These type conventions and symbols are used in this guide:

<b>Bold</b>	Literal command-line arguments, such as options and flags
<i>Italics</i>	Executable names, filenames, IRIX commands, manual and book titles, new terms, and onscreen button names
Fixed-width type	Error messages, prompts, and onscreen text.
<b>Bold fixed-width type</b>	User input, including keyboard keys (printing and nonprinting)
""	(Double quotation marks) Onscreen menu items and references in text to document section titles
()	(Parentheses) Following IRIX commands, surround reference page (man page) section numbers
#	IRIX shell prompt for the superuser ( <i>root</i> )
%	IRIX shell prompt for users other than superuser

## Related Documentation

These documents contain additional information that is related to using SX.25:

- *SX.25 User's Guide*
- *SX.25 Release Notes*
- *IRIX Admin: System Configuration and Operation*
- *IRIX Admin: Software Installation and Licensing*

See also the online reference pages (man pages): *dlpi(7)*, *llctemplate(4)*, *llc2(7)*, *lltune(1M)*, *snetd(1M)*, *snetd.options(4)*, and *x25addr(5)*.



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## Understanding the SX.25 Application

SX.25 is a STREAMS implementation of the X.25 network standard recommended by the CCITT. Silicon Graphics workstations and servers running SX.25 can establish virtual circuit connections to other hosts in X.25 wide area networks (WANs) or local area networks (LANs) that operate by CCITT standards. In addition to this basic connection service, SX.25 also supports PAD, Transmission Control Protocol/Internet Protocol (TCP/IP), the UNIX®-to-UNIX Copy Program (UUCP), and a network layer interface for developing custom applications.

SX.25 implements these CCITT recommendations:

- X.3/X.28/X.29 packet assembler/disassembler program (*pad*).
- X.25 Level III, '80, '84, and '88 versions. The '84 and '88 versions support basic (modulo 8) and extended (modulo 128) packet sequence numbering.
- X.25 Level II LAPB, '80, '84, and '88 versions. The '84 and '88 versions support basic and extended packet sequence numbering.

SX.25 also supports the following functions:

- ISO 8208 support for DTE-DTE operation
- DTE and DCE operation
- IP to X.25 encapsulation (IXE)
- LLC-2 over IEEE 802.3, used to run X.25 over the LAN
- virtual call (VC) and permanent virtual circuit (PVC) services
- per-call facilities

## X.25 Network Fundamentals

X.25 is a communication protocol for LANs and WANs that comprises a series of functional layers. Each layer operates in a prescribed way, implementing its own protocol. Because layer functions are standardized, equivalent layers of other protocols can be substituted for X.25 layers, increasing the services that the network offers (see Figure 1-1 for an illustration of the protocol layers as implemented by SX.25). The combination of protocol layers implementing a particular network function is referred to as a *protocol stack*.

Data is exchanged across an X.25 LAN or WAN by means of *packet switching*. Networks that implement the X.25 protocol are referred to as packet-switched data networks (PSDNs), or more generally as public data networks (PDNs). Although many widely known PDNs are public networks, such as the European telephone and telegraph agencies, many PDNs are private service providers, such as Tymnet in the United States. PDNs offer a commercial service to the organizations or individuals who subscribe to them.

The CCITT published a series of technical specification for packet switching (the X series) in 1976, 1980, 1984, and 1988. These specifications came to be known as the X.25 recommendations. Most public and private X.25 network service providers conform to the 1980, 1984, or 1988 X.25 recommendations. The International Organization for Standards (ISO) has also published X.25 protocol standards: ISO 8208 specifies the standard for packet-level functions, and ISO 7776 specifies the standard for link-level functions (see Figure 1-1).

## How Packet-Switched Networks Work

On packet-switched networks, transactions in which users on one host obtain services on another host are known as *calls*. During a call, the local and remote hosts operate as data terminal equipment (DTEs): each DTE performs the functions required to send and receive data. Data circuit-terminating equipment (a DCE), to which each DTE is attached, performs the network interface functions that are required, such as establishing and maintaining connections and performing signal conversions (modem functions).

The line connecting an X.25 host to the network is assigned a *network user address* (NUA) that is used to direct call packets to the host. Hosts with more than one line connected to a network (or multiple networks) require an address for each line. The X.121 standard

defines X.25 address formats and is used by the majority of PDNs (see Appendix A for format information).

### **Virtual Circuits**

A connection between a calling DTE and a responding DTE is known as a *virtual circuit*. One or more virtual circuits can be sustained on a channel, and several channels may be allocated to each physical line on a host. *Switched virtual circuits* (SVCs) handle calls to an address that the user specifies; SVCs terminate when the call is complete, freeing the channel capacity for other calls. *Permanent virtual circuits* (PVCs) are dedicated to calls between two designated addresses. PVCs do not use DCE services, but they require the exclusive use of a dedicated channel.

### **Logical Channels**

When a user initiates a call to a remote X.25 host, the DTE assigns the call a *logical channel*, identified by a *logical channel number*, over which the call is conducted. The responding DTE also assigns a logical channel number for the call, which might be different from that on the calling DTE. Because each DTE includes the call's logical channel number in all packets that it sends, the DCE is able to route the data to its correct destination.

*Two-way channels* support the flow of data in the inbound and the outbound direction. X.25 networks also support permanent channels for PVCs and one-way channels that allow data flow in a single direction: *permanent incoming channels* and *permanent outgoing channels*. The rate at which DTE channels transmit data determines their *throughput class*.

### **Packet Types**

The function that a packet performs determines the format and contents of the packet. In general, X.25 communications require three types of packets: call request packets, data packets, and call termination packets. The calling DTE and responding DTE have their own version of each packet type. For example, the equivalent of a call request packet (on the calling DTE) is a call accept packet (on the responding DTE).

When the calling DTE sends a call request packet to initiate a call, the responding DTE sends a call accept packet to agree to the connection; the virtual circuit is established at this time. If the call request packet contains a set D-bit (delivery confirmation bit), the responding DTE acknowledges each data packet that it receives. When the D-bit is not used, the *window size* determines the number of packets that can be sent without a

confirmation. When a call is complete, the calling and responding DTE exchange clear-request packets to terminate the virtual circuit.

Either DTE may send interrupt packets to transmit urgent information. The data flow is normally resumed after the interrupt sequence is processed. By contrast, reset packets, which reset the virtual circuit, sometimes clear all data and interrupt packets from the circuit. For this reason, DTEs transmit reset packets only in unusual circumstances.

### **Packet Sizes**

The maximum size of network packets is set by the X.25 version that a network uses: the 1980 recommendation sets the maximum packet size to 1024 bytes, and the 1984 recommendation sets maximum packet size to 4096. Generally, the size of packets that are actually used on a network is fixed and understood by the DTEs. However, some networks offer an option that allows the DTE and DCE to negotiate the size of packets when the call is placed.

## **SX.25 Software Components**

Figure 1-1 illustrates the X.25 protocol layers as implemented in the SX.25 application. Notice from Figure 1-1 that the Internet Protocol (IP) is substituted for upper X.25 layers, and that each application layer is supported by a different combination of layers below it.

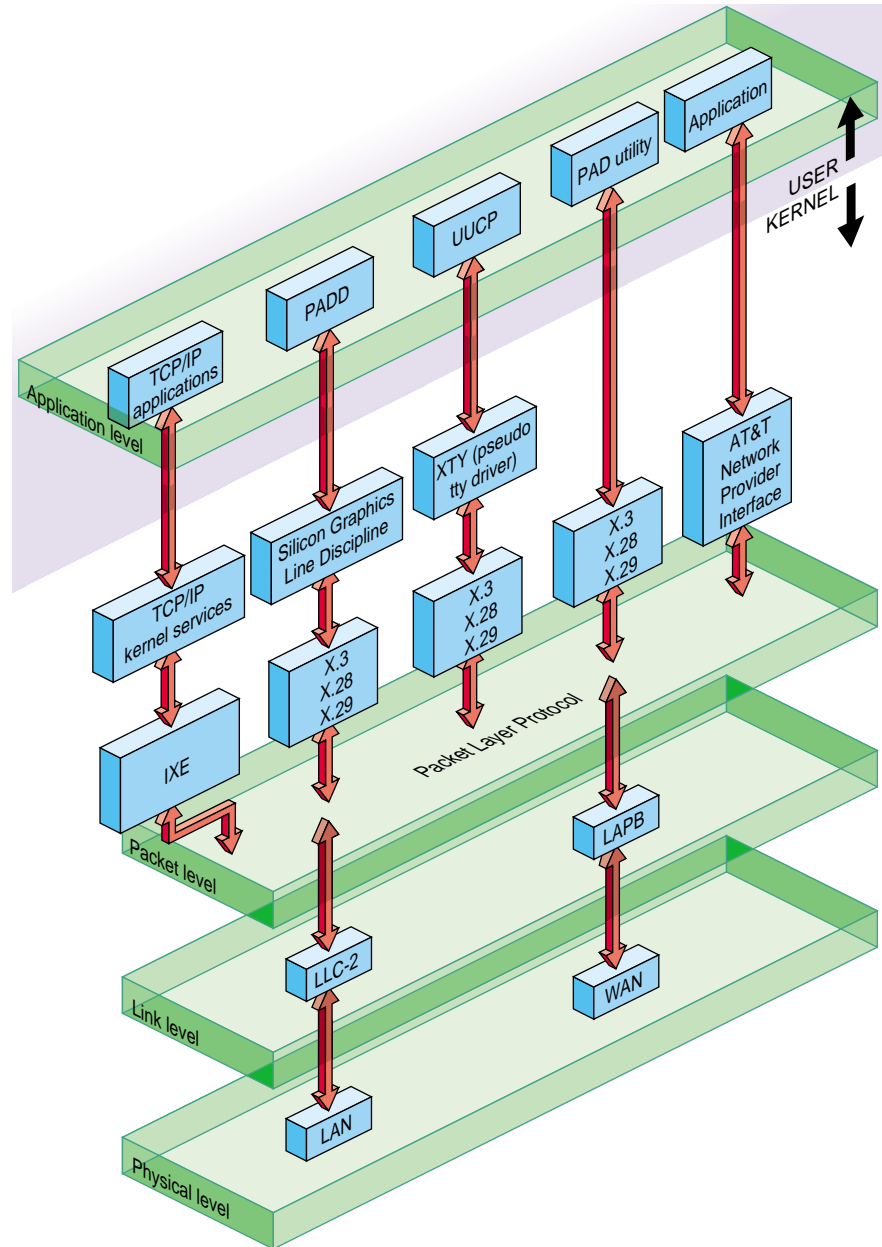


Figure 1-1 SX.25 Protocol Layers

## SX.25 Functional Layers

Level 1 of the X.25 protocol is the *physical* layer that governs the transmission of electrical signals on the network. Level 1 comprises the hardware itself, which is referred to as the *link*, and the device driver that interfaces to the hardware, which is referred to as the *port*. Figure 1-1 represents the physical level as a LAN and WAN port on the SX.25 host.

Level 2, the *data link* level, manages access to the hardware channel and the sequencing of data over the channel. The link level prepares information for transmission in units known as *frames*. In Figure 1-1, the link-level function is represented by LLC-2, which performs link-level functions in LANs, and LAPB, which performs link-level functions for WAN connections.

Level 3, the packet level, establishes the logical connection between the communicating hosts and controls the flow of information between them. Level 3 transmits information in packets, which contain addressing and control information in addition to data. Figure 1-1 refers to level 3 as the *packet level protocol*, or PLP, layer.

The application level, (level 7 in the OSI model), supports user and administrative services. Figure 1-1 indicates that SX.25 offers PAD (X.25 user services) and PADD (the PAD daemon), TCP/IP, UUCP, and locally developed user applications at this level. The interface between the application level and the lower level protocols is provided by the IRIX operating system and IRIX networking services.

## Subnet IDs and DTE Addresses

Each WAN and LAN port on a Silicon Graphics host operates as a DTE. Every port is assigned its own *DTE address*, which uniquely identifies the port to the network. To SX.25 software, however, the port is considered a subnetwork. SX.25 uses a *subnet ID* to direct incoming packets internally after the packets arrive. For this reason, every SX.25 port must be assigned both a DTE address and a subnet ID when you configure it for network operation.

## The SX.25 Configuration File

The SX.25 configuration file defines the operation of all X.25 network connections on a Silicon Graphics host. The default SX.25 configuration file is `/etc/config/snetd.options`. You can specify an alternate filename for `snetd.options`, and you can create multiple configuration files with unique filenames if you choose to.



The SX.25 configuration file contains a record for each configured port on the system. The record contains a subnetwork ID, a network address, and the names of the parameter files to be used to configure the port's protocol stack.

## Protocol Parameter Files

The protocol stack for an X.25 port contains dozens of adjustable parameters that must be set to coincide with the operating parameters of the network to which the port is connected. To make port configuration more efficient, SX.25 provides parameter files that contain the parameter settings used by the vast majority of PDNs. These factory-shipped files make it unnecessary to specify protocol parameters individually, in most cases.

Two files configure the protocol stack for a given port: a packet-level parameter file and a link-level parameter file. When the host's networking applications start, the *snetd* daemon builds the protocol stack for a port using the parameter files that are specified in the configuration file.

Notice from Figure 1-1 that the LAPB protocol defines link-level functions on WAN ports, and LLC2 defines link-level functions on LAN ports. To accommodate all port configuration possibilities, SX.25 provides three types of protocol parameter files: X.25 parameter files, a LAPB parameter file, and LLC2 parameter files.

## X.25 Parameter Files

An X.25 parameter file specifies the packet-level functions for WAN and LAN ports. These specifications include logical channel assignments, packet and window sizes, timers, and other transmission specifications. Factory-shipped X.25 parameter files implement 1980, 1984, and 1988 X.25 recommendations for DTEs and DCEs. Because the packet-level parameter settings in these files are compatible with the requirements of most PSNs, it is usually not necessary to specify packet-level parameters individually.

To configure a port with a factory-shipped file, you select the file from the X.25 Parameter File list during the port configuration procedure (see Figure 4-7). You can check the settings in any file on this list by opening it with `gx25adm` (see "The Open Button" in Chapter 4).

If you determine that factory-shipped files are not suitable, you can create custom X.25 parameter files (this process is described in "Creating an X.25 Parameter File" in Chapter 7). Any custom parameter file that you create is added to the X.25 Parameter File list so that you can select it during subsequent port configuration procedures.

### LAPB Parameter Files

A LAPB parameter specifies link-level functions for WAN ports. These specifications include timer settings, window and frame sizes, and other WAN transmission parameters. Information in the LAPB parameter file is passed to *LAPB*, the IRIX LAP multiplexer that manages port I/O. One factory-shipped LAPB file is included in the SX.25 application. Because the parameter settings in this file comply with link-level requirements of most PSNs, it is usually not necessary to specify link-level parameters individually.

To configure a port with the factory-shipped file, you select the file from the LAPB Parameter File list during the port configuration procedure (see Figure 4-7). You can check the settings in this file by opening it with *gx25adm* (see “The Open Button” in Chapter 4).

If you determine that the factory-shipped file is not suitable, you can create a custom LAPB parameter file (this process is described in “Creating a LAPB Parameter File” in Chapter 7). Any custom parameter file that you create is added to the LAPB Parameter File list so that you can select it during subsequent port configuration procedures.

### LLC2 Parameter Files

An LLC2 parameter file specifies link-level functions for LAN ports. These specifications include timer settings, window sizes, P-bit acknowledgment, and other LAN transmission parameters. Information in the LLC2 parameter file is passed to *LLC2*, the IRIX LAP multiplexer that manages port I/O. Parameter settings for link-level functions are defined by network media, so the SX.25 application provides a factory-shipped LLC2 parameter file for Ethernet, FDDI, and Token Ring LANs. Because the settings in this file comply with industry standards, it is usually not necessary to specify LLC2 parameters individually.

To configure a port with a factory-shipped file, you select the file from the LLC2 Parameter File list during the port configuration procedure (see Figure 4-10). You can check the settings this file by opening it with *gx25adm* (see “The Open Button” in Chapter 4).

If you determine that the factory-shipped file is not suitable, you can create a custom LLC2 parameter file (this process is described in “Creating an LLC2 Parameter File” in Chapter 7). Any custom parameter file that you create is added to the LLC2 Parameter File list so that you can select it during subsequent port configuration procedures.

## IP Network Connections

SX.25 supports connections to Internet Protocol (IP) networks, allowing users on the SX.25 host to use TCP/IP network services. It also supports an IP host map, which allows users to enter hostnames rather than addresses in their connection requests. The SX.25 implementation complies with RFC 877.

In IP/X.25 internetworks, X.25 networks function as subnetworks of the IP network. X.25 connections to IP networks are implemented by means of the IP to X.25 encapsulation driver (IXE), which links IP networks with the X.25 stack (see Figure 1-1). IXE transmits IP datagrams between X.25 nodes over an X.25 virtual circuit. The remote X.25 node may be on the same network or on a different one.

Hosts linked to the IXE driver have two associated addresses: an Internet address and an X.25 address. Address mapping is determined by the mode of operation that is in use, CCITT or DDN.

**Note:** Sending IP broadcast packets over an X.25 network is impractical and is not supported.

### CCITT Addressing

SX.25 maintains an internal address table called the IXE map. The IXE map holds address pairs that associate the IP address with the X.25 address of a node. The IXE database is consulted when an outgoing IP packet requires a new connection and when incoming X.25 connections contain IP packets. Requests to send IP packets to X.25 nodes for which there is no IXE map record result in an error.

When an incoming connection arrives at the X.25 layer and is destined for the IXE driver, the X.25 address must match an entry in the IXE map. If no matching entry is located, the connection is refused. In general, if an incoming connection has been established, the same connection is used for outgoing datagrams to the calling party.

For each name and address pair, you can specify the packet and window sizes to be requested on connections and the number of concurrent virtual circuits that are allowed. The default maximum number of entries in the IXE map is 100.

### DDN Addressing

When operating in DDN mode, IP to X.25 address mappings are not normally obtained from the internal address table. This means that in normal operation, only the default X.25 facilities are available. It is possible, however, to use different facilities, packet and window sizes, and so on. To do this, you must enter the information into the internal address table yourself. This means entering the correct X.25 address, derived from the DDN address; refer to the *Defense Data Network X.25 Host Interface Specification*.

### PAD and PADD Connections

The basic connection service on an SX.25 host allows its users to run PAD applications. To simplify the connection process for users, you can create a PAD map. This map is a database of X.25 hostnames, addresses, and connection parameters that automatically supplies addresses and connection parameters in PAD connection requests; users supply only the remote hostname in their *pad* commands. The PAD map can also contain host aliases for situations in which a host is known by multiple names.

SX.25 hosts offer PAD services to network users by means of PADD, the PAD daemon service. The PADD server listens for incoming requests from PAD users and creates a login process that supports the virtual terminal connection. If you wish, you can restrict the X.25 hosts to which the SX.25 host can supply PAD services by creating a list of *listen strings*. The listen strings list contains the hosts addresses from which PADD accepts connection requests.

### About gx25adm Menus

When the gx25adm utility starts, the primary window is displayed (shown in Figure 3-1). The menus offered on the primary window provide access to all SX.25 configuration functions and the files that store configuration information.

Figure 1-2 illustrates how gx25adm menus are used to access configuration functions and the files that support them.

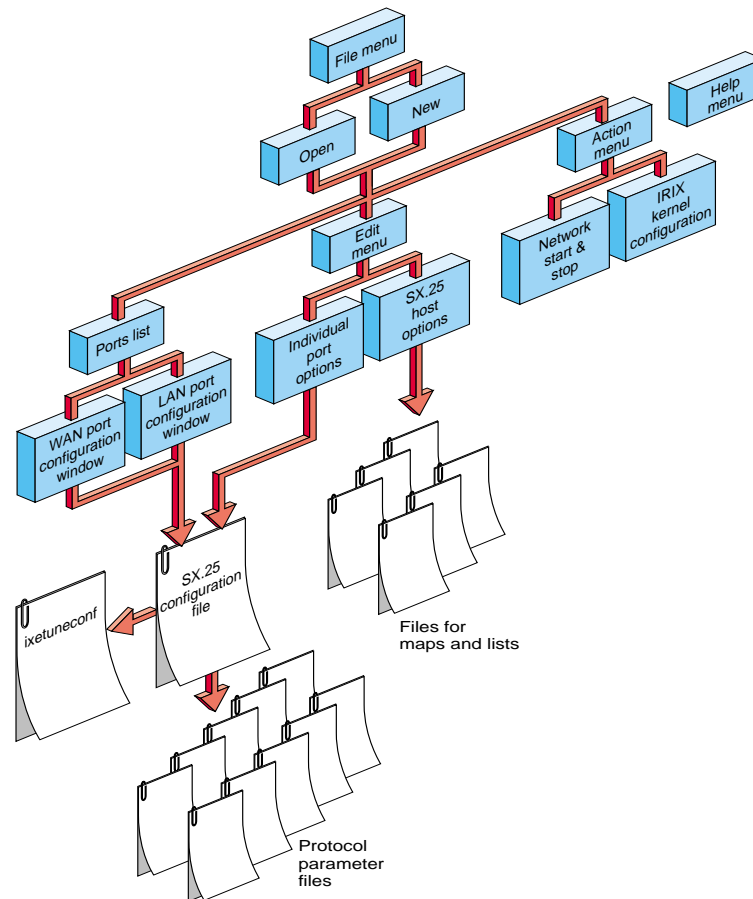


Figure 1-2 Overview of gx25adm Menus

## Accessing Port Configuration Functions

WAN and LAN ports are configured using the WAN and LAN port configuration windows (see Figure 4-7 and Figure 4-10). These windows provide access to the SX.25 configuration file, which contains a record for each configured port on the host (see “The SX.25 Configuration File” for details). You open the configuration file using options on the File menu (shown in Figure 3-2), then you select a port to configure. Selecting a port

displays the WAN or LAN port configuration window and opens the configuration file record for the port.

The WAN and LAN port configuration windows also provide access to the protocol parameter files for a given port (see “Protocol Parameter Files”), but these files are not normally opened during a configuration session. You open protocol parameter files only if you plan to create customized versions of these files (see “Evaluating SX.25 Parameter Files” in Chapter 2).

### **Accessing Optional Features**

The Edit menu (shown Figure 3-3) provides access to the optional features that you can add to an SX.25 host or to individual ports on the host. SX.25 host options include IP and X.25 host maps, lists of the PADD services and subnetworks on the host, and IRIX kernel parameters for the SX.25 application. This information is stored in database files that are accessed when you choose an Edit menu option.

Individual port options include adding IP network connections and PVCs to the port. When you configure an individual port option, the configuration information is recorded in the SX.25 configuration file. For this reason, you must open the configuration file from the File menu before you use these Edit menu features.

### **Accessing Support Functions**

The gx25adm utility provides two support functions: a network function that stops and starts IRIX network services on the host, and a kernel function that rebuilds the IRIX operating system kernel. Support functions are accessed from the Action menu (shown in Figure 3-4).

---

## Planning for SX.25

Planning an SX.25 host configuration involves identifying the communications ports on the system and deciding on the services that each port will provide (see Chapter 1 for an explanation of available SX.25 services). It is also necessary to collect information that must be provided during the configuration process. This chapter contains these sections to help you with configuration planning:

- “Port Naming Conventions”
- “Evaluating SX.25 Parameter Files”
- “Collecting Information for Port Configurations”

### Port Naming Conventions

When the SX.25 application starts, it requests a hardware inventory (see the `hinv(1M)` reference page) of the number of communications ports that are installed on the system. SX.25 automatically assigns a name to each port that the inventory reports.

The maximum number of serial ports on a Silicon Graphics system varies with the bus architecture used on different system models. Table 2-1 lists the bus type and model of

each Silicon Graphics system, the maximum number of communication ports that each model can contain, and the name that SX.25 software assigns to each port:

**Table 2-1** Port Numbering on Silicon Graphics Systems

Bus Type	Model	Maximum Ports	Distribution of Ports	Port Name
GIO	Indy	4	Slot 1, 2 ports	wan00 wan01
			Slot 2, 2 ports	wan10 wan11
	Indigo	4	Same as Indy	Same as Indy
	CHALLENGE S	4	Same as Indy	Same as Indy
EISA	Indigo 2	8	Slot 1, 2 ports	wan00 wan01
			Slot 2, 2 ports	wan10 wan11
			Slot 3, 2 ports	wan20 wan21
			Slot 4, 2 ports	wan30 wan31
	CHALLENGE M	8	Same as Indigo2	Same as Indigo2



**Table 2-1 (continued)** Port Numbering on Silicon Graphics Systems

Bus Type	Model	Maximum Ports	Distribution of Ports	Port Name
VME	CHALLENGE L	16	Slot 1, 4ports	wan00
				wan01
				wan02
				wan03
			Slot 2, 4ports	wan10
				wan11
				wan12
				wan13
			Slot 3, 4 ports	wan20
				wan21
				wan22
				wan23
			Slot 4, 4 ports	wan30
				wan31
				wan32
				wan33
	CHALLENGE XL	16	Same as CHALLENGE L	Same as CHALLENGE L

## Evaluating SX.25 Parameter Files

SX.25 software includes a collection of files that set parameters for link-level and packet-level protocols to values used by the vast majority of PDNs. In most cases, these values are appropriate for your port connections, and you can establish X.25 WAN and LAN connections using SX.25 parameter files. However, if you are using SX.25 for the first time, it is important to evaluate the suitability of the as-shipped files for connecting to your particular network and to identify any adjustments that might be needed. You can check factory-shipped parameter settings by opening the files with gx25adm (see “The Open Button” in Chapter 4).

If you are unsure of the operating requirements for a network to which you are connecting, discuss your questions with your network service provider.

## Collecting Information for Port Configurations

If you plan to use SX.25 protocol parameter files, be prepared to supply this information during the configuration procedure:

- A subnet ID for the port. This ID identifies the protocol stack to the SX.25 daemon.
- A DTE address for the port. Ask your network service provider to supply addresses. See “X.121 Addresses” in Appendix A if you need detailed information.
- The names of the ports to be configured. See Table 2-1 for the list of SX.25 port names.
- Whether ports will operate as a DTE or DCE and the X.25 recommendation to which the port must conform (1980, 1984, or 1988).
- The link procedure to be used on each port: LAP, LAPB, or LAPB with extended addressing for WAN ports; LLC1 or LLC2 for LAN ports.

## Additional Information for Custom Protocol Files

If you plan to create custom parameter files, be prepared to substitute settings in the X.25 parameter files for settings that are required by your network service.

You might need to reset one or several of the packet-level parameters listed below to operate on the network to which you subscribe:

- The extended address for any ports on which you plan to use OSI NSAP or other extended addressing.
- The modulo number (8 or 128) used for packet sequencing
- The type of logical channels that you will use and their numbers. (See “Logical Channels” in Chapter 1 and Figure 7-3.) Include PVCs if you plan to use them.
- The default maximum size of packets and windows on local and remote DTEs, and the maximum size of the network service data unit (NSDU). (See Figure 7-4.)
- Settings for packet-level timers, counters, and delays. (See Figure 7-5, Figure 7-6, and Figure 7-7.)
- Throughput class boundaries. (See Figure 7-8.)
- The types of negotiation that are supported: packet size, window size, and throughput class

- If you belong to a closed user group (CUG), the conventions that are followed. (See Figure 7-9.)
- The optional facilities to which you subscribe. (See Figure 7-10.)
- Conventions for handling international calls, priority requests, addresses in outgoing calls, and diagnostic packets. (See Figure 7-11.)
- Conventions for handling D-bits. (See Figure 7-12.)

You might need to reset one or several of the link-level parameters listed below to operate on the network to which you subscribe:

- Frame and window specifications. (See Figure 7-14 and Figure 7-17.)
- Link-level timers. (See Figure 7-15 and Figure 7-18.)
- Link-level error handling and state indicators. (See Figure 7-16.)
- XID parameters for LANs. (See Figure 7-19.)

### **Additional Information for IP Connections**

If you plan to configure IP on any connections (see “IP Network Connections” in Chapter 1), plan to supply this information during the configuration procedure (also see Figure 5-1):

- For each network to which the SX.25 host is connecting, a local Internet address for the SX.25 host, the subnetwork mask of the network, the version of X.25 run on the network, and the addressing scheme that the network uses (CCITT or DDN)
- Whether to allow broadcast packets
- The high-water mark for data concatenation (if higher than 576 octets)
- Maximum idle and minimum connection time for virtual circuits
- Mode of operation, CCITT or DDN
- How to handle reset and expedited data requests
- PVC channel ranges, if you plan to use PVCs
- Listen information for applications using the connection

If you plan to create an IP/IXE map, which allows users to designate hosts by their name rather than by their address, you need to supply this information:

- The address or name of the IP hosts to which the SX.25 host will connect. If you plan to use a hostname, it must be listed in SX.25 hosts file (*/etc/hosts*).
- The maximum packet and window size to be used in connections

### **Additional Information for PAD and PADD Connections**

If you plan to use the PAD map (see “PAD and PADD Connections” in Chapter 1), plan to supply this information:

- The name of the X.25 hosts to which local users will connect and any aliases by which these hosts are known (see Figure 5-6 and Figure 5-9)
- The address of the X.25 hosts to which users will connect for PAD sessions. For WAN connections, the address is an X.121 address; for LAN connections, it is an LSAP address. Address information must include an extension for any host that is using extended addressing.
- The X.29 version used on the remote host and any call user data (CUD) that is required in a connection request
- The incoming and outgoing packet and window sizes on the remote host, whether it uses fast select, and whether it accepts reverse call charges (see Figure 5-7)
- The closed user group (CUG) number and whether the CUG is bilateral or multilateral. If calls are routed by means of a recognized private operating agency (RPOA), the RPOA numbers (Figure 5-8).

If you plan to offer PADD services (see “PAD and PADD Connections” in Chapter 1), plan to supply this information:

- Any CDU that is required in incoming calls
- The addresses of hosts from which calls will be accepted
- Whether CDU and address data must match exactly or in part
- Whether the addresses are X.25 DTE (WAN connections) or X.25 NSAP (LAN connections)

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## Getting Started With gx25adm

The gx25adm utility is a graphical interface for configuring the SX.25 application on Silicon Graphics workstations and servers. Using gx25adm menus and dialogs, you can configure connections to X.25 WANs, X.25 LANs, or connections to IP networks. You can also configure PAD and other user applications that rely on the underlying X.25 network connection. Because configuration parameters are preset to conform to the requirements of most X.25 network service providers, the configuration process is quick and efficient.

This chapter contains these sections to help you get started using gx25adm:

- “Starting the gx25adm Utility”
- “Using the Primary Window”
- “Using the File Menu”
- “Using the Edit Menu”
- “Using the Action Menu”
- “Using gx25adm Help”
- “Configuration Procedure at a Glance”

### Starting the gx25adm Utility

The gx25adm utility allows a privileged user or root to configure the protocol stack for an X.25 port on a host; gx25adm also allows you to configure features on the host that support network services. The utility is accessible from the Indigo Magic™ Desktop. You can start gx25adm by any of the these methods:

### From the Find Toolchest

Use this procedure to start gx25adm from the Find toolchest:

1. Choose "An Icon" from the Find toolchest.
2. Type **gx25adm** in the "Find an Icon" dialog.
3. Drag the icon onto your desktop.
4. Double-click on the gx25adm icon to launch the utility.

### From the Icon Catalog

Use this procedure to start gx25adm from the Icon Catalog:

1. Choose "Desktop Tools" from the Find toolchest.
2. Double-click the gx25adm icon to launch the utility.

### From a Shell

If you are configuring a remote workstation or server from a local system that runs from an ASCII console, start gx25adm from a shell. In this case, the local system must be running xcoe client software (see the *SX.25 Release Notes* for information on software prerequisites).

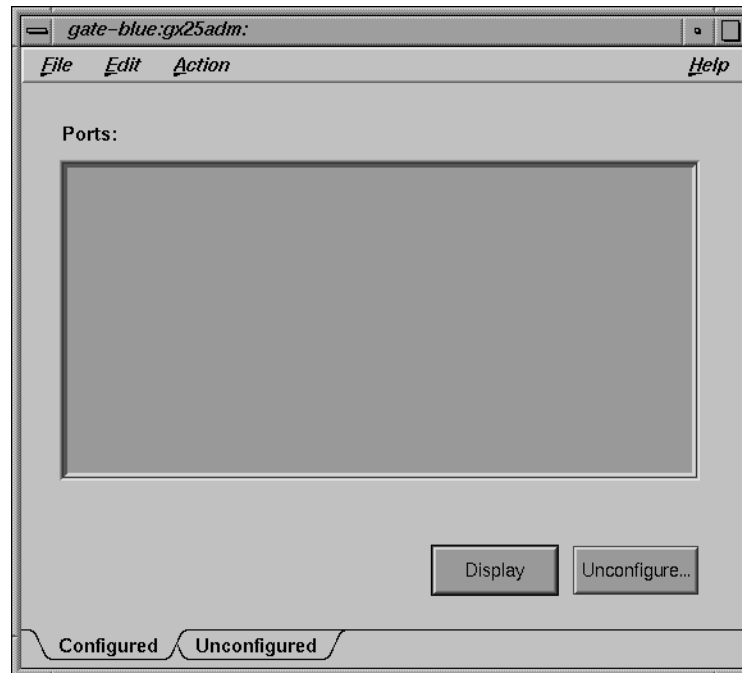
Use this procedure to start gx25adm from a shell:

1. Type **su** to become the root user.
2. Type **gx25adm** command from an IRIX shell:  
# **gx25adm**

## Using the Primary Window

The gx25adm primary window is displayed when you start the gx25adm utility (see Figure 3-1). Use the primary window to access the list of ports that are present on the SX.25 host, and to access the menus and other windows that allow you to configure the host and its ports for operation on an X.25 network.

When you first start gx25adm, the “Ports:” list is empty. To display entries in the ports list, open an SX.25 configuration file (see “Using the File Menu” for information on opening files). Then, use the ports list to select a port to be configured, reconfigured, or removed from the configured ports list.



**Figure 3-1** Primary Window for gx25adm

### Primary Window Tabs

When you select the Configured tab (shown in Figure 3-1), the primary window shows a list of ports that are already configured for network operation. When you select the Unconfigured tab (shown in Figure 4-2), the primary window shows a list of ports that are available but not yet configured. (Remember that the configuration file must be open to display a ports list.) Notice from Figure 3-1 and Figure 4-2 that the buttons on the primary window change, depending on the tab that is selected.

### Primary Window Buttons

When the Unconfigured tab is active, select a port on the ports list and click the *Configure* button to display an empty port configuration record. Complete this record to configure the port (see “WAN Port Configuration Procedure” and “LAN Port Configuration Procedure” in Chapter 4 for instructions).

When the Configured tab is active, select a port on the ports list and click the *Display* button to display the current port configuration record. Make the necessary changes to this record to reconfigure the port. If you want to remove a port from the ports list, click the *Delete* button. If you save the configuration file after removing the port from the list, you remove the port from service and the port is returned to the Unconfigured ports list (see “Using the File Menu” for instructions on saving the configuration file).

### Using the File Menu

Use the File menu, shown in Figure 3-2, to open and save configuration files, the files that define how individual X.25 ports on the system operate. For any given port on the system, this file must contain a subnetwork and network address and the name of the parameter files that define the protocol stack for the port. Also use the File menu to create customized versions of the protocol parameter files (if you determine that the original SX.25 parameter files are unsuitable for your needs) and to save updates to the maps and other records that support SX.25 options.

**Note:** Information that you add to a configuration file or protocol parameter file during an gx25adm session is not permanently recorded until you explicitly save the file using the “Save” or “Save As” option on the File menu.

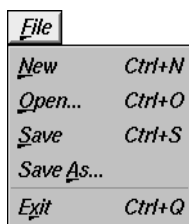


Figure 3-2 File Menu



### **The New Option**

Use the “New” option at the beginning of a port configuration session to create a configuration file that does not currently exist. The new file will contain the information that you enter in gx25adm windows during the session. This information will be recorded in the new file when you save it with the “Save” or “Save As” option.

### **The Open Option**

Use the “Open” option at the beginning of a port configuration session to open an existing configuration file to review its contents or change them. When you select this option, gx25adm prompts you to enter the name of the file that you plan to modify. Enter the full pathname of the file. It is important to remember that no changes are made to this file until you save it using the “Save” or “Save As” option.

### **The Save Option**

Use the “Save” option to store information in a configuration file that you opened earlier in the session. If you are saving a new configuration file, gx25adm prompts you to enter a filename. Enter the full pathname of the file. You can save the new file in any directory; however, by convention, IRIX configuration files are stored in the */etc/config* directory. If you are saving changes to an existing file, gx25adm saves a new copy of the file that you specified when you opened the file.

### **The Save As Option**

Use the “Save As” option to store a configuration file under a new filename. When you select this option, gx25adm prompts you to enter the new filename. Enter the full pathname of the file. You can save the file in any directory; however, by convention, IRIX configuration files are stored in the */etc/config* directory.

### **The Exit Option**

Use the “Exit” option to end a gx25adm session. If you made any configuration changes that you want to save, be sure to use the “Save” or “Save As” options on the File menu before selecting the “Exit” option. If you have any unsaved changes remaining from the

session when you select the “Exit” option, gx25adm warns you that your changes will be lost unless you take action with “Save” or “Save As.”

## Using the Edit Menu

Use the Edit menu, shown in Figure 3-3, to set the IRIX kernel parameters for an SX.25 host and to configure the optional features that SX.25 offers. SX.25 optional features rely on maps and other information about network hosts and services that you supply during gx25adm sessions. This information is stored in the configuration file (*snetd.options*, by default) and other supporting files.

Whenever you create or modify a configuration file, you must save your changes using File menu options. Whenever you create or modify supporting files, you use the Close button to save your changes (shown in Figure 5-2). To put the new file into effect, you must also stop and restart the network using Action menu options. Whenever you use the Edit menu to set kernel parameters, you must reboot the SX.25 host.

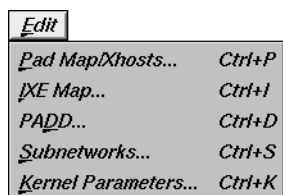


Figure 3-3 Edit Menu

## The PAD Map/Xhosts Option

Use the “PAD Map/Xhosts” option to create a list of the names of remote PADD hosts and the connection information that the hosts require. This map reduces the amount of information that users must supply when they begin a PAD session. After the list is created, use this option to modify X.25 host information or remove hosts from the list. See “The PAD Map Option” in Chapter 5 for instructions on creating the PADD map.

### **The IXE Map Option**

Use the “IXE Map” option to create the list of Internet (IP) hosts with which this system will communicate. You are required to supply the name and address of each IP host; you can also specify a host alias if you choose to use one. After the list is created, use this option to modify Internet host information or remove hosts from the list. See “The IXE Map Option” in Chapter 5 for instructions on creating the IXE map.

### **The PADD Option**

Use the “PADD” option to compose a list of listen strings that identify the calls for which the SX.25 host will provide PAD services. Incoming calls for service are handled by the PAD daemon, PADD. See “The PADD Listen Strings Option” in Chapter 5 for instructions on creating and changing this list.

### **The Subnetworks Option**

Use the “Subnetworks Option” to create a list of the subnetwork names on this host. The subnetwork list allows users to designate subnetworks by a name instead of by an address. See “The Subnetwork Names Option” in Chapter 5 for instructions on configuring subnetwork names.

### **The Kernel Parameters Option**

Use the “Kernel Parameters” option to set system-wide limits on the number of virtual circuits and UUCP connections that an SX.25 host will support. Because these parameters affect the IRIX kernel, you must reboot the SX.25 host whenever you use this option. See “Procedure to Configure Global Kernel Parameters” in Chapter 4 for instructions on configuring global kernel parameters.

## Using the Action Menu

Use the Action menu, shown in Figure 3-4, to start and stop networking and to create a new IRIX kernel.

**Caution:** When you use this menu to stop networking, all network activity is suspended until you restart the host; when you use this menu to rebuild the IRIX kernel, the X.25 host must be rebooted.

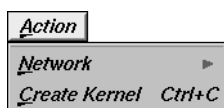


Figure 3-4 Action Menu

### The Network Option

Use the "Network" option to start and stop X.25 operations on the system. When you select "Start" from this option, gx25adm prompts you to specify the configuration file to be used for operation. Enter the full pathname of the configuration file or use the *Filter* button on the file specification prompt to enter wildcards in your specification. If the configuration file that you specify contains any changes, the changes become effective at network startup. An information message is posted when the network starts.

When you select "Stop" from this option, an information message is posted when the network stops. Stopping the network suspends connections to all networks in which the host is a member.

### The Create Kernel Option

Use the "Create Kernel" option to build a new IRIX kernel after you set new IRIX kernel parameters with the "Kernel Parameters" option on the Edit menu (see "The Kernel Parameters Option" in Chapter 3 for details) or the Setup menu on the WAN port configuration window (see "The Setup Menu" in Chapter 4 for details). Selecting the "Create Kernel" option configures and stores the new IRIX kernel; however, the new kernel is not installed until the next system reboot. See "Procedure to Rebuild the IRIX Kernel" in Chapter 4 for instructions on configuring and rebuilding an IRIX kernel.

## Using gx25adm Help

Use the Help menu on the primary window (see Figure 3-1) to display a list of the help topics that are available from this window. Select the "Overview" option to display general information about the primary window and port configuration windows and the features that these windows offer.

In addition to the Help menu, you can also get help on individual window features by using the **F1** key. For example, to request help on the File menu, move the cursor to the label on the menu bar and press **F1**.

## Configuration Procedure at a Glance

Figure 3-5 illustrates a typical gx25adm session in which an SX.25 host is configured for basic X.25 network connection services. In this session, the host's global parameters are configured first, then individual ports on the host are configured. When all ports are configured, configuration information is saved in the configuration file and the IRIX kernel is rebuilt.

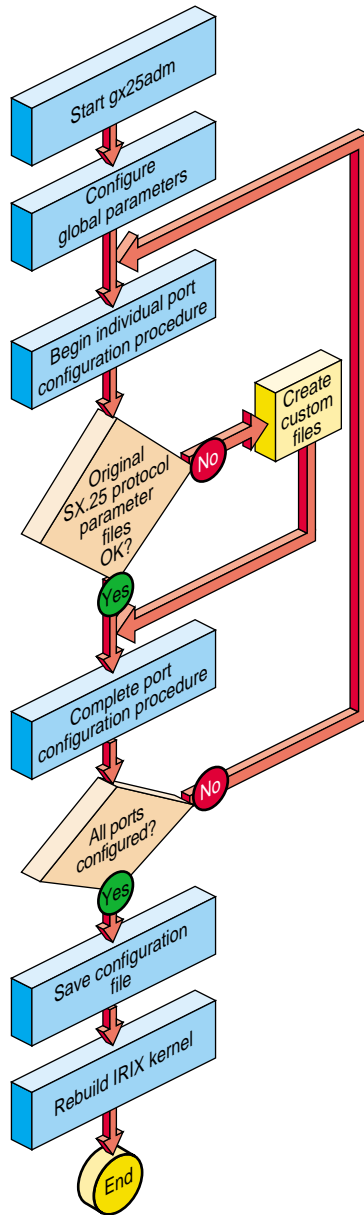


Figure 3-5 The Port Configuration Process

The order of the configuration process can vary from the order that is illustrated in Figure 3-5. However, because all changes to global parameters and some changes to individual port parameters affect the IRIX kernel, you must rebuild the IRIX kernel (the final step in Figure 3-5) after configuring kernel parameters.

Notice from Figure 3-5 that individual port configurations might be interrupted by an additional step: creating custom parameter files. If SX.25 factory-shipped parameter files are not suitable for connection to a particular network, you must create custom parameter files as part of the configuration process (see “Protocol Parameter Files” in Chapter 1 for information on factory-shipped files). Any custom file that you create can be used to configure other ports that require the same parameters. (Detailed configuration instructions are given in Chapter 4.)

Figure 3-5 does not include procedures for configuring the optional X.25 features that SX.25 offers. In general, however, optional features are added to a port after it is configured for the basic connection service. Options that affect the SX.25 host (such as PADD services) can be added at any time. (See Chapter 5 for a list and description of SX.25 optional features and instructions on configuring them.)





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## Configuring a Host for Basic Connections

Configuring an SX.25 host for basic X.25 WAN or LAN connections involves setting global parameters for the SX.25 host, setting parameters on individual ports, and rebuilding the IRIX kernel. All global configuration parameters and some individual port parameters affect the contents of the IRIX kernel. So whenever you change IRIX kernel parameters, the kernel must be rebuilt to put your changes into effect.

This chapter contains the sections listed below to help you configure an SX.25 host for basic X.25 network connections. It might be useful to refer to Figure 3-5 for an illustration of the configuration process as you do these procedures:

- “The Global Kernel Parameters Option”
- “Procedure to Configure Global Kernel Parameters”
- “About the Ports List”
- “Port Selection Procedure”
- “Using Port Configuration Windows”
- “WAN Port Configuration Procedure”
- “LAN Port Configuration Procedure”
- “Procedure to Rebuild the IRIX Kernel”

**Note:** Because rebuilding the kernel requires rebooting the host, you might want to delay the kernel rebuild until after you configure the global parameters and the basic connection service for all WAN ports.

## The Global Kernel Parameters Option

Kernel parameters specify how to create the streams and memory blocks that support X.25 network connections. Use the “Kernel Parameters” option on the Edit menu to specify global kernel parameters for an SX.25 host. These parameters specify the number of virtual circuits and UUCP connections that the host can sustain simultaneously. They also specify the X.29 protocol, which is the interface between PAD users on the host and the X.25 network.

Do not confuse the global Kernel Parameters option (on the Edit menu) with the “Kernel Parameters” option on the Setup menu of the WAN port configuration screen. Whereas global kernel parameters pertain to the entire host, port kernel parameters pertain only to the individual WAN port for which they are set (see “Setting WAN Port Kernel Parameters” for details). Whenever you use either Kernel Parameters option, you must reboot the SX.25 host to put your changes into effect.

## Procedure to Configure Global Kernel Parameters

Use this procedure to configure global kernel parameters.

1. Start `gx25adm` to display the primary window.

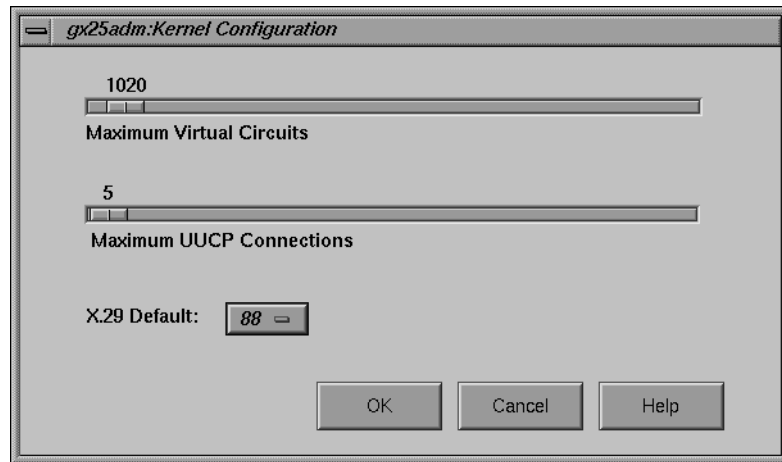
The primary `gx25adm` menu is displayed when you start the utility (shown in Figure 4-2). See “Starting the `gx25adm` Utility” in Chapter 3 if you need startup instructions.

2. Open `snetd.options` to store the global kernel parameters.

Use the “Open” option from the File menu to open the SX.25 configuration file, which is normally `/etc/config/snetd.options` (see “The SX.25 Configuration File” for information on this file). If you prefer to create a new configuration file by a different name, use the “New” option from the File menu instead (see “The Open Option” or “The New Option” for information on using these options).

3. Select “Kernel Parameters” from the Edit menu.

After your selection, the Kernel Configuration screen, shown in Figure 4-1, is displayed.



**Figure 4-1** The Kernel Configuration Screen

4. Specify the maximum number of virtual circuits for this system.  
Use the slider to specify the maximum number of virtual circuits that this system can support simultaneously. The valid range is 0 through 32,768.
5. Enter the maximum number of UUCP connections for this system.  
Use the slider to specify the maximum number of UUCP connections that this system can support simultaneously. The valid range is 0 through 2048.
6. Enter the X.29 protocol recommendation to be used on this system.  
The default X.29 protocol recommendation is 88, for 1988. Click the option menu to make a different selection (84 for 1984 or 80 for 1980).
7. Click the *OK* button to confirm your kernel parameter settings.  
Clicking *OK* signals gx25adm that the kernel parameter settings you entered are correct; it does not record the settings permanently. Settings are not recorded until you explicitly save them in a configuration file (step 8, which follows).
8. Save your selections in the SX.25 configuration file.  
Use the “Save” option from the File menu to save your configuration selections in the `/etc/config/snetd.options` file. If you used the “New” option to create a new configuration file in step 2, use the “Save As” option to save your selections instead. (See “Using the File Menu” in Chapter 3 if you need instructions for saving files.)

Because the information that you specified affects the IRIX kernel, you must complete the procedures in “Procedure to Rebuild the IRIX Kernel” to put your changes into effect. However, you should plan to complete individual port configuration procedures before rebuilding the kernel, since some WAN port parameters affect kernel contents.

## About the Ports List

Before you perform any configuration procedure on a port, you must first select the port from the ports list. This list comprises all ports on the system that SX.25 software determines to be available for configuration: previously configured ports are listed when the Configured tab is selected, and unconfigured ports are listed when the Unconfigured tab is selected. Selecting a port opens the record for the port in the SX.25 configuration file (see “The SX.25 Configuration File” in Chapter 1 for a description of this file). After the port is selected, go on to the instructions in a specific configuration procedure to complete the configuration process.

Two loopback ports, wloop0 and wloop1, are automatically included in the list of ports available for configuration. If you plan to do local testing of the X.25 protocol stack, or if you plan to test an X.25 network application, configure the loopback ports first using the WAN and LAN port configuration procedures in this chapter. Your loopback configuration must include a DTE and a DCE component.

## Port Selection Procedure

Use this procedure to select a port from the ports list:

1. Start the gx25adm utility, if you have not already done so.  
See “Starting the gx25adm Utility” in Chapter 3 if you need startup instructions.
2. Open the configuration file, if you have not already done so.

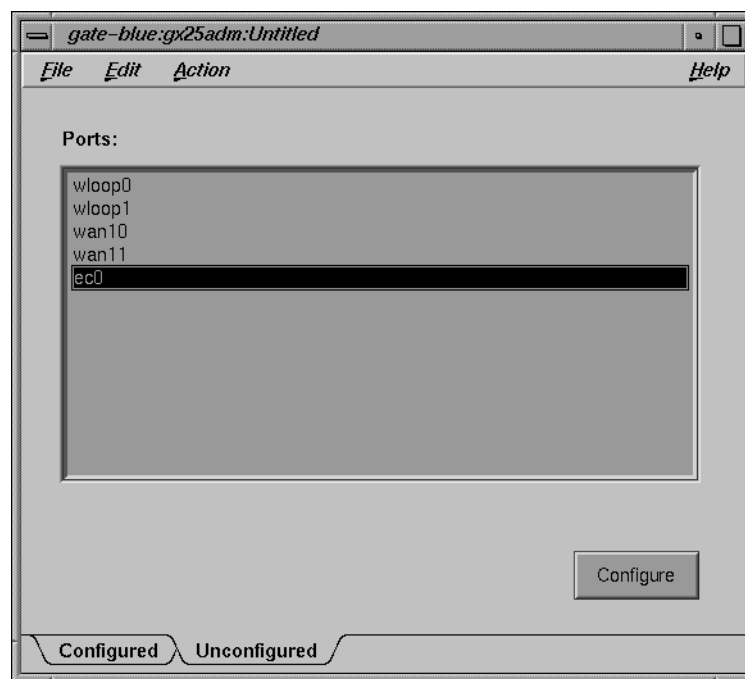
Use the “Open” option from the File menu to open an SX.25 configuration file. The default configuration file is */etc/config/snetd.options* (see “The SX.25 Configuration File” for information on this file). If you prefer to create a new configuration file by a different name, use the “New” option from the File menu instead (see “The Open Option” or “The New Option” for information on using these options).

3. Select the Configured or Unconfigured tab from the primary window.

If you are configuring a port that is not yet set up for X.25 operation, select the “Unconfigured” tab. A list of unconfigured ports appears in the Ports window after your selection.

If you are changing the operating parameters of a port that is already configured, select the Configured tab. A list of configured ports appears in the ports window after your selection.

Figure 4-2 illustrates the primary window with a list of unconfigured ports.



**Figure 4-2** Sample Ports List

4. Select the port that you want to configure.

For an unconfigured port, select a port from the Ports list on the Unconfigured tab and click the *Configure* button. For a previously configured port, select a port from the Ports list on the Configured tab and click the *Display* button. Figure 4-2 shows that LAN port ec0 is selected from the unconfigured ports list.

Go to the “WAN Port Configuration Procedure,” the “LAN Port Configuration Procedure,” or a procedure in Chapter 5 to complete the configuration process on the port that you selected.

## Using Port Configuration Windows

Use the WAN or LAN port configuration window, shown in Figure 4-7 and Figure 4-10, to configure a port for connection to an X.25 network. The information that you enter in this window creates a configuration record for the port in the *snetd.options* file (or an alternative configuration file, if you choose to use one). The new record is written to *snetd.options* when you save the file using an option from the File menu (see “Using the File Menu” in Chapter 3 for details). The port configuration record governs how the port will function when *snetd.options* is put into effect (see “The Network Option” in Chapter 3 for information on putting configuration files into effect).

To configure a port, specify its subnet ID and its DTE address; then, select a factory-shipped parameter file from each scroll list to specify link-level and packet-level parameter settings. Port configuration windows contain two scroll lists: an X.25 files and LAPB files list appears in the WAN window, and an X.25 files and LLC2 files list appears in the LAN window (See “SX.25 Software Components” in Chapter 1 for information on factory shipped files and “Evaluating SX.25 Parameter Files” in Chapter 2 to determine the suitability of factory-shipped files for your network connections.)

### The Setup Menu

The Setup menu appears only on the WAN port configuration window. Use this menu to set kernel parameters for a WAN port when you configure it. Whenever you set port kernel parameters, you must reboot the SX.25 host to put your settings into effect. (See “Setting WAN Port Kernel Parameters” for more information.)

### The Options Menu

The Options menu offers two port configuration options: use the IP/IXE option on this menu to configure ports for connections to IP networks; use the PVC Map option to specify the logical channels that will be dedicated to permanent virtual circuits. (See “The IP/IXE Option” and “The PVC Map Option” in Chapter 5 for more information.)

## The Run Time Stacks Menu

The Run-Time Stacks menu offers options to configure an alternative X.25 and LABP protocol stack. Use these options on an operating port to check its performance with modified protocol parameter settings. The alternative stack can be used temporarily to evaluate port performance; it can also be saved as the permanent protocol stack for the port. (See “Run Time Parameters Option” in Chapter 5 for more information.)

## The Help Menu

Use the Help menu on the WAN or LAN port configuration window to display a list of the help topics that are available from this window. Select the “Overview” option to display general information about the port configuration windows and the features that they offer.

In addition to the Help menu, you can also get help on individual window features by using the **F1** key. For example, to request help on the SubnetID field, move the cursor to the entry field and press **F1**.

## Port Configuration Window Buttons

Both port configuration windows contain buttons for selecting a link procedure, buttons for controlling entries in the scroll lists, and buttons for closing the port configuration window. These buttons are described in the subsections that follow.

### The Open Button

Use the *Open* button to open a parameter file in the scroll list and review the file’s contents. If you open a factory-shipped file and find that you need to change it, you must create a custom file to save your changes—the settings in a factory-shipped file are permanent (see “The Save As Option” in Chapter 3 for instructions). If you open a custom file and you want to change it, you can save your changes directly to the opened file (see “The Save Option” in Chapter 3 for instructions).

### **The Delete Button**

Use the *Delete* button to remove a parameter file from the scroll list. You cannot use *Delete* to remove a factory-shipped parameter file from a scroll list—the original version of each factory-shipped file must always be available for port configurations.

### **The Assign Button**

Use the *Assign* button after you select a parameter file from a scroll list to specify the file in the configuration record for this port. When you click *Assign*, the selected filename is displayed in the filename field above the scroll list. When you save the configuration file, the parameter file that you selected is permanently recorded in the port's configuration record (see "The Save Option" in Chapter 3 for instructions).

### **Link Procedure Buttons**

Use these buttons to specify the link procedure for a port. Click *LAP* or *LAPB* to select the link procedure for a WAN port. If a WAN port uses extended addressing, click both the *LAPB* and *Extended LAPB* buttons. Click *LLC1* or *LLC2* to select the link procedure for a LAN port. If a local or loop SAP is required for the LAN port, specify the SAP as a hexadecimal number in the Local SAP or Loop SAP entry field.

### **The OK Button**

Use the *OK* button to close the port configuration window and confirm that your entries are correct. These entries are recorded in the port's configuration record when you save the configuration file using an option from the File menu (see "The Save Option" in Chapter 3 for instructions).

### **The Cancel Button**

Use the *Cancel* button to close the port configuration window and discard your entries. When you click *Cancel*, no changes are made to the configuration file; any information that was saved in the port configuration record from previous sessions remains unchanged.



## WAN Port Configuration Procedure

The WAN port configuration procedure is described in two parts: the first part, “Setting WAN Port Kernel Parameters,” explains how to set kernel parameters on a WAN port; the second part, “Creating a WAN Port Configuration Record,” explains how to enter information in a port configuration record and save it in the configuration file. Perform both procedures to configure a new port, or perform either procedure separately to change an existing configuration.

### Setting WAN Port Kernel Parameters

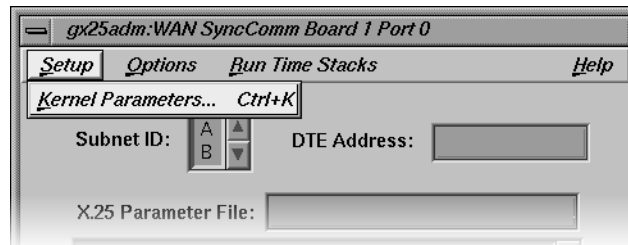
Use this procedure to configure a port for connection to an X.25 WAN:

1. Complete the “Port Selection Procedure” if you have not already done so.

When you select a WAN port using the port selection procedure, the WAN port configuration window is displayed (see Figure 4-7).

2. Use the Setup menu to specify the kernel parameters for this port.

Select the “Kernel Parameters” option from the Setup menu, shown in Figure 4-3, to specify the parameters for this port that affect the IRIX kernel.



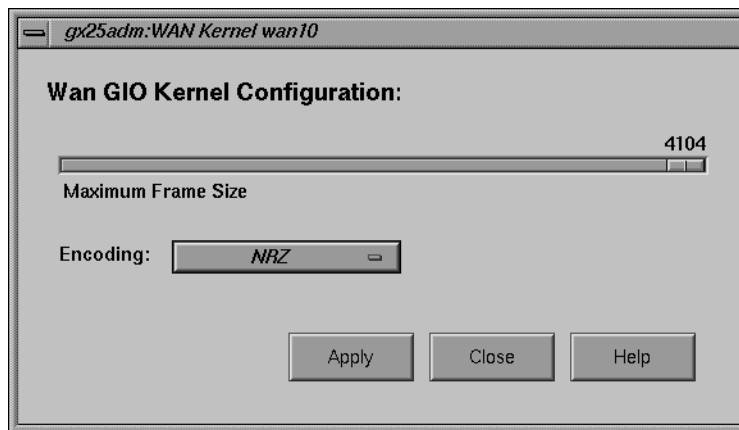
**Figure 4-3** Kernel Parameters Option on the Setup Menu

3. Specify port kernel parameters listed on the Kernel Configuration window.  
Port kernel parameters vary with the bus architecture of the SX.25 host. Use the information in “Kernel Parameter Settings For GIO Systems,” “Kernel Parameter Settings For ISC Systems,” and “Kernel Parameter Settings For VSC Systems” to specify parameter settings for ports on a particular system mode.
4. Click the *Apply* and *Close* buttons when you finish specifying kernel parameters.  
The port kernel parameters dialog closes after you apply your changes.

Continue the configuration process, using the instructions in “Creating a WAN Port Configuration Record,” which follows. If this port was previously configured and the configuration record is still correct, it is not necessary to create a new configuration record. Go on to additional port configurations or, when all WAN port kernel parameters are configured, go on to “Procedure to Rebuild the IRIX Kernel.”

#### Kernel Parameter Settings For GIO Systems

Use the parameter descriptions that follow Figure 4-4 to specify kernel level parameters for GIO bus systems.



**Figure 4-4** Kernel Parameters for Ports on a GIO Bus

Maximum Frame Size

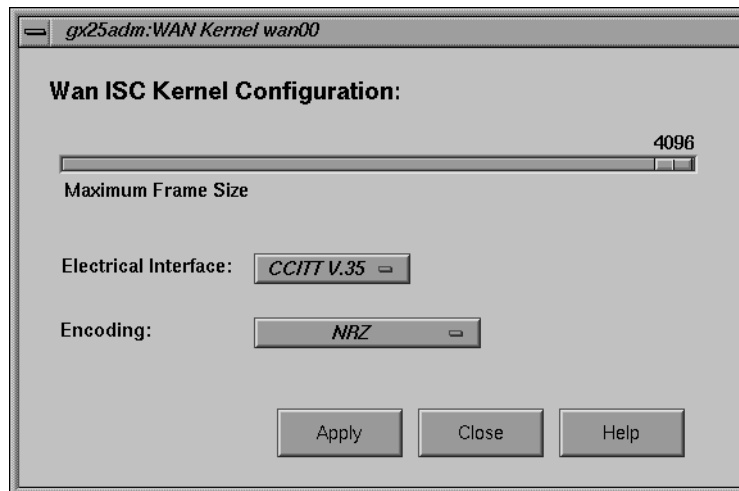
Valid range is 0 to 4104 bytes.

Encoding

Set to “NRZI” for SNA; set to “NRZ” for all other protocols.

### Kernel Parameter Settings For ISC Systems

Use the parameter descriptions that follow Figure 4-5 to specify kernel level parameters for ISC bus systems.



**Figure 4-5** Kernel Parameters for Ports on an ISC Bus

**Maximum Frame Size**

Valid frame size is 0 to 4096 bytes.

**Electrical Interface**

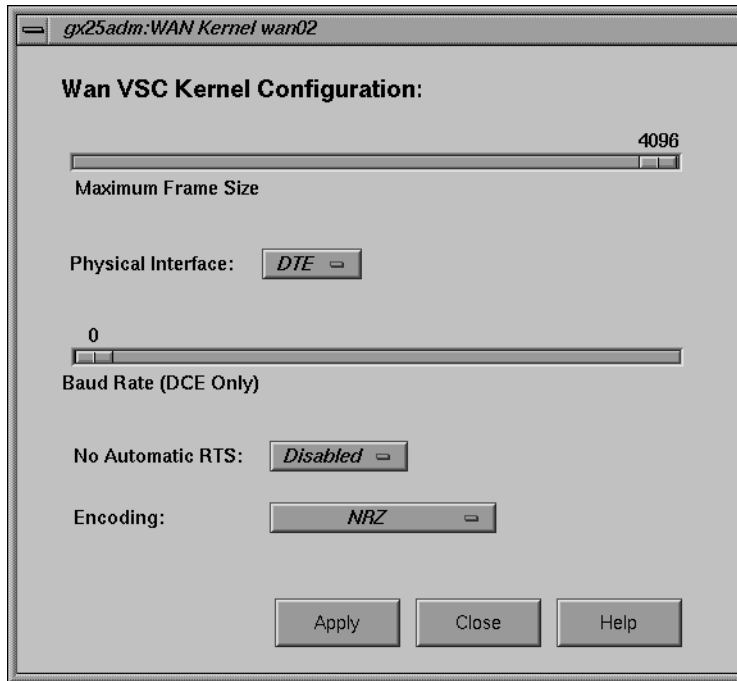
Select the electrical interface standard: CCITT V.35, CCITT X.21, or EIA 232.

**Encoding**

Set to "NRZI" for SNA; set to "NRZ" for all other protocols.

### Kernel Parameter Settings For VSC Systems

Use the parameter descriptions that follow Figure 4-6 to specify kernel level parameters for VSC bus systems.



**Figure 4-6** Kernel Parameters for Ports on a VME Bus

**Maximum Frame Size**

Valid range is 0 to 4104 bytes.

**Physical Interface**

Set to "DTE" or "DCE."

**Baud Rate**

If this host will function as a DCE, set a baud rate. The valid range is 0 to 1544000.

**No Automatic RTS**

Set to "Disabled" to allow automatic request to send packets to be transmitted; set to "Enabled" to prevent automatic request to send packets from being transmitted.

Encoding      Set to "NRZI" for SNA; set to "NRZ" for all other protocols.

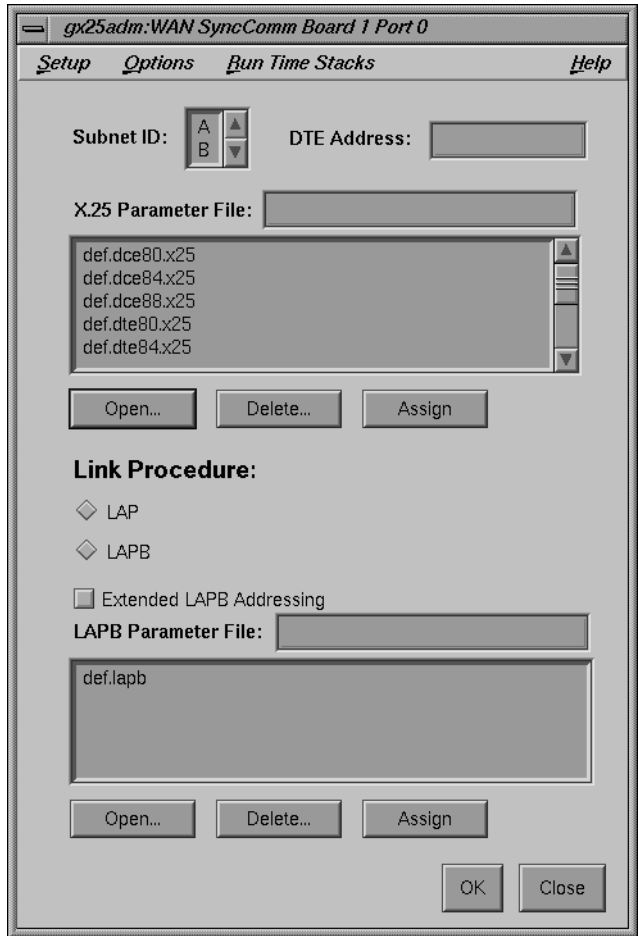
### Creating a WAN Port Configuration Record

The procedure in this section explains how to configure a port for connection to an X.25 WAN using factory-shipped SX.25 parameter files to specify packet-level and link-level protocol parameters. However, if you determine that a port requires customized parameter files (see "Evaluating SX.25 Parameter Files" in Chapter 2 for details), you will be instructed to perform additional procedures at step 4 and step 7 to create the necessary files.

**Note:** If you decide to quit the port configuration procedure before completing it, click the *Cancel* button to close the port configuration window and discard your entries.

1. Complete the "Port Selection Procedure" or "Setting WAN Port Kernel Parameters" if you have not already done so.

If you have not already done so, perform these preliminary procedures to open the port's record in the configuration file and specify its kernel parameters to the IRIX operating system. After you complete either of these procedures, the WAN port configuration window is displayed (shown in Figure 4-7).



**Figure 4-7** The WAN Port Configuration Window

2. Assign a subnet ID to the WAN port.

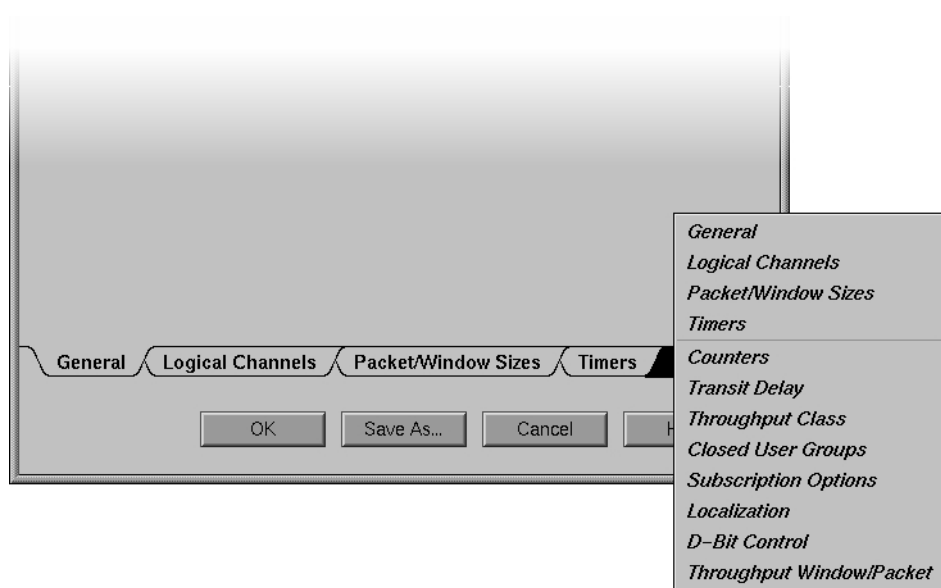
Select a letter from the Subnet ID field to assign the subnet ID. Use the up and down arrows to scroll through the list. Your selection may be any letter from A through Z, but it must be unique to this port; subnet addresses that are already assigned do not appear in the scroll list (see “Subnet IDs and DTE Addresses” in Chapter 1 for more information).

3. Assign a DTE address to the port.

Enter a DTE address in the DTE Address field to assign an address to this port. (See “Subnet IDs and DTE Addresses” in Chapter 1 for background information and “X.121 Addresses” in Appendix A for address formatting information.)

4. Selecting an X.25 parameter file and check its settings.

Select a file from the X.25 Parameter Files list, based on the port’s function as DTE or DCE equipment and on the X.25 recommendation implemented on the network (see “X.25 Parameter Files” in Chapter 1 for background information). To check the settings in the selected file, click the *Open* button (or double-click on the file) to display its contents. Select the labeled tabs at the bottom of the window to view additional parameter settings. To view an unlabeled tab, move the pointer to the unlabeled area and use the right mouse button to select a tab from a pull down list (see Figure 4-8).



**Figure 4-8** Tabs of X.25 Parameters

**Note:** Original X.25 parameter files cannot be modified. If you determine that settings in the factory-shipped file are not suitable for the network to which this port connects, go to “Creating an X.25 Parameter File” in Chapter 7 and complete that procedure to create a customized file. Return to step 5 of this procedure when you finish creating the custom file.

5. Assign the selected X.25 file as a port configuration specification.

Click the *Assign* button to assign a selected X.25 parameter file as a configuration specification for this port. Port configuration specifications are stored in the SX.25 configuration file when you save it using the File menu. If you want to remove a file that you assigned, click the *Delete* button.

6. Select a link procedure for the port.

The link procedure is determined by the link access protocol implemented on the network to which the port will connect. Most X.25 networks use LAPB rather than LAP, since it allows either end to initiate transmissions. Click the check box beside LAP or LAPB to select the link procedure for this port. If the network uses LAPB with extended addressing, select both LAPB and Extended LAPB Addressing.

7. Select the LAPB parameter file and check its settings.

Select the LAPB parameter file for this port (see “LAPB Parameter Files” in Chapter 1 for background information). To check the settings in the selected file, click the *Open* button (or double-click on the file) to display its contents. Select the labeled tabs at the bottom of the window to view additional parameter settings. To view an unlabeled tab, move the pointer to the unlabeled area and use the right mouse button to select a tab from a pulldown list (see Figure 4-9).



**Figure 4-9** Tabs of LAPB Parameters

**Note:** The factory-shipped LAPB parameter file cannot be modified. If you determine that settings in the factory-shipped file are not suitable for the network to which this port connects, go to “Creating a LAPB Parameter File” in Chapter 7 and complete that procedure to create a customized file. Return to step 8 of this procedure when you finish creating the custom file.

8. Assign the LAPB parameter file as a port configuration specification.



Click the *Assign* button to assign the LAPB parameter file as a configuration specification for this port. Port configuration specifications are stored in the SX.25 configuration file when you save it using the File menu. If you want to remove a file that you assigned, click the *Delete* button.

9. Click *OK* to confirm this port configuration.

Clicking *OK* confirms the configuration specifications that you made during the session, but it does not save your settings to a file. Settings are recorded in an SX.25 configuration file when you explicitly save them using the File menu.

10. Save your selections in the configuration file.

Use the “Save” option from the File menu to save your configuration selections in the */etc/config/snetd.options* file. If you opened a new file in step 2 of this procedure, use the “Save As” option instead. (See “Using the File Menu” in Chapter 3 if you need instructions for saving files.)

The WAN port is now configured. To put the configured port into operation, you must rebuild the IRIX kernel and stop and restart the network (see “Procedure to Rebuild the IRIX Kernel” in this chapter and “Using the Action Menu” in Chapter 3 for procedures). If you have other WAN ports to configure, however, complete those configurations before rebuilding the kernel.

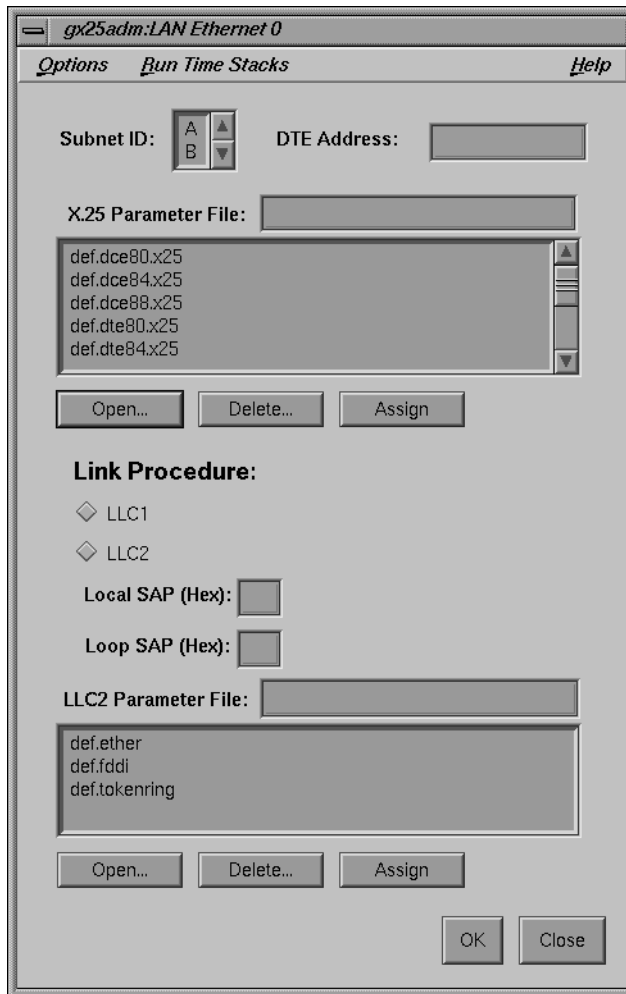
## LAN Port Configuration Procedure

The procedure in this section explains how to configure a port for connection to an X.25 LAN using factory-shipped SX.25 parameter files to specify packet-level and link-level protocol parameters. However, if you determine that a port requires customized parameter files (see “Evaluating SX.25 Parameter Files” in Chapter 2 for details), you will need to perform an additional procedure at step 4 and step 7 to create the necessary files.

**Note:** If you decide to quit the port configuration procedure before completing it, click the *Cancel* button to close the port configuration window and discard your entries.

1. Complete the “Port Selection Procedure” if you have not already done so.

When you select a LAN port using the port selection procedure, the LAN port configuration window is displayed (see Figure 4-10).



**Figure 4-10** LAN Port Configuration Window

2. Assign a subnet ID to the LAN port.

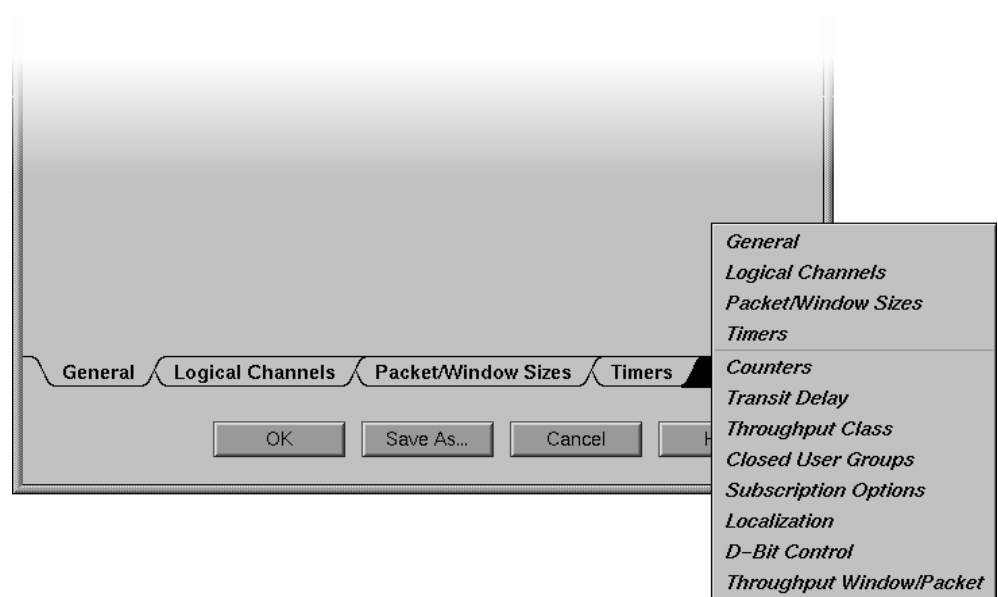
Select a letter from the list in the Subnet ID field to assign the subnet ID. Use the up and down arrows to scroll through the list. Your selection may be any letter from A through Z, but it must be unique to this port (see “Subnet IDs and DTE Addresses” in Chapter 1 for more information).

3. Assign a DTE address to the port.

Enter a DTE address in the DTE Address field to assign a port address. (See “X.121 Addresses” in Appendix A for more information.)

4. Select an X.25 parameter file to specify the packet-level settings for this port.

Select a file from the X.25 Parameter Files list, based on the port’s function as DTE or DCE equipment and on the X.25 recommendation implemented on the network. If you would like to check the settings in the selected file before you assign it to this port, click the *Open* button (or double-click on the file) to display file contents. Select the labeled tabs at the bottom of the window to view additional parameter settings. To view an unlabeled tab, move the pointer to the unlabeled area and use the right mouse button to select a tab from a pull down list (see Figure 4-11).



**Figure 4-11** Tabs of X.25 Parameters

**Note:** Original X.25 parameter files cannot be modified. If you determine that settings in the factory-shipped file are not suitable for the network to which this port connects, go to “Creating an X.25 Parameter File” in Chapter 7 and complete that procedure to create a customized file. Return to step 5 of this procedure when you finish.

5. Assign the selected X.25 file as a port configuration specification.

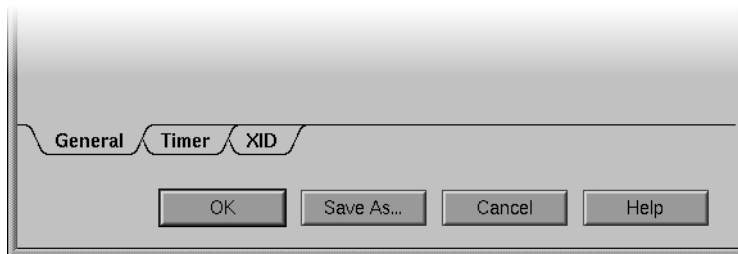
Click the *Assign* button to assign the selected X.25 parameter file as a configuration specification for this port. Port configuration specifications are stored in the SX.25 configuration file that you save in step 10 of this procedure.

6. Select a LAN link procedure.

Click the checkbox beside LLC1 or LLC2. Enter the service access point, Local SAP or Loop SAP, as a hexadecimal number.

7. Open an LLC2 parameter file and check its settings.

SX.25 supports connections to Ethernet LANs, FDDI LANs, and token ring LANs. Select the LLC2 parameter file that corresponds to the physical medium of your LAN. If you would like to check the settings in the selected file before you assign it, click the *Open* button (or double-click on the file) to display file contents. Select the labeled tabs at the bottom of the window to view additional parameter settings (see Figure 4-12).



**Figure 4-12** Tabs of LLC2 Parameters

**Note:** Original LLC2 parameter files cannot be modified. If you determine that settings in the factory-shipped file are not suitable for the network to which this port connects, go to “Creating an LLC2 Parameter File” in Chapter 7 and complete that procedure to create a customized file. Return to step 8 of this procedure when you finish creating the custom file.

8. Assign the selected LLC2 file as a port configuration specification.

Click the *Assign* button to assign the selected LLC2 parameter file as a configuration specification for this port. Port configuration specifications are stored in the SX.25 configuration file that you save in step 10 of this procedure.

9. Click *OK* to confirm this port configuration.

Clicking *OK* ends the port configuration session, but it does not record parameter settings. Settings are not recorded in an SX.25 configuration file until you explicitly save them (step 10, which follows).

10. Save your selections in the configuration file.

Use the “Save” option from the File menu to save your configuration selections in the */etc/config/snetd.options* file. If you opened a new file in step 2 of this procedure, use the “Save As” option instead. (See “Using the File Menu” in Chapter 3 if you need instructions on saving files.)

The LAN port is now configured. The new port goes into operation the next time that you restart the network (see “The Network Option” in Chapter 3 for information on stopping and starting the network).

## Procedure to Rebuild the IRIX Kernel

The IRIX kernel must be rebuilt whenever you modify a global kernel parameter (see “Procedure to Configure Global Kernel Parameters”) or a kernel parameter for an individual port (see “Setting WAN Port Kernel Parameters”). Rebuilding the kernel requires a temporary shutdown of the SX.25 host; for this reason, you should complete all changes to kernel parameters before rebuilding the kernel, if possible. To rebuild the kernel, use options on the Action menu of the SX.25 primary window (see “Using the Action Menu” in Chapter 3 if you need information on using these options).

Use the procedure below to rebuild the IRIX kernel.

**Note:** Be sure to make standard host shutdown preparations before you perform this procedure.

1. Stop network operations using the “Network” option on the Action menu.
2. Rebuild the kernel using the “Create Kernel” option on the Action menu.
3. Reboot the system.

You can reboot the system using the “Restart System” option on the System tool of your toolchest.

4. Restart the *gx25adm* utility, if needed.

By default, the SX.25 application restarts when your system is restarted. If you disabled this function, you must restart SX.25 before you can perform this step. See “Starting the gx25adm Utility” in Chapter 3 if you need instructions.

The SX.25 host is now operating with the new kernel parameters that you specified.

---

## Configuring X.25 Options

SX.25 offers several options that may be added to the basic X.25 connection service. Some options affect the SX.25 application globally; these options are accessed from the Edit menu on the primary window. Other options pertain only to the individual ports where they are configured; these options are accessed from the Options menu and the Run Time Stacks menu on the WAN and LAN port configuration windows.

This chapter describes the configuration options that SX.25 offers and explains how to configure them:

- “The IP/IXE Option”
- “The PVC Map Option”
- “Run Time Parameters Option”
- “The IXE Map Option”
- “The PAD Map Option”
- “The PADD Listen Strings Option”
- “The Subnetwork Names Option”

**Note:** To make the procedures in this chapter take effect, you must stop and restart the network on the SX.25 host. For this reason, you might want to delay the network restart sequence until you have configured all the options that you plan to use.

### The IP/IXE Option

Use the IP/IXE option to connect a port on the SX.25 host to an IP network. To support an IP connection, the IXE driver, which is the interface between the X.25 and the IP network, needs information about the IP network and the associated X.25 subnetworks (see “IP Network Connections” in Chapter 1 for more information). You provide this information by specifying parameter settings in the IP/IXE configuration window (shown in Figure 5-1).

Consider implementing the IXE map in conjunction with the IP network connection service. The IXE map enables hostnames to be entered in network transactions instead of addresses (see “The IXE Map Option” for instructions).

**Note:** If you are implementing IP on an unconfigured WAN port, you must rebuild the IRIX kernel to put the port into operation. Otherwise, you must stop and restart the network to put the new IP connection into effect.

### IP/IXE Configuration Procedure

Follow this procedure to configure a port for an IP network connection:

1. Complete the “Port Selection Procedure” in Chapter 4.

When you complete the port selection procedure, the WAN or LAN port configuration window is displayed (see Figure 4-7 or Figure 4-10).

**Note:** If this is an unconfigured WAN port, complete the instructions in “Setting WAN Port Kernel Parameters” in Chapter 4 before going on to step 2, below.

2. Specify the basic connection parameters for the port that you selected.

If this port is already configured, go directly to step 3 of this procedure. If this is an unconfigured port, complete steps 2 through 8 of “Creating a WAN Port Configuration Record” in Chapter 4 or steps 2 through 8 of “LAN Port Configuration Procedure” in Chapter 4 to configure the port. When you complete the instructions in Chapter 4, return to step 3, below.



3. Select the "IP/IXE" option from the Options menu of the port configuration window.

After your selection, the IP/IXE Configuration parameters window is displayed:

**IP/IXE Configuration:**

IP Address:

IP Mask:

Forward Broadcast Packets

128  
NSDU High Water Mark

0  
Maximum Idle Time (Seconds)

0  
Minimum Connection Time (Seconds)

X.25 Mode:  1980  1984  1988

CCITT/DDN Mode:  CCITT  DDN

Reset Action:  ACK  DISC

Expedited Data Action:  ACK  DISC  RESET

PVC Channel Range:

Ignore PVC Range Values

Low PVC Range Value (Hex):

High PVC Range Value (Hex):

Listen Information:

OK Clear... Cancel Help

**Figure 5-1** IP/IXE Configuration Parameters

4. Specify IXE driver information in the IP/IXE configuration window.  
Refer to the information in "IP/IXE Parameters" for an explanation of the IXE parameters that must be specified. When you complete the IXE specifications, click *OK* on the IP/IXE configuration window to confirm your IXE entries. The IP/IXE configuration window closes after your confirmation.
5. Click *OK* on the port configuration window to confirm this port configuration.  
Clicking *OK* confirms the parameter settings for the basic connection service and for the IP/IXE function on this port. These settings are recorded in the SX.25 configuration file when you save it (step 6, which follows).
6. Save your selections in the configuration file.  
Use the "Save" option from the File menu to save your configuration selections in the */etc/config/snetd.options* file. If you opened a new file in step 1 of this procedure, use the "Save As" option instead. (See "Using the File Menu" in Chapter 3 if you need instructions for saving files.)

The IP option is configured on this port. It will go into effect the next time you restart the network (see "The Network Option" in Chapter 3 for instructions). However, if you have configured IP on a previously unconfigured WAN port, you must rebuild the IRIX kernel to put the new port into operation (see "Procedure to Rebuild the IRIX Kernel" in Chapter 4 for instructions).

### IP/IXE Parameters

Use this information to determine how to set IP/IXE parameters in the IP/IXE configuration window:

- |            |  |
|------------|--|
| IP Address | Specifies the Internet address of the network to which this port will connect. Use dotted notation in your entry. The address for a new network should not duplicate an address that is already in use. (See Appendix A for address formatting information.)   |
| IP Mask    | Specifies the subnet mask for this network, which designates the network portion of the Internet address. Use dotted notation in your entry.<br><br>For example, the mask 255.254.0.0 shows that the network portion of the address is 15 bits long and the host portion is the remaining 17 bits. The default subnetwork mask is 255.0.0.0. |

Forward Broadcast Packets	Specifies whether broadcast packets are received or rejected at this port; a check marks indicates that broadcast packets will be received.
NSDU High Water Mark	Specifies the length at which a data packet, marked with the "More Data" mark (M-bit), is concatenated into a single network service data unit (NSDU). Override concatenation by specifying a maximum length. When the maximum is exceeded, concatenation stops and currently held data is passed to the Network Service user (with the More parameter set). Increase this value if you want IP to send or receive packets of over 576 octets, the default value.
Maximum Idle Time	Specifies the time, in tenths of a second, that a connection on this network can remain idle before being closed. A timer is configurable for each X.25 network. When this timer expires, if there is no data on a connection, the virtual circuit to that network is closed. If data arrives from IP after the circuit is closed, the circuit is reopened. The default is 30.
Minimum Connection Time	Specifies, in seconds, the minimum time that a connection must remain open before it can be preempted by another connection. If all X.25 circuits that are available to IXE are in use when an IP packet arrives for transmission to a new destination, one of the existing connections is closed. The connection that was idle for the longest time is selected for closing. The default value is 20.
X.25 mode	Specifies whether the network operates in X.25(80), X.25(84), or X.25(88) mode.
CCITT/DDN Mode	Specifies whether the network uses CCITT or DDN X.25. This is the way in which IP addresses are mapped onto X.25 addresses, as described in "IP Network Connections" in Chapter 1.
Reset Action	Specifies how to handle reset requests. Select ACK to acknowledge the reset and discard it. Select DISC to disconnect the connection in response to reset requests.

#### Expedited Data Action

Specifies how to handle expedited data requests. Select one:

ACK - acknowledge the expedited data but discard it.

DISC - disconnect the connection in response to expedited data.

RESET - reset the connection in response to expedited data (no reset).

#### PVC Channel Range

Specifies how to handle the logical channels on this port that are allocated to PVCs. Select Ignore PVC Range Values to ignore all logical channels allocated to PVCs; or specify Low PVC Value and High PVC Value, in hexadecimal numbers, to include these PVC channels in the IXE configuration.

Low and high PVC comprise three hexadecimal digits and must be separated by a dash ("-"). For example, "009-00b" allocates three IXE PVC channels.

#### Listen Information

Sets the application to listen for incoming calls with the specified CUD fields and called addresses. There are two possible formats:

*CUD field , called addresses field;*

**I|S bytes | X , I|S D|N semi-octets | X;**

The fields in the previous address format signify:

I means "match this field identically"

S means "match this field starting with"

X means "ignore this field"

D means "this field refers to an X.25 DTE"

N means "this field refers to an X.25 NSAP"

This is the last IXE parameter. Return to step 5 of "IP/IXE Configuration Procedure" to complete the IXE configuration process.

### Removing the IP/IXE Service From a Port

To remove the IP/IXE service from a port, display the IP/IXE parameters window (shown in Figure 5-1; see steps 1 through 3 of "The IP/IXE Option" for details). Click *Clear* on the IP/IXE parameters window to remove all IP/IXE information for the port.

To put your changes into effect, stop and restart the network (see "The Network Option" in Chapter 3 for more information).

## The PVC Map Option

Use the PVC Map option to configure a port to operate with permanent virtual circuits. Because the default settings in SX.25 parameter files do not provide for PVCs, you must first create a custom X.25 parameter file that specifies the logical channel ranges for the PVCs. After you create this file, you can configure the remaining PVC parameters, shown in Figure 5-2, and use the customized file to store your settings.

**Note:** If you are implementing PVCs on an unconfigured WAN port, you must rebuild the IRIX kernel to put the port into operation. Otherwise, you must stop and restart the network to put new PVCs into effect.

### PVC Configuration Procedure

Use this procedure to create an X.25 parameter file and configure PVCs.

1. Perform the “Port Selection Procedure” in Chapter 4 to select the port for the PVCs.

After your selection, the WAN or LAN configuration window is displayed (see Figure 4-7 or Figure 4-10).

**Note:** If this is an unconfigured WAN port, complete the instructions in “Setting WAN Port Kernel Parameters” in Chapter 4 before going on to step 2, below.

2. Specify the subnet ID and DTE address if the port is unconfigured.

If this is a configured port, the subnet ID and DTE address are automatically displayed on the WAN or LAN configuration window, and you can go directly to step 3. If this is an unconfigured port, these fields are empty; enter the subnet ID and DTE address of the port where the PVCs will operate; then go on to step 3.

3. Open an X.25 parameter file to use as a template.

You cannot modify a factory-shipped X.25 parameter file, but you can open an existing file, specify changes, and save the file under a different name. To open a file, select the X.25 parameter file that is most appropriate for the port where the PVCs will operate; then, click the *Open* button to display the contents of the file.

4. Select the Logical Channels tab and reset the PVC channel range.

Selecting the Logical Channels tab displays the list of logical channel parameters and their settings (see Figure 7-3). By default, Low PVC Channel and High PVC Channel are set to zero. Refer to the information following Figure 7-3 or use the values recommended by your service provider to reset these values.

5. Click the *Save As* button to record your changes.

The *Save As* button (shown in Figure 7-1) prompts you to assign the new X.25 parameter file a name. Enter the new filename in the dialog box and click the *OK* button.

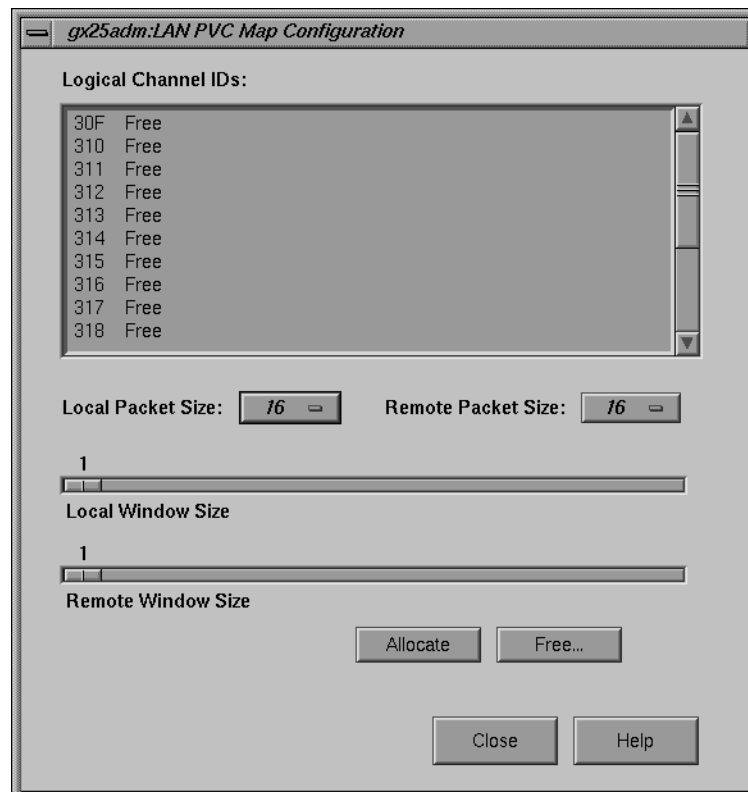
Notice that the new file is listed in the X.25 Parameter Files list.

6. Assign the new X.25 parameter file to this port.

Select the new X.25 parameter file and click the *Assign* button (shown in Figure 4-7 and Figure 4-10) to designate it as the packet-level parameter file to be used on this port.

7. Select “PVC Map” from the Options menu to configure the remaining parameters.

After your selection, the PVC Map is displayed (shown in Figure 5-2).



**Figure 5-2** PVC Map Parameters

8. Allocate the logical channels for this port.

To allocate a channel for a PVC, select it and modify the packet-size and window-size parameters according to the specifications of your network service provider; then, click the *Allocate* button. When you finish the channel allocations, click the *Close* button to close and save the PVC map and return to the port configuration window.

9. Specify the link procedure for this port.

Refer to step 6 of "Creating a WAN Port Configuration Record" or the step 6 of "LAN Port Configuration Procedure" if you need more information on this step.

10. Specify the LAPB (for WANs) or LLC2 (for LANs) parameter file for this port.

Refer to step 8 of “Creating a WAN Port Configuration Record” or the step 8 of “LAN Port Configuration Procedure” if you need more information on this step.

11. Click *OK* to confirm your settings.

After your entry, the WAN or LAN port configuration screen closes; however, the PVC configuration is not recorded until you explicitly save it to a configuration file (step 12, which follows).

12. Save the PVC configuration in an SX.25 configuration file.

To save the PVC information in an SX.25 configuration file, use the “Save” option from the File menu on the Primary Window; use the “Save As” option from the File menu if you opened a new file in step 2 of “Port Selection Procedure”. (See “Using the File Menu” in Chapter 3 if you need instructions for saving files.)

This port is configured for PVCs. It will go into effect the next time that you restart the network (see “The Network Option” in Chapter 3 for instructions). However, if you configured PVCs on a previously unconfigured port, you must rebuild the IRIX kernel to put the new port into effect (see “Procedure to Rebuild the IRIX Kernel” in Chapter 4 for instructions).

### Removing a Permanent Virtual Circuit

To remove a PVC from a port, display the PVC map for the port (shown in Figure 5-2; see steps 1 through 7 of “The PVC Map Option” for details). Then, select the PVC that you want to remove and click the *Free* button. Notice that the PVC is now designated free on the PVC map.

To put your changes into effect, stop and restart the network (see “The Network Option” in Chapter 3 for instructions).

### Run Time Parameters Option

A run-time stack provides a means to operate a port using alternate protocol parameters to test or tune port operation. The port can remain in operation while you configure and test its run-time parameters. If you wish, you can save the run-time parameters in a file and use them as the permanent configuration settings for the port.



Use this procedure to set run-time parameters on a configured port:

1. Complete the “Port Selection Procedure” in Chapter 4.

Open the configuration file that contains the port’s configuration information (normally */etc/config/snethd.options*); then, select the port from the list of configured ports. The WAN or LAN port configuration window is displayed after your selection (see Figure 4-7 or Figure 4-10).

2. Select a stack from the Run Time Parameters menu.

The Run Time Stacks menu contains two options: “X.25” and “LAPB.” Select “X.25” to reset packet-level parameters or “LAPB” to reset link-level parameters for run-time operation.

If you select “X.25,” the X.25 General Parameters window is displayed (see Figure 7-2). If you select “LAPB,” the LAPB General Parameters window is displayed (see Figure 7-14). The parameter settings that you see in the general parameter window are the settings that the port is currently using: settings from the parameter file that were applied to the port during the previous port configuration session, or settings that were most recently assigned as run-time parameters.

3. Set the new run-time parameters for the port.

Adjust the port parameters that require changes. If you need more information, see “Creating an X.25 Parameter File” in Chapter 7 for resetting packet-level parameters and “Creating a LAPB Parameter File” in Chapter 7 for resetting link-level parameters.

4. Click *OK* to put the run-time parameters into effect.

The new parameters that you set take effect as soon as you click *OK*.

5. Save the run time parameters in a file (optional).

If you decide that you want to save these parameters in a file, click the *Save As* button; then, enter the name of the new file in the filename dialog box. If you decide to use the new parameters permanently, reconfigure the port and apply the new parameter files in the port configuration procedure (described in the “WAN Port Configuration Procedure” and the “LAN Port Configuration Procedure” in Chapter 4).

## The IXE Map Option

Use the IXE map to enable users to designate IP network hosts by their hostname instead of their address. This map contains the IP address or hostname of each IP network node to which the SX.25 host will connect. Hostname entries in the IXE map must appear in the */etc/hosts* file of the SX.25 host. The IXE Map Configuration window, shown in Figure 5-3, allows you to add, delete, and change IP host entries.

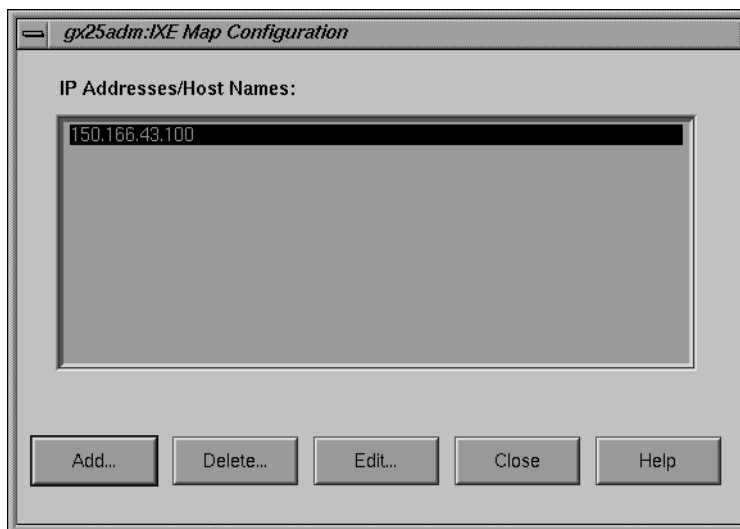
**Note:** You must stop and restart the network to put a new IXE map into effect.

### IXE Map Configuration Procedure

To create the IXE map, follow this procedure:

1. Select the “IXE Map” option from the Edit menu.

After your selection, the IXE Map Configuration window is displayed:



**Figure 5-3** IXE Map of IP Hosts

2. Click the *Add* button on the IXE map configuration window.

Clicking the *Add* button displays the IP/IXE map record, shown in Figure 5-4.



The screenshot shows a dialog box titled "gx25adm:IXE Map New Record". The main heading is "IP/IXE Map Record Configuration:". There are three input fields: "IP Address/Host Name:", "X.25 Address:", and "Packet Size:". The "Packet Size" field is a spinner box currently set to "16". Below these fields is a "Window Size" slider, which is currently set to "0". At the bottom of the dialog are three buttons: "OK", "Cancel", and "Help".

**Figure 5-4** IP/IXE Map Record

3. Complete a map record for each IP network to which this SX.25 host connects.

Each record associates a port with an IP network by associating the port DTE address with the IP address of the remote node. The record also specifies the window and packet size for data exchanges over the connection. Refer to "IP/IXE Map Parameters" to enter your specifications for each record.

4. When a record is complete, click *OK* to record your specifications.
5. Close and save the IXE map.

When the IXE map contains a record for each IP host, click the *Close* button on the IXE Map Configuration window (see Figure 5-3) to close and save the map.

To put the new IP/IXE map into effect, stop and restart the network (see "The Network Option" in Chapter 3 for instructions).

## IP/IXE Map Parameters

Use this information to determine how to set IP/IXE map parameters:

IP Address/Host Name	Specifies the Internet address of the reciprocating host on the IP network. You can use the IP hostname instead of its address if the IP node is listed in the SX.25 <i>/etc/hosts</i> file. See "IP Network Connections" in Chapter 1 for information on address formats.
X.25 Address	Specifies the DTE address of the port that supports the connection to the IP network. The DTE address is specified in the port configuration procedure (see Figure 4-7 and Figure 4-10).
Packet Size	Specifies the maximum packet size of incoming and outgoing datagrams; fragmentation takes place if a packet exceeds the maximum packet size configured for the port (default packet size is 576 octets). Use the Packet Size option menu to select a packet size.
Window Size	Specifies the maximum window size for incoming and outgoing data. The valid range is 0 through 127.

## Changing the IXE Map

To remove a record from the IXE Map, select an entry on the map and click the *Delete* button (see Figure 5-3). To modify information in an IXE map record, select an entry and click the *Edit* button. Clicking the *Edit* button displays the record for the selected entry and allows you to change it. Click *OK* to record your changes; then, click *Close* on the IXE Map Configuration window to save the IXE map.

**Note:** To put your changes into effect, stop and restart the network (see "The Network Option" in Chapter 3 for instructions).

## The PAD Map Option

The PAD map allows users to designate X.25 network hosts by their hostname instead of their address. This map contains the name, address, and call information for each X.25 network host reciprocating in PAD connections. The address and call information is automatically supplied in user connection requests. Hostnames can be associated with aliases. The PAD map configuration window (shown in Figure 5-5) allows you to add,

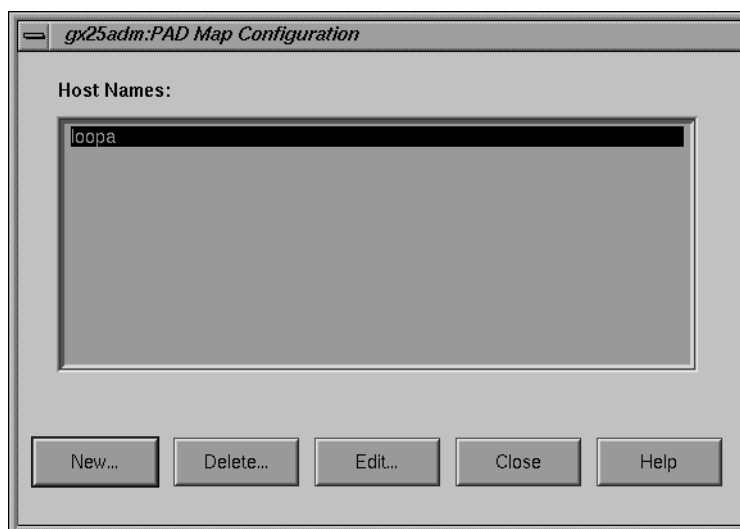
delete, and change X.25 host entries. The record that you create for a PAD host comprises several screens.

**Note:** You must stop and restart the network to put a new PAD map into effect.

## PAD Map Configuration Procedure

To create a PAD map, follow this procedure:

1. Select the "PAD Map" option from the Edit menu on the primary window.  
After your entry, the PAD Map Configuration window is displayed:



**Figure 5-5** PAD Map Configuration Window

2. Click the *New* button on the PAD Map Configuration window.  
Clicking the *New* button displays the first field of the PAD map record, shown in Figure 5-6. Each record identifies a reciprocating X.25 host and defines its services.
3. Complete a PAD map record for each X.25 network host to which users will connect.  
A complete PAD map record comprises four groups of parameters, which are shown in Figure 5-6 through Figure 5-9. Refer to the parameter descriptions that follow each figure to enter your specifications for each record.

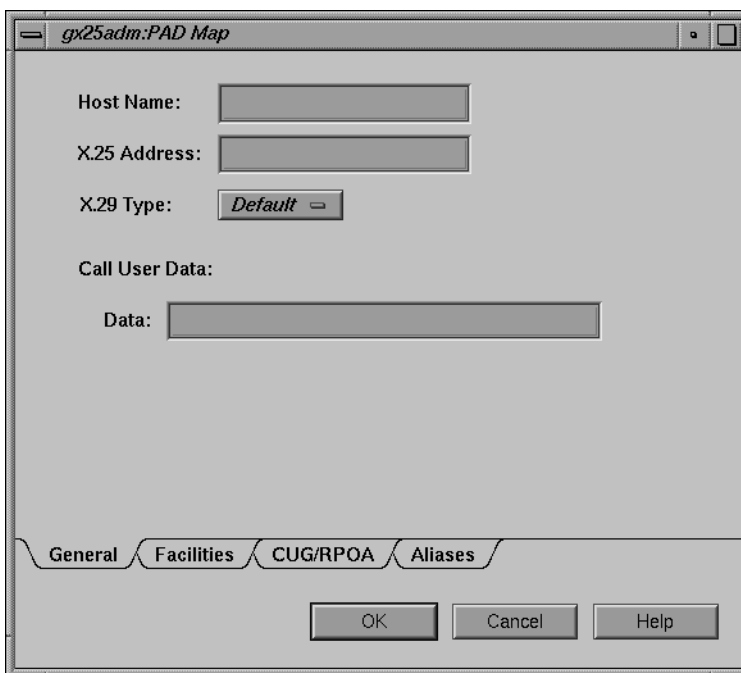
4. When a record is complete, click *OK* to record your specifications.
5. Close and save the PAD map.

When the PAD map contains a record for each X.25 host, click the *Close* button on the PAD Map Configuration window (see Figure 5-5) to close and save the map.

The new PAD map is ready to use. To put it into effect, stop and restart the network (see “The Network Option” in Chapter 3 for instructions).

### General Parameters of the PAD Map

The General tab is illustrated in Figure 5-6; its parameters are described in the information that follows the figure.

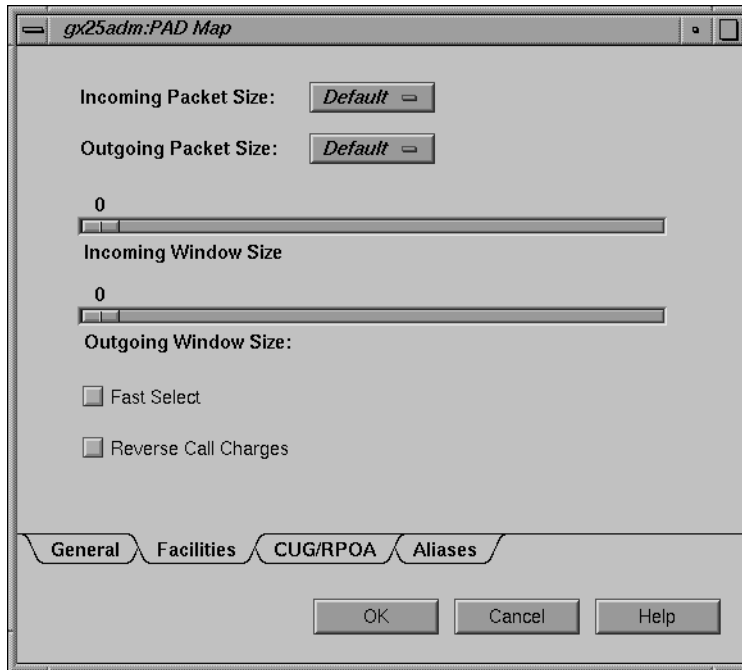


**Figure 5-6** General Parameters in a PAD Map Record

Host Name	Specifies the name of the X.25 host reciprocating in the connection.
X.25 Address	Specifies the X.25 address of the reciprocating host. An X.25 address comprises four fields (refer to the x25addr(5) reference page or “X.121 Addresses” in Appendix A). The field entries should be separated by a dot. Only the first field is mandatory for a WAN address. Two fields are mandatory for a LAN address. Trailing dots may be omitted. This is a valid X.25 address:  A.234231500010.N.38826110002345678941
X.29 Type	Specifies the X.29 protocol to be used in connections. Accept the default or use the option menu beside the X.29 Type field to reset it to 1980, 1984, or 1988. The default is the value set in the X.25 parameter file.
Call User Data	Specifies the Call User Data string that is sent in a call request. It may be of any length up to 124 ASCII characters. If you enter more than 12 characters, fast select is automatically used.

#### **Facilities Parameters of the PAD Map**

The Facilities tab is illustrated in Figure 5-7; its parameters are described in the information that follows the figure.



**Figure 5-7** Facilities Parameters in a PAD Map Record

**Incoming and Outgoing Packet Size**

Specifies the incoming and outgoing packet sizes. The range for the parameter is 16 to 4096 bytes.

**Incoming and Outgoing Window Size**

Specifies the values of the incoming and outgoing window sizes. The range for the window size is 1 through 127.

**Fast Select**

Specifies whether fast select is in effect (check mark indicates that fast select is active).

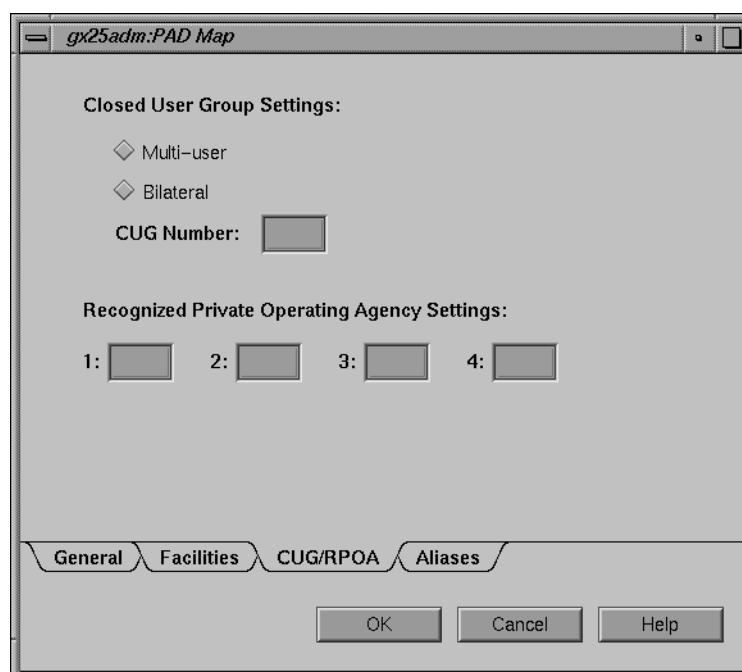
**Reverse Call Charges**

Specifies whether reverse call charges is in effect (check mark indicates that reverse call charges is active).



### CUG and RPOA Parameters of the PAD Map

The closed user group (CUG) and recognized private operating agency (RPOA) tab is illustrated in Figure 5-8; its parameters are described in the information that follows the figure.



**Figure 5-8** CUG and RPOA Parameters in a PAD Map Record

**CUG Settings** Specifies the user group class. Select Multi-user or Bilateral.

**CUG Number** Specifies that the call is to be made to the specified Closed User Group on the specified host. Enter the CUG number (up to four digits).

**RPOA Settings** Specifies additional routing information about calls to this host to transit networks. Enter up to four RPOA numbers; each entry consists of four digits.

### Aliases Parameters of the PAD Map

The Aliases tab is illustrated in Figure 5-9. An alias is any alternative hostname that a user might enter in connection requests to the host.



**Figure 5-9** Alias Parameters on a PAD Map Record

### Changing the PAD Map

To remove a record from the PAD Map, select an entry on the map and click the *Delete* button (see Figure 5-5). To modify information in a PAD map record, select an entry on the map and click the *Edit* button. Clicking the *Edit* button displays the record for the selected entry and allows you to change it. Click *OK* to record your changes; then, click *Close* on the PAD Map Configuration window to save the PAD map.

To put your changes into effect, stop and restart the network (see “The Network Option” in Chapter 3 for instructions).

## The PADD Listen Strings Option

PADD listen strings specify the called addresses and CUD field values for which the SX.25 application is prepared to accept calls. The PADD Listen String Configuration window is shown in Figure 5-10.

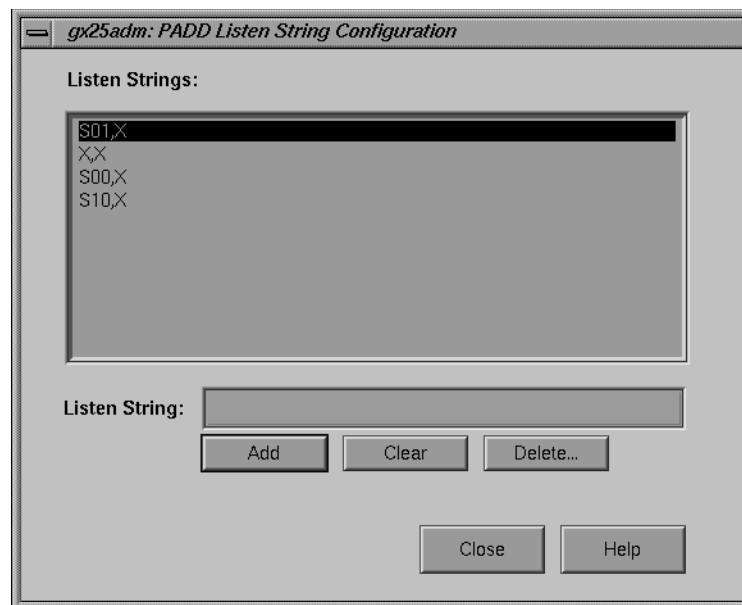
**Note:** If you add, delete, or modify a listen string, you must stop and restart the network to put your changes into effect.

### Listen Strings Configuration Procedure

To add PADD listen strings, follow this procedure:

1. Select the PADD option from the Options menu on the primary window.

After your selection, the PADD Listen String Parameters window is displayed:



**Figure 5-10** PADD Listen String Parameters

2. Enter the string in the Listen String field.  
See "PADD Listen String Formats," which follows, for information on entering listen strings.
3. Click *Add* to add your entry to the Listen String list.
4. Repeat steps 1 and 2 for each listen string you want to add.
5. Click *Close* when the list is complete to save the Listen Strings list.

The listen string list is ready to use. To put it into effect, stop and restart the network (see "The Network Option" in Chapter 3 for instructions).

### **PADD Listen String Formats**

Listen strings restrict the hosts that are allowed to access PAD services on this host. The strings have two formats:

*CUD field, called addresses field;*  
*I|S bytes | X , I|S D|N semi-octets | X;*

The fields in the previous address format signify:

- I means "match this field identically"
- S means "match this field starting with"
- X means "ignore this field"
- D means "this field refers to an X.25 DTE"
- N means "this field refers to an X.25 NSAP"

For example, suppose the CUD field starts with 01000000; the address field starts with 2342 and contains an X.25 DTE address. The following listen string would be entered:

*S01000000 ,SD2342;*

### **Changing and Removing PADD Listen Strings**

To change a PADD listen string, display the PADD Listen String Parameters window (shown in Figure 5-10), select the listen string that you want to change, and click *Clear*. Enter the new listen string and click *Add* to add it to the Listen String list. When your changes are complete, click *Close* to save the modified Listen String list.

To remove a PADD listen string, display the PADD Listen String Parameters window, select the listen string that you want to remove, and click *Delete* to remove it from the Listen String list.

To put your changes into effect, stop and restart the network (see “The Network Option” in Chapter 3 for instructions).

## The Subnetwork Names Option

As a convenience to users, you can assign names to WAN and LAN subnetworks so that users can enter a name to designate a subnetwork instead of its address. The Subnetworks Configuration window (shown in Figure 5-11) allows you to create the records that associate subnetwork addresses with their name and description.

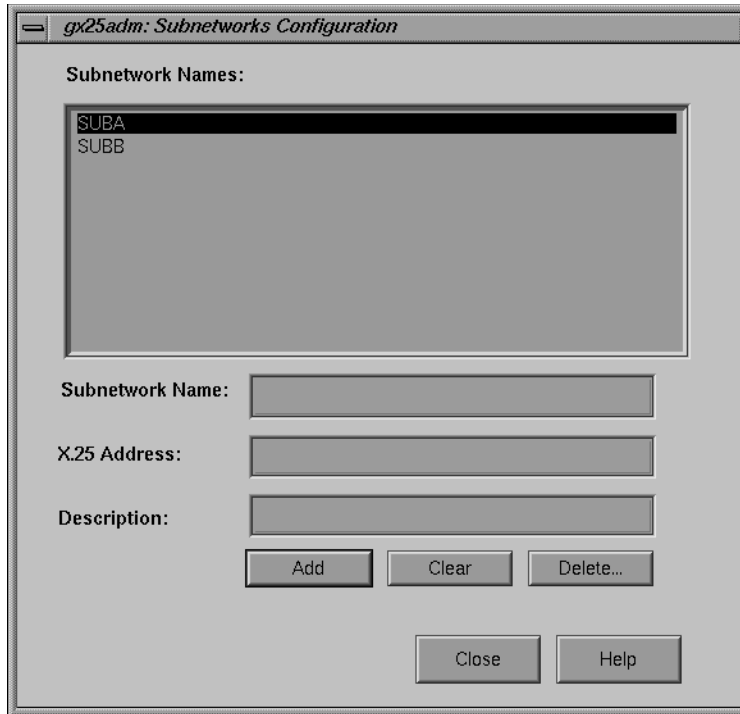
**Note:** After you configure subnetwork IDs, you must stop and restart the network to put your changes into effect.

### Subnetwork Names Configuration Procedure

To configure subnetwork names, follow this procedure:

1. Select the “Subnetworks” option from the Edit menu on the primary window.

After your selection, the Subnetworks Configuration window is displayed:



**Figure 5-11** Subnetworks Configuration Window

2. Enter the name, address, and description of the subnetwork.

The subnetwork name is a name that is easily identified by users on the SX.25 host; the X.25 address is the DTE address that you assigned in the port configuration procedure (see Figure 4-7 and Figure 4-10) and the description field is any information about the subnetwork that helps to identify it.

3. Click the *Add* button to enter the subnetwork on the Subnetwork Names list.
4. Complete a record for each subnetwork that you want to make available by name.
5. When all subnetwork names are entered, click *Close* to save the Subnetwork Names list.

The subnetwork names list is ready to use. To put the list into effect, stop and restart the network (see “The Network Option” in Chapter 3 for instructions).

## Changing the Subnetwork Names List

To change a subnetwork record, select the subnetwork in the Subnetwork Names field and click *Clear*; then enter the new record for the subnetwork. To remove a subnetwork record, select the subnetwork in the Subnetwork Names list and click *Delete* (removing a subnetwork record does not remove the port from service; it simply makes it unavailable by its subnetwork name). After you make your changes, click *Close* to save the modified subnetwork names list.

To put your changes into effect, stop and restart the network (see “The Network Option” in Chapter 3 for instructions).





---

## UUCP Configuration

SX.25 provides a mechanism for using the standard UNIX *uucp*, *cu*, and associated commands over the PAD program by using the *xtty* device driver. The *xtty* device behaves like a *tty* device that supports both blocking and non-blocking opens of the same logical device. It can support *gettys* for incoming calls that make a blocking open on the *xtty* device.

This chapter provides information on these UUCP topics:

- “Configuring the XTY System”
- “Files Associated with UUCP”

### Configuring the XTY System

SX.25 supports a STREAMS interface called the XYT\_OUT system, which uses the *xtty* STREAMS module only for outgoing *uucp/cu* calls. This type of system does not require *getty* processes. Incoming calls are handled directly by the PAD daemon that executes the login process.

### Files Associated with UUCP

A number of files need modification before *uucp/cu* type calls can be made over the *xtty* driver. These files and their uses are described below. All these files can be found in the directory */usr/lib/uucp*. For detailed information on individual files, refer to *IRIX Admin: Networking and Mail*.

<i>Devices</i>	Specifies which <i>xtty</i> devices are available for outgoing calls.
<i>Dialcodes</i>	Specifies a number of host-to-SX.25 address mappings.

<i>Permissions</i>	Specifies permissions that remote users have when sending files, whether local users can request files, and which commands users are allowed to use.  <b>Caution:</b> System security can be compromised if <i>Permissions</i> is incorrectly configured.
<i>Dialers</i>	Specifies the command that <i>uucp</i> issues to the <i>pad</i> program to make a <i>uucp</i> call.
<i>Systems</i>	Specifies the hosts that <i>uucp</i> knows about. It includes login names and character sequences that <i>uucp</i> is to send and expects to receive as responses.

These files would have the format presented below for a typical UUCP-over-X.25 configuration.

### Devices

Typically, one line is entered for each outgoing *xy* device. Lines like the following should be added to the *Devices* file:

```
Pad xty80 - 9600 pad
Pad xty81 - 9600 pad
Pad xty82 - 9600 pad
Pad xty83 - 9600 pad
```

### Dialcodes

The new entries in the *Dialcodes* file specify a name to X.25 address mapping. This name is used in the *Permissions* and *Systems* files. Lines like the following should be added to the *Dialcodes* file:

```
hostname1 A.1234567891
hostname2 A.1234567892
```

## Permissions

Lines like the following should be added to the *Permissions* file:

```
MACHINE=hostname1:hostname2 \  
REQUEST=yes \  
SENDFILES=yes \  
READ=/ WRITE=/ \  
COMMANDS=ALL  
LOGNAME=nuucp \  
REQUEST=yes \  
SENDFILES=yes \  
READ=/ WRITE=/ \  
COMMANDS=ALL
```

**Note:** These permissions let users do almost anything, so you may need to be more restrictive. For more detail, refer to *IRIX Admin: Networking and Mail*.

## Dialers

The added entry in this file tells *uucp* the command to issue to the *pad* program to allow outgoing calls. Add the following line to the *Dialers* file:

```
pad " " " CALL\s\T
```

## Systems

Add lines like the following to the *Systems* file:

```
hostname1 Any Pad 9600 hostname1 " "\r\d\r in:--in: nuucp  
hostname2 Any Pad 9600 hostname2 " "\r\d\r in:--in: nuucp
```



---

## Creating Customized Parameter Files

In most cases, the protocol parameter files that SX.25 provides are appropriate for X.25 WANs and LANs, so it is not necessary to create customized parameter files. However, if you determined that the settings in the factory-shipped parameter files do not meet your connection requirements (see “Evaluating SX.25 Parameter Files” in Chapter 2 for details), you need to perform the procedures in this chapter. These procedures explain how to use factory-shipped files as templates to create your own custom parameter files.

**Note:** Factory-shipped SX.25 parameter files cannot be modified. To create a custom file, you open a factory-shipped file, make your changes, and save them in a new file under a different name.

This chapter contains three procedures for creating configuration files:

- “Creating an X.25 Parameter File”
- “Creating a LAPB Parameter File”
- “Creating an LLC2 Parameter File”

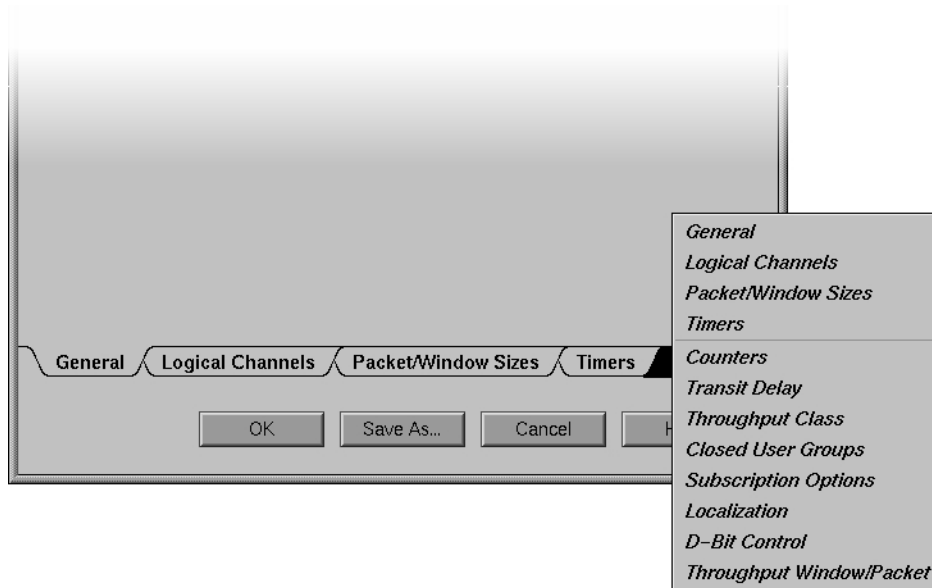
### Using Parameter Files as Templates

The contents of X.25, LAPB, and LLC2 parameter files are displayed in a series of windows that you use as templates to create custom parameter files. Each template contains a logical grouping of protocol parameters (such as LLC2 timer parameters) and input widgets for specifying custom settings (such as option menus and sliders). In addition, the lower edge of a template contains tabs and buttons for controlling the file creation process.

#### Template Tabs

When you open a protocol parameter file, the General parameters tab is displayed. Use the labeled tabs at the lower edge of the window to display a different group of

parameters. If the parameters that you wish to display do not appear on a labeled tab, move the pointer to the unlabeled tab area and use the right mouse button to select a tab from a pull-down list, as shown in Figure 7-1.



**Figure 7-1** Unlabeled Tabs on Template Windows

### The OK Button

Use the *OK* button to record changed settings in a previously-created custom parameter file. (You cannot use *OK* to write to a factory-shipped file; see “The Save As Button.”). Clicking *OK* confirms your changes and closes the custom file, but it does not save the modified version of the file. The modified parameter file is permanently saved when you save the configuration file (normally, this is done at the end of the port configuration procedure).

### The Save As Button

Use the *Save As* button to record your changes to a factory-shipped file in a custom parameter file. When you click *Save As*, you are prompted to enter a name for the new

custom file. Entering a name for the new custom file does not save it. The file is permanently saved when you save the configuration file (normally, this is done at the end of the port configuration procedure).

### The Cancel Button

Use the *Cancel* button to close the parameter file and discard your entries. When you click *Cancel*, no changes are made to the parameter file; any information that was in the file from previous sessions remains unchanged.

### The Help Button

Use the *Help* button to get information about using parameter windows.

## Creating an X.25 Parameter File

Use the procedure below to create a custom X.25 parameter file for a WAN or LAN port. This procedure assumes that you completed steps 1 through 3 of either “Creating a WAN Port Configuration Record” (for WAN ports) or “LAN Port Configuration Procedure” (for LAN ports) in Chapter 4. It also assumes that you plan to use a factory-shipped file as a template for the custom file, but you can also use a previously-created custom file as a template.

1. Open a factory-shipped X.25 parameter file.

To open a factory-shipped file, select a file from the X.25 Parameter Files list, based on the port’s function as DTE or DCE equipment and on the X.25 recommendation implemented on the network. Click the *Open* button (or double-click on the file) to display file contents. Click on the labeled tabs at the bottom of the window to view additional parameter settings. To view an unlabeled tab, move the pointer to the unlabeled area and use the right mouse button to select a tab from a pull down list (see Figure 7-1).

2. Modify the settings that need changing.

The contents of X.25 parameter files comprise several windows. Figure 7-2 through Figure 7-13 illustrate X.25 protocol parameters and their factory-shipped settings; see the information that follows each figure for information about the parameters that the figure contains. Use the values specified by your network service provider

or your knowledge of the operating characteristics of your network to change X.25 parameter settings. When you finish your changes, return to step 3 of this procedure.

3. Create a new X.25 parameter file under a different name to save your settings.  
You cannot modify the original X.25 parameter file, but you can create a modified version of the original file and save it under a different name. To save your changes to X.25 parameter settings, click the *Save As* button; then, enter the name of the new file in the filename dialog box.  
Notice that the new X.25 file appears in the X.25 Parameter Files list and that the new file is selected.
4. Return to step 5 of “Creating a WAN Port Configuration Record” or “LAN Port Configuration Procedure” in Chapter 4 to continue the configuration process.

### X.25 General Operating Parameters

Figure 7-2 illustrates the panel of general operating parameters for X.25. Each parameter is explained in the information that follows the figure.

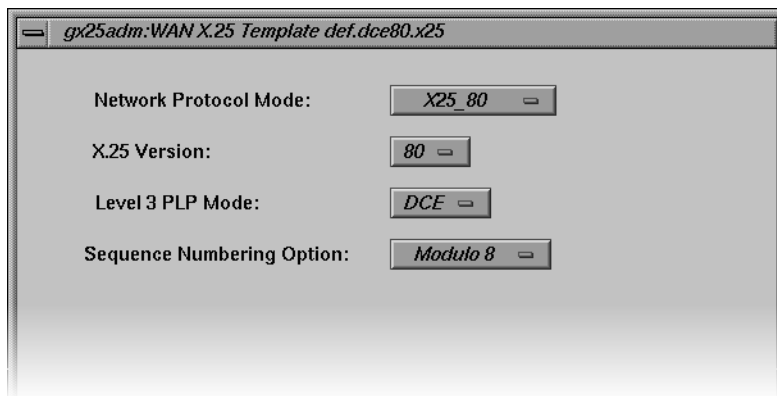


Figure 7-2 X.25 General Parameters



Network Protocol Mode

Specifies the characteristics of the network protocol. For example, a value "X25\_LLC" specifies either 1984 or 1988 X.25 over LLC2 procedures. Use the option popup menu beside the Network Protocol Mode parameter to make your selection.

X.25 Version

Specifies the X.25 protocol recommendation used on the network. Use the option popup menu beside the X.25 Version parameter to make your selection.

**Note:** Selecting X25\_LLC as the network protocol mode sets an X.25(80) selection in this field to X.25(84).

Level 3 PLP Mode

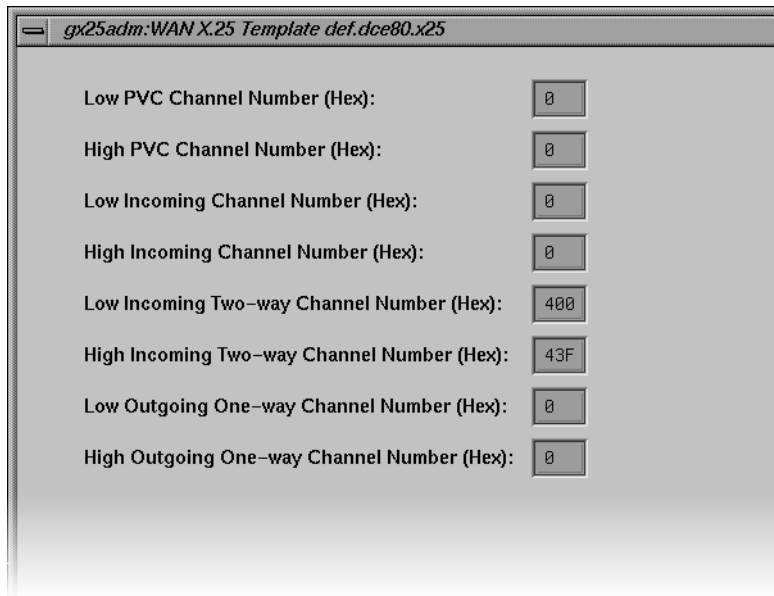
Specifies whether the port will function as a DTE or DCE. Use the option popup menu beside the Level 3 PLP Mode parameter to make your selection.

Sequence Numbering Option

Sets sequence numbering to Modulo 8 or Modulo 128. Use the option popup menu beside the Sequence Numbering parameter to make your selection.

### Logical Channel Parameters

Figure 7-3 illustrates the panel of logical channel parameters for X.25 and their default settings. Channel parameters are explained in the information that follows the figure.



**Figure 7-3** Logical Channel Parameters

In a DTE/DTE environment, one DTE sees the range of lowest incoming logical channels as presented in Figure 7-3. The other DTE sees these ranges from the viewpoint of a DCE. For example, it views the range from lowest incoming logical channels to highest incoming logical channels as one-way *outgoing*.

The numbers of logical channels of each type are calculated from the values of the pairs of parameters:

$$\text{Number of PVCs} = \text{Highest PVC} - \text{Lowest PVC} + 1$$

**Note:** If highest and lowest logical channels are both set to zero, no channels are allocated in that grouping.

These parameters specify logical channel functions:

Low and High PVC Channel Number

Specifies the range of channels to be allocated to permanent virtual circuits.

Low and High Incoming Channel Number

Specifies the range of channels to be allocated for receiving inbound calls only.

Low and High Two-way Channel Number

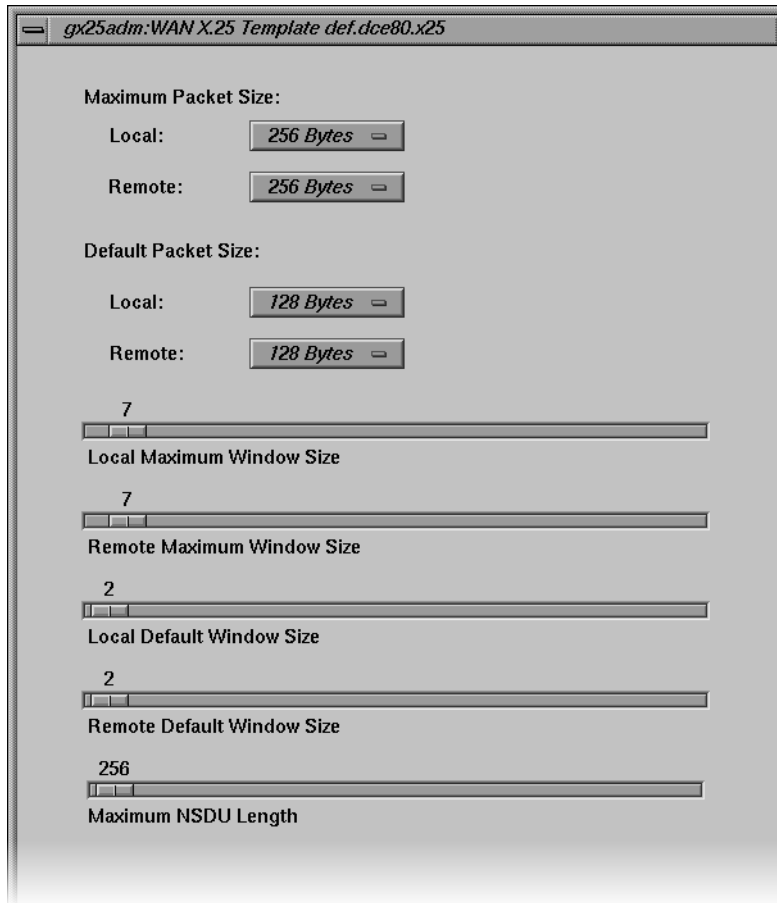
Specifies the range of channels to be allocated for receiving inbound calls and sending outbound packets.

Low and High Outgoing Channel Number

Specifies the range of channels to be allocated for sending outbound calls only.

### Packet- and Window- Size Parameters

Figure 7-4 illustrates the panel of packet-size and window-size parameters for X.25. Each parameter is explained in the information that follows the figure.



**Figure 7-4** Packet- and Window-Size Parameters

#### Local and Remote Maximum Packet Size

Specifies the maximum size for outbound packets; remote maximum packet size specifies the maximum size for inbound packets.

Use these parameters to set the maximum size of data packets that are acceptable on the X.25 link. On any incoming call, a value for the packet-size parameter greater than the lowest outgoing logical channel (shown in Figure 7-3) or remote maximum packet size is negotiated down to this value when the call is accepted.

**Note:** Be sure that lowest outgoing logical channel is greater than the frame size that you set for the underlying protocol: the LAPB I frame on the WAN or the LLC-2 I frame on the LAN. The I frame size is set in the LAPB template (shown in Figure 7-14) or the LLC2 template (shown in Figure 7-17).

#### Local and Remote Default Packet Size

Specifies the default size for outbound packets; remote default packet size specifies the default size for inbound packets.

Use this parameter to specify the default packet size for a particular network. The standard value is 7, which sets a default data packet size for each direction of transmission to 128 octets ( $2^7$ , that is,  $1 << 7$ ). The value may be nonstandard if it is agreed between all communicating parties on the LAN or between the DTE and DCE.

#### Local and Remote Maximum Window Size

Specifies the maximum size of windows for outgoing calls; remote maximum window size specifies the maximum size of windows for incoming calls.

Use this parameter to specify the maximum window size acceptable on the subnetwork. On any incoming call, a window size value greater than lowest outgoing logical channel (shown in Figure 7-3) or remote maximum window size is negotiated down to this value when the call is accepted. For Modulo 8 networks, the range for lowest outgoing logical channel or remote maximum window is 2 through 7, and for Modulo 128 the range is 2 through 127.

#### Local and Remote Default Window Size

Specifies the default size of windows for outgoing calls; remote default window size specifies the default size of windows for incoming calls.

Use this parameter to specify the value of the default window size for a particular network. The standard value is 2. The value may be nonstandard provided it is agreed between all communicating parties on the LAN, or between the DTE and DCE.

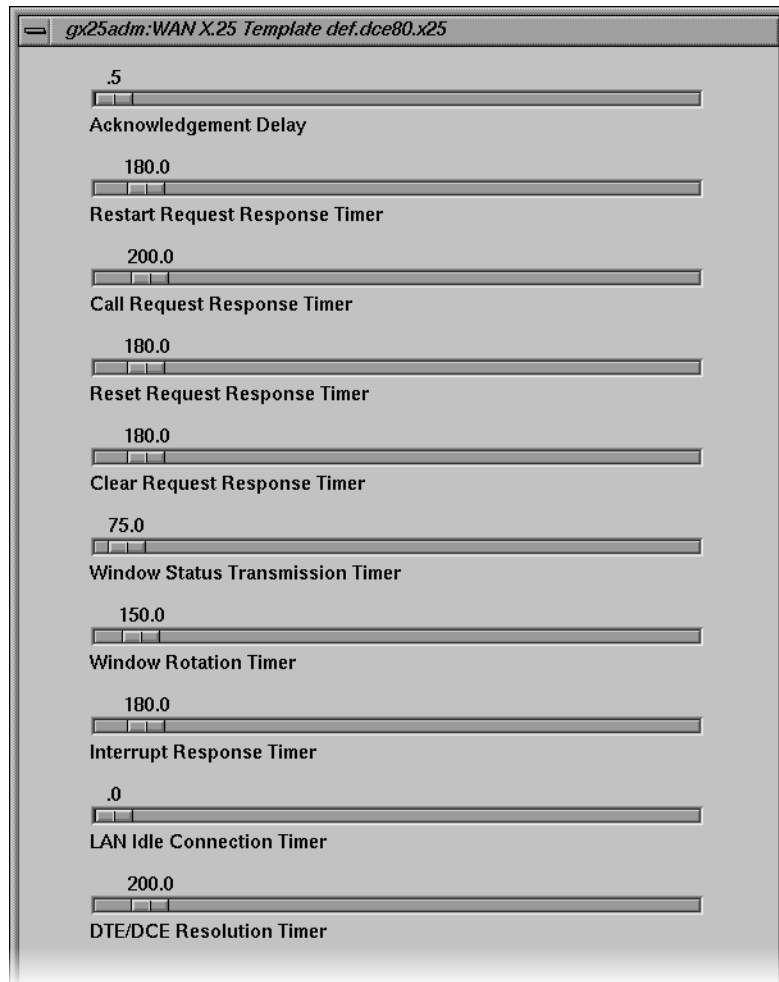
**Note:** The sequence numbering scheme, modulo 8 or modulo 128 (shown in Figure 7-2), affects the range of this parameter. For modulo 8 networks, the range for lowest outgoing logical channel (shown in Figure 7-3) or remote default window size is 1 through 7, and for modulo 128 the range is 1 through 127.

#### Maximum NSDU Length

Specifies the maximum length of a network service data unit (NSDU). SX.25 tries to concatenate data packets marked with the “More Data” mark (M-bit) into a NSDU. However, you can specify a maximum length to avoid running out of buffers. When this maximum is exceeded, concatenation stops and currently held data is passed to the network service user with the M-bit set. Applications can override this parameter for specific circuits using the nsdulimit field of the Quality Of Service parameter on Connect Requests and Connect Confirmations. The default value for this parameter is 256; the maximum value is 32,000.

### Timer Parameters

Figure 7-5 illustrates the tab of timer parameters for X.25. Notice that timer parameter names are descriptive of their function. For parameters known by a mnemonic equivalents, the mnemonic is given in parentheses in the descriptions that follow. All timer values are measured in tenths of a second except where noted.



**Figure 7-5** Timer Parameters

**Acknowledgement Delay**

Specifies the maximum time during which a pending acknowledgement is withheld. SX.25 attempts to suppress the generation of Level 3 Receive Ready control packets. Acknowledgment carried by data or multiple acknowledgements is preferred to each data packet being explicitly and separately acknowledged. The permitted range is .1 to 3200.

Restart Request Response Timer

(T20) The default value is 180, the permitted range 0 to 3200.

Call Request Response Timer

(T21) The default value is 200, the permitted range 0 to 3200.

Reset Request Response Timer

(T22) The default value is 180, the permitted range 0 to 3200.

Clear Request Response Timer

(T23) The default value is 180, the permitted range 0 to 3200.

Window Status Transmission Timer

(similar to T24) Specifies the maximum interval during which data received from the remote transmitter can remain unacknowledged due to a flow control condition. After this timer expires, any outstanding acknowledgements are carried by an X.25 Level 3 Receive-Not-Ready packet. Use this timer to ensure that if the remote transmitter does not receive an acknowledgement, this does not cause resets within the virtual circuit. This timer should be approximately half the value set for the window rotation timer.

The default value is 75, the permitted range 0 to 3200.

Window Rotation Timer

(T25) This timer should be approximately twice the value set for the window status transmission timer. The default value is 150, the permitted range 0 to 3200.

Interrupt Response Timer

(T26) The default value is 180, the permitted range 0 to 3200.

LAN Idle Connection Timer

Specifies the period for maintaining a link-level connection when there is no reciprocating connections. If the link is to a WAN, set the value to zero (that is, infinity). This timer is appropriate only when running X.25 over the LAN.

The default LAN value is 60; the default WAN value is 0. For both, the permitted range is 0 to 3200.

Resolution Timer

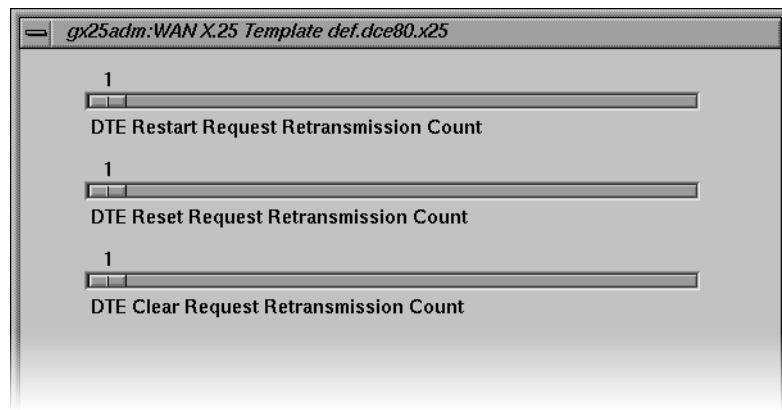
Specifies the interval during which the DTE/DCE resolution should be completed. This prevents two packet-level entities failing to resolve their DTE/DCE nature. When this timer expires, the link connection is disconnected and all pending connections are aborted.



The default value is 200; the permitted range 0 to 3200.

## Counter Parameters

Figure 7-6 illustrates the panel of counters parameters for X.25. Each parameter is explained in the information that follows the figure.



**Figure 7-6** Counter Parameters

DTE Restart Request Retransmission Count

(R20) The default value is 1; the permitted range 1 to 255.

DTE Reset Request Retransmission Count

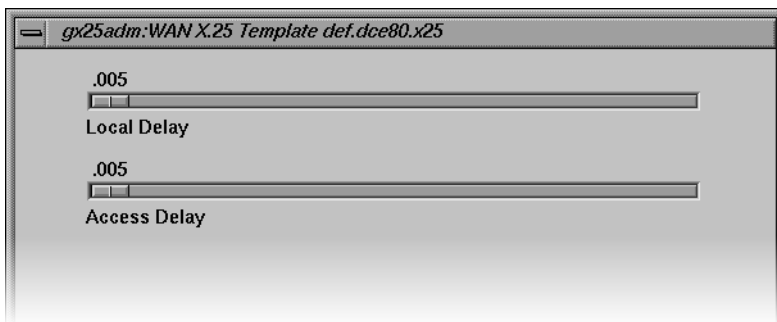
(R22) The default value is 1; the permitted range 1 to 255.

DTE Clear Request Retransmission Count

(R23) The default value is 1; the permitted range 1 to 255.

### Transit Delay Parameters

Figure 7-7 illustrates the panel of transit delay parameters for X.25. Each parameter is explained in the information that follows the figure.

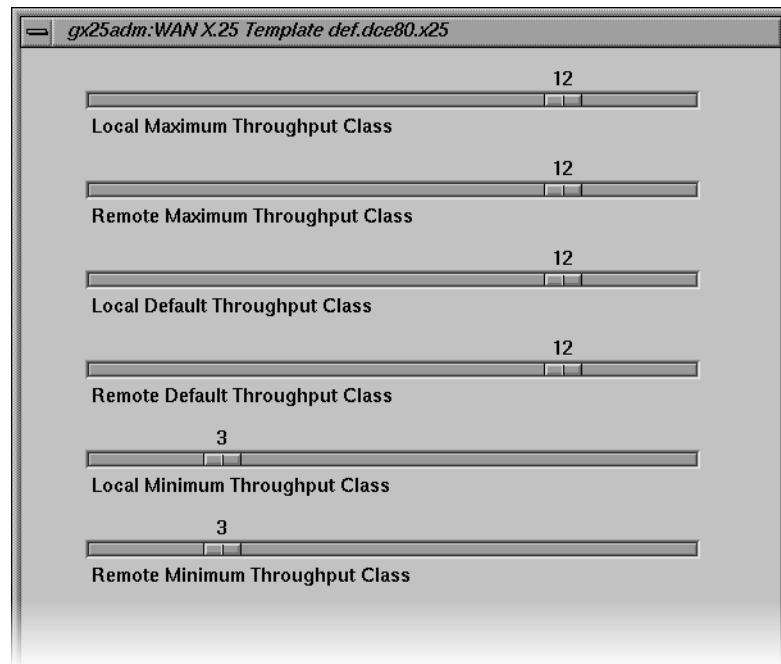


**Figure 7-7** Transit Delay Parameters

- Local Delay      Specifies the transit delay that results from internal processing.
- Access Delay    Specifies the transit delay that results from the line transmission rate. The default for both parameters is .005; the permitted range 0 to 32.

### Throughput Class Parameters

Figure 7-8 illustrates the panel of throughput class parameters for X.25. Each parameter is explained in the information that follows the figure.



**Figure 7-8** Throughput Class Parameters

Be sure to observe the following points when you set these parameters:

- The value of local maximum throughput class and remote maximum throughput class should be greater than or equal to that of local default throughput class and remote default throughput class, respectively.
- The value of local default throughput class and remote default throughput class should be greater than or equal to that of local minimum throughput class and remote minimum throughput class, respectively.

#### Local and Remote Maximum Throughput Class

Defines the maximum packets size for each transmission direction: local maximum throughput class specifies the maximum size for outbound packets; remote maximum throughput class specifies the maximum size for inbound packets.

These parameters are the maximum supported value of the throughput class Quality Of Service parameter. ISO 8208 specifies a value for lowest outgoing logical channel (shown in Figure 7-3) or remote maximum

throughput class in the range of 3 through 12, corresponding to a range of 75 to 48,000 bps. However, the supported valid range is 0 to 15. This accommodates nonstandard X.25 implementations that use the Throughput Class parameters to map to packet/window sizes (see “Throughput Window and Packet Parameters”).

#### Local and Remote Default Throughput Class

Defines the default packet sizes for each transmission direction: local default throughput class specifies the default size for outbound packets; remote default throughput class specifies the default size for inbound packets.

In some networks (TELENET, for example), negotiation of throughput class is towards a configured default throughput class. In such cases, the negotiate throughput class parameter (shown in Figure 7-13) is non-zero and lowest outgoing logical channel (shown in Figure 7-3) or remote default throughput class is the default. In other PSDNs, you should set lowest outgoing logical channel or remote default throughput class to the value of lowest outgoing logical channel or remote default throughput class.

#### Local and Remote Minimum Throughput Class

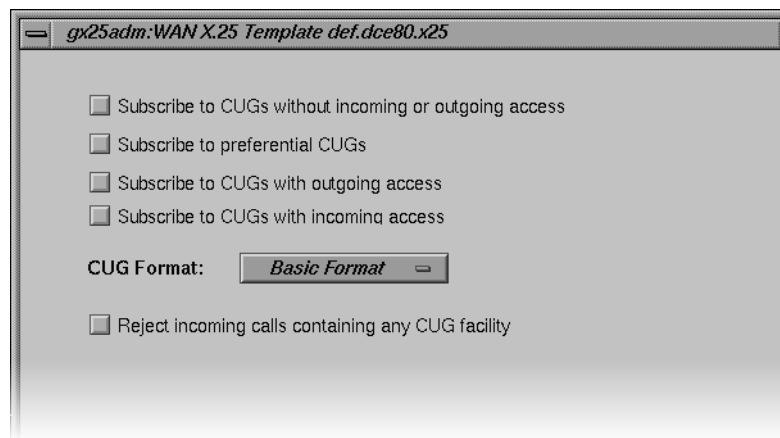
Defines the minimum packet sizes for each transmission direction: local minimum throughput class specifies the minimum size for outbound packets; remote minimum throughput class specifies the minimum size for inbound packets.

According to ISO 8208, the throughput class parameter is defined in the range of 3 through 12. Some PSDNs may provide a different mapping, in which case lowest outgoing logical channel (shown in Figure 7-3) or remote minimum throughput class is the minimum value.

## Closed User Group Parameters

Figure 7-9 illustrates the panel of closed user group (CUG) parameters for X.25. To change a CUG parameter, click the check box beside it to turn the parameter on or off. Use the option menu beside the “CUG Format” parameter to select either basic or extended CUG format.

**Note:** Some networks, such as DDN, require you to set the flag to reject incoming calls carrying any closed user group optional facility.

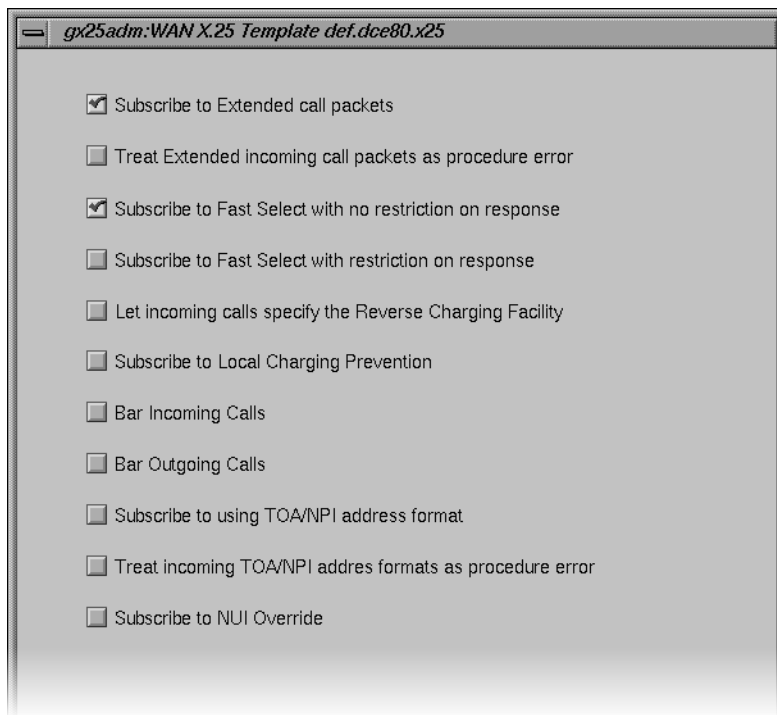


**Figure 7-9** Closed User Group Parameters

### Subscription Option Parameters

Figure 7-10 illustrates the panel of subscription option parameters for X.25. To change a subscription parameter, click the check box beside it to turn the parameter on or off.

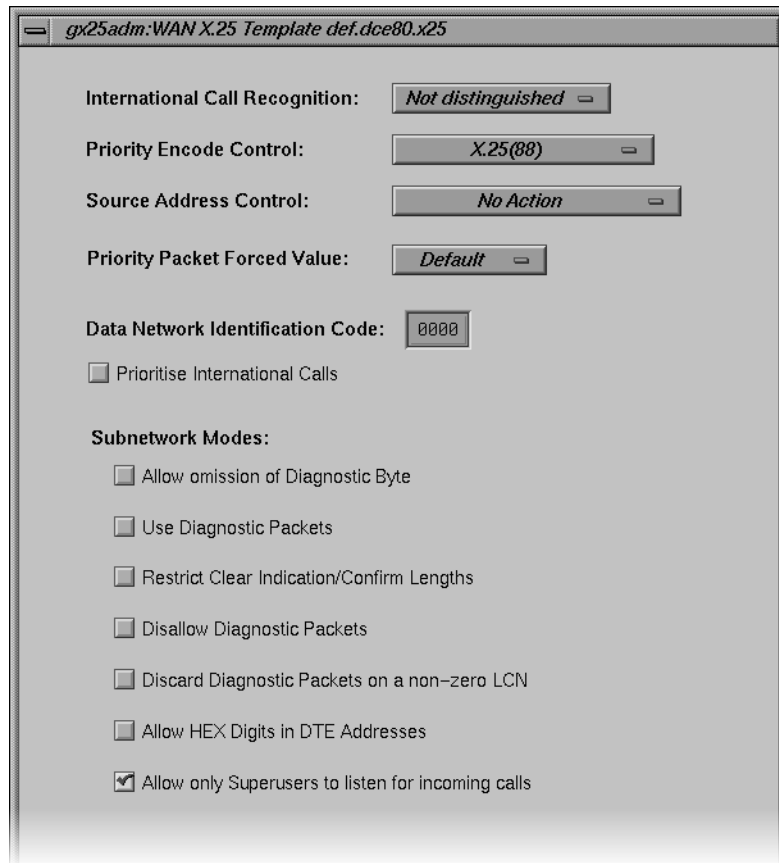
**Note:** Subscribing to extended call packets enables window- and packet-size negotiation, which permits the exchange of extended call packets. Treating extended incoming call packets as a procedure error prevents the exchange of extended call packets.



**Figure 7-10** Subscription Options Parameters

## Localization Parameters

Figure 7-11 illustrates the panel of localization parameters for X.25, which are used to tune options for a particular subnetwork. Each parameter is explained in the information that follows the figure.



**Figure 7-11** Localization Parameters

### International Call Recognition

Governs whether outgoing international call requests are to be recognized and how. Use the popup option menu beside the International Call Recognition parameter to select one of these settings:

- Not distinguished: international calls are not distinguished.
- DNIC mismatch: the data network identification code (DNIC) of the called DTE address is examined and compared with that held in psdn\_local members dnic1 and dnic2. A mismatch implies an international call.
- DTE prefix of 1: International calls are distinguished by a 1111 prefix on the DTE address (DATAPAC, among others, use this feature).
- DTE prefix of 0: International calls are distinguished by a 0000 prefix on the called DTE address. This feature is generally used in conjunction with the Priority Encode Control parameter.

#### Priority Encode Control

Governs how priority requests are to be encoded for this PSDN. Use the popup option menu beside the Priority Encode Control parameter to set the value according to the following:

- The priority is encoded according to X.25(88).
- DATAPAC Priority Bit: Encode the priority request using the DATAPAC Priority Bit (1976 version).
- DATAPAC Traffic Class: Encode the priority request using the DATAPAC Traffic Class (1980 version employing the Calling Network facility marker).

#### Source Address Control

Overrides or sets the calling address in outgoing call requests for this PSDN. Use the popup option menu beside the Source Address Control parameter to set the value according to the following:

- No Action: Calling DTE addresses are encoded as if provided by the network service user.
- Omit Calling DTE Address: address of the calling DTE is omitted even if the network service user supplied one.
- Use Local DTE Address: If the network service user does not supply a DTE address, use the configured DTE address for this PSDN (which can be NULL).
- Calling DTE is Local DTE: Use the local DTE address even if the network service user supplied a calling DTE address.



**Priority Packet Forced Value**

Sets the packet size on all priority call requests and incoming calls to the value specified in this parameter.

**Data Network Identification Code**

Contains the first four BCD digits of the DNIC and is used only when international call recognition is set.

**Prioritize International Calls**

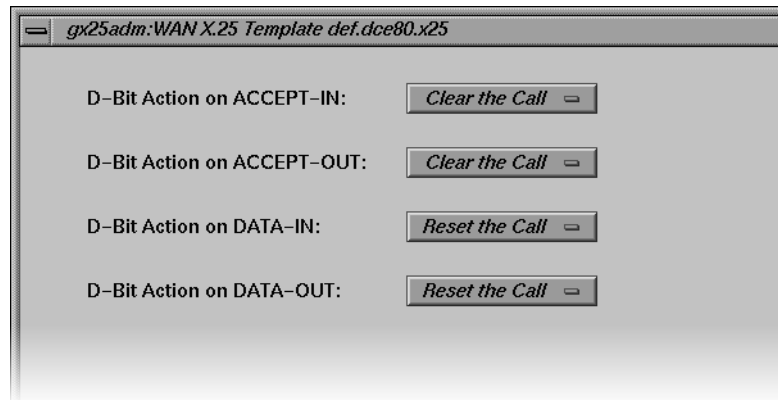
Specifies whether a prioritization method is to be used for international calls (assuming that the PSDN supports such a feature). Use this parameter in conjunction with two other parameters: priority encode control and priority packet forced value.

**Subnetwork Modes**

Specify network tuning options for treatment of diagnostic packets and other functions. You can control these functions by setting indicators on or off. Click on the selection box beside an indicator to set it; a check mark indicates that an indicator is on.

**D-Bit Control Parameters**

The X.25 standard does not give specific recommendations for handling the D-bit. To provide flexibility to accommodate local PSDN requirements, SX.25 lets you specify how the D-bit should be handled. Figure 7-12 illustrates the panel of D-bit control parameters for X.25. Each parameter is explained in the information that follows the figure.



**Figure 7-12** D-Bit Control Parameters

Use the popup option menu beside each D-bit control parameter to select a new value for the parameter. Your choices for D-bit parameters are Clear the Call, Zero the D-bit, or No Action.

D-Bit Action on ACCEPT-IN

Defines what happens during the call setup phase if a Call Accept is received and there is no local D-bit support.

D-Bit Action on ACCEPT-OUT

Defines what happens during the call setup phase if a Call Accept is sent and there is no request for D-bit from the other end.

D-Bit Action on DATA-IN

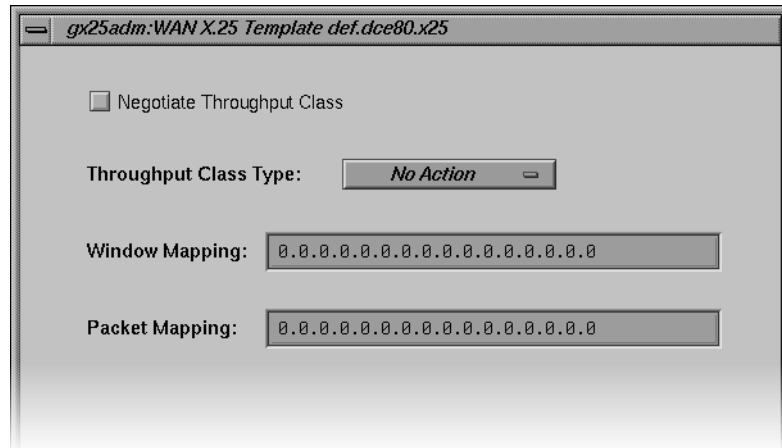
Defines what happens when a data packet is received and there is no request for the D-bit from the local user.

D-Bit Action on DATA-OUT

Defines what happens when a data packet is sent and there is no indication of D-bit support from the remote party.

### **Throughput Window and Packet Parameters**

Some implementations of X.25 do not use the X.25 packet and window negotiation function. Instead, these implementations use throughput class window and packet mapping to determine window and packet sizes. Figure 7-13 illustrates the panel of X.25 throughput class parameters. Each parameter is explained in the information that follows the figure.



**Figure 7-13** Throughput Window and Packet Parameters

#### Negotiate Throughput Class

Specifies whether to negotiate throughput class towards the defaults, which are specified by the lowest outgoing logical channel (shown in Figure 7-3) and the remote default throughput class (shown in Figure 7-4).

Click on the check box to set this parameter on for networks like TELENET, which require negotiation of the throughput class towards those defaults. When this parameter is off (the default), throughput class is negotiated according to the X.25 procedures instead.

#### Throughput Class Type

When set to a value other than No Action, specifies the way in which window and packet sizes are mapped. The values of lowest outgoing logical channel (shown in Figure 7-3) and remote maximum throughput class (shown in Figure 7-4) may limit the range of the mapped values. The value that you select for this parameter applies to both transmission directions.

Keep these points in mind when setting this parameter:

- Do not select the Use Low Nibble, Use High Nibble, or Use Both Nibbles value if window and packet size negotiation are necessary: this algorithm is designed for PSDNs that support the mapping procedure only.

- In call requests, specify equal values for local throughput and remote throughput in the qosformat, to ensure that low nibble and high nibble values behave correctly.
- Selecting the Use Low Nibble or Use High Nibble value prevents users and applications from negotiating window and packet size.
- If you select the Use Both Nibbles value, users can negotiate window and packet sizes only through the throughput class parameter.
- If you subscribe to the extended facility option and you select the Use Both Nibbles value, negotiation using flow negotiation parameters is overridden.
- Because window and packet size negotiation is suppressed when you use window and packet mapping, it is important that your entries for the window mapping parameter and packet mapping parameter are correct for your PSDN. This ensures that both called and calling parties agree on the values associated with a particular throughput class.

#### Window Mapping

Maps the value of the throughput class for each direction of transmission to a window parameter. This value is a number from 0 to 15 (a value of zero for any individual value is interpreted as the default value for the subnetwork). The permitted range is between 1 and the value of either the lowest outgoing logical channel or the remote maximum window size; the maximum possible value is 127. The maximum for the subnetwork is the smaller of two values: lowest outgoing logical channel parameter or remote maximum window size parameter.

#### Packet Mapping

Maps the value of the throughput class for each direction of transmission to a packet parameter. This value is a number from 0 to 15. (a value of zero for any individual value is interpreted as the default value for the subnetwork). The permitted range is between 1 and the value of either the lowest outgoing logical channel or the remote maximum window size; the maximum possible value is 127. The maximum for the subnetwork is the smaller of two values: lowest outgoing logical channel parameter or remote maximum window size parameter.

These are the last X.25 parameters. Return to step 3 of “Creating a LAPB Parameter File” to continue the file creation process.

## Creating a LAPB Parameter File

Use the procedure in this section to create a custom LAPB parameter file. This procedure assumes that you completed steps 1 through 6 of “Creating a WAN Port Configuration Record” in Chapter 4. It also assumes that you plan to use a factory-shipped file as a template for the custom file, but you can also use a previously-created custom file as a template.

1. Open the factory-shipped LAPB parameter file.

To open a factory-shipped file, select the file from the LAPB Parameter File list and click the *Open* button (or double-click on the file) to display its contents. Click on the labeled tabs at the bottom of the window to view additional parameter settings.

2. Modify the settings that need changing.

The contents of the LAPB parameter file comprise several windows. Figure 7-14 through Figure 7-16 illustrate LAPB protocol parameters and their factory-shipped settings; see the information that follows each figure for information about the parameters that the figure contains. Use the values specified by your network service provider or your knowledge of the operating characteristics of your network to change LAPB parameter settings. When you finish your changes, return to step 3 of this procedure.

3. Create a new LAPB parameter file under a different name to save your settings.

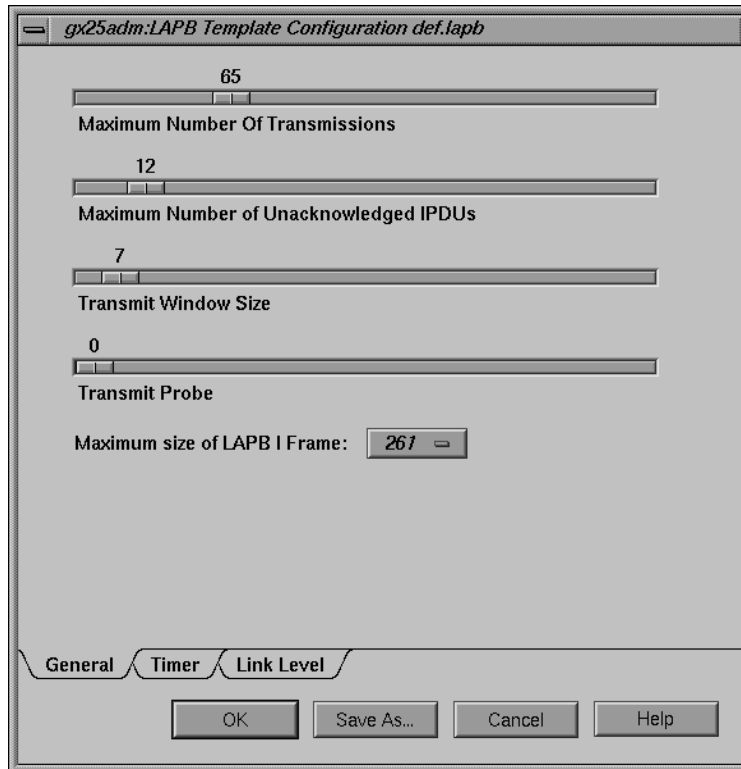
You cannot modify the original LAPB parameter file, but you can create a modified version of the original file and save it under a different name. To save your changes to LAPB parameter settings, click the *Save As* button; then, enter the name of the new file in the filename dialog box.

Notice that the new file LAPB appears in the LAPB Parameter Files list and that the new file is selected.

4. Return to step 8 of “Creating a WAN Port Configuration Record” to continue with the port configuration process.

### LAPB General Operating Parameters

Figure 7-14 illustrates the panel of general operating parameters for LAPB. Each parameter is explained in the information that follows the figure.



**Figure 7-14** LAPB General Parameters

#### Maximum Number of Transmissions

Specifies the maximum number of times that a PDU is sent after the Acknowledgment Timer, the P-bit timer, or the Reject Timer expires. It also limits the number of times Receive Ready with P-bit set is sent when the remote is busy and the Busy Timer expires.

The default value is 65 and the permitted range is 1 to 255.

**Maximum Number of Unacknowledged IPDUs**

Specifies the maximum number of unacknowledged IPDUs that can be received before the Reset Request acknowledging them must be sent.

The default value is 12 and the permitted range is 0 to 127.

**Transmit Window Size**

The number of unacknowledged IPDUs that LAPB can send.

In normal mode, when Modulo 8 sequence numbering is used, the default value is 7 and the permitted range is 1 to 7.

In extended mode when Modulo 128 sequence numbering is used, the default value is 7 and the permitted range is 1 to 127.

**Transmit Probe**

The position before the window is closed at which an IPDU, with the P-bit set, is sent to ask for an acknowledgement from the receiver.

In normal mode when Modulo 8 sequence numbering is used, the default value is 0 and the permitted range is 0 to 7.

In extended mode, when Modulo 128 sequence numbering is used, the default value is 0 and the permitted range is 0 to 127.

**Maximum Size of LAPB I frame**

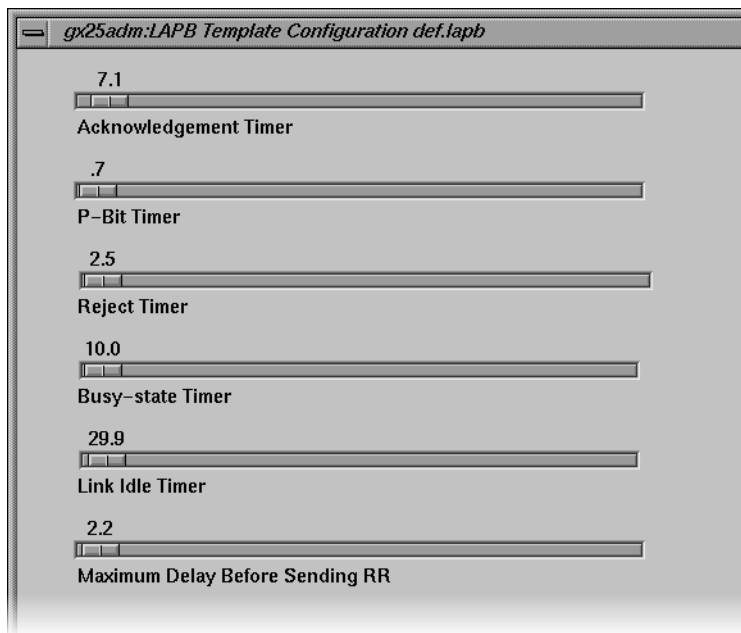
Specifies the maximum size of incoming I frames; I frames above the specified size are rejected by an FRMR. The size is equal to this sum:

maximum X.25 data size + X.25 protocol length + LAPB protocol length

The default value is 261. Permitted values are: 261 to 263, 517 to 519, 1029 to 1031, 2053 to 2055, and 4101 to 4103.

## LAPB Timer Parameters

Figure 7-15 illustrates the panel of timer parameters for LAPB. Each parameter is explained in the information that follows the figure. Unless noted otherwise, LAPB timer values are expressed in tenths of a second.



**Figure 7-15** LAPB Timer Parameters

### Acknowledgement Timer

Specifies the time during which the LAPB expects to receive an acknowledgement to an outstanding IPDU or an expected response to a sent unnumbered PDU.

The default value is 7.1 and the permitted range is .1 to 300.

### P-Bit Timer

Specifies the time during which the LAPB expects to receive a PDU with the F-bit set to 1 in response to a command with the P-bit set to 1. This value should be less than that specified for the Acknowledgment Timer.

The default value is .7 and the permitted range is .1 to 300.



Reject Timer

Specifies the time during which the LAPB expects to receive a reply to a sent REJ TPDU.

The default value is 2.5 and the permitted range is .1 to 1000.

Busy-state Timer

Specifies the time during which the LAPB waits for an indication of the clearance of a busy condition at the other LAPB.

The default value is 10.0 and the permitted range is .1 to 3000.

Link Idle Timer

Specifies the time during which the LAPB expects to receive a PDU from the other LAPB. If it expires, the P/F cycle is initiated, which may result in link disconnection. A value of zero disables this function.

The default value is 29.9 and the permitted range is 0 to 3200.

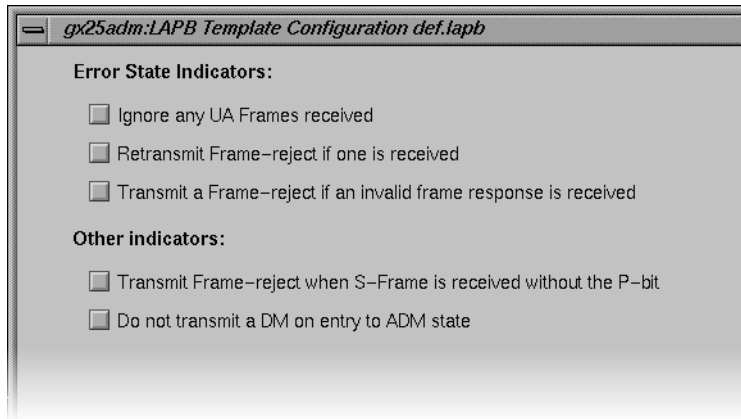
Maximum Delay Before Sending RR

Specifies the maximum delay in tenths of a second before transmitting a delayed RR (Reset Request). This must be considerably less than the Acknowledgment Timer value.

The default value is 2.2 and the permitted range is 0 to 300.

## LAPB Link-Level Parameters

Figure 7-16 illustrates the panel of link-level parameters for LAPB.



**Figure 7-16** LAPB Link-Level Parameters

### Error State and Other Indicators

These parameters control LAPB conformance tuning by defining its operation in certain states. You can control state operations by setting error state indicators on or off. Click the check box beside an indicator to set it; a check mark indicates that an indicator is on.

These are the last LAPB parameters. Return to step 3 of "Creating a LAPB Parameter File" to complete the file creation process.

## Creating an LLC2 Parameter File

Use the procedure below to create a custom LLC2 parameter file. This procedure assumes that you completed steps 1 through 5 of the “LAN Port Configuration Procedure” in Chapter 4. It also assumes that you plan to use a factory-shipped file as a template for the custom file, but you can also use a previously-created custom file as a template.

1. Open the factory-shipped LLC2 parameter file.

To open a factory-shipped file, select the file from the LLC2 Parameter File list that is appropriate for the type of media on the LAN where this port will connect. Click the *Open* button (or double-click on the file) to display file contents. Click on the labeled tabs at the bottom of the window to view additional parameter settings.

2. Modify the settings that need changing.

The contents of the LLC2 parameter file comprise several windows. Figure 7-17 through Figure 7-19 illustrate LAPB protocol parameters and their factory-shipped settings; see the information that follows each figure for information about the parameters that the figure contains. Use the values specified by your network service provider or your knowledge of the operating characteristics of your network to change LLC2 parameter settings. When you finish your changes, return to step 3 of this procedure.

3. Create a new LLC2 parameter file under a different name.

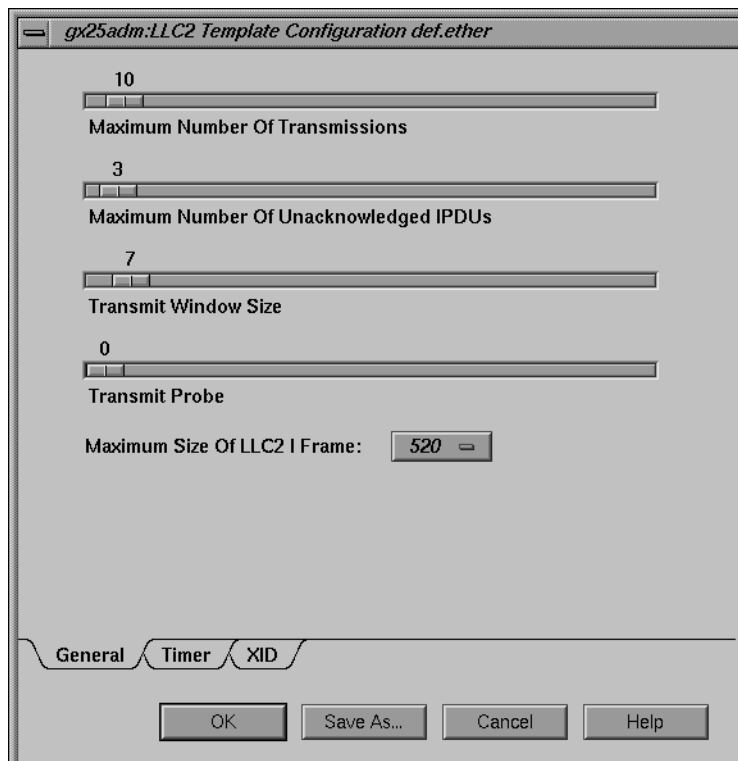
You cannot modify the original LLC2 parameter file, but you can create a modified version of the original file and save it under a different name. To save your changes to LLC2 parameter settings, click the *Save As* button; then, enter the name of the new file in the filename dialog box.

Notice that the new file LLC2 appears in the LLC2 Parameter Files list and that the new file is selected.

4. Return to step 8 of “LAN Port Configuration Procedure” to complete the port configuration process.

### LLC2 General Operating Parameters

Figure 7-17 illustrates the panel of general operating parameters for LLC2, which are the same for all media types. Each parameter is explained in the information that follows the figure.



**Figure 7-17** LLC2 General Parameters

#### Maximum Number of Transmissions

Specifies the maximum number of times that a PDU is sent after the Acknowledgment Timer, the P-bit timer, or the Reject Timer expires. It also limits the number of times Receive Ready with P-bit set is sent when the remote is busy and the Busy Timer expires.

The default value is 10 and the permitted range is 1 to 255.

Maximum Number of Unacknowledged IPDUs

Specifies the maximum number of unacknowledged IPDUs that can be received before the Reset Request acknowledging them must be sent.

The default value is 3 and the permitted range is 0 to 127.

Transmit Window Size

Specifies the maximum number of unacknowledged IPDUs that LLC can send.

The default value is 7 and the permitted range is 1 to 127.

Transmit Probe

Specifies the position before the window is closed at which an IPDU, with the P-bit set, is sent to ask for an acknowledgement from the receiver.

The default value is 0 and the permitted range is 0 to 127.

Maximum Size of LLC2 I frame

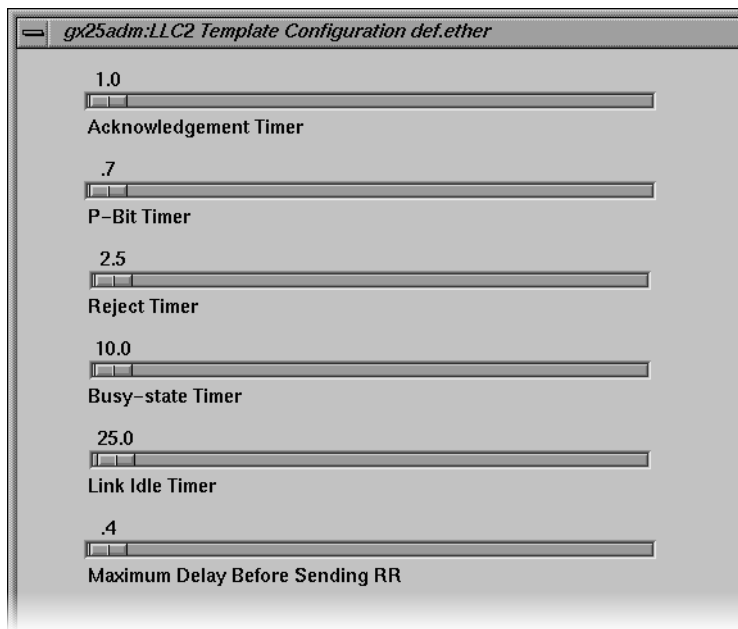
Specifies the maximum size, which is equal to this sum:

maximum X.25 data size + X.25 protocol length + LLC protocol length

The default value is 263. Permitted values are: 263 to 264, 519 to 520, and 1031 to 1032.

## LLC2 Timer Parameters

Figure 7-18 illustrates the panel of timer parameters for LLC2, which are the same for all media types. Each parameter is explained in the information that follows the figure. Timer parameters are expressed in tenths of a second unless otherwise noted.



**Figure 7-18** LLC2 Timer Parameters

### Acknowledgement Timer

Specifies the time, in tenths of a second, during which the LLC expects to receive an acknowledgement to an outstanding IPDU or an expected response to a sent unnumbered PDU.

The default value is 1.0 and the permitted range is .1 to 300.

### P-Bit Timer

Specifies the time, in tenths of a second, during which the LLC expects to receive a PDU with the F-bit set to 1 in response to a command with the P-bit set to 1. This value should be less than that specified for the Acknowledgement Timer.

The default value is .7 and the permitted range is .1 to 300.

Reject Timer

Specifies the time, in tenths of a second, during which the LLC expects to receive a reply to a sent REJ TPDU.

The default value is 2.5 and the permitted range is .1 to 1000.

Busy-state Timer

Specifies the time, in tenths of a second, during which the LLC waits for the clearance of a busy condition at the other LLC.

The default value is 10.0 and the permitted range is 0 to 3000.

Link Idle Timer

Specifies the time, in tenths of a second, during which the LLC expects to receive a PDU from the other LLC. If the timer expires, the P/F cycle is initiated, which may result in link disconnection.

The default value is 25.0 and the permitted range is 0 to 3200.

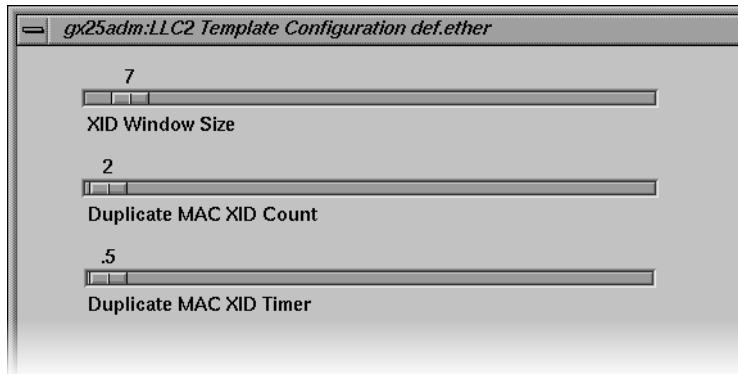
Maximum Delay Before Sending RR

Specifies the maximum delay in tenths of a second before transmitting a delayed RR (Reset Request). This must be considerably less than the Acknowledgement Timer value.

The default value is .4 and the permitted range is 0 to 300.

### LLC2 XID Parameters

Figure 7-19 illustrates the panel of XID parameters for LLC2, which are the same for all media types. Each parameter is explained in the information that follows the figure.



**Figure 7-19** LLC2 XID Parameters

#### XID Window Size

Specifies the size of the receive window when the remote window size is unknown or zero.

The default value is 7 and the permitted range is 1 to 127.

#### Duplicate MAC XID Count

Specifies the number of attempts at finding any stations with duplicate MAC addresses. If you set it to zero, no attempt is made.

The default value is 0 and the permitted range is 0 to 255.

#### Duplicate MAC XID Timer

Specifies the time in tenths of a second for which incoming XID response frames are checked for a duplicate response to the station LSAP. If a value of zero is specified, the duplicate address check is not performed.

The default value is .5 and the permitted range is 0 to 300.

These are the last LLC2 parameters. Return to step 3 of "Creating an LLC2 Parameter File" to complete the file creation process.



---

## Troubleshooting

SX.25 provides troubleshooting information by means of the STREAMS trace and logging utilities, and in error messages from IRIX and IRIX networking services. This chapter provides information on each source of troubleshooting information:

- “STREAMS Trace Messages”
- “STREAMS Error Messages”
- “Network Board-Loading (nload) Error Messages”
- “Network Daemon (snetd) Error Messages”

### STREAMS Trace Messages

STREAMS trace messages can be printed out by using *strace* (see the trace (1M) reference page). Without arguments, it writes all STREAMS event trace messages from all drivers and modules to its standard output, or a subset of these when arguments are given. Arguments define what the subset should be, and arguments must be in triplets of the form *mid*, *sid*, *level*. Arguments have these meanings:

- *mid* is the STREAMS module/driver ID number for the module or driver submitting the log message.
- *sid* is an internal sub\_id number.
- *level* is a tracing level that allows for selective filtering of low-priority messages from the tracer.

Each triplet indicates that tracing messages are to be received from the given module or driver, sub\_id, and priority level equal to or less than the given level. The token *all* may be used for any member to indicate no restriction for that attribute.

The following modules and drivers within SX.25 currently generate STREAMS trace messages.

### **X.25 PLP Driver**

**Module Id**     200  
**Sid**            Set to identifier of subnetwork packet tx/rx on  
**Levels**        1 - 6

Six levels of tracing are available.

#### **Trace Level 1 - Call Activity**

Monitors incoming calls, outgoing calls, calls accepted, and calls connected. For each event, a description, the subnetwork ID, LCI, and GFI are logged.

```
CALL In  : `65' lcn 400 gfi 5  
CALL Out : `66' lcn 401 gfi 1  
CAA Out  : `65' lcn 400 gfi 1  
CAA In   : `66' lcn 401 gfi 1
```

#### **Trace Level 2 - Clear Activity**

Monitors clear requests, clear indications, and clear confirmations. For each event, a description, the subnetwork ID, and the LCI are logged. For clear requests and clear indications, the cause and diagnostic are also logged.

```
CLR In   : `65' lcn 400 C/D 0043  
CLR Out  : `66' lcn 401 C/D 80F2  
CLC In   : `66' lcn 401  
CLC Out  : `65' lcn 400
```

#### **Trace Level 3 - Reset Activity**

Monitors reset indications, reset requests, and reset confirmations. For each event, a description, the subnetwork ID, and the LCI are logged. For reset requests and reset indications, the cause and diagnostic are also logged.

```
RST In   : `65' lcn 400 C/D 0003  
RST Out  : `66' lcn 401 C/D 00FA  
RSC In   : `66' lcn 401  
RSC Out  : `67' lcn 400
```

**Trace Level 4 - Restart Activity**

Monitors restart indications, restart requests, and restart confirmations. For each event, a description and the subnetwork ID are logged. For restart requests and restart indications, the cause and diagnostic are also logged.

```
REST In   : '65' C/D 1300
REST Out  : '66' C/D 0000
RETC In   : '66'
RETC Out  : '65'
```

**Trace Level 5 - Interrupt Activity**

Monitors interrupt data indications, interrupt data requests, and interrupt confirmations. For each event, a description, the subnetwork ID, and the LCI are logged.

```
INT In    : '65' lcn 400
INT Out   : '66' lcn 401
INTC In   : '66' lcn 401
INTC Out  : '65' lcn 400
```

**Trace Level 6 - Data Activity**

Monitors data indications and data requests. For each event, a description, the subnetwork ID, the LCI, the send sequence number, and the receive sequence number are logged.

```
DATA In   : '65' lcn 400 ns/nr 0702
DATA Out  : '66' lcn 401 ns/nr 0500
```

**Example Trace Logging Output**

```
# strace 200 all all
```

```
000187 16:07:30 0001c15b 4 ... 200 67 REST In   : '67' C/D 0000
000188 16:07:30 0001c15b 4 ... 200 67 REVC Out  : '67'
000189 16:08:01 0001cf60 1 ... 200 67 CALL Out  : '67' lci 001 gfi 1
000190 16:08:03 0001cf62 1 ... 200 67 CLR In    : '67' lci 001 C/D 0900
000199 16:08:11 0001cfa8 6 ... 200 65 DATA In   : '65' lci 43f ns/nr 0000
000200 16:08:11 0001cfbo 6 ... 200 65 DATA Out  : '65' lci 43f ns/nr 0001
000201 16:08:12 0001d5c8 3 ... 200 65 RST Out   : '65' lci 43f C/D 00fa
000202 16:08:12 0001d5cb 3 ... 200 65 RSC In    : '65' lci 43f
```

**Notes:**

1. Tracing of an incoming event does not imply that the packet has been accepted by the X.25 driver. This is because tracing of incoming events is triggered on receiving data from the link level. At this point, the packet has still to be verified and, if in error, may be discarded or cause some further protocol action.
2. Similarly, tracing of an outgoing event does not imply that the packet has been sent to the link-level driver. This is because tracing of outgoing events is triggered on requests to send data to the link level. At this point, various consistency checks are performed on the required link-level database, and, if they fail, the packet is discarded.

**LAPB Driver**

**Module Id**     201  
**Sid**             Set to identifier of subnetwork packet tx/rx on  
**Levels**         1 - 4

Four levels of tracing are available.

**Trace Level 1 - Setup and Disconnection Activity**

Monitors all link setup and disconnection events. For each event, a description and the subnetwork ID are logged. For disconnection events, an indication of whether locally or remotely initiated is also logged.

```
LINK Up : '65'  
LINK Dwn : '66' Remote
```

**Trace Level 2 - Reset Activity**

Monitors all link reset events. For each event, a description, the subnetwork ID, and an indication of whether locally and remotely initiated are logged.

```
LINK Rst : '66' Local  
LINK Rst : '65' Remote
```

### Trace Level 3 - Error Activity

Monitors sending and receiving of FRMR and REJ frames. For each event, a description and the subnetwork ID are logged. For FRMR frames, the error flag is also logged. For REJ frames, the send sequence number in error is also logged.

```
FRMR In : '65' Err 01
FRMR Out : '66' Err 08
REJ In : '66' N(007)
REJ Out : '68' N(006)
```

### Trace Level 4 - Busy Activity

Monitors all link busy conditions. For each event, a description, the subnetwork ID, and an indication of whether locally or remotely initiated events are logged.

```
LINK Bsy : '65' Local
LINK Bsy : '66' Remote
```

### Example Trace Logging Output

```
# strace 201 all all
000187 16:07:30 0001c15b 1 ... 201 65 LINK Up : '65'
000188 16:07:30 0001c15b 1 ... 201 65 LINK Dwn : '65' Local
000189 16:08:01 0001cf60 3 ... 201 65 FRMR In : '65' Err 01
000190 16:08:03 0001cf62 2 ... 201 65 LINK Rst : '65' Remote
000197 16:08:06 0001cf6c 3 ... 201 65 REJ Out : '65' N(006)
000198 16:08:06 0001cfa7 4 ... 201 65 LINK Bsy : '65' Local
```

### Notes:

1. Tracing of an incoming event does not imply that the frame has been accepted by the LAPB driver. This is because tracing of incoming events is triggered on receiving data from the WAN. At this point, the frame has still to be verified and, if in error, may be discarded or cause some further protocol action.
2. Tracing of an outgoing event implies that the frame has been sent to the WAN driver. It does not imply that the frame will be transmitted on the line.

### LLC2 Driver

**Module Id** 202  
**Sid** Set to identifier of subnetwork packet tx/rx on  
**Levels** 1 - 5

Five levels of tracing are available.

#### Trace Level 1 - Setup and Disconnection Activity

Monitors all link setup and disconnection events. For each event, a description, the subnetwork ID, and the connection identifier are logged. For disconnection events, an indication of whether locally or remotely initiated is also logged.

```
LINK Up : 'C' Id 001  
LINK Dwn : 'C' Id 002 Remote
```

#### Trace Level 2 - Reset Activity

Monitors all link reset events. For each event, a description, the subnetwork ID, the connection identifier, and an indication of whether locally or remotely initiated are logged.

```
LINK Rst : '68' Id 001 Local  
LINK Rst : '67' Id 021 Remote
```

#### Trace Level 3 - Error Activity

Monitors sending of FRMR and REJ frames. For each event, a description, the subnetwork ID, the connection identifier, and an indication of whether locally or remotely initiated are logged. For FRMR frames, the error flag is also logged. For REJ frames, the send sequence number in error is also logged.

```
FRMR In : '67' Id 010 Err 01  
FRMR Out : '68' Id 009 Err 08  
REJ In : '67' Id 010 N(007)  
REJ Out : '67' Id 023 N(006)
```

**Trace Level 4 - Busy Activity**

Monitors all link busy conditions. For each event, a description, the subnetwork ID, the connection identifier, and an indication of whether locally or remotely initiated are logged.

```
LINK Bsy : '67' Id 012 Local  
LINK Bsy : '67' Id 013 Remote
```

**Trace Level 5 - Type 1 Activity**

The following type 1 events are monitored: sending and receiving of XID and TEST frames. For each event, a description, the subnetwork ID, and the connection identifier are logged.

```
TEST Out : '67' Id 000  
XID In : '67' Id 013  
XID Out : '67' Id 013
```

**Example Trace Logging Output**

```
# strace 202 67 all  
000186 16:07:27 0001c150 5 ... 202 67 XID Out : '67' Id 001  
000187 16:07:30 0001c152 1 ... 202 67 LINK Up : '67' Id 001  
000188 16:07:30 0001c15b 1 ... 202 67 LINK Dwn : '67' Id 010 Local  
000189 16:08:01 0001cf60 3 ... 202 67 FRMR In : '67' Id 038 Err 01  
000190 16:08:03 0001cf62 2 ... 202 67 LINK Rst : '67' Id 231 Remote  
000197 16:08:06 0001cf6c 3 ... 202 67 REJ Out : '67' Id 128 N(006)  
000198 16:08:06 0001cfa7 4 ... 202 67 LINK Bsy : '67' Id 007 Local
```

**Notes:**

1. Tracing of an incoming event does not imply that the frame has been accepted by the LLC2 driver. This is because tracing of incoming events is triggered on receiving data from the Ethernet level. At this point, the frame has still to be verified and, if in error, may be discarded or cause some further protocol action.
2. Tracing of an outgoing event implies that the frame has been sent to the Ethernet driver. It does not imply that the frame will be transmitted on the Ethernet.

### Tracing Summary

Table 8-1 shows the available tracing levels for the three types of drivers:

**Table 8-1** Tracing Levels

Level	X.25 Driver ID 200	LAPB Driver ID 201	LLC2 Driver ID 202
1	Call Setup	Link Up/Down	Link Up/Down
2	Call Clearing	Link Reset	Link Reset
3	Call Reset	Error Activity	Error Activity
4	Restart Activity	Link Busy	Link Busy
5	Interrupt Packets	--	Type 1 Activity
6	Data Packets	--	--

### STREAMS Error Messages

STREAMS error messages can be captured using *strerr* (see the *strerr* (1M) reference page). This receives error messages and appends them to an error log file. This utility is normally run when the system initializes to multiuser state.

The following types of errors are logged:

System errors Errors in the internal workings of the module/driver.

Reference errors

Errors in the references used between upper and lower modules/drivers

Interface errors Errors in messages passed over the interfaces.

Allocation errors

Errors in the allocation of memory for database elements.

The X25 PLP driver, the LAPB driver, and the LLC2 driver of SX.25 currently generate STREAMS error log messages.



## Network Board-Loading (nload) Error Messages

Error *<reason>* in GETDET command

The specified board could not be opened for loading, for the reason stated in *<reason>*. For example, a board has been configured but is not present. Reconfigure the boards using *x25adm ipconfig* and *x25adm x25config*.

Error *<reason>* in EXECUTE command - line *<lineno>* of */var/opt/snet/brdconf*

The program downloaded to the board could not be executed, for the reason stated in *<reason>*. The board can be identified by referring to line number *<lineno>* in */etc/brdconf*. This error may be due to a board crash. Reboot the system.

nload: Invalid address for X.25 (WAN) board on line *<lineno>* of */var/opt/snet/brdconf*

An address has been configured for use on an X.25 (WAN) board. This field should be null. Reconfigure the board using *x25adm x25config*.

## Network Daemon (snetd) Error Messages

attempt to multiplex module *<module>*  
bad format

The */etc/config/snetd.options* file is not in the expected format. Configure the network parameters using *x25adm*.

ECHO\_TYPE ioctl failed:*<reason>*

The Echo/Ethernet registration failed. This may be due to an incorrectly configured Ethernet card.

Reconfigure the Ethernet card.

failed to open *<file>*:*<reason>*

The configuration file *<file>* (default:*/etc/config/snetd.options*) could not be opened, for the reason stated in *<reason>*. The configuration of the Internet address and other network parameters has not been successfully completed.

Configure the network parameters.

failed to open driver *<driver>*:*<reason>*

The lines referring to the driver *<driver>* in the */etc/config/snetd.options* file are wrong. The operation failed for the reason stated in *<reason>*. Configure the network parameters.

failed to open Ethernet Driver:*<reason>*

The Ethernet driver could not be opened, for the reason stated.

failed to open stream *<stream>*:*<reason>*

The lines referring to the stream *<stream>* in the */etc/config/snetd.options* file are wrong. The operation failed for the reason stated in *<reason>*. Configure the network parameters.

failed to link stream *<stream>* under driver *<driver>*:*<reason>*

The lines referring to the stream *<stream>* in the */etc/config/snetd.options* file are wrong. The operation failed for the reason stated in *<reason>*. Configure the network parameters.

failed to push module *<module>*:*<reason>*

The lines referring to the module *<module>* in the */etc/config/snetd.options* file are wrong. The operation failed for the reason stated in *<reason>*. Configure the network parameters.

I\_PUSH (*<module>*):*<reason>*

The kernel module *<module>* could not be pushed onto a stream, for the reason stated in *<reason>*.

IP\_NET\_ADDR ioctl failed

The Internet address, subnet mask, and other parameters on the IP\_NET line in the */etc/config/snetd.options* file have not been correctly configured. This error may also be given if more IP-IXE lines have been configured in the */etc/config/snetd.options* file than are configured in the IXE kernel. This error can only occur if you also have SGI TCP in your network.

Reconfigure the network parameters for this IP network.

IXE\_SNREG ioctl failed

This failure is due to IXE being incorrectly configured. For example, an IP address referring to an IP-IXE link in the */etc/config/snetd.options* does not match the address in the */etc/ixetuneconf* file.

Reconfigure IXE correctly.

must specify 'd' or 'm' flag

One of the flags in a line at the top of the */etc/config/snetd.options* file declaring the name of a driver, cloneable driver, or a module is not valid.

no driver below module <module>

unknown module <module>

The lines referring to the module <module> in the */etc/config/snetd.options* file are wrong.

Configure the network parameters.

unexpected delimiter

The */etc/config/snetd.options* file is not in the expected format.

Configure the network parameters.

non numeric instantiation

The explicit association of multiple instances of a module in the */etc/config/snetd.options* file has a non-numeric label.

out of memory

There is insufficient memory for the data structures required to start the network.

unknown control action: <reason>

The file */etc/config/snetd.options* contains a line with the unknown registration message <reason>

<parameter> arg count (number) wrong!

The number of arguments to the parameter <parameter> in the */etc/config/snetd.options* file is incorrect.

Configure the network parameters.

warning: ignoring <flag> flag

One of the flags in a line at the top of the */etc/config/sneta.options* file declaring the name of a driver, cloneable driver, or a module is not valid.

warning: assuming 'c' flags means driver

One of the flags in a line at the top of the */etc/config/sneta.options* file declaring the name of a driver, cloneable driver, or a module is not valid.

warning: 'm' flag ignored for driver

One of the flags in a line at the top of the */etc/config/sneta.options* file declaring the name of a driver, cloneable driver, or a module is not valid.

warning: 'c' flag ignored for

One of the flags in a line at the top of the */etc/config/sneta.options* file declaring the name of a driver, cloneable driver, or a module is not valid.

---

## Address Formats

### X.121 Addresses

X.25 addresses are X.121 DTE strings that contain a maximum of four fields. The format of the address depends on the type of network and the version of X.25 recommendation that the network uses. Table A-1 illustrates X.121 address formats.

**Table A-1** X.25 Network Address Formats

Network Type	X.25 Version	Address Formats
LAN	1984 and 1988	id.LSAP
		id.LSAP[.N].OSI NSAP id.LSAP.X.non-OSI address extension
WAN	1980	id.DTE id.LCI.P (for permanent virtual circuits)
	1984 and 1988	id.DTE[.N].OSI NSAP id.DTE.X.non-OSI address extension id.LCI.P (for permanent virtual circuits)

The fields in the previous address formats have these meanings:

id	is a single-character (alphanumeric) subnetwork identifier. This identifies a connection to or from the WAN or LAN.
DTE	defines the Subnetwork Point of Attachment (SNPA) for each WAN line. This is entered as an address of up to 15 decimal digits; or, for X.25(88) TOA/NPI addresses, a maximum of 17 decimal digits.
LSAP	defines the SNPA for each LAN line. It comprises the MAC address plus the DSAP address, 14 hexadecimal digits in all:

The MAC address is a unique 12-digit address identifying hosts and devices on the Ethernet; it is also called an Ethernet address. An MAC address looks like this example:

08004e011f37

The DSAP address is the Destination Service Access Point, which is a two-digit address indicating the destination Link Layer service access point.

N or X	is an indicator that identifies the next part of the address as either an OSI NSAP address or a non-OSI address extension.
OSI NSAP	is the Network Service Access Point, the point at which the Network Service is provided. The NSAP address can be up to 40 hexadecimal digits.
non-OSI address extension	indicates that the given address (up to 40 hexadecimal digits) is encoded in the X.25 Call Request packet as an "eXtended" address, that is, non-OSI, as opposed to an NSAP address (OSI).
LCI	is the logical channel identifier, three hexadecimal digits. Pad in front with zeroes if necessary, for example, enter "009" rather than "9". (The "P" that follows indicates that the LCI describes a permanent virtual circuit.)

## Internet Addresses

An Internet address has 32 bits. It can be thought of as containing four fields, each ranging from 0 to 255 (decimal). The four fields are usually represented with "." field delimiters. An Internet Address can be represented as decimal, octal, or hexadecimal:

- Decimal addresses have no prefixes and may not begin with zero. An example is "83.0.0.127".
- Octal addresses begin with a zero. For example, "83.0.0.127" in decimal is "0123.0.0.177" in octal.
- Hexadecimal addresses are preceded by the 0x or 0X prefix. For example, "83.0.0.127" in decimal is "0x53.0x0x0x7F".

---

## Glossary

**CCITT**

International Consultative Committee for Telegraphy and Telephony.

**CONS**

Connection-Oriented Network Service.

**DCE**

Data Circuit-Terminating Equipment.

**DDN**

Defense Data Network.

**DNIC**

Data Network Identification Code.

**DSAP**

Destination Service Access Point.

**DTE**

Data Terminal Equipment. The user equipment (computer, terminal, etc.) connected to a network.

**Ethernet**

Ethernet, or IEEE 802.3, is a network based on an access method called CSMA/CD. Ethernet was originally developed by the Xerox Corporation in 1972. A specification was published in 1980 for other implementors to use.

**Ethernet Address**

A 48-bit station identifier. Each network node has a unique address. The high-order bytes are usually manufacturer-specific. Certain reserved addresses have special meaning.

**getty**

A process that handles incoming calls.

**IEEE**

Institute of Electrical and Electronic Engineers.

**Internet Address**

A 32-bit address used to identify nodes on the network that use the Internet Protocol.

**ISO**

International Organization for Standardization.

**IXE**

IP to X.25 Encapsulation.

**LAN**

A Local Area Network, where several hosts and devices are located near each other and connected physically by cables. Typically, these cables are Ethernet coaxial cables.

**LAP**

Link Access Procedure.

**LAPB**

Link Access Procedure - Balanced.

**LCI**

Logical Channel Identifier.

**LLC**

Logical Link Control.

**LLC-2**

Logical Link Control - Class II.

**LSAP**

Link Service Access Point.



**NLI**

Network Layer Interface.

**NSAP**

Network Service Access Point.

**OSI**

Open Systems Interconnection.

**Packet**

Units of information that contain a header with addresses and handling information and a message. Longer messages can be split up into several different packets and sent separately.

**PAD**

Packet Assembler/Disassembler. A means of interfacing a character terminal to an X.25-based network.

**PDU**

Protocol Data Unit.

**PVC**

Permanent Virtual Circuit.

**RFC**

A "Request for Comment" discussion document, produced by interested parties, which may be adopted as a standard by the Internet Activities Board.

**RPOA**

Recognized Private Operating Agency.

**SNPA**

Subnetwork Point of Attachment.

**SSAP**

Source Service Access Point.

**STREAMS**

A set of system calls, kernel resources, and utility routines that create, use, and dismantle a stream.

**Subnetwork**

In this document, this term refers to a single physical DTE/DCE link or a single physical Ethernet link.

**TOA/NPI**

Type Of Address / Numbering Plan Identification. An address format that provides increased addressing capacity suitable for communication with ISDNs.

**VC**

Virtual Call.

**WAN**

Wide Area Network. Computers with long distances between them connected by, for example, telephone lines.

**X.25**

The CCITT recommendations covering network access protocols for ISO layers 1, 2, and 3 made in 1980, 1984, and 1988.

**X.3, X.28, X.29**

The CCITT recommendations covering PAD operation made in 1980, 1984, and 1988.

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# Index

## A

Acknowledgment Delay, 93  
Acknowledgment Timer, 110, 116

## B

broadcast packets, 9  
Busy-state Timer, 111, 117

## C

CCITT, 9, 57  
Closed User Groups, 99  
CUD fields, 58

## D

data link level (X.25 level 2 protocol), 6  
Data Network Identification Code, 103  
D-Bit Control, 103  
DDN, 10, 57, 99  
Destination Service Access Point, 132  
Devices file, 80  
Dialcodes file, 80  
Dialers file, 81  
DTE, 131  
DTE address, 6

## E

error messages, 127  
/etc/config/snetd.options file, 127  
/etc/netconf file, 128  
Ethernet driver, 125, 128

## F

frames, 6  
FRMR frames, 124

## I

international call priority, 103  
international call recognition, 101  
Internet address, 56, 132  
IP address, 129  
IRIX Admin: Networking and Mail, 81  
ISO 8208, 97  
IXE driver, 9

## L

LAPB driver, 122, 123  
levels (protocol). *See also individual protocol names.*, 6  
link level (X.25 level 2 protocol), 6  
LLC-2 driver, 124, 125

localization, 101  
logical channel, 3  
logical channel identifier, 120, 132  
logical channel number, 3  
loopback ports, 34  
LSAP, 131

## M

M-bit, 57, 92  
Modulo 128, 87, 91, 92, 109  
Modulo 8, 87, 91, 92, 109

## N

Network Service Access Point, 132  
network user address, 2  
NSAP address, 132  
NSDU length, 92  
NUA, 2  
Number of Transmissions, 108, 114

## P

packet level (X.25 level 3 protocol), 6  
packet level protocol, 6  
packet size, 91, 97, 105  
P-bit, 110, 116  
permanent virtual circuits, 1, 3  
Permissions file, 81  
physical level (X.25 level 1 protocol), 6  
PLP, 6  
port (definition), 6  
Priority Packet Forced Value, 103

PVC, 3

## R

Reject Timer, 111, 117

## S

snetd program, 127  
Source Address Control, 102  
strace utility, 119  
strerr utility, 126  
subnet ID, 6  
subnet mask, 56  
subnetwork ID, 120, 131  
subnetwork modes, 101  
Subnetwork Point of Attachment, 131  
SVC, 3  
switched virtual circuit, 3  
Systems file, 81

## T

TCP/IP, 128  
TELENET, 98, 105  
TEST frames, 125  
throughput class, 3, 105  
timer parameters, 92  
Transmit Probe, 109, 115  
troubleshooting, 119

## U

UUCP configuration, 79

**V**

virtual calls, 1  
virtual circuit, 3  
virtual circuits, 9

**W**

WAN driver, 123  
window size, 3, 91, 109, 115

**X**

X.121 string, 131  
X.25 PLP driver, 120  
X.25 Version, 87  
XID frames, 125  
xty device driver, 79





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