X.25
Low-level Interface

DC 900-1307L

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Preface

Purpose of Document

This document describes how to use the low-level interface to X.25 on Freeway. Although Protogate provides the Data Link Interface (DLI) as a high-level application program interface for Freeway X.25, the DLI itself uses the low-level interface described in this document.

Although intended primarily for use with Freeway X.25, this document also applies to a Protogate intelligent communications processor (ICP) installed as a front-end processor in a host computer, provided that the ICP is loaded with the correct Freeway X.25 services module.

Protogate also provides a high-level X.25 interface (described in the *X.25 Call Service API Guide*) which is adequate for many applications.

Note

In this document, the term "Freeway" can mean either a Freeway server or an embedded ICP. For the embedded ICP, also refer to the user's guide for your ICP and operating system (for example, the *ICP2432 User's Guide for Windows NT*).

Intended Audience

Any programmer who intends to access the Freeway X.25 low-level interface directly from an application program will need the information contained in this document.

Prerequisites

This document describes the exchange of command and response packets between the DLI (or application) in the client and the Freeway X.25 services module loaded on the ICP.

If you are using Protogate's Freeway X.25 with supported client machines, you may use Protogate's transport subsystem interface library to provide packet transport support.

If you are using an embedded ICP, you must use the associated Protogate Toolkit ICP driver to provide the required packet transport support. If no Protogate Toolkit ICP driver is available for your system, you may need to contract with Protogate to provide engineering support services.

Organization of Document

Chapter 1 introduces concepts and terminology used throughout the rest of the document. Read this chapter first, before referring to other chapters.

Chapter 2 lists the types of packets you may write to or receive from Freeway X.25 services. It also describes in detail the events, states, and processing you must implement to successfully use the Freeway X.25 low-level interface.

Chapter 3, Chapter 4, and Chapter 5 describe X.25 protocol configuration options, facilities registration options, and the potential for conflicts between them.

Chapter 6 contains complete information about packet formats. The contents of required header fields and optional data area fields are described in detail.

Appendix A shows the meaning assigned to various X.25 diagnostic codes associated with the quality of service item HF_DIAG.

Appendix B shows the X25ERR.H source code.

The Glossary contains acronyms and terms used in this document.

The Index provides a comprehensive cross reference between Freeway configuration information in Chapter 3 and Chapter 4, and the configuration procedures described in Chapter 6. To locate the cross references, refer to the index entry "**Cross reference**."

Protogate References

The following general product documentation list is to familiarize you with the available Protogate Freeway and embedded ICP products. The applicable product-specific reference documents are mentioned throughout each document (also refer to the "readme" file shipped with each product). Most documents are available on-line at Protogate's web site, www.protogate.com.

General Product Overviews

- *ICP2432 Technical Overview* 25-000-0420
- *ICP6000X Technical Overview* 25-000-0522

Hardware Support

- *Freeway 1100/1150 Hardware Installation Guide* DC 900-1370
- *Freeway 1200/1300 Hardware Installation Guide* DC 900-1537
- *Freeway 2000/4000 Hardware Installation Guide* DC 900-1331
- *Freeway 8800 Hardware Installation Guide* DC 900-1553
- *Freeway ICP6000R/ICP6000X Hardware Description* DC 900-1020
- *ICP6000(X)/ICP9000(X) Hardware Description and Theory of Operation* DC 900-0408
- *ICP2424 Hardware Description and Theory of Operation* DC 900-1328
- *ICP2432 Hardware Description and Theory of Operation* DC 900-1501
- *ICP2432 Hardware Installation Guide* DC 900-1502

Freeway Software Installation Support

- *Freeway Release Addendum: Client Platforms* DC 900-1555
- *Freeway User's Guide* DC 900-1333
- *Loopback Test Procedures* DC 900-1533

Embedded ICP Installation and Programming Support

- *ICP2432 User's Guide for Digital UNIX* — DC 900-1513
- *ICP2432 User's Guide for OpenVMS Alpha* — DC 900-1511
- *ICP2432 User's Guide for OpenVMS Alpha (DLITE Interface)* — DC 900-1516
- *ICP2432 User's Guide for Solaris STREAMS* — DC 900-1512
- *ICP2432 User's Guide for Windows NT* — DC 900-1510
- *ICP2432 User's Guide for Windows NT (DLITE Interface)* — DC 900-1514

Application Program Interface (API) Programming Support

- *Freeway Data Link Interface Reference Guide* — DC 900-1385
- *Freeway Transport Subsystem Interface Reference Guide* — DC 900-1386
- *QIO/SQIO API Reference Guide* — DC 900-1355

Socket Interface Programming Support

- *Freeway Client-Server Interface Control Document* — DC 900-1303

Toolkit Programming Support

- *Freeway Server-Resident Application and Server Toolkit Programmer's Guide* — DC 900-1325
- *OS/Impact Programmer's Guide* — DC 900-1030
- *Protocol Software Toolkit Programmer's Guide* — DC 900-1338

Protocol Support

- *ADCCP NRM Programmer's Guide* — DC 900-1317
- *Asynchronous Wire Service (AWS) Programmer's Guide* — DC 900-1324
- *Addendum: Embedded ICP2432 AWS Programmer's Guide* — DC 900-1557
- *AUTODIN Programmer's Guide* — DC 908-1558
- *Bit-Stream Protocol Programmer's Guide* — DC 900-1574
- *BSC Programmer's Guide* — DC 900-1340
- *BSCDEMO User's Guide* — DC 900-1349
- *BSCTRAN Programmer's Guide* — DC 900-1406
- *DDCMP Programmer's Guide* — DC 900-1343
- *FMP Programmer's Guide* — DC 900-1339

- *Military/Government Protocols Programmer's Guide* DC 900-1602
- *N/SP-STD-1200B Programmer's Guide* DC 908-1359
- *SIO STD-1300 Programmer's Guide* DC 908-1559
- *X.25 Call Service API Guide* DC 900-1392
- *X.25/HDLC Configuration Guide* DC 900-1345
- *X.25 Low-Level Interface* DC 900-1307

Document Conventions

This document follows the most significant byte first (MSB) and most significant word first (MSW) conventions for byte ordering. This is commonly called network order or Big Endian order, which is the native byte order for Freeway X.25. If, however, your system follows other conventions, you may still use Freeway X.25. See Chapter 6 for details on how to declare your system's native ordering to Freeway X.25 services.

The term "Freeway" refers to any of the Freeway server models (for example, Freeway 500/3100/3200/3400 PCI-bus servers, Freeway 1000 ISA-bus servers, or Freeway 2000/4000/8800 VME-bus servers). References to "Freeway" also may apply to an embedded ICP product using DLITE (for example, the embedded ICP2432 using DLITE on a Windows NT system).

Physical "ports" on the ICPs are logically referred to as "links." However, since port and link numbers are usually identical (that is, port 0 is the same as link 0), this document uses the term "link."

Program code samples are written in the "C" programming language.

Revision History

The revision history of the *X.25 Low-level Interface*, Protogate document DC 900-1307L, is recorded below:

Revision	Release Date	Description
DC 900-1307A	August 1994	Original release.
DC 900-1307B	October 1994	Add information about Freeway 1000.
DC 900-1307C	November 1994	Update file names.
DC 900-1307D	December 1994	Add index Alphabetize sections in Chapter 6.
DC 900-1307E	February 1995	Minor formatting changes.
DC 900-1307F	September 1996	Minor changes for 2.4.1 server release.
DC 900-1307G	November 1996	Section 6.2.14 DLI_X25_HOST_CLOSE_SESSION_REQ: Change PROTHDR.usProtLinkID to say ICP physical port ID (0-*n*).
DC 900-1307H	March 1998	Modify Section 1.1 through Section 1.4. Restore Communication and Segmentation buffer size information to Revision E level (Chapter 3 and Chapter 6). Clarify EIA information (Section 3.4.15 on page 93). Add notes on page 83 and page 90.
DC 900-1307I	April 1998	Add EIA Mil-Std 188C support (Section 3.4.15 on page 93 and Section 6.2.11.1 on page 157).
DC 900-1307J	November 1998	Add exceptions monitoring to Section 6.2.27 on page 180. Add 32-bit statistics reporting (Section 6.2.2 on page 140, Section 6.2.1 on page 137, and Section 6.3.1 on page 197).
DC 900-1307K	June 1999	Add HF_ICF_CALLBUSY qos parameter (page 254 and Table 6–10 on page 248).
DC 900-1307L	October 2004	Update contact information for Protogate. Add four commands/responses for SAP_SLP services: DLI_X25_HOST_TEST_FRAME (Section 6.2.35 on page 192) DLI_X25_HOST_UNNUMBERED_DATA (Section 6.2.36 on page 193) DLI_X25_ICP_TEST_FRAME (Section 6.3.35 on page 244) DLI_X25_ICP_UNNUMBERED_DATA (Section 6.3.36 on page 245)

Customer Support

If you are having trouble with any Protogate product, call us at (858) 451-0865 Monday through Friday between 8 a.m. and 5 p.m. Pacific time.

You can also fax your questions to us at (877) 473-0190 any time. Please include a cover sheet addressed to “Customer Service.”

We are always interested in suggestions for improving our products. You can use the report form in the back of this manual to send us your recommendations.

Chapter 1

Introduction

1.1 Product Overview

Protogate provides a variety of wide-area network (WAN) connectivity solutions for real-time financial, defense, telecommunications, and process-control applications. Protogate's Freeway server offers flexibility and ease of programming using a variety of LAN-based server hardware platforms. Now a consistent and compatible embedded intelligent communications processor (ICP) product offers the same functionality as the Freeway server, allowing individual client computers to connect directly to the WAN.

Both Freeway and the embedded ICP use the same data link interface (DLI). Therefore, migration between the two environments simply requires linking your client application with the proper library. Various client operating systems are supported (for example, UNIX, VMS, and Windows NT).

Protogate protocols that run on the ICPs are independent of the client operating system and the hardware platform (Freeway or embedded ICP).

1.1.1 Freeway Server

Protogate's Freeway communications servers enable client applications on a local-area network (LAN) to access specialized WANs through the DLI. The Freeway server can be any of several models (for example, Freeway 1100/1150, Freeway 1200/1300, Freeway 2000/4000, or Freeway 8000/8800). The Freeway server is user programmable and communicates in real time. It provides multiple data links and a variety of network services to LAN-based clients. Figure 1–1 shows the Freeway configuration.

To maintain high data throughput, Freeway uses a multi-processor architecture to support the LAN and WAN services. The LAN interface is managed by a single-board computer, called the server processor. It uses the commercially available BSD Unix operating system to provide a full-featured base for the LAN interface and layered services needed by Freeway.

Freeway can be configured with multiple WAN interface processor boards, each of which is a Protogate ICP. Each ICP runs the communication protocol software using Protogate's real-time operating system.

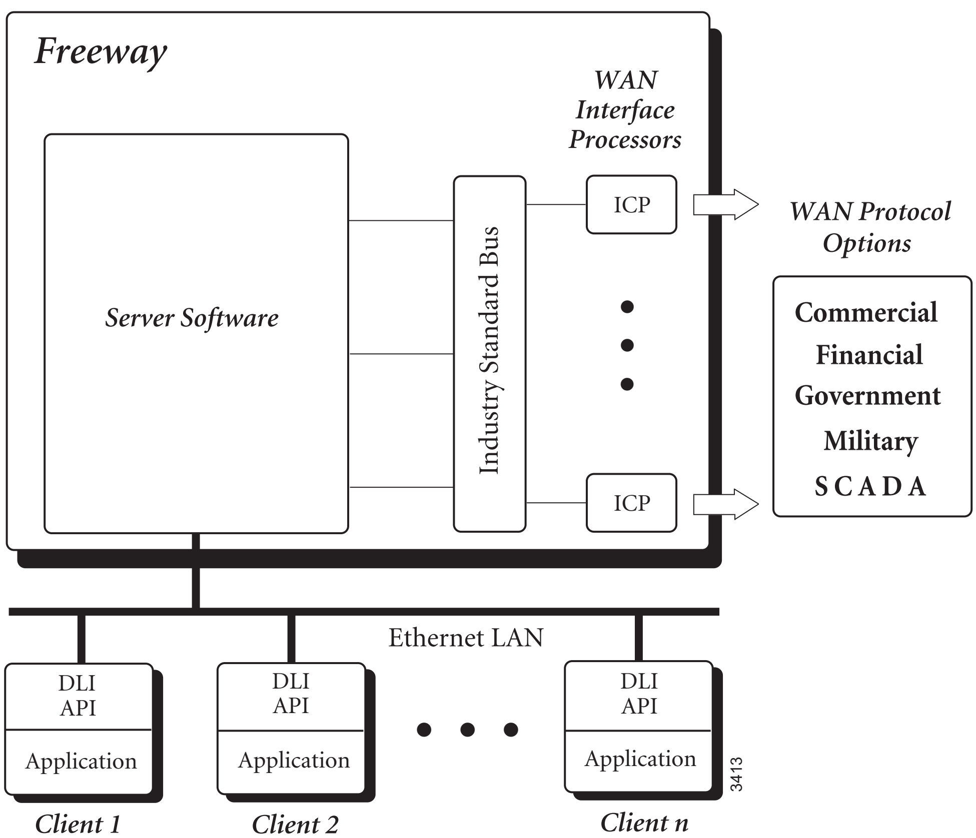

Figure 1–1: Freeway Configuration

1.1.2 Embedded ICP

The embedded ICP connects your client computer directly to the WAN (for example, using Protogate's ICP2432B PCIbus board). The embedded ICP provides client applications with the same WAN connectivity as the Freeway server, using the same data link interface (via the DLITE embedded interface). The ICP runs the communication protocol software using Protogate's real-time operating system. Figure 1–2 shows the embedded ICP configuration.

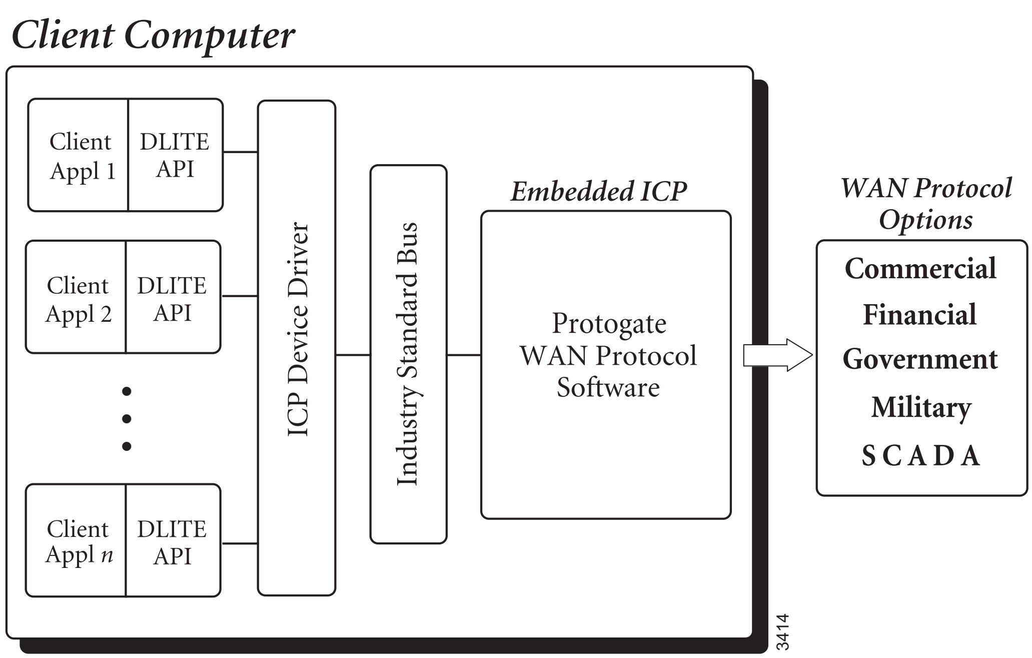

Figure 1–2: Embedded ICP Configuration

Summary of product features:

- Provision of WAN connectivity either through a LAN-based Freeway server or directly using an embedded ICP
- Elimination of difficult LAN and WAN programming and systems integration by providing a powerful and consistent data link interface
- Variety of off-the-shelf communication protocols available from Protogate which are independent of the client operating system and hardware platform
- Support for multiple WAN communication protocols simultaneously
- Support for multiple ICPs (two, four, eight, or sixteen communication lines per ICP)
- Wide selection of electrical interfaces including EIA-232, EIA-449, EIA-530, and V.35
- Creation of customized server-resident and ICP-resident software, using Protogate's software development toolkits
- Freeway server standard support for Ethernet and Fast Ethernet LANs running the transmission control protocol/internet protocol (TCP/IP)
- Freeway server standard support for FDDI LANs running the transmission control protocol/ internet protocol (TCP/IP)
- Freeway server management and performance monitoring with the simple network management protocol (SNMP), as well as interactive menus available through a local console, telnet, or rlogin

1.2 Freeway Client-Server Environment

The Freeway server acts as a gateway that connects a client on a local-area network to a wide-area network. Through Freeway, a client application can exchange data with a remote data link application. Your client application must interact with the Freeway server and its resident ICPs before exchanging data with the remote data link application.

One of the major Freeway server components is the message multiplexor (MsgMux) that manages the data traffic between the LAN and the WAN environments. The client application typically interacts with the Freeway MsgMux through a TCP/IP BSD-style socket interface (or a shared-memory interface if it is a server-resident application (SRA)). The ICPs interact with the MsgMux through the DMA and/or shared-memory interface of the industry-standard bus to exchange WAN data. From the client application's point of view, these complexities are handled through a simple and consistent data link interface (DLI), which provides dlOpen, dlWrite, dlRead, and dlClose functions.

Figure 1–3 shows a typical Freeway connected to a locally attached client by a TCP/IP network across an Ethernet LAN interface. Running a client application in the Freeway client-server environment requires the basic steps described in Section 1.2.1 and Section 1.4.

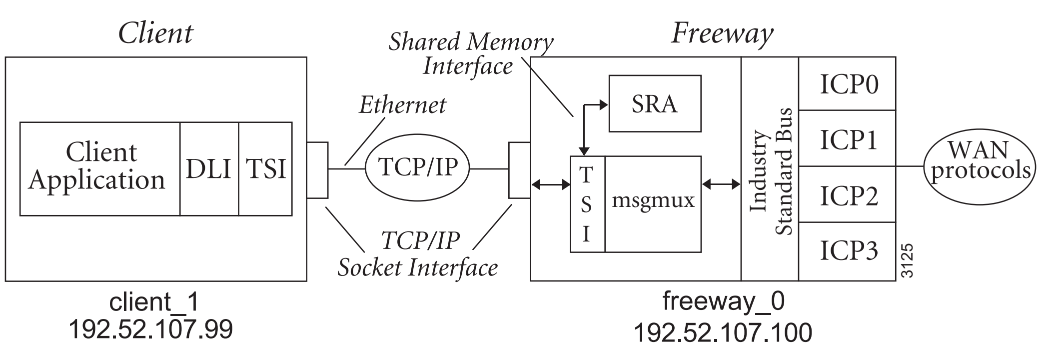

Figure 1–3: A Typical Freeway Server Environment

1.2.1 Establishing Freeway Server Internet Addresses

The Freeway server must be addressable in order for a client application to communicate with it. In the Figure 1–3 example, the TCP/IP Freeway server name is freeway2, and its unique Internet address is 192.52.107.100. The client machine where the client application resides is client1, and its unique Internet address is 192.52.107.99. Refer to the *Freeway User's Guide* to initially set up your Freeway and download the operating system, server, and protocol software.

1.3 Embedded ICP Environment

Refer to the user's guide for your embedded ICP and operating system (for example, the *Freeway Embedded ICP2432 User's Guide for Windows NT*) for software installation and setup instructions. The user's guide also gives additional information regarding the data link interface (DLI) and embedded programming interface descriptions for your specific embedded environment. Refer back to Figure 1–2 on page 23 for a diagram of the embedded ICP environment. Running a client application in the embedded ICP environment requires the basic steps described in Section 1.4

1.4 Client Operations

1.4.1 Defining the DLI and TSI Configuration

In order for your client application to communicate with the ICP's protocol software, you must define the DLI sessions and the transport subsystem interface (TSI) connections between your client application and Freeway (or an embedded ICP). To accomplish this, you first define the configuration parameters in DLI and TSI ASCII configuration files, and then you run two preprocessor programs, dlicfg and tsicfg, to create binary configuration files. The dlInit function uses the binary configuration files to initialize the DLI environment.

1.4.2 Opening a Session

After the DLI and TSI configurations are properly defined, your client application uses the dlOpen function to establish a DLI session with an ICP link. As part of the session establishment process, the DLI establishes a TSI connection with the Freeway MsgMux through the TCP/IP BSD-style socket interface for the Freeway server, or directly to the ICP driver for the embedded ICP environment.

1.4.3 Exchanging Data with the Remote Application

After the link is enabled, the client application can exchange data with the remote application using the dlWrite and dlRead functions.

1.4.4 Closing a Session

When your application finishes exchanging data with the remote application, it calls the dlClose function to disable the ICP link, close the session with the ICP, and disconnect from the Freeway server or the embedded ICP driver.

1.5 Getting Started

Before you can configure or use Freeway communications services, you must make sure the following prerequisites have been met:

Install the Freeway Hardware. Freeway must be physically connected to an Ethernet local-area network that is logically accessible to both the boot server system and the intended client workstation. If you intend to verify the installation later, you must also install Protogate external loopback cables between the odd and even link pairs you want to test. Refer to the *Freeway 2000/4000 Hardware Installation Guide* and the *Freeway User's Guide*.

Download the X.25/HDLC Software. Freeway is a programmable communications server that has software you must download after any power-up or hardware reset. Protogate provides software that supports both the X.25 and HDLC protocols.

Read the *Freeway User's Guide* for instructions on how to set up your boot server system to respond to Freeway requests for software download.

1.6 Overview of X.25/HDLC

This document describes the procedures required to properly configure the Freeway X.25 protocol service and to access X.25 virtual circuits through Freeway. It also describes configuration procedures for the Freeway high-level data link control (HDLC) protocol service, which bypasses the X.25 protocol service to use HDLC services directly. Figure 1–4 shows examples of Freeway X.25 and HDLC connections.

1.6.1 X.25 Protocol Summary

The X.25 protocol is based on the International Standards Organization (ISO) seven-layer model for open systems interconnect and implements the first three layers of this model. From the lowest, most "primitive" level, the seven levels of the ISO model are defined as follows:

1. **Physical level** — This level defines the line characteristics for the physical connection.

2. **Link (frame) level** — This level defines a bit- or byte-oriented protocol for information exchange, acknowledgment, error detection, and retransmission on the data link.

3. **Network (packet) level** — This level defines a higher-level protocol to provide the multiplexing function required to route information between a local user and a remote user over the data link.

4. **Transport level** — This level ensures the integrity of user-to-user data transfer, including all required error recovery not handled at lower levels.

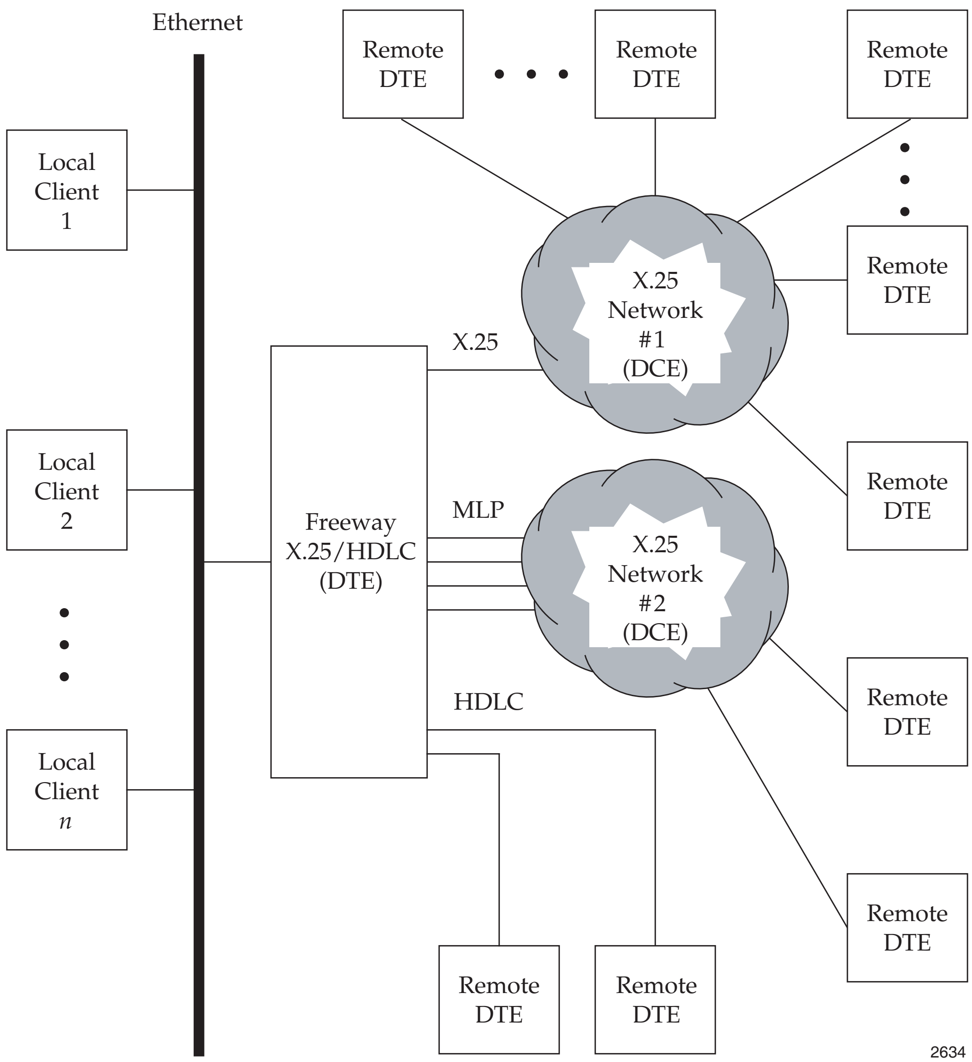

Figure 1–4: Freeway X.25 and HDLC Connections

5. **Session level** This level handles the establishment and termination of the virtual connection between two users.

6. **Presentation level** This level handles data format translation between the user's data format and the network's data format.

7. **Application level** This is the user level.

At the physical level, X.25 offers two choices: X.21/V.11 or X.21 bis. For more information, refer to the CCITT X.25 reference documents. Protogate's default X.25 physical-level interface is X.21 bis, which is available in EIA-232, EIA-449, EIA-530, or V.35 format.

At the link level, referred to as the frame level or single link procedure (SLP) in this document, X.25 employs the HDLC LAPB[1] protocol. HDLC LAPB is a standard, full-duplex protocol that simplifies the exchange of information between computers by using network or direct connections. It provides link-level functions such as link connect, link reset, link disconnect, information exchange, frame acknowledgment, information flow control, frame sequence number generation and checking, frame check sequence (FCS) generation and error detection, frame rejection, and frame retransmission. The content of information exchanged on the link is unknown (transparent) at this level and does not affect link operation.

At the network level (referred to as the packet level in this document), X.25 provides a method for establishing a logical channel (a virtual circuit or data path) between the local data terminal equipment (DTE) and a remote DTE elsewhere on the X.25 network. A DTE may operate several such logical channels to different remote DTEs simultaneously. The data exchange on each logical channel is unaffected by that on other logical channels. Data exchange on all logical channels (at the packet level) is statistically multiplexed transparently at the frame level.

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1. High-level Data Link Control Link Access Procedure Balanced

Implementation of the ISO levels 4 through 7 is the responsibility of the client application.

1.6.2 Multilink Procedures

Both the 1984 and 1988 CCITT recommendations for X.25 and the ISO 7776 standard support the optional use of a multilink procedure (MLP) to allow packet-level traffic to be distributed across more than one physical data link. When the multilink procedure is enabled, the packet level sends and receives data by means of the MLP rather than interfacing directly with the frame-level SLP.

MLP operation provides the following features:

Bandwidth economy Although a network DCE may arbitrarily limit the bandwidth of each HDLC LAPB data link, MLP permits the DTE to increase the effective bandwidth of its network interface by coordinating the use of several physical data links simultaneously to implement a single logical DTE/DCE interface with a bandwidth equal to the sum of the individual data link bandwidths.

Load-sharing MLP management of the logical DTE/DCE interface ensures that X.25 demands for transmission bandwidth are evenly distributed across all available data links under MLP control.

Reliability MLP operation includes a sophisticated fail-over feature that gracefully handles data link failure by shifting the transmission load to other active data links without losing data.

Graceful degradation The reliability of the MLP results in a graceful degradation of service when a data link fails or is taken off-line for maintenance.

With respect to the ISO seven-layer model, MLP logic is on the thin line between the frame level and the packet level. MLP logic relies heavily on frame-level (SLP) indications of successful or unsuccessful transmission, MLP-level timers, and MLP-level sequence numbers to support DCE/DTE packet-level operation by means of the MLP/SLPs transmission pathway.

Note

The Protogate X.25 protocol services provide *optional* support for multilink procedures. The HDLC protocol services do not support multilink procedures.

1.6.3 DTE and DCE

When X.25 is used with a network, the connection to the network is made through data circuit-terminating equipment (DCE). The computer connected to the network is referred to as data terminal equipment (DTE). In this environment, each X.25 interface in the network has a DTE-to-DCE connection. The remote DTEs are attached to a different DCE elsewhere on the network.

When X.25 is used for a direct point-to-point connection between computers, it is DTE-to-DTE. One end of the connection must be configured to play the role of the DCE while the other remains a DTE. The differences between the DCE and the DTE in this environment are primarily found in the characteristics of the HDLC frame addressing. Other behavioral traits of a genuine network DCE are not necessarily preserved in the point-to-point environment.

The designation of a call as *incoming* or *outgoing* is always from the perspective of the DTE. When Freeway is configured to adopt the role of the DCE, it also adjusts its definition of incoming and outgoing calls to fit the perspective of the other DTE. For more information on incoming and outgoing calls, see Section 1.6.6 on page 35.

1.6.4 Freeway Configuration and Startup Steps

After Freeway hardware and software installation and downloading of the X.25 software to the ICP, the system administrator must configure the required X.25 and/or HDLC parameters before the associated protocol service(s) can be used to establish connections and transfer data.

Configuration of the X.25 protocol service must be requested by a DLI_X25_MGR_API client using the service access point for X.25 (DLI_X25_SAP_X25), and includes the following steps:

1. Send DLI_X25_HOST_CFG_BUF packet to configure buffer and station resource limits
2. Send DLI_X25_HOST_CFG_LINK packet to configure data links
3. Send DLI_X25_HOST_CFG_MLP packet to configure X.25 multilink procedures (optional)
4. Send DLI_X25_HOST_CFG_CALL_SERVICE packet to configure X.25 call service (optional)
5. Send DLI_X25_HOST_CFG_LINK packet to configure X.25 stations for each link (optional)
6. Send DLI_X25_HOST_ENABLE_LINK packet to enable X.25 data links

Note

Buffer configuration through the X.25 service access point is also performed before HDLC data link configuration.

Configuration of the HDLC protocol service must be requested by a DLI_X25_MGR_API client using the service access point for HDLC (DLI_X25_SAP_SLP), and includes the following steps:

1. Send DLI_X25_HOST_CFG_LINK packet to configure data links
2. Send DLI_X25_HOST_CFG_CALL_SERVICE packet to configure TL1 link activation timer (optional)
3. Send DLI_X25_HOST_CFG_CALL_SERVICE packet to configure modem control signal monitoring (optional)

For descriptions of the configuration options, see Chapter 3. For descriptions of the configuration packets, see Chapter 6.

1.6.5 Permanent Virtual Circuit

A permanent virtual circuit (PVC) provides a non-switched virtual circuit between a DLI_X25_SAP_X25 DLI_X25_USER_API client and the remote host. The data transfer state is active immediately after a successful DLI_X25_HOST_OPEN_PVC request. The circuit can be reset, but cannot be disconnected in the normal sense. Instead, the client terminates a PVC by issuing a DLI_X25_HOST_CLOSE_PVC request. The circuit can be reset either by the client or by the remote host. See Section 2.2.3.5 on page 63 (PVC Session States), Section 2.2.3.8 on page 72 (PVC/SVC Data Transfer States), and Section 2.2.3.9 on page 77 (PVC/SVC Interrupt Transfer).

Freeway manages a PVC that is not currently opened by a client as follows. Data received from the network DCE is held without acknowledging it on the network until a client opens the PVC. When a client opens a PVC, all data currently being held is delivered to the client and the data is acknowledged on the network. If an X.25 restart condition occurs, or if the server detects a network DCE-reset indication for that PVC, the server discards any data currently being held and finishes the normal restart/reset processing.

1.6.6 Switched Virtual Circuit

A switched virtual circuit (SVC) provides a dynamically set up virtual circuit between a DLI_X25_SAP_X25 DLI_X25_USER_API client and a specified remote host. The method of communication requires that the connection be explicitly established by the client before data transfer occurs. The circuit can be reset or disconnected either by the client or by the remote host.

1.6.6.1 Outgoing SVC Calls

Freeway X.25 allows client applications to initiate a switched virtual circuit (SVC) connection to a remote host by sending a DLI_X25_HOST_CALL_REQ packet to Freeway. See Section 2.2.3.6 on page 65 (SVC Outgoing Call States).

1.6.6.2 Incoming SVC Calls

Freeway X.25 allows client applications to receive and handle incoming SVC connection indications (calls) from remote hosts. This ability is provided by allowing the client to register an incoming call filter with the X.25 protocol service; the client then listens for incoming connection indications from that X.25 protocol service.

A client application indicates its desire to receive incoming connection indications by sending an incoming connection handler (DLI_X25_HOST_ADD_INCALL_FILTER packet) specifying optional filtering information to be compared against the characteristics of incoming connections. The X.25 protocol service returns a DLI_X25_ICP_ACK packet and inserts the client's registration into an internal list of incoming call filters.

If no optional filtering information was provided when the client registered an incoming connection handler, the filter matches all incoming connection indications, and the service sends the call information back to the associated client.

If the registered filtering information matches the characteristics of an incoming connection indication when the X.25 protocol service receives one, the service sends the call information back to the associated client in a DLI_X25_ICP_AUTO_CONNECT or DLI_X25_ICP_INCOMING_CALL packet.

If the client receives a DLI_X25_ICP_AUTO_CONNECT packet, it is permitted to send and receive data immediately.

If the client receives a DLI_X25_ICP_INCOMING_CALL packet, it must take one of the following actions:

1. Accept the connection. The client has determined that it wants to communicate with the remote host, so it sends a DLI_X25_HOST_CALL_ACCEPTED packet to establish the connection.

2. Refuse the connection. The client has determined that the connection should not be established and sends a DLI_X25_HOST_CLR_REQ packet.

3. Redirect the connection. The client has determined that it does not want to accept the connection, but it will allow other clients to accept the connection if they desire. It sends a DLI_X25_HOST_REDIRECT packet that causes the X.25 protocol service to continue scanning the internal list of incoming call filters from the current location for other clients whose filters match the characteristics of the incoming connection.

4. Pass the incoming connection information to another client, which can perform one of the three handling functions itself. This is done using the PROTHDR.circuit field value, which is a unique identifier reported with the incoming connection indication. The PROTHDR.circuit field value is used in the DLI_X25_HOST_CALL-_ACCEPTED, DLI_X25_HOST_CLR_REQ, and DLI_X25_HOST_REDIRECT packets to identify the call that is being handled; any client that has the correct PROTHDR.circuit field value can perform one of these functions.

Freeway X.25 does not apply a timeout to the connection indications. The client can hold that indication without taking action on it for as long as is desired. It should be noted, however, that many X.25 networks impose a timeout on connection indications; the client should be prepared to receive a DLI_X25_ICP_CLR_INDICATION packet indicating that the X.25 network has cancelled the incoming connection indication already.

After the client accepts an incoming connection indication, Freeway marks the client as busy. While the client is busy with one connection, the X.25 protocol service places any additional connection indications for that client on hold, unless specifically configured to redirect such calls. This is useful to a client designed to intercept each incoming connection indication and validate it further before passing its call PROTHDR.circuit field value to another client authorized to handle the call.

Any client that does not want additional incoming connection indications to be placed on hold may send a DLI_X25_HOST_DEL_INCALL_FILTER packet to delete its registered incoming call filter. Later, after the connection is disconnected, the client might again send a DLI_X25_HOST_DEL_INCALL_FILTER packet to indicate its readiness to handle another incoming connection indication. However, if the client uses the HF_ICF_CALLBUSY quality of service parameter to configure the incoming call filter to redirect calls when busy, then the application need not send DLI_X25_HOST_DEL_INCALL_FILTER to avoid placing calls on hold.

1.6.7 Quality of Service

The quality of service (qos) is a specification of the characteristics of the X.25 connection. The qos specifications can include X.25 call service facilities, virtual circuit local priority, X.25 cause and diagnostic codes for circuit clear or reset events, or incoming connection (X.25 call indication) filter specifications. The available qos characteristics allow a client to determine or negotiate the characteristics of transmission needed to communicate with the remote host. For more information on the use of the qos specification, see Section 6.4 on page 247.

1.6.8 Fast Select Call Transactions

Transaction processing applications for which the data transfer requirement is very small (128 bytes or less) can decrease the total X.25 overhead by using X.25 SVC fast-select facilities. These facilities allow the X.25 call request to include up to 128 bytes of user data, such as a data base query request. The call recipient also returns up to 128 bytes of user data in an X.25 clear request.

The value of the fast-select operation is that the transfer of the 128 byte query and response data does not require the acceptance of the call. Contrast this with the overhead required to establish an SVC call, exchange the query and response data after the call is accepted, then terminate the SVC connection. The result is that fast-select procedures can be used to reduce a simple query and response exchange from six X.25 packets to only two X.25 packets.

The procedures for using X.25 fast select are the same as those for handling normal SVC calls, except that the call recipient usually sends a DLI_X25_HOST_CLR_REQ packet rather than a DLI_X25_HOST_CALL_ACCEPTED packet. The qos parameters in the DLI_X25_HOST_CALL_REQ packet must specify both the X.25 fast-select facility and the user query data. The qos parameters in the DLI_X25_HOST_CLR_REQ packet specify the user response data.

Chapter

2 X.25 Programming Requirements

This chapter lists the types of packets that are defined for the Freeway X.25 low-level interface, and describes the hierarchical state machine you must implement to correctly manage this interface. You may implement this state machine within your application. Section 2.3 on page 80 describes practical considerations and different client environments which could affect your choice of implementation.

2.1 Packet Types

We use a distinct mnemonic name for each type of packet you may send to or receive from the Freeway X.25 services. All packets that may be sent are identified by a mnemonic that begins with DLI_X25_HOST. All packets that may be received are identified by a mnemonic that begins with DLI_X25_ICP. Table 2–1 and Table 2–2 show the correspondence between the command or response number, mnemonic name, and description for each supported packet type. See Chapter 6 for complete details on the format of each type of packet.

Table 2–1: Packets (Commands) Sent to Freeway X.25 Services

Cmd #	Mnemonic	Description
1	DLI_X25_HOST_CALL_REQ	Host SVC call request
3	DLI_X25_HOST_CALL_ACCEPTED	Host SVC call accepted
5	DLI_X25_HOST_CLR_REQ	Host SVC clear request
9	DLI_X25_HOST_RESET_REQ	Host SVC/PVC reset request
11	DLI_X25_HOST_RESET_CONFIRMED	Host SVC/PVC reset confirmation
13	DLI_X25_HOST_INIT_SLP	Host SLP reset request
14	DLI_X25_HOST_UNNUMBERED_DATA	Host SLP unnumbered data
15	DLI_X25_HOST_32BIT_SAMPLE_STATISTICS	Host sample 32-bit statistics request
17	DLI_X25_HOST_DATA	Host SVC/PVC normal data
19	DLI_X25_HOST_INTERRUPT	Host SVC/PVC interrupt data
21	DLI_X25_HOST_INT_CONFIRMED	Host SVC/PVC interrupt confirmation
23	DLI_X25_HOST_ENABLE_LINK	Host SLP enable request
25	DLI_X25_HOST_DISABLE_LINK	Host SLP disable request
27	DLI_X25_HOST_CFG_LINK	Host communications configuration request
29	DLI_X25_HOST_ADD_INCALL_FILTER	Host register SVC incoming call filter
31	DLI_X25_HOST_DEL_INCALL_FILTER	Host delete SVC incoming call filter
33	DLI_X25_HOST_GET_STATISTICS	Host read statistics request
37	DLI_X25_HOST_CFG_BUF	Host buffer & station resources config. request
41	DLI_X25_HOST_ABORT	Host SVC abort request
43	DLI_X25_HOST_CFG_CALL_SERVICE	Host call service configuration request
45	DLI_X25_HOST_CFG_MLP	Host multilink procedures configuration request
47	DLI_X25_HOST_REDIRECT	Host SVC call redirect request
51	DLI_X25_HOST_32BIT_GET_STATISTICS	Host read and clear 32-bit statistics request
53	DLI_X25_HOST_MONITOR_REG	Host configure line analyzer monitor
55	DLI_X25_HOST_GET_VERSION	Host X.25 software version request
57	DLI_X25_HOST_CLR_STATISTICS	Host clear statistics request
59	DLI_X25_HOST_SAMPLE_STATISTICS	Host sample statistics request
61	DLI_X25_HOST_ADJUST_FLOW_CONTROL	Host SVC/PVC adjust flow request
63	DLI_X25_HOST_OPEN_PVC	Host open PVC request
65	DLI_X25_HOST_CLOSE_PVC	Host close PVC request
69	DLI_X25_HOST_CTL_LINE_STATE_REQ	Host control line query request
71	DLI_X25_HOST_REGISTER	Host X.25 facilities registration request
77	DLI_X25_HOST_TEST_FRAME	Host SLP TEST frame
81	DLI_X25_HOST_BUF_CLR	Host buffer clearing configuration request
65533	DLI_X25_HOST_CLOSE_SESSION_REQ	Host close client session request
65535	DLI_X25_HOST_OPEN_SESSION_REQ	Host open client session request

Table 2–2: Packets (Responses) Received from Freeway X.25 Services

Rsp #	Mnemonic	Description
2	DLI_X25_ICP_INCOMING_CALL	ICP SVC call indication
4	DLI_X25_ICP_CALL_ACCEPTED	ICP SVC call connected
6	DLI_X25_ICP_CLR_INDICATION	ICP SVC clear indication
8	DLI_X25_ICP_CLR_CONFIRMED	ICP SVC clear confirmation
10	DLI_X25_ICP_RESET_INDICATION	ICP SVC/PVC reset indication
12	DLI_X25_ICP_RESET_CONFIRMED	ICP SVC/PVC reset confirmation
16	DLI_X25_ICP_32BIT_STATISTICS	ICP 32-bit statistics
18	DLI_X25_ICP_DATA	ICP SVC/PVC normal data
20	DLI_X25_ICP_INTERRUPT	ICP SVC/PVC interrupt data
22	DLI_X25_ICP_INT_CONFIRMED	ICP SVC/PVC interrupt confirmation
24	DLI_X25_ICP_LINK_ENABLED	ICP SLP active (online)
26	DLI_X25_ICP_LINK_DISABLED	ICP SLP inactive (offline)
28	DLI_X25_ICP_ROTATE_XMIT_WINDOW	ICP SVC/PVC rotate transmit window
30	DLI_X25_ICP_MLP_SLP_RESET	ICP SLP reset indication/confirmation
32	DLI_X25_ICP_ERROR	ICP SVC/PVC procedure error
34	DLI_X25_ICP_STATISTICS	ICP statistics
36	DLI_X25_ICP_CMD_REJECTED	ICP rejection of host packet
38	DLI_X25_ICP_CFG_BUF_CONFIRMED	ICP buffer configuration confirmation
40	DLI_X25_ICP_ABORT	ICP SVC abort initiated
42	DLI_X25_ICP_STATION_OK	ICP SVC station OK (abort ended)
44	DLI_X25_ICP_STATION_FAILED	ICP SVC station failure
46	DLI_X25_ICP_AUTO_CONNECT	ICP SVC incoming call automatically connected
48	DLI_X25_ICP_CMD_TIMEOUT	ICP SLP timeout notification
50	DLI_X25_ICP_DIAGNOSTICS	ICP X.25 network diagnostic notification
54	DLI_X25_ICP_MONITOR_RSP	ICP line analyzer monitor report
56	DLI_X25_ICP_VERSION	ICP X.25 software version data
62	DLI_X25_ICP_ACK	ICP acknowledgment of host packet
64	DLI_X25_ICP_PVC_OPENED	ICP PVC opened
66	DLI_X25_ICP_PVC_CLOSED	ICP PVC closed
70	DLI_X25_ICP_CTL_LINE_STATE_RSP	ICP control line state (CTS/DCD)
72	DLI_X25_ICP_REGISTERED	ICP X.25 facilities registration confirmation
74	DLI_X25_ICP_SLP_XMIT_OK	ICP SLP transmission successful
76	DLI_X25_ICP_SLP_XMIT_ERROR	ICP SLP transmission failed
78	DLI_X25_ICP_TEST_FRAME	ICP SLP TEST frame
80	DLI_X25_ICP_UNNUMBERED_DATA	ICP SLP unnumbered data
65532	DLI_X25_ICP_SESSION_CLOSED	ICP client session closed
65534	DLI_X25_ICP_SESSION_OPENED	ICP client session opened

2.2 Hierarchical State Machine

The following sections describe a hierarchical state machine you must implement to correctly manage the Freeway X.25 low-level interface. Each processing state table shows rows labeled by packet mnemonic name and columns labeled by processing state. Processing requirements for a given packet mnemonic name and processing state appear in the box positioned at the intersection of the associated row and column in the table. Host packets are those written to the Freeway X.25 services on the ICP, and ICP packets are those read from Freeway by the application.

Where a change of state is required, the new state is shown. If an action is required, the action is shown. If an action and a new state are shown together, both are required.

If you are implementing an API, you may wish to shield your application from selected ICP packets by converting the event to a notification in a different form. For example, because the DLI_X25_ICP_ROTATE_XMIT_WINDOW packet acknowledges one or more DLI_X25_HOST_DATA packets, you may wish to convert DLI_X25_ICP_ROTATE_XMIT_WINDOW packets to application I/O write completion notifications.

As you examine the various state tables shown in the following sections, remember that both the DLI_X25_ICP_ACK packet and the DLI_X25_ICP_CMD_REJECTED packet identify the specific host packet type that is acknowledged or rejected.

2.2.1 Client/Server Session States

Freeway X.25 conforms to the client/server programming model. The Freeway X.25 software on the ICP provides X.25 protocol services to the client API or application software in the host machine. To support multiple clients on multiple host machines, Freeway X.25 requires each client to open a session with the X.25 protocol services on the ICP. The manner in which the client opens a session with the server determines which services are supported for that client, and identifies the client machine's byte ordering preference[1].

Figure 2–1 shows the hierarchy for the states shown in Table 2–3 through Table 2–16. The figure shows that the session state for a specified service access point (SAP) must be S4 before access to the service is allowed. Each service enforces its own hierarchy of substates.

The client selects HDLC LAPB or X.25 protocol services by indicating the required service access point[2] DLI_X25_SAP_SLP or DLI_X25_SAP_X25, respectively, in the DLI_X25_HOST_OPEN_SESSION_REQ packet header. Section 2.2.2.1 through Section 2.2.2.5 describe the state machine associated with HDLC LAPB services for DLI_X25_SAP_SLP. Section 2.2.3.1 through Section 2.2.3.9 describe the state machine associated with X.25 services for DLI_X25_SAP_X25.

When the client opens a session with the server, it also selects one of two access modes or privileges. Selecting the DLI_X25_MGR_API privilege gives the client access to configuration services for the associated service access point. Selecting the DLI_X25_USER_API privilege gives the client access to data transfer services for that service access point.

1. Big Endian or Little Endian

2. The term "service provider" is sometimes used in this document to refer to the services being accessed.

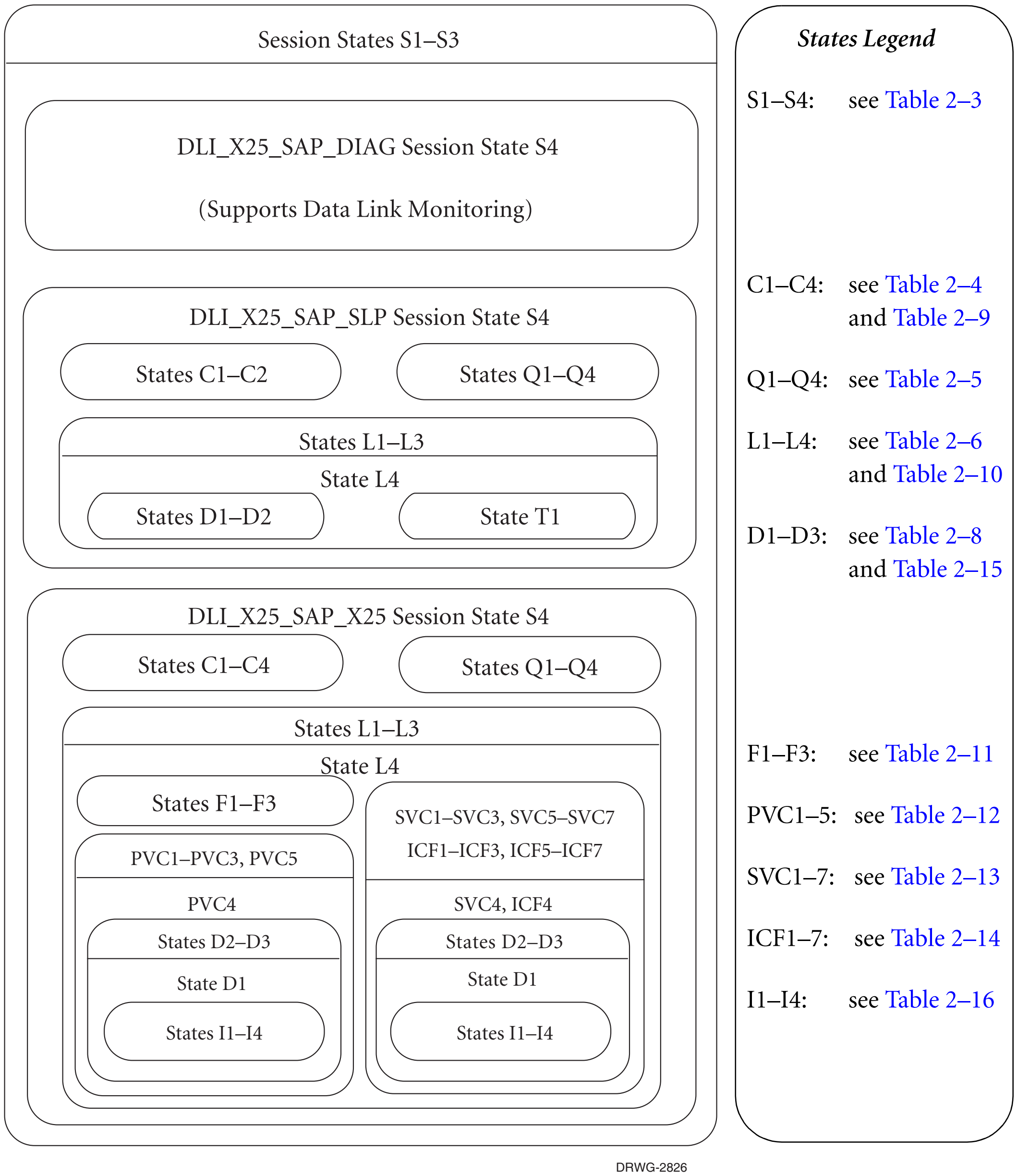

Figure 2–1: Freeway X.25 State Machine Hierarchy

Each DLI_X25_USER_API client/server session supports one full-duplex data transfer service for that session. The client must open a separate session for each additional HDLC LAPB data link or X.25 virtual circuit it wishes to use.

The client may also select the Freeway X.25 diagnostic services by specifying the DLI_X25_SAP_DIAG service access point and the DLI_X25_MGR_API privilege when opening a client/server session. Only one such diagnostic session per Freeway ICP is permitted. These services currently support an online data link monitor function that reports transmission, reception, and selected error conditions on one (or more) specified data link(s) on the ICP. Section 2.2.4 on page 79 describes the services for DLI_X25_SAP_DIAG.

As shown in Table 2–3, the client is responsible for opening and closing sessions with the server. If the server cannot open the requested session, it responds with a DLI_X25_ICP_SESSION_CLOSED packet to indicate the failure. If the server is unable to successfully process a client's DLI_X25_HOST_CLOSE_SESSION_REQ request, the server may reject the client's request by returning a DLI_X25_ICP_CMD_REJECTED packet. Such problems are usually the result of an error in one of the header fields of the DLI_X25_HOST_CLOSE_SESSION_REQ packet.

Table 2–3: Client/Server Session[a] State Table

Mnemonic	Closed S1	Opening S2	Closing S3	Open S4
DLI_X25_HOST_CLOSE_SESSION_REQ	—	—	—	S3
DLI_X25_HOST_OPEN_SESSION_REQ	S2	—	—	—
DLI_X25_ICP_SESSION_CLOSED	—	S1	S1	—
DLI_X25_ICP_SESSION_OPENED	—	S4	—	—
DLI_X25_ICP_CMD_REJECTED	—	—	S4[b]	—

[a] Two types of client/server sessions are supported by the Freeway X.25: DLI_X25_MGR_API and DLI_X25_USER_API.

[b] Change state only if DLI_X25_HOST_CLOSE_SESSION_REQ is rejected.

Figure 2–2 shows the typical sequence of packet exchanges for opening and closing client sessions with the ICP. The `DLI_X25_HOST_OPEN_SESSION_REQ` request packet specifies both the service access point and the access mode or privilege.

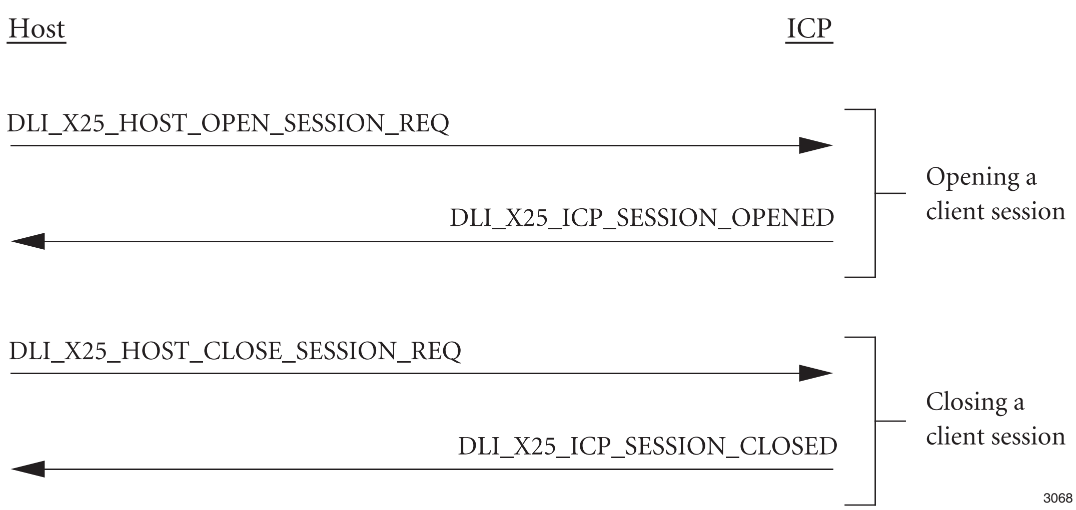

Figure 2–2: Opening and Closing Client Sessions

2.2.2 DLI_X25_SAP_SLP Services

The access point for HDLC LAPB services is DLI_X25_SAP_SLP, which supports data link configuration, information transfer, and statistics collection services. HDLC LAPB services are limited to a maximum of one DLI_X25_MGR_API session and one DLI_X25_USER_API session per data link.

2.2.2.1 DLI_X25_MGR_API Configuration States

The states shown in Table 2–4 are valid when a DLI_X25_MGR_API session for DLI_X25_SAP_SLP is in the S4 state shown in Table 2–3. The client may configure the data link characteristics, the control line monitoring for CTS and/or DCD, or the data link timeout period. The DLI_X25_MGR_API client for DLI_X25_SAP_SLP cannot enable the link or perform data transfer.

Table 2–4: DLI_X25_MGR_API Configuration State[a] Table

Mnemonic	No Request C1	Configuration Request C2
DLI_X25_HOST_CFG_LINK	C2	—
DLI_X25_HOST_CFG_CALL_SERVICE	C2	—
DLI_X25_ICP_ACK	—	C1
DLI_X25_ICP_CMD_REJECTED	—	C1

[a] These configuration states are valid when the DLI_X25_MGR_API session state for DLI_X25_SAP_SLP is S4.

Figure 2–3 shows the typical sequence of packet exchanges for configuring DLI_X25_SAP_SLP (HDLC LAPB) services once a DLI_X25_MGR_API session has been established between the client application and the DLI_X25_SAP_SLP services on Freeway.

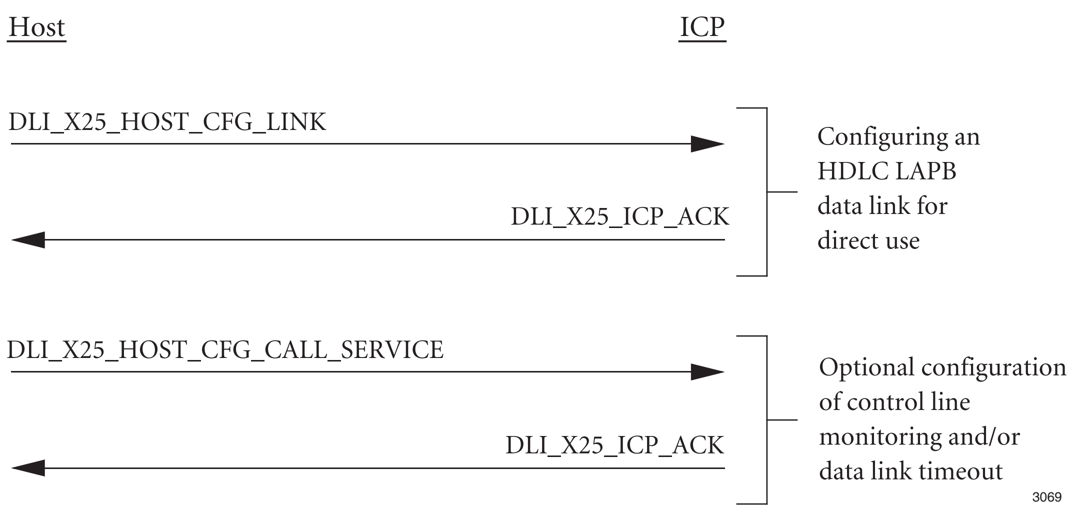

Figure 2–3: Configuring HDLC LAPB for Direct Use

2.2.2.2 DLI_X25_MGR_API Link Status Query States

The states shown in Table 2–5 are valid when a DLI_X25_MGR_API session for DLI_X25_SAP_SLP is in the S4 state shown in Table 2–3 on page 45, and the specified link has already been configured. The client may read, clear, or sample link statistics. It may read control line states (CTS/DCD) for a link regardless of the current link configuration state, operation state, or data transfer state. If the specified data link has not been configured, the client may receive a DLI_X25_ICP_CMD_REJECTED response packet rejecting the client's request.

Table 2–5: DLI_X25_MGR_API Link Status Query State[a] Table

Mnemonic	No Query Q1	Statistics Query Q2	Clearing Statistics Q3	Control Line Query Q4
DLI_X25_HOST_32BIT_GET_STATISTICS	Q2	—	—	—
DLI_X25_HOST_32BIT_SAMPLE_STATISTICS	Q2	—	—	—
DLI_X25_HOST_CTL_LINE_STATE_REQ	Q4	—	—	—
DLI_X25_HOST_GET_STATISTICS	Q2	—	—	—
DLI_X25_HOST_CLR_STATISTICS	Q3	—	—	—
DLI_X25_HOST_SAMPLE_STATISTICS	Q2	—	—	—
DLI_X25_ICP_32BIT_STATISTICS	—	Q1	—	—
DLI_X25_ICP_ACK	—	—	Q1	—
DLI_X25_ICP_CTL_LINE_STATE_RSP[b]	—	—	—	Q1
DLI_X25_ICP_CMD_REJECTED	—	Q1	Q1	Q1
DLI_X25_ICP_STATISTICS	—	Q1	—	—

[a] These states are valid when the DLI_X25_MGR_API session state for DLI_X25_SAP_X25 or DLI_X25_SAP_SLP is S4 and the link has already been configured.

[b] Unsolicited DLI_X25_ICP_CTL_LINE_STATE_RSP packets are normal when modem control signal monitoring is enabled.

Figure 2–4 shows the typical sequence of packet exchanges for obtaining link status information once a DLI_X25_MGR_API session has been established between the client application and the DLI_X25_SAP_SLP services on Freeway.

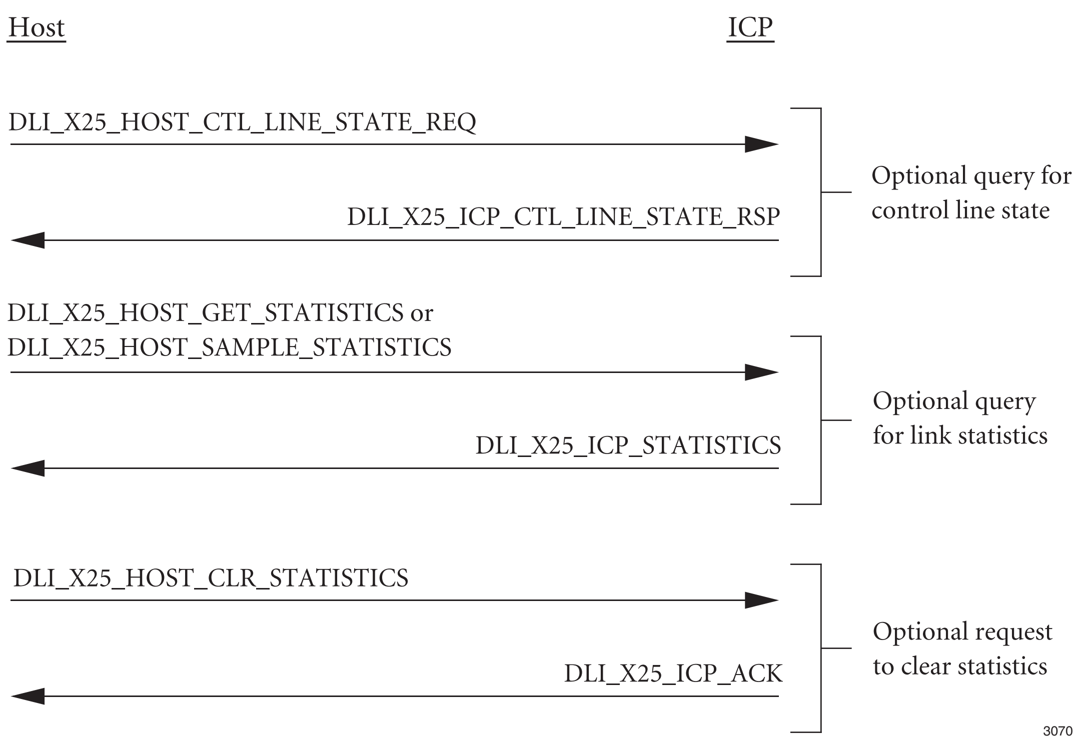

Figure 2–4: Obtaining HDLC LAPB Link Statistics

2.2.2.3 DLI_X25_USER_API Link Operation States

The states shown in Table 2–6 are valid when a DLI_X25_USER_API session for DLI_X25_SAP_SLP is in the S4 state shown in Table 2–3 on page 45 and the specified link has already been configured. The client may enable or disable the link. If the specified data link has not been configured, the client may receive a DLI_X25_ICP_CMD_REJECTED response packet rejecting the client's request.

Table 2–6: DLI_X25_USER_API Link Operation State[a] Table

Mnemonic	Link Disabled L1	Enabling Link L2	Disabling Link L3	Link Active L4
DLI_X25_HOST_DISABLE_LINK	—	L3	—	L3
DLI_X25_HOST_ENABLE_LINK	L2	—	—	—
DLI_X25_ICP_LINK_DISABLED	—	—	L1	L1[b]
DLI_X25_ICP_LINK_ENABLED	—	L4	—	—
DLI_X25_ICP_CMD_REJECTED	—	L1[c]	—	—
DLI_X25_ICP_CMD_TIMEOUT	—	—	—	—

[a] These states are valid when the DLI_X25_USER_API session state for DLI_X25_SAP_SLP is S4 and the link has already been configured.

[b] Note how this differs from Table 2–10 on page 60; DLI_X25_SAP_SLP service assumes that the DLI_X25_USER_API client will re-enable the link if desired.

[c] Change state only if DLI_X25_HOST_ENABLE_LINK is rejected.

Figure 2–5 shows the typical sequence of packet exchanges for enabling and disabling the data link once a DLI_X25_USER_API session has been established between the client application and the DLI_X25_SAP_SLP services on Freeway.

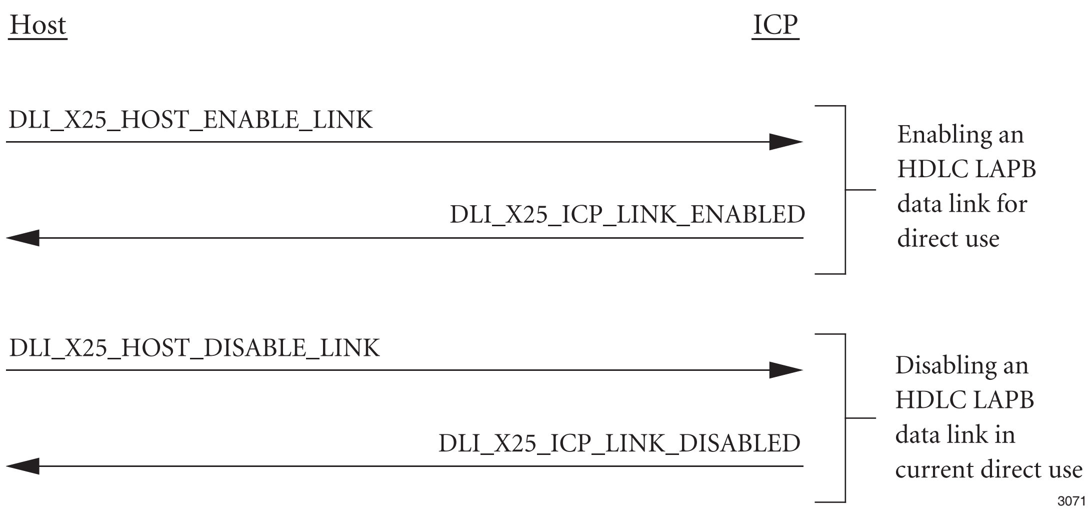

Figure 2–5: Enabling/Disabling HDLC LAPB Data Link

2.2.2.4 DLI_X25_USER_API Data Transfer States

The states shown in Table 2–8 are valid when a DLI_X25_USER_API session for DLI_X25_SAP_SLP is in the S4 state shown in Table 2–3 on page 45, the specified link has already been configured, and the link is in the L4 state shown in Table 2–6 on page 51.

Table 2–7: DLI_X25_USER_API Data Transfer State[a] Table

Mnemonic	Data Transfer D1	Sent Reset D2
DLI_X25_HOST_DATA	Increase writes pending	—
DLI_X25_HOST_UNNUMBERED_DATA[b]	—	—
DLI_X25_HOST_INIT_SLP	D2	—
DLI_X25_ICP_DATA	—	—
DLI_X25_ICP_SLP_XMIT_ERROR	Decrease writes pending	Decrease writes pending
DLI_X25_ICP_MLP_SLP_RESET	—	D1
DLI_X25_ICP_CMD_REJECTED	—	—
DLI_X25_ICP_SLP_XMIT_OK	Decrease writes pending	Decrease writes pending

[a] These states are valid when the DLI_X25_USER_API session state for DLI_X25_SAP_SLP is S4 and the link operation state is L4.

[b] This command is valid when ISO HDLC Option 4 (UI frames) is selected.

Figure 2–6 shows a typical sequence of packet exchanges occurring during outgoing HDLC LAPB data transfer. The illustration shows how maintenance of a count of pending writes (DLI_X25_HOST_DATA packets) awaiting acknowledgment may be used to enforce flow control on outgoing data.

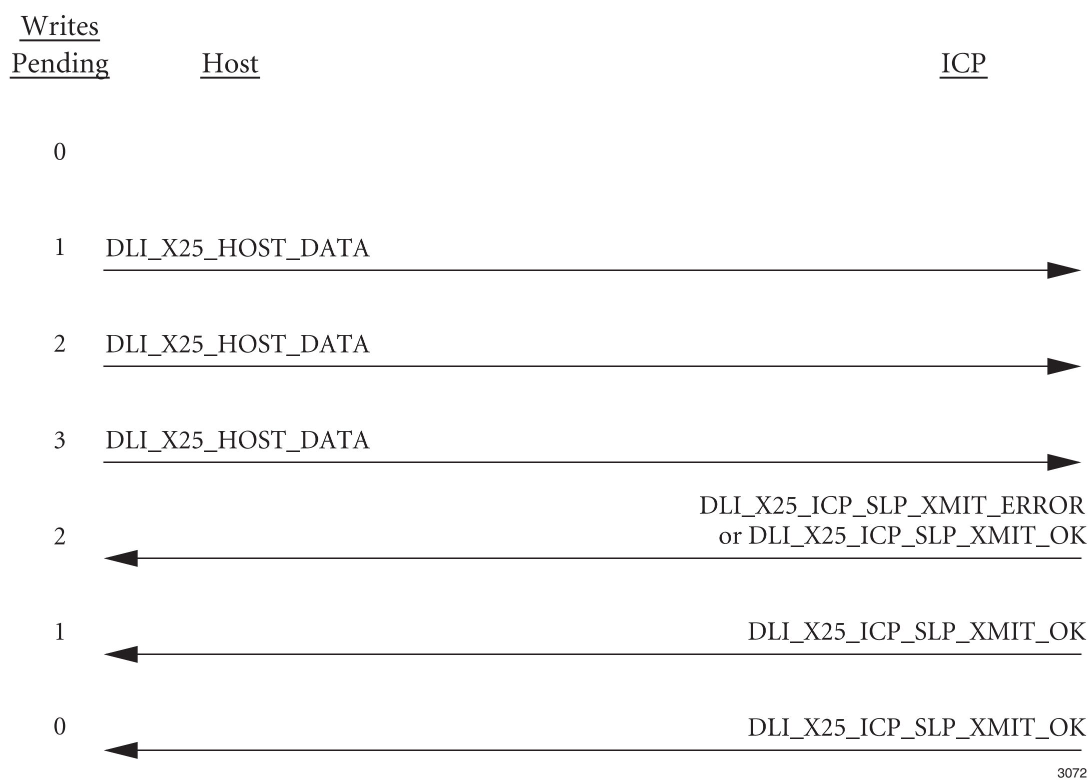

Figure 2–6: Outgoing HDLC Data with Flow Control

2.2.2.5 DLI_X25_MGR_API TEST Frame States

The state shown in Table 2–8 is valid when a DLI_X25_MGR_API session for DLI_X25_SAP_SLP is in the S4 state shown in Table 2–3 on page 45, the specified link has already been configured, the link is in the L4 state shown in Table 2–6 on page 51, and the HDLC LAPB Option 12 (TEST Frames) is selected.

Table 2–8: DLI_X25_USER_API TEST Frame State[a] Table

Mnemonic	TEST Frames Authorized T1
DLI_X25_HOST_TEST_FRAME	T1
DLI_X25_ICP_TEST_FRAME	T1

[a] This state is valid when the DLI_X25_USER_API session state for DLI_X25_SAP_SLP is S4, the link operation state is L4, and the HDLC LAPB Option 12 (TEST Frames) is selected.

2.2.3 DLI_X25_SAP_X25 Services

The access point for X.25 services is DLI_X25_SAP_X25, which supports configuration, information transfer, and statistics collection services. X.25 services are limited to a maximum of one DLI_X25_MGR_API session per data link, but allow multiple simultaneous DLI_X25_USER_API sessions per data link.

The maximum number of client/server sessions is finite. By default, Freeway X.25 can support up to 256 client/server sessions per ICP. Use the DLI_X25_HOST_CFG_BUF packet to configure support for more sessions by increasing the maximum number of X.25 circuits; the ICP assumes a need to support one client/server session per X.25 circuit, and increases the maximum number of sessions accordingly. Protogate recommends that you not exceed 1024 sessions (or circuits) per ICP.

2.2.3.1 DLI_X25_MGR_API Configuration States

The states shown in Table 2–9 are valid when a DLI_X25_MGR_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45. The client may configure the data link characteristics, the control line monitoring for CTS and/or DCD, the multilink procedures (MLP), the data link timeout period, or the X.25 call service characteristics.

Table 2–9: DLI_X25_MGR_API Configuration State[a] Table

Mnemonic	No Request C1	Configuration Requested C2	Version Requested C3	Buffers Requested C4
DLI_X25_HOST_BUF_CLR	C2	—	—	—
DLI_X25_HOST_CFG_BUF	C4	—	—	—
DLI_X25_HOST_CFG_LINK	C2	—	—	—
DLI_X25_HOST_CFG_MLP	C2	—	—	—
DLI_X25_HOST_CFG_CALL_SERVICE	C2	—	—	—
DLI_X25_HOST_GET_VERSION	C3	—	—	—
DLI_X25_ICP_ACK	—	C1	—	—
DLI_X25_ICP_CFG_BUF_CONFIRMED	—	—	—	C1
DLI_X25_ICP_CMD_REJECTED	—	C1	C1	C1
DLI_X25_ICP_VERSION	—	—	C1	—

[a] These configuration states are valid when the DLI_X25_MGR_API session for DLI_X25_SAP_X25 is in the S4 state.

Figure 2–7 shows the typical sequence of packet exchanges for configuring X.25 services once a DLI_X25_MGR_API session has been established between the client application and the DLI_X25_SAP_X25 services on Freeway.

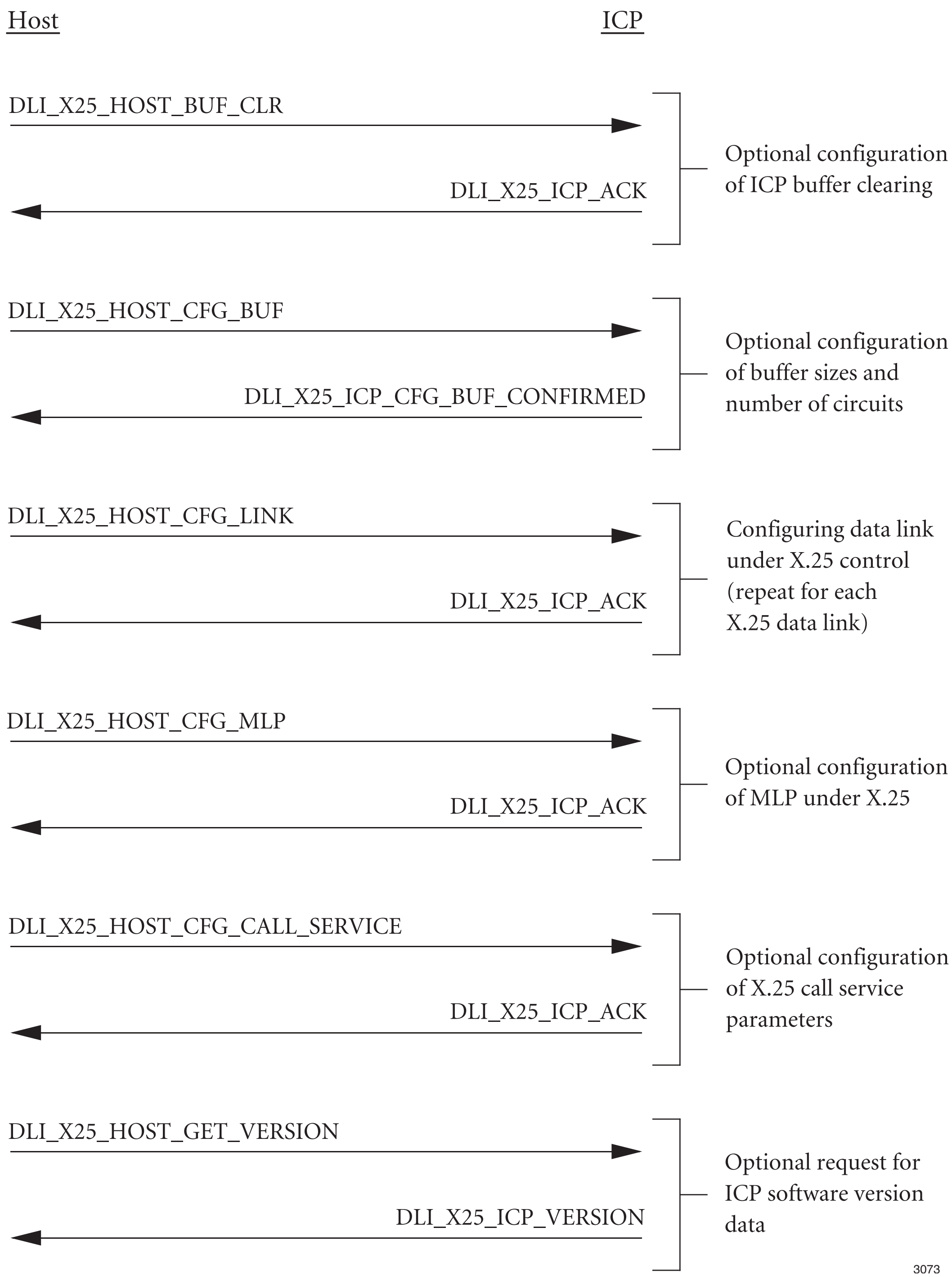

Figure 2–7: Configuring X.25

2.2.3.2 DLI_X25_MGR_API Link Status Query States

The states shown in Table 2–5 on page 49 and the packet exchanges shown in Figure 2–4 on page 50 are also valid when a DLI_X25_MGR_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45, and the specified link has already been configured. The client may read, clear, or sample link statistics, and it may read control line states (CTS/DCD) for a link regardless of the current link configuration state, operation state, or PVC/SVC state. If the specified data link has not been configured, the client may receive a DLI_X25_ICP_CMD_REJECTED response packet rejecting the client's request.

2.2.3.3 DLI_X25_MGR_API Link Operation States

The states shown in Table 2–10 are valid when a DLI_X25_MGR_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45, and the specified link has already been configured. The client may enable or disable the link. If the specified data link has not been configured, the client may receive a DLI_X25_ICP_CMD_REJECTED response packet rejecting the client's request.

Table 2–10: DLI_X25_MGR_API Link Operation Link State[a] Table

Mnemonic	Link Disabled L1	Enabling Link L2	Disabling Link L3	Link Active L4
DLI_X25_HOST_DISABLE_LINK	—	L3	—	L3
DLI_X25_HOST_ENABLE_LINK	L2	—	—	—
DLI_X25_ICP_LINK_DISABLED	—	—	L1	L2[b]
DLI_X25_ICP_LINK_ENABLED	—	L4	—	—
DLI_X25_ICP_CMD_REJECTED	—	L1[c]	—	—
DLI_X25_ICP_CMD_TIMEOUT	—	—	—	—

[a] These states are valid when the DLI_X25_MGR_API session state for DLI_X25_SAP_X25 is S4 and the specified link has already been configured.

[b] Note how this differs from Table 2–6 on page 51; DLI_X25_SAP_X25 service attempts to re-enable the link automatically. The DLI_X25_MGR_API may cancel this action by sending a DLI_X25_HOST_DISABLE_LINK packet while still in the L2 state.

[c] Change state only if DLI_X25_HOST_ENABLE_LINK is rejected.

The packet exchanges shown in Figure 2–5 on page 52 are also applicable once a DLI_X25_MGR_API session has been established between the client application and the DLI_X25_SAP_X25 services on Freeway. Unlike DLI_X25_SAP_SLP, DLI_X25_SAP_X25 treats the HDLC LAPB data link as a common resource that may be shared by several virtual circuits and restricts data link operational control to DLI_X25_MGR_API clients.

2.2.3.4 DLI_X25_MGR_API Facilities Registration States

The states shown in Table 2–11 are valid when a DLI_X25_MGR_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45. If the associated link is not in the L4 state shown in Table 2–10 on page 60, the ICP rejects each DLI_X25_HOST_REGISTER request packet by returning a DLI_X25_ICP_CMD_REJECTED packet because the data link is offline. When multilink procedures (MLP) are configured, at least one of the data links under the MLP must be in the L4 state to successfully register facilities.

Table 2–11: DLI_X25_MGR_API Facilities Registration State[a] Table

Mnemonic	Facilities Not Registered F1	Facility Registration Requested F2	Facilities Registered F3
DLI_X25_HOST_REGISTER	F2	—	F2
DLI_X25_ICP_REGISTERED	F3	F3	—
DLI_X25_ICP_CMD_REJECTED	—	F1	—

[a] These states are valid when a DLI_X25_MGR_API session state for DLI_X25_SAP_X25 is S4.

Figure 2–8 shows the typical sequence of packet exchanges for registering X.25 facilities with an X.25 network DCE. The illustration shows the DTE initiating the exchange, but as you can see in Table 2–11, the X.25 network DCE may provide an unsolicited report of registered facilities.

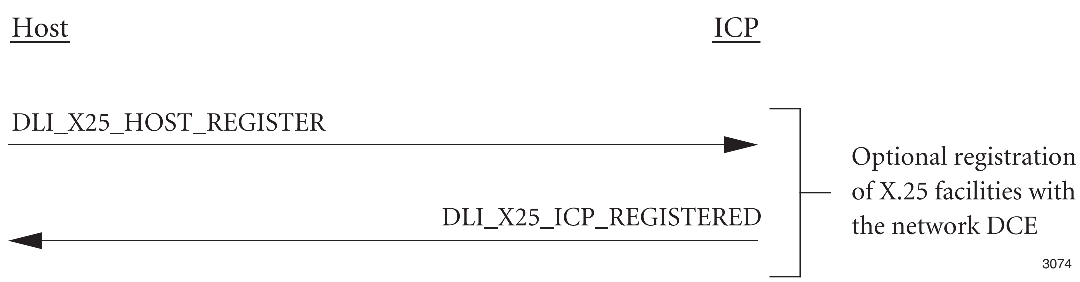

Figure 2–8: Registering X.25 Facilities

2.2.3.5 DLI_X25_USER_API PVC Session States

The states shown in Table 2–12 are valid when a DLI_X25_USER_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45, and the specified PVC has already been configured. If the associated link is not in the L4 state shown in Table 2–10 on page 60, the ICP rejects each DLI_X25_HOST_OPEN_PVC request packet by returning a DLI_X25_ICP_CMD_REJECTED packet because the data link is offline. When multilink procedures (MLP) are configured, at least one of the data links under the MLP must be in the L4 state to successfully open the PVC.

Each configured PVC supports one client. If a client tries to open a PVC that is already in use, the ICP rejects the DLI_X25_HOST_OPEN_PVC request packet by returning a DLI_X25_ICP_CMD_REJECTED packet because access is denied.

Table 2–12: DLI_X25_USER_API PVC Session State[a] Table

Mnemonic	PVC Closed PVC1	PVC Opening PVC2	PVC Closing PVC3	PVC Open PVC4	PVC Inoperative PVC5
DLI_X25_HOST_CLOSE_PVC	—	—	—	PVC3	PVC3
DLI_X25_HOST_OPEN_PVC	PVC2	—	—	—	—
DLI_X25_ICP_PVC_CLOSED	—	—	PVC1	—	—
DLI_X25_ICP_ERROR	—	—	—	See Table 2–15 on page 72	PVC4
DLI_X25_ICP_PVC_OPENED	—	PVC4	—	—	—
DLI_X25_ICP_CMD_REJECTED	—	PVC1	—	—	—
DLI_X25_ICP_STATION_FAILED	—	—	—	PVC5	—

[a] These states are valid when the DLI_X25_USER_API session state for DLI_X25_SAP_X25 is S4 and the specified PVC has already been configured.

Figure 2–9 shows the typical sequence of packet exchanges for opening and closing access to an X.25 PVC once a DLI_X25_USER_API session has been established between the client application and the DLI_X25_SAP_X25 services on Freeway.

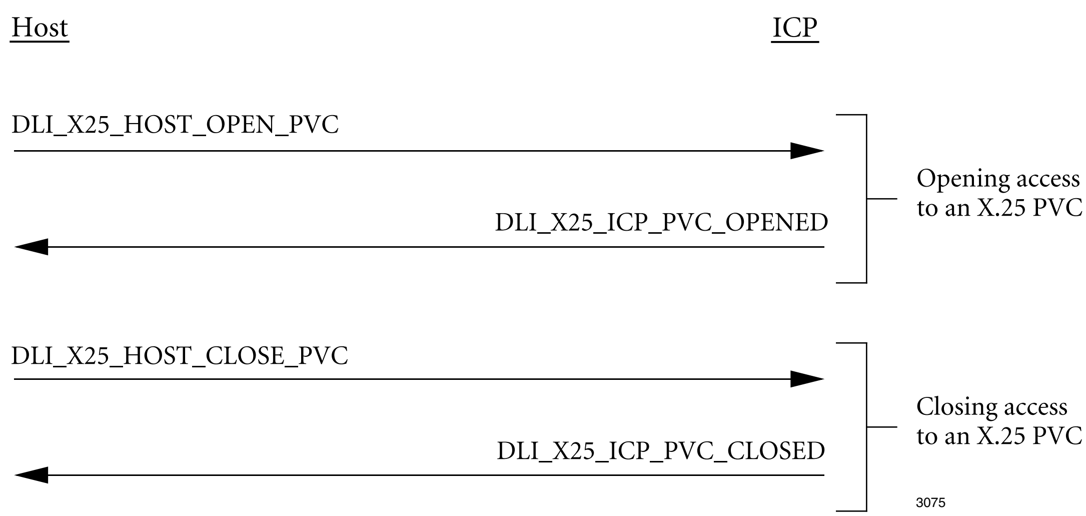

Figure 2–9: Opening and Closing X.25 PVC Access

2.2.3.6 DLI_X25_USER_API SVC Outgoing Call States

The X.25 protocol requires that to open a switched virtual circuit, there must be a call initiator at one end and a call recipient at the other. If both ends try to initiate a call, no virtual circuit is possible. This section describes the state machine for the call initiator. See Section 2.2.3.7 on page 68 for information about the call recipient.

The states shown in Table 2–13 are valid when a DLI_X25_USER_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45, and no incoming call filter (ICF) is currently acknowledged. If the associated link is not in the L4 state shown in Table 2–10 on page 60, the ICP rejects each DLI_X25_HOST_CALL_REQ request packet by returning a DLI_X25_ICP_CMD_REJECTED packet because the data link is offline. When multilink procedures (MLP) are configured, at least one of the data links under the MLP must be in the L4 state to successfully initiate an SVC call.

Figure 2–10 shows the typical sequence of packet exchanges for initiating an outgoing X.25 SVC call. Once the SVC is connected, operation and termination of the SVC is the same as for the call recipient.

Table 2–13: DLI_X25_USER_API SVC Call Initiator State[a] Table

Mnemonic	No Call SVC1	Call Sent SVC2	(Resrvd) SVC3	Data Transfer SVC4	(Resrvd) SVC5	Clear Sent SVC6	SVC Aborted SVC7
DLI_X25_HOST_ABORT	—	—	—	SVC7	—	—	—
DLI_X25_HOST_CALL_REQ	SVC2	—	—	—	—	—	—
DLI_X25_HOST_CLR_REQ	—	—	—	SVC6	—	—	—
DLI_X25_HOST_ADD_INCALL_FILTER	—	—	—	—	—	—	—
DLI_X25_ICP_ABORT	—	SVC7	—	SVC7	—	SVC7	—
DLI_X25_ICP_ACK	ICF1[b] See Table 2–14 on page 69	—	—	—	—	—	—
DLI_X25_ICP_CALL_ACCEPTED	—	SVC4	—	—	—	—	—
DLI_X25_ICP_CLR_INDICATION	—	SVC1	—	SVC1	—	SVC1	—
DLI_X25_ICP_CMD_REJECTED	—	SVC1[c]	—	SVC7[d] Send DLI_X25-_HOST-_ABORT	—	—	—
DLI_X25_ICP_STATION_OK	—	—	—	—	—	—	SVC1
DLI_X25_ICP_CLR_CONFIRMED	—	—	—	—	—	SVC1	—

[a] These states are valid when the DLI_X25_USER_API session state for DLI_X25_SAP_X25 is S4 and no ICF registration is currently acknowledged.

[b] Change state only if DLI_X25_HOST_ADD_INCALL_FILTER is acknowledged.

[c] Change state only if DLI_X25_HOST_CALL_REQ is rejected.

[d] Do not change state if DLI_X25_HOST_ADD_INCALL_FILTER is rejected.

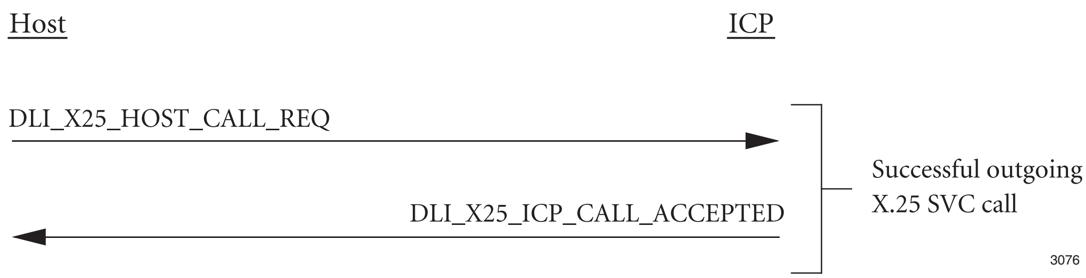

Figure 2–10: Initiating an Outgoing X.25 SVC Call

2.2.3.7 DLI_X25_USER_API SVC Incoming Call States

The X.25 protocol requires that to open a switched virtual circuit, there must be a call initiator at one end and a call recipient at the other. If both ends wait to receive a call, no virtual circuit is possible. This section describes the state machine for the call recipient. See Section 2.2.3.6 on page 65 for information about the call initiator.

The states shown in Table 2–14 are valid when a DLI_X25_USER_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45, and the client has already sent a DLI_X25_HOST_ADD_INCALL_FILTER packet to the ICP and has received the associated DLI_X25_ICP_ACK response packet.

Figure 2–11 shows the typical sequence of packet exchanges for receiving an incoming X.25 SVC call. Once the SVC is connected, you may wish to send a DLI_X25_HOST_DEL_INCALL_FILTER packet to avoid having additional incoming calls placed on hold pending termination of the currently active SVC; otherwise, operation and termination of the SVC is the same as for the call initiator.

Figure 2–12 shows several typical sequences of packet exchanges that result in X.25 SVC termination.

Table 2–14: DLI_X25_USER_API SVC Call Recipient State[a] Table

Mnemonic	ICF1	Redi-recting Call ICF2	Rcvd Call ICF3	Data Transfer ICF4	Con-necting Call ICF5	Clear Sent ICF6	SVC Aborted ICF7
DLI_X25_HOST_ABORT	—	—	ICF7	ICF7	—	—	—
DLI_X25_HOST_CALL_ACCEPTED	—	—	ICF5	—	—	—	—
DLI_X25_HOST_DEL_INCALL-_FILTER	—	—	—	—	—	—	—
DLI_X25_HOST_CLR_REQ	—	—	ICF6	ICF6	—	—	—
DLI_X25_HOST_REDIRECT	—	—	ICF2	—	—	—	—
DLI_X25_ICP_ABORT	—	ICF7	ICF7	ICF7	ICF7	ICF7	—
DLI_X25_ICP_ACK[b]	SVC1 See Table 2–13	ICF1[c]	SVC1 See Table 2–13	SVC4 See Table 2–13	ICF4[d]	SVC6 See Table 2–13	SVC7 See Table 2–13
DLI_X25_ICP_AUTO_CONNECT	ICF4	—	—	—	—	—	—
DLI_X25_ICP_INCOMING_CALL	ICF3	—	—	—	—	—	—
DLI_X25_ICP_CLR_INDICATION	—	ICF1	ICF1	ICF1	ICF1	ICF1	—
DLI_X25_ICP_CMD_REJECTED	—	—	—	ICF7[e] Send DLI_X25-_HOST-_ABORT	—	—	—
DLI_X25_ICP_STATION_OK	—	—	—	—	—	—	ICF1
DLI_X25_ICP_CLR_CONFIRMED	—	—	—	—	—	ICF1	—

[a] These states are valid when the DLI_X25_USER_API session state for DLI_X25_SAP_X25 is S4 and the client has sent a DLI_X25-_HOST_ADD_INCALL_FILTER packet to the ICP and has received the associated DLI_X25_ICP_ACK response packet.

[b] Change state only if DLI_X25_HOST_DEL_INCALL_FILTER is acknowledged, except where noted otherwise.

[c] In this case, change state only if DLI_X25_HOST_REDIRECT is acknowledged.

[d] In this case, change state only if DLI_X25_HOST_CALL_ACCEPTED is acknowledged

[e] Do not change state if DLI_X25_HOST_DEL_INCALL_FILTER is rejected.

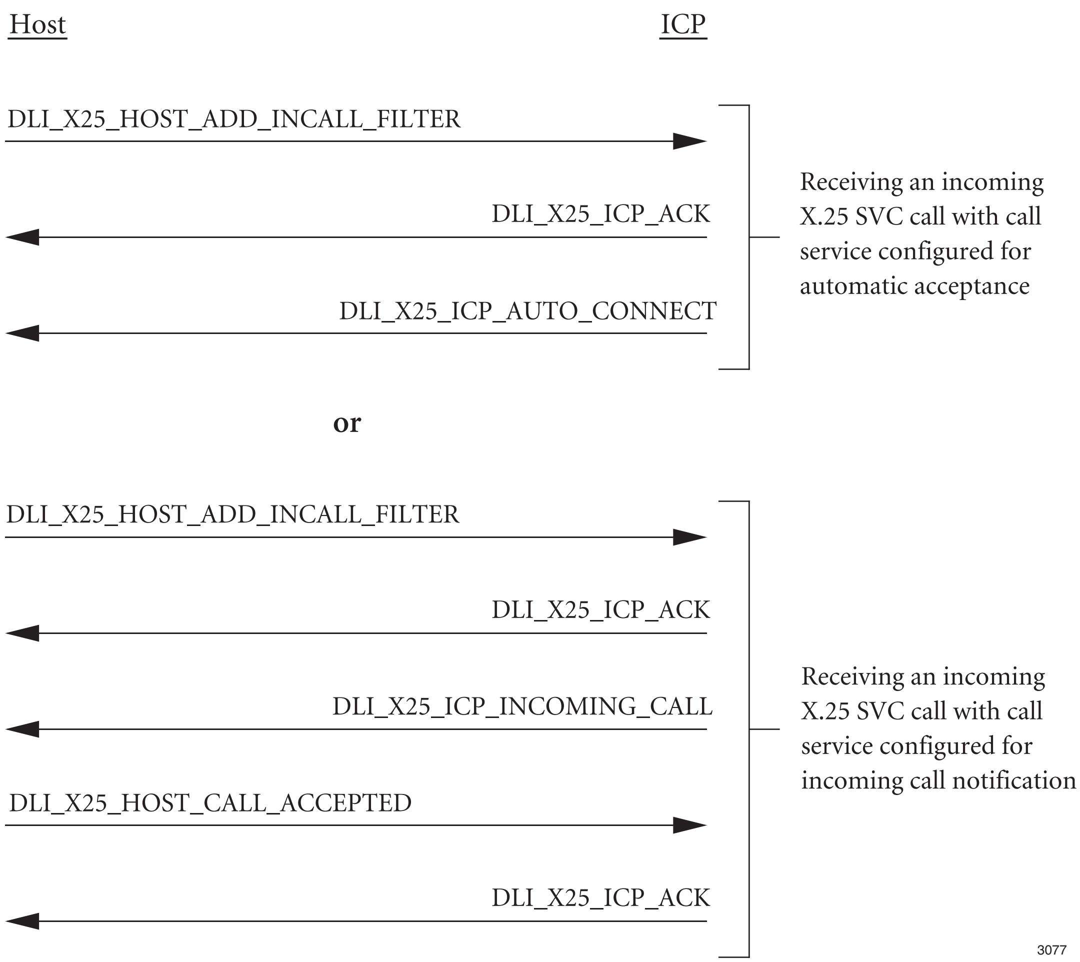

Figure 2–11: Receiving an Incoming X.25 SVC Call

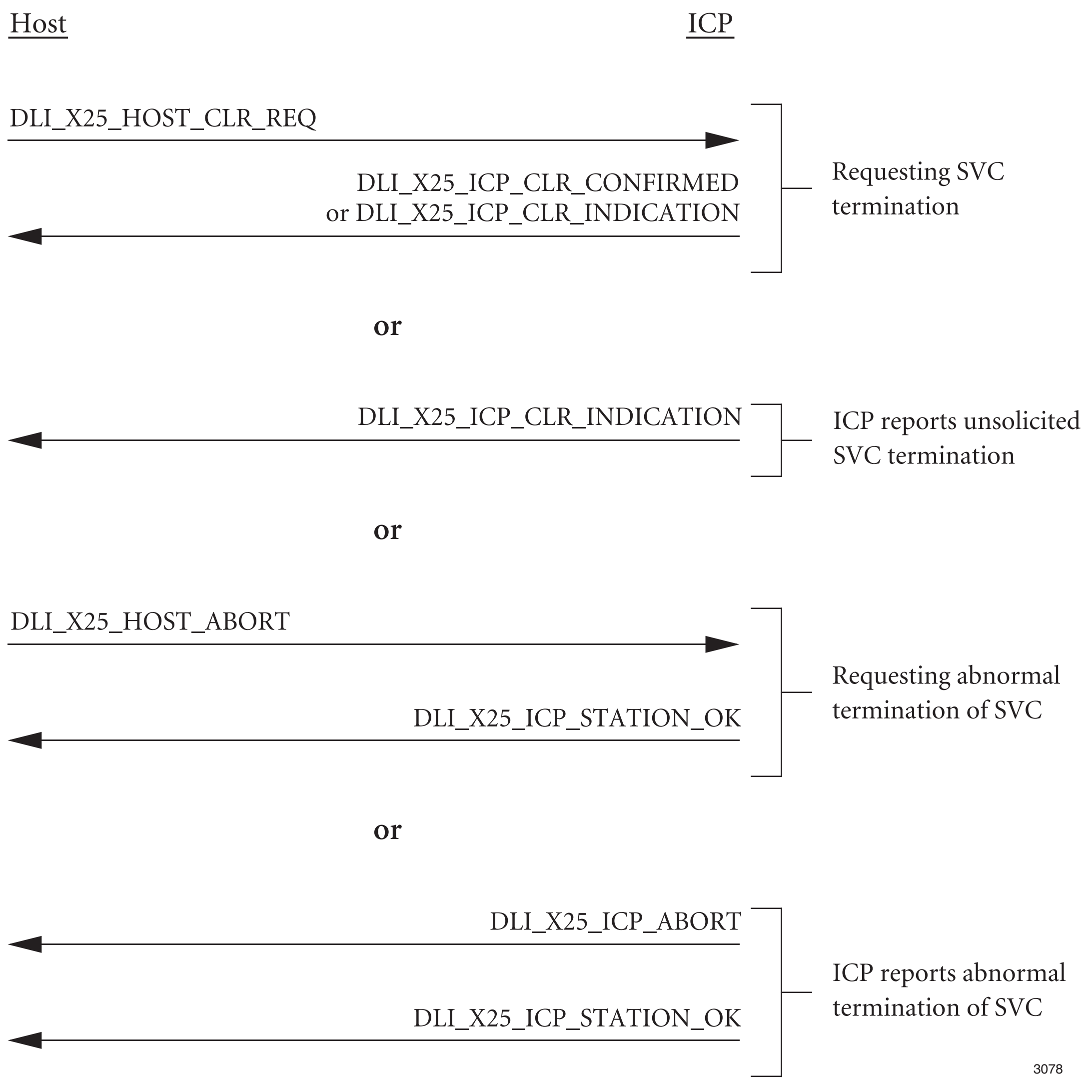

Figure 2–12: X.25 SVC Termination

2.2.3.8 DLI_X25_USER_API PVC/SVC Data Transfer States

For a PVC, the states shown in Table 2–15 are valid when a DLI_X25_USER_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45, and the PVC is in the PVC4 state shown in Table 2–12 on page 63.

For an SVC, the states shown in Table 2–15 are valid when a DLI_X25_USER_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45, and the SVC is in the SVC4 state shown in Table 2–13 on page 66 or the ICF4 state shown in Table 2–14 on page 69.

In both cases, the data transfer states D1 through D3 shown in Table 2–15 correspond directly to the R1P4D1 through R1P4D3 states normally described in CCITT and ISO X.25 specifications.

Table 2–15: DLI_X25_USER_API PVC/SVC Data Transfer State[a] Table

Mnemonic	Data Transfer D1	Sent Reset D2	Received Reset D3
DLI_X25_HOST_ADJUST_FLOW_CONTROL	Increase reads authorized	—	—
DLI_X25_HOST_DATA	Increase writes pending	—	—
DLI_X25_HOST_RESET_REQ	D2 clear writes pending and reads authorized	—	D1
DLI_X25_HOST_RESET_CONFIRMED	—	—	D1
DLI_X25_ICP_DATA	Decrease reads authorized	—	—
DLI_X25_ICP_ERROR	D2 clear writes pending and reads authorized Send DLI_X25_HOST-_RESET_REQ	Send DLI_X25_HOST-_RESET_REQ	—
DLI_X25_ICP_CMD_REJECTED	Close PVC or abort SVC		
DLI_X25_ICP_ROTATE_XMIT_WINDOW	Decrease writes pending	—	—
DLI_X25_ICP_RESET_INDICATION	D3 clear writes pending and reads authorized	D1	—
DLI_X25_ICP_RESET_CONFIRMED	—	D1	—

[a] These states are valid when the DLI_X25_USER_API session state for DLI_X25_SAP_X25 is S4 and the PVC session state is PVC4 or the SVC session state is SVC4 or ICF4.

Figure 2–13 shows a typical sequence of packet exchanges occurring during outgoing X.25 data transfer. The illustration shows how maintenance of a count of pending writes (DLI_X25_HOST_DATA packets) awaiting acknowledgment (via DLI_X25_ICP_ROTATE_XMIT_WINDOW packets) may be used to enforce flow control on outgoing data. Each DLI_X25_ICP_ROTATE_XMIT_WINDOW packet reports the number of DLI_X25_HOST_DATA packets acknowledged, and all such acknowledgment is on a first-in-first-out basis.

Figure 2–14 shows a typical sequence of packet exchanges occurring during incoming X.25 data transfer. The illustration shows how maintenance of a count of the number of reads (DLI_X25_ICP_DATA packets) authorized may be used to enforce flow control on incoming data. The ICP holds incoming data until authorized to transfer it (via one or more DLI_X25_ICP_DATA packets) to the client application. All authorizations to receive incoming data are on a first-in-first-out basis.

Figure 2–15 shows several typical sequences of packet exchanges that result in the reset of an X.25 PVC or SVC. The reset disturbs flow control for both outgoing and incoming data, regardless of whether the client application or the network DCE initiates the reset. The client application must clear both its count of writes pending and its count of the number of reads authorized. Normal data flow control methods may be used again following completion of the reset; however, any outgoing data that was not acknowledged prior to the circuit reset remains unacknowledged.

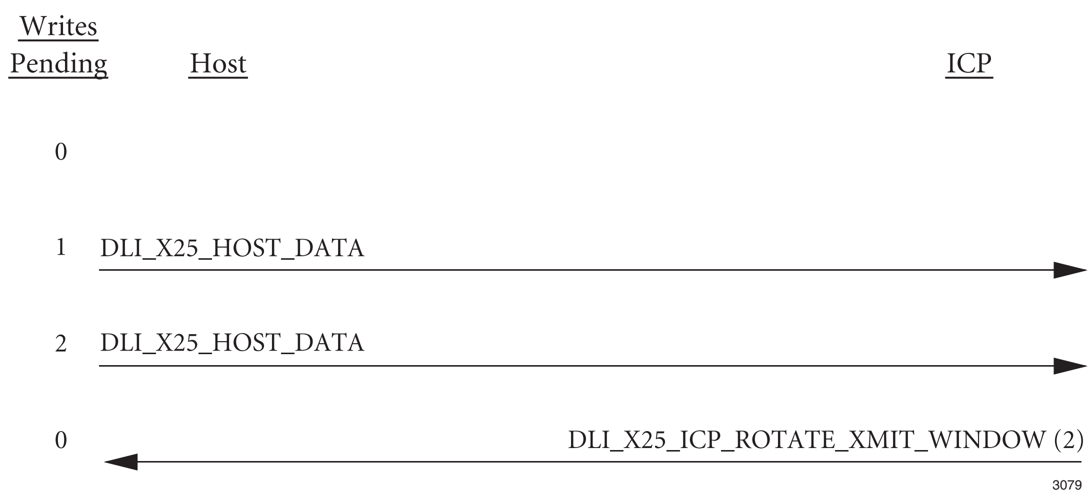

Figure 2–13: Outgoing X.25 Data with Flow Control

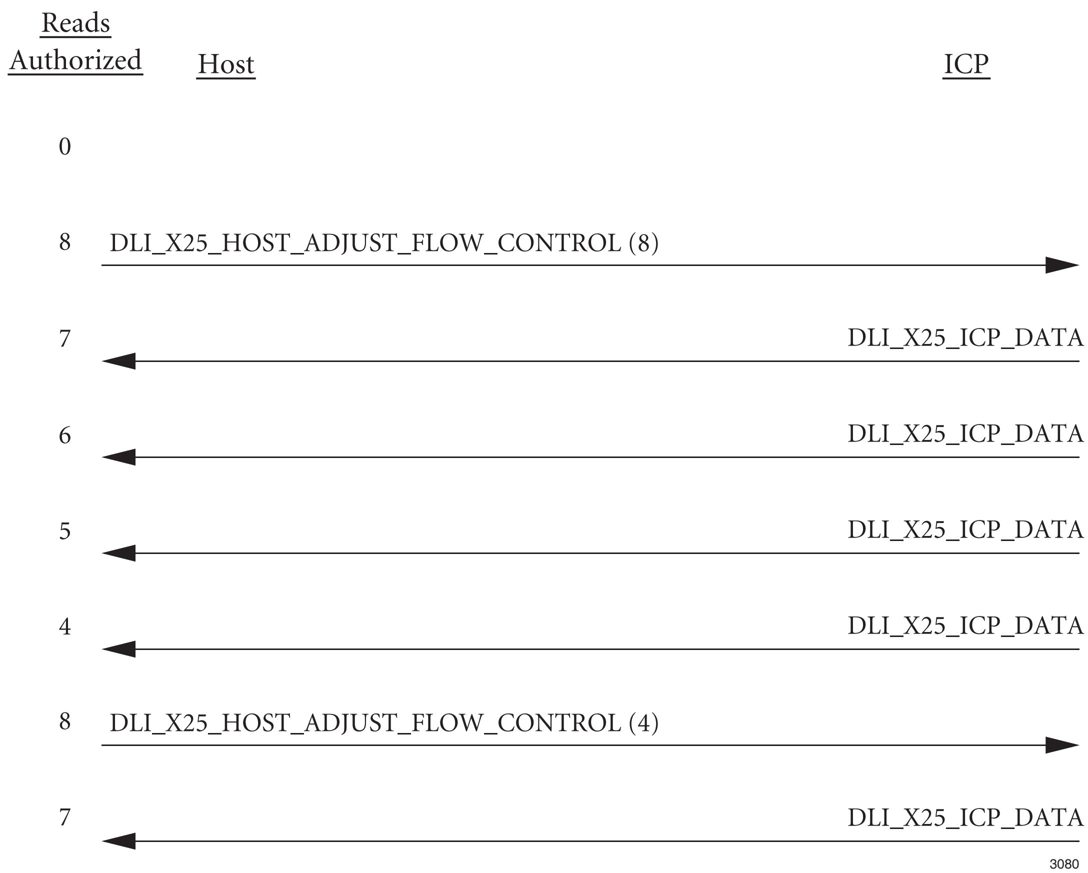

Figure 2–14: Incoming X.25 Data with Flow Control

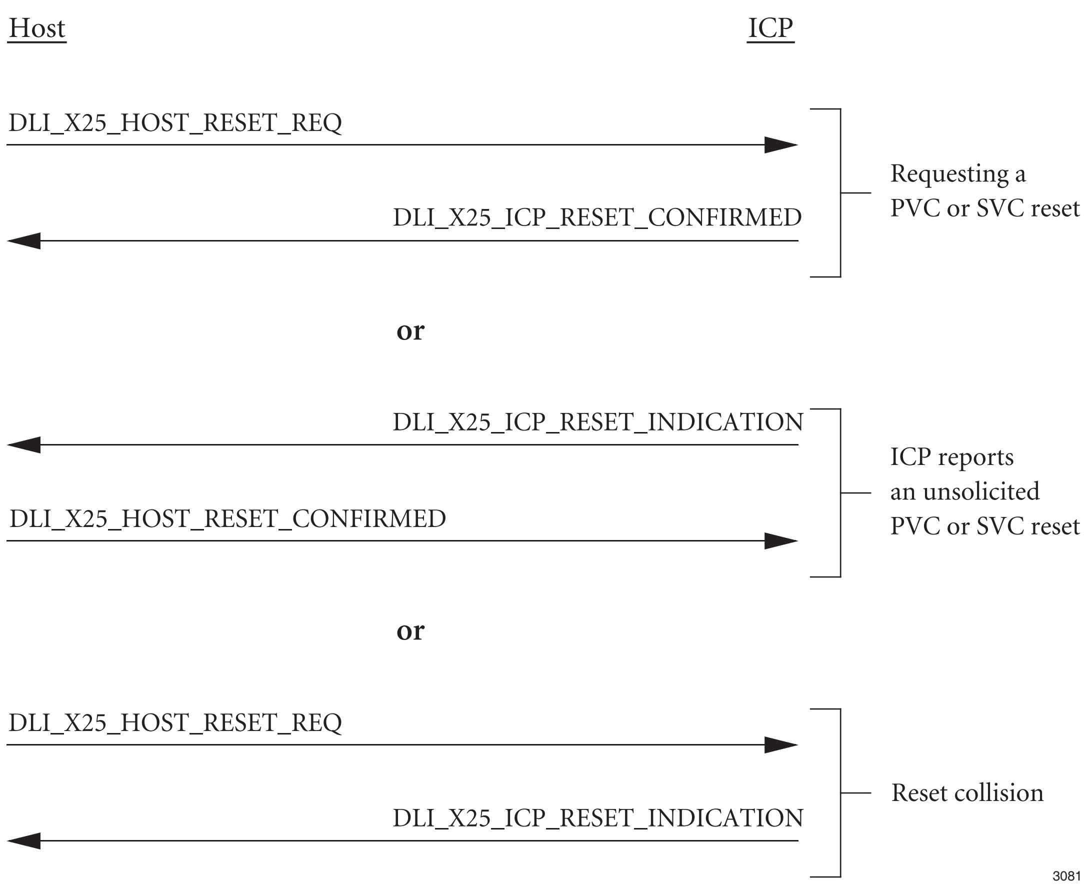

Figure 2–15: X.25 PVC/SVC Reset

2.2.3.9 DLI_X25_USER_API PVC/SVC Interrupt Transfer

In addition to supporting normal data transfer which is flow controlled, the X.25 protocol supports interrupt data transfer which bypasses normal data flow. Typical usage includes sending an X.25 interrupt after an extended period during which normal data transfer has been blocked. If the remote application fails to acknowledge the interrupt within a reasonable time limit, we assume it is not operating normally.

Each side may send only one outstanding (unacknowledged) interrupt at a time. If each side sends an interrupt simultaneously, each side must still acknowledge the other interrupt when received.

For a PVC, the states shown in Table 2–16 are valid when a DLI_X25_USER_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45, the PVC is in the PVC4 state shown in Table 2–12 on page 63, and the data transfer state is D1 as show in Table 2–15 on page 72.

For an SVC, the states shown in Table 2–16 are valid when a DLI_X25_USER_API session for DLI_X25_SAP_X25 is in the S4 state shown in Table 2–3 on page 45, the SVC is in the SVC4 state shown in Table 2–13 on page 66 or the ICF4 state shown in Table 2–14 on page 69, and the data transfer state is D1 as shown in Table 2–15 on page 72.

Table 2–16: DLI_X25_USER_API PVC/SVC Interrupt Transfer State[a]

Mnemonic	No Interrupt I1	Interrupt Sent I2	Interrupt Received I3	Interrupt Collision I4
DLI_X25_HOST_INTERRUPT	I2	—	I4	—
DLI_X25_HOST_INT_CONFIRMED	—	—	I1	I2
DLI_X25_ICP_INTERRUPT	I3	I4	—	—
DLI_X25_ICP_INT_CONFIRMED	—	I1	—	I3
DLI_X25_ICP_CMD_REJECTED	Close PVC or abort SVC			

[a] These states are valid when the DLI_X25_USER_API session state for DLI_X25_SAP_X25 is S4, the PVC session state is PVC4 or the SVC session state is SVC4 or ICF4, and the data transfer state is D1.

Figure 2–16 shows a typical sequence of packet exchanges occurring during the transmission or reception of an X.25 interrupt.

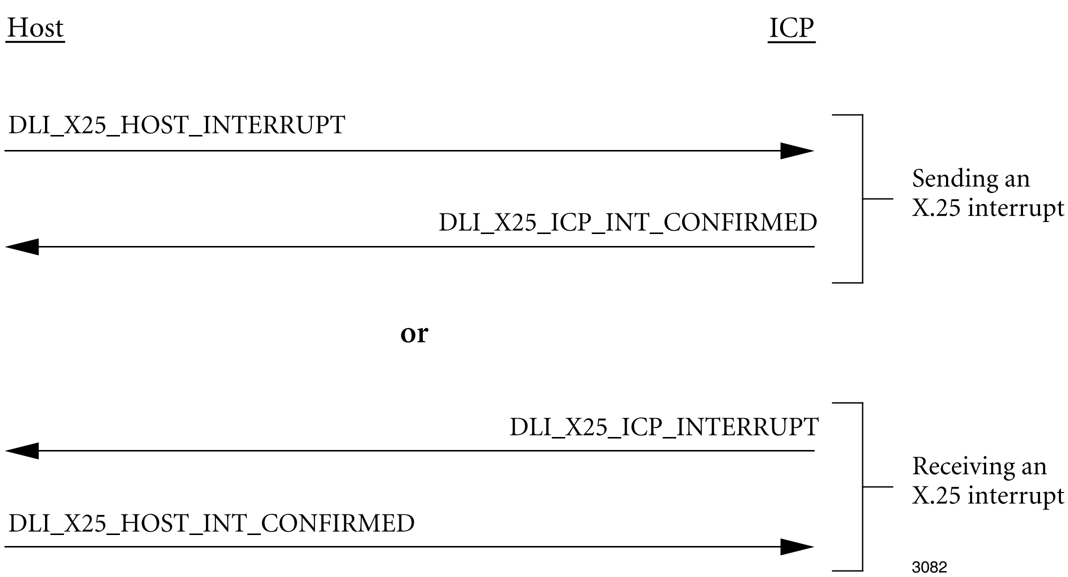

Figure 2–16: X.25 Interrupt

2.2.4 DLI_X25_SAP_DIAG Data Link Monitor Service

Freeway X.25 provides an online data link monitor service to assist in diagnosis of communications faults at the ICP's serial data link interface. This service is especially useful when an external data link analyzer is not available. It is also useful in identifying differences between what an external analyzer reports and what the ICP actually sees on the data link.

Protogate's Freeway X.25 standard product includes a client program and API which give you access to this service. If you are not using Protogate's standard package, see Chapter 6 for details on DLI_X25_HOST_MONITOR_REG and DLI_X25_ICP_MONITOR_RSP packet formats.

First, open a DLI_X25_MGR_API session with DLI_X25_SAP_DIAG service on the Freeway ICP. Then send the DLI_X25_HOST_MONITOR_REG packet to select the link to be monitored and the format of the link monitor report information. All link monitoring information is returned in a stream of DLI_X25_ICP_MONITOR_RSP packets from the Freeway ICP. Although you may request monitoring of more than one link simultaneously, Protogate recommends monitoring only one link at a time due to the significant increase in client/server interaction and ICP processing imposed by this service. If you request monitoring of exceptions only, multiple links can be monitored simultaneously.

2.3 Practical Considerations

At the beginning of this chapter, we stated that you must implement the hierarchical state machine presented in Section 2.2. However, it may not always be practical to do so. It would be more accurate to say that Freeway X.25 logic on the ICP implements this state machine, and that your program design must be compatible with it.

Freeway is designed to support many client sessions on multiple client computers. This makes it nearly impossible for software on client computers to enforce the sequencing implied by this state machine. For example, a DLI_X25_SAP_X25 DLI_X25_USER_API client on one machine has no way of knowing the link operation state on a Freeway ICP that was configured by a DLI_X25_SAP_X25 DLI_X25_MGR_API client on another machine. In this case, you may prefer to rely on the validation logic within the X.25 services software on the ICP, rather than attempt to implement your own.

Even if you intend to handle all Freeway client sessions within one process on a single client computer, it is not necessary to implement the entire state machine as program code. Instead, you may find it simpler to design an application that assumes Freeway X.25 is already configured. By handling Freeway X.25 configuration as a special case, you may limit your program design to a small subset of the state machine.

Protogate's own Freeway X.25 asynchronous call service application program interface (CS_API) relies heavily on validation logic within the Freeway ICP. The API implements a limited portion of the state machine for DLI_X25_SAP_SLP and DLI_X25_SAP_X25 DLI_X25_USER_API clients, but relies entirely on the ICP to police DLI_X25_MGR_API client requests from the application.

Chapter 3 X.25 Configuration Options

This chapter describes each configuration option available for the X.25 protocol service on Freeway. Each main section heading in this chapter includes the packet type in parentheses to aid in cross referencing to Chapter 6 which describes the packet format.

The Index provides a comprehensive cross reference between this chapter and Chapter 6. To locate the cross references, refer to the index entry titled "**Cross reference.**"

3.1 Software Version Data (DLI_X25_HOST_GET_VERSION)

Information about the version of X.25 protocol services software resident on Freeway may be obtained from Freeway itself. Freeway returns data in the form of an ASCII text string that may be displayed or printed. Software version data may be requested through the X.25 protocol service (DLI_X25_SAP_X25) at any time after Freeway has been downloaded.

3.2 Buffer and Station Resource Limits (DLI_X25_HOST_CFG_BUF)

Freeway buffer sizes and the maximum number of virtual circuits are configurable. Section 3.2.1 through Section 3.2.3 describe these configuration options. Before initializing buffers and virtual circuits, all data links on Freeway must be disabled, which is the case immediately after downloading the X.25 software to Freeway. If you do not send an initialization packet to Freeway after download, the default communication buffer size is 256 bytes, no segmentation buffers are used, and the maximum number of virtual circuits is 256.

3.2.1 Segmentation Buffer Size

The Freeway X.25 protocol service provides optional support for X.25 message segmentation. The segmentation feature is enabled when the segmentation buffer size is configured to a valid non-zero value. Segmentation is disabled when a segmentation buffer size of zero is configured. Segmentation is not supported by the Freeway HDLC protocol service (DLI_X25_SAP_SLP).

The Freeway message segmentation feature improves host CPU efficiency by reducing the number of I/O calls to the host operating system. The host application reads and writes each message as a block of data. Freeway then converts each outgoing client message into an X.25 complete packet sequence. The message is transmitted as a series of message fragments, and is reassembled at the remote DTE into its original form.

Freeway supports a maximum segmentation buffer size of 8192 bytes. If the client message exceeds the size of the segmentation buffer, the client may use the M-bit to indicate that more data follows an initial full segment. This process may be repeated for each additional full segment, until the final segment of the message is sent without the M-bit.

The segmentation buffer size is normally configured to fit the maximum size of a single client message. The segmentation buffer size (in bytes) must be a multiple of 64 between 128 and 8192 bytes. A client may write any amount of data up to the segmentation buffer size, but must always be prepared to read a full segment buffer. It is the system administrator's responsibility to make the segmentation buffer size known to all client application programmers.

Segmentation buffers are not needed if the sizes of the data blocks sent by the host to Freeway are the same size as the communication buffers. However, if segmentation buffers are not configured, Freeway can negotiate and accept only a *local* DTE packet data size (outgoing data) exactly equal to the communication buffer size. On the other hand, if segmentation buffers are configured, Freeway can negotiate and accept all valid *local* DTE packet data sizes up to the configured communication buffer size. In both cases, Freeway can negotiate and accept all valid *remote* DTE packet data sizes (incoming data) up to the configured communication buffer size.

3.2.2 Communication Buffer Size

Freeway permits the frame data size for each link to be set independently (Section 3.4.8 on page 89). The Freeway communication buffer size must be big enough to contain the largest required frame data size, but should otherwise be the smallest multiple of 64 between 64 and 8192 sufficient to do so. If segmentation buffers are configured, the communication buffer size must be less than or equal to the segmentation buffer size.

Note

Communication buffer sizes larger than 4096 should be specified only when required to support transfer of large HDLC I-frames. The maximum I-frame size for X.25 is 4096.

The specified communication buffer size need only accommodate actual data. Freeway reserves extra room for various protocol headers required for actual transmission and reception on the data links.

3.2.3 Virtual Circuit Maximum

Although limited to a maximum of 128 separate client processes distributed on the LAN, Freeway supports multiple client sessions per distinct client process. Each client session supports one virtual circuit. Freeway allocates one station resource per possible virtual circuit.

The maximum number of virtual circuits supported on Freeway is configurable. The default limit is 256 virtual circuits per ICP. This can be increased to a maximum of 1024 virtual circuits per ICP. The limit applies to the total number of simultaneously active virtual circuits on all data links on an ICP. Control of this large number of virtual circuits may be managed by a single client process, or may be distributed among up to 128 distinct client processes. In either case, a separate API client session is required for each virtual circuit.

The configured limit on number of virtual circuits also limits the number of clients using the Freeway X.25 protocol service. Although a DLI_X25_MANAGER_API client cannot access virtual circuits, it does count as a client using the X.25 protocol service, and therefore reduces (by one) the actual maximum number of virtual circuits supported as long as the DLI_X25_MANAGER_API client session is open.

3.3 ICP Buffer Clearing (DLI_X25_HOST_BUF_CLR)

Each Freeway ICP meets data buffering requirements by obtaining buffers from a buffer resource pool on the ICP when needed, and releasing buffers to the pool when they are no longer needed. The ICP does not normally clear buffers before releasing them to the pool; instead, the ICP overwrites old data when the buffer is reused.

Each Freeway ICP may be configured to clear each buffer before returning it to the ICP buffer pool. This ensures that data is not kept on the ICP longer than is required to successfully complete reception or transmission of the data. Buffer clearing may be enabled at any time after Freeway is downloaded.

Note

Once enabled, buffer clearing cannot be disabled without downloading the affected Freeway ICP.

3.4 Data Links (DLI_X25_HOST_CFG_LINK)

Each HDLC LAPB data link is individually configurable. Configuring a link cancels all previous local station assignments on that link. If the single link procedure (SLP) controlling the data link belongs to a multilink procedure (MLP), reconfiguring the link removes the SLP from MLP control, but does not cancel local station assignments until all SLPs are disassociated from the MLP. The links must be configured before configuring MLP, call service, or station parameters.

All links assigned together under the control of the same multilink procedure (MLP) must use the same configuration option values. Section 3.4.1 through Section 3.4.14 describe individual options applicable to link configuration.

3.4.1 Bit Encoding Format

The method for encoding bits on the link is configurable. The two options are non-return to zero (NRZ) and non-return to zero inverted (NRZI). Most X.25 implementations use NRZ encoding, which is the default bit encoding format used by Freeway.

3.4.2 Clock Source

Freeway may be configured to use internally generated transmit timing, or to use an external clock for transmit timing. Because Freeway is shipped with each ICP set for external clock, software configuration must also be set for external clock.

The clock source can be selected independently for each link on an ICP. If you need to set internal clock, call the Protogate customer support number given in the *Preface*.

Note

Clock source configuration applies to transmit timing only. Timing for received data is always supplied as an external input.

3.4.3 Data Rate

The nominal data rate must be specified regardless of the selected clock source. When Freeway is configured to use the internal clock source, it supports data rates from 300 to 64000 b/s on all links simultaneously. Specification of data rates in excess of 64000 b/s may yield an increase in the number of recoverable errors recorded in Freeway link statistics.

3.4.3.1 Custom Data Rate

Freeway permits the specification of custom data rates not found in the standard data rates listed in the next section. Because the serial line controller chips on Freeway cannot support all internal clock bit rates, Freeway substitutes the nearest supported data rate for the specified custom data rate.

The following formula may be used to determine whether a selected custom data rate is supported accurately. Substitute the selected data rate (bits per second) in place of the *bps* variable, and compute the indicated quotient ($Q1$). If the quotient ($Q1$) is an integer (that is, there is no remainder), the data rate is 99.99% accurate.

$$Q1 = \frac{3686400}{bps}$$

If the above computation indicates that the selected data rate is not accurately supported, the actual data rate may be approximated as follows, where $INT(Q1)$ is the integer value obtained by truncating any fractional portion of the quotient ($Q1$) obtained from the above computation.

$$bps = \frac{3686400}{INT(Q1)}$$

3.4.3.2 Standard Data Rate

Freeway supports the following standard data rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 56000, 57600 and 64000 bits per second. Standard data rate accuracies are typically as follows when the configured clock source is internal: 56000 is 98.73% accurate; 64000 is 98.94% accurate; all other standard data rates are 99.99% accurate.

3.4.4 Custom Frame Addressing

For each HDLC LAPB data link, transmitted and received frames contain a single frame address byte. Two choices are permitted for the frame address byte: the DTE address, or the DCE address. Frames transmitted by the DTE contain the DCE address in commands, or the DTE address in responses. Similarly, frames transmitted by the DCE contain the DTE address in commands, or the DCE address in responses. All frames exchanged on the data link contain one of these two addresses.

The custom frame addressing option permits the specification of non-standard DTE and DCE frame addressing. Both a local address and a remote address must be specified.

3.4.5 DTE/DCE Role Selection

The DTE/DCE selection option determines the data link's role (DTE vs. DCE). Protogate's X.25 is primarily DTE software, and the Freeway physical interface is strictly DTE. When two X.25 links are connected to each other through a modem-eliminator or loopback cable, one X.25 link must use DTE addressing and the other must use DCE addressing. X.25 does not recognize DTE-to-DTE or DCE-to-DCE connections.

Selection of the DCE role affects the following only:

Frame address The default frame address is determined by the role selected (DTE or DCE), unless custom frame addressing is also specified. For a non-MLP data link, the default local address for a DTE is 3, and the default remote address is 1. Correspondingly, the default local address for a DCE is 1, and the default remote address is 3. For an MLP data link, the default local address for a DTE is 15, and the default remote address is 7. Correspondingly, the default local address for a DCE is 7, and the default remote address is 15.

Call collision[1] Normally, the network DCE is responsible for resolving call collisions, should they occur. In a point-to-point connection between two DTEs, one DTE must adopt the role of the DCE. When Protogate's X.25 is configured for DCE operation, it handles call collisions by immediately clearing the call. When the DTE role is selected, Protogate's X.25 waits for the DCE to clear or accept the call.

LCN assignment To decrease the probability of call collisions, the Consultative Committee on International Telephone and Telegraph (CCITT) recommends that the DTE makes logical channel number (LCN) assignments high-to-low, while the DCE makes LCN assignments low-to-high. For switched virtual circuit (SVC) stations, Protogate's X.25 follows the LCN assignment strategy appropriate to the DTE/DCE role selected. LCN assignments for permanent virtual circuit (PVC) stations are made during station configuration (Section 3.7 on page 114).

REJ packet When optional packet retransmission facilities are supported, the DTE may transmit REJ (reject) packets, and the DCE must process them by initiating retransmission of the requested X.25 data packets. Because the DTE cannot receive REJ packets and the DCE cannot send REJ packets (Section 3.6.14 on page 108), the DTE/DCE role is critical to correct handling of packet retransmission procedures.

3.4.6 Frame Modulus

The HDLC LAPB data link may be configured for either modulo 8 or modulo 128 sequence number operation. Frame sequence numbers cycle from 0 through one less than the modulus; that is, modulo 8 sequence numbers are 0–7, while modulo 128 sequence numbers are 0–127. Modulo 8 operation is normal for ground-based data links, while modulo 128 operation is more common for data links via satellite.

1. A call collision is defined as the simultaneous occurrence of a DCE call indication and a DTE call request on the same logical channel group number (LCGN)/LCN channel.

Note

Frame-level modulo 128 operation is not supported by the CCITT X.25 1980 recommendation, but is optional for other supported X.25 operation profiles.

3.4.7 Frame Transmit Window Size

The frame transmit window size limits the number of information frames (I-frames) that may be transmitted by a data link without acknowledgment. If the number of unacknowledged I-frames reaches the frame transmit window size, the frame transmit window closes and transmission of additional I-frames stops until acknowledgment is received.

The configured frame transmit window size must always be greater than 0 and less than the configured frame modulus. For modulo 8 operation, a frame transmit window size of 7 is customary. For modulo 128 operation, the frame transmit window size is usually at least 8, but must be less than 127.

3.4.8 N1 Maximum Frame Data Size

The CCITT X.25 recommendation describes the N1 parameter as the number of bits permitted within an I-frame, including all bits in the HDLC LAPB address and control fields, the MLP header (if present), the X.25 packet header, the X.25 data field, and the FCS. Protogate's X.25 requires only the specification of the X.25 data field size (in bytes), and automatically adjusts the implied N1 value for the size of the additional fields in a complete I-frame.

The maximum frame data size cannot be larger than the X.25 software communication buffer size (Section 3.2.2 on page 83). If the configured communication buffer size exceeds 4096 (to accommodate large HDLC I-frames on a non-X.25 link), then the X.25 link configuration must specify an N1 parameter of 4096 or less.

Figure 3–1 shows the relationships between the various portions of an X.25 frame. The byte labeled GFI/LCGN consists of the high-order four bits which are the general format indicator (GFI) and the low-order four bits which are the LCGN.

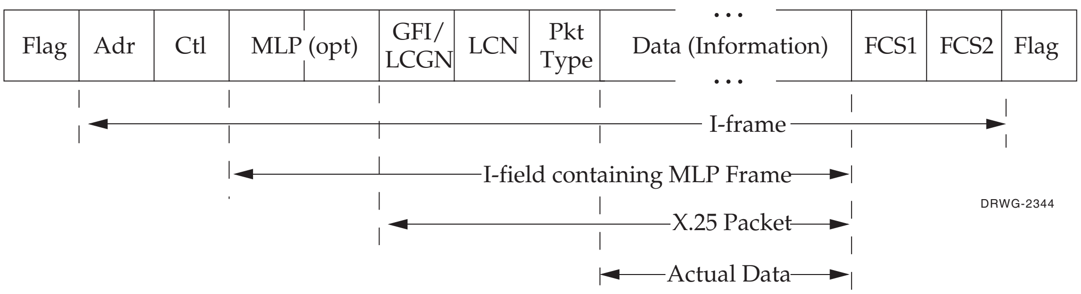

Figure 3–1: X.25 Modulo 8 Information Frame (I-frame)

Note

The maximum frame data size permitted for CCITT X.25 1980 operation is 1024 bytes. For CCITT X.25 1984/1988 and ISO 8208, the maximum frame data size is 4096.

3.4.9 N2 Retry Limit (for T1 Timer)

The N2 retry limit is the maximum number of times that the HDLC LAPB data link attempts to retransmit the same frame. Each retransmission attempt is triggered by expiration of the T1 timer. After N2 retransmission attempts for the same frame, Freeway automatically attempts to reset the HDLC LAPB data link. If Freeway also fails to reset the data link after N2 attempts, Freeway attempts to disconnect the data link. If Freeway then fails to obtain acknowledgment of the disconnect request, Freeway declares the data link inactive. For an X.25 data link, the ICP attempts to reactivate the data link until it succeeds, or until an authorized X.25 DLI_X25_MANAGER_API client commands Freeway to disable the link. For an HDLC data link, the DLI_X25_USER_API client must specifically re-enable the link.

3.4.10 T1 CCITT/ISO Retry Timer

The T1 timer limits the period of time that the HDLC LAPB data link waits for transmission acknowledgment. This time limit is usually at least four times the transmission time of an I-frame of maximum size, and is rarely set lower than 2 seconds. Expiration of the T1 timer triggers Freeway attempts to retransmit the unacknowledged I-frame, request acknowledgment, or reset the data link.

Note

If the T1 timer is set too low, the HDLC LAPB protocol breaks down; if it is set too high, recovery from transmission failures takes an excessive period of time.

3.4.11 T2 CCITT/ISO Acknowledgment Delay Timer

The T2 timer specifies the maximum time that the HDLC LAPB data link may wait to acknowledge a received I-frame. Delaying transmission of a supervisory receiver-ready (RR) frame to acknowledge receipt of an I-frame permits the data link to increase the probability that the acknowledgment may be sent on the next I-frame available for transmission. This is especially true of X.25, because receipt of an I-frame containing an X.25 data packet is followed shortly thereafter by the transmission of an I-frame containing an X.25 packet acknowledging the data.

The actual delay between receipt of an I-frame and transmission of acknowledgment varies, and is influenced by the following factors:

Outgoing I-frame If an outgoing I-frame is available, acknowledgment is included in the I-frame as it is transmitted and the T2 timer is stopped.

T2 timer If the T2 timer expires before acknowledgment has been sent, a supervisory acknowledgment is transmitted immediately.

Window closure If the number of unacknowledged I-frames received reaches the configured frame transmit window size, a supervisory acknowledgment is transmitted immediately to authorize continued transfer of incoming I-frames.

3.4.12 T3 ISO Idle Link Timer

The ISO 7776 standard defines an optional T3 timer that limits the duration of an idle link condition on an active link. Receipt of continuous "1" bits on the data link for a period of T3 seconds causes Freeway to report the link inactive (disconnected).

Note

Although the T3 timer is not a CCITT-specified feature, it is compatible with CCITT X.25 operations.

3.4.13 T4 ISO Link Integrity (Keep Alive) Timer

The ISO 7776 standard defines an optional T4 timer that causes periodic transmission of a supervisory polling frame in the absence of other data link activity. Polling continues at T1 time intervals until a valid response is received. In the absence of a valid response, Freeway follows normal N2 retry limit procedures.

The T4 timer may be used as a "keep-alive" timer to periodically check data-link integrity. The T4 timer length must be greater than the configured T1 timer length.

Note

Although the T4 timer is not a CCITT-specified feature, it is compatible with CCITT X.25 operations.

3.4.14 X.21/V.11 Clock Source

The X.21/V.11 clock source configuration option is provided to permit the use of an X.21/V.11 physical layer interface instead of an X.21 bis interface. This option is valid only when Freeway is fitted with X.21/V.11 DTE connectors.

Because the X.21/V.11 physical interface utilizes only a single clock line, Freeway must be configured both to use an external clock source (Section 3.4.2 on page 85) and to specify receive timing input as the X.21/V.11 clock source for send timing.

3.4.15 EIA Electrical Interface

The EIA electrical interface for each Freeway ICP card complies with one or more of the following interface standards:

- EIA_232
- EIA_449
- EIA_530
- EIA_V35
- MIL_188C

A Freeway ICP that supports more than one electrical interface standard requires that the link configuration specify which EIA interface is to be used. Software-selectable EIA configuration is supported on the ICP2424 and ICP2432 only. The ICP6000 disregards this option because EIA is determined by the hardware.

3.5 MLP — Multilink Procedures (DLI_X25_HOST_CFG_MLP)

The use of MLPs in X.25 effectively increases the throughput capacity of X.25 virtual circuits by supporting the use of several serial data links to carry X.25 data traffic simultaneously. The MLP provides a single access point for packet-level transmission and reception.

When using a multilink procedure (MLP), configure the MLP after configuring data links (or SLPs) but before configuring call service parameters or stations. This practice ensures that call service parameters and stations are validated correctly. If the host attempts to configure an MLP after configuring call service parameters or stations, Freeway may reject the request.

The host can configure more than one MLP, but no two MLPs can share the same SLP. *Each SLP to be assigned to an MLP must be in the disabled state.*

Both the DTE and the DCE must be configured for MLP operation over the same data links. MLP operation is local to the DTE/DCE interface, and does not impose any requirement for MLP operation at another DTE/DCE interface elsewhere on the network.

To X.25, an MLP-controlled set of data links appears as a single logical data link interface. The MLP itself does not have an associated identifier; all SLPs to be assigned to an MLP are included in one host configure MLP packet. Additional SLPs cannot be added without listing all SLPs again, and the requirement that all SLPs be inactive still holds. After MLP configuration, the link id field in host packets (PROTHDR.link, Section 6.1.2 on page 135) must identify one of the links under the MLP's control. The link id field is used to find the associated MLP but does not determine the actual data link used for data transmission.

An SLP may be deleted from an MLP by reconfiguring the link. The more usual procedure is to disable an SLP to take it out of service, but leave it associated with its MLP. The host merely re-enables the SLP to place it in service again.

Section 1.6.2 on page 31 lists the features of MLP operation. Section 3.5.1 through Section 3.5.6 describe all parameters specific to MLP configuration.

Note

Multilink procedure (MLP) usage is not supported for CCITT X.25 1980 operation, but is optional for other supported X.25 operation profiles.

3.5.1 MT1 Lost Frame Timer Value

The MT1 timer is used during periods of low traffic to limit the time that the MLP waits to receive a missing MLP frame required to complete the original sequence of MLP frames. At the end of this period, the MLP assumes that the MLP frame for which it is waiting has been lost, and begins waiting for the next expected MLP frame.

Note

If MT1 is set too low, MLP processing of data link failures may result in the assumed loss of MLP frames.

Data loss may occur if the MT1 timer expires before the MLP data link fail-over processing can retransmit I-frames not acknowledged on the data link. The value chosen for the MT1 timer should not be less than the product of the T1 retry timer and the N2 retry limit values configured for the data link under MLP control, and should be large enough to permit transmission of an entire frame transmit window's worth of I-frames on the data link.

3.5.2 MT2 Group Busy Timer Value

The MT2 timer is used when all data links are busy[2] to limit the time that the MLP waits to receive a missing MLP frame required to complete the original sequence of MLP

2. A data link is said to be *busy* after it transmits a supervisory receiver-not-ready (RNR) frame to inform the DCE that it is unable to handle additional incoming I-frames due to buffer congestion or other internal processing limitations. The data link later transmits a supervisory RR (receiver-ready) frame to notify the DCE that the busy condition is resolved.

frames. At the end of this period, the MLP assumes that the MLP frame for which it is waiting has been lost, and begins waiting for the next expected MLP frame.

The value chosen for the MT2 timer is non-critical on Freeway. Its value may be set very large to avoid loss of MLP frames during local RNR conditions, should they occur.

3.5.3 MT3 Reset Confirmation Timer Value

The MT3 timer is used during MLP reset operations to limit the time that the MLP waits to receive confirmation of its MLP reset request. At the end of this period, the MLP assumes that its original MLP reset request was lost, and issues another MLP reset request.

Note

If MT3 is set too low and temporary data link transmission problems occur, MLP reset procedures may not complete successfully.

The value chosen for the MT3 timer should not be less than the product of the T1 retry timer and the N2 retry limit values configured for the data link under MLP control.

3.5.4 MW Multilink Window Size

The MW parameter determines the size of the multilink receive window by specifying the maximum number of MLP frames that the multilink receive window can accommodate for resequencing. MLP frames received from the lower layer (data links) are held for resequencing and delivery to the higher layer (X.25) as long as each MLP frame's sequence number lies within the multilink receive window. As MLP frames are resequenced successfully and delivered to the higher layer, the position of the multilink receive window rotates within the modulo 4096 cycle used for MLP frame sequencing.

The value for MW must be the same for both the DTE and the DCE. It should also be larger than the product of the number of data links and the configured frame transmit window size, but should not be so large as to commit a majority of the available receive buffering capacity to resequencing of incoming MLP frames.

For example, the MW window size for an MLP controlling four data links, each with a frame transmit window size of 7 may reasonably be set to any value in the range 28–64; with a frame transmit window size of 127 over the same four data links, MW may reasonably be set to any value in the range 508–1024 (provided that the configured communication buffer size is small enough to guarantee a large number of available buffers).

3.5.5 MX Window Guard Region Size

The MX parameter defines the size of the MLP window guard region. The MX window guard region lies just beyond the MW multilink receive window. Receipt of an MLP frame with a sequence number outside the MW multilink receive window but within the MX window guard region signals the loss of MLP frames, and causes the MLP to rotate its MW multilink receive window and MX window guard region.

The value for MX must be large enough for the receiving MLP to recognize receipt of an MLP frame with the highest sequence number outside its multilink receive window that it may legitimately receive after a multilink frame loss has occurred. However, the value for MX should not exceed the value for MW, and the sum of MX and MW cannot exceed 4095.

3.5.6 MLP Data Links

When the MLP is configured, a list of HDLC LAPB data links must be explicitly assigned to the MLP. Each data link in the list must already be configured, must be inactive, and must not already be assigned to another MLP.

3.6 X.25 Call Service Configuration (DLI_X25_HOST_CFG_CALL_SERVICE)

The host configures the optional call service parameters after configuring the link (and the MLP, if applicable). Each X.25 network connection has a unique call service configuration (an X.25 network connection might be a single link, or it could be an MLP). If you are using multiple X.25 network connections, you must separately configure each connection for call service. Most call service parameters may be adjusted either prior to or after beginning normal X.25 operations. However, certain parameters may not be adjusted if doing so would conflict with facilities registered with the network DCE through X.25 facilities registration procedures. See Chapter 5.

Caution

Do not confuse call service *configuration* (which remains in effect until changed) with the call service *facilities* that can be specified dynamically by a DLI_X25_USER_API client during SVC call establishment. The latter category is implemented using quality of service (qos) parameters within packets sent to the Freeway ICP during call establishment.

Section 3.6.1 through Section 3.6.17 describe the available X.25 call service configuration parameters. The function codes are shown in parentheses to aid in cross referencing to Chapter 6.

3.6.1 Calling DTE Address (HF_CLLNG)

The calling DTE address is an optional call service configuration parameter, and specifies the network address associated with the local DTE/DCE network interface. When configured, the DTE calling address is included in outgoing X.25 call request packets, unless specifically replaced by a quality-of-service (qos) parameter item in a client DLI_X25_HOST_CALL_REQ request packet.

3.6.2 Fast Select (HF_FASCN)

This call service configuration parameter permits the DLI_X25_MANAGER_API client to configure the manner in which Freeway handles incoming calls containing fast select facilities. Freeway may be configured to take one of the following actions:

BAR calls Freeway is configured to bar each incoming call containing a fast select facility by immediately clearing the call without notifying any client.

NOTIFY client (default) Freeway is configured to notify a registered DLI_X25_USER_API client (if any) when such a call is received. The client so notified must issue one of the following request packets: DLI_X25_HOST_CALL_ACCEPTED, DLI_X25_HOST_REDIRECT, or DLI_X25_HOST_CLR_REQ. If no client can be notified, Freeway clears the incoming call.

Note

Freeway cannot automatically accept incoming fast select calls, even when incoming call handling is configured to accept incoming calls.

3.6.3 Reverse Charge (HF_RVCN)

This call service configuration parameter permits the DLI_X25_MANAGER_API client to configure the manner in which Freeway handles incoming calls containing the reverse charging facility. Freeway may be configured to take one of the following actions:

BAR calls Freeway bars each incoming call containing the reverse charging facility by immediately clearing the call without notifying any client.

ACCEPT calls (default) Freeway automatically accepts each such incoming call, provided that a registered DLI_X25_USER_API client is available to handle the call. If no DLI_X25_USER_API client is available, Freeway instead clears the call without notifying any client.

NOTIFY client Freeway notifies a registered DLI_X25_USER_API client (if any) when such a call is received. If no client can be notified, Freeway clears the incoming call.

3.6.4 Incoming Calls (HF_INCM)

This call service configuration parameter permits the DLI_X25_MANAGER_API client to configure the manner in which Freeway handles incoming calls in general. Freeway may be configured to take one of the following actions:

BAR calls Freeway bars each incoming call by immediately clearing the call without notifying any client.

ACCEPT calls (default) Freeway automatically accepts each incoming call, provided that a registered DLI_X25_USER_API client is available to handle the call. If no DLI_X25_USER_API client is available, Freeway instead clears the call without notifying any client.

NOTIFY client Freeway notifies a registered DLI_X25_USER_API client (if any) when a call is received. If no client can be notified, Freeway clears the incoming call.

3.6.5 T2X Timers (HF_T2XCN)

Each of the call service T2X timers listed below controls a specific aspect of X.25 error handling. A separate set of T2X timers is individually selectable for each configured Freeway X.25 network connection. That is, the T2X timers for one data link may differ from those configured for X.25 on another data link, if those two links belong to separate network connections. When configured to run over an MLP layer, the T2X timers apply to X.25 operations over that MLP (and all of its underlying data links).

T20 This CCITT/ISO restart request timer limits the time that Freeway waits for confirmation of an X.25 restart request. When the timer expires, Freeway repeats its X.25 restart request. The allowed range is 1–255 seconds; the default is 180.

T21 This CCITT/ISO call request timer limits the time that Freeway waits for the DCE to connect or clear an outgoing DTE call request. When the timer expires, Freeway issues a DTE clear request to terminate the outstanding call. The allowed range is 1–255 seconds; the default is 200.

T22 This CCITT/ISO reset request timer limits the time that Freeway waits for confirmation of an X.25 reset request. When the timer expires, Freeway repeats its X.25 reset request, unless doing so would exceed the R22 retry limit. The allowed range is 1–255 seconds; the default is 180.

T23 This CCITT/ISO clear request timer limits the time that Freeway waits for confirmation of an X.25 clear request. When the timer expires, Freeway repeats its X.25 clear request, unless doing so would exceed the R23 retry limit. The allowed range is 1–255 seconds; the default is 180.

T24 This optional ISO window status transmission timer defines the periodic interval at which the DTE transmits a supervisory RR or RNR X.25 packet on each active SVC or PVC that has not transmitted any packet within that interval. The timer is provided for compliance with ISO 8208, but its use is not generally required for operation of X.25 over HDLC LAPB layers. The allowed range is 1–255 seconds; by default the T24 timer is disabled.

T25 This optional ISO window rotation timer provides for periodic retransmission of unacknowledged X.25 data packets. The timer is provided for compliance with ISO 8208, but its use is not generally required for operation of X.25 over HDLC LAPB layers. The allowed range is 1–255 seconds; by default the T25 timer is disabled.

T26 This ISO interrupt response timer limits the time that Freeway waits for confirmation of an X.25 interrupt. When the timer expires, Freeway issues an X.25 reset request. The allowed range is 1–255 seconds; by default the T26 timer is disabled.

T27 This ISO reject response timer limits the time that Freeway waits for receipt of the X.25 data packet previously requested through transmission of an X.25 REJ packet. When the timer expires, Freeway retransmits an X.25 REJ packet (Section 3.6.14 on page 108), unless the R27 retry limit would be exceeded. The allowed range is 1–255 seconds; by default the T27 timer is disabled.

T28 This CCITT/ISO registration request timer limits the time that Freeway waits for confirmation of an X.25 facilities registration request. When the timer expires, Freeway retransmits an X.25 facilities registration request, unless the R28 retry limit would be exceeded. The allowed range is 0.1–25.5 minutes; the default is 5.0.

Note

The T24–T27 ISO timers are not supported for CCITT X.25 operations. The T28 CCITT/ISO timer is not supported for CCITT X.25 1980 operations.

3.6.6 R2X Retry Limits (HF_R2XCN)

Each of the call service R2X retry limits listed below controls a specific aspect of T2X timeout error handling. A separate set of R2X retry limits is individually selectable for each configured Freeway X.25 network connection. That is, the R2X retry limits for one data link may differ from those configured for X.25 on another data link, if those two links belong to separate network connections. When configured to run over an MLP layer, the R2X retry limits apply to X.25 operations over that MLP (and all of its underlying data links).

R20 This is the retry limit for the T20 timer. After R20 attempts to restart X.25, Freeway reports an X.25 link timeout to the DLI_X25_MANAGER_API client (if any) responsible for managing the X.25 service. The allowed range is 1–255 retries; the default is 2.

R22 This is the retry limit for the T22 timer. After R22 attempts to reset the virtual circuit, Freeway reports an SVC connection failure or a PVC procedure error. The allowed range is 1–255 retries; the default is 2.

R23 This is the retry limit for the T23 timer. After R23 attempts to clear the virtual circuit, Freeway reports an SVC connection failure. The allowed range is 1–255 retries; the default is 2.

R25 This is the retry limit for the T25 timer. After R25 attempts to retransmit X.25 data, Freeway issues an X.25 reset request. The allowed range is 1–255 retries; the default is 1.

R27 This is the retry limit for the T27 timer. After R27 attempts to request X.25 data by sending an REJ packet (Section 3.6.14 on page 108), Freeway issues an X.25 reset request. The allowed range is 1–255 retries; the default is 1.

R28 This is the retry limit for the T28 timer. After R28 attempts to register facilities, Freeway reports a NULL registration confirmation to the DLI_X25_MANAGER_API client (if any) responsible for managing the X.25 service. The allowed range is 1–255 retries; the default is 2.

Note

The R25 and R27 retry limits are not supported for CCITT X.25 operations. The R28 retry limit is not supported for CCITT X.25 1980 operations.

3.6.7 TL1 Link Activation Timer (HF_TLX)

This call service configuration parameter sets the periodic interval at which the X.25 DLI_X25_MANAGER_API client or HDLC DLI_X25_USER_API client is notified of continuous failure to activate a data link or reactivate a data link after it fails. After notifying the client of a TL1 timeout event, Freeway continues both to attempt to establish the data link and to provide periodic notification of TL1 timeout events unless the client specifically disables the data link. The allowed range is 1–255 seconds; the default is 180.

3.6.8 LCN Bounds — Logical Channel Types Ranges (HF_LCN)

The term logical channel number (LCN) is often used ambiguously to refer either to the least significant 8 bits, or to the entire 12 bits of the composite number formed by concatenating the 4-bit logical channel group number (LCGN) with the 8-bit LCN. In this context, LCN refers to the 12-bit composite LCGN/LCN number.

The LCN bounds call service configuration parameter sets the permitted 12-bit logical channel number range for each of the three categories of SVC call listed below. The ranges cannot overlap, and each number range must generally be higher than those that precede it. An exception is made for ranges that are to be omitted by specifying a range of zero.

The designation of a call as *incoming* or *outgoing* is always from the perspective of the DTE. When Freeway is configured to adopt the role of the DCE, it also adjusts its definition of incoming and outgoing calls to fit the perspective of the other DTE.

LIC–HIC This defines the LCN value range for calls from the DCE to the DTE. LIC is the lowest incoming call LCN, and HIC is the highest incoming call LCN. The HIC value must be greater than or equal to the LIC value. The LIC value must be higher than the highest LCN value assigned to a PVC, unless zero is specified to omit the LIC–HIC range. The default is zero for both LIC and HIC.

LTC–HTC This defines the LCN value range for calls from the DCE to the DTE or vice versa. LTC is the lowest two-way call LCN, and HTC is the highest two-way call LCN. The default LTC is 1; the default HTC is 4095. The HTC value must be greater than or equal to the LTC value. The LTC value must be higher than each of the following, unless zero is specified to omit the LTC–HTC range:

- The highest LCN value assigned to a PVC

- The HIC value

LOC–HOC This defines the LCN value range for calls from the DTE to the DCE. LOC is the lowest outgoing call LCN, and HOC is the highest outgoing call LCN. The default is zero for both LOC and HOC. The HOC value must be greater than or equal to the LOC value. The LOC value must be higher than each of the following, unless zero is specified to omit the LOC–HOC range:

- The highest LCN value assigned to a PVC
- The HIC value
- The HTC value

Note

The LCN bounds configuration option may not be set using call service configuration if X.25 facilities registration procedures (Chapter 4) have already determined the logical channel types ranges permitted by the network DCE. See Chapter 5.

3.6.9 Certification Mode (HF_CERT)

DCE emulator equipment used to certify DTE X.25 operation is typically limited in its capacity to recognize valid X.25 protocol behavior that deviates from expected testable behavior. The certification mode call service configuration parameter is used to inform Freeway whether or not it is connected to DCE emulator test equipment for certification so that Freeway can accommodate typical limitations in the DCE emulator test equipment.

For example, both the CCITT X.25 recommendation and the ISO 7776 specification state that a DTE can initialize the data link by sending SABM. A network DCE handles receipt of a SABM correctly every time, but DCE emulator test equipment might not expect receipt of a SABM until after it sends a Disconnected Mode (DM) response.

Although call service certification mode is primarily intended for use during certification of X.25 operations, it can also be used during normal operations. Certification mode enforces the following modifications to data link operation, and has no effect on X.25 packet-level operation:

1. During data link startup, certification mode inhibits transmission of SABM (or SABME) prior to receiving a DM, SABM (or SABME) from the DCE. This ensures that the DCE simulator controls the timing and manner of data link startup.

2. Certification mode inhibits supervisory polling following receipt of an RNR frame from the DCE. This eliminates the need for the DCE simulator to handle RR frames from the DTE when the intent is to test DTE halting of I-frame transmissions.

3. Certification mode disables the N2 retry limit when Freeway is sending SABM (or SABME) to reset the data link. This eliminates a race condition between the DTE and the DCE simulator that might cause the DTE to start sending DISC frames.

4. Certification mode enforces the use of the configured T1 timer value when resetting or disconnecting the data link instead of using a fixed 2-second interval. This ensures that the DCE simulator can measure the DTE's T1 timer in any state.

Note

When not in certification mode, Freeway temporarily shortens the T1 timer to two seconds following transmission of FRMR, SABM, SABME or DISC because the transmission time for these frames is very short. The T1 timer value is always used during information transfer.

3.6.10 Flow Control Negotiation (HF_FLOW)

This call service configuration parameter permits the DLI_X25_MANAGER_API client to configure the manner in which Freeway handles flow control negotiation. Freeway may be configured to take one of the following actions:

BAR negotiation (default) Freeway immediately clears calls that would negotiate flow control facilities[3] in conflict with Freeway configuration. Outgoing calls are not permitted to contain packet window size and/or packet data size facilities (specified by quality of service (qos) parameters in the DLI_X25_HOST_CALL_REQ request packet).

ACCEPT negotiation Freeway is configured to permit the use of flow control negotiation facilities during SVC call establishment. In particular, using quality of service (qos) parameters in the DLI_X25_HOST_CALL_REQ request packet, you may specify a packet window size and/or packet data size that do not match the Freeway configuration.

Note

Flow control negotiation may not be set using call service configuration if X.25 facilities registration procedures (Chapter 4) have already determined whether flow control negotiation is permitted by the network DCE. See Chapter 5.

3.6.11 Modem Control Signal Monitoring (HF_CLM)

This call service configuration parameter directs Freeway to begin or end the monitoring of changes in the modem input leads for data carrier detect (DCD) or clear to send (CTS). By default, both DCD and CTS monitoring are disabled. If the monitoring is enabled, changes in the signal condition are reported to the host in a modem control

3. Flow control negotiation specifies the packet data size and the packet window size for an SVC call.

signal information packet (DLI_X25_ICP_CTL_LINE_STATE_RSP). You can also set a time period for which the condition must be true before the change is reported, using function code HF_CLTMR in the following section.

3.6.12 Modem Control Signal Debounce Time (HF_CLTMR)

This call service configuration parameter sets the time period a modem signal must remain on or off before a change is reported.

3.6.13 X.25 Restarts (HF_RESTART)

This call service configuration parameter controls Freeway handling of X.25 packet layer detection of lower layer (MLP or HDLC LAPB) initialization. When this option is enabled, Freeway transmits an X.25 restart packet upon detection of lower layer initialization. When this option is disabled, Freeway refrains from sending any X.25 restart packet following lower layer initialization.

3.6.14 REJ — Packet Retransmission Support (HF_REJ)

This call service configuration parameter determines whether Freeway supports the X.25 REJ packet type. When this option is enabled, the DTE may send an REJ packet to the DCE to request retransmission of all X.25 data packets beginning at a specified packet sequence number. The DCE processes REJ packets received from the DTE, but never sends an REJ packet to the DTE.

The X.25 REJ packet type is not normally used, because the robustness of the lower layer is generally sufficient to protect the X.25 packet layer from data loss. This option is provided primarily for full compliance with CCITT X.25 and ISO 8208 specifications for DTE operations. This option is disabled by default.

Note

The packet retransmission support option may not be set using call service configuration if X.25 facilities registration procedures (Chapter 4) have already determined whether packet retransmission is permitted by the network DCE. See Chapter 5.

3.6.15 Extended Packet Sequence Numbering (HF_MOD128)

This call service configuration parameter determines whether Freeway supports modulo 8 (default) or modulo 128 packet sequence numbers. All virtual circuits must use the same packet numbering modulus, and both the DTE and the DCE must be configured to use the same modulus.

Note

The extended packet sequence numbering option may not be set using call service configuration if X.25 facilities registration procedures (Chapter 4) have already determined whether extended packet sequence numbering is expected by the network DCE. See Chapter 5.

Note

If extended packet sequence numbering is to be used, the host must enable the facility by configuring call service prior to configuring stations. Attempts to configure stations with default packet window sizes greater than seven are rejected if call service has not been configured to support extended packet sequence numbering.

3.6.16 X.25 Operation Profile (HF_X25_PROFILE)

This call service configuration parameter selects the CCITT or ISO specification to which Freeway is expected to conform during normal X.25 operations. The option is individually selectable for each configured X.25 network connection. That is, the X.25

profile for one network connection may differ from that selected for another X.25 network connection. When configured to run over an MLP layer, the X.25 operation profile applies to the X.25 operation over that MLP (and all of its underlying data links).

3.6.16.1 Unrestricted X.25 Profile

The unrestricted X.25 profile permits the use of all Protogate X.25 configuration options. This selection permits the widest degree of freedom in X.25 usage, but also permits use of features that may not be supported by the network DCE.

3.6.16.2 CCITT X.25 1980 Profile

Selection of the CCITT X.25 1980 profile disables the use of X.25 packet layer features specific to CCITT X.25 1984 and enforces the following restrictions on X.25 operation:

- The maximum data field size for data packets is 1024 bytes
- The maximum data field size for interrupt packets is 1 byte
- The maximum optional user facilities size is 63 bytes
- The DTE-specified cause code must be zero
- The address length and facility length in CLEAR REQUEST and CLEAR INDICATION packets are permitted only when user data is present, and must be zero when present
- The extended format for CLEAR CONFIRMATION packets is not permitted
- Frame-level modulo 8 operation is mandatory

3.6.16.3 CCITT X.25 1984 Profile

Selection of the CCITT X.25 1984 profile (default) enables the following X.25 packet layer features specific to CCITT X.25 1984:

- The maximum data field size for data packets is 4096 bytes (excluding header information fields)
- The maximum data field size for interrupt packets is 32 bytes
- The maximum optional user facilities size is 109 bytes
- The DTE-specified cause code must be zero or 128–255
- The address length and facility length in CLEAR REQUEST and CLEAR INDICATION packets are permitted only in the extended format. When present, these field lengths must be zero unless the called line address modified notification facility is used in clearing, in response to an incoming call or call request packet.
- The extended format for CLEAR CONFIRMATION packets may be used only by the DCE in conjunction with the charging information facility
- Frame-level modulo 128 operation is optional
- Multilink procedure (MLP) operation is optional
- The following optional user facilities (not supported in CCITT X.25 1980) are added for CCITT X.25 1984:

    1. On-line facilities registration
    2. Local charging prevention
    3. Network user identification
    4. Charging information
    5. Hunt group
    6. Call redirection

7. Called line address modified notification
8. Call redirection notification
9. Transit delay selection and indication
10. Extended format CUG selection facility
11. Closed user group with outgoing access (CUG/OA) selection facility
12. User data field in CLEAR REQUEST and CLEAR INDICATION packets after acceptance of an unrestricted fast select call
13. Extended-format Recognized Private Operating Agency (RPOA) selection facility
14. CCITT-specified DTE facilities to support the OSI Network Service

3.6.16.4 ISO 8208 X.25 Profile

Selection of the ISO 8208 X.25 profile enables the following features specific to ISO 8208, in addition to those supported for CCITT X.25 1984:

- T24 window status transmission timer
- T25 window rotation timer and associated R25 retry limit
- T26 interrupt response timer
- T27 reject packet response timer and associated R27 retry limit (supported only when REJ support is configured, or is negotiated through on-line facilities registration with the network DCE)

3.6.16.5 CCITT X.25 1988 Profile

Selection of the CCITT 1988 X.25 profile enables the following features in addition to all features available to CCITT X.25 1984:

- Extended DTE address support for type-of-address (TOA) numbering-plan identification (NPI) address formats
- Call deflection selection facilities
- Facility for 64,000 b/s throughput class
- Enhanced call redirection or deflection notification

3.6.17 Local DTE Address Length (HF_ADDR_LEN)

The typical X.25 DTE address follows the CCITT X.121 recommendation. The X.121 recommendation specifies that a DTE address is formed by concatenating address subfields in the order shown in Table 3–1.

Table 3–1: CCITT X.121 DTE Address Fields

Name	Digits	Description
Prefix	1	(Optional)
DNIC	4	Data network identification code
NTN	10	National terminal number

Many packet-switched public data networks (PDNs) use only the first 8 digits on the NTN to identify the DTE/DCE interface on the network. In these cases, the last two digits of the NTN may be used as an optional DTE subaddress. The DTE subaddress may be used to identify a device, application process, or local DTE not known to the PDN, but known to the DTE actually attached to the PDN.

The local DTE address length is the number of digits in the main portion of the DTE address, excluding the local DTE subaddress field at the end of the NTN. The local DTE address length must be specified separately for each Freeway X.25 network connection. This parameter must be specified correctly for the attached X.25 network to ensure correct operation when lowest and highest local DTE subaddress values are specified in the parameters for the DLI_X25_HOST_ADD_INCALL_FILTER request packet.

3.6.18 Configure DTE Address Format (HF_TOANPI)

This function code is used in the call service configuration packet to select the X.25 DTE address format. This function is supported only when the X.25 operation profile selected is 1988 or is unrestricted.

Two DTE address formats are supported: normal address format and type-of-address (TOA) numbering-plan identification (NPI) format. Each X.25 network connection supports one (but not both) of these DTE address formats.

The normal DTE address format limits the length of each DTE address to 15 digits. By default, Freeway supports normal DTE address format.

The TOA/NPI address format increases the maximum DTE address length to 17 digits. In this case, the first DTE address digit specifies the type of address (TOA), and the second DTE address digit gives the numbering-plan identification (NPI). The remaining 15 digits identify a specific DTE.

3.7 X.25 Station Resources (DLI_X25_HOST_CFG_LINK)

Freeway requires a local station resource for each active X.25 virtual circuit it manages. The maximum number of station resources is equal to the configured maximum number of virtual circuits set during Freeway buffer configuration procedures (Section 3.2 on page 81).

There are only 8–16 data links per ICP on Freeway, but there can be many station resources configured for those links. All station resources may be configured for the same link, or they may be distributed in any fashion to one or more links on the same ICP. However, no station resource may be associated with more than one link simultaneously. A station resource configured for a specific data link supports one virtual circuit on that link only.

The user is not required to configure all available station resources on an ICP. If a station resource is not explicitly configured for a data link, it becomes an available resource for SVC operations on any data link on the ICP.

Any station resource configured for an SLP under MLP control is automatically associated with the single logical data link interface represented by the MLP.

3.7.1 X.25 Virtual Circuits — PVCs and SVCs

X.25 defines two different types of virtual circuits: the permanent virtual circuit (PVC) and the switched virtual circuit (SVC). They differ in several ways, though data transfer is the same for both.

- A PVC is analogous to a leased phone line in that it is a permanent point-to-point connection between two DTEs. There is no way for it to connect to any other DTE.
- An SVC is analogous to a dialed phone connection in that it is temporary and switched.
- PVCs are common in applications using X.25 point-to-point communications, but may also be defined on a network.
- SVCs are common in applications that use a network to provide local access to data at several remote locations.
- PVC station resources must be configured.

- Configuration of SVC station resources is optional.
- An SVC requires call setup and clearing procedures by the DLI_X25_USER_API client; a PVC does not.

When a DLI_X25_USER_API client places or receives an X.25 call, the virtual circuit associated with the call is considered to be active, and Freeway associates a station resource with the client for the duration of the X.25 virtual circuit. Freeway selects a configured station resource, if one exists; otherwise, Freeway dynamically configures an available station resource for the job.

3.7.2 Configured Station Resources

Freeway requires that PVC station resources be configured by selecting a station ID, logical channel number (LCN) and logical channel group number (LCGN). Configuring of SVC station resources is optional and requires selection of only the station ID and LCGN; the LCN is selected by Freeway when the DLI_X25_USER_API client places a call.

The advantage to configuring station resources is that the distribution of their use is controlled by the configuration. This may be of importance to application environments that require predictable availability of X.25 SVC access.

Station resource configuration includes the following parameters:

Station ID This parameter identifies the specific station resource being configured to support the associated virtual circuit. The valid values are 1 to the configured virtual circuit maximum (256 by default). All station identifiers for an ICP must be unique on that ICP. The station identifier is only for coordination between the host and Freeway; it is not used on the communications line.

PVC LCN This parameter selects the least-significant 8-bit logical channel number (LCN) portion of the composite 12-bit LCGN/LCN X.25 channel number. If the LCGN is 0, valid values for the LCN are 1– 255. If the LCGN is non-zero, the LCN may be in the range 0–255. For a PVC, the LCGN/LCN must be the same at each end of the DTE/DCE interface. No LCGN/LCN may be assigned twice on the same Freeway X.25 network connection.

PVC/SVC LCGN This parameter represents a group of LCNs designated for a particular type of access to the network. It forms the most significant 4 bits of the 12-bit LCGN/LCN X.25 channel number.

Packet Window Size This parameter controls how many data packets may be sent to the network by a station. The default packet window size is 2, but may be overridden on Freeway by specifying this parameter for the affected station. The packet window size can also be set dynamically either through flow control negotiation[4] (Section 3.6.10 on page 107) or through facilities registration (Section 4.3.10 on page 126).

3.7.3 Dynamic Station Resources for SVCs

When a DLI_X25_USER_API client places an SVC call and any configured station resources for the data link are currently in use, Freeway supports the use of dynamic station resources. Freeway selects an available non-configured station resource and assigns the station ID, LCN and LCGN.

Non-configured station resources may be used for SVC operations on any data link on the same ICP. Failure to configure station resources on an ICP allows Freeway complete freedom to respond to DLI_X25_USER_API client demands for X.25 SVC access. It also permits commitment of all available station resources to manage X.25 SVCs on a single data link on that ICP, leaving no station resources available for X.25 SVCs on any other link until one of the active SVCs terminates.

4. Use the HF_PWSIZE quality of service (qos) parameter in the DLI_X25_HOST_CALL_REQ request packet to specify the packet window size facility.

Chapter

4 X.25 Facilities Registration

This chapter describes optional procedures for X.25 networks that support on-line facilities registration (packet types DLI_X25_HOST_REGISTER and DLI_X25_ICP_REGISTERED). These procedures normally follow successful link activation, and precede virtual circuit access by DLI_X25_USER_API clients. However, the facilities listed in Section 4.2 may be registered regardless of virtual circuit activity.

The Index provides a comprehensive cross reference between this chapter and Chapter 6. To locate the cross references, refer to the index entry entitled "**Cross reference**."

Following successful link activation, the X.25 DLI_X25_MGR_API client uses the following general procedure for on-line facilities registration. Each X.25 network connection has its own unique facilities registration.

1. After successful link activation, the X.25 DLI_X25_MGR_API client issues a host facilities registration request packet (DLI_X25_HOST_REGISTER), without data, to Freeway.
2. Freeway responds with a facilities registration confirmation packet (DLI_X25_ICP_REGISTERED). The data area indicates the available facilities supported by the network DCE.
3. The X.25 DLI_X25_MGR_API client issues another facilities registration request packet (DLI_X25_HOST_REGISTER). The data area indicates the desired facilities to be enabled or disabled.

4. Freeway responds with a facilities registration confirmation packet (DLI_X25_ICP_REGISTERED). The data area indicates the updated status of all available facilities.

Note

The values reported by the network DCE through the facilities registration confirmation packet (DLI_X25_ICP_REGISTERED) override any previous values configured on Freeway.

Protogate's X.25 product supports use of the registration packets described in the CCITT X.25 1984 and 1988 recommendations. The function codes are listed in Table 4–1. Most of the facilities may appear in either host facilities registration request packets (DLI_X25_HOST_REGISTER) or Freeway facilities registration confirmation packets (DLI_X25_ICP_REGISTERED). However, the *availability of facilities* and *non-negotiable facilities values* classes of facilities cannot be specified in host facilities registration packets.

Section 6.2.31 on page 184 shows the format of the data areas. Potential conflicts between facilities registration and call service are discussed in Chapter 5.

Section 4.1 through Section 4.8 describe the function codes used in the facilities registration packets, arranged in ascending numerical order.

4.1 Facilities Negotiable in State *p1* (HF_NEGP1)

This class of facilities affects operation of all logical channels at the DTE/DCE interface. All logical channels used for SVC calls must be in the *p1* state when these facilities are specified in a host facilities registration request packet. The *p1* state is a "ready" state in which the LCN/LCGN that identifies a given logical channel is not currently assigned to a virtual circuit (that is, no SVC call has been placed or received).

Table 4–1: Function Codes for Facilities Registration Packets

Code Symbol	Code Number	Function	Allowed Packet Type
HF_NEGP1	128	Facilities negotiable in state *p1*	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED
HF_NEGANY	129	Facilities negotiable in any state	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED
HF_AVAIL	130	Availability of facilities	DLI_X25_ICP_REGISTERED only
HF_NON_NEG	131	Non-negotiable facilities	DLI_X25_ICP_REGISTERED only
HF_DFTHRU	132	Default throughput classes assignment	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED
HF_NSPACK	133	Non-standard default packet data sizes	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED
HF_NSWIN	134	Non-standard default packet window sizes	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED
HF_LOGCHAN	135	Logical channel types ranges	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED

4.1.1 Extended Packet Sequence Numbering Facility

When the *extended packet sequence numbering* facility is enabled, modulo 128 packet sequence numbers are used. When this facility is disabled, modulo 8 packet sequence numbers are used. This facility setting should be compatible with the packet window size.[1]

This facility is normally disabled, unless modulo 128 sequence numbers are used at the frame level as well.

1. Packet window size can be set at the station configuration level (Section 3.7 on page 114), through facilities registration (Section 4.3.10 on page 126), or through flow control negotiation facilities using the HF_PWSIZE quality of service (qos) parameter of the DLI_X25_HOST_CALL_REQ request packet.

4.1.2 REJ — Packet Retransmission Facility

When the *packet retransmission* facility is enabled, the DTE may use REJ procedures (Section 3.6.14 on page 108) to recover lost data packets. This facility is normally disabled, because frame-level operation includes a similar data recovery procedure.

4.1.3 Delivery Bit (D-bit) Modification Facility

When the *D-bit modification* facility is enabled, the DCE ensures that end-to-end acknowledgment is used for data sent to other DTEs. This facility is normally disabled, because normal D-bit procedures allow the local DTE selective control over the use of end-to-end data acknowledgment.

4.2 Facilities Negotiable in any State (HF_NEGANY)

This class of facilities affects the validity of selected call service facilities during normal operation. These facilities can be enabled or disabled at any time.

When any of the facilities in Section 4.2.3 through Section 4.2.7 is enabled, the DLI_X25_USER_API client uses one or more of the quality of service (qos) parameters to specify or receive the call service facility information. See Section 6.4 on page 247 for complete information on qos parameter formats.

4.2.1 Incoming Calls Barred Facility

When the *incoming calls barred* facility is enabled, the DCE intercepts and clears all incoming calls. This facility differs from the *configure incoming calls* function described in Section 3.6.4 on page 100; the latter affects Freeway operation only.

4.2.2 Outgoing Calls Barred Facility

When the *outgoing calls barred* facility is enabled, the DCE intercepts and clears all outgoing calls.

4.2.3 Fast Select Acceptance Facility

When the *fast select acceptance* facility is enabled, the DCE is permitted to transmit to the DTE incoming calls which request the fast select facility. When the *fast select acceptance* facility is disabled, the DCE is not permitted to transmit to the DTE incoming calls which request the fast select facility.

4.2.4 Reverse Charging Acceptance Facility

When the *reverse charging acceptance* facility is enabled, the DCE is permitted to transmit to the DTE incoming calls which request the reverse charging facility. When the *reverse charging acceptance* facility is disabled, the DCE is not permitted to transmit to the DTE incoming calls which request the reverse charging facility.

4.2.5 Flow Control Negotiation Facility

When the *flow control negotiation* facility is enabled, both the DTE and DCE are permitted to specify flow control facilities (packet data size and packet window size) when establishing an SVC connection. When this facility is disabled, flow control facilities are not permitted.

4.2.6 Default Throughput Class Negotiation Facility

When the *default throughput class negotiation* facility is enabled, both the DTE and DCE are permitted to specify throughput class facilities when establishing an SVC connection. When this facility is disabled, throughput class facilities are not permitted.

4.2.7 Charging Information Facility

When the *charging information* facility is enabled, the DCE automatically provides charging information in each clear indication packet and each clear confirmation packet. When the *charging information* facility is disabled, the DCE provides charging information only if the DTE includes a request for charging information in its call request packet or its call accept packet when the virtual circuit is established.

4.3 Availability of Facilities (HF_AVAIL)

This class of facilities appears only in the Freeway registration confirmation packet (DLI_X25_ICP_REGISTERED). The network DCE notifies the DTE which facilities are available. Facilities that the DCE indicates are not available cannot be requested by the DTE.

The data area of the confirmation packet lists the facilities as a series of bytes in the order shown in Table 4–2. A byte value of "0" means the facility is not available; a "1" means it is available. Use a host facilities registration packet (DLI_X25_HOST_REGISTER) and the function codes listed to enable the desired facilities that are available. For function codes listed as "qos," use the appropriate quality of service (qos) parameters in associated call establishment packets. See Section 6.4 on page 247 for complete information on qos parameter formats.

Table 4–2: Confirmation Packet Facilities (DLI_X25_ICP_REGISTERED)

Facility	Code Symbol	Code Number
Extended packet sequence numbering facility	HF_NEGP1	128
Packet retransmission facility	HF_NEGP1	128
D-bit modification facility	HF_NEGP1	128
Called line address modified facility	HF_CLDADMOD	qos
Charging information (per interface) facility	HF_NEGANY	129
Charging information (per call) facility	HF_RQCRGIN	qos
Reverse charging acceptance facility	HF_NEGANY	129
Reverse charging facility	HF_RVFC	qos
Default throughput classes registration	HF_DFTHRU	132
Non-standard default window sizes registration	HF_NSWIN	134
Non-standard default packet sizes registration	HF_NSPACK	133
Logical channel types ranges registration	HF_LOGCHAN	135
RPOA selection (per call) facility	HF_RPOA	qos

4.3.1 Extended Packet Sequence Numbering Facility

If the *extended packet sequence numbering* facility is available, use the "Facilities Negotiable in State *p1*" (HF_NEGP1) function code to enable it.

4.3.2 REJ — Packet Retransmission Facility

If the *packet retransmission* facility is available, use the "Facilities Negotiable in State *p1*" (HF_NEGP1) function code to enable it.

4.3.3 D-bit Modification Facility

If the *D-bit modification* facility is available, use the "Facilities Negotiable in State *p1*" (HF_NEGP1) function code to enable it.

4.3.4 Called Line Address Modified Facility

If the *called line address modified* facility is available, use the HF_CLDADMOD quality of service parameter to specify it in the DLI_X25_HOST_CALL_ACCEPTED or DLI_X25_HOST_CLR_REQ request packet.

4.3.5 Charging Information (per interface) Facility

If the *charging information (per interface)* facility is available, use the "Facilities Negotiable in any State" (HF_NEGANY) function code to enable it.

4.3.6 Charging Information (per call) Facility

If the *charging information (per call)* facility is available, use the HF_RQCRGIN quality of service parameter to specify it in the DLI_X25_HOST_CALL_REQ or DLI_X25_HOST_CALL_ACCEPTED request packet.

4.3.7 Reverse Charging Acceptance Facility

If the *reverse charging acceptance* facility is available, use the "Facilities Negotiable in any State" (HF_NEGANY) function code to enable it.

4.3.8 Reverse Charging Facility

If the *reverse charging* facility is available, use the HF_RVFC quality of service parameter to specify it in the DLI_X25_HOST_CALL_REQ request packet.

4.3.9 Default Throughput Classes Registration Facility

If the *default throughput classes registration* facility is available, use the "Default Throughput Classes Assignment" (HF_DFTHRU) function code to enable it.

4.3.10 Non-standard Default Packet Window Sizes Registration

If the *non-standard default packet window sizes* registration is available, use the "Non-standard Default Packet Window Sizes" (HF_NSWIN) function code to enable it.

4.3.11 Non-standard Default Packet Data Sizes Registration

If the *non-standard default packet data sizes* registration is available, use the "Non-standard Default Packet Data Sizes" (HF_NSPACK) function code to enable it.

4.3.12 Logical Channel Types Ranges Registration

If the *logical channel types ranges* registration is available, use the "Logical Channel Types Ranges" (HF_LOGCHAN) function code to enable it.

4.3.13 RPOA Selection (per call) Facility

If the *RPOA selection (per call)* facility is available, use the HF_RPOA quality of service parameter to specify it in the DLI_X25_HOST_CALL_REQ request packet.

4.4 Non-negotiable Facilities (HF_NON_NEG)

This class of facilities may appear only in the Freeway registration confirmation packet (DLI_X25_ICP_REGISTERED). *Local charging prevention* is the only facility in this class. If the non-negotiable class of facilities is present, it indicates whether *local charging prevention* is enabled or disabled.

4.5 Default Throughput Classes Assignment (HF_DFTHRU)

This facility is valid in a host facilities registration packet (DLI_X25_HOST_REGISTER) only if the “Availability of Facilities” (HF_AVAIL) indicated by the network DCE specifies that *default throughput classes* registration is supported.

4.6 Non-standard Default Packet Data Sizes (HF_NSPACK)

This facility is valid in a host facilities registration packet (DLI_X25_HOST_REGISTER) only if the “Availability of Facilities” (HF_AVAIL) indicated by the network DCE specifies that *non-standard default packet data sizes* registration is supported.

4.7 Non-standard Default Packet Window Sizes (HF_NSWIN)

This facility is valid in a host facilities registration packet (DLI_X25_HOST_REGISTER) only if the “Availability of Facilities” (HF_AVAIL) indicated by the network DCE specifies that *non-standard default packet window sizes* registration is supported. If the “Facilities Negotiable in State *p1*” (HF_NEGP1) function code is used to enable *extended packet sequence numbering*, then packet window size values 1–127 are valid; otherwise, only window sizes 1–7 are valid.

4.8 Logical Channel Types Ranges (HF_LOGCHAN)

The logical channel group number and the logical channel number together form a unique 12-bit channel number at the DTE/DCE interface. The host facilities registration packet (DLI_X25_HOST_REGISTER) uses this facility to identify the following valid 12-bit channel number ranges:

- Lowest incoming channel (LIC)
- Highest incoming channel (HIC)
- Lowest two-way channel (LTC)
- Highest two-way channel (HTC)
- Lowest outgoing channel (LOC)
- Highest outgoing channel (HOC)

The ranges should progress from lower numbers to higher numbers and must not overlap. The highest valid channel number for a PVC is one lower than that specified by the LIC parameter. Channels in the range LIC through HIC are available only to incoming calls. Channels in the range LTC through HTC are available to either incoming or outgoing calls. Channels in the range LOC through HOC are available only to outgoing calls. The *one-way* restriction applies only to the SVC calls; once an SVC is connected, two-way data traffic is permitted.

To exclude all calls in a specific category, specify both the lowest and highest channels to be zero. For example, to exclude the two-way channel category, specify both LTC and HTC to be zero. In all other cases, channel numbers must be from 1 through 4095.

This facility differs from the call service *configure LCN bounds* parameter described in Section 3.6.8 on page 104; the latter affects Freeway operation only.

Chapter

5

X.25 Configuration vs. Facilities Registration

The following facilities are available through either Freeway call service configuration or on-line facilities registration:

- Extended packet sequence numbering
- Flow control negotiation
- Packet retransmission
- Logical channel type ranges

If the network to which the DTE is connected does *not* support on-line facilities registration, there is no potential conflict situation. In this case, use Freeway call service configuration (Section 3.6 on page 98) to enable these facilities.

However, when the network does support on-line facilities registration, a potential conflict may arise. To resolve conflicts for these facilities, the values reported by the network through the Freeway facilities registration confirmation packet (DLI_X25_ICP_REGISTERED) override any previous values configured on Freeway, and any facilities not available through the network are disabled on Freeway.

The following example illustrates a potential conflict and how to properly use the network-provided registration procedure. Although this example uses extended sequence numbering, the same procedure applies to flow control negotiation, packet retransmission, and logical channel type ranges. A facility does not take effect until a Freeway registration confirmation packet (DLI_X25_ICP_REGISTERED) is received showing it is enabled.

1. The host enables extended sequence numbering using call service configuration (packet type DLI_X25_HOST_CFG_CALL_SERVICE). Typically, call service is configured prior to enabling the data link.

2. The host enables the data link (packet type DLI_X25_HOST_ENABLE_LINK).

3. The host issues a facilities registration request (packet type DLI_X25_HOST_REGISTER without any data) to determine which facilities are available through the network.

4. The host receives a facilities registration confirmation (packet type DLI_X25_ICP_REGISTERED) indicating the availability of facilities (function code HF_AVAIL) through the network. The packet may also include other function codes (Table 4–1 on page 121) indicating the current status of each facility (enabled or disabled).

5. The next step depends on the information in the confirmation packet.

   - If the confirmation packet indicates that extended sequence numbering is not available, Freeway call service configuration (from step 1) of that facility is disabled. Because extended sequence numbering is not supported by the network, this facility may not be used at all.

   - If the confirmation packet indicates extended sequence numbering is available, but not enabled, the host must issue another facilities registration request packet to enable extended sequence numbering.

   - If the confirmation packet indicates that extended sequence numbering is available and enabled, the host takes no action.

Table 5–1 and Table 5–2 give an overview of the required actions depending upon whether on-line facilities registration is supported by the network.

Table 5–1: Network Not Supporting Facilities Registration

	Action Required to Enable Facility
Facility[a]	Issue configure call service packet

[a] The facility may be extended sequence numbering, flow control negotiation, packet retransmission, and logical channel type ranges.

Table 5–2: Network Supporting Facilities Registration

	Registration Confirmation Packet Indicates	**Action Required to Enable Facility**
	Unavailable[a]	Cannot be enabled
Facility[b]	Available and disabled	Issue registration request packet and wait for registration confirmation packet
	Available and enabled	Facility already enabled

[a] Not applicable to the flow control negotiation facility

[b] The facility may be extended sequence numbering, flow control negotiation, packet retransmission, and logical channel type ranges.

Chapter

6 X.25 Packet Formats

This chapter describes the format for all packets exchanged with the Freeway X.25 services on the ICP. Section 6.1 describes the basic structure of the packet header used by all packets. Section 6.2 describes each packet you may send to Freeway. Section 6.3 describes each packet you may receive from Freeway. Section 6.4 describes the format of the quality of service (qos) parameters used in some packets.

The Index provides a comprehensive cross reference between this chapter and Chapter 3 and Chapter 4. To locate the cross references, refer to the index entry titled "**Cross reference**."

6.1 Optional Arguments

The DLI provides the optional argument structure as a means for the application to exchange data with the ICP directly. The optional arguments can be used with the DLI raw mode to provide the application a complete access to ICP and protocol header information without the need for future modifications to these headers. See the *Freeway Data Link Interface Reference Guide* for further information.

6.1.1 ICP Header

The ICP header structure, shown in Figure 6–1, is used by both the Freeway server itself and the X.25 services module on the ICP. The ICPHDR header structure is always written and read in network order (that is, Big Endian: Motorola or SPARC).

ICPHDR.usICPClientID This field contains two critical types of information about the service user (or client). The two most significant bits identify the client's preferred

```
struct ICPHDR_STRUCT {
        unsigned short usICPClientID;     /* service user (client) id */
        unsigned short usICPServerID;     /* service provider id      */
        unsigned short usICPCommand;      /* API command code         */
        unsigned short iICPStatus;        /* command status           */
        unsigned short usICPParms[3];     /* generic parameters       */
} ICPHDR;
```

Figure 6–1: ICP Header Format

native byte ordering for all fields following the ICP header; the value 0x0000 indicates Big Endian, while the value 0xC000 indicates Little Endian. The remaining fourteen bits identify the ICP's return node number for sending packets from the ICP back to the client; Freeway itself selects the return ICP node number when the client opens a session. This field must appear in all packets sent to the ICP.

ICPHDR.usICPServerID This field identifies the services to be used on the ICP. Valid values for this field are DLI_X25_SAP_X25 for X.25 protocol services, DLI_X25_SAP_DIAG for data link monitoring services, and DLI_X25_SAP_SLP for HDLC LAPB protocol services.

ICPHDR.usICPCommand This field must contain the value DLI_ICP_CMD_WRITE or DLI_ICP_CMD_WRITE_EXP. The DLI_ICP_CMD_WRITE command indicates that the transfer path between the client and Freeway is the normal flow-controlled path. The DLI_ICP_CMD_WRITE_EXP command indicates that the expedited transfer path is to be used. For more information on which packets use which ICPHDR.usICPCommand value, see Section 6.2 on page 137 and Section 6.3 on page 194.

The remaining fields of the ICP header are normally zeroed.

6.1.2 Protocol Header

The protocol header structure, shown in Figure 6–2, is used by the X.25 services module on the ICP. The PROTHDR structure immediately follows the ICPHDR structure and must always be present.

```
struct PROTHDR_STRUCT {
        unsigned short usProtCommand;         /* ICP command code        */
        unsigned short iProtModifier;         /* ICP command modifier */
        unsigned short usProtLinkID;          /* physical port number */
        unsigned short usProtCircuitID;       /* circuit identifier      */
        unsigned short usProtSessionID;       /* session identifier      */
        unsigned short usProtSequence;        /* sequence number         */
        unsigned short usProtXParms[2];       /* reserved area           */
} PROTHDR;
```

Figure 6–2: Protocol Header Format

PROTHDR.usProtCommand This field identifies the type of packet and determines the type of processing to be applied to the packet. Some types of packet use the PROTHDR.iProtModifier field to further specify command or response attributes. For example, the DLI_X25_HOST_OPEN_SESSION_REQ packet requires the modifier DLI_X25_MGR_API or DLI_X25_DLI_X25_USER_API. Also, both the DLI_X25_ICP_ACK and DLI_X25_ICP_CMD_REJECTED packets use the modifier to identify the PROTHDR.usProtCommand field from the host packet that is acknowledged or rejected.

PROTHDR.usProtLinkID This field identifies the physical port ID on the ICP. Valid port ID numbers range from zero to one less than the number of ports on the ICP. For packet types that do not use the port ID, the PROTHDR.usProtLinkID field must be zero.

PROTHDR.usProtCircuitID This field identifies the virtual circuit ID on the ICP. Valid circuit ID numbers range from one through the maximum number of circuits supported by the ICP. For packet types that do not use the virtual circuit ID, the PROTHDR.usProtCircuitID field must be zero.

PROTHDR.usProtSessionID This field is unique for each active client session with services on a single ICP. Because Freeway may contain more than one ICP, this field may not be unique for client sessions with different ICPs. Although no header field identifies the ICP itself, the ICP's identity is implicit in the TSI transport layer connection between the client (or API) and a specific ICP. The ICP itself is unaware of the possible existence of other ICPs and does not require such information within the packet header.

PROTHDR.usProtSequence This field is used when opening a client session. The client specifies a unique value in the PROTHDR.usProtSequence field in each DLI_X25_HOST_OPEN_SESSION_REQ packet. The ICP returns the same PROTHDR.usProtSequence value in its corresponding DLI_X25_ICP_SESSION_OPENED or DLI_X25_ICP_SESSION_CLOSED packet. This practice ensures that multiple DLI_X25_HOST_OPEN_SESSION_REQ requests can be processed without ambiguity as each client session is established.

The iProtModifier field of the protocol header is normally zeroed.

6.2 Host Packets Sent to Freeway

This section describes the format of each packet you may send to the Freeway X.25 services on the ICP. Table 6–1 summarizes the usage of important fields within the protocol header, and shows the required I/O path (determined by the ICPHDR.usICPCommand field value). Remember that all fields in both the ICPHDR and PROTHDR portions of the packet header must be specified.

6.2.1 DLI_X25_HOST_32BIT_GET_STATISTICS (51)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to request Freeway to clear the statistics on a link. Freeway sends the current statistics in a DLI_X25_ICP_32BIT_STATISTICS (16) response packet and then clears the statistics.

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_32BIT_GET_STATISTICS
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Table 6–1: Host Packet PROTHDR Fields

ICPHDR.-usICPCommand	PROTHDR.-usProtCommand	PROTHDR.-iProtModifier	PROTHDR.-usProtLinkID	PROTHDR.-usProtCircuitID	PROTHDR.-usProtSessionID	PROTHDR.-usProtSequence
DLI_ICP_CMD_WRITE	DLI_X25_HOST_32BIT-GET_STATISTICS	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_32BIT-SAMPLE_STATISTICS	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE_EXP	DLI_X25_HOST_ABORT	0	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-ADD_INCALL_FILTER	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE_EXP	DLI_X25_HOST_-ADJUST_FLOW_-CONTROL	0	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-BUF_CLR	0	0	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CALL_ACCEPTED	0	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CALL_REQ	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CFG_BUF	0	0	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CFG_CALL_SERVICE	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CFG_LINK	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CFG_MLP	0	0	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CLOSE_PVC	0	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CLOSE_SESSION_REQ	0	0	0	Session ID	Request ID
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CLR_REQ	0	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CLR_STATISTICS	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-CTL_LINE_STATE_REQ	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_DATA	Q/M/D	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-DEL_INCALL_FILTER	0	Port ID	0	Session ID	0

Table 6–1: Host Packet PROTHDR Fields *(Cont'd)*

ICPHDR.-usICPCommand	PROTHDR.-usProtCommand	PROTHDR.-iProtModifier	PROTHDR.-usProtLinkID	PROTHDR.-usProtCircuitID	PROTHDR.-usProtSessionID	PROTHDR.-usProtSequence
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-DISABLE_LINK	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-ENABLE_LINK	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-GET_STATISTICS	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-GET_VERSION	0	0	0	Session ID	0
DLI_ICP_CMD_WRITE_EXP	DLI_X25_HOST_-INT_CONFIRMED	0	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-INIT_SLP	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE_EXP	DLI_X25_HOST_-INTERRUPT	0	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-MONITOR_REG	0	0	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-OPEN_PVC	0	Port ID	Station ID	Session ID	0
DLI_ICP_CMD_WRITE_EXP	DLI_X25_HOST_-OPEN_SESSION_REQ	Session Type	Port ID	0	0	Request ID
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-REDIRECT	0	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-REGISTER	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-RESET_CONFIRMED	0	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-RESET_REQ	0	Port ID	Circuit ID	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-SAMPLE_STATISTICS	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-TEST_FRAME	0	Port ID	0	Session ID	0
DLI_ICP_CMD_WRITE	DLI_X25_HOST_-UNNUMBERED_DATA	0	Port ID	0	Session ID	0

6.2.2 DLI_X25_HOST_32BIT_SAMPLE_STATISTICS (15)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to request Freeway to report the current statistics for a specified link without altering them. To clear the statistics after reading them, use the DLI_X25_HOST_32BIT_GET_STATISTICS (51) command. Freeway responds to a DLI_X25_HOST_32BIT_SAMPLE_STATISTICS command with an DLI_X25_ICP_32BIT_STATISTICS (16) packet.

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_32BIT_SAMPLE_STATISTICS
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.3 DLI_X25_HOST_ABORT (41)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to abort SVC operation for this session. The usual circumstance is that the client has detected a procedural error in which a packet was received that was not valid for the current state of the switched virtual circuit. The DLI_X25_HOST_ABORT packet forces the ICP to shut down the SVC. The expected Freeway response is a DLI_X25_ICP_STATION_OK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error.

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE_EXP
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_ABORT
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_AUTO_CONNECT, DLI_X25_ICP_INCOMING_CALL, or DLI_X25_ICP_CALL-_ACCEPTED packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.4 DLI_X25_HOST_ADD_INCALL_FILTER (29)

The DLI_X25_SAP_X25 DLI_X25_USER_API client registers to receive incoming X.25 calls by sending this packet to the Freeway ICP. The expected Freeway response is a DLI_X25_ICP_ACK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_ADD_INCALL_FILTER
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

In addition, the client may specify optional incoming call filter (ICF) information in the data area immediately after the packet header. When present, the ICF information is specified as one or more of the following quality of service (QOS) parameters as described in Section 6.4 on page 247.

HF_DTE_REMOTE	ICF remote (calling) DTE address
HF_DTE_SA_HIGH	ICF local (called) DTE subaddress (high)
HF_DTE_SA_LOW	ICF local (called) DTE subaddress (low)
HF_ICF_CALLBUSY	ICF call busy configuration
HF_ICF_PRIORITY	ICF priority
HF_USER	User data
HF_USER_MASK	ICF user data mask

6.2.5 DLI_X25_HOST_ADJUST_FLOW_CONTROL (61)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to change the flow control authorization counter for a specified virtual circuit. The packet may be used to increment or decrement the authorization count. The authorization count adjustment is specified as a 16-bit signed integer in the first two bytes of the data portion of the packet. Virtual circuits will not transfer data to the client without authorization.

This packet must be used only when the virtual circuit is in a data-ready state. This applies to both permanent virtual circuits (PVCs) and switched virtual circuits (SVCs). The DLI_X25_HOST_ADJUST_FLOW_CONTROL packet is rejected on SVCs not having a call connection. The packet is also rejected on any SVC or PVC in a reset state.

The ICP also rejects the DLI_X25_HOST_ADJUST_FLOW_CONTROL packet if it would cause the authorization count for the affected virtual circuit to become negative. This may happen if the magnitude of the incremental change is too large or if the client's copy of its authorization count differs from that maintained by the ICP.

To keep its own copy of the authorization count correct, the client must follow a few simple rules:

1. Zero the authorization count when it receives one of the following ICP packets:

    - DLI_X25_ICP_ABORT
    - DLI_X25_ICP_AUTO_CONNECT
    - DLI_X25_ICP_CALL_ACCEPTED
    - DLI_X25_ICP_CLR_CONFIRMED
    - DLI_X25_ICP_CLR_INDICATION
    - DLI_X25_ICP_INCOMING_CALL
    - DLI_X25_ICP_RESET_CONFIRMED
    - DLI_X25_ICP_RESET_INDICATION

- DLI_X25_ICP_STATION_FAILED
- DLI_X25_ICP_STATION_OK

2. Adjust its authorization count when it sends a DLI_X25_HOST_ADJUST_FLOW_CONTROL packet
3. Decrement its authorization count each time it receives a DLI_X25_ICP_DATA packet

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE_EXP
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_ADJUST_FLOW_CONTROL
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_AUTO_CONNECT, DLI_X25_ICP_INCOMING_CALL, DLI_X25_ICP_CALL-_ACCEPTED, or DLI_X25_ICP_PVC_OPENED packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data area must contain a single 16-bit signed integer that specifies the change in the number of DLI_X25_ICP_DATA packets the ICP is authorized to report.

6.2.6 DLI_X25_HOST_BUF_CLR (81)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client sends this packet to configure Freeway to clear used buffers on the ICP before returning them to the ICP buffer pool resource. After buffer clearing is enabled, it cannot be disabled without downloading Freeway again. The expected Freeway response is a DLI_X25_ICP_ACK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error.

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_BUF_CLR
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.7 DLI_X25_HOST_CALL_ACCEPTED (3)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to accept the incoming call indication associated with a received DLI_X25_ICP_INCOMING_CALL packet. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CALL_ACCEPTED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_INCOMING_CALL packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Optional information in the data area may include one or more of the following quality of service (qos) parameters as described in Section 6.4 on page 247. The user data facility (HF_USER) may be included only if the associated DLI_X25_ICP_INCOMING_CALL packet contains the unrestricted fast select facility (HF_FASNR).

HF_CLDADMOD	Called line address modified notification facility
HF_CLLED	Called DTE address
HF_CLLNG	Calling DTE address
HF_D_BIT_SUPPORT	D-bit support request and indication
HF_NONSTD	Non-standard user facilities
HF_NWUSID	Network user identification facility
HF_PDSIZE	Packet data size facility
HF_PRIORITY	Virtual circuit priority on Freeway
HF_PWSIZE	Packet window size facility
HF_RQCRGIN	Request charging information facility
HF_THRUCLASS	Throughput class
HF_USER	User data

6.2.8 DLI_X25_HOST_CALL_REQ (1)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to place a call to a remote DTE. The expected Freeway response is a DLI_X25_ICP_CALL_ACCEPTED packet if the call is connected, a DLI_X25_ICP_CLR_INDICATION or DLI_X25_ICP_ABORT packet if the call is not connected, or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CALL_REQ
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Optional information in the data area may include one or more of the following quality of service (qos) parameters as described in Section 6.4 on page 247. The called DTE address (HF_CLLED) parameter is required.

HF_BLCLUS	Bilateral closed user group facility
HF_CLLED	Called DTE address
HF_CLLNG	Calling DTE address

HF_CLUSG	Closed user group selection facility
HF_CLUSGOAS	CUG with outgoing access selection facility
HF_D_BIT_SUPPORT	D-bit support request and indication
HF_FASNR	Fast select facility — no restriction
HF_FASR	Fast select facility — restriction on response
HF_NONSTD	Non-standard user facilities
HF_NWUSID	Network user identification facility
HF_PDSIZE	Packet data size facility
HF_PRIORITY	Virtual circuit priority on Freeway
HF_PWSIZE	Packet window size facility
HF_RPOA	RPOA selection facility
HF_RQCRGIN	Request charging information facility
HF_RVFC	Reverse charging facility
HF_THRUCLASS	Throughput class
HF_TRDLYSEL	Transit delay selection and indication facility
HF_USER	User data

6.2.9 DLI_X25_HOST_CFG_BUF (37)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client sends this packet to configure the segmentation buffer size, the communication buffer size, and the number of virtual circuits. The expected Freeway response is a DLI_X25_ICP_CFG_BUF_CONFIRMED packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CFG_BUF
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The information in the data area is as follows:

word 0:	Number of 64-byte pages in the segmentation buffers. Valid values are zero through 128. A value of zero implies segmentation is not used. The default is zero.
word 1:	Number of 64-byte pages in the communication buffers. Valid values[1] are 1 through 64. The default value is four pages (256 bytes).
word 2:	Number of virtual circuits (1–1024). The default is 256.

1. You should analyze the SVC call request user data and fast select data requirements before configuring a communication buffer size of less than four pages (256 bytes).

6.2.10 DLI_X25_HOST_CFG_CALL_SERVICE (43)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client or DLI_X25_SAP_SLP DLI_X25_MGR_API client sends this packet to configure call service parameters for a data link. The expected Freeway response is a DLI_X25_ICP_ACK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. Table 6–2 lists the function codes for call service configuration packets. The default configuration values, shown in the data descriptions below, apply if not overridden by the client.

Table 6–2: Function Codes for Call Service Configuration Packets

Code Symbol	Code Number	Function	X.25/HDLC Support
HF_CLLNG	1	Calling DTE address	X.25
HF_FASCN	3	Fast select option	X.25
HF_RVCN	6	Reverse charge option	X.25
HF_INCM	8	Incoming calls option	X.25
HF_T2XCN	11	T2X timers	X.25
HF_R2XCN	12	R2X retry limits for T2X timers	X.25
HF_TLX	13	TL1 timer	X.25/HDLC
HF_LCN	17	LCN bounds	X.25
HF_CERT	18	X.25 certification mode	X.25
HF_FLOW	19	Flow control negotiation	X.25
HF_CLM	22	Modem control signal monitoring	X.25/HDLC
HF_CLTMR	23	Modem control signal debounce time	X.25/HDLC
HF_RESTART	25	Restart on SLP/MLP initialization	X.25
HF_REJ	42	Packet retransmission support	X.25
HF_MOD128	43	Extended packet sequence numbering	X.25
HF_X25_PROFILE	44	X.25 operation profile	X.25
HF_ADDR_LEN	45	Local DTE address length	X.25
HF_TOANPI	47	DTE address format	X.25

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CFG_CALL_SERVICE
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The call service configuration parameters are described below, arranged in ascending function code order.

Note

For some function codes, byte 1 is a fixed data length which is *not* variable. You must include all the data indicated.

Configure Calling DTE Address (1)

byte 0: HF_CLLNG (1)
byte 1: Calling DTE address length in bytes (0–15) (default = 0)
bytes 2–*n*: Calling DTE address (ASCII string)

Fast Select (3)

byte 0: `HF_FASCN` (3)
byte 1: 0 = bar, 2 = notify (default)

Reverse Charge (6)

byte 0: `HF_RVCN` (6)
byte 1: 0 = bar, 1 = accept (default), 2 = notify

Incoming Calls (8)

byte 0: `HF_INCM` (8)
byte 1: 0 = bar, 1 = accept (default), 2 = notify

T2X Timer (CCITT) (11)

byte 0: `HF_T2XCN` (11)
byte 1: Data length (4 or 5)
byte 2: T20 timeout value (1–255 seconds) (default = 180)
byte 3: T21 timeout value (1–255 seconds) (default = 200)
byte 4: T22 timeout value (1–255 seconds) (default = 180)
byte 5: T23 timeout value (1–255 seconds) (default = 180)
byte 6: T28 timeout value (0.1–25.5 minutes)
(default = 5.0 minutes) (CCITT 1984 and 1988)

T2X Timer (ISO 8208 or Unrestricted) (11)

byte 0: `HF_T2XCN` (11)
byte 1: Data length (9)
byte 2: T20 timeout value (1–255 seconds) (default = 180)
byte 3: T21 timeout value (1–255 seconds) (default = 200)
byte 4: T22 timeout value (1–255 seconds) (default = 180)
byte 5: T23 timeout value (1–255 seconds) (default = 180)
byte 6: T24 timeout value (1–255 seconds) (default = disabled)
byte 7: T25 timeout value (1–255 seconds) (default = disabled)
byte 8: T26 timeout value (1–255 seconds) (default = disabled)
byte 9: T27 timeout value (1–255 seconds) (default = disabled)
byte 10: T28 timeout value (0.1–25.5 minutes)
(default = 5.0 minutes)

Note

A T2X timer or R2X retry limit value of zero does not update the current setting.

R2X Retry Limits for T2X Timers (CCITT) (12)

byte 0:	`HF_R2XCN` (12)
byte 1:	Data length (4 or 5)
byte 2:	R20 retry limit value (1–255) (default = 2)
byte 3:	0
byte 4:	R22 retry limit value (1–255) (default = 2)
byte 5:	R23 retry limit value (1–255) (default = 2)
byte 6:	R28 retry limit value (1–255) (default = 2) (CCITT 1984 and 1988)

R2X Retry Limits for T2X Timers (ISO 8208 or Unrestricted) (12)

byte 0:	`HF_R2XCN` (12)
byte 1:	Data length (9)
byte 2:	R20 retry limit value (1–255) (default = 2)
byte 3:	0
byte 4:	R22 retry limit value (1–255) (default = 2)
byte 5:	R23 retry limit value (1–255) (default = 2)
byte 6:	0
byte 7:	R25 retry limit value (1–255) (default = 1)
byte 8:	0
byte 9:	R27 retry limit value (1–255) (default = 1)
byte 10:	R28 retry limit value (1–255) (default = 2)

TL1 Link Activation Timer (13)

byte 0:	`HF_TLX` (13)
byte 1:	Data length (1)
byte 2:	TL1 timer limit (1–255) (default = 180)

LCN Bounds (17)

byte 0:	`HF_LCN` (17)
byte 1:	Data length (12)
bytes 2, 3:	Lowest incoming channel (LIC) (default = 0)
bytes 4, 5:	Highest incoming channel (HIC) (default = 0)
bytes 6, 7:	Lowest two-way channel (LTC) (default = 1)
bytes 8, 9:	Highest two-way channel (HTC) (default = 4095)
bytes 10, 11:	Lowest outgoing channel (LOC) (default = 0)
bytes 12, 13:	Highest outgoing channel (HOC) (default = 0)

Certification Mode (18)

byte 0:	`HF_CERT` (18)
byte 1:	0 = no (default), 1 = yes

Flow Control Negotiation (19)

byte 0:	`HF_FLOW` (19)
byte 1:	0 = bar (default), 1 = accept

Modem Control Signal Monitoring (22)

byte 0:	`HF_CLM` (22)
byte 1:	Signal to be monitored (1 = CTS, 2 = DCD)
byte 2:	Status of monitoring (0 = stop (default), 1 = start)

Modem Control Signal Debounce Time (23)

byte 0:	`HF_CLTMR` (23)
byte 1:	Signal associated with timer (1 = CTS, 2 = DCD)
byte 2:	Debounce time value (1–255 seconds) (default = 15)

X.25 Restart Following SLP/MLP Initialization (25)

byte 0:	`HF_RESTART` (25)
byte 1:	0 = no (default), 1 = yes

REJ Packet Retransmission (42)

byte 0: HF_REJ (42)
byte 1: 0 = disable (default), 1 = enable

Extended Packet Sequence Numbering (43)

byte 0: HF_MOD128 (43)
byte 1: 0 = modulo 8 (default), 1 = *extended* modulo 128

X.25 Operation Profile (44)

byte 0: HF_X25_PROFILE (44)
byte 1: X.25 standard selection option
0 = unrestricted
1 = reserved
2 = CCITT 1980
3 = CCITT 1984 (default)
4 = ISO 8208
5 = CCITT 1988

Local DTE Address Length (45)

byte 0: HF_ADDR_LEN (45)
byte 1: Address length value (1–15, or 3–17 TOA/NPI)

DTE Address Format (47)

byte 0: HF_TOANPI (47)
byte 1: 0 = normal (default), 1 = TOA/NPI

6.2.11 DLI_X25_HOST_CFG_LINK (27)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client sends this packet to configure either a data link or an X.25 station resource for a particular data link. The DLI_X25_SAP_SLP DLI_X25_MGR_API client sends this packet to configure a data link. The expected Freeway response is a DLI_X25_ICP_ACK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. Chapter 3 gives more information on each link configuration option. The two configuration methods are described in the following sections.

6.2.11.1 Configure Link

The DLI_X25_SAP_X25 DLI_X25_MGR_API client sends this packet to configure an X.25 data link. The DLI_X25_SAP_SLP DLI_X25_MGR_API client sends this packet to configure an HDLC data link. The expected Freeway response is a DLI_X25_ICP_ACK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CFG_LINK
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The first 16-bit word following the header must contain the following specifications. Refer to Section 3.4.14 on page 93 for the X.21/V.11 clock source.

word 0:	Bits 0–3:	nominal data rate (see Table 6–3)
	Bit 4:	addressing (0 = DTE (default), 1 = DCE)
	Bit 5:	0
	Bit 6:	clock (0 = internal, 1 = external (required on Freeway))
	Bit 7:	0
	Bits 8–15:	Number of flags in interframe gap[2] (0–255)

Table 6–3: Nominal Data Rate

Value of bits 0–3	Data Rate
0	Custom rate[a]
1	Reserved
2	Reserved
3	Reserved
4	Reserved
5	300
6	600
7	1200
8	2400
9	4800
10	9600
11	19200
12	38400
13	56000
14	57600
15	64000

[a] Other data rates may be specified by using the custom data rate function (6) in the packet data area

2. The interframe gap specification affects operation on selected ICP boards, such as the ICP2424 and ICP2432. It has no effect on the ICP6000.

In addition, the data area may contain the following optional information for setting link configuration options, listed in ascending function code order. Each optional specification consists of a set of two or three 16-bit word values.

word 0:	SFWSIZE[3] (1)
word 1:	Frame transmit window size (1–7 or 1–127 *extended*) (Default is 7)
word 0:	SDATSIZE (2)
word 1:	Maximum frame data size in bytes (64 through the configured communication buffer size) (Default is the comm. buffer size)
word 0:	ST1TIME[4] (3)
word 1:	T1 timer value, where bits 0–7 = seconds (0–255), bits 8–15 = tenths (0–9) (Default is 2.0 seconds)
word 0:	SN2 (4)
word 1:	N2 retry limit value (1–255) (Default is 10)
word 0:	ENCODING (5)
word 1:	Bit encoding format value (0=NRZ, 1=NRZI) (Default is 0 (NRZ))
word 0:	DATARATE[5] (6)
words 1–2:	Custom data rate value (longword)
word 0:	ST2TIME[6] (7)
word 1:	T2 timer value, where bits 0–7 = seconds (0–255), bits 8–15 = tenths (0–9) (Default is 0.1 seconds.)
word 0:	LAPB_MODULUS (8)
word 1:	Frame modulus value (0 = modulo 8, 1 = *extended* modulo 128) (Default is 0 (modulo 8))

3. Frame transmit window size must be compatible with the frame modulus (function 8).

4. A T1 timer value of 2.0 seconds may be insufficient at data rates below 9.6 kb/s. Protogate recommends a T1 timer value of three to four times the transmission time of the longest packet.

5. Specify a custom data rate only when the nominal data rate is not indicated.

6. The T2 value for the DTE must be sufficiently less than the T1 value for the DCE to ensure that delaying DTE transmission of acknowledgments by T2 seconds will not cause a T1 timeout in the DCE.

word 0:	CUSTOM_ADDRESS (9)
word 1:	Local SLP address
word 2:	Remote SLP address

word 0:	INTEGRITY_TIMER (10)
word 1:	T4 integrity check timer value, where bits 0–7 = seconds (0–255), bits 8–15 = tenths (0–9) (Default is zero, no timer active)

word 0:	IDLE_TIMER (11)
word 1:	T3 idle link timer value, where bits 0–7 = seconds (0–255), bits 8–15 = tenths (0–9) (Default is zero, no timer active)

word 0:	XMIT_CLOCK (12)
word 1:	X.21/V.11 external transmit clock source selection (0 = send timing, 1 = receive timing) (Default is zero (send))

word 0:	OPTION_SREJ[7] (13)
word 1:	Data link SREJ option switch (0 = off, 1 = on) (Default is 0 (off))

word 0:	OPTION_RAW[8] (14)
word 1:	Raw HDLC option switch (0 = off, 1 = on) (Default is 0 (off))

word 0:	EIA_TYPE[9] (15)
word 1:	EIA selection indication (EIA_232 = 1, EIA_449 = 2, EIA_530 = 3, EIA_V35 = 4, MIL_188C = 5) (There is no default)

word 0:	OPTION_UI[10] (16)
word 1:	HDLC UI Option switch (0 = off, 1 = on) (Default is 0 (off))

word 0:	OPTION_TEST[11] (17)
word 1:	HDLC TEST Option switch (0 = off, 1 = on) (Default is 0 (off))

7. Neither CCITT X.25 nor ISO7776 permits the use of the SREJ option.
8. May be used to bypass HDLC LAPB protocol rules; not recommended for an X.25 data link.
9. Valid only for ICPs with IUSC serial port controllers.
10. Valid only for HDLC LAPB services.
11. Valid only for HDLC LAPB services.

6.2.11.2 Configure Station

After configuring the data links, the DLI_X25_SAP_X25 DLI_X25_MGR_API client sends a separate DLI_X25_HOST_CFG_LINK packet for each PVC station associated with an X.25 data link. Configuration of SVC stations is optional. Multiple stations can be configured for each link. The expected Freeway response is a DLI_X25_ICP_ACK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CFG_LINK
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	Station ID (1–*n*) (*n* = virtual circuit maximum)
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The first 16-bit word following the header must contain the following specifications:

word 0:	Bits 0–7:	LCN value (only for PVC) (0–255)
	Bits 8–11:	LCGN value (for PVC or SVC) (0–15)
	Bit 12:	Set to 1 for PVC and set to zero for SVC

In addition, the data area may contain the following optional word pair to set the station packet window size:

word 0: SPWSIZE (1)
word 1: Packet window size (1–7 or 1–127 *extended*[12])
(Default is 2)

12. Before configuring stations with extended packet window sizes on a link, first send a DLI_X25_HOST_CFG_CALL_SERVICE packet to enable extended packet sequence numbering on the link.

6.2.12 DLI_X25_HOST_CFG_MLP (45)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client sends this packet to assign one or more X.25 SLPs to a common MLP and configure the timer and window parameters. The expected Freeway response is a DLI_X25_ICP_ACK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CFG_MLP
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data format is as follows:

word 0:	MT1 lost frame timer (1–255 seconds)
word 1:	MT2 group busy timer (1–255 seconds)
word 2:	MT3 reset confirmation timer (1–255 seconds)
word 3:	MW multilink window size parameter (1–2048)
word 4:	MX receive MLP window guard region parameter (1 to 2048–MW)
word 5:	First SLP link identification
word 6:	Second SLP link identification, *etc.*

6.2.13 DLI_X25_HOST_CLOSE_PVC (65)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to close a specified permanent virtual circuit. The expected Freeway response is a DLI_X25_ICP_PVC_CLOSED packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CLOSE_PVC
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_PVC_OPENED packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.14 DLI_X25_HOST_CLOSE_SESSION_REQ (65533)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client or DLI_X25_SAP_X25 DLI_X25_USER_API client terminates access to a service on the Freeway ICP by sending this packet to close a specified session. The expected Freeway response is a DLI_X25_ICP_SESSION_CLOSED packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CLOSE_SESSION_REQ
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	Client-specified request reference ID (0–0xFFFF)
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.15 DLI_X25_HOST_CLR_REQ (5)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to signify that it wants to terminate a currently active switched virtual circuit (SVC) or to clear the incoming call associated with a received DLI_X25_ICP_INCOMING_CALL packet. The ICP issues the X.25 clear request to the DCE and monitors the channel for a clear confirmation from the DCE. If the T23 timer's time limit runs out before the clear confirmation is received, the ICP issues the clear request again. The timeout and retransmit cycle continues until a clear confirmation is received, a clear indication is received, or the configured number of retries (R23) is exhausted. The expected Freeway response is a DLI_X25_ICP_CLR_CONFIRMED or DLI_X25_ICP_CLR_INDICATION packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CLR_REQ
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_AUTO_CONNECT, DLI_X25_ICP_INCOMING_CALL, or DLI_X25_ICP_CALL-_ACCEPTED packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Optional information in the data area may include one or more of the following quality of service (qos) parameters as described in Section 6.4 on page 247. The user data facility (HF_USER) may be included only if the fast select facility (HF_FASNR or HF_FASR) was present in the DLI_X25_HOST_CALL_REQ or DLI_X25_ICP_INCOMING_CALL packet when the SVC call started.

HF_CAUSE	Cause
HF_CLDADMOD	Called line address modified notification facility
HF_CLDEFLECT	Call deflection selection facility
HF_CLLED	Called DTE address
HF_CLLNG	Calling DTE address
HF_DIAG	Diagnostic
HF_NONSTD	Non-standard user facilities
HF_USER	User data

6.2.16 DLI_X25_HOST_CLR_STATISTICS (57)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_MGR_API client sends this packet to request Freeway to clear the current statistics for a specified link. To read the statistics before clearing them, use the DLI_X25_HOST_GET_STATISTICS packet. The expected Freeway response is a DLI_X25_ICP_ACK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error.

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CLR_STATISTICS
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.17 DLI_X25_HOST_CTL_LINE_STATE_REQ (69)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_MGR_API client sends this packet to request Freeway to report on the current status of either the clear to send (CTS) or the data carrier detect (DCD) modem signal. The expected Freeway response is a DLI_X25_ICP_CTL_LINE_STATE_RSP packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error.

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_CTL_LINE_STATE_REQ
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data area contains the single byte shown below.

byte 0: modem signal ID (1 = CTS, 2 = DCD)

6.2.18 DLI_X25_HOST_DATA (17)

The DLI_X25_SAP_X25 DLI_X25_USER_API client or the DLI_X25_SAP_SLP DLI_X25_USER_API client sends this packet to send data to the remote DTE. The data can be sent in any format or code set the user selects; it is transparent to the X.25 software. The expected Freeway response is a DLI_X25_ICP_ROTATE_XMIT_WINDOW packet[13] if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_DATA
PROTHDR.iProtModifier	Q-bit, M-bit, and/or D-bit
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_AUTO_CONNECT, DLI_X25_ICP_INCOMING_CALL, DLI_X25_ICP_CALL_ACCEPTED, or DLI_X25_ICP_PVC_OPENED packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

13. In the DLI_X25_ICP_ROTATE_XMIT_WINDOW packet, the PROTHDR.iProtModifier field indicates the number of DLI_X25_HOST_DATA packets acknowledged.

The user has control of the Q-bit, M-bit, and D-bit for each DLI_X25_HOST_DATA packet. The PROTHDR.iProtModifier field contains the bit flags defined in Table 6–4.

Table 6–4: DLI_X25_HOST_DATA PROTHDR.iProtModifier Field Bit Flags

Bit	Definition
0	Q-bit, data qualifier flag 0 = Q-bit off, normal data 1 = Q-bit on, qualified data
1	M-bit, more data flag 0 = M-bit off, this packet is the last or only packet in a complete packet sequence 1 = M-bit on, this is a full block of data that is part of a segmented packet
2	D-bit, remote acknowledgment flag 0 = D-bit off, local acknowledgment 1 = D-bit on, remote acknowledgment

6.2.19 DLI_X25_HOST_DEL_INCALL_FILTER (31)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to delete the incoming call filter, registered by the previous DLI_X25_HOST_ADD_INCALL_FILTER packet. The expected Freeway response is a DLI_X25_ICP_ACK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_DEL_INCALL_FILTER
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.20 DLI_X25_HOST_DISABLE_LINK (25)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_USER_API client sends this packet to disable a data link. The expected Freeway response is a DLI_X25_ICP_LINK_DISABLED packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_DISABLE_LINK
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.21 DLI_X25_HOST_ENABLE_LINK (23)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_USER_API client sends this packet to enable a data link. The expected Freeway response is a DLI_X25_ICP_LINK_ENABLED packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error.

Each link must be enabled separately. The application program must wait for the DLI_X25_ICP_LINK_ENABLED confirmation packet from Freeway before the DLI_X25_USER_API client can start data transfer or call placement on that link. When using an MLP, the application program must wait for the DLI_X25_ICP_LINK_ENABLED confirmation for *at least one* of the MLP's SLPs before starting data transfer. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_ENABLE_LINK
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.22 DLI_X25_HOST_GET_STATISTICS (33)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_MGR_API client sends this packet to read the statistics on a link. Freeway sends the current statistics in a DLI_X25_ICP_STATISTICS response packet and then clears the statistics. The expected Freeway response is DLI_X25_ICP_STATISTICS if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_GET_STATISTICS
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.23 DLI_X25_HOST_GET_VERSION (55)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client sends this packet to request the software version information. The expected Freeway response is a DLI_X25_ICP_VERSION packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_GET_VERSION
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.24 DLI_X25_HOST_INIT_SLP (13)

The DLI_X25_SAP_SLP DLI_X25_USER_API client sends this packet to reset an HDLC LAPB data link. The expected Freeway response is a DLI_X25_ICP_MLP_SLP_RESET packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_INIT_SLP
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.25 DLI_X25_HOST_INT_CONFIRMED (21)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to acknowledge receipt of a DLI_X25_ICP_INTERRUPT packet. Only one outstanding DLI_X25_ICP_INTERRUPT packet is permitted at any time. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE_EXP
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_INT_CONFIRMED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_AUTO_CONNECT, DLI_X25_ICP_INCOMING_CALL, DLI_X25_ICP_CALL_ACCEPTED, or DLI_X25_ICP_PVC_OPENED packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.26 DLI_X25_HOST_INTERRUPT (19)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to send from 1 to 32 bytes of data that is not subject to packet-level flow control and packet transmit window restrictions. The expected Freeway response is a DLI_X25_ICP_INT_CONFIRMED packet (unless the circuit is reset or cleared) or a DLI_X25_ICP_CMD_REJECTED packet on error. Only one outstanding DLI_X25_HOST_INTERRUPT packet is permitted at any time. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE_EXP
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_INTERRUPT
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_AUTO_CONNECT, DLI_X25_ICP_INCOMING_CALL, DLI_X25_ICP_CALL-_ACCEPTED, or DLI_X25_ICP_PVC_OPENED packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data area may contain from 1 to 32 bytes of data; however, CCITT X.25 for 1980 permits only one byte of data.

6.2.27 DLI_X25_HOST_MONITOR_REG (53)

The DLI_X25_SAP_DIAG DLI_X25_MGR_API client sends this packet to control optional line analyzer data collection functions. See Section 6.3.21 on page 226. The packet enables or disables monitoring on one or more specified data links. The packet overrides any previous line analyzer control specification. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_MONITOR_REG
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data area contains one or more of the following link monitoring specification two-byte parameter sets:

byte 0: Link ID (*0–n*)
byte 1: Set monitoring (0 = off, 1 = brief, 2 = full, 3 = exceptions)

where: “off” disables monitoring
“brief” enables monitoring and skips data packet contents
“full” enables monitoring and reports data packet contents
“exceptions” enables monitoring and reports unusual events only

6.2.28 DLI_X25_HOST_OPEN_PVC (63)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to open a specified preconfigured PVC station for permanent virtual circuit operation. The expected Freeway response is a DLI_X25_ICP_PVC_OPENED packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_OPEN_PVC
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Preconfigured PVC station ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.29 DLI_X25_HOST_OPEN_SESSION_REQ (65535)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client or DLI_X25_SAP_X25 DLI_X25_USER_API client gains access to services on the Freeway ICP by sending this packet to open a session with a specified service. The expected Freeway response is a DLI_X25_ICP_SESSION_OPENED packet if successful or a DLI_X25_ICP_SESSION_CLOSED packet on error. The required header fields for this packet are shown below. Note that the ICPHDR.usICPParms[0] field is normally set by the Freeway server as the packet is passed from the client to the ICP. However, in a non-Freeway environment, the client must set this field to a number ranging from 1 through 126.

ICPHDR.usICPClientID	Client byte order (0x0000 = Big Endian, 0xC000 = Little Endian)
ICPHDR.usICPServerID	Service provider (11 = DLI_X25_SAP_X25, 12 = DLI_X25_SAP_DIAG, or 14 = DLI_X25_SAP_SLP)
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE_EXP
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	ICP return node (set by Freeway server)
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_OPEN_SESSION_REQ
PROTHDR.iProtModifier	Session type (DLI_X25_MGR_API or DLI_X25_USER_API)
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	0
PROTHDR.usProtSequence	Client-specified request reference ID (0–0xFFFF)
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.30 DLI_X25_HOST_REDIRECT (47)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to dismiss a received DLI_X25_ICP_INCOMING_CALL packet and allow the ICP to report the same DLI_X25_ICP_INCOMING_CALL packet to another client. The expected Freeway response is a DLI_X25_ICP_ACK packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_REDIRECT
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_INCOMING_CALL packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.31 DLI_X25_HOST_REGISTER (71)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client sends this packet to invoke or revoke specific X.25 facilities for the DTE and to adjust default values for DTE/DCE interface parameters. The client may also send this packet to request a report of available X.25 facilities from the network DCE by sending only the packet header (without data). The expected Freeway response is a DLI_X25_ICP_REGISTERED packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error.

Table 6–5 lists the function codes for registration packets. Function codes 130 and 131 appear only in a DLI_X25_ICP_REGISTERED response packet (described in Section 6.3.24 on page 231).

Table 6–5: Function Codes for Facilities Registration Packets

Code Symbol	Code Number	Function	Packet Type
HF_NEGP1	128	Facilities negotiable in state *p1*	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED
HF_NEGANY	129	Facilities negotiable in any state	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED
HF_AVAIL	130	Availability of facilities	DLI_X25_ICP_REGISTERED only
HF_NON_NEG	131	Non-negotiable facilities	DLI_X25_ICP_REGISTERED only
HF_DFTHRU	132	Default throughput classes assignment	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED
HF_NSPACK	133	Non-standard default packet data sizes	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED
HF_NSWIN	134	Non-standard default packet window sizes	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED
HF_LOGCHAN	135	Logical channel types ranges	DLI_X25_HOST_REGISTER or DLI_X25_ICP_REGISTERED

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_REGISTER
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The facilities registration parameters are described below, arranged in ascending function code order:

Facilities Negotiable in State *p1* (128)

byte 0: HF_NEGP1 (128)
byte 1: Facility length (3)
byte 2: Extended packet sequence numbering facility (0 = no, 1 = yes)
byte 3: Packet retransmission facility (0 = no, 1 = yes)
byte 4: D-bit modification facility (0 = no, 1 = yes)

Facilities Negotiable in Any State (129)

byte 0: HF_NEGANY (129)
byte 1: Facility length (7)
byte 2: Incoming calls barred facility (0 = no, 1 = yes)

byte 3: Outgoing calls barred facility (0 = no, 1 = yes)
byte 4: Fast select acceptance facility (0 = no, 1 = yes)
byte 5: Reverse charging acceptance facility (0 = no, 1 = yes)
byte 6: Flow control negotiation facility (0 = no, 1 = yes)
byte 7: Throughput class negotiation facility (0 = no, 1 = yes)
byte 8: Charging information facility (0 = no, 1 = yes)

Default Throughput Class (132)

byte 0: `HF_DFTHRU` (132)
byte 1: Transmit throughput class selection (3–13)
byte 2: Receive throughput class selection (3–13)

b/s rate selections are:

3 = 75	9 = 4800
4 = 150	10 = 9600
5 = 300	11 = 19200
6 = 600	12 = 48000
7 = 1200	13 = 64000[14]
8 = 2400	

Non-standard Default Packet Data Sizes (133)

byte 0: `HF_NSPACK` (133)
byte 1: Transmit packet data size selection (4–12)
byte 2: Receive packet data size selection (4–12)

Data size selections are expressed as the power-of-two exponent of the actual size:

4 = 16	9 = 512
5 = 32	10 = 1024
6 = 64	11 = 2048
7 = 128	12 = 4096
8 = 256	

14. The default throughput class of 64000 b/s is supported for the CCITT 1988 and unrestricted profiles only.

Non-standard Default Packet Window Sizes (134)

byte 0: HF_NSWIN (134)
byte 1: Transmit packet window size (1–127)
byte 2: Receive packet window size (1–127)

Window size values 8–127 are valid only when the *facilities negotiable in state p1*, function code HF_NEGP1, are used to enable extended packet sequence numbering.

Logical Channel Types Ranges (135)

byte 0: HF_LOGCHAN (135)
byte 1: Facility length (12)
bytes 2, 3: Lowest incoming channel (LIC)
bytes 4, 5: Highest incoming channel (HIC)
bytes 6, 7: Lowest two-way channel (LTC)
bytes 8, 9: Highest two-way channel (HTC)
bytes 10,11: Lowest outgoing channel (LOC)
bytes 12,13: Highest outgoing channel (HOC)

6.2.32 DLI_X25_HOST_RESET_CONFIRMED (11)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to acknowledge receipt of a DLI_X25_ICP_RESET_INDICATION packet from the ICP, provided that the client is not currently expecting a DLI_X25_ICP_RESET_CONFIRMED packet in response to a DLI_X25_HOST_RESET_REQ packet. This action completes a reset of the PVC or SVC circuit. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_RESET_CONFIRMED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_AUTO_CONNECT, DLI_X25_ICP_INCOMING_CALL, DLI_X25_ICP_CALL-_ACCEPTED, or DLI_X25_ICP_PVC_OPENED packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.33 DLI_X25_HOST_RESET_REQ (9)

The DLI_X25_SAP_X25 DLI_X25_USER_API client sends this packet to reset a PVC or SVC circuit. The expected Freeway response is a DLI_X25_ICP_RESET_INDICATION or DLI_X25_ICP_RESET_CONFIRMED packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error. When a circuit is reset, the following events occur:

- Any packets currently being transmitted or received by the ICP are discarded
- The packet transmit and receive windows are each opened for additional packets
- Any “waiting for interrupt confirmation” condition is cleared

The required header fields for this packet are shown below

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_RESET_REQ
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtCircuitID	Circuit ID matches same field in DLI_X25_ICP_AUTO_CONNECT, DLI_X25_ICP_INCOMING_CALL, DLI_X25_ICP_CALL-_ACCEPTED, or DLI_X25_ICP_PVC_OPENED packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Optional information in the data area may include one or more of the following quality of service (qos) parameters as described in Section 6.4 on page 247.

HF_CAUSE	Cause
HF_DIAG	Diagnostic
HF_PRIORITY	Virtual circuit priority on Freeway

6.2.34 DLI_X25_HOST_SAMPLE_STATISTICS (59)

The DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_MGR_API client sends this packet to request Freeway to report the current statistics for a specified link without altering them. To clear the statistics after reading them, use the DLI_X25_HOST_GET_STATISTICS packet. The expected Freeway response is a DLI_X25_ICP_STATISTICS packet if successful or a DLI_X25_ICP_CMD_REJECTED packet on error.

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_SAMPLE_STATISTICS
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.35 DLI_X25_HOST_TEST_FRAME (77)

The DLI_X25_SAP_SLP DLI_X25_MGR_API client sends this packet to send a TEST command frame to the remote DTE. The expected eventual Freeway response is a DLI_X25_ICP_TEST_FRAME packet, reporting the receipt of the matching TEST response frame from the remote DTE.

The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_TEST_FRAME
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.2.36 DLI_X25_HOST_UNNUMBERED_DATA (14)

The DLI_X25_SAP_SLP DLI_X25_USER_API client sends this packet to send unnumbered data (a UI command frame) to the remote DTE. The data can be sent in any format or code set the user selects; it is transparent to the HDLC LAPB software. There is no expected Freeway response if successful; a DLI_X25_ICP_CMD_REJECTED packet is received on error. The required header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_HOST_UNNUMBERED_DATA
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3 ICP Packets Received from Freeway

This section describes the format of each packet you may receive from the Freeway X.25 services on the ICP. Table 6–6 summarizes the usage of important fields within the protocol header and shows the associated I/O path (determined by the ICPHDR.usICPCommand field value). Remember that all fields in both the ICPHDR and PROTHDR portions of the packet header are present in the packet.

Table 6–6: ICP Packet PROTHDR Fields

ICPHDR.-usICPCommand	PROTHDR.-usProtCommand	PROTHDR.-iProtModifier	PROTHDR.-usProtLinkID	PROTHDR.-usProtCircuitID	PROTHDR.-usProtSessionID	PROTHDR.-usProtSequence
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-32BIT_STATISTICS	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_ABORT	Diagnostic	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_ACK	Command	Port ID	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP-_AUTO_CONNECT	—	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-CALL_ACCEPTED	—	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_CFG_-BUF_CONFIRMED	—	—	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-CLR_CONFIRMED	—	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-CLR_INDICATION	—	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-CMD_REJECTED	Command	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-CMD_TIMEOUT	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_CTL_-LINE_STATE_RSP	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_DATA	Q/M/D[a]	Port ID[b]	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-DIAGNOSTICS	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_ERROR	Diagnostic	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-INCOMING_CALL	—	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-INT_CONFIRMED	—	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-INTERRUPT	—	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-LINK_DISABLED	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-LINK_ENABLED	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-MLP_SLP_RESET	—	Port ID	—	Session ID	—

[a] X.25 data only.
[b] HDLC LAPB data only.

Table 6–6: ICP Packet PROTHDR Fields *(Cont'd)*

ICPHDR.-usICPCommand	PROTHDR.-usProtCommand	PROTHDR.-iProtModifier	PROTHDR.-usProtLinkID	PROTHDR.-usProtCircuitID	PROTHDR.-usProtSessionID	PROTHDR.-usProtSequence
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-MONITOR_RSP	—	—	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-PVC_CLOSED	—	Port ID	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-PVC_OPENED	—	Port ID	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-REGISTERED	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-RESET_CONFIRMED	—	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-RESET_INDICATION	—	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_ ROTATE_XMIT_-WINDOW	Count	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-SESSION_CLOSED	—	Port ID	—	Session ID	Request ID
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-SESSION_OPENED	Session Type	Port ID	—	Session ID	Request ID
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-SLP_XMIT_ERROR	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-SLP_XMIT_OK	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-STATION FAILED	Diagnostic	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-STATION_OK	—	—	Circuit ID	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-STATISTICS	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-TEST_FRAME	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-UNNUMBERED_DATA	—	Port ID	—	Session ID	—
DLI_ICP_CMD_WRITE	DLI_X25_ICP_-VERSION	—	—	—	Session ID	—

6.3.1 DLI_X25_ICP_32BIT_STATISTICS (16)

Freeway sends this packet in response to a DLI_X25_HOST_32BIT_GET_STATISTICS or DLI_X25_HOST_32BIT_SAMPLE_STATISTICS packet from the DLI_X25_SAP_X25 DLI_X25_MGR_API client, or the DLI_X25_SAP_SLP DLI_X25_MGR_API client. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_32BIT_STATISTICS
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data following the header has the following format (72 bytes for X.25 or 56 bytes for HDLC):

longword 0: Receive FCS errors
longword 1: Receive I-frames too long
longword 2: Receive overrun errors
longword 3: Transmit underrun errors
longword 4: Transmit watchdog errors
longword 5: Unrecognized frames received

longword 6:	I-frames received	
longword 7:	I-frames sent	
longword 8:	FRMR frames received	
longword 9:	FRMR frames sent	
longword 10:	REJ frames received	
longword 11:	REJ frames sent	
longword 12:	SABM frames received	
longword 13:	SABM frames sent	
longword 14:	Restart packets received	X.25 only
longword 15:	Restart packets sent	X.25 only
longword 16:	LCNs currently in use	X.25 only
longword 17:	LCN usage high-water mark	X.25 only

6.3.2 DLI_X25_ICP_ABORT (40)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client to report that an SVC circuit is terminating abnormally. The client must wait for the DLI_X25_ICP_STATION_OK packet. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_ABORT
PROTHDR.iProtModifier	Diagnostic code
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The PROTHDR.iProtModifier field contains one of the CCITT X.25 diagnostic codes listed in Appendix A.

6.3.3 DLI_X25_ICP_ACK (62)

Freeway sends this response packet to the DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_MGR_API client to report the successful processing of one of the client packets listed below.

DLI_X25_HOST_BUF_CLR
DLI_X25_HOST_CFG_LINK
DLI_X25_HOST_CFG_MLP
DLI_X25_HOST_CFG_CALL_SERVICE
DLI_X25_HOST_CLR_STATISTICS

Freeway also sends this response packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client to report the successful processing of one of the client packet listed below.

DLI_X25_HOST_CALL_ACCEPTED
DLI_X25_HOST_DEL_INCALL_FILTER
DLI_X25_HOST_REDIRECT
DLI_X25_HOST_ADD_INCALL_FILTER

The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_ACK
PROTHDR.iProtModifier	Contains PROTHDR.usProtCommand field from acknowledged packet
PROTHDR.usProtLinkID	ICP physical port ID matches same field in acknowledged packet

PROTHDR.usProtCircuitID	Circuit ID matches same field in acknowledged packet
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.4 DLI_X25_ICP_AUTO_CONNECT (46)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client to report that the ICP has received an incoming call from the X.25 network and has responded with a call accepted packet. No action by the client is necessary to connect the call; the client can begin sending data packets immediately. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_AUTO_CONNECT
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	ICP station ID to use as circuit ID for SVC
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Optional information in the data area may include one or more of the following quality of service (qos) parameters as described in Section 6.4 on page 247.

HF_BLCLUS	Bilateral closed user group facility
HF_CLLED	Called DTE address
HF_CLLNG	Calling DTE address
HF_CLREDR	Call redirection or deflection notification facility
HF_CLUSG	Closed user group selection facility

HF_CLUSGOAS	CUG with outgoing access selection facility
HF_D_BIT_SUPPORT	D-bit support request and indication
HF_FASNR	Fast select facility — no restriction
HF_FASR	Fast select facility — restriction on response
HF_NONSTD	Non-standard user facilities
HF_PDSIZE	Packet data size facility
HF_PRIORITY	Virtual circuit priority on Freeway
HF_PWSIZE	Packet window size facility
HF_RVFC	Reverse charging facility
HF_THRUCLASS	Throughput class
HF_TRDLYSEL	Transit delay selection and indication facility
HF_USER	User data

6.3.5 DLI_X25_ICP_CALL_ACCEPTED (4)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client to report that the client's DLI_X25_HOST_CALL_REQ packet has been processed successfully, and the virtual circuit is ready for use. At this point, you may send DLI_X25_HOST_DATA packets and receive DLI_X25_ICP_DATA packets. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_CALL_ACCEPTED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	ICP station ID to use as circuit ID for this SVC
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Optional information in the data area may include one or more of the following quality of service (QOS) parameters as described in Section 6.4 on page 247.

HF_CLDADMOD	Called line address modified notification facility
HF_CLLED	Called DTE address
HF_CLLNG	Calling DTE address
HF_D_BIT_SUPPORT	D-bit support request and indication
HF_NONSTD	Non-standard user facilities
HF_PDSIZE	Packet data size facility

HF_PRIORITY	Virtual circuit priority on Freeway
HF_PWSIZE	Packet window size facility
HF_THRUCLASS	Throughput class
HF_TRDLYSEL	Transit delay selection and indication facility
HF_USER	User data

6.3.6 DLI_X25_ICP_CFG_BUF_CONFIRMED (38)

Freeway sends this packet in response to a DLI_X25_HOST_CFG_BUF packet from the DLI_X25_SAP_X25 DLI_X25_MGR_API client. It confirms that the buffer-pool data structure is initialized. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_CFG_BUF_CONFIRMED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data format is as follows:

word 0: Number of buffers in the segmentation buffer pool
word 1: Number of buffers in the communication buffer pool

6.3.7 DLI_X25_ICP_CLR_CONFIRMED (8)

Freeway sends this packet to the DLI_X25_DLI_X25_SAP_X25 DLI_X25_USER_API client to report that the client's DLI_X25_HOST_CLR_REQ packet has been processed successfully and the virtual circuit has been disconnected. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_CLR_CONFIRMED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Optional information in the data area may include one or more of the following quality of service (qos) parameters as described in Section 6.4 on page 247.

HF_RCVCLDR	Receive charging call duration facility
HF_RCVMONY	Receive charging monetary unit facility
HF_RCVSGCNT	Receive charging segment count facility

6.3.8 DLI_X25_ICP_CLR_INDICATION (6)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client when the call is terminated by either the X.25 network or the remote DTE. No reply is required. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_CLR_INDICATION
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Optional information in the data area may include one or more of the following quality of service (qos) parameters as described in Section 6.4 on page 247.

HF_CAUSE	Cause
HF_CLDADMOD	Called line address modified notification facility
HF_CLLED	Called DTE address
HF_CLLNG	Calling DTE address
HF_DIAG	Diagnostic
HF_NONSTD	Non-standard user facilities
HF_RCVCLDR	Receive charging call duration facility
HF_RCVMONY	Receive charging monetary unit facility
HF_RCVSGCNT	Receive charging segment count facility
HF_USER	User data

6.3.9 DLI_X25_ICP_CMD_REJECTED (36)

Freeway sends this packet to the client to report an error in processing the client's packet identified in the PROTHDR.iProtModifier field. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID from rejected packet
ICPHDR.usICPServerID	Service provider ID from rejected packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_CMD_REJECTED
PROTHDR.iProtModifier	Contains PROTHDR.usProtCommand field from rejected packet
PROTHDR.usProtLinkID	Matches same field from rejected packet
PROTHDR.usProtCircuitID	Matches same field from rejected packet
PROTHDR.usProtSessionID	Matches same field from rejected packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The packet data area contains an ASCII description of the reason for rejecting the associated host packet. The following list illustrates several forms in which information may be presented in DLI_X25_ICP_CMD_REJECTED diagnostic messages. Square brackets enclose information extracted from the host packet. Angle brackets enclose a description of variable information provided by the ICP. Brackets are shown here for illustrative purposes, and do not appear in the actual diagnostic messages.

```
hhhh Host packet [i] invalid because <reason>
hhhh Host packet [i] argument [j] invalid because <reason>
hhhh Host packet [i] station [j] invalid because <reason>
hhhh Host packet [i] data size [j] invalid because <reason>
hhhh Host packet [i] parameter [j] invalid because <reason>
hhhh Host packet [i] parameter [j] length [k] invalid because <reason>
hhhh Host packet [i] parameter [j] value [k] invalid because <reason>
```

The first four characters in the data area of DLI_X25_ICP_CMD_REJECTED packets from the ICP contain a hexadecimal representation of two 8-bit fields; the fifth character is a blank. The first two hexadecimal characters give an error item code to identify which item in a rejected request is invalid. See Table 6–7. The last two characters give an error reason code for why the indicated item is invalid. See Table 6–8. The x25err.h include file defines the numerical value for each error name symbol shown (see Appendix B).

Table 6–7: DLI_X25_ICP_CMD_REJECTED Error Item Codes

Item Name	Item Description
X25ERR_ARGUMENT	Argument or modifier
X25ERR_BLCUG	Bilateral closed user group
X25ERR_CALL_DEFLECTION	Call deflection selection
X25ERR_CALLED_DTE	Called DTE address
X25ERR_CHGINFO	Charging information
X25ERR_CLA_MODIFIED	Called line address modified notification
X25ERR_COMBUF	Communications buffer pages
X25ERR_CUG	Closed user group (CUG)
X25ERR_CUGOAS	CUG with outgoing access selection
X25ERR_DATA_SIZE	Data size
X25ERR_D_BIT_MOD	D-bit modification
X25ERR_DC	CCITT diagnostic code
X25ERR_DDN	DDN service selection
X25ERR_EXTENDED	Extended sequence numbers
X25ERR_FCL_LEN	Facility length
X25ERR_LEN	Length
X25ERR_LINK	Link
X25ERR_MAXLSN	Maximum virtual circuits
X25ERR_MODEM	Modem signal selection
X25ERR_ON_OFF	ON/OFF switch selection
X25ERR_PARAM	Parameter
X25ERR_PKT	Host packet
X25ERR_RATE	Bits/second data rate
X25ERR_REJ	Packet retransmission
X25ERR_REVCHG	Reverse charging
X25ERR_SAP	Service access point
X25ERR_SEGBUF	Segmentation buffer pages
X25ERR_SESSION	Session
X25ERR_STATION	Station
X25ERR_TENTHS	Tenths
X25ERR_VAL	Value

Table 6–8: DLI_X25_ICP_CMD_REJECTED Error Reason Codes

Reason Name	Reason Description
X25ERR_ACTIVE	Circuit active
X25ERR_BARRED	Barred
X25ERR_CONFLICT	Configuration conflict
X25ERR_DENIED	Service access denied
X25ERR_DEPLETED	Resource depleted
X25ERR_DOESNT_MATCH	Doesn't match parameter list
X25ERR_DUPLICATE	Duplicate specification
X25ERR_ENABLED	Data link enabled
X25ERR_EXCEEDS	Exceeds maximum value
X25ERR_FCL_CONFLICT	Facility conflict
X25ERR_FCL_MISSING	Facility missing
X25ERR_FS_RESTRICTED	Facility restricted
X25ERR_LESS_THAN	Less than minimum value
X25ERR_MISSING	Missing
X25ERR_NEQ	Not equal to required value
X25ERR_NO_MLP	No multilink procedure configured
X25ERR_NON_ZERO	Non-zero when zero required
X25ERR_NOT_AVAILABLE	Registered facility not available
X25ERR_NOT_ENABLED	Registered facility not enabled
X25ERR_NOT_PVC	Not a permanent virtual circuit
X25ERR_NOT_SVC	Not a switched virtual circuit
X25ERR_OFFLINE	Data link offline
X25ERR_ONLINE	Data link online
X25ERR_ORDER	Out of order
X25ERR_OVERFLOW	Data size overflow
X25ERR_RANGE	Not in range
X25ERR_REGISTERED	Facility registered
X25ERR_STATE	Wrong state
X25ERR_UNKNOWN	Unknown
X25ERR_USERS	User session open
X25ERR_X25_PROFILE	Incompatible with selected X.25 profile
X25ERR_ZERO	Zero when non-zero required

6.3.10 DLI_X25_ICP_CMD_TIMEOUT (48)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_USER_API client when a link does not become active within the TL1 time limit (Section 3.6.7 on page 103), or upon expiration of the T3 idle link timer (Section 3.4.12 on page 92). The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_CMD_TIMEOUT
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.11 DLI_X25_ICP_CTL_LINE_STATE_RSP (70)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_MGR_API client for two reasons:

- In response to a DLI_X25_HOST_CTL_LINE_STATE_REQ packet
- Periodically when a DLI_X25_HOST_CFG_CALL_SERVICE packet has configured the modem control signal monitoring (HF_CLM) option

The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_CTL_LINE_STATE_RSP
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data format is as follows:

byte 0: Modem signal ID (1 = CTS, 2 = DCD)
byte 1: Signal status (0 = off, 1 = on)

6.3.12 DLI_X25_ICP_DATA (18)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client when data is received from the X.25 network, and a DLI_X25_HOST_ADJUST_FLOW_CONTROL packet has authorized its transfer to the client. The Q-bit, M-bit, and D-bit are reported for the packet as flags in the PROTHDR.iProtModifier field. The bit flags are defined in Table 6–9. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_DATA
PROTHDR.iProtModifier	Q/M/D bit indicators[a]
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)[b]
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

[a] X.25 data only.
[b] HDLC LAPB data only.

The data area contains pure data in the format received from the X.25 network.

Table 6–9: DLI_X25_ICP_DATA PROTHDR.iProtModifier Field Bit Flags

Bit	Definition
0	Q-bit, data qualifier flag 0 = Q-bit off, normal data 1 = Q-bit on, qualified data
1	M-bit, more data flag 0 = M-bit off, this packet is the last or only packet in a complete packet sequence 1 = M-bit on, this is a full block of data that is part of a segmented packet
2	D-bit, remote acknowledgment flag 0 = D-bit off, local acknowledgment 1 = D-bit on, remote acknowledgment

6.3.13 DLI_X25_ICP_DIAGNOSTICS (50)

Freeway forwards all diagnostic packets received from the network to the DLI_X25_SAP_X25 DLI_X25_MGR_API client. No specific client action is required. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_DIAGNOSTICS
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data format is as follows:

byte 0: Diagnostic code from network
byte 1–*n*: Diagnostic explanation from network

6.3.14 DLI_X25_ICP_ERROR (32)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client to report errors that may affect data integrity on the virtual circuit. X.25 restarts, MLP or SLP resets, and other interruptions of normal X.25 operation may cause the ICP to declare a procedure error. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_ERROR
PROTHDR.iProtModifier	Diagnostic code
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The PROTHDR.iProtModifier field contains one of the CCITT X.25 diagnostic codes listed in Appendix A.

6.3.15 DLI_X25_ICP_INCOMING_CALL (2)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client when an incoming call from a remote DTE matches the incoming call filter registered by the client. The client must send a DLI_X25_HOST_CALL_ACCEPTED packet to accept the call, send a DLI_X25_HOST_CLR_REQ packet to refuse the call, or send a DLI_X25_HOST_REDIRECT packet to allow the ICP to send the DLI_X25_ICP_INCOMING_CALL packet to another client. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_INCOMING_CALL
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	ICP station ID to use as circuit ID for this SVC call
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Optional information in the data area may include one or more of the following quality of service (qos) parameters as described in Section 6.4 on page 247.

HF_BLCLUS	Bilateral closed user group facility
HF_CLLED	Called DTE address
HF_CLLNG	Calling DTE address
HF_CLREDR	Call redirection or deflection notification facility

HF_CLUSG	Closed user group selection facility
HF_CLUSGOAS	CUG with outgoing access selection facility
HF_D_BIT_SUPPORT	D-bit support request and indication
HF_FASNR	Fast select facility — no restriction
HF_FASR	Fast select facility — restriction on response
HF_NONSTD	Non-standard user facilities
HF_PDSIZE	Packet data size facility
HF_PRIORITY	Virtual circuit priority on Freeway
HF_PWSIZE	Packet window size facility
HF_RVFC	Reverse charging facility
HF_THRUCLASS	Throughput class
HF_TRDLYSEL	Transit delay selection and indication facility
HF_USER	User data

6.3.16 DLI_X25_ICP_INT_CONFIRMED (22)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client when an interrupt confirmation packet is received from the X.25 network. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_INT_CONFIRMED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.17 DLI_X25_ICP_INTERRUPT (20)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client when an interrupt packet is received from the X.25 network. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_INTERRUPT
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data area contains from 1 to 32 bytes of data in the format received from the X.25 network.

6.3.18 DLI_X25_ICP_LINK_DISABLED (26)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_USER_API client in response to a DLI_X25_HOST_DISABLE_LINK packet or to report data link failure. It confirms or reports a link-inactive state. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_LINK_DISABLED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.19 DLI_X25_ICP_LINK_ENABLED (24)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_USER_API client in response to a DLI_X25_HOST_ENABLE_LINK packet. Freeway also sends this packet to report the restoration of a DLI_X25_SAP_X25 data link connection following a previously reported link failure (DLI_X25_ICP-_LINK_DISABLED) that was not a response to a DLI_X25_HOST_DISABLE_LINK packet. It confirms a link-active state. Freeway does not attempt to restore a DLI_X25_SAP_SLP data link connection after reporting link failure.

The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_LINK_ENABLED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.20 DLI_X25_ICP_MLP_SLP_RESET (30)

Freeway sends this packet to the DLI_X25_SAP_SLP DLI_X25_USER_API client to report the successful processing of the client's DLI_X25_HOST_INIT_SLP packet or to report when the remote DTE or the ICP resets the data link for any other reason. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_MLP_SLP_RESET
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.21 DLI_X25_ICP_MONITOR_RSP (54)

Freeway sends this packet to the DLI_X25_SAP_DIAG DLI_X25_MGR_API client periodically to report one or more line monitoring events when line monitoring is enabled (using DLI_X25_HOST_MONITOR_REG, Section 6.2.27 on page 180). The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_MONITOR_RSP
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data area concatenates one or more of the following event data entries. Each event data entry begins on a longword boundary within the data area. Any entry whose length is not an exact multiple of four is padded with additional NULL characters to the next longword boundary.

The sequence of these entries is the same as they occurred on the ICP. When data link analysis has been enabled on more than one link, the entries are intermixed in the approximate order in which they occurred. Due to small internal processing delays on the ICP, the order of events detected and reported by the ICP may differ from that determined by external frames of reference such as client program trace logs and serial data line monitors.

Due to internal accuracy limits on the ICP, the millisecond time stamp in each event report is approximate. The actual accuracy is roughly to the nearest 10 milliseconds. For most diagnostic purposes, protocol event sequencing, data transfer contents, and approximate timing are required. Because the shortest protocol timer setting available is 100 milliseconds, 10 millisecond accuracy is adequate.

Monitoring Event Data Entry Format

byte 0: Monitoring change function code (1)
byte 1: Link ID (0–*n*)
byte 2: Reserved
byte 3: Status (0 = off, 1 = on)
byte 4–7: Event time stamp (milliseconds)

Modem Signal Event Data Entry Format

byte 0: Modem signal event function code (2)
byte 1: Link ID (0–*n*)
byte 2: V.24 circuit ID (105 = RTS, 106 = RS, 107 = DSR, 108 = DTR, 109 = DCD)
byte 3: Status (0 = off, 1 = on)
byte 4–7: Event time stamp (milliseconds)

Transmit Event Data Entry Format

byte 0: Transmit event function code (3)
byte 1: Link ID (0–*n*)
byte 2: Data format definition bit fields:
- bit 0: C/R indicator (0 = command, 1 = response)
- bits 1–2: SLP header size (0, 2, or 3)
- bits 3–4: MLP header size (0 or 2)
- bits 5–7: X.25 header size (0, 3, or 4)

byte 3: Status (0 = normal, 1 = timeout, 2 = abort, 3 = underrun)
bytes 4–7: Event time stamp (milliseconds)
bytes 8–9: Total transmit sample size *n*
bytes 10–11: Total transmit packet size *n*
bytes 12–*n* + 12: Transmit sample contents

Receive Event Data Entry Format

byte 0: Receive event function code (4)
byte 1: Link ID (0–*n*)
byte 2: Data format definition bit fields:
- bit 0: C/R indicator (0 = command, 1 = response)
- bits 1–2: SLP header size (0, 2, or 3)
- bits 3–4: MLP header size (0 or 2)
- bits 5–7: X.25 header size (0, 3, or 4)

byte 3: Status (0 = FCS good, 1 = FCS bad, 2 = abort, 3 = underrun, 4 = oversize)
bytes 4–7: Event time stamp (milliseconds)
bytes 8–9: Total receive sample size *n*
bytes 10–11: Total receive packet size *n*
bytes 12–*n* + 12: Receive sample contents

6.3.22 DLI_X25_ICP_PVC_CLOSED (66)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client to report the successful processing of the client's DLI_X25_HOST_CLOSE_PVC packet. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_PVC_CLOSED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_HOST_CLOSE_PVC packet
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.23 DLI_X25_ICP_PVC_OPENED (64)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client to report the successful processing of the client's DLI_X25_HOST_OPEN_PVC packet. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_PVC_OPENED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_HOST_OPEN_PVC packet
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.24 DLI_X25_ICP_REGISTERED (72)

Freeway sends this packet in response to a DLI_X25_HOST_REGISTER packet from the DLI_X25_SAP_X25 DLI_X25_MGR_API client. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_REGISTERED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data area of the DLI_X25_ICP_REGISTERED packet includes the following information but may also include additional function codes detailed in Section 6.2.31 on page 184.

Availability of Facilities (130)

byte 0:	HF_AVAIL (130)
byte 1:	Facility length (13)
byte 2:	Extended packet sequence numbering facility (0 = no, 1 = yes)
byte 3:	Packet retransmission facility (0 = no, 1 = yes)
byte 4:	D-bit modification facility (0 = no, 1 = yes)
byte 5:	Called line address modified facility (0 = no, 1 = yes)
byte 6:	Charging information (per interface) facility (0 = no, 1 = yes)

byte 7: Charging information (per call) facility (0 = no, 1 = yes)
byte 8: Reverse charging acceptance facility (0 = no, 1 = yes)
byte 9: Reverse charging facility (0 = no, 1 = yes)
byte 10: Default throughput classes (0 = no, 1 = yes)
byte 11: Non-standard default packet window sizes (0 = no, 1 = yes)
byte 12: Non-standard default packet data sizes (0 = no, 1 = yes)
byte 13: Logical channel types ranges (0 = no, 1 = yes)
byte 14: RPOA selection (per call) facility (0 = no, 1 = yes)

Non-negotiable Facilities (131)

byte 0: `HF_NON_NEG` (131)
byte 1: Facility length (1)
byte 2: Local charging prevention facility (0 = disabled, 1 = enabled)

6.3.25 DLI_X25_ICP_RESET_CONFIRMED (12)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client when a reset confirmation packet is received from the X.25 network. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_RESET_CONFIRMED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.26 DLI_X25_ICP_RESET_INDICATION (10)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client when a reset indication packet is received from the X.25 network. The client must send a DLI_X25_HOST_RESET_CONFIRMED packet unless it is currently expecting a response to a DLI_X25_HOST_RESET_REQ packet. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_RESET_INDICATION
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

Optional information in the data area may include one or more of the following quality of service (QOS) parameters as described in Section 6.4 on page 247.

HF_CAUSE	Cause
HF_DIAG	Diagnostic
HF_PRIORITY	Virtual circuit priority on Freeway

6.3.27 DLI_X25_ICP_ROTATE_XMIT_WINDOW (28)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client to confirm the transmission and acknowledgment of one or more DLI_X25_HOST_DATA packets sent by the client. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_ROTATE_XMIT_WINDOW
PROTHDR.iProtModifier	Number of DLI_X25_HOST_DATA packets acknowledged
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.28 DLI_X25_ICP_SESSION_CLOSED (65532)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_MGR_API client or DLI_X25_SAP_X25 DLI_X25_USER_API client to report the successful processing of the client's DLI_X25_HOST_CLOSE_SESSION_REQ packet or to report an error in processing the client's DLI_X25_HOST_OPEN_SESSION_REQ packet. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID
ICPHDR.usICPServerID	Service provider ID
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_SESSION_CLOSED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_HOST_CLOSE_SESSION_REQ or DLI_X25_HOST_OPEN_SESSION_REQ packet
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID
PROTHDR.usProtSequence	Request ID matches same field in DLI_X25_HOST_CLOSE_SESSION_REQ or DLI_X25_HOST_OPEN_SESSION_REQ packet
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.29 DLI_X25_ICP_SESSION_OPENED (65534)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_MGR_API client or DLI_X25_SAP_X25 DLI_X25_USER_API client to report the successful processing of the client's DLI_X25_HOST_OPEN_SESSION_REQ packet. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID for this session
ICPHDR.usICPServerID	Service provider ID for this session
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_SESSION_OPENED
PROTHDR.iProtModifier	Session type (DLI_X25_MGR_API or DLI_X25_USER_API)
PROTHDR.usProtLinkID	ICP physical port ID matches same field in DLI_X25_HOST_OPEN_SESSION_REQ packet
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID for this session
PROTHDR.usProtSequence	Request ID matches same field in DLI_X25_HOST_OPEN_SESSION_REQ packet
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.30 DLI_X25_ICP_SLP_XMIT_ERROR (76)

Freeway sends this packet to the DLI_X25_SAP_SLP DLI_X25_USER_API client to report failure to transmit or failure to receive acknowledgment for one DLI_X25_HOST_DATA packet sent by the client. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_SLP_XMIT_ERROR
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data area contains the data from the associated DLI_X25_HOST_DATA packet that failed.

6.3.31 DLI_X25_ICP_SLP_XMIT_OK (74)

Freeway sends this packet to the DLI_X25_SAP_SLP DLI_X25_USER_API client to confirm the transmission and acknowledgment of one DLI_X25_HOST_DATA packet sent by the client. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_SLP_XMIT_OK
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.32 DLI_X25_ICP_STATION_FAILED (44)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client when a PVC station becomes inoperative. This is the result of a link shutdown or expiration of the N2 retry counter (Section 3.4.9 on page 90). The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_STATION_FAILED
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.33 DLI_X25_ICP_STATION_OK (42)

Freeway sends this packet to the DLI_X25_SAP_X25 DLI_X25_USER_API client to report completion of abnormal SVC termination previously reported in a DLI_X25_ICP_ABORT packet or requested by the client in a DLI_X25_HOST_ABORT packet. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_STATION_OK
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	Circuit ID
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.34 DLI_X25_ICP_STATISTICS (34)

Freeway sends this packet in response to a DLI_X25_HOST_GET_STATISTICS or DLI_X25_HOST_SAMPLE_STATISTICS packet from the DLI_X25_SAP_X25 DLI_X25_MGR_API client or the DLI_X25_SAP_SLP DLI_X25_MGR_API client. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_STATISTICS
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data following the header has the following format:

word 0:	Receive FCS errors
word 1:	Receive I-frames too long
word 2:	Receive overrun errors
word 3:	Transmit underrun errors
word 4:	Transmit watchdog errors
word 5:	Unrecognized frames received
word 6:	I-frames received

word 7:	I-frames sent	
word 8:	FRMR frames received	
word 9:	FRMR frames sent	
word 10:	REJ frames received	
word 11:	REJ frames sent	
word 12:	SABM frames received	
word 13:	SABM frames sent	
word 14:	Restart packets received	X.25 only
word 15:	Restart packets sent	X.25 only
word 16:	LCNs currently in use	X.25 only
word 17:	LCN usage high-water mark	X.25 only

6.3.35 DLI_X25_ICP_TEST_FRAME (78)

Freeway sends this packet to the DLI_X25_SAP_SLP DLI_X25_MGR_API client to report receipt of a TEST response frame from the remote DTE. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_TEST_FRAME
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.36 DLI_X25_ICP_UNNUMBERED_DATA (80)

Freeway sends this packet to the DLI_X25_SAP_SLP DLI_X25_USER_API client to report receipt of a UI frame from the remote DTE. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_UNNUMBERED_DATA
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	ICP physical port ID (0–*n*)
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

6.3.37 DLI_X25_ICP_VERSION (56)

Freeway sends this packet in response to a DLI_X25_HOST_GET_VERSION packet from the DLI_X25_SAP_X25 DLI_X25_MGR_API client. It contains the ICP X.25 software version information. The header fields for this packet are shown below.

ICPHDR.usICPClientID	Service user ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPServerID	Service provider ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
ICPHDR.usICPCommand	DLI_ICP_CMD_WRITE
ICPHDR.iICPStatus	0
ICPHDR.usICPParms[0]	0
ICPHDR.usICPParms[1]	0
ICPHDR.usICPParms[2]	0
PROTHDR.usProtCommand	DLI_X25_ICP_VERSION
PROTHDR.iProtModifier	0
PROTHDR.usProtLinkID	0
PROTHDR.usProtCircuitID	0
PROTHDR.usProtSessionID	Session ID matches same field in DLI_X25_ICP_SESSION_OPENED packet
PROTHDR.usProtSequence	0
PROTHDR.usProtXParms[0]	0
PROTHDR.usProtXParms[1]	0

The data area contains ASCII text identifying the software loaded, its version number, and its date of release.

6.4 Quality of Service (qos) Parameter Formats

This section describes the format of the call service facilities specified by placing quality of service (qos) parameters in the data area of various virtual circuit call establishment packets. Most of the items have three subfields: an identification code, a size (which might be variable), and data; however, some items have two subfields, and a few have only one. Table 6–10 shows the qos parameters listed by code showing their qos symbol and a brief description of their purpose. Table 6–11 shows the qos parameters listed alphabetically showing the packet types that support them and whether the qos parameters are specified by the client or returned by the ICP.

The following list describes each qos parameter and its applicable subfields.

Bilateral Closed User Group Selection Facility (32)

This facility requires network support for closed user group facilities.

Code: HF_BLCLUS (32)

Size: Field length in bytes (4)

Data: Four-digit group number (string of decimal digits 0 through 9)

Cause Code Facility (14)

This facility identifies the reason for the associated event or action.

Code: HF_CAUSE (14)

Data: Cause code byte (must be zero, or 128 through 255 when specified by the client)

Table 6–10: qos Parameters by Code Number

qos Symbol	Code	Description
HF_CLLNG	1	Calling DTE address
HF_CLLED	2	Called DTE address
HF_FASNR	4	Fast select facility — no restriction
HF_FASR	5	Fast select facility — restriction on response
HF_RVFC	7	Reverse charging facility
HF_USER	10	User data
HF_CAUSE	14	Cause
HF_DIAG	15	Diagnostic
HF_NONSTD	24	Non-standard user facilities
HF_THRUCLASS	26	Throughput class
HF_PRIORITY	27	Virtual circuit priority on Freeway
HF_PWSIZE	28	Packet window size facility
HF_PDSIZE	29	Packet data size facility
HF_CLUSG	30	Closed user group selection facility
HF_CLUSGOAS	31	CUG with outgoing access selection facility
HF_BLCLUS	32	Bilateral closed user group facility
HF_NWUSID	33	Network user identification facility
HF_RQCRGIN	34	Request charging information facility
HF_RCVMONY	35	Receive charging monetary unit facility
HF_RCVSGCNT	36	Receive charging segment count facility
HF_RCVCLDR	37	Receive charging call duration facility
HF_RPOA	38	RPOA selection facility
HF_CLDADMOD	39	Called line address modified notification facility
HF_CLREDR	40	Call redirection or deflection notification facility
HF_TRDLYSEL	41	Transit delay selection and indication facility
HF_D_BIT_SUPPORT	46	D-bit support request and indication
HF_CLDEFLECT	48	Call deflection selection facility
HF_ICF_PRIORITY	64	ICF priority
HF_DTE_REMOTE	65	ICF remote (calling) DTE address
HF_DTE_SA_LOW	66	ICF local (called) DTE subaddress (low)
HF_DTE_SA_HIGH	67	ICF local (called) DTE subaddress (high)
HF_USER_MASK	68	ICF user data mask
HF_ICF_CALLBUSY	69	ICF call busy configuration

Table 6–11: qos Support in Packets

qos Symbol	Code	DLI_X25_HOST_ CALL_REQ	DLI_X25_HOST_ CALL_ACCEPTED	DLI_X25_HOST_ CLR_REQ	DLI_X25_HOST_ ADD_INCALL_FILTER	DLI_X25_HOST_ RESET_REQ	DLI_X25_ICP_ AUTO_CONNECT	DLI_X25_ICP_ INCOMING_CALL	DLI_X25_ICP_ CALL_ACCEPTED	DLI_X25_ICP_ CLR_INDICATION	DLI_X25_ICP_ RESET_INDICATION	DLI_X25_ICP_ CLR_CONFIRMED
HF_BLCLUS	32	Q					R	R				
HF_CAUSE	14			Q		Q				R	R	
HF_CLDADMOD	39		Q	Q					R	R		
HF_CLDEFLECT	48			Q								
HF_CLLED	2	Q	Q	Q			R	R	R	R		
HF_CLLNG	1	Q	Q	Q			R	R	R	R		
HF_CLREDR	40						R	R				
HF_CLUSG	30	Q					R	R				
HF_CLUSGOAS	31	Q					R	R				
HF_DIAG	15			Q		Q				R	R	
HF_DTE_REMOTE	65				Q							
HF_DTE_SA_HIGH	67				Q							
HF_DTE_SA_LOW	66				Q							
HF_D_BIT_SUPPORT	46	Q	Q				R	R	R			
HF_FASNR	4	Q					R	R				
HF_FASR	5	Q					R	R				
HF_ICF_CALLBUSY	69				Q							
HF_ICF_PRIORITY	64				Q							
HF_NONSTD	24	Q	Q	Q			R	R	R	R		

Called Line Address Modified Notification Facility (39)

This facility reports that the HF_CLLED facility value differs from that specified in the original call request issued by the calling DTE identified by the HF_CLLNG facility.

Code: HF_CLDADMOD (39)

Data: Reason code byte

Call Deflection Selection Facility (48)

This facility is used when refusing an incoming call to specify an alternate DTE address to which the call is to be deflected. The DTE must also include any CCITT-specified DTE facilities and user data to be sent to the alternate DTE.

Code: HF_CLDEFLECT (48)

Size: Field length in bytes

Data: Reason code byte (192 through 255) followed by alternate called DTE address (string of ASCII digits 0 through 9)

Called DTE Address (2)

This is the network address of the destination DTE to which the SVC connection is directed.

Code: HF_CLLED (2)

Size: Called DTE address length in bytes (0 through 15, or 3 through 17 for TOA/NPI)

Data: Called DTE address (string of ASCII digits 0 through 9); if TOA/NPI format is used, the TOA and NPI digits must precede the DTE address

Calling DTE Address (1)

This is the network address of the DTE requesting the SVC connection.

Code: HF_CLLNG (1)

Size: Calling DTE address length in bytes (0 through 15, or 3 through 17 for TOA/NPI)

Data: Calling DTE address (string of ASCII digits 0 through 9); if TOA/NPI format is used, the TOA and NPI digits must precede the DTE address

Call Redirection or Call Deflection Notification Facility (40)

This facility informs the client that the call has been redirected by the network (or deflected by the called DTE), the reason for the redirection (or deflection), and the address of the originally called DTE.

Code: HF_CLREDR (40)

Size: Field length in bytes

Data: Reason code byte (1 = busy, 7 = call distribution within a hunt group, 9 = out-of-order, 15 = systematic, 192 through 255 = deflection by originally called DTE) followed by originally called DTE address (string of ASCII digits 0 through 9)

Closed User Group Selection Facility (30)

This facility requires network support for closed user group facilities. The HF_CLUSG and HF_CLUSGOAS facilities cannot both appear in the same list of qos parameters.

Code: HF_CLUSG (30)

Size: Field length in bytes (2 or 4)

Data: Two-digit or four-digit group number (string of decimal digits 0 through 9)

Closed User Group with Outgoing Access Selection Facility (31)

This facility requires network support for closed user group facilities. The HF_CLUSG and HF_CLUSGOAS facilities cannot both appear in the same list of qos parameters.

Code: HF_CLUSGOAS (31)

Size: Field length in bytes (2 or 4)

Data: Two-digit or four-digit group number (string of decimal digits 0 through 9)

Diagnostic Code Facility (15)

This facility provides an additional diagnosis of the reason for the associated event or action. A list of diagnostic codes appears in Appendix A.

Code: HF_DIAG (15)

Data: Diagnostic code byte

Remote DTE Address (65)

This is the portion of the main DTE address that must match the actual calling DTE address in incoming calls. If the DTE address length for the X.25 network has not previously been configured on Freeway, this parameter can be rejected.

Code: HF_DTE_REMOTE (65)

Size: Field length in bytes (1 through 15, or 3 through 17 for TOA/NPI)

Data: Remote DTE address (string of ASCII digits 0 through 9); if TOA/NPI format is used, the TOA and NPI digits must precede the DTE address

Highest Local DTE Subaddress (67)

This is the highest acceptable called DTE subaddress in incoming calls. The DTE subaddress immediately follows the main DTE address, whose length (HF_ADDR_LEN[15]) has previously been configured.

Code: HF_DTE_SA_HIGH (67)

Size: Field length in bytes (1 through 15 (17 for TOA/NPI) minus the configured DTE_address_length)

Data: Highest local DTE subaddress (string of ASCII digits 0 through 9)

Lowest Local DTE Subaddress (66)

This is the lowest acceptable called DTE subaddress in incoming calls. The DTE subaddress immediately follows the main DTE address, whose length (HF_ADDR_LEN) has previously been configured.

Code: HF_DTE_SA_LOW (66)

Size: Field length in bytes (1 through 15 (17 for TOA/NPI) minus the configured DTE_address_length)

Data: Lowest local DTE subaddress (string of ASCII digits 0 through 9)

D-bit Support Request/Indication Facility (46)

This is the D-bit support request/indication facility.

Code: HF_D_BIT_SUPPORT (46)

Data: Single byte value (0 = D-bit not supported; 1 = D-bit supported)

Fast Select Facility (Unrestricted) (4)

This facility allows the called DTE to accept the call.

Code: HF_FASNR (4)

Fast Select Facility (Restricted) (5)

This facility prevents the called DTE from accepting the call.

Code: HF_FASR (5)

15. The HF_ADDR_LEN must be set when configuring Freeway X.25 call service parameters for data links. See Section 6.2.10 on page 151 for more information.

Incoming Call Filter Call Busy Configuration (69)

The incoming call filter call busy configuration parameter is internal to Freeway. The default configuration is to hold additional calls when an existing call is already associated with the incoming call filter. This parameter may be used to request call redirection rather than call holding.

Code: HF_ICF_CALLBUSY (69)

Size: Field size in bytes (1)

Data: 0 = hold additional calls when call busy
1 = redirect additional calls when call busy

Incoming Call Filter Priority Level (64)

The incoming call filter priority level is internal to Freeway. The ICF priority is independent of the virtual circuit local priority HF_PRIORITY that can be set when the client accepts a call or resets a virtual circuit.

Code: HF_ICF_PRIORITY (64)

Size: Field size in bytes (1)

Data: Value zero through 255, where zero is the lowest ICF priority

Non-standard User Facility (24)

This is the non-standard user facility.

Code: HF_NONSTD (24)

Size: Field size in bytes

Data: Non-standard facilities marker code byte 0, followed by parameter byte (–1, 0, or 15), and actual non-standard facilities (binary)

Network User Identification Facility (33)

Not all networks support the use of this facility.

Code: HF_NWUSID (33)

Size: Field size in bytes

Data: Network user identification

Packet Data Size Facility (29)

This facility is used to negotiate the allowed size of the data field within X.25 data packets exchanged between the local and remote DTE. It does not apply to the size of data transfers requested by the client using cs_read and cs_write requests.

Code: HF_PDSIZE (29)

Data: Two packet data size selection bytes (for local and remote DTE); selection codes 4 through 12 indicate the power-of-two data sizes 16 through 4096

Virtual Circuit Local Priority Facility

This is a Freeway facility. It selects the degree to which Freeway is to favor transmitting data sent using this virtual circuit. When Freeway has data ready to send on more than one virtual circuit, it sends data first on the virtual circuit with the higher local priority. This facility does not affect the handling of received data, which is always on a first-come, first-served basis.

Code: HF_PRIORITY (27)

Data: Priority code byte (0 = low; 1 = normal; 2 = high)

Packet Window Size Facility (28)

This facility is used to negotiate the allowed size of the packet transmit window for the local and remote DTE.

Code: HF_PWSIZE (28)

Data: Two packet window size selection bytes (for local and remote DTE). Packet windows are 1 through 7, or extended, 1 through 127. The extended packet window is allowed only if Freeway is configured to support extended packet sequence numbers.

Receiving Charging Call Duration Facility (37)

This facility can be reported by the network DCE to the DTE for accounting purposes.

Code: `HF_RCVCLDR` (37)

Size: Field size in bytes (multiple of 4)

Data: List of tariff periods (string of ASCII digits 0 through 9), each expressed as a four-digit code giving the number of days, hours, minutes, and seconds for the period

Receiving Charging Monetary Unit Facility (35)

This facility can be reported by the network DCE to the DTE for accounting purposes.

Code: `HF_RCVMONY` (35)

Size: Field size in bytes

Data: List of monetary unit octets (binary)

Receiving Charging Segment Count Facility (36)

This facility can be reported by the network DCE to the DTE for accounting purposes.

Code: `HF_RCVSGCNT` (36)

Size: Field size in bytes (multiple of 8)

Data: List of segment count information sets. Each information set contains a DCE segment count binary longword and a DTE segment count binary longword for a specific tariff period. Information for multiple tariff periods is sequentially listed.

RPOA Selection Facility (38)

This is the RPOA selection facility.

Code: `HF_RPOA` (38)

Size: Field size in bytes (multiple of 4)

Data: List of four-digit RPOA transit points (string of decimal digits 0 through 9)

Request Charging Information Facility (34)

This facility requests the network DCE to provide charging information facilities (HF_RCVCLDR, HF_RCVMONY, or HF_RCVSGCNT) when the virtual circuit is terminated.

Code: HF_RQCRGIN (34)

Reverse Charging Facility (7)

This facility requests the network to reverse the charges for the call by charging the called DTE.

Code: HF_RVFC (7)

Throughput Class Facility (26)

This facility is used to negotiate the throughput class for data transferred using this virtual circuit through the network. The throughput class negotiated for the local DTE can differ from that negotiated for the remote DTE. The throughput class does not apply to the actual data rate at the interface between the network DTE and the attached local or remote DTE. Instead, the throughput class applies to the propagation rate through the network.

Code: HF_THRUCLASS (26)

Data: Two throughput class selection bytes (for local and remote DTE). Selection codes 3 through 12 indicate throughput classes 75, 150, 300, 600, 1200, 2400, 4800, 9600, 19200, and 48000, respectively. For CCITT 1988, a selection code of 13 indicates throughput class 64000.

Transit Delay Selection and Indication Facility (41)

This facility gives the nominal maximum network transit delay applicable to data transferred through the network.

Code: HF_TRDLYSEL (41)

Size: Field size in bytes (2)

Data: Transit delay in milliseconds (16-bit binary)

User Data Facility (10)

This facility is used to pass user data associated with SVC connection and termination.

Code: HF_USER (10)

Size: Field size in bytes (1 through 16 normally, or fast select, 1 through 128)

Data: User data (binary)

User Data Mask for Incoming Call Filter (68)

This specifies a binary mask of bits to be logically ANDed with the actual HF_USER facility data in the incoming call and the HF_USER facility data in a registered incoming call filter before comparing the HF_USER facilities data fields.

Code: HF_USER_MASK (68)

Size: Field size in bytes (1 through 16)

Data: User data mask (binary)

Appendix

A X.25 Diagnostic Codes

Table A–1 shows the meanings of various X.25 diagnostic codes associated with the quality of service parameter HF_DIAG. Not all diagnostic codes need apply to a specific network, but those used are as coded in the table. A given diagnostic need not apply to all packet types (that is, reset indication, clear indication, restart indication, registration confirmation, and diagnostics packets).

The first diagnostic in each group is a generic diagnostic and can be used in place of the more specific diagnostics within the grouping. The decimal 0 diagnostic code can be used in situations where no additional information is available.

Table A–1: X.25 Diagnostic Codes for qos Parameter HF_DIAG

Diagnostic Description	Decimal Value	Hexadecimal Value
No additional information	0	0
Invalid P(S)	1	1
Invalid P(R)	2	2
Not defined	3–15	3–F
Packet type invalid	16	10
For state r1	17	11
For state r2	18	12
For state r3	19	13
For state p1	20	14
For state p2	21	15
For state p3	22	16
For state p4	23	17
For state p5	24	18
For state p6	25	19
For state p7	26	1A
For state d1	27	1B
For state d2	28	1C
For state d3	29	1D
Not defined	30–31	1E–1F
Packet not allowed	32	20
Unidentifiable packet	33	21
Call on one-way logical channel	34	22
Invalid packet type on a permanent virtual circuit	35	23
Packet on assigned logical channel	36	24
Reject not subscribed to	37	25
Packet too short	38	26
Packet too long	39	27
Invalid general format identifier	40	28

Table A–1: X.25 Diagnostic Codes for qos Parameter HF_DIAG *(Cont'd)*

Diagnostic Description	Decimal Value	Hexadecimal Value
Restart or registration packet with nonzero in bits 1 to 4 of octet 1, or bits 1 to 8 of octet 2	41	29
Packet type not compatible with facility	42	2A
Unauthorized interrupt confirmation	43	2B
Unauthorized interrupt	44	2C
Unauthorized reject	45	2D
Not defined	46–47	2E–2F
Time expired	48	30
For incoming call	49	31
For clear indication	50	32
For reset indication	51	33
For restart indication	52	34
Not defined	53–63	35–3F
Call set up, call clearing, or registration problem	64	40
Facility/registration code not allowed	65	41
Facility parameter not allowed	66	42
Invalid called address	67	43
Invalid calling address	68	44
Invalid facility/registration length	69	45
Incoming calls barred	70	46
No logical channel available	71	47
Call collision	72	48
Duplicate facility requested	73	49
Nonzero address length	74	4A
Nonzero facility length	75	4B
Facility not provided when expected	76	4C
Invalid CCITT-specified DTE facility	77	4D
Not defined	78–79	4E–4F
Miscellaneous	80	50

Table A–1: X.25 Diagnostic Codes for qos Parameter HF_DIAG *(Cont'd)*

Diagnostic Description	Decimal Value	Hexadecimal Value
Improper cause code from DTE	81	51
Not aligned octet	82	52
Inconsistent Q-bit setting	83	53
Not defined	84–95	54–5F
Not assigned	96–111	60–6F
International problem	112	70
Remote network problem	113	71
International protocol problem	114	72
International link out of order	115	73
International link busy	116	74
Transit network facility problem	117	75
Remote network facility problem	118	76
International routing problem	119	77
Temporary routing problem	120	78
Unknown called DNIC	121	79
Maintenance action[a]	122	7A
Not defined	123–127	7B–7F
Reserved for network-specific diagnostic information	128–255	80–FF

[a] This diagnostic may also apply to a maintenance action within a national network.

Appendix B X25ERR.H Source Code

```
*****************************************************************************
*
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*
*****************************************************************************
*****************************************************************************/
/*
*
* MODULE NAME:
*
*       X25ERR.H
*
* MODULE DESCRIPTION:
*
*       Contains "define" statements for X.25 IREJECT packet error item
*       codes and error reason codes.  The first four characters in the data
*       area of "verbose" format IREJECT packets from the CNS (or ICP) to the
*       client (or host) contain a hexadecimal representation of these two
*       8-bit fields; the fifth character is a blank.  The first two
*       hexadecimal characters give the X.25 error item code, and the
*       last two characters give the error reason code.
*
* MODULE TYPE:
*
*       "C" include file
*
* MODULE UPDATE HISTORY:
*
*       2.1.2  10/06/92 Created.
*
```

```
*       2.1.4  02/24/93 Added X25ERR_IO_ERR for CNS6200.
*
*       3.0.5  08/02/94 Cleaned up for publication.
*
******************************************************************************/
#ifndef X25ERR_H
#define X25ERR_H

/*
*       X.25 ERROR ITEM CODE DEFINITIONS
*/
#define X25ERR_ARGUMENT        0x01 /* argument or modifier        */
#define X25ERR_BLCUG           0x02 /* bilateral closed user group */
#define X25ERR_CALLED_DTE      0x03 /* called DTE address          */
#define X25ERR_CALL_DEFLECTION 0x04 /* call deflection selection   */
#define X25ERR_CHGINFO         0x05 /* charging information        */
#define X25ERR_CLA_MODIFIED    0x06 /* called line adr modified notification */
#define X25ERR_COMBUF          0x07 /* communications buffer pages */
#define X25ERR_CUG             0x08 /* closed user group (CUG)     */
#define X25ERR_CUGOAS          0x09 /* CUG with outgoing access selection */
#define X25ERR_DATA_SIZE       0x0a /* data size                   */
#define X25ERR_D_BIT_MOD       0x0b /* D-bit modification          */
#define X25ERR_DDN             0x0c /* DDN service selection       */
#define X25ERR_DC              0x0d /* CCITT diagnostic code       */
#define X25ERR_EXTENDED        0x0e /* extended sequence numbers   */
#define X25ERR_FCL_LEN         0x0f /* facility length             */
#define X25ERR_LEN             0x10 /* length                      */
#define X25ERR_LINK            0x11 /* link                        */
#define X25ERR_MAXLSN          0x12 /* maximum virtual circuits    */
#define X25ERR_MODEM           0x13 /* modem signal selection      */
#define X25ERR_ON_OFF          0x14 /* ON/OFF switch selection     */
#define X25ERR_PARAM           0x15 /* parameter                   */
#define X25ERR_PKT             0x16 /* Host packet                 */
#define X25ERR_RATE            0x17 /* bits/second data rate       */
#define X25ERR_REJ             0x18 /* packet retransmission       */
#define X25ERR_REVCHG          0x19 /* reverse charging            */
#ifdef SERVER
#define X25ERR_SAP             0x1a /* service access point        */
#endif
#define X25ERR_SEGBUF          0x1b /* segmentation buffer pages   */
#ifdef SERVER
#define X25ERR_SESSION         0x1c /* session                     */
#endif
#define X25ERR_STATION         0x1d /* station                     */
#define X25ERR_TENTHS          0x1e /* tenths                      */
#define X25ERR_VAL             0x1f /* value                       */


/*
* X.25 ERROR REASON CODE DEFINITIONS
*/
#ifdef SERVER
#define X25ERR_ACTIVE          0x80 /* circuit active              */
#endif
#define X25ERR_BARRED          0x81 /* barred                      */
```

```
#define X25ERR_CONFLICT        0x82 /* configuration conflict      */
#define X25ERR_DENIED          0x83 /* service access denied       */
#define X25ERR_DEPLETED        0x84 /* resource depleted           */
#define X25ERR_DOESNT_MATCH    0x85 /* doesn't match parameter list*/
#define X25ERR_DUPLICATE       0x86 /* duplicate specification     */
#define X25ERR_ENABLED         0x87 /* data link enabled           */
#define X25ERR_EXCEEDS         0x88 /* exceeds                     */
#define X25ERR_FCL_CONFLICT    0x89 /* facility conflict           */
#define X25ERR_FCL_MISSING     0x8a /* facility missing            */
#define X25ERR_FS_RESTRICTED   0x8b /* facility restricted         */
#define X25ERR_LESS_THAN       0x8c /* less than                   */
#define X25ERR_MISSING         0x8d /* missing                     */
#define X25ERR_NEQ             0x8e /* not equal to                */
#define X25ERR_NO_MLP          0x8f /* no MLP configured           */
#define X25ERR_NON_ZERO        0x90 /* non-zero                    */
#define X25ERR_NOT_AVAILABLE   0x91 /* registered facility not available */
#define X25ERR_NOT_ENABLED     0x92 /* registered facility not enabled   */
#ifdef SERVER
#define X25ERR_NOT_PVC         0x93 /* not a PVC                   */
#define X25ERR_NOT_SVC         0x94 /* not a SVC                   */
#endif
#define X25ERR_OFFLINE         0x95 /* data link offline           */
#define X25ERR_ONLINE          0x96 /* data link online            */
#define X25ERR_ORDER           0x97 /* out of order                */
#define X25ERR_OVERFLOW        0x98 /* data size overflow          */
#define X25ERR_RANGE           0x99 /* not in range                */
#define X25ERR_REGISTERED      0x9a /* facility registered         */
#define X25ERR_STATE           0x9b /* wrong state                 */
#define X25ERR_UNKNOWN         0x9c /* unknown                     */
#define X25ERR_USERS           0x9d /* user session open           */
#define X25ERR_X25_PROFILE     0x9e /* incompatible with X.25 profile */
#define X25ERR_ZERO            0x9f /* zero                        */
#ifdef CNS6200
#define X25ERR_IO_ERR          0xa0 /* CNS6200 I/O error           */
#endif
#endif /* X25ERR_H */
```

Glossary

API	application program interface
b/s	bits per second
CCITT	Consultative Committee of International Telephone and Telegraph
CTS	clear to send
CUG/OA	closed user group with outgoing access
D-bit	delivery bit, used in X.25 packets
DCD	data carrier detect
DCE	data circuit-terminating equipment
DISC	disconnect, an HDLC frame type
DLI	data link interface
DM	disconnected mode, an HDLC frame type
DNIC	data network identification code
DTE	data terminal equipment
FCS	frame check sequence
GFI	general format indicator
FRMR	frame reject, an HDLC frame type
HDLC	high-level data link control

HIC	highest incoming channel
HOC	highest outgoing channel
HTC	highest two-way channel
ICP	intelligent communications processor
I-frame	information frame, an HDLC frame type
ISO	International Standards Organization
LAPB	link access procedure balanced, a specific type of HDLC
LCGN	logical channel group number
LCN	logical channel number
LIC	lowest incoming channel
LOC	lowest outgoing channel
LTC	lowest two-way channel
M-bit	more-data bit, specified using the CS_DF_X25MORE flag in the API cs_write request
MLP	multilink procedure; uses multiple SLPs
MW	multilink window size
MX	receive MLP window guard region
NTN	national terminal number
OSI	open systems interconnect
PDN	public data network
PVC	permanent virtual circuit
QOS	quality of service
REJ	reject, an HDLC frame or X.25 packet type

RNR	receiver not ready, an HDLC frame or X.25 packet type
RPOA	recognized private operating agency
RR	receive ready, an HDLC frame or X.25 packet type
SABM	set asynchronous balanced mode, an HDLC frame type
SAP	service access point
SLP	single link procedure, an HDLC LAPB data link
SRA	server resident application
SVC	switched virtual circuit
TOA/NPI	type-of-address/numbering-plan identifier
TSI	transport subsystem interface
X.25	a packet-switching communications protocol

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Customer Report Form

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