Chapter 12

X.25

Introduction

This chapter describes the main features of X.25 Packet Switched Networks, support for X.25 on the router, and how to configure and operate the router to provide, or connect to, an X.25 Packet Switched Network.

This feature is available on routers with PIC bays.

CCITT Recommendation X.25 specifies the connection between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals attached to a public data network. The term *X.25* usually refers to Recommendation X.25 plus a number of related CCITT recommendations and other standards produced by organisations such as the Defence Data Network (DDN) and International Standards Organisation (ISO). Since Recommendation X.25 was first produced in 1976, the standard has been adapted for more uses than its original purpose, which was connecting to a public packet switched network.

The general principle of X.25 is that many connections are made over a single physical link. The single link into the data network is maintained at the *data link layer*, while the separate *packet layer* maintains the connections or circuits from one DTE to other DTEs attached to the network. The data link layer is maintained between a DTE and its connected DCE, while packet layer circuits are maintained between pairs of DTEs.

Two main types of circuits exist, *permanent virtual circuits* and *switched virtual circuits*. The permanent circuits are set up by configuration in the DTEs at either end of the circuit and in the X.25 network. When a DTE starts running, it can send data on a permanent circuit straight away. In contrast, switched circuits are not set up when the DTE starts running. Instead a DTE must make a call through the X.25 network to set up the call. A special *call request* packet is sent to the network, containing the DTE address of the DTE being called. DTE addresses are set up by the network administration and uniquely identify DTEs. The DTE being called must accept the call before data transmission can begin. The call may be refused for a number of reasons. Once the call is in progress, data can be exchanged on the switched circuit. Either end of the circuit may terminate the call.

The DTE is the end user equipment that uses the X.25 network. Two common types of DTE are computers and PADs. The term *PAD* means literally *packet assembly/disassembly* but in this context means a terminal server that runs over X.25. A typical PAD has a number of asynchronous ports for supporting terminals and a synchronous port for connecting to the X.25 network. Users of terminals connected to the PAD can call up a remote DTE through the X.25 network.

Computers use X.25 in a number of different ways. Software on the computer can act as a *virtual PAD*, allowing users logging in to the computer to call a remote DTE through the X.25 network. Different software on the computer can use X.25 circuits to set up network connections to other computers for mail and general transfer of data. In all cases the general principle is the same, that of two DTEs making a packet layer connection via the X.25 network.

For more information about the X.25 recommendation and how computers and PADs use X.25, see CCITT recommendations X.25, X.21 and X.121, and ISO 8208.

The router supports X.25 as both a DCE and a DTE. An interface on the router can be configured as either a DCE or a DTE. Commands relating to DCE mode operations have the form:

```
verb X25C parameter...
```

whereas commands relating to DTE mode operations have the forms:

```
verb X25T parameter...
```

LAPB

Before either a DCE or DTE interface can be configured to run over a synchronous port, an LAPB interface must be configured to provide the data link layer protocol.

The link layer defines the logical interface between an X.25 DTE and an X.25 DCE. It consists of procedures for controlling the flow of information over the access link. The link level provides a robust error-free connection for transmitting packets between two interconnected packet-mode DTEs.

LAPB (*Link Access Procedure Balanced*) was incorporated into the X.25 recommendation in 1977. It uses the balanced mode of HDLC, and therefore more effectively handles link reset conditions than the previously used link access procedure (LAP). LAPB is the link level protocol supported by the router. It is a bit-oriented protocol that uses information, supervisory and unnumbered frames.

Features of the router's implementation of the LAPB protocol include:

- Link layer modulus of 8 or 128.
- Link Layer window size of 1 to 7 for modulo 8 and 1 to 127 for modulo 128.
- Support of acknowledge timer T1 and idle timer T3.
- Packet size of 128 to 4099 bytes.
- Adjustable retransmission counter.

DCE Mode

A network of routers can be configured as DCEs to act as an X.25 network, providing a packet switched X.25-based network for DTEs. This network runs over the same wide area links as other protocols carried by the router.

The router supports switched virtual circuits over the network. Permanent virtual circuits are not supported. Any synchronous interface on a router can be set up to carry X.25 traffic. Having set up an X.25 DCE interface, an X.25 DTE can be linked to the router, and it may then make X.25 calls via the router.

Each X.25 switched virtual circuit is carried over a TCP connection within the network (see Chapter 14, Internet Protocol (IP) for more information about TCP connections). When a call is made, the DTE address being called is examined by the router and a TCP connection is made to the remote router that is the DCE for the given address. Once this connection has been made, the X.25 packets from either end of the connection are carried over the TCP link.

Features of the router's implementation of an X.25 DCE include:

- A packet layer modulus of 8 is the only modulus supported.
- The D bit is ignored but carried through. However, data packets are acknowledged on an end-to-end basis, that is, as if the D bit was always set.
- Packets with the GFI bit (Qbit, Dbit, Mbit) in the X.25 header set to 1 are passed through.
- Once the X.25 packet link is established, IT and IF packets are passed through.
- The packet size can be negotiated between 128 and 4096 bytes, and the default packet size can be configured.
- The packet layer window size can be negotiated, and the default packet layer window size can be configured.
- The through-put class can be negotiated, and the default through-put class can be configured.
- Logical channel group numbers and logical channel numbers are configured for incoming, outgoing and two-way calls.
- Using the TCP Keepalive feature, the router can monitor the connectivity of the TCP connection even when there is no traffic being sent on the connection.

DTE Mode

The router can be configured to act as a DTE and be attached to an X.25 Packet Switched Network. This allows the routing of information and other protocols through the X.25 network to other routers or DTEs.

The DTE packet layer defines procedures for handling virtual calls over an X.25 network. It provides services to attached modules and specifies the manner in which calls are established, maintained and cleared. When a virtual call is established, a virtual circuit (or call) is set up between the calling and called DTEs. By using a packet-interleaved multiplexing scheme, a single physical circuit can support communications to numerous X.25 DTEs simultaneously. The virtual call is identified at the local DTE–DCE interface by a logical channel number. Each X.25 interface can theoretically support up to 4095 virtual calls.

In order to support multiple virtual circuits over a single data link a unique logical channel number (LCN) is assigned to each virtual call. The significance of LCNs is local between the network components at both ends of the logical data link.

The maximum number of virtual circuits dictates the number of simultaneous sessions that can be supported over a single X.25 data link. Logical channels ranges can be allocated in four categories:

- Permanent virtual circuits.
- Switched virtual circuits for incoming calls only.
- Switched virtual circuits for outgoing calls only.
- Switched virtual circuits for two-way calls only.

A switched virtual circuit (SVC) is required for each virtual call. A virtual call is set up dynamically when one DTE attached to the X.25 network needs to communicate with another DTE. Networks can differentiate between the various types of circuits by the appropriate allocation of logical channel number sequences. When a user places a call either the highest or lowest numbered free channel in the appropriate channel range is selected for the call. If the DTE is connected to a DCE then the highest channel in the particular SVC range is selected. If the interface is in a DTE-to-DTE situation, role negotiation during the restart procedure determines which DTE emulates a DCE, and it selects channels from the lowest free channel in the particular SVC range.

A permanent virtual circuit (PVC) is essentially a pre-configured permanent logical connection between two end points of a network. It can be likened to a point-to-point leased line. PVCs do not require any connection or disconnection procedures and data can be sent on PVCs as soon as the X.25 link is active.

The router supports both permanent and switched virtual circuits. X.25 can be configured over synchronous interfaces using LAPB, or over ISDN using LAPD. Having set up an X.25 DTE interface, the router can be linked to the X.25 network, and it may then make X.25 calls to other routers or DTE equipment.

When the X.25 DTE interface is operational, IP can be initialised to run over the X.25 network (see Chapter 14, Internet Protocol (IP) for further information about configuring IP to run over X.25).

Features of the router's implementation of an X.25 DTE include:

- Packet layer modulus of 8 or 128.
- Packet layer window size of 1 to 7 for modulo 8 and 1 to 127 for modulo 128.
- Variable packet size supporting data packets from 128 to 1024 bytes.
- Role determination for DTE-to-DTE connections.
- There is currently no support for call facilities.
- Ability to transport IP over X.25.

DTE Addresses

The syntax of DTE addresses is covered in Recommendation X.25. A related standard, Recommendation X.121, specifies a numbering plan for public data networks that follows the format outlined in X.25. To access a DTE on a public data network, an address conforming to X.121 must be used. However, if a private X.25 network is being run over a network of routers, any DTE addresses may be used.

A DTE address consists of 1 to 15 decimal digits. On the router any X.25 interface can be set up to respond to any DTE address. A single interface can be set up to respond to a number of different DTE addresses. Wildcards may also be used in the DTE address to further expand the addresses to which an interface responds. This facility has been provided for two reasons:

- Some PADs respond to a range of DTE addresses, for example in accessing particular ports on the PAD.
- The router may be attached to an X.25 gateway, which may, for example, be providing access to a public X.25 network.

An example of DTE wildcard addressing is an interface set up to respond to DTE addresses 12345, 12346 and 2345X. The last address contains the wildcard character 'X'. The interface with these addresses responds to calls to any of these addresses, with the wildcard address mapping all addresses from 23450 to 23459.

X.25 DCE Route Mapping

To enable X.25 DCE calls to be made via TCP a routing table must be set up. This table provides mappings from X.25 DTE addresses to IP addresses. The IP address for a given X.25 DTE address is the address of the router that is attached to the DTE being called. The table is set up with the command:

```
ADD X25C ROUTE
```

A route can be inspected with the command:

```
SHOW X25C ROUTE
```

And it can be removed with the command:

```
DELETE X25C ROUTE
```

Only one X.25 route mapping table exists for each router, and it applies to all X.25 DCE interfaces receiving call requests on that router.

When an X.25 DCE interface receives a call request from the attached DTE, the router first searches through its own DTE address table. This table contains the DTE addresses for all X.25 interfaces on the local router. If a match is found in the local DTE address table, the call is routed to the relevant interface on the local router. If the called address does not match any of the local router's DTE addresses, the X.25 route table is searched sequentially. If a match is found the call is routed to the remote router via TCP and the IP address found in the route mapping table. If a match is not found an error indication is returned to the calling DTE.

Each entry in the X.25 route mapping table consists of an X.25 DTE address and an IP address. The DTE address may have wildcard digits, to allow a range of DTE addresses to be mapped to the same IP address. The IP address in the table is the address of the router that takes the X.25 call. The DTE addresses in the table do not have to be unique. Wildcard patterns may be present in the table that would match other explicit DTE addresses in the table. However, since the table is searched sequentially and the first match is taken as fulfilling the search, more general patterns for DTE addresses should appear later in the table for the route mapping to work. See the description of the **show x25c route** command on page 12-87 for an example.

Encapsulations

The MIOX (*Multiprotocol Interconnect on X.25*) encapsulation scheme defined in RFC 1356, *Multiprotocol Interconnect on X.25 and ISDN in the Packet Mode*, specifies the encapsulation of IP and other network layer protocols over X.25 networks in accordance with ISO/IEC and CCITT standards.

Virtual circuits are opened on demand when datagrams arrive at the network interface for transmission, and are closed after a specified period of activity or when the interface runs out of virtual circuits. When an attempt is made to open a virtual circuit, the first octet of the Call User Data field of the Call Request packet is a Network Layer Protocol Identifier (NLPID) used to specify the protocol encapsulation to be used on the virtual circuit (Table 12-1 on page 12-8).

Table 12-1: NLPID values for protocol encapsulation over X.25 circuits

NLPID (hexadecimal)	Protocol Encapsulation
CC	Internet Protocol (IP)
CF	Point-to-Point Protocol (PPP)
81	CLNP
82	ES-IS
80	SNAP (Subnetwork Address Protocol)
00	Null encapsulation

If the SNAP encapsulation is used, the five octets following the NLPID in the Call User Data field contain the SNAP header for the network layer protocol. (For IPX the following five octets are: 00 00 00 81 37. For AppleTalk the following five octets are: 00 00 00 80 9B.) Only a single protocol may be carried over a virtual circuit using the IP, CLNP, ES-IS or SNAP encodings. Multiple virtual circuits must be established to transport multiple protocols over the same X.25 connection. Once the circuit has been established, the data field of X.25 data packets contains only Protocol Data Units (PDUs) for the specified network layer protocol.

The Null encapsulation may be used to multiplex multiple network layer protocols over a single virtual circuit. The NLPID in the Call User Data field contains the null value, and the first octet of the data field of each X.25 data packet contains the NLPID followed by the PDU for the specified network layer protocol.

Only the IP, IPX and NULL encapsulations are supported on PVC.

The same encapsulation must be specified on the routers at each end of the circuit. If different encapsulations are used, the routers cannot communicate with one another over the MIOX circuit.

A MIOX circuit is created with the command:

```
ADD MIOX=x25t-interface CIRCUIT=circuit-name
    ENCAP=encapsulation
```

and deleted with the command:

```
DELETE MIOX=x25t-interface CIRCUIT=circuit-name
```

A MIOX circuit can be explicitly activated and deactivated to test the configuration of the circuit without generating protocol traffic, using the commands:

```
ACTIVATE MIOX=x25t-interface CIRCUIT=circuit-name
DEACTIVATE MIOX=x25t-interface CIRCUIT=circuit-name
```

A MIOX circuit may be temporarily disabled or enabled, without losing the configuration, using the commands:

```
DISABLE MIOX=x25t-interface CIRCUIT=circuit-name
ENABLE MIOX=x25t-interface CIRCUIT=circuit-name
```

Parameters that affect the operation of the MIOX module and individual MIOX circuits may be changed after the MIOX circuits have been created, using the commands:

```
SET MIOX=x25t-interface
SET MIOX=x25t-interface CIRCUIT=circuit-name
```

The status of the MIOX module and individual MIOX circuits can be displayed with the commands:

```
SHOW MIOX=[x25t-interface]
SHOW MIOX=[x25t-interface] COUNT
SHOW MIOX=[x25t-interface] CIRCUIT=[circuit-name]
```

The IP module can be configured to use a MIOX circuit with the command:

```
ADD IP ARP=ipadd INTERFACE=interface CIRCUIT=circuit-name
```

Configuring LAPB

When setting up LAPB on a router, consider the following:

- Configure an LAPB interface to run over a synchronous port.
- Configure the parameters for the LAPB interface.

When default parameters are acceptable, it may not be necessary to configure them for an LAPB interface.

Configuring an Interface for LAPB

Before an X.25 DTE or DCE interface can be configured, an LAPB interface must be created for the X.25 interface to run over. To configure an LAPB interface, use the command:

```
create lapb=lapb-interface over={synn|isdn-callname}
   [dod={on|off|yes|no}] [maxdata=1080..32792] [modulus={8|
   128}] [n2=1..40] [role={dce|dte|dxe}] [window=1..127]
   [rmaxdata=1080..32792] [tmaxdata=1080..32792] [t1=1..120|
   500..10000] [t3=3..120]
```

This command creates an LAPB interface that runs over the specified synchronous port or ISDN call. No other modules may already be configured to the synchronous port.

The following commands set up LAPB interfaces 1 and 3 to run over synchronous ports 0 and 1 respectively as DCEs:

```
create lapb=1 over=syn0 role=dce
create lapb=3 over=syn1 role=dce
```

Note that there is no direct relationship required between LAPB instance and synchronous port number. However it may be beneficial to keep a direct 1 to 1 mapping between LAPB interface number and synchronous port number for ease of management.

The LAPB interface is initialised on successful execution of the CREATE command. However, the interface becomes active (attempts to setup the link) when a module (X.25 DTE or DCE) configures to the interface.

Configuring LAPB Interface Parameters

The parameters that define the operation of an LAPB interface can be set when the LAPB interface is created or by using the command:

```
set lapb=lapb-interface [modulus={8|128}] [n2=1..40]
   [role={dce|dte|dxe}] [maxdata=1080..32792] [window=1..127]
   [rmaxdata=1080..32792] [tmaxdata=1080..32792][t1=1..120|
   500..10000] [T3=3..120]
```

When first created, an LAPB interface has default operational parameters that may need to be changed for communication over the interface to begin.

It is essential that the packet modulus be identical at both ends of the link and that the role of the LAPB interface be set up correctly. If an X.25 DCE interface is to be configured to the LAPB interface, then the LAPB role parameter should be set to DCE. If an X.25 DTE interface is to be configured to the LAPB interface, then the LAPB role should be DTE unless the connection operates in a direct DTE-to-DTE connection where the role for one LAPB interface must be configured as DCE and the peer LAPB interface as DTE.The LAPB interface timers must be set up correctly so the T1 parameter is greater than the maximum time it takes for the transmission of a packet and the reception of that packet's acknowledgement.

When the operational parameters are changed for an LAPB interface, changes do not take place immediately, and are not reflected in the **show lapb** command until the LAPB interface is reset with the command:

```
reset lapb=lapb-interface
```

The **reset** command updates changes to operational parameters and initiates the LAPB link reset procedure.

Configuring X.25 DCE

When setting up X.25 DCE on a router, consider the following:

- Configure an LAPB interface to run over a synchronous port.
- Configure an X.25 DCE interface to run over the LAPB interface.
- Set up the DTE address(es) for the X.25 interface.
- Set up the X.25 route mapping table.
- Set X.25 TCP Keepalive parameters.

Some steps are not necessary when default parameters are acceptable, or when an X.25 DCE interface and route mapping table already exist. The sequence may also vary. However, an LAPB interface must be created before an X.25 DCE interface, and a DCE interface must exist before DTE addresses can be set up for it.

Configure an LAPB Interface

An example of configuring an LAPB interface was presented in the section *Configuring LAPB*. The rest of this example assumes the same setup exists, that is, LAPB interfaces 1 and 3 created to use synchronous ports 0 and 1 respectively as DCEs.

Configure the X.25 DCE Interface

To configure an interface to run X.25 DCE, use the command:

```
CREATE X25C=x25-interface OVER=LAPBn [DEFPKT={128|256|512|
   1024|2048|4096}] [DEFTHROUGH={75|150|300|600|1200|2400|
   4800|9600}] [DEFWIN=2..7] [HGROUP=huntname][INLCGN=0..15]
   [INLCN=0..128] [MAXACTIVE=0..128] [OUTLCGN=0..15]
   [OUTLCN=0..128] [PACKETSIZE={ON|OFF}] [THROUGHPUT={ON|
   OFF}] [TWOLCGN=0..15] [TWOLCN=0..128] [WINDOW={ON|OFF}]
```

The following commands set up two X.25 DCE interfaces to use the LAPB interfaces previously created:

```
CREATE X25C=2 OVER=LAPB1
CREATE X25C=4 OVER=LAPB0
```

The X.25 DCE interface number is not directly related to the LAPB interface number, and the two DCE interfaces set up do not have consecutive numbers. Consecutive numbers are not necessary but we recommend using them for ease of management. Each interface number must be from 0 to 7 since no more than 8 X.25 DCE interfaces can be set up on a router.

When first created, a DCE interface has no logical channels assigned to it. The numbers of each type of channel allowed on the X.25 DCE interface and the total number of available channels can be set, along with other parameters, with the command:

```
SET X25C=x25-interface [DEFPKT={128|256|512|1024|2048|4096}]
    [DEFTHROUGH={75|150|300|600|1200|2400|4800|9600}]
    [DEFWIN=2..7] [HGROUP[=huntname]] [INLCGN=0..15]
    [INLCN=0..128] [MAXACTIVE=0..128] [OUTLCGN=0..15]
    [OUTLCN=0..128] [PACKETSIZE={ON|OFF}] [THROUGHPUT={ON|
    OFF}] [TWOLCGN=0..15] [TWOLCN=0..128] [WINDOW={ON|OFF}]
```

Note that when creating or setting an X.25 DCE interface, the default packet size, default through-put class and default window size parameters must be the same on all the routers in the X.25 network.

To add incoming and outgoing channels to the X.25 DCE interfaces set up in the previous step, use the commands:

```
SET X25C=2 INLCGN=0 INLCN=12 MAXACTIVE=48 OUTLCGN=1 OUTLCN=12
SET X25C=4 INLCGN=0 INLCN=12 MAXACTIVE=48 OUTLCGN=1 OUTLCN=12
```

Configuring DTE Addresses on DCEs

The DTE addresses for an X.25 DCE interface are set with the command:

```
ADD X25C=n DTEADDRESS=dteaddress
```

At least one DTE address must be set up for an X.25 DCE interface if incoming calls are to be processed correctly. The DTE address is not required when only outgoing calls are to be made. More than one DTE address can be set up for a DCE interface and each address may have wildcard digits in it so that a range of addresses can be responded to.

The following commands set up DTE addresses for the DCE interfaces configured in the previous step:

```
ADD X25C=2 DTEADDRESS=00002300
ADD X25C=2 DTEADDRESS=4600000085
ADD X25C=4 DTEADDRESS=001xxx00
```

Note that DCE interface 2 has 2 DTE addresses defined. Incoming calls with either of these addresses are answered. DCE interface 4 has a wildcard DTE address. Incoming calls with a DTE address that matches the wildcard specification are answered.

Configuring X.25 Route Mapping

Setting up an X.25 route mapping table is not required every time an X.25 DCE interface is added to the router. However, if other routers are going to call the new interface, the route mapping tables on these other routers must be changed. Only one route mapping table exists for each router.

The route mapping table can be changed with the commands:

```
ADD X25C ROUTE
DELETE X25C ROUTE
```

For example, the following command adds an entry to the end of the table that maps DTE address 00002300 to a router with the IP address 172.16.8.32:

```
ADD X25C ROUTE=00002300 IP=172.16.8.32
```

Configuring X.25 DCE TCP Keepalive parameters

The TCP Keepalive feature allows a TCP connection to be monitored for connectivity even when there is no traffic being sent on the connection. Normally, when data is sent on a TCP connection, a break in the connection is detected early because when data is not acknowledged, the sending end retransmits and eventually drops the connection. However, when no data is being sent, the ends of the connection normally have no way of knowing whether the connection is good. The TCP Keepalive function allows X.25 DCE users of TCP to configure two parameters to cause constant monitoring of the connection to occur. The first parameter TXINT, specifies a time in seconds between the TCP connection sending a TCP packet on the link that contains no data. This time is also used to monitor TCP packets coming in on the link. The FAILNUMBER parameter specifies how many TXINT intervals pass without receiving data before the TCP connection is deemed to be down. The default values of these parameters keep TCP connections alive for a few seconds when there is no data sent, and can be modified using the command:

```
SET X25C TCPKEEPALIVE [TXINT=5..180] [FAILNUMBER=2..10]
```

To show the current settings of these parameters, use the command:

```
SHOW X25C TCPKEEPALIVE
```

Displaying and Debugging X.25 DCE Interfaces

Configuration, counters, and state information for an X.25 DCE interface can be displayed with the commands:

```
SHOW X25C=x25-interface

SHOW X25C=x25-interface COUNTER

SHOW X25C=x25-interface STATE
```

Debugging of the X.25 DCE interface is enabled and disabled with the commands:

```
ENABLE X25C=x25-interface DEBUG

DISABLE X25C=x25-interface DEBUG
```

Configuring X.25 DTE

When setting up X.25 DTE over a synchronous interface on a router, consider the following:

- Configure an LAPB interface to run over a synchronous port.
- Configure an X.25 DTE interface to run over an LAPB interface.
- Configure Call Parameter entries.
- Configure Permanent Virtual Circuits.

The LAPB interface must be created before the X.25 DTE interface. Additionally, it may not be necessary to configure parameters for an X.25 DTE interface if defaults are acceptable.

The following steps are required to set up X.25 DTE over an ISDN interface on the router.

- Configure an X.25 DTE interface to run over a LAPD interface.
- Configure Call Parameter entries.

Configure an LAPB Interface

An example of configuring an LAPB interface was presented in the section *Configuring LAPB*. The rest of this description assumes the same setup exists; that is, LAPB interfaces 1 and 3 created to use synchronous ports 0 and 1 respectively.

Configure the X.25 DTE Interface

To configure an interface to run X.25 DTE over LAPB, use the command:

```
CREATE X25T=interface OVER=LAPBn
```

The following commands set up two X.25 DTE interfaces to use the LAPB interfaces created previously:

```
CREATE X25T=2 OVER=LAPB1
CREATE X25T=4 OVER=LAPB0
```

The X.25 DTE interface number is not directly related to the LAPB interface number, and the two DTE interfaces do not have consecutive numbers. Consecutive numbers are not necessary but we recommend using them for ease of management. Each interface number must be from 0 to 7 since no more than 8 X.25 DTE interfaces can be set up on a router. The LAPB interface must be created before the X.25 DTE interface.

To configure an interface to run X.25 DTE over LAPD, use the command:

```
CREATE X25T=interface OVER=LAPDn
```

Note that the X.25 DTE interface number is not directly related to the LAPD interface number

The parameters that define the operation of an X.25 DTE interface can either be set when the X.25 DTE interface is created, or by using the command:

```
SET X25T
```

An X.25 DTE interface, when first created, has operational parameters set to default values that may need to be altered for communication over the interface to begin.

It is essential that certain operational parameters are identical between the DTE interface and the X.25 DCE network or peer DTE to which it is connected.

The packet modulus must be identical at both ends of the link and the logical channel number ranges must be consistent to provide correct identification of incoming calls.

The X.25 DTE interface must be configured with a DTE address before any data traffic can be transmitted over the X.25 DTE interface. This address is placed in the calling field of outgoing call request packets and provides peer DTEs with an indication of where the call originated.

The X.25 DTE interface timers must be set up correctly so that the various timers allow enough time to correctly deal with packet retransmissions and other timing constraints.

When the operational parameters are altered for a X.25 DTE interface the changes do not take place immediately, and are not reflected in the **show x25t command on page 12-90** until the X.25 DTE interface is reset, using the command:

```
RESET X25T
```

The RESET command updates all changes to operational parameters and initiates the X.25 DTE link restart procedure.

Configuring Call Parameter Entries

Call parameter entries are used to specify parameters to use for individual calls. Call parameter entries contain information about the data and window sizes to be used by an X.25 call. To create a call parameter entry use the following command:

```
ADD X25T CPAR
```

The following command creates a call parameter entry and calls that reference this entry use the specified operational parameters for these calls:

```
ADD X25T CPAR=1 MAXDATA=512
```

A maximum of 8 call parameter entries can be configured. The valid range for the call parameter index is 1 to 8. A call parameter with index 0 is automatically created by the router and becomes the default if no other is specified.

Configuring Permanent Virtual Circuits

When PVCs (*Permanent Virtual Circuits*) are used these must be configured as a MIOX circuit, using the command:

```
ADD MIOX=x25t-interface CIRCUIT=circuit-name PVC=0..4095
```

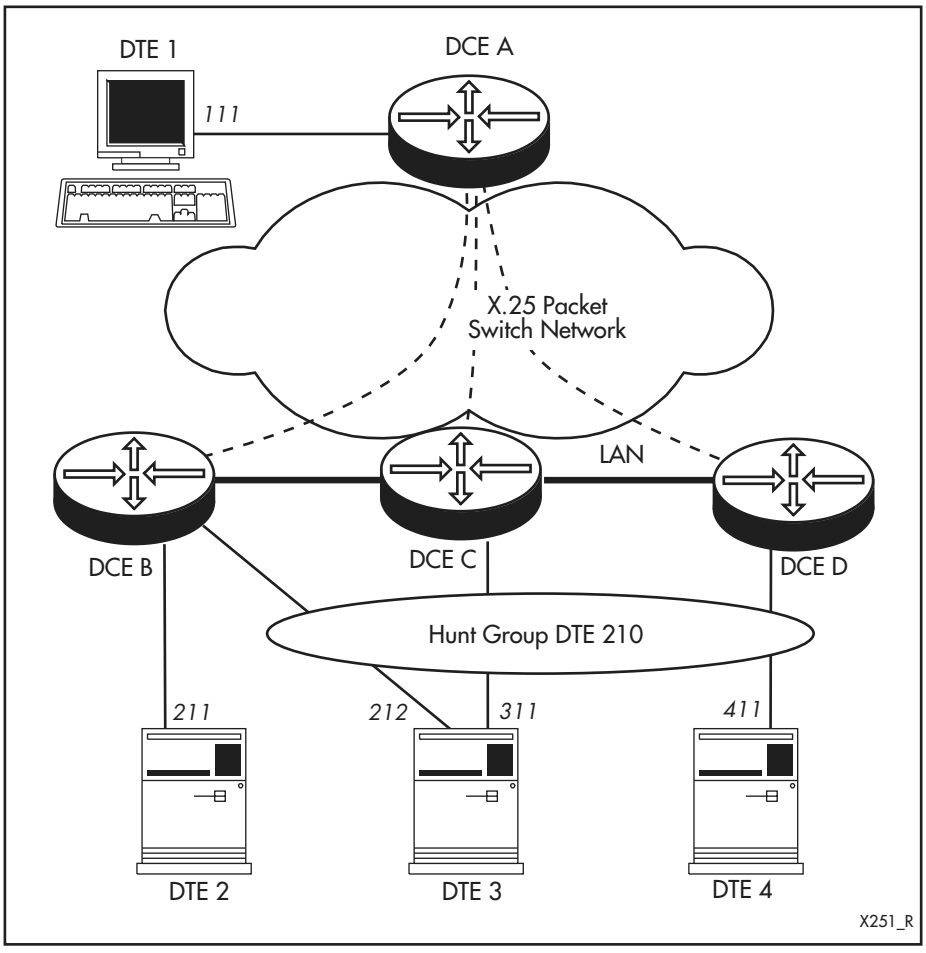
PVC channels are supplied by the X.25 network and are configured to provide a direct line to a peer DTE. To configure PVCs the DTE interface logical channel range parameters must be set up correctly, using the command:

```
CREATE X25T=x25-interface OVER={LAPBn|LAPDn} NPVC=0..4095
```

Hunt Groups

A hunt group is a set of DCE-DTE links that can be accessed from a remote DTE via a single DTE address. The DCEs in the hunt group work together to ensure that all LCNs in all the DCE-DTE links are used as fully as possible, and that the load of incoming X.25 calls is spread over X.25 lines as much as possible. This can be used to spread the traffic for a particular service over a number of X.25 lines on a single router acting as a DCE, or over a number of routers. Where there are many X.25 calls for a service that can be provided on more than one DCE-DTE link, hunt groups may reduce traffic congestion, and improve performance from the view point of callers.

Figure 12-1: X.25 DCE hunt groups



A hunt group can span up to ten routers on one LAN, and each router can belong to up to six hunt groups. Other DCEs connect to the hunt group on the router using a specified IP address, the IP address of one of the IP interfaces on each router. When other DTEs make a call to the hunt group, they use its unique DTE address, different from the DTE address of any of the actual X.25 lines. To create or destroy a hunt group on a router, use the commands:

```
CREATE X25C HUNTGROUP=huntname IPADDRESS=ipadd
   DTEADDRESS=dteadd [FORWARDTIME=1..360]
   [RECONNECTTIME=1..360]

DESTROY X25C HUNTGROUP=huntname
```

When DTE wants to call the DTE address of a hunt group (210), the DCE it is connected to (DCE A) sends a call request to a router belonging to this hunt group (DCE B). The DCE called (DCE B) first searches the link channels on its own X.25 interfaces belonging to the hunt group. If it has a free link channel, it sets the *Reconnect timer* for this link channel, reserves it, and sends a *Channel Reserved* message back to DCE A. The Channel Reserved message tells the calling router (DCE A) that it can connect the call to the interface with the free channel (DTE address 212 on DCE B), and DTE 1 and DTE 2 are connected. Each X.25 DCE interface can belong to one hunt group, and up to six X.25 DCE interfaces can belong to each hunt group on a router. To set the hunt group membership for an X.25 DCE interface, use the following command with a hunt group name to add it to the hunt group, or without a hunt group name to remove it from the hunt group to which it belonged:

```
set x25c=x25-interface HUNTGROUP[=huntname]
    [other-X25C-options...]
```

If the first router called (DCE B) has no free link channels on interfaces in the hunt group, it checks whether there are IP addresses for other DCEs in the same hunt group. A hunt group can have up to ten member DCEs, so each router in the hunt group can have up to nine IP addresses for forwarding call requests to other DCEs in the same hunt group. All the DCEs in the hunt group should be configured with the IP addresses of all the other DCEs in the hunt group. To add or delete an IP address from this forwarding list, use the commands:

```
ADD X25C HUNTGROUP=huntname FORWARD=ipadd

DELETE X25C HUNTGROUP=huntname FORWARD=ipadd
```

If the first router called (DCE B) finds other IP addresses in the same hunt group, it starts the *Forward timer, and* sends a *Forward Request* message to one of them (for instance DCE C), asking whether it has any link channels available for the DTE of the hunt group. The router that receives this Forward Request (DCE C) checks whether it has a free channel in the hunt group, and sends a *Forward Response* message back (to DCE B). If this message tells the first router called (DCE B) that DCE C has no free channels (rejection), DCE B sends a Forward Request message to each of the other DCEs in the hunt group in turn, waiting for a Forward Response or the time specified by the Forward timer before trying the next IP address in the forward list. If none of the Forward Response messages to DCE B indicate a free channel available in the hunt group, DCE B terminates the call from DCE A with a busy signal.

If one of these routers (DCE D) has a channel available in the hunt group, it reserves the channel, starts the *Reconnect timer* for the channel, and sends a Forward Response message back to DCE B indicating acceptance. The Forward Response message includes the DTE address of the X.25 line available, and the link channel number (LCN). When DCE B receives this positive Forward Response message, it sends a Channel Reserved message back to DCE A, telling it the DTE address of the X.25 line that has a channel available and reserved for it (DTE address 411 on DCE D). The call between the two DTEs (DTE 1 and DTE 4) is connected.

The DCE that has reserved a channel for this call (DCE D) waits for the time specified by the Reconnect timer for the call from the original calling router (DCE A) to connect the two DTEs.

The IP address and DTE address of a hunt group are set when it is created on a router, and can thereafter be modified using the command:

```
set x25c huntgroup=huntname [IPADDRESS=ipadd]
    [DTEADDRESS=dteadd]
```

The Reconnect timer determines how long a channel is reserved, waiting for a call to be connected. and the Forward timer determines how long the DCE/router waits after sending a Forward Request Message for the Forward Response to be returned by the other DCE. These timers should have the same values on all the DCEs in a hunt group. The default of 60 seconds for both these timers can be modified when the hunt group is created on the router, or by using the command:

```
SET X25C HUNTGROUP=huntname [FORWARDTIME=1..360]
   [RECONNECTTIME=1..360]
```

Details about the hunt groups on a router can be displayed using the command:

```
SHOW X25C HUNTGROUP[=huntname]
```

To display connection information about active calls on DCE interfaces, use the command:

```
SHOW X25C[=x25-interface] PATH
```

All DCEs spanned by a hunt group should be configured with the same hunt group name, DTE address, and Reconnect and Forward timers. A hunt group on each DCE should be configured with the IP addresses of all the other DCEs in the hunt group.

Configuration Examples

The following examples illustrate the steps required to configure an X.25 network, from a basic X.25 configuration over a synchronous interface through to an extended configuration and the use of X.25 over the ISDN D channel.

A Basic X.25 Setup

This example shows how to set up the router to provide a wide area network based on access to an X.25 packet switched network, and how to route IP traffic over the X.25 network. The router supports both IP and IPX protocols over X.25.

Two routers are to be connected via an X.25 network, and routes TCP/IP over the X.25 network (Figure 12-2 on page 12-19, Table 12-2 on page 12-19). Each router has a single Ethernet LAN segment, to which local hosts and PCs are attached. The router supports both *Switched Virtual Circuits* (SVCs) and *Permanent Virtual Circuits* (PVCs). For this example a PVC has been used to connect the two routers.

Figure 12-2: Example configuration for a basic X.25 network

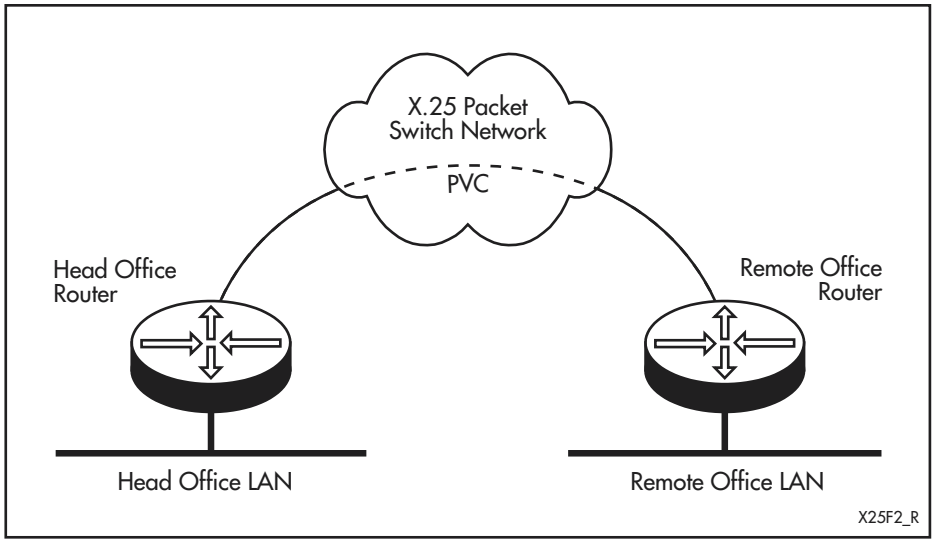
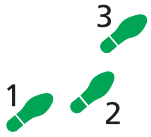


Table 12-2: Example configuration parameters for a basic X.25 network

Parameter	Head Office	Remote Office
Router name	HO	RO
Router Ethernet interface	eth0	eth0
Router Ethernet IP address	172.16.8.33	192.168.31.30
Ethernet network mask	255.255.255.0	255.255.255.240
Router SYN interface	syn0	syn0
Router LAPB interface	lapb0	lapb0
Router X.25 DTE interface	x25t0	x25t0
X.25 DTE IP address	172.16.254.1	172.16.254.2
X.25 network mask	255.255.255.0	255.255.255.0
X.25 network packet size	128	128
X.25 network window size	2	2
X.25 network supplied PVCs	5	5
X.25 network supplied SVCs	10	10
MIOX call name for HO to	-	RemoteOffice
MIOX call name for RO to	HeadOffice	-



To configure a basic X.25 network for IP and IPX traffic

1. Configure the X.25 DTE interface.

An X.25 DTE interface requires a data link layer to provide communication between the X.25 DTE and the DCE (network). The router supports both LAPB over synchronous interfaces and LAPD over the ISDN D channel. LAPB over a synchronous interface will be used for this example. The synchronous interface must not be in use by another data link layer protocol.

To create an LAPB interface over synchronous port 0, use the following command on both routers:

```
CREATE LAPB=0 OVER=SYN0
```

By default, an LAPB interface on the router operates as a DTE, which is appropriate for connecting to an X.25 switch or network service.

Once the LAPB interface has been initialised, the X.25 DTE interface must be created. For this example it is assumed that the network subscription supplies default values with a packet size of 128 bytes and a window size of 2. It is essential that the X.25 DTE interface parameters reflect the service provided by the X.25 network. This involves matching the channel numbers of the interface to the channel numbers provided by the network. In this example the network supplies five PVCs and ten two-way SVCs. The X.25 DTE parameter NPVC is set to 5 to provide PVC support on channels 1 to 5. The parameters LTC and HTC are set to 6 and 15 respectively to provide two-way SVCs on channel numbers 6 through 15.

To create X.25 DTE interface 0 over LAPB interface 0, use the following command on both routers:

```
CREATE X25T=0 OVER=LAPB0 NPVC=5 LTC=6 HTC=15
```

The X.25 DTE interface is now configured. To use the IP protocol over the interface it is necessary to configure the MIOX control layer to provide support for the IP routing module.

2. Configure the MIOX control layer.

MIOX (*Multiprotocol Interconnect Over X.25*) provides support for routing modules to use an X.25 DTE interface. For each X.25 DTE interface a MIOX circuit must be created for each remote router that is accessed over the DTE interface. MIOX circuits are responsible for managing X.25 calls to remote routers, opening calls on demand and closing calls when the call is idle for a period of time. MIOX circuits carry routing protocols such as IP and IPX, as well as providing support for TCP header compression and payload compression.

A MIOX circuit must be created on each router to represent the remote router. To add the appropriate circuit to router HO representing a connection to router RO, use the command:

```
ADD MIOX=0 CIRCUIT=RemoteOffice PVC=1 ENCAP=NULL
```

To add a MIOX circuit to router RO representing router HO use the command:

```
ADD MIOX=0 CIRCUIT=HeadOffice PVC=1 ENCAP=NULL
```

Adding the MIOX circuits allows routing modules to attach to these circuits and permits them to access the remote router.

3. Configure the IP routing module.

Use the following commands on all routers to enable the IP module and purge the old configuration.

```
PURGE IP
ENABLE IP
```

The IP module must now be configured and linked to the interfaces. Both the X.25 and the Ethernet interfaces must be linked. To configure the IP module interfaces for router HO use the commands:

```
ADD IP INT=eth0 IP=172.16.8.33 MASK=255.255.255.0
ADD IP INT=X25T0 IP=172.16.254.1 MASK=255.255.255.0
```

To configure the IP module interfaces for router RO use the commands:

```
ADD IP INT=eth0 IP=192.168.31.30 MASK=255.255.255.240
ADD IP INT=X25T0 IP=172.16.254.2 MASK=255.255.255.0
```

To allow communication over the X.25 interface, static ARP entries must be added to specify a route to the remote router. ARP entries are associated with MIOX circuits for X.25 DTE Interfaces. To configure the ARP entries for router HO use the commands:

```
ADD IP ARP=172.16.254.2 INT=X25T0 CIRC=RemoteOffice
```

To configure the ARP entries for router RO use the commands:

```
ADD IP ARP=172.16.254.1 INT=X25T0 CIRC=HeadOffice
```

A routing protocol must now be enabled to allow the routers to communicate and to update the internal routing tables. For this example RIP is used. This is to be broadcast on to the Ethernet LAN for each router, and across the X.25 connection. To enable RIP broadcast over an X.25 link the remote routers X.25 DTE Interface's IP address is specified. To configure the RIP routing protocol for router HO use the command:

```
ADD IP RIP INT=eth0
ADD IP RIP INT=X25T0 IP=172.16.254.2 CIRC=RemoteOffice
```

To configure the RIP routing protocol for router RO use the command:

```
ADD IP RIP INT=eth0
ADD IP RIP INT=X25T0 IP=172.16.254.1 CIRC=RemoteOffice
```

It is important to note that if RIP is not enabled across an X.25 connection, it is necessary to add static routes to allow access to IP subnets that reside at the remote end of the link.

4. Test the configuration.

The router configuration is now complete. The configuration can now be checked using the following commands and tested by use of the Ping command and Telneting between the routers, or into some remote host across the link. To check that the MIOX circuits are active type:

```
SHOW MIOX CIRC ENCAP
```

This command should produce a display (on router HO) like that shown in Figure 12-3 on page 12-22. If the MIOX circuit RemoteOffice indicates a channel state of INACTIVE then the X.25 interface is not active. See *"Troubleshooting" on page 12-22*.

Figure 12-3: Example output from the SHOW MIOX CIRCUIT ENCAPSULATION command for a basic X.25 network

```
miox interface 0
------------------------------------------------------------------------------
RemoteOffice
  module  IP        packets sent          0    packets rcvd          0
    channel    1    state  ACTIVE
```

If the MIOX circuit to the remote router is active then test the connection by using the PING command from router HO:

```
PING 172.16.254.2
```

If the PING command fails then there is a configuration problem. See *"Troubleshooting" on page 12-22*.

Check that RIP is transmitting IP routes over the PVC connection between HO and RO. This is done using the following command:

```
SHOW IP ROUTE
```

This command should produce a display (on router HO) like that shown in Figure 12-4 on page 12-22.

Figure 12-4: Example output from the SHOW IP ROUTE command for a basic X.25 network

```
Destination       Mask              NextHop             Interface          Age
DLCI/Circ.        Type     Policy   Protocol            Metrics      Preference
------------------------------------------------------------------------------
172.16.254.0      255.255.255.240   0.0.0.0             x25t0                7
-                 direct   0        interface           1                    0
172.16.8.0        255.255.255.0     0.0.0.0             eth0                 7
-                 direct   0        interface           1                    0
------------------------------------------------------------------------------
```

Try using Telnet to access the remote router. To Telnet from router HO to router RO use the following command:

```
TELNET 172.16.254.2
```

Troubleshooting

X.25 DTE interface is inactive

1. If the PVC circuits are INACTIVE then there is a problem with the X.25 DTE interface configuration or the network service. Check that the X.25 DTE parameters that have been specified correspond to the service provided by the network supplier.
2. If the parameters are correct, then check the LAPB interface status by using the command:

   ```
   SHOW LAPB COUNT
   ```

   This command should produce a display (on router HO) like that shown in Figure 12-5 on page 12-23.

Figure 12-5: Example output from the SHOW LAPB COUNT command for a basic X.25 network

```
lapb0
Interface Counters
  inDataOctets                3198      outDataOctets                2172
  inDataPkts                   123      outDataPkts                    89
  inDiscards                     0      outDiscards                     0

Control Packet Counters
                          Received    Processed  ModeChanges  Transmitted
  sabmPkts                       1            1            1            1
  unnumAckPkts                   0            0            0            0
  disconnectModePkts             0            0            0            0
  frameRejectPkts                0            0            0            0
  rxReadyPkts                    1            0            0            0
  rxNotReadyPkts                 0            0            0            0
  rejectPkts                     0            0            0            0

Packet Error Counters
  badFormat                      0      shortPackets                    0
  badAddresses                   0      longPackets                     0

Timeout Counters
  responseTimeouts               0      ackTimeouts                     0
  idleTimeouts                   0      rejectTimeouts                  0

State Information
  state                          DATA_TRANSFER
  stateChanges                   1
  reasonForLastChange            n2Timeout
```

If the Current mode is not *DataTransfer,* then a problem exists with the LAPB configuration or the network service. Check that the LAPB configuration corresponds to the data link layer parameters supplied by the service provider. If packets are being received but timeouts are occurring, then it may be necessary to update the timer values. If long packets are received, then the N1 parameter may need to be increased. If the parameters are correct and the LAPB counters indicate that no packets have been received, then check the cabling installation. If a problem persists, contact the network service supplier.

No routes exist to the remote router

1. Make sure that the X.25 DTE interface is active. Wait at least one minute to ensure that a RIP update has been received. If no RIP routes have been received, ensure the RIP entry and IP addresses are correct in the configuration and that the MIOX circuits carrying RIP do not have TCP header compression enabled.
2. Restart the IP module (a warm restart) by using the command:

   ```
   RESET IP
   ```

   If the routes are still not appearing, check with the network equipment supplier.

Telnet fails

1. If a Telnet into a remote router fails, check that the IP address being used matches the one assigned to this router. If RIP is being used, check that it is configured correctly. Otherwise, check that the static route to the remote router has been added correctly.

2. If a Telnet into a host remote LAN fails, but works into the remote router, Check that either RIP is enabled or a static route has been added to the remote LAN.

Back-to-back testing

If the routers are being configured back-to-back for test purposes, the LAPB interface on one router must be configured to operate as a DTE and the LAPB interface on the other router must be configured to act as a DCE. To change the operational mode of the LAPB interface on one of the routers, use the following commands after the LAPB interface has been created:

```
SET LAPB=0 ROLE=DCE
RESET LAPB=0
```

Changes to the configuration of LAPB and X.25 DTE interfaces using the **set lapb** command on page 12-59 and the **set x25t** command on page 12-66 do not take effect until the interface is reset with the **reset lapb** command on page 12-58 or the **reset x25t** command on page 12-58 (respectively), or the router is restarted.

An Extended X.25 Setup

This example shows how to set up the router to provide a wide area network based on access to an X.25 packet switched network, and how to route IP over the X.25 network. In this example, three routers are to be connected to the X.25 network, and will route TCP/IP over the X.25 network (Figure 12-6 on page 12-24, Table 12-3 on page 12-25). Each router has a single Ethernet LAN segment, to which local hosts and PCs are attached.

Figure 12-6: Example configuration for an extended X.25 network

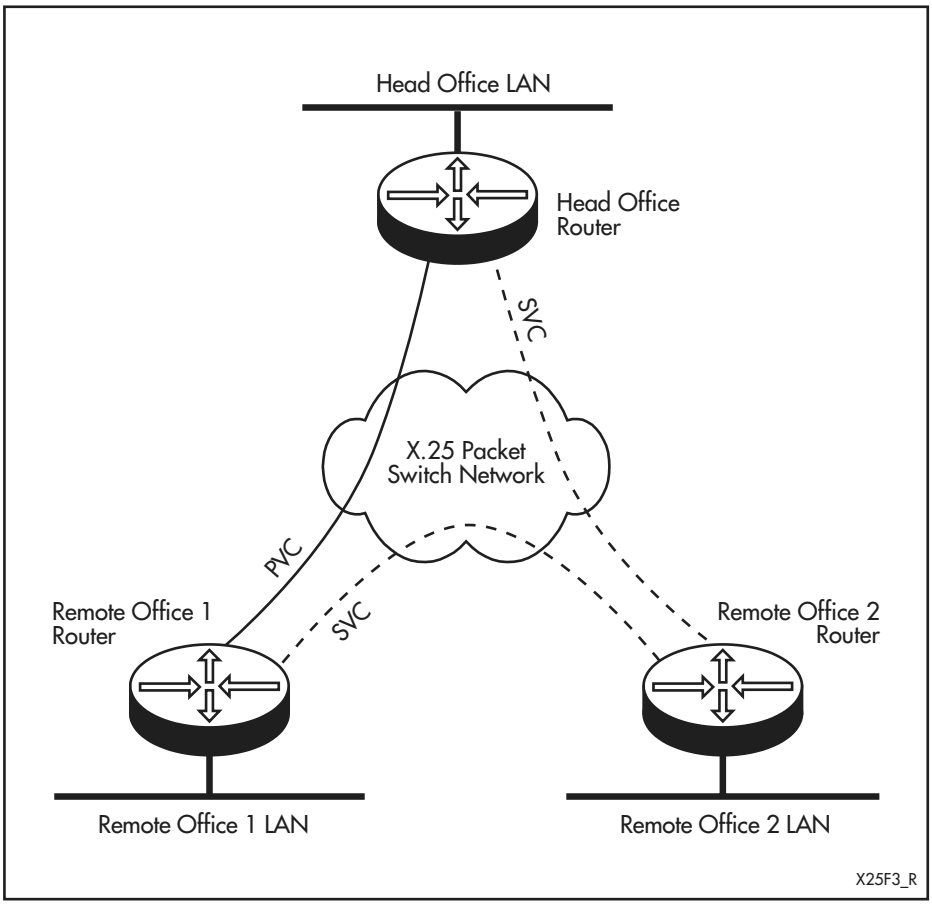
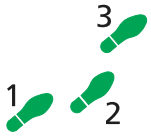


Table 12-3: Example configuration parameters for an extended X.25 network

Parameter	Head Office	Remote Office 1	Remote Office 2
Router name	HO	RO1	RO2
Router Ethernet interface	eth0	eth0	eth0
Router Ethernet IP address	172.16.8.33	192.168.31.30	192.168.30.5
Ethernet IP subnet address	172.16.8.0	192.168.31.16	192.168.30.0
Ethernet network mask	255.255.255.0	255.255.255.240	255.255.255.240
Router SYN interface	syn1	syn0	syn0
Router LAPB interface	lapb0	lapb0	lapb0
Router X.25 DTE interface	x25t0	x25t0	x25t0
X.25 DTE (X.121) address	3302013	3302794	3320721
X.25 DTE IP address	172.16.254.1	172.16.254.2	172.16.254.3
X.25 network subnet address	172.16.254.0	172.16.254.0	172.16.254.0
X.25 network mask	255.255.255.0	255.255.255.0	255.255.255.0
X.25 network packet size	256	256	256
X.25 network window size	4	4	4
X.25 network supplied PVCs	5	5	0
X.25 network supplied SVCs	10	10	10
MIOX call name for HO to	-	Remote1C	Remote2C
MIOX call name for RO1 to	HeadC	-	Remote2C
MIOX call name for RO2 to	HeadC	Remote1C	-
Connection	**HO to RO1**	**HO to RO2**	**RO1 to RO2**
Circuit type	PVC	SVC	SVC
RIP required	Yes	No	No
TCP compression	No	Yes	Yes
MIOX Encapsulation	IP	IP	IP

There is a constant, heavy traffic between Head Office and Remote Office 1, as staff at Remote Office 1 use Telnet to access accounting, purchasing and inventory applications running on a host attached to the Head Office LAN. Traffic between Head Office and Remote Office 2 is more sporadic, comprising electronic mail, occasional large file transfers, and infrequent terminal traffic. Traffic between RO1 and RO2 is primarily electronic mail with occasional file transfers.

Because there is heavy traffic between HO and RO1, a PVC has been chosen to connect these two sites. SVCs connect HO and RO2 and also RO1 and RO2. RIP needs to be broadcast between HO and RO1 but is not required between HO and RO2. As RIP is required between HO and RO1 TCP header compression may not be used as these two options are mutually exclusive.



To configure an X.25 network with both PVCs and SVCs to carry IP and IPX traffic

1. Configure an LAPB interface.

An X.25 DTE interface requires a data link layer. For this example, LAPB over a synchronous port will be used. The synchronous port must not have any other module currently attached to it.

To create an LAPB interface for router HO over synchronous port 1, use the command:

```
CREATE LAPB=0 OVER=SYN1
```

To create LAPB interfaces for routers RO1 and RO2 over synchronous ports 0, use the following command on routers RO1 and RO2:

```
CREATE LAPB=0 OVER=SYN0
```

2. Configure the X.25 DTE interface.

Once the LAPB interface has been created the X.25 DTE interface can be initialised. As the network subscription supplies non default values for packet size and window size a call parameter structure must be created to reflect the network values. This is created using the following command for each router:

```
ADD X25T CPAR=1 MAXDATA=256 WINDOW=4
```

Now the X.25 DTE interfaces can be created. It is vital that the X.25 DTE interface parameters reflect the service provided by the network. This involves matching the channel numbers of the interface to the network. For router HO the network service provides 5 PVCs and 10 two-way SVCs. The X.25 DTE parameter NPVC is set to 5 to provide PVC support on channels 1 to 5. The X.25 DTE parameters LTC and HTC are set to 6 and 15 respectively to provide two-way SVCs on channel numbers 6 through 15. As router RO2 has no PVCs supplied two-way channels are set from 1 to 11. The DEFCPAR parameter is used to specify the previously created call parameter structure so that the X.25 DTE packet and window sizes are correct for the network. The value specified for DEFCPAR must be the same as a previously-defined value for CPAR.

To create an X.25 DTE interface for router HO over LAPB interface 0, use the command:

```
CREATE X25T=0 OVER=LAPB0 NPVC=5 LTC=6 HTC=15 DEFCPAR=1
```

To create an X.25 DTE interface for router RO1 over LAPB interface 0, use the command:

```
CREATE X25T=0 OVER=LAPB0 NPVC=5 LTC=6 HTC=15 DEFCPAR=1
```

To create an X.25 DTE interface for router RO2 over LAPB interface 0, use the command:

```
CREATE X25T=0 OVER=LAPB0 LTC=1 HTC=10 DEFCPAR=1
```

After the X.25 DTE interfaces are created, it is necessary to create a PVC circuit for routers HO and RO1. To do this, use the following command on both routers:

```
ADD X25T=0 PVC=1 CPAR=1
```

3. Configure the MIOX control layer.

Creating the X.25 DTE interfaces also initialises the corresponding MIOX interfaces. MIOX circuits are added to provide a communication path to a remote router. MIOX circuits specify whether the connection is made via a PVC or SVC and if TCP header compression is used for TCP/IP traffic. Note that TCP compression is not enabled for the PVC circuit. This is because RIP information is directed over the circuit and these two functions are mutually exclusive.

To add the appropriate circuits to remote routers RO1 and RO2 on router HO1, use the commands:

```
ADD MIOX=0 CIRCUIT=Remote1C PVC=1 ENCAP=IP
ADD MIOX=0 CIRCUIT=Remote2C DTEADDRESS=3320721 ENCAP=IP
   TCPCOMP=ON
```

To add the appropriate circuits to routers HO and RO2 for router RO1, use the commands:

```
ADD MIOX=0 CIRCUIT=HeadC PVC=1 ENCAP=IP
ADD MIOX=0 CIRCUIT=Remote2C DTEADDRESS=3320721 ENCAP=IP
   TCPCOMP=ON
```

To add the appropriate circuits to routers HO and RO1 for router RO2, use the commands:

```
ADD MIOX=0 CIRCUIT=HeadC DTEADDRESS=3302013 ENCAP=IP
   TCPCOMP=ON
ADD MIOX=0 CIRCUIT=Remote1C DTEADDRESS=3302794 ENCAP=IP
   TCPCOMP=ON
```

4. Configure the IP routing module.

To enable the IP module and purge the old configuration, use the following commands on all routers:

```
PURGE IP
ENABLE IP
```

The IP module must now be configured and linked to the interfaces. Both the X.25 and the Ethernet interface must be linked. To configure the IP module interfaces for router HO, use the commands:

```
ADD IP INT=eth0 IP=172.16.8.33 MASK=255.255.255.0
ADD IP INT=X25T0 IP=172.16.254.1 MASK=255.255.255.0
```

To configure the IP module interfaces for router RO1, use the commands:

```
ADD IP INT=eth0 IP=192.168.31.30 MASK=255.255.255.240
ADD IP INT=X25T0 IP=172.16.254.2 MASK=255.255.255.0
```

To configure the IP module interfaces for router RO2, use the commands:

```
ADD IP INT=eth0 IP=192.168.30.5 MASK=255.255.255.240
ADD IP INT=X25T0 IP=172.16.254.3 MASK=255.255.255.0
```

The IP modules are now enabled and linked to the physical interfaces. To allow communication over the X.25 interface, static ARP entries must be added to specify routes to the remote routers. ARP entries are associated with MIOX circuits for X.25 DTE Interfaces. To configure the ARP entries for router HO, use the commands:

```
ADD IP ARP=172.16.254.2 INT=X25T0 CIRC=Remote1C
ADD IP ARP=172.16.254.3 INT=X25T0 CIRC=Remote2C
```

To configure the ARP entries for router RO1, use the commands:

```
ADD IP ARP=172.16.254.1 INT=X25T0 CIRC=HeadC
ADD IP ARP=172.16.254.3 INT=X25T0 CIRC=Remote2C
```

To configure the ARP entries for router RO2, use the commands:

```
ADD IP ARP=172.16.254.1 INT=X25T0 CIRC=HeadC
ADD IP ARP=172.16.254.2 INT=X25T0 CIRC=Remote1C
```

A routing protocol must now be enabled to allow the routers to communicate and to update the internal routing tables. For this example RIP is used. This is to be broadcast on to the Ethernet LAN for each router. For the X.25 connections, RIP is directed explicitly to each end of the PVC connection between router HO and router RO1. RIP is not enabled over either of the SVC connections because this would keep the SVCs constantly open, transmitting new RIP information every 30 seconds. To configure the RIP routing protocol for router HO, use the commands:

```
ADD IP RIP INT=X25T0 IP=172.16.254.2
ADD IP RIP INT=eth0
```

To configure the RIP routing protocol for router RO1, use the commands:

```
ADD IP RIP INT=X25T0 IP=172.16.254.1
ADD IP RIP INT=eth0
```

To configure the RIP routing protocol for router RO2, use the command:

```
ADD IP RIP INT=eth0
```

Now that RIP has been configured for the routers it is necessary to add static routes so that it is possible to access remote subnets over the SVC connections. A static route must be added for each remote subnet that is accessed over an X.25 SVC connection from that router. The next hop is the remote router's X.25 IP address. To configure static routes for router HO to access LAN RO2, use the command:

```
ADD IP ROUTE=192.168.30.0 INT=X25T0 NEXT=172.16.254.3
   MET=2
```

To configure static routes for router RO1 for accessing LAN RO2, use the command:

```
ADD IP ROUTE=192.168.30.0 INT=X25T0 NEXT=172.16.254.3
   MET=2
```

To configure static routes for router RO2 for accessing LAN RO1 and LAN HO, use the commands:

```
ADD IP ROUTE=172.16.8.0 INT=X25T0 NEXT=172.16.254.1 MET=2
ADD IP ROUTE=192.168.31.16 INT=X25T0 NEXT=172.16.254.2
   MET=2
```

5. Test the configuration.

The router configuration is now complete. The configuration can now be checked using the following commands and tested by Telneting into a remote router, or into some remote host across the link.

Note that the IP ping command does not function over links with TCP header compression enabled. Only TCP/IP traffic is processed successfully. To check that the MIOX circuits are active, use the command:

```
SHOW MIOX CIRC ENCAP
```

This command produces a display (on Router HO) similar to the one in Figure 12-7 on page 12-29.

Figure 12-7: Example output from the SHOW MIOX CIRCUIT ENCAPSULATION command for an extended X.25 network

```
miox interface 0
------------------------------------------------------------------------------
Remote1C
  module  IP        packets sent           0    packets rcvd           0
    channel    1    state  ACTIVE

Remote2C
  module  IP        packets sent           0    packets rcvd           0
    channel    0    calls
    state           successful        failed      accepted
    CLOSED                   0             0             0
```

If the PVC circuit Remote1C for router HO indicates a channel state of INACTIVE, then the X.25 interface is not active. See *"Troubleshooting" on page 12-22* in *A Basic X.25 Setup*.

Check that RIP is transmitting IP routes over the PVC connection between HO and RO1. To do this, use the following command on either router:

```
SHOW IP ROUTE
```

This command should produce a display (on router HO) like that shown in Figure 12-8.

Figure 12-8: Example output from the SHOW IP ROUTE command for an extended X.25 network

```
Destination       Mask              NextHop             Interface          Age
DLCI/Circ.        Type     Policy   Protocol            Metrics      Preference
------------------------------------------------------------------------------
192.168.31.16     255.255.255.240   172.16.254.1        x25t0                2
-                 remote   0        static              2                   60
172.16.254.0      255.255.255.240   0.0.0.0             x25t0                7
-                 direct   0        interface           1                    0
172.16.8.0        255.255.255.0     0.0.0.0             eth0                 7
-                 direct   0        interface           1                    0
------------------------------------------------------------------------------
```

To Telnet from router HO to router RO1 and RO2, use the following commands respectively:

```
TELNET 192.168.31.30
TELNET 192.168.30.5
```

To Telnet from router RO1 to router HO and RO2, use the following commands respectively:

```
TELNET 172.16.8.33
TELNET 192.168.30.5
```

To Telnet from router RO2 to router HO and RO1, use the following commands respectively:

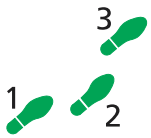
```
TELNET 172.16.8.33
TELNET 192.168.31.30
```

For a troubleshooting information, see *"Troubleshooting" on page 12-22* in *A Basic X.25 Setup*.

X.25 over ISDN D Channel

X.25 over the D Channel allows ISDN customers to make and receive packet switched calls using the ISDN D Channel as an access point. This provides approximately a 4800 bps switched connection that the router can use to transport IP traffic over X.25.

This example illustrates how to configure an X.25 DTE interface over the ISDN D channel, and then configure IP to use the X.25 interface.



To configure X.25 over the ISDN D channel

1. **Create an X.25 DTE interface over the ISDN D channel.**

   To create X.25 DTE interface 0 over the D channel of ISDN interface 0, which supports X.25 packet network access, use the command:

   ```
   CREATE X25T=0 OVER=LAPD0
   ```

2. **Configure the X.25 DTE interface.**

   To assign logical channel numbers 1 and 2 to two-way channels to correspond with the channel ranges supplied by the network, use the command:

   ```
   SET X25T=0 LTC=1 HTC=2 DTE=123456
   ```

   Set the packet window and packet length parameters if the network values for these parameters are different from the default router configuration. Default values for the router are a window size of 2 and a packet length of 128 octets. If the network supplied values are different a call parameter must be created to specify the required values. For example, to create a call parameter with an index number of 1, a packet length of 256 octets and a window size of 4, use the command:

   ```
   ADD X25T CPAR=1 MAXDATA=256 WINDOW=4
   ```

   Once the call parameter is created the interface must be configured to use the call parameters for the default values and reset for the changes to take effect. To configure DTE interface 0 to use call parameter set 1, use the command:

   ```
   SET X25T=0 DEFCPAR=1
   RESET X25T=0
   ```

3. **Configure the IP routing module.**

   To create an IP interface for X.25 DTE interface 0, with an IP address of 192.168.35.101, use the command:

   ```
   ADD IP INT=X25T0 IP=192.168.35.101 MASK=255.255.255.240
   ```

   To enable IP traffic to be transmitted over the X.25 DTE interface, ARP entries must be created for other routers that are accessible via the X.25 DTE interface by using the command:

   ```
   ADD MIOX=0 CIRC=TEST DTE=54321

   ADD IP ARP=192.168.35.102 INT=X25T0 CIRC=TEST
   ```

   The IP parameter specifies the IP address of the remote router's X.25 DTE interface and the DTE parameter specifies the ISDN DTE address of the router's ISDN connection. ARP entries must be created for every remote router that the router makes switched calls to via X.25 over the D Channel. The remote routers must also have ARP entries specifying this router's X.25 DTE IP address and DTE number.

X.25 Hunt Groups

In this configuration example (Figure 12-9 on page 12-31):

- DCEs A, B and C must all be Allied Telesyn routers or L3 switches running Software Release 2.0 or higher, with the hunt group feature.DTEs E, F and G must have standard X.25 DTE interfaces with the DTE addresses shown, but need not be separate devices. DTE D is an Allied Telesyn router, but could be any other standard X.25 DTE.
- DCEs A, B and C are on the same Ethernet LAN, but they need not be, as long as they can use IP to communicate with DCEs B and C.
- The hunt group Office spans DCEs B and C. An X.25 interface from DCE B to DTE F, and from DCE C to DTE G belong to this hunt group.
- DCE A belongs to no hunt groups. It can call the Office hunt group on DCE B, in addition to the individual DCE interfaces on DCE B. If DCE B has no channels available for a call to the Office hunt group, it checks whether DCE C has any channels available. If a channel is available, DCE B sends DCE A the information it needs to complete a connection.

Figure 12-9: Example configuration for an X.25 network with hunt groups

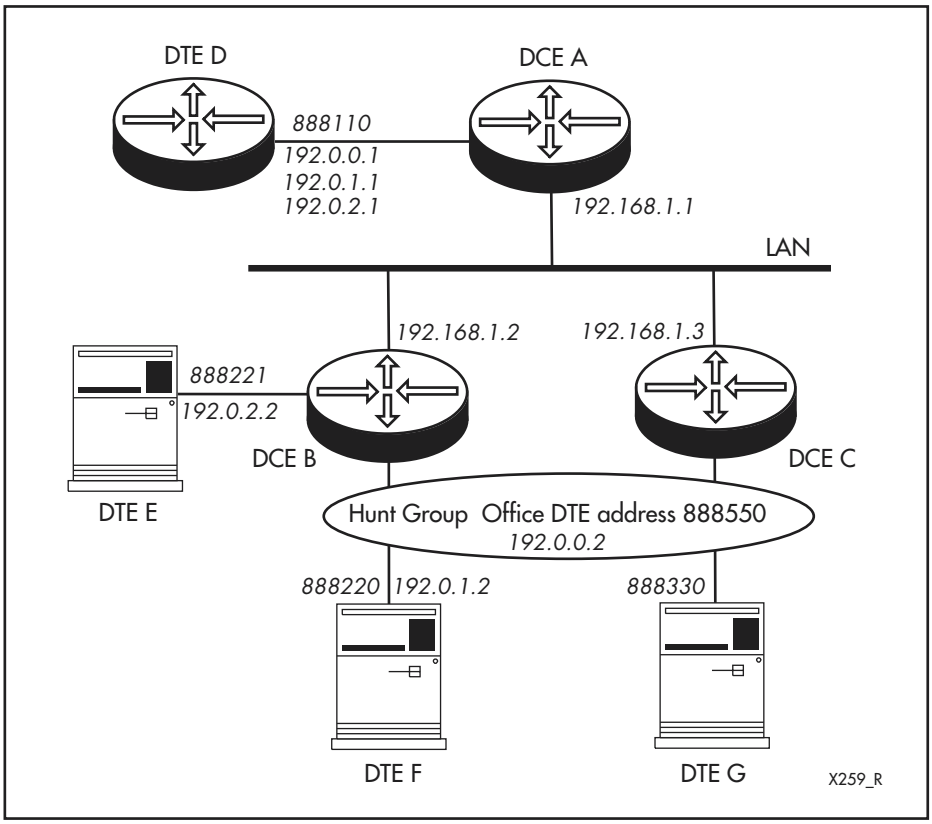


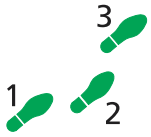
Table 12-4 on page 12-32 summarises the configuration parameters for the DCEs, Table 12-5 on page 12-32 summarises the configuration parameters for the DTEs, and the procedures that follow provide step by step instructions for configuring Routers A, B, C and D.

Table 12-4: Configuration parameters for DCE Routers A, B and C

Parameter	Router A	Router B	Router C
System name	DCE Router A	DCE Router B	DCE Router C
IP interfaces	192.168.1.1 over eth0	192.168.1.2 over eth0	192.168.1.3 over eth0
LAPB interfaces	LAPB0 over SYN0	LAPB0 over SYN0 LAPB1 over SYN1	LAPB0 over SYN0
X.25 DCE interfaces	X25C0 over LAPB0	X25C0 over LAPB0 X25C1 over LAPB1	X25C0 over LAPB0
DTE addresses	888110 over X25C0	888220 over X25C0 888221 over X25C1	888330 over X25C0
Hunt groups	—	Office	Office
Hunt group: DTE address	—	Office: 888550	Office: 888550
Hunt group Forwarding Hunt group: IP address	—	Office: 192.168.1.3	Office: 192.168.1.2
Interfaces in hunt group X25C: hunt group	—	X25C0: Office	X25C0: Office
X.25 Routes DTE address: IP address	888220: 192.168.1.2 888221: 192.168.1.2 888550: 192.168.1.2	888110: 192.168.1.1	888110: 192.168.1.1

Table 12-5: Configuration parameters for DTE Routers D, T, F and G.

Parameter	Router D	DCE E	DCE F	DCE G
System name	DTE Router D			
LAPB interfaces	LAPB0 over SYN0			
X.25 DTE interfaces	X25T0 over LAPB0			
MIOX circuits	Hunt0 over X25T0 Nohunt0 over X25T0 Nohunt1 over X25T0			
IP interfaces	192.0.0.1 over X25T0-0 192.0.1.1 over X25T0-1 192.0.2.1 over X25T0-2			
DTE address	888110	888221	888220	888330



To configure Router A

Router A has no hunt groups configured on it, but must be configured to call the DTE address of the hunt groups on Router B. Information that it needs to complete a connection with Router B is sent in a Channel Reserve message from Router A when it needs it.

1. **Set the system name for the router.**

   To set the system name for the router, use the command:

   ```
   SET SYS NAME="DCE Router A"
   ```

2. **Configure an IP interface.**

   The DCEs communicate with each other using IP. To enable the IP module and add an IP interface to an Ethernet interface, use the commands:

   ```
   ENABLE IP
   ADD IP INT=eth0 IP=192.168.1.1
   ```

3. **Configure LAPB interfaces to DTE D.**

   The DCE interfaces connecting Router A to DTE D use the LAPB protocol over a synchronous interface. To create an LAPB interface and set the router to take the DCE role on this interface, use the command:

   ```
   CREATE LAPB=0 OVER=SYN0 ROLE=DCE
   ```

4. **Configure X.25 DCE interfaces.**

   To create an X.25 DCE interface that uses the LAPB connection, use the command:

   ```
   CREATE X25C=0 OVER=LAPB0 INLCGN=5 INLCN=4 TWOLCGN=6
      TWOLCN=5 OUTLCN=7 OUTLCN=6
   ```

5. **Assign a DTE address for the X.25 DCE interface.**

   The DTE address is called by other DTEs. To assign it to the X.25 DCE interface, use the command:

   ```
   ADD X25C=0 DTEADDR=888110
   ```

6. **Configure X.25 routes to the DTE addresses on Router B.**

   Router A requires X.25 routes to the hunt groups on Router B. Routers A and B communicate using IP, so the routes to the DTE address of the hunt group is an IP address. To add this route, use the command:

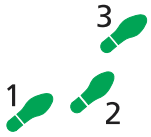
   ```
   ADD X25C ROUTE=888550 IP=192.168.1.2
   ```

   In order for Router A to call the X.25 DCE interfaces on Router B individually, it also requires routes to their individual DTE addresses. To add these routes, use the commands:

   ```
   ADD X25C ROUTE=888220 IP=192.168.1.2
   ADD X25C ROUTE=888221 IP=192.168.1.2
   ```

   Router A cannot call the individual DTE address on Router C, so no route is configured for this.

   In this example, the same IP address is used for both the hunt group and the individual DTE addresses. They could instead be configured with different IP addresses for each of these routes.



To configure Router B

1. **Set the system name.**

   To set the system name for the router, use the command:

   ```
   SET SYS NAME="DCE Router B"
   ```

2. **Configure an IP interface.**

   To add an IP interface to an Ethernet interface, use the commands:

   ```
   ENABLE IP
   ADD IP INT=eth0 IP=192.168.1.2
   ```

3. **Configure LAPB interfaces to DTE E and DTE F.**

   The DCE interfaces connecting Router B to DTEs E and F use the LAPB protocol over a synchronous interface. To create two LAPB interfaces and set the router to take the DCE role on these interfaces, use the commands:

   ```
   CREATE LAPB=0 OVER=SYN0 ROLE=DCE
   CREATE LAPB=1 OVER=SYN1 ROLE=DCE
   ```

4. **Configure X.25 DCE interfaces.**

   To create X.25 DCE interfaces to use the LAPB connections, use the commands:

   ```
   CREATE X25C=0 OVER=LAPB0 INLCGN=5 INLCN=4 OUTLCN=7
      OUTLCN=6
   CREATE X25C=1 OVER=LAPB1 INLCGN=5 INLCN=4 TWOLCGN=6
      TWOLCN=5 OUTLCGN=7 OUTLCN=6
   ```

5. **Configure DTE addresses for the X.25 DCE interfaces.**

   To add DTE addresses to the X.25 DCE interfaces, use the commands:

   ```
   ADD X25C=0 DTEADDR=888220
   ADD X25C=1 DTEADDR=888221
   ```

6. **Configure the hunt group.**

   To create a hunt group with a unique DTE address and an IP address by which the other DCEs can access it, use the command:

   ```
   CREATE X25C HUNT=Office IPADD=192.168.1.2 DTEADDR=888550
   ```

   The hunt group on router B uses IP to communicate with the corresponding hunt group on Router C. Add the IP address of the hunt group on Router C to the hunt group on Router B, using the command:

   ```
   ADD X25C HUNT=Office FORWARD=192.168.1.3
   ```

7. **Include the X.25 DCE interface in the hunt group.**

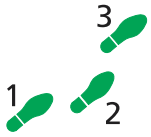
   To set the X.25 DCE interface to belong to the Office hunt group, use the command:

   ```
   SET X25C=0 HG=Office
   ```

8. **Configure an X.25 route to Router A.**

   Router B requires an X.25 route to the DTE address on Router A. To add this route, use the command:

   ```
   ADD X25C ROUTE=888110 IP=192.168.1.1
   ```



To configure Router C

1. **Set the system name for the router.**

   To set the system name for the router, use the command:

   ```
   SET SYS NAME="DCE Router C"
   ```

2. **Configure an IP interface.**

   To add an IP interface to one of the Ethernet interfaces, use the commands:

   ```
   ENABLE IP

   ADD IP INT=eth0 IP=192.168.1.3
   ```

3. **Configure an LAPB interface to DTE G.**

   To create an LAPB interface on a synchronous port and set the router to take the DCE role on this connection, use the command:

   ```
   CREATE LAPB=0 OVER=SYN0 ROLE=DCE
   ```

4. **Configure an X.25 DCE interface.**

   To create an X.25 DCE interface to use this LAPB connection, use the command:

   ```
   CREATE X25C=0 OVER=LAPB0 INLCGN=5 INLCN=4 TWOLCGN=6
      TWOLCN=5 OUTLCGN=7 OUTLCN=6
   ```

5. **Configure a DTE address for the X.25 DCE interface.**

   To add a DTE address to the X.25 DCE interface, use the command:

   ```
   ADD X25C=0 DTEADDR=888330
   ```

6. **Configure hunt groups.**

   To create the same hunt group with the same DTE address as on DTE B, and the IP address by which other DCEs can access it, use the command:

   ```
   CREATE X25C HUNT=Office IPADD=192.168.1.3 DTEADDR=888550
   ```

   To add the IP address of the hunt group on Router B to the hunt group on Router C, use the command:

   ```
   ADD X25C HUNT=Office FORWARD=192.168.1.2
   ```

7. **Include the X.25 DCE interface in the hunt group.**

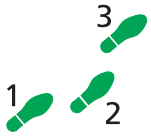
   To set the X.25 DCE interface to belong to the hunt group, use the command:

   ```
   SET X25C=0 HG=Office
   ```

8. **Configure an X.25 route to Router A.**

   Router C requires an X.25 route to the DTE address on Router A. To add this route, use the command:

   ```
   ADD X25C ROUTE=888110 IP=192.168.1.1
   ```



To configure Router D

1. **Set the system name for the router.**

```
SET SYS NAME="DTE Router D"
```

2. **Configure an LAPB interface to DCE A.**

   The DCE interface connecting DTE D to DCE A uses the LAPB protocol over a synchronous interface. To create an LAPB interface with the default DTE mode for this connection, use the command:

```
CREATE LAPB=0 OVER=SYN0
```

3. **Configure an X.25 DTE interface.**

   To create an X.25 DTE interface with a DTE address that uses this LAPB interface, use the command:

```
CREATE X25T=0 OVER=LAPB0 LIC=1281 HIC=1284 LTC=1537
   HTC=1541 LOC=1793 HOC=1798 DTE=888110
```

4. **Configure MIOX circuits over the X.25 DTE interface.**

   MIOX circuits are required from the X.25 DTE interface to each of the DTE interfaces at other end of the communication. This lets IP communication be carried over the X.25 connections between DTE D and DTEs E, F and G. To add MIOX circuits from X.25 DTE interface 0 (created in the previous step) to the individual DTE addresses and the hunt group DTE address on Router B, use the commands:

```
ADD MIOX=0 CIRC=Hunt0 DTE=888550 ENCAP=IP

ADD MIOX=0 CIRC=Nohunt0 DTE=888220 ENCAP=IP

ADD MIOX=0 CIRC=Nohunt1 DTE=888221 ENCAP=IP
```

5. **Configure IP interfaces.**

   By IP multihoming DTE D, it can be accessed by routers on different IP subnetworks. To create logical IP interfaces over X.25 DTE interface 0, use the commands:

```
ENABLE IP

ADD IP INT=X25T0-0 IP=192.0.0.1

ADD IP INT=X25T0-1 IP=192.0.1.1

ADD IP INT=X25T0-2 IP=192.0.2.1
```

6. **Associate IP addresses with the MIOX circuits.**

   Entries in the *Address Resolution Protocol* (ARP) cache determine the X.25 DTE interface and MIOX circuit that are used to access particular IP addresses on the network. To add ARP entries for the IP addresses and the X.25T interface and circuits, use the commands:

```
ADD IP ARP=192.0.0.2 INT=X25T0-0 CIRC=Hunt0

ADD IP ARP=192.0.1.2 INT=X25T0-1 CIRC=Nohunt0

ADD IP ARP=192.0.2.2 INT=X25T0-2 CIRC=Nohunt1
```

7. **Configure DTEs E, F and G.**

   If DTEs E, F and G are AR400 routers, their configuration follows similar procedures to those for configuring Router D.

8. Test the hunt group configuration.

To test the configuration, ping each of the configured IP addresses from DTE D. When the ping succeeds and the corresponding MIOX circuit opens, a call has been made to the DTE address. To check that a call can be made to the Office hunt group at DTE address 888550, use the command:

```
PING 192.0.0.2
```

A successful ping response should be received. To check that the correct circuit opened, use the command:

```
SHOW MIOX=0 CIRCUIT=Hunt0
```

The output displayed should show that circuit Hunt0 opened. To check calls to the individual DTE address 888220, use the commands:

```
PING 192.0.1.2
```

```
SHOW MIOX=0 CIRCUIT=Nohunt0
```

To check calls to DTE address 888221, use the commands:

```
PING 192.0.2.2
```

```
SHOW MIOX=0 CIRCUIT=Nohunt1
```

Command Reference

This section describes the commands available on the router to set up and configure the router as an X.25 DCE or DTE.

The router supports X.25 as both a DCE and a DTE. An interface on the router can be configured as either a DCE or a DTE. Commands relating to DCE mode operations have the following format:

```
verb X25C parameter...
```

Commands relating to DTE mode operations have the following format:

```
verb X25T parameter...
```

See "Conventions" on page xcv of Preface in the front of this manual for details of the conventions used to describe command syntax. See Appendix A, Messages for a complete list of messages and their meanings.

activate x25c test

Syntax

```
ACTIVATE X25C=interface TEST LCGN=0..15 LCN=0..128
   REMOTE=Remote-DTE-address LOCAL=Local-DTE-address
   [ACTION={DTE|DCE|DXE}]
```

where *interface* specifies the X.25 DTE logical interface on which to make a call from 0 to 7

Description

This command enables a systems administrator or technician to send a test call through the network.

The logical channels specified by the **lcgn** and the **lcn** parameters must not be currently in use for active calls.

The **local** parameter specifies the local DTE address.

The **remote** parameter specifies the remote DTE address.

The **action** parameter specifies whether the call is terminated at the DCE or goes right through to the DTE. The default is DCE.

activate miox circuit

Syntax

```
ACTIVATE MIOX=x25t-interface CIRCUIT=circuit-name
   [USER={APPLE|IP|IPX|PPP}]
```

where:

- *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7.
- *circuit-name* is an alphanumeric string from 1 to 15 characters long.

Description

This command pertains to circuits configured over SVCs. It activates a MIOX circuit, forcing an X.25 call to be set up to the remote router without the need to generate protocol traffic. This command can be used to test that the MIOX circuit has been correctly configured at both ends of the X.25 DTE link. If the circuit is already open or is attempting to open the command is ignored.

The **miox** parameter specifies the X.25 DTE interface over which the MIOX circuit has been defined. The X.25 DTE interface must already exist.

The **circuit** parameter specifies the name of the MIOX circuit to activate. The circuit name must already exist for the interface and must specify an SVC circuit. The circuit must be enabled and have a user module attached to it.

The **user** parameter specifies the user module and must be used if the circuit encapsulation supports multiple circuits. MIOX activates an X.25 call for the specified user module. The user module must be attached to the circuit. The **user** parameter is required for circuits with multiple encapsulations.

Examples

To activate the MIOX circuit “HeadOffice” on X.25 DTE interface 1, use the command:

```
activate miox=1 circuit=headoffice
```

Related Commands

add miox circuit
deactivate miox circuit
delete miox circuit
disable miox circuit
enable miox circuit
set miox circuit
show miox circuit

add miox circuit

Syntax

```
ADD MIOX=x25t-interface CIRCUIT=circuit-name
   {DTEADDRESS=dteaddress|PVC=1..4095} [CPAR=1..8]
   [ENCAP={APPLE|IP|IPX|NULL|MULTIPLE|PPP}]
   [COMMENT=comment] [COMP={ON|OFF}] [TCPCOMP={ON|OFF}]
```

where:

- *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7.
- *circuit-name* is an alphanumeric string from 1 to 15 characters long.
- *dteaddress* is a valid DTE address from 1 to 15 characters long.
- *comment* is an alphanumeric string from 1 to 40 characters long.

Description

This command adds a MIOX circuit over the X.25 DTE interface. Adding a MIOX circuit to an interface allows the router to transport protocols over the X.25 packet network to a remote router. A MIOX circuit, with appropriate local configuration settings, must be added to the routers at both ends of the X.25 DTE link for communication to take place.

The **miox** parameter specifies the X.25 DTE interface over which the MIOX circuit has been defined. The X.25 DTE interface must already exist.

The **circuit** parameter specifies the circuit name of the MIOX circuit to add, and must identify a unique circuit. The MIOX circuit name must not exist for the interface.

The **dteaddress** parameter specifies the DTE address of the remote router, if it is to be accessed via an SVC (*switched virtual circuit*). The DTE address must not be in use by any other MIOX circuits. Calls made to the remote router use the specified DTE address to make the call.

The **pvc** parameter creates a PVC channel to the remote router to be used by this MIOX circuit. The PVC channel must be valid for the X.25 DTE interface and must not be in use by another circuit or module.

Either **dteaddress** or **pvc** must be specified, but not both. A circuit can be supported over a PVC or an SVC, but not both simultaneously.

The **cpar** parameter specifies the index for the call parameters to use for the MIOX circuit. If a value is not specified, the default is the default call parameters assigned for the X.25 DTE interface in the last **create x25t** or **set x25t** command executed. If a call parameter index is specified, it must already exist. If no call parameter is specified, the call parameter index of 0 is created and used.

The **encap** parameter specifies the encapsulation to use. If MULTIPLE is specified, one X.25 channel is used for each higher layer protocol (e.g. IP, PPP, IPX). This may result in several circuits being opened to a remote router, each carrying a different protocol. If NULL is specified, the Null encapsulation is used to multiplex more than one higher layer protocol over a single X.25 circuit to the remote router associated with the circuit. If IP is specified, the circuit supports only IP encapsulation. Calls received for other protocols are rejected. If PPP is specified, the circuit supports only PPP encapsulation. Calls received for other protocols are rejected. If APPLE is specified, the circuit supports only

AppleTalk encapsulation. Calls received for other protocols are rejected. If IPX is specified, the circuit supports only IPX encapsulation. Calls received for other protocols are rejected. If the MIOX circuit is connected over a PVC, then only IP, IPX or NULL can be specified since the MULTIPLE option requires several X.25 channels and cannot run over a PVC. The default is MULTIPLE for SVCs and NULL for PVCs.

The same encapsulation must be specified on the routers at each end of the circuit. If different encapsulations are used, the routers cannot communicate with one another over the MIOX circuit.

The **comment** parameter specifies a string that provides a textual description of the MIOX circuit and is displayed in the output of the **show miox circuit** command on page 12-76.

The **comp** parameter enables or disables the use of packet compression for the MIOX circuit. When packet compression is used the remote router must be a compatible router that also supports the use of compression. The default is OFF.

The **tcpcomp** parameter enables or disables the use of TCP header compression. This is relevant when the circuit encapsulation supports IP. Van Jacobson's compression is used. Compression provides the most advantage on slower link speeds (up to 48 kbps). At speeds of 64 kbps and higher, compression actually reduces efficiency and so should be disabled. For successful TCP header compression, the remote router must also have TCP compression enabled for its corresponding circuit. The default is OFF.

Examples

To create a MIOX circuit called "RemoteOffice" on X.25 DTE interface 0 using PVC 1 and the NULL encapsulation, use the command:

```
add miox=1 circuit=remoteoffice pvc=1 encap=null
```

Related Commands

activate miox circuit
deactivate miox circuit
delete miox circuit
disable miox circuit
enable miox circuit
set miox circuit
show miox circuit

add x25c dteaddress

Syntax

`ADD X25C=`*`x25-interface`* `DTEADDRESS=`*`dteaddress`*

where:

- *x25-interface* is the number of the X.25 DCE logical interface from 0 to 7.
- *dteaddress* is a valid DTE address 1 to 15 characters long.

Description

This command adds a DTE address for a given X.25 DCE interface. The X.25 DCE interface must be specified and must already exist. A DTE address is any combination of decimal digits and the wildcard character 'x'. There is currently a limit of 20 DTE addresses that can be configured for any one X.25 DCE

interface. The X.25 interface responds to calls received through the network for any DTE addresses configured for that interface. The addition of a DTE address takes effect immediately.

Examples To configure X.25 DCE interface 2 to respond to calls from the network to DTE address 3302013, use the command:

```
add x25c=2 dteaddress=3302013
```

Related Commands
delete x25c dteaddress
show x25c dteaddress

add x25c huntgroup

Syntax `ADD X25C HUNTGROUP=`*`huntname`* `FORWARD=`*`ipadd`*

where:

- *huntname* is a character string from 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0–9), the underscore character ("_"), and the hyphen (-). If *huntname* contains spaces, it must be in double quotes.
- *ipadd* is an IP address in dotted decimal notation.

Description This command adds a DCE to a hunt group. This adds the IP address of another DCE in the hunt group.

The **huntgroup** parameter specifies the name of the hunt group to which the DCE is to be added. The hunt group must already exist.

The **forward** parameter specifies the IP address of the DCE to be added to the hunt group. The IP address cannot be a member of the hunt group already.

Examples To add a DCE with an IP address of 192.168.1.3 to the hunt group *Central*, use the command:

```
add x25c huntgroup=central forward=192.168.1.3
```

Related Commands
create x25c huntgroup
delete x25c huntgroup
destroy x25c huntgroup
set x25c
set x25c huntgroup
show x25c huntgroup

add x25c route

Syntax

```
ADD X25C ROUTE=dteaddress IPADDRESS=ipadd
   [INDEX=route-index]
```

where:

- *dteaddress* is a valid DTE address 1 to 15 characters long.
- *ipadd* is an IP address in dotted decimal notation.
- *route-index* is the position in the route table where the new route is to be inserted.

Description

This command adds a DTE route entry to the X.25 DCE route table. This table provides mappings between X.25 DTE addresses and the IP address of the router in the network that provides a connection to that address.

The DTE address and IP address must be specified. DTE address syntax is described in the section *DTE addresses*. The IP address must be specified in dotted decimal form.

If the index number is not specified, the new entry is added to the end of the X.25 route mapping table. If the index number is specified, the new entry is inserted into the table at that position and entries that had that number or higher are pushed down in the table. The index number is significant because the X.25 route table is searched sequentially in order of index number and the first match is taken as the mapping used. If the index number is higher that the number of entries in the table, the new entry is added to the end of the table, as if the index number was not specified at all. The index numbers for X.25 address mapping can be displayed with the **show x25c route** command on page 12-87.

The X.25 interface responds to incoming calls received from the DTE for the DTE addresses in the route table by routing them to their corresponding IP address. The addition of a route mapping takes effect immediately.

Examples

To configure the router to route calls received for DTE address 3302013 to the DTE with IP address 172.16.8.1, use the command:

```
add x25c route=3302013 ipaddress=172.16.8.1
```

Related Commands

delete x25c route
show x25c route

add x25t cpar

Syntax

```
ADD X25T CPAR=call-index [COPY=call-index] [MAXDATA={128|
   256|512|1024}] [NUI=nui] [RMAXDATA={128|256|512|1024}]
   [RWINDOW=1..127] [TMAXDATA={128|256|512|1024}]
   [TWINDOW=1..127] [USERDATA=hex-string] [WINDOW=1..127]
```

where:

- *call-index* is the index of the new call parameters or the call parameters to copy.
- *nui* is a character string from 1 to 16 characters long.
- *hex-string* is a string with 2 to 20 hexadecimal digits.

Description

This command creates a set of call parameters for X.25. The call parameter must not already exist. The **copy** parameter specifies a set of existing call parameters to copy as the default values for this call parameter set. The **copy** parameter, if present, must immediately follow the **cpar** parameter. Any parameters after COPY modify the copy of the call parameter set.

The **nui** parameter specifies the Network User Identification (NUI) to be used by this call.

The **tmaxdata** and **rmaxdata** parameters specify the maximum packet sizes for transmission and reception, respectively. The **maxdata** parameter is a shorthand form to specify the same maximum packet size for both transmission and reception. In all cases, the default is 0, which means use the interface default for a call (128).

The **twindow** and **rwindow** parameters specify the window for transmission and reception, respectively. The **window** parameter is a shorthand form to specify the same window for both transmission and reception. In all cases, the default is 0, which means use the interface default for a call (2).

The **userdata** parameter specifies the contents of the user data field for the call request for this call. This parameter specifies the protocol that this circuit carries.

Examples

To create call parameter set 1 for X.25 DTE interfaces that uses a maximum packet size of 256 bytes and a window size of 4 for both transmission and reception, use the command:

```
add x25t cpar=1 maxdata=256 window=4
```

Related Commands

create x25t
delete x25t cpar
set x25t cpar
show x25t cpar

create lapb

Syntax

```
CREATE LAPB=lapb-interface OVER={SYNn|ISDN-callname}
   [DOD={ON|OFF|YES|NO}] [MAXDATA=1080..32792]
   [MODULUS={8|128}] [N2=0..65535] [ROLE={DCE|DTE|DXE}]
   [WINDOW=1..127] [RMAXDATA=1080..32792]
   [TMAXDATA=1080..32792] [T1=1..120|500..10000]
   [T3=3..120]
```

where:

- *lapb-interface* is the number of the LAPB logical interface from 0 to 7.
- *n* is the number of the synchronous port over which the LAPB interface operates.

Description

This command creates an LAPB interface. The LAPB interface must not already exist.

The **over** parameter specifies the physical interface (synchronous port or ISDN call) to be used by the LAPB interface. The synchronous port must not have any other routing module configured to it.

The **dod** parameter specifies whether the LAPB interface is a dial-on-demand interface. The default is OFF.

The **maxdata** parameter specifies the maximum LAPB frame length in bits that the router uses or expects in an LAPB frame. The default is 2072.

The **modulus** parameter specifies the flow control modulus number. This is modulo 8 for operation in Basic mode, and modulo 128 for operation in Extended mode. When an LAPB interface is created, the default modulus setting is modulo 8.

The **n2** parameter specifies the number of times a frame is to be retransmitted at the expiration of the T1 timer. When the retransmission counter is exhausted the link is reset. The default for **n2** is 10.

The **role** parameter is used to determine the role of the LAPB interface. This parameter affects frame addressing and should be set according to the purpose of the interface. If the interface is connecting to a DCE network then the role should be set to DTE. If the interface is connecting to a DTE device then the role should be set to DCE. There is an exception to this when directly connecting two routers as DTE devices. In this situation, one router is set to DCE while the other is set to DTE. When an LAPB interface is created, the default role setting is DTE.

The **t1** parameter specifies the time in seconds or milliseconds for the T1 timer associated with the LAPB interface. Timer T1 prevents frames from being lost by the LAPB interface. The time period should be longer than the maximum time delay between transmission of a frame and reception of its acknowledgement. When the time expires, an unacknowledged frame is retransmitted. If the value specified is from 1 to 120, it is assumed to be in units of seconds. If the value specified is from 500 to 10 000, it is assumed to be in milliseconds. The default is 2000.

The **t3** parameter specifies the time in seconds for the T3 timer associated with the LAPB interface. Timer T3 is used as a watchdog to check that the line is still active after a period of T3 seconds with no frames being exchanged. The default for **t3** is set to 40 seconds.

The **window** parameter is used to specify the maximum number of information frames that the LAPB interface may send before requiring an acknowledgement for the outstanding frames. The maximum ranges for this value are dependant on the modulus of the interface. When operating in modulo 8 the window size may be set from 1 to 7, when operating in modulo 128 the window size may be set from 1 to 127. The default window size is 7.

Examples To create LAPB interface 0 over synchronous interface 0 with default settings for all parameters, use the command:

```
create lapb=0 over=syn0
```

Related Commands
destroy lapb
reset lapb
set lapb
show lapb

create x25c

Syntax

```
CREATE X25C=x25-interface OVER=LAPBn [DEFPKT={128|256|512|
   1024|2048|4096}] [DEFTHROUGH={75|150|300|600|1200|2400|
   4800|9600}] [DEFWIN=2..7] [HGROUP=huntname]
   [INLCGN=0..15] [INLCN=0..128] [MAXACTIVE=0..128]
   [OUTLCGN=0..15] [OUTLCN=0..128] [PACKETSIZE={ON|OFF}]
   [THROUGHPUT={ON|OFF}] [TWOLCGN=0..15] [TWOLCN=0..128]
   [WINDOW={ON|OFF}]
```

where:

- *x25-interface* is the number of the X.25 DCE logical interface from 0 to 7.
- *n* is the number of the LAPB interface over which the X.25 DCE interface runs.

Description This command creates an X.25 DCE interface. The X.25 DCE interface must not already exist. The TCP listen port 01998 is closed by default until this command or the SET X25C TCPKEEPALIVE command is executed. The port then remains open until a router restart.

The **over** parameter specifies the layer 2 entity (LAPB) to be used by the X.25 DCE interface. The layer 2 entity must already exist and must not be in use by any other routing module.

The **defpkt** parameter sets the default packet size for the X.25 DCE interface. This parameter must have the same value on all routers in the X.25 network. The default is 128.

The **defthrough** parameter sets the default through-put class for the X.25 DCE interface. This parameter must have the same value on all routers in the X.25 network. The default is 9600.

The **defwin** parameter sets the default window size for the X.25 DCE interface. This parameter must have the same value on all routers in the X.25 network. The default is 2.

The **inlcgn** parameter specifies the Logical Channel Group Number (LCGN) for incoming calls on the X.25 DCE interface. The value must be unique; the same LCGN cannot be used for outgoing or two-way calls. The default is 0.

The **inlcn** parameter specifies the maximum number of active channels permitted for incoming calls on the X.25 DCE interface. LCN 0 is reserved. If INLCN is set to zero, no channels are available for incoming calls. Setting INLCN to *n* allocates LCNs 1 to *n* for incoming calls. The default is 0.

The **maxactive** parameter specifies the total maximum number of active channels permitted on the X.25 DCE interface. The default is 24.

The **outlcgn** parameter specifies the Logical Channel Group Number (LCGN) for outgoing calls on the X.25 DCE interface. The value must be unique; the same LCGN cannot be used for incoming or two-way calls. The default is 0.

The **outlcn** parameter specifies the maximum number of active channels permitted for outgoing calls on the X.25 DCE interface. LCN 0 is reserved. If OUTLCN is set to zero, no channels are available for outgoing calls. Setting OUTLCN to *n* allocates LCNs 1 to *n* for outgoing calls. The default is 0.

The **packetsize** parameter specifies whether packet size negotiation is enabled or disabled. The default is OFF.

The **throughput** parameter specifies whether through-put class negotiation is enabled or disabled. The default is OFF.

The **twolcgn** parameter specifies the Logical Channel Group Number (LCGN) for two-way calls on the X.25 DCE interface. The value must be unique; the same LCGN cannot be used for incoming or outgoing calls. The default is 0.

The **twolcn** parameter specifies the maximum number of active channels permitted for two-way calls on the X.25 DCE interface. LCN 0 is reserved. If TWOLCN is set to zero, no channels are available for two-way calls. Setting TWOLCN to *n* allocates LCNs 1 to *n* for two-way calls. The default is 0.

The window parameter specifies whether window size negotiation is enabled or disabled. The default is OFF.

Examples

To create X.25 DCE interface 0 over LAPB interface 0 with a maximum of 64 incoming calls on Logical Channel Group Number 0, 64 outgoing calls on LCGN 1, 32 two-way calls on LCGN 2 and 48 active channels, use the command:

```
create x25c=0 over=lapb0 inlcgn=0 inlcn=64 maxactive=48
   outlcgn=1 outlcn=64 twolcgn=2 twolcn=32
```

Related Commands

destroy x25c
set x25c
show x25c

create x25c huntgroup

Syntax

```
CREATE X25C HUNTGROUP=huntname IPADDRESS=ipadd
   DTEADDRESS=dteadd [FORWARDTIME=1..360]
   [RECONNECTTIME=1..360]
```

where:

- *huntname* is a character string from 1 to 15 characters long. Valid characters are uppercase and, lowercase letters, digits (0-9), the underscore character ("_"), and the hyphen (-). If *huntname* contains spaces, it must be in double quotes.
- *ipadd* is an IP address in dotted decimal notation.
- *dteadd* is a DTE address consisting of from 1 to 15 characters of decimal digits (0-9).

Description

This command creates an X.25 DCE hunt group on the router.

The **huntgroup** parameter specifies the name of the hunt group to be created. The hunt group must not already exist. The name is case insensitive for distinguishing hunt groups, but the case entered is preserved for display purposes.

The **ipaddress** parameter specifies the IP address by which this hunt group is connected to. This must be the address of an IP interface on this router.

The **dteaddress** parameter specifies the DTE address for the hunt group. All incoming calls for this DTE address are assumed to be for the hunt group. The address must be different from the DTE addresses of the individual X.25 interfaces on the router, and different from the DTE address of other hunt groups defined on this router.

The **forwardtime** parameter specifies the time in seconds for the forward timer. This timer determines the time that the router waits for a response when forwarding an incoming X.25 call request to a forward router in the hunt group. This timer should be set to the same values on all the DCEs in a hunt group. The default is 60.

The **reconnecttime** parameter specifies the time in seconds for the reconnect timer. This timer determines how long the router reserves a channel after it has sent a Channel Reserved message to the calling router with the DTE address and IP address required to make the call. This timer should be set to the same values on all the DCEs in a hunt group. The default is 60.

Examples

To create a hunt group called Central, with a DTE address of 55512345 and an IP address of 192.168.2.45, use the command:

```
create x25c huntgroup=central ip=192.168.2.45 dte=55512345
```

Related Commands

add x25c huntgroup
delete x25c huntgroup
destroy x25c huntgroup
set x25c
set x25c huntgroup
show x25c huntgroup

create x25t

Syntax

```
CREATE X25T=x25-interface OVER={LAPBn|LAPDn}
   [MAXACTIVE=0..4095] [MODULUS={8|128}] [T20=1..360]
   [T21=1..360] [T22=1..360] [T23=1..360] [T24={1..360|
   OFF}] [T27={1..360|OFF}] [MINRECALL=1..360]
   [R20=0..65535] [R22=0..65535] [R23=0..65535]
   [R27=0..65535] [NPVC=0..4095] [DEFCPAR=0..8]
   [DTEADDRESS=dteaddress] [LIC=0..4095] [HIC=0..4095]
   [LTC=0..4095] [HTC=0..4095] [LOC=0..4095] [HOC=0..4095]
   [ROLE={DYNAMIC|DCE|DTE}]
```

where:

- *x25-interface* is the number of the X.25 DTE logical interface from 0 to 7.
- *n* is the number of the LAPB or LAPD interface over which the X.25 interface runs.
- *dteaddress* is a valid DTE address 1 to 15 characters long.

Description

This command creates an instance of the X.25 DTE module, that is, an X.25 interface. The X.25 interface must not already exist.

The **over** parameter specifies the layer 2 entity (LAPB or LAPD) to be used by the X.25 interface. The layer 2 entity must already exist and must not be in use by another X.25 DTE interface. If an LAPB interface is used, it must not be in use by any other routing module.

The **maxactive** parameter sets the maximum number of circuits this X.25 DTE can support, including PVCs. It must not be less than the actual number of PVCs. The default is 4095. The X.25 DTE interface must be reset with the **reset x25t** command on page 12-58 before this command takes effect, since there may be more than the maximum number of circuits active already.

The **modulus** parameter sets the modulus of packet sequence numbers for this interface. The default is 8. The X.25 DTE interface must be reset with the **reset x25t** command on page 12-58 before this command takes effect, since this command affects all circuits on the interface.

The **t20** parameter sets the value in seconds of the restart timer. The default is 180. The **t21** parameter sets the value in seconds of the call timer. The default is 200. The **t22** parameter sets the value in seconds of the reset timer. The default is 180. The **t23** parameter sets the value in seconds of the clear timer. The default is 180. The **t24** parameter sets the value in seconds of the optional window timer. The default is 60. The timer can be turned off by specifying the value OFF. The **t27** parameter sets the value in seconds of the reject response timer. The default is 60. The timer can be turned off by specifying the value OFF. The **minrecall** parameter sets the value in seconds of the time to wait before retrying a particular call. The default is 60.

The **r20** parameter sets the value of the restart retransmission counter. The default is 1. The R22 parameter sets the value of the reset request retransmission counter. The default is 1. The **r23** parameter sets the value of the clear request retransmission counter. The default is 1. The **r27** parameter sets the value of the reject retransmission counter. The default is 0.

The **npvc** parameter sets the number of channels reserved as PVCs. The default is 0.

The **defcpar** parameter specifies the index of the default call parameter definition to use for this interface. If 0 or no value is specified, a CPAR is created and used, which has a value of 0. The call parameter definition (if not 0) must already exist.

The **dteaddress** parameter specifies the DTE address for the interface.

The **lic** parameter specifies the lowest incoming channel number. The default is 0. The **hic** parameter specifies the highest incoming channel number. A value of 0 means no incoming channels. The default is 0. The **ltc** parameter specifies the lowest two-way channel number. The default is 1. The **htc** parameter specifies the highest two-way channel number. A value of 0 means no two-way channels. The default is 4095. The **loc** parameter specifies the lowest outgoing channel number. The default is 0. The **hoc** parameter specifies the highest outgoing channel number. A value of 0 means no outgoing channels. The default is 0. The values of **lic, hic, ltc, htc, loc, ltc, npvc and maxactive** must be consistent with one another.

The **role** parameter specifies the role this DTE plays in a DTE-DTE environment. The default is DYNAMIC, which means that during the restart procedure, the two DTEs negotiate which DTE will act as DCE.

Examples To create X.25 DTE interface 0 over LAPB interface 0 with PVCs on channels 1 to 5, two-way SVCs on channels 6 to 15 and default call parameter set 1, use the command:

```
create x25t=0 over=lapb0 npvc=5 ltc=6 htc=15 defcpar=1
```

Related Commands

add x25t cpar
destroy x25t
set x25t
set x25t cpar
reset x25t
show x25t
show x25t cpar

deactivate miox circuit

Syntax

```
DEACTIVATE MIOX=x25t-interface CIRCUIT=circuit-name
   [USER={APPLE|IP|IPX|PPP}]
```

where:

- *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7.
- *circuit-name* is an alphanumeric string from 1 to 15 characters long.

Description This command deactivates a MIOX circuit. When a circuit has an active X.25 call this command can be used to closed the call to the remote router. If the circuit is already closed the command is ignored.

The **miox** parameter specifies the X.25 DTE interface over which the MIOX circuit has been defined. The X.25 DTE interface must already exist.

The **circuit** parameter specifies the name of the MIOX circuit to deactivate. The circuit name must already exist for the interface and must specify an SVC circuit. The circuit must be enabled and have a user module attached to it.

The **user** parameter specifies the user module and must be used if the circuit encapsulation supports multiple circuits. MIOX deactivates the X.25 call for the specified user module. The user module must be attached to the circuit. The USER parameter is required for circuits with multiple encapsulations.

Examples To deactivate the MIOX circuit "HeadOffice" on X.25 DTE interface 1, use the command:

```
deactivate miox=1 circuit=headoffice
```

Related Commands

activate miox circuit
add miox circuit
delete miox circuit
disable miox circuit
enable miox circuit
set miox circuit
show miox circuit

delete miox circuit

Syntax `DELETE MIOX=`*`x25t-interface`* `CIRCUIT=`*`circuit-name`*

where:

- *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7.
- *circuit-name* is an alphanumeric string from 1 to 15 characters long.

Description This command deletes a MIOX circuit. Deleting a MIOX circuit from an interface destroys the connection to the remote router. When a MIOX circuit is deleted, the remote router's corresponding MIOX circuit should also be deleted. A MIOX circuit cannot be deleted when protocols are using the circuit. Configured protocols must be detached before deleting the circuit.

The **miox** parameter specifies the X.25 DTE interface over which the MIOX circuit has been defined. The X.25 DTE interface must already exist.

The **circuit** parameter specifies the name of the MIOX circuit to delete. The circuit name must already exist for the interface. The circuit must not have any user modules attached to it.

Examples To delete the MIOX circuit "HeadOffice" on X.25 DTE interface 1, use the command:

```
delete miox=1 circuit=headoffice
```

Related Commands

activate miox circuit
add miox circuit
deactivate miox circuit
disable miox circuit
enable miox circuit
set miox circuit
show miox circuit

delete x25c dteaddress

Syntax `DELETE X25C=`*`x25-interface`* `DTEADDRESS=`*`dteaddress`*

where:

- x25-interface is the number of the X.25 DCE logical interface from 0 to 7.
- *dteaddress* is a valid DTE address 1 to 15 characters long, or the index into the DTE address table for the specified X.25 DCE Interface.

Description This command removes a DTE address from a given X.25 DCE interface. The X.25 DCE interface must be specified and must already exist.

The parameter **dteaddress** searches configured DTE addresses for a specific interface. If a matching DTE address is found, then it is removed from the table. If no matching DTE address is found and DTEADDRESS is a valid index number, then the DTE address with the corresponding index number is removed from the table. Index numbers can be obtained by looking at the display of the **show x25c dteaddress** command.

This command takes effect immediately. The given X.25 DCE interface no longer responds to calls to the DTE address.

Examples To delete DTE address 3302013 from X.25 DCE interface 0 so that the interface no longer responds to calls to that DTE address, use the command:

```
delete x25c=0 dteaddress=3302013
```

Related Commands

add x25c dteaddress
show x25c dteaddress

delete x25c huntgroup

Syntax `DELETE X25C HUNTGROUP=`*`huntname`* `FORWARD=`*`ipadd`*

where:

- *huntname* is a character string from 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character ("_"), and the hyphen (-). If *huntname* contains spaces, it must be in double quotes.
- *ipadd* is an IP address in dotted decimal notation.

Description This command deletes a DCE from a hunt group. This deletes the IP address of a DCE in the hunt group.

The **huntgroup** parameter specifies the name of the hunt group from which the DCE is deleted. The hunt group must exist.

The **forward** parameter specifies the IP address of the DCE to be deleted from the hunt group. The IP address must already be a member of the hunt group.

Examples To delete a DCE with an IP address of 192.168.1.2 from the hunt group *Central*, use the command:

```
delete x25c huntgroup=central forward=192.168.1.2
```

Related Commands
add x25c huntgroup
create x25c huntgroup
destroy x25c huntgroup
set x25c huntgroup
show x25c huntgroup

delete x25c route

Syntax `DELETE X25C ROUTE=`*`dteaddress`*

where:

- *dteaddress* is a valid DTE address 1 to 15 characters long, or the index into the DTE address table for the specified X.25 DCE Interface.

Description This command removes a DTE route entry from the X.25 DCE route table. This table provides mappings between X.25 DTE addresses and the IP address of the router in the network that provides a connection to that address.

The **dteaddress** parameter must be specified and may be either a DTE address or the index into the route table of a DTE address. The table is first checked for a matching DTE address, and if found that DTE address and its route mapping are deleted. If no matching DTE address was found and the DTEADDRESS parameter is a valid index into the table then the DTE address corresponding to the index number is removed. The index number for a particular X.25 address mapping can be obtained from the output of the **show x25c route** command on page 12-87. Once a route entry is deleted, all entries with a higher number than

the one deleted are renumbered, so that the table has consecutively numbered entries.

Examples To delete the route to DTE address 3302013, use the command:

```
delete x25c route=3302013
```

Related Commands
add x25c route
show x25c route

delete x25t cpar

Syntax `DELETE X25T CPAR=`*`call-index`*

where *call-index* is the index of the call parameters to delete

Description This command deletes a set of call parameters for X.25. The call parameters must already exist, and must not be the default for an X.25 DTE interface or PVC, or be in use by an active call.

Examples To delete X.25 DTE call parameter set 1, use the command:

```
delete x25t cpar=1
```

Related Commands
add x25t cpar
set x25t cpar
show x25t cpar

destroy lapb

Syntax `DESTROY LAPB=`*`lapb-interface`*

where *lapb-interface* is the number of the LAPB logical interface from 0 to 7

Description This command destroys an LAPB interface. The LAPB interface must already exist. No routing module may be configured to LAPB for the command to be successful. If a module is configured to LAPB then that module must be destroyed or deconfigured before the LAPB interface may be destroyed.

Examples To destroy LAPB interface 2, use the command:

```
destroy lapb=2
```

Related Commands
create lapb
reset lapb
set lapb
show lapb

destroy x25c

Syntax `DESTROY X25C=`*`x25-interface`*

where *x25-interface* is the number of the X.25 DCE logical interface, from 0 to 7

Description This command destroys an X.25 DCE interface. The X.25 DCE interface must already exist.

Examples To destroy X.25 DCE interface 1, use the command:

```
destroy x25c=1
```

Related Commands
create x25c
set x25c
show x25c

destroy x25c huntgroup

Syntax `DESTROY X25C HUNTGROUP=`*`huntname`*

where *huntname* is a character string from 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character ("_"), and the hyphen (-). If *huntname* contains spaces, it must be in double quotes.

Description This command destroys an X.25 DCE hunt group on the router.

The **huntgroup** parameter specifies the name of the hunt group to be destroyed. The hunt group must exist.

Examples To destroy a hunt group called *Remote*, use the command:

```
destroy x25c huntgroup=remote
```

Related Commands
create x25c huntgroup
set x25c
SHOW X25C HUNTGROUP

destroy x25t

Syntax `DESTROY X25T=`*`x25-interface`*

where *x25-interface* is the number of the X.25 DTE logical interface, from 0 to 7

Description This command destroys an X.25 DTE interface. The X.25 DTE interface must already exist. The interface is not destroyed when higher layer entities are attached to the X.25 DTE interface.

Examples To destroy X.25 DTE interface 1, use the command:

```
destroy x25t=1
```

Related Commands
create x25t
set x25t
reset x25t
show x25t

disable miox circuit

Syntax `DISABLE MIOX=x25t-interface CIRCUIT=circuit-name`

where:

- *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7.
- *circuit-name* is an alphanumeric string from 1 to 15 characters long.

Description This command disables a previously enabled MIOX circuit. Once a circuit is disabled, X.25 calls are not attempted or accepted and data is not exchanged with the remote router. If the call is active and is an SVC, the call is closed.

The **miox** parameter specifies the X.25 DTE interface over which the MIOX circuit has been defined. The X.25 DTE interface must already exist.

The **circuit** parameter specifies the name of the MIOX circuit to disable. The circuit name must already exist for the interface.

Examples To temporarily disable MIOX circuit "HeadOffice" on X.25 DTE interface 1, use the command:

```
disable miox=1 circuit=headoffice
```

Related Commands
activate miox circuit
add miox circuit
deactivate miox circuit
delete miox circuit
enable miox circuit
set miox circuit
show miox circuit

disable x25c debug

Syntax `DISABLE X25C=x25-interface DEBUG`

where *x25-interface* is the number of the X.25 DCE logical interface from 0 to 7

Description This command disables debugging on the X25C interface. Debugging is disabled by default.

Example To disable debugging on a on X25C interface 0, use the command:

```
disable x25c=0 debug
```

Related Commands
create x25c
enable x25c debug
set x25c
show x25c

enable miox circuit

Syntax `ENABLE MIOX=`*`x25t-interface`* `CIRCUIT=`*`circuit-name`*

where:

- *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7.
- *circuit-name* is an alphanumeric string from 1 to 15 characters long.

Description This command enables a previously disabled MIOX circuit. When MIOX circuits are added to the X.25 DTE interface they are by default enabled. Once a circuit is enabled, X.25 calls are attempted and accepted and data is exchanged with the remote router.

The **miox** parameter specifies the X.25 DTE interface over which the MIOX circuit has been defined. The X.25 DTE interface must already exist.

The **circuit** parameter specifies the name of the MIOX circuit to enable. The circuit name must already exist for the interface.

Examples To enable MIOX circuit "HeadOffice" on X.25 DTE interface 1, use the command:

```
enable miox=1 circuit=headoffice
```

Related Commands
activate miox circuit
add miox circuit
deactivate miox circuit
delete miox circuit
disable miox circuit
set miox circuit
show miox circuit

enable x25c debug

Syntax `ENABLE X25C=`*`x25-interface`* `DEBUG`

where *x25-interface* is the number of the X.25 DCE logical interface from 0 to 7

Description This command enables debugging on the X25C interface. When debugging is enabled for an X25C interface, packet traces for all packets sent and received on all LCNs on the interface are displayed on the terminal from which the command was entered. Debugging is disabled by default.

Example To enable debugging on a on X25C interface 0, use the command:

```
enable x25c=0 debug
```

Related Commands
create x25c
disable x25c debug
set x25c
show x25c

reset lapb

Syntax `RESET LAPB=`*`lapb-interface`*

where *lapb-interface* is the number of the LAPB logical interface from 0 to 7

Description This command resets an LAPB interface. The LAPB interface must already exist. This is used to update the operational parameters for an LAPB interface and initiates the LAPB restart procedure.

Examples To reinitialise LAPB interface 0, use the command:

```
reset lapb=0
```

Related Commands
create lapb
destroy lapb
set lapb
show lapb

reset x25t

Syntax `RESET X25T=`*`x25-interface`*

where *x25-interface* is the number of the X.25 DTE logical interface, from 0 to 7

Description This command resets an X.25 DTE instance. The X.25 DTE interface must already exist. Two copies of an X.25 interface's parameters exist, the administrative copy and the operational copy. The administrative copy is altered by the ADD, CREATE, DELETE and SET commands. The operational

copy is the copy used for the actual operation of the interface. The RESET command copies the administrative parameters to the operational parameters, clears all switched circuits, resets all PVCs, and restarts the interface. The RESET command must be used after changes have been made to X.25 parameters for those changes to take effect.

Examples To reset X.25 DTE interface 1 to its configured settings, use the command:

```
reset x25t=1
```

Related Commands

create x25t
destroy x25t
set x25t
show x25t

set lapb

Syntax

```
SET LAPB=lapb-interface [MODULUS={8|128}] [N2=1..40]
   [ROLE={DCE|DTE|DXE}] [RMAXDATA=1080..32792]
   [TMAXDATA=1080..32792] [WINDOW=1..127] [T1=1..120|
   500..10000] [T3=3..120]
```

where *lapb-interface* is the number of the LAPB logical interface, from 0 to 7

Description This command sets the operational parameters for an LAPB interface. The LAPB interface must already exist. The LAPB interface must be reset with the **reset lapb** command on page 12-58 for the changes to take effect.

The **maxdata** parameter specifies the maximum LAPB frame length, in bits, that the router uses or expects in an LAPB frame. The default is 2072.

The **modulus** parameter specifies the flow control modulus number. This is modulo 8 for operation in Basic mode, and modulo 128 for operation in Extended mode. When an LAPB interface is created, the default modulus setting is modulo 8.

The **role** parameter is used to determine the role of the LAPB interface. This parameter affects frame addressing and should be set to according to the purpose of the interface. If the interface is connecting to a DCE network then the role should be set to DTE. If the interface is connecting to a DTE device then the role should be set to DCE. There is an exception to this when directly connecting two routers as DTE devices. When an LAPB interface is created, the default role setting is DTE.

The **window** parameter is used to specify the maximum number of information frames that the LAPB interface may send before requiring an acknowledgement for the outstanding frames. The maximum ranges for this value are dependant on the modulus of the interface. When operating in modulo 8 the window size may be set from 1 to 7, when operating in modulo 128 the window size may be set from 1 to 127. The default window size is 7.

The **t1** parameter specifies the time, in seconds or milliseconds, for the T1 timer associated with the LAPB interface. Timer T1 is used to prevent frames from being lost by the LAPB interface. The timer period should be longer than the maximum time delay between transmission of a frame and reception of its

acknowledgement. When the time expires, an unacknowledged frame is retransmitted. If the value is from 1 to 120, it is assumed to be seconds. If the value is from 500 to 10 000, it is assumed to be milliseconds. The default is 2000.

The **t3** parameter specifies the time in seconds for the T3 timer associated with the LAPB interface. Timer T3 is used as a watchdog to check that the line is still active after a period of T3 seconds with no frames being exchanged. The default for **t3** is 40 seconds.

The **n2** parameter specifies the number of times a frame is to be retransmitted at the expiration of the T1 timer. When the retransmission counter is exhausted, the link is reset. The default for **n2** is 10.

Examples To set the modulus for LAPB interface 3 to 128, use the command:

```
set lapb=0 modulus=128
```

Related Commands
create lapb
destroy lapb
reset lapb
show lapb

set miox

Syntax

```
SET MIOX=x25t-interface [MINOPEN=10..360]
   [INACTIVE=10..360] [HOLDDOWN=10..360]
   [COLLISION=10..360] [FAILURE=10..360]
```

where *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7

Description This command sets the operational parameters for the MIOX entity associated with an X.25 DTE interface. The X.25 DTE interface must already exist. All parameters are timer values that are used to determine the operation of switched virtual calls over the X.25 DTE interface. Alterations to the MIOX parameters take effect immediately. All MIOX timer parameters are specified in seconds.

The **minopen** parameter sets the minimum time in seconds to keep a call open after it has been successfully established. After the specified time, the MIOX layer closes the call provided the link has been idle for a period of time specified by the **inactive** parameter. The default is 60 seconds.

The **inactive** parameter specifies the time in seconds that a call must remain inactive before it is closed. A call is considered inactive when no data has been transmitted or received over that call. The call is not closed if the **minopen** parameter would be compromised by doing so. The default is 60 seconds.

The **holddown** parameter sets the minimum time in seconds to wait after a call has failed before retrying the call. The default is 60 seconds.

The **collision** parameter specifies the time in seconds to wait before retrying a call after a call failed due to a lack of available X.25 channels. The default is 60 seconds.

The **failure** parameter sets the time in seconds to wait before considering an attempted outgoing call to have failed. The call is retried after the time specified by the **holddown** parameter. The default is 60 seconds.

Examples To configure the MIOX circuits on X.25 DTE interface 1 to disconnect after 30 seconds of inactivity, use the command:

```
set miox=1 inactive=30
```

Related Commands **show miox**

set miox circuit

Syntax

```
SET MIOX=x25t-interface CIRCUIT=circuit-name
   [{DTEADDRESS=dteaddress|PVC=1..4095}] [CPAR=1..8]
   [ENCAP={APPLE|IP|IPX|NULL|MULTIPLE|PPP}]
   [COMMENT=comment] [COMP={ON|OFF}] [TCPCOMP={ON|OFF}]
```

where:

- *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7
- *circuit-name* is an alphanumeric string from 1 to 15 characters long.
- *dteaddress* is a valid DTE address from 1 to 15 characters long.
- *comment* is an alphanumeric string from 1 to 40 characters long.

Description This command sets the operational parameters of a MIOX circuit and takes effect immediately. The circuit must already exist. Equivalent changes must be made to the MIOX circuits on the routers at both ends of the X.25 DTE link for communication to take place.

The **miox** parameter specifies the X.25 DTE interface over which the MIOX circuit has been defined. The X.25 DTE interface must already exist.

The **circuit** parameter specifies the circuit name of the MIOX circuit, and must identify a unique circuit. The MIOX circuit name must already exist for the interface.

The **dteaddress** parameter specifies a DTE address for the remote router, if it is to be accessed via an SVC (*switched virtual circuit*). The DTE address must not be in use by any other MIOX circuits. Changing the DTE address causes currently active calls to the old DTE address to be closed. Calls made to the remote router after the successful execution of this command use the DTE address to make the call. If the circuit was previously active over an X.25 PVC, then the circuit detaches from the PVC.

The **pvc** parameter creates a PVC channel to the remote router to be used by this MIOX circuit. The PVC channel number must be valid for the X.25 DTE interface and must not be in use by another circuit or module. Changing the PVC channel closes current calls to the remote router and detaches the circuit from the old PVC.

Either DTEADDRESS or PVC must be specified, but not both. A circuit can be supported over a PVC or an SVC, but not both simultaneously.

The **cpar** parameter specifies the index for the call parameters to use for the MIOX circuit. If a value is not specified, the default is the default call parameters assigned for the X.25 DTE interface in the last **create x25t** command or **set x25t** command executed. If a call parameter index is specified, it must already exist. If no call parameter is specified, the call parameter index of 0 is created and used.

The **encap** parameter specifies the encapsulation to use. If MULTIPLE is specified, one X.25 channel is used for each higher layer protocol (i.e. IP, IPX, Frame Relay). This may result in several circuits being opened to a remote router, each carrying a different protocol. If NULL is specified, the Null encapsulation is used to multiplex more than one higher layer protocol over a single X.25 circuit to the remote router associated with the circuit. If IP is specified, the circuit supports only the encapsulation. Calls received for other protocols are be rejected. If APPLE is specified, the circuit supports only AppleTalk encapsulation. Calls received for other protocols are rejected. If IPX is specified, the circuit supports only IPX encapsulation. Calls received for other protocols are rejected. If IPX is specified, the circuit supports only IPX encapsulation. Calls received for other protocols are rejected. If the MIOX circuit is connected over a PVC, then only IP, IPX or NULL can be specified since the MULTIPLE option requires several X.25 channels and cannot run over a PVC.

The same encapsulation must be specified on the routers at each end of the circuit. If different encapsulations are used the routers cannot communicate with one another over the MIOX circuit.

The **comment** parameter specifies a string that provides a textual description of the MIOX circuit and is displayed in the output of the **show miox circuit** command on page 12-76.

The **comp** parameter enables or disables the use of packet compression for the MIOX circuit. When packet compression is used the remote router must be a compatible router that also supports the use of compression.

The **tcpcomp** parameter enables or disables the use of TCP header compression. This is relevant when the circuit encapsulation supports IP. Van Jacobson's compression is used. Compression provides the most advantage on slower link speeds (up to 48 kbps). At speeds of 64 kbps and higher, compression actually reduces efficiency and so should be disabled. For successful TCP header compression, the remote router must also have TCP compression enabled for its corresponding circuit.

Examples

To set the encapsulation to IP and enable TCP header compression for MIOX circuit "HeadOffice" on X.25 DTE interface 1, use the command:

```
set miox=1 circuit=headoffice encap=ip tcpcomp=on
```

Related Commands

activate miox circuit
add miox circuit
deactivate miox circuit
delete miox circuit
disable miox circuit
enable miox circuit
show miox circuit

set x25c

Syntax

```
SET X25C=x25-interface [DEFPKT={128|256|512|1024|2048|
   4096}] [DEFTHROUGH={75|150|300|600|1200|2400|4800|
   9600}] [DEFWIN=2..7] [HGROUP[=huntname]] [INLCGN=0..15]
   [INLCN=0..128] [MAXACTIVE=0..128] [OUTLCGN=0..15]
   [OUTLCN=0..128] [PACKETSIZE={ON|OFF}] [THROUGHPUT={ON|
   OFF}] [TWOLCGN=0..15] [TWOLCN=0..128] [WINDOW={ON|OFF}]
```

where:

- *x25-interface* is the number of the X.25 DCE logical interface, from 0 to 7.
- *huntname* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character (“_”), and the hyphen (-). If *huntname* contains spaces, it must be in double quotes.

Description

This command changes the operational parameters of an X.25 DCE interface. The X.25 DCE interface number must be specified and must already exist. The X.25 DCE interface must be reset with the RESET X25C command for the changes to take effect.

The **defpkt** parameter sets the default packet size for the X.25 DCE interface. This parameter must have the same value on all routers in the X.25 network. The default is 128.

The **defthrough** parameter sets the default through-put class for the X.25 DCE interface. This parameter must have the same value on all routers in the X.25 network. The default is 9600.

The **defwin** parameter sets the default window size for the X.25 DCE interface. This parameter must have the same value on all routers in the X.25 network. The default is 2.

The **hgroup** parameter specifies the hunt group to which the X.25 DCE interface belongs. If no hunt group is specified, the **huntgroup** parameter removes the X.25 DCE interface from any hunt group to which it belonged. The hunt group, if specified, must already exist on the router. The default is for the interface not to belong to a hunt group.

The **inlcgn** parameter specifies the Logical Channel Group Number (LCGN) for incoming calls on the X.25 DCE interface. The value must be unique; the same LCGN cannot be used for outgoing or two-way calls. The default is 0.

The **inlcn** parameter specifies the maximum number of active channels permitted for incoming calls on the X.25 DCE interface. LCN 0 is reserved. If INLCN is set to zero, no channels are available for incoming calls. Setting INLCN to *n* allocates LCNs 1 to *n* for incoming calls. The default is 0.

The **maxactive** parameter specifies the total maximum number of active channels permitted on the X.25 DCE interface. The default is 24.

The **outlcgn** parameter specifies the Logical Channel Group Number (LCGN) for outgoing calls on the X.25 DCE interface. The value must be unique; the same LCGN cannot be used for incoming or two-way calls. The default is 0.

The **outlcn** parameter specifies the maximum number of active channels permitted for outgoing calls on the X.25 DCE interface. LCN 0 is reserved. If **outlcn** is set to zero, no channels are available for outgoing calls. Setting **outlcn** to *n* allocates LCNs 1 to *n* for outgoing calls. The default is 0.

The **packetsize** parameter specifies whether packet size negotiation is enabled or disabled. The default is OFF.

The **throughput** parameter specifies whether through-put class negotiation is enabled or disabled. The default is OFF.

The **twolcgn** parameter specifies the Logical Channel Group Number (LCGN) for two-way calls on the X.25 DCE interface. The value must be unique; the same LCGN cannot be used for incoming or outgoing calls. The default is 0.

The **twolcn** parameter specifies the maximum number of active channels permitted for two-way calls on the X.25 DCE interface. LCN 0 is reserved. If **twolcn** is set to zero, no channels are available for two-way calls. Setting **twolcn** to *n* allocates LCNs 1 to *n* for two-way calls. The default is 0.

The **window** parameter specifies whether window size negotiation is enabled or disabled. The default is OFF.

Examples

To set the Logical Channel Group Number (LCGN) for two-way calls on X.25 DCE interface 0 to 2, the maximum number of active channels permitted for two-way calls to 16, and the maximum number of active channels permitted on the X.25 DCE interface to 128, use the command:

```
set x25c=0 maxactive=128 twolcgn=2 twolcn=16
```

Related Commands

create x25c
destroy x25c
set x25c huntgroup
show x25c

set x25c huntgroup

Syntax

```
SET X25C HUNTGROUP=huntname [IPADDRESS=ipadd]
   [DTEADDRESS=dteadd] [FORWARDTIME=1..360]
   [RECONNECTTIME=1..360]
```

where:

- *huntname* is a character string 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character ("_"), and the hyphen (-). If *huntname* contains spaces, it must be in double quotes.
- *ipadd* is an IP address in dotted decimal notation.
- *dteadd* is a DTE address consisting of 1 to 15 characters of decimal digits (0-9).

Description

This command changes the parameters for an X.25 DCE hunt group on the router.The **huntgroup** parameter specifies the name of the hunt group to be modified. The hunt group must exist.

The **ipaddress** parameter specifies the IP address by which other DCEs connect to this hunt group. This must be the address of an IP interface on this router, but not the IP address by which any of the individual DTE addresses on the DCE or any other hunt groups on the DCE are accessed.

The **dteaddress** parameter specifies the DTE address for the hunt group. All incoming calls for this DTE address are assumed to be for the hunt group. The address must be different from the DTE addresses of the individual X.25 interfaces on the router, and different from the DTE address of other hunt groups defined on this router.

The **forwardtime** parameter specifies the time in seconds for the forward timer. This timer is used to detect the lack of response from other routers in the hunt group when an incoming call is being forwarded to one of those routers. This timer should be set to the same values on all the DCEs in a hunt group. The default is 60.

The **reconnecttime** parameter specifies the time in seconds for the reconnect timer. This timer determines how long the router reserves a channel after it has sent a Channel Reserved message to the calling router with the DTE address and IP address required to make the call. This timer should be set to the same values on all the DCEs in a hunt group. The default is 60.

Examples

To change the reconnect time of a hunt group called *Central* to 30s, use the command:

```
set x25c huntgroup=central reconnect=30
```

Related Commands

add x25c huntgroup
create x25c huntgroup
delete x25c huntgroup
destroy x25c huntgroup
set x25c
show x25c huntgroup

set x25c tcpkeepalive

Syntax

```
SET X25C TCPKEEPALIVE [TXINT=5..180] [FAILNUMBER=2..10]
```

Description

This command modifies parameters for the TCP Keepalive feature. The TCP listen port 01998 is closed by default until this command or the **create x25c** command is executed. The port then remains open until a router restart.

The **txint** parameter specifies the time in seconds between sending ACK packets to the other end of the TCP connection. The default is 5.

The **failnumber** parameter is the number of times an ACK packet is sent without receiving a reply before bringing the link down. The default is 2.

Example

To set the interval between ACK packets to 10 seconds, use the command:

```
set x25c tcpkeepalive txint=10
```

Related Commands

show x25c tcpkeepalive

set x25t

Syntax

```
SET X25T=x25-interface [MAXACTIVE=0..4095] [MODULUS={8|
   128}] [T20=1..360] [T21=1..360] [T22=1..360]
   [T23=1..360] [T24={1..360|OFF}] [T27={1..360|OFF}]
   [MINRECALL=1..360] [R20=0..65535] [R22=0..65535]
   [R23=0..65535] [R27=0..65535] [NPVC=0..4095]
   [DEFCPAR=0..8] [DTEADDRESS=dteaddress] [LIC=0..4095]
   [HIC=0..4095] [LTC=0..4095] [HTC=0..4095] [LOC=0..4095]
   [HOC=0..4095] [ROLE={DYNAMIC|DCE|DTE}]
```

where:

- *x25-interface* is the number of the X.25 DTE logical interface from 0 to 7.
- *dteaddress* is a valid DTE address 1 to 15 characters long.

Description

This command is used to change the operational parameters of an X.25 DTE interface. The X.25 interface must already exist.

The **maxactive** parameter sets the maximum number of circuits this X.25 DTE can support, including PVCs. It must not be less than the actual number of PVCs. The default is 4095. The X.25 DTE interface must be reset with the **reset x25t** command on page 12-58 before this command takes effect, since there may be more than the maximum number of circuits active already.

The **modulus** parameter sets the modulus of packet sequence numbers for this interface. The default is 8. The X.25 DTE interface must be reset with the **reset x25t** command on page 12-58 before this command takes effect, since this command affects all circuits on the interface.

The **t20** parameter sets the value in seconds of the restart timer. The default is 180. The **t21** parameter sets the value in seconds of the call timer. The default is 200. The **t22** parameter sets the value in seconds of the reset timer. The default

is 180. The **t23** parameter sets the value in seconds of the clear timer. The default is 180. The **t24** parameter sets the value in seconds of the optional window timer. The default is 60. The timer can be turned off by specifying the value OFF. The **t27** parameter sets the value in seconds of the reject response timer. The default is 60. The timer can be turned off by specifying the value OFF. The **minrecall** parameter sets the value in seconds of the time to wait before retrying a particular call. The default is 60.

The **r20** parameter sets the value of the restart retransmission counter. The default is 1. The **r22** parameter sets the value of the reset request retransmission counter. The default is 1. The **r23** parameter sets the value of the clear request retransmission counter. The default is 1. The **r27** parameter sets the value of the reject retransmission counter. The default is 0.

The **npvc** parameter sets the number of channels reserved as PVCs. The default is 0.

The **defcpar** parameter specifies the index of the default call parameter definition to use for this interface. If 0 or no value is specified, a CPAR is created and used, which has a value of 0. The call parameter definition (if not 0) must already exist.

The **dteaddress** parameter specifies the DTE address for the interface.

The **lic** parameter specifies the lowest incoming channel number. The default is 0. The **hic** parameter specifies the highest incoming channel number. A value of 0 means no incoming channels. The default is 0. The **ltc** parameter specifies the lowest two-way channel number. The default is 1. The **htc** parameter specifies the highest two-way channel number. A value of 0 means no two-way channels. The default is 4095. The **loc** parameter specifies the lowest outgoing channel number. The default is 0. The **hoc** parameter specifies the highest outgoing channel number. A value of 0 means no outgoing channels. The default is 0. The values of **lic, hic, ltc, htc, loc, ltc, npvc** and **maxactive** must be consistent with one another.

The **role** parameter specifies the role this DTE plays in a DTE-DTE environment. The default is DYNAMIC, which means that during the restart procedure, the two DTEs negotiate which DTE will act as DCE.

Examples

To configure X.25 DTE interface 1 to negotiate its role in a DTE-to-DTE link, use the command:

```
set x25t=1 role=dynamic
```

Related Commands

add x25t cpar
create x25t
destroy x25t
set x25t cpar
reset x25t
show x25t
show x25t cpar

set x25t cpar

Syntax

```
SET X25T CPAR=call-index [MAXDATA={128|256|512|1024}]
   [NUI=nui] [RMAXDATA={128|256|512|1024}]
   [RWINDOW=1..127] [TMAXDATA={128|256|512|1024}]
   [TWINDOW=1..127] [USERDATA=hex-string] [WINDOW=1..127]
```

where:

- *call-index* is the index of the call parameters to modify.
- *hex-string* is a string of 2 to 20 hexadecimal digits.
- *nui* is a character string 1 to 16 characters long.

Description

This command is used to change the attributes of a set of call parameters. The call parameters must already exist, and must not be the default for an X.25 DTE interface or PVC, or be in use by an active call.

The **nui** parameter specifies the Network User Identification (NUI) to be used by this call.

The **tmaxdata** and **rmaxdata** parameters specify the maximum packet sizes for transmission and reception, respectively. The **maxdata** parameter is a shorthand form to specify the same maximum packet size for both transmission and reception. In all cases, the default is 0, which means use the interface default for a call (128).

The **twindow** and **rwindow** parameters specify the window for transmission and reception, respectively. The **window** parameter is a shorthand form to specify the same window for both transmission and reception. In all cases, the default is 0, which means use the interface default for a call (2).

The **userdata** parameter specifies the contents of the user data field for the call request for this call. This parameter specifies the protocol that this circuit carries.

Examples

To set the contents of the user data field in all call requests using call parameter set 7 to “ff0d5B3c”, use the command:

```
set x25t cpar=7 userdata=ff0d5b3c
```

Related Commands

add x25t cpar
delete x25t cpar
show x25t cpar

show lapb

Syntax

```
SHOW LAPB[=lapb-interface] [{CONFIG|COUNT|IDLETIMER}]
```

where *lapb-interface* is the number of the LAPB logical interface from 0 to 7

Description

This command displays information about LAPB interfaces. If no optional parameters are specified, summary information about the specified LAPB

interface or all LAPB interfaces is displayed (Figure 12-10 on page 12-69, Table 12-6 on page 12-69).

The **config** parameter displays the configuration of the specified or all LAPB interfaces (Figure 12-11 on page 12-69, Table 12-7 on page 12-70).

The **count** parameter displays LAPB counters (Figure 12-12 on page 12-70, Table 12-8 on page 12-71).

The **idletimer** parameter displays information about the idle timers on LAPB interfaces (Figure 12-13 on page 12-73Table 12-9 on page 12-73).

Figure 12-10: Example output from the SHOW LAPB command

```
Name        Over          Link Status      State
-------------------------------------------------------
lapb0       isdn-btb      ACTIVATED        AWAITACK
lapb1       syn0          DOWN             DISCONNECTED
-------------------------------------------------------
```

Table 12-6: Parameters in the output of the SHOW LAPB command

Parameter	Meaning
Name	Name of the LAPB logical interface.
Over	Physical interface used by the LAPB interface; either "syn*N*" or "isdn-*callname*".
Link Status	Status of the physical link. For synchronous interface, either "UP" or "DOWN". For ISDN calls, one of "UP", "DOWN", "ACTIVATED", or "IDLE".
State	Current state of the interface; either "DSICONNECTED", "LINK_SETUP", "FRAME_REJECT", "DISCONNECT_REQUEST", "DATA_TRANSFER", "REJSENT", "AWAITACK", "BUSY", "REMOTEBUSY", "BOTHBUSY", "AWAITACK_BUSY", "AWAITACK_REMOTEBUSY", "AWAITACK_BOTHBUSY", or "REJSENT_REMOTEBUSY".

Figure 12-11: Example output from the SHOW LAPB CONFIG command

```
Interface
  Parameter                          Value
-----------------------------------------------
lapb0
  Over ............................ isdn-btb
  Dial-on-demand .................. ON
  Role ............................ DTE
  Modulus ......................... 8
  Maximum Frame Bits .............. 8232
  Window .......................... 7
  Ack Timer (T1) (secs) ........... 10
  Idle Timer (T3) (secs) .......... 40
  Receive Count (N2) .............. 10
-----------------------------------------------
```

Table 12-7: Parameters in the output of the SHOW LAPB CONFIG command

Parameter	Meaning
Interface	Name of the LAPB logical interface.
Over	Whether the physical interface used by the LAPB interface is syn*N* or isdn-*callname*.
Dial-on-demand	Whether the LAPB interface is a dial-on-demand interface.
Role	Whether the role of the LAPB interface is DCE, DTE, or DYNAMIC.
Modulus	Modulus for sequence numbers.
Maximum Frame Bits	Maximum frame size expected in bits.
Window	Window size.
Ack Timer (T1) (secs)	Timeout period in seconds for acknowledgement timer T1.
Idle Timer (T3) (secs)	Timeout period for idle timer T3, in seconds.
Receive Count (N2)	Maximum number of retransmissions permitted.

Figure 12-12: Example output from the SHOW LAPB COUNT command

```
lapb0
Interface Counters
  inDataOctets                  0      outDataOctets                  0
  inDataPkts                    0      outDataPkts                    0
  inDiscards                    0      outDiscards                    0

Control Packet Counters
                        Received    Processed  ModeChanges  Transmitted
  sabmPkts                     1            1            1            1
  disconnectPkts               0            0            0            0
  unnumAckPkts                 0            0            0            0
  disconnectModePkts           0            0            0            0
  frameRejectPkts              0            0            0            0
  rxReadyPkts                  1            0            0            0
  rxNotReadyPkts               0            0            0            0
  rejectPkts                   0            0            0            0

FRMR transmissions
  FRMR packets sent            0
    W bit                      0
    X bit                      0
    Y bit                      0
    Z bit                      0

Timeout Counters
  responseTimeouts             0      idleTimeouts                   0
    retrySABM                  0
    retryDISC                  0
    retryFRMR                  0
  rejectTimeouts               0
  ackTimeouts                  0

State Information
  state                        DISCONNECTED
  stateChanges                 0
  reasonForLastChange          notStarted
```

Table 12-8: Parameters in the output of the SHOW LAPB COUNT command

Parameter	Meaning
lapb*n*	LAPB logical interface.
Interface Counters	Counters for the LPAB interface
inDataOctets	Number of octets of data received over the interface.
inDataPkts	Number of data packets received over the interface.
inDiscards	Number of packets received by the interface that were discarded.
outDataOctets	Number of octets of data transmitted by the interface.
outDataPkts	Number of data packets transmitted by the interface.
outDiscards	Number of packets discarded before they could be transmitted by the interface.
Control Packet Counters	Counters for LAPB control packets
Received	Number of frames received by the interface.
Processed	Number of frames processed by state machine.
ModeChanges	Number of frames that caused a state change.
Transmitted	Number of frames transmitted by the interface.
sabmPkts	Set asynchronous balanced mode frames.
`disconnectPkts`	Disconnect frames
unnumAckPkts	Unnumbered acknowledgement frames.
disconnectModePkts	Disconnect mode frames.
frameRejectPkts	Frame Rejection frames.
rxReadyPkts	Receiver ready frames.
rxNotReadyPkts	Receiver not ready frames.
rejectPkts	Reject frames.
Packet Error Counters	Counters for packet errors
badFormat	Number of frames received that contained errors.
badAddresses	Number of frames received that contained an invalid address.
shortPackets	Number of underlength frames received.
longPackets	Number of overlength frames received.
noInfoINFOPkts	Number of INFO frames received with no data in them
shortFRMRPkts	Number of underlength FRMR frames received
longINFOPkts	Number of overlength INFO frames received
longSPackets	Number of overlength supervisory frames received
longFRMRPkts	Number of overlength FRMR frames received
longUPackets	Number of overlength unnumbered frames received
undefinedAddress	Number of frames received that contained an invalid address
badResponse	Number of frames received that were response frames using a command address
badCommand	Number of frames received that were command frames using a response address
Unmatched States	
badNRPkts	Number of frames received that contained a bad N(R) value

Table 12-8: Parameters in the output of the SHOW LAPB COUNT command

Parameter	Meaning
N2Timeouts	
nonDMLinkInits	Number of times the link was unexpectedly initialised
linkResets	Number of times the link has been reset by receiving a SABM in a REMOTE_BUSY state
FRMR transmissions	Counters for FRMR frames transmitted
FRMR packets sent	Counters for counting bits set in transmitted FRMR frames
W bit	Number of FRMR packets sent with the W bit set
X bit	Number of FRMR packets sent with the X bit set
Y bit	Number of FRMR packets sent with the Y bit set
Z bit	Number of FRMR packets sent with the Z bit set
Timeout Counters	Counters for LAPB timer expiries
responseTimeouts	Number of times the T1 timer expired waiting for a response to a Supervisory frame.
idleTimeouts	Number of times the T3 timer expired for line idle.
retrySABM	Number of times the T1 timer expired waiting for response to a SABM frame
retryDISC	Number of times the T1 timer expired waiting for response to a DISC frame
retryFRMR	Number of times the T1 timer expired waiting for response to a FRMR frame
rejectTimeouts	Number of times the T1 timer expired waiting for a reject clearance.
ackTimeouts	Number of times the T1 timer expired waiting for an acknowledgement for an Info frame.
State Information	Information about the state of the LAPB interface.
state	Current state of the interface; either “DISCONNECTED”, “LINK_SETUP”, “FRAME_REJECT”, “DISCONNECT_REQUEST”, “DATA_TRANSFER”, “REJSENT”, “AWAITACK”, “BUSY”, “REMOTEBUSY”, “BOTHBUSY”, “AWAITACK_BUSY”, “AWAITACK_REMOTEBUSY”, “AWAITACK_BOTHBUSY”, or “REJSENT_REMOTEBUSY”.
stateChanges	Number of state machine state changes.
reasonForLastChange	Reason for the last state change; either “notStarted”, “abmEntered”, “abmeEntered”, “abmReset”, “abmeReset”, “dmReceived”, “dmSent”, “discReceived”, “discSent”, “frmrReceived”, “frmrSent”, “n2Timeout”, or “other”.

Figure 12-13: Example output from the SHOW LAPB IDLETIMER command

```
Interface
  Configured Idle Time       Idle Timer Value
-------------------------------------------
lapb0
                    40                EXPIRED
lapb1
                    40                    23
-------------------------------------------
```

Table 12-9: Parameters in the output of the SHOW LAPB IDLETIMER command

Parameter	Meaning
Interface	Name of the LAPB logical interface.
Configured Idle Time	Configured idle timeout period, in seconds.
Idle Timer Value	Current value of the idle timer, or "EXPIRED"

Examples To display the counters for LAPB interface 0, use the command:

```
show lapb=0 count
```

Related Commands

create lapb
destroy lapb
reset lapb
set lapb

show miox

Syntax `SHOW MIOX[=x25t-interface]`

where *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7

Description This command displays the operational parameters for the MIOX entity related to the X.25 DTE interface (Figure 12-14 on page 12-73, Table 12-10 on page 12-74). If the X.25 DTE interface is not specified, information for all MIOX entities is displayed.

Figure 12-14: Example output from the SHOW MIOX command

```
miox interface 0
-------------------------------------------------------------------------
timer values
  minopen  25    inactive  25    holddown 240    collision  60    failure  60

miox interface 1
-------------------------------------------------------------------------
timer values
  minopen  60    inactive  60    holddown  60    collision  35    failure  15
```

Table 12-10: Parameters in the output of the SHOW MIOX command

Parameter	Meaning
minopen	Value in seconds of the minimum open timer.
inactive	Value in seconds of the inactivity timer.
holddown	Value in seconds of the hold down timer.
collision	Value in seconds of the collision retry timer.
failure	Value in seconds of the link failure timer.

Examples To display the MIOX configuration for all X.25 DTE interfaces, use the command:

```
show miox
```

Related Commands set miox

show miox count

Syntax `SHOW MIOX[=x25t-interface] COUNT`

where *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7

Description This command displays the counters for the MIOX entity related to the X.25 DTE interface (Figure 12-15 on page 12-74, Table 12-11 on page 12-75). If the X.25 DTE interface is not specified, counters for all MIOX entities are displayed.

Figure 12-15: Example output from the SHOW MIOX COUNT command

```
miox interface 0
-------------------------------------------------------------------------------
  statistics
    circuits              1
    link state        ALIVE
  incoming calls              failure reason
    accepted              4   bad encap             0
    failed                1   bad protocol          0
    total calls           4   call exists           1
  outgoing calls
    initiation cause          closure cause             failure cause
    closed                8   minopen               0   failure               0
    holddown              0   inactive              3   collision             0
    collision             1   network               2   network               1
    total calls           9   successful            5   unsuccessful          1
  packets
    total sent           38   total recvd          42   discarded             0
  timeouts
    minopen               9   inactive              3   holddown              1
    collision             0   failure               0
```

Table 12-11: Parameters in the output of the SHOW MIOX COUNT command

Parameter	Meaning
miox interface	Number of the X.25 DTE logical interface.
statistics	General MIOX statistics for the DTE interface.
circuits	The total number of MIOX circuits configured for the MIOX entity.
link state	Status of the X.25 link; either "ALIVE" or "DEAD".
incoming calls	Information about incoming calls on this DTE interface.
accepted	Number of incoming calls that were accepted.
failed	Number of incoming calls that were rejected.
total calls	Total number of incoming calls.
failure reason	Information about the causes of failed incoming calls.
bad encap	Number of incoming calls that were rejected due to an unsupported encapsulation.
bad protocol	Number of incoming calls that were rejected due to a supported encapsulation with an unattached protocol.
call exists	Number of incoming calls that were rejected due to the circuit already having an active connection.
outgoing calls	Information about outgoing calls.
initiation cause	Information about the initiation of outgoing calls.
closed	Number of outgoing calls that were initiated when the circuit was in the closed state.
holddown	Number of calls that were initiated after a previously failed call on a circuit.
collision	The number of calls that were initiated after the previous call failed due to insufficient free X.25 channels to make the call on.
total calls	The total number of outgoing calls initiated.
closure cause	Information about the reasons for closing outgoing calls.
minopen	The number of calls that were closed due to the expiry of the minimum open timer.
inactive	The number of calls that were closed due to the expiry of the call inactivity timer.
network	The number of calls that were closed by the network. This includes calls that were closed by the remote router.
successful	The number of calls that were closed because they were completed successfully.
failure cause	Information about the causes of failed outgoing calls.
failure	The number of calls that failed due to the call not being confirmed within the call failure timer period.
collision	The number of calls that failed due to insufficient free X.25 channels to make the call.
network	The number of calls that failed due to the network or the remote router refusing the call.
unsuccessful	The number of calls that were closed because they were not completed successfully.

Table 12-11: Parameters in the output of the SHOW MIOX COUNT command

Parameter	Meaning
packets	Packet statistics.
total sent	The number of packets sent on the X.25 DTE interface by the MIOX entity.
total recvd	The number of packets received on the X.25 DTE interface by the MIOX entity.
discarded	The number of packets that were received and discarded due to an unsupported protocol.
timeouts	Information about timeouts.
minopen	The number of times the minimum open timer has expired.
inactive	The number of times the inactivity timer has expired.
holddown	The number of times the hold down timer has expired.
collision	The number of times the collision retry timer has expired.
failure	The number of times the link failure timer has expired.

Examples To display the MIOX counters for X.25 DTE interface 1, use the command:

```
show miox=1 count
```

Related Commands set miox

show miox circuit

Syntax

```
SHOW MIOX[=x25t-interface] CIRCUIT[=circuit-name]
   [COUNTER|ENCAP]
```

where:

- *x25t-interface* is the index number of the X.25 DTE logical interface from 0 to 7.
- *circuit-name* is an alphanumeric string from 1 to 15 characters long.

Description This command displays information about MIOX circuits for the MIOX entity related to the specified X.25 DTE interface. If the X.25 DTE interface is not specified, circuits for all MIOX entities are displayed. If a circuit name is specified, then circuits matching the circuit name are displayed. If neither COUNTER or ENCAP is specified, the operational parameters for the MIOX circuit are displayed (Figure 12-16 on page 12-77, Table 12-12 on page 12-77). If COUNTER is specified counters for the MIOX circuit are displayed (Figure 12-17 on page 12-77, Table 12-13 on page 12-78). If ENCAP is specified encapsulation information and specific counters for higher layer protocols using the circuit are displayed (Figure 12-18 on page 12-79, Table 12-14 on page 12-79).

Figure 12-16: Example output from the SHOW MIOX CIRCUIT command

```
miox interface 0
-------------------------------------------------------------------------------
headoffice                      comment                                ENABLED
  pvc          1                Permanent Circuit to Head Office.
  encap        NULL             cpar     0      comp    OFF      tcpcomp  OFF

regionaloffice                  comment                                ENABLED
  dteaddress   300043275
  encap        IP               cpar     0      comp    OFF      tcpcomp   ON
```

Table 12-12: Parameters in the output of the SHOW MIOX CIRCUIT command

Parameter	Meaning
miox interface	Number of the X.25 DTE logical interface.
<circuit-name>	Name of the MIOX circuit.
comment	String that describes the circuit.
ENABLED	Whether the circuit is enabled.
pvc	PVC for this MIOX circuit (displayed when the circuit is configured to operate over a PVC).
dteaddress	DTE address for this MIOX circuit (displayed when the circuit is configured to operate over an SVC).
encap	Type of encapsulation for the circuit.
cpar	Call parameter entry to use for the circuit.
comp	Whether payload compression is enabled for the circuit.
tcpcomp	Whether TCP header compression is enabled for the circuit.

Figure 12-17: Example output from the SHOW MIOX CIRCUIT COUNTER command

```
miox interface 0
-------------------------------------------------------------------------------
regionaloffice
  incoming calls              failure reason
    accepted             10   bad encap              0
    failed                2   bad protocol           2
    total calls          12   call exists            0
  outgoing calls
    initiation cause          closure cause             failure cause
    closed                5   minopen                0  failure                0
    holddown              2   inactive               3  collision              0
    collision             0   network                1  network                1
    total calls           7   successful             4  unsuccessful           1
  packets
    total sent          355   total recvd          432  discarded              0
  timeouts
    minopen               9   inactive               3  holddown               2
    collision             0   failure                0
```

Table 12-13: Parameters in the output of the SHOW MIOX CIRCUIT COUNTER command

Parameter	Meaning
miox interface	The number of the X.25 DTE logical interface.
<circuit-name>	The name of the MIOX circuit.
incoming calls	Information about incoming calls on this DTE interface.
accepted	The number of incoming calls that were accepted for the circuit.
failed	The number of incoming calls that were rejected for the circuit.
total calls	The total number of incoming calls for the circuit.
failure reason	Information about the causes of failed incoming calls.
bad encap	The number of incoming calls that were rejected due the circuit not supporting encapsulation.
bad protocol	The number of incoming calls that were rejected due to a supported encapsulation with an unattached protocol.
call exists	The number of incoming calls that were rejected due to the circuit already having an active connection.
outgoing calls	Information about outgoing calls.
initiation cause	Information about the initiation of outgoing calls.
closed	The number of outgoing calls that were initiated when the circuit was in the closed state.
holddown	The number of calls that were initiated after a previously failed call on a circuit.
collision	The number of calls that were initiated after the previous call failed due to insufficient free X.25 channels to make the call on.
total calls	The total number of outgoing calls for the circuit.
closure cause	Information about the reasons for closing outgoing calls.
minopen	The number of calls that were closed due to the expiry of the minimum open timer.
inactive	The number of calls that were closed due to the expiry of the call inactivity timer.
network	The number of calls that were closed by the network. This includes calls that were closed by the remote router.
successful	The total number of successful outgoing calls for the circuit.
failure cause	Information about the causes of failed outgoing calls.
failure	The number of calls that failed due to the call not being confirmed within the call failure timer period.
collision	The number of calls that failed due to insufficient free X.25 channels to make the call on.
network	The number of calls that failed due to the network or the remote router refusing the call.
unsuccessful	The total number of outgoing calls for the circuit that failed.
packets	Packet statistics.
total sent	The number of packets sent on the MIOX circuit.
total recvd	The number of packets received on the MIOX circuit.
discarded	The number of packets that were received and discarded due to an unsupported protocol.

Table 12-13: Parameters in the output of the SHOW MIOX CIRCUIT COUNTER command (continued)

Parameter	Meaning
timeouts	Information about timeouts.
minopen	The number of times the minimum open timer has expired for the circuit.
inactive	The number of times the inactivity timer has expired for the circuit.
holddown	The number of times the hold down timer has expired for the circuit.
collision	The number of times the collision retry timer has expired for the circuit.
failure	The number of times the link failure timer has expired for the circuit.

Figure 12-18: Example output from the SHOW MIOX CIRCUIT ENCAP command

```
miox interface 0
-------------------------------------------------------------------------------
headoffice
  module  IP        packets sent          45    packets rcvd          32
    channel    1    state  ACTIVE

regionaloffice
  module  IP        packets sent         420    packets rcvd         598
    channel  245    calls
    state           successful        failed      accepted
    OPEN                    12             0             4
```

Table 12-14: Parameters in the output of the SHOW MIOX CIRCUIT ENCAP command

Parameter	Meaning
miox interface	Number of the X.25 DTE logical interface.
<circuit-name>	Name of the MIOX circuit.
module	Attached higher layer protocol.
packets sent	Number of packets sent by the specified protocol.
packets rcvd	Number of packets received for the specified protocol.
channel	Displays the X.25 channel number that the call is currently using.
state	Displays the link state for PVCs and the call state for circuits operating over SVCs.
successful	Displayed for SVCs, shows the number of successful outgoing calls.
failed	Displayed for SVCs, shows the number of failed outgoing calls.
accepted	Displayed for SVCs, shows the number of incoming calls accepted.

Examples To display the operational parameters for MIOX circuit "HeadOffice" on X.25 DTE interface 1, use the command:

```
show miox=1 circuit=headoffice
```

To display the counters for MIOX circuit "HeadOffice" on X.25 DTE interface 1, use the command:

```
activate miox=1 circuit=headoffice counter
```

Related Commands set miox

show x25c

Syntax `SHOW X25C[=x25-interface]`

where *x25-interface* is the number of the X.25 DCE logical interface from 0 to 7

Description This command displays information about the specified X.25 DCE interface. If the interface is not specified, information about all X.25 DCE interfaces is displayed (Figure 12-19 on page 12-80, Table 12-15 on page 12-80).

Figure 12-19: Example output from the SHOW X25C command

```
X.25 DCE Interfaces
---------------------------------------------------
X.25 DCE interface 0
Over ................... LAPB0
Max active channels .... 24
Hunt group ............. Central
Incoming channels
  LCGN ................. 0
  Number of channels ... 8
Two way channels
  LCGN ................. 1
  Number of channels ... 8
Outgoing channels
  LCGN ................. 2
  Number of channels ... 8
Throughput
  Default .......... 9600
  Negotiation ...... No
Packet size
  Default .......... 1024
  Negotiation ...... No
Window size
  Default .......... 2
  Negotiation ...... No
---------------------------------------------------
```

Table 12-15: Parameters in the output of the SHOW X25C command

Parameter	Meaning
X.25 DCE Interface	Number of the X.25 DCE logical interface.
Over	Layer 2 entity used by this X.25 DCE interface.
Max active channels	Maximum number of active channels allowed for the interface.

Table 12-15: Parameters in the output of the SHOW X25C command (continued)

Parameter	Meaning
Hunt group	Name of the hunt group to which this X.25 DCE interface belongs, or "-" if the interface does not belong to a hunt group.
Incoming channels	Information about channels reserved for incoming calls.
Two way channels	Information about channels reserved for two-way calls.
Outgoing channels	Information about channels reserved for outgoing calls.
LCGN	Logical Channel Group Number for the associated incoming, two-way or outgoing calls.
Number of channels	Number of call channels reserved for the associated incoming, two-way or outgoing calls.
Throughput	Information about the through-put class for the X.25 DCE interface.
Packet size	Information about the packet size for the X.25 DCE interface.
Window size	Information about the window size for the X.25 DCE interface.
Default	Default setting for the through-put class, packet size or window size for the X.25 DCE interface.
Negotiation	Whether negotiation is enabled for the through-put class, packet size or window size.

Examples To display the configuration of X.25 DCE interface 0, use the command:

```
show x25c=0
```

Related Commands

create x25c
destroy x25c
set x25c
show x25c counter
show x25c huntgroup
show x25c path
show x25c state
show x25c tcpkeepalive

show x25c counter

Syntax `SHOW X25C=`*`x25-interface`* `COUNTER`

where *x25-interface* is the number of the X.25 DCE logical interface, from 0 to 7

Description This command displays the counters for the X25C interface (Figure 12-20 on page 12-82, Table 12-16 on page 12-82).

Figure 12-20: Example output from the SHOW X25C COUNTER command

```
X25C-0 Counters

  inSQ ............................ 0       outSI ............................ 0
  inSF ............................ 0       outSF ............................ 0
  inCR ............................ 0       outCN ............................ 0
  inCA ............................ 0       outCC ............................ 0
  inCQ ............................ 0       outCI ............................ 0
  inCF ............................ 0       outCF ............................ 0
  inRQ ............................ 0       outRI ............................ 0
  inRF ............................ 0       outRF ............................ 0
  inIT ............................ 0       outIT ............................ 0
  inIF ............................ 0       outIF ............................ 0
  inRNR ........................... 0       outRNR ........................... 0

  Open Calls ...................... 0       Discard Calls .................... 0

X25C-0 Packet Error Counters

Reset factor (Reset_Indication):
  Window Size Over ................ 0       Bad P(S) ......................... 0
  Packet Size Over ................ 0       Bad P(R) ......................... 0
  Bad P(S) in XOT ................. 0

Packet Link Call Down factor (Clear_Indication):
  TCP Error ....................... 0       Recv undefined pkt ............... 0
  Fac not supported ............... 0       Fac negotiation err .............. 0
  Fac parameter err ............... 0       Fac invalid length ............... 0

Packet link connection phase:
  Source DTE addr err ............. 0       Dest DTE addr err ................ 0
  LCN error ....................... 0       Neg packet size err .............. 0
  Neg window size err ............. 0       Neg throughput err ............... 0
```

Table 12-16: Parameters in the output of the SHOW X25C COUNTER command

Parameter	Meaning
inSQ	The number of *Restart Request* messages received from the DTE.
outSI	The number of *Restart Indication* messages sent to the DTE.
inSF	The number of *Restart Confirmation* messages received from the DTE.
outSF	The number of *Restart Confirmation* messages sent to the DTE.
inCR	The number of *Call Request* messages received from the DTE.
outCN	The number of *Incoming Call* messages sent to the DTE.
inCA	The number of *Call Accepted* messages received from the DTE.
outCC	The number of *Call Connected* messages sent to the DTE.
inCQ	The number of *Clear Request* messages received from the DTE.
outCI	The number of *Clear Indication* messages sent to the DTE.
inCF	The number of *Clear Confirmation* messages received from the DTE.
outCF	The number of *Clear Confirmation* messages sent to the DTE.
inRQ	The number of *Reset Request* messages received from the DTE.
outRI	The number of *Restart Indication* messages sent to the DTE.

Table 12-16: Parameters in the output of the SHOW X25C COUNTER command (continued)

Parameter	Meaning
inRF	The number of *Reset Confirmation* messages received from the DTE.
outRF	The number of *Restart Confirmation* messages sent to the DTE.
inIT	The number of *Interrupt* messages received from the DTE.
outIT	The number of *Interrupt* messages sent to the DTE.
inIF	The number of *Interrupt Confirmation* messages received from the DTE.
outIF	The number of *Interrupt Confirmation* messages sent to the DTE.
inRNR	The number of Receiver Not Ready messages received from the DTE
outRNR	The number of Receiver Not Ready messages sent to the DTE
Open Calls	The number of calls that were successful (reached the OPEN state).
Discard Calls	The number of calls disconnected by the router.
Reset factor (Reset_Indication)	Counters associated with channel resets
Window Size Over	The number of DATA packets received from the DTE outside the current receive window but with the next expected P(S) value
Bad P(S)	The number of DATA packets received from the DTE that didn't have the expected P(S) value
Packet Size Over	The number of DATA packets received from the DTE that were overlength
Bad P(R)	The number of supervisory packets received from the DTE with an incorrect value for P(R)
Bad P(S) in XOT	The number of DATA packets received from a remote DCE with an incorrect value for P(S)
Packet Link Call Down factor (Clear_Indication)	Counters associated with channel clearing
Recv undefined pkt	The number of undefined packets received. Some of these clear the channel.
Fac not supported	The number of channel clears caused when a facility cannot be negotiated and an attempt is made to negotiate the facility
Fac negotiation err	The number of times a facility negotiation has failed
Fac parameter err	The number of channel clears caused when a facility negotiation attempts to negotiate an unsupported value
Fac invalid length	The number of packets received with bad facilities field due to incorrect length of the field
Packet link connection phase	Counters for errors when making a channel connection
Source DTE addr err	The number of call requests received containing a calling DTE address that is not one of our own addresses
Dest DTE addr err	The number of call requests failed due to missing called DTE address, or because the DTE address destination could not be determined

Table 12-16: Parameters in the output of the SHOW X25C COUNTER command (continued)

Parameter	Meaning
LCN error	The number of call requests made to channels not defined, or that can accept only incoming calls
Neg packet size err	The number of times negotiation of packet size failed
Neg window size err	The number of times negotiation of window size failed
Neg throughput err	The number of times negotiation of throughput failed

Example To display the counters for X.25 DCE interface 0, use the command:

```
show x25c=0 counter
```

Related Commands

create x25c
set x25c
show x25c
show x25c state

show x25c dteaddress

Syntax `SHOW X25C[=x25-interface] DTEADDRESS`

where *x25-interface* is the number of the X.25 DCE logical interface, from 0 to 7

Description This command displays the DTE addresses that have been configured for the specified X.25 DCE interface. If the interface is not specified, the DTE addresses for all X.25 DCE interfaces are displayed (Figure 12-21 on page 12-84, Table 12-17 on page 12-85).

Figure 12-21: Example output from the SHOW X25C DTEADDRESS command

```
X.25 DCE address table

Int   Ind   DTE Address
-----------------------------------------------
  0         No DTE addresses for this interface
  1     1   000016XX
        2   1XXXX
        3   90XXX03
        4   4600000016
-----------------------------------------------
```

Table 12-17: Parameters in the output of the SHOW X25C DTEADDRESS command

Parameter	Meaning
Int	The X.25 DCE logical interface number.
Ind	The index of the DTE address.
DTE Address	The DTE addresses configured for the specified interface.

Examples To display the list of DTE addresses to which X.25 DCE interface 0 will respond, use the command:

```
show x25c=0 dteaddress
```

Related Commands
add x25c dteaddress
delete x25c dteaddress

show x25c huntgroup

Syntax `SHOW X25C HUNTGROUP[=`*`huntname`*`]`

where *huntname* is a character string from 1 to 15 characters long. Valid characters are uppercase and lowercase letters, digits (0-9), the underscore character ("_"), and the hyphen (-). If *huntname* contains spaces, it must be in double quotes.

Description This command displays information about the specified X.25 DCE mode hunt group, or all X.25 DCE mode hunt groups in the router (Figure 12-22 on page 12-85, Table 12-18 on page 12-86).

The **huntgroup** parameter specifies the name of the hunt group to be displayed. The hunt group must exist.

Figure 12-22: Example output from the SHOW X25C HUNTGROUP command

```
X25C hunt groups
-------------------------------------------------
Hunt group name ................. Central
DTE address ..................... 34004032
IP address ...................... 192.168.10.34
Forward time .................... 60s
Reconnect time .................. 60s
X25C interfaces ................. 0, 1, 2, 3
Forward IP addresses ............ 192.168.11.2
                                  192.168.11.3
                                  192.168.11.5
-------------------------------------------------
```

Table 12-18: Parameters in the output of the SHOW X25C HUNTGROUP command

Parameter	Meaning
Hunt group name	Name of the hunt group.
DTE address	DTE address of the hunt group. This is used by remote DCEs to connect to the hunt group (and not to an individual X.25 line.
IP address	IP address of the hunt group. This is used by remote DCEs to connect to the hunt group.
Forward time	Time in seconds that the router waits for a response when forwarding an incoming X.25 call request to a forward router in the hunt group.
Reconnect time	Time in seconds that the router waits for a response when informing the calling DCE that a channel has been reserved for the call, and giving the DTE address and IP address required to make the call.
X25C interfaces	List of the instance numbers of the X25 DCE interfaces that belong to this hunt group.
Forward IP addresses	List of the IP addresses of remote DCEs belonging to this hunt group.

Examples To display all hunt groups on the router, use the command:

```
show x25c huntgroup
```

Related Commands

add x25c huntgroup
create x25c huntgroup
delete x25c huntgroup
destroy x25c huntgroup
set x25c huntgroup
show x25c path

show x25c path

Syntax `SHOW X25C[=`*`x25-interface`*`] PATH`

where *x25-interface* is the number of the X.25 DCE logical interface from 0 to 7

Description This command displays information about the connection details of active calls on the specified X.25 DCE interface. If an interface is not specified, information about all X.25 DCE interfaces is displayed (Figure 12-23 on page 12-86, Table 12-19 on page 12-87).

Figure 12-23: Example output from the SHOW X25C PATH command

```
LCGN/LCN  Dir   In DTE           Out DTE          Remote DTE       Remote router
-------------------------------------------------------------------------------
X.25 DCE interface 0
12/123    In    123456789012345  123456789012346  123456789012346  192.168.123.234
-------------------------------------------------------------------------------
```

Table 12-19: Parameters in the output of the SHOW X25C PATH command

Parameter	Meaning
LCGN/LCN	Logical Channel Group Number and Logical Channel Number of the X.25 call.
Dir	Whether the direction of the call is in or out from the viewpoint of the DTE for which this is the DCE.
In DTE	The called DTE address on the router that originated the call. If the call was to a hunt group address, the hunt group address called. On the router receiving the call: the called DTE address, i.e., the actual DTE address sent to the DTE device.
Out DTE	The calling DTE address.
Remote DTE	The called DTE address on the router that originated the call. If the call is to a hunt group address, the second called DTE address, after hunt group address resolution. On the router receiving the call, the DTE address of the remote router that is connected, i.e., the original calling DTE address.
Remote router	IP address of the remote router that is terminating this call.

Examples To display connection details for all active calls on X.25 DCE interface 2, use the command:

```
show x25c=2 path
```

Related Commands **show x25c**

show x25c route

Syntax `SHOW X25C ROUTE`

Description This command displays the X.25 DCE route mapping table. All entries are displayed, one per line, in the order of the entry number in the table (Figure 12-24 on page 12-88, Table 12-20 on page 12-88).

Note that the more specific DTE entries appear first in the table. This example might represent a situation where a private X.25 network of routers is set up, with one of the routers connecting to a gateway to a public network. The private addresses appear first in the table. If none of the entries match and the called address has the right number of digits to be a valid public network address, the call is routed to the gateway, in this case with IP address 172.16.8.253.

Figure 12-24: Example output from the SHOW X25C ROUTE command

```
X.25 DCE route table

Ind   DTE address       IP address
--------------------------------------
  1   00002300          172.16.16.254
  2   00003400          172.16.32.99
  3   XXXXXXXX          172.16.8.253
  4   XXXXXXXXXX        172.16.8.253
  5   XXXXXXXXXXXXXXX   172.16.8.253
--------------------------------------
```

Table 12-20: Parameters in the output of the SHOW X25C ROUTE command

Parameter	Meaning
Ind	Index of the route entry in the route table.
DTE Address	DTE address for the X.25 call.
IP address	IP address of the router that accepts the call.

Examples To display the X.25 DCE route mapping table, use the command:

```
show x25c route
```

Related Commands **add x25c route**
delete x25c route

show x25c state

Syntax `SHOW X25C=`*`x25-interface`* `STATE`

Where *x25-interface* is the number of the X.25 DCE logical interface from 0 to 7

Description This command displays the status information for the Logical Channel Number on the X.25 DCE interface (Figure 12-25 on page 12-88, Table 12-21 on page 12-89).

Figure 12-25: Example output from the SHOW X25C STATE command

```
LCGN    LCN    State     PktSize      WinSize    Throughput
                         Tx    Rx     Tx  Rx     Tx     Rx
-------------------------------------------------------------
   0      1    OPEN      4096  4096   2   2      9600   9600
   0      2    CR-WAIT   -     -      -   -      -      -
   1      1    CR-WAIT   -     -      -   -      -      -
   1      2    OPEN      256   512    3   5      2400   4800
-------------------------------------------------------------
```

Table 12-21: Parameters in the output of the SHOW X25C STATE command

Parameter	Meaning
LCGN	Logical Channel Group Number.
Number of channels	Number of logical channels in the LCGN.
State	State of the X.25 DCE logical interface; either "OPEN", "CR-WAIT", "CA-WAIT", "CQ-WAIT", or "CI-WAIT".
PktSize Tx/Rx	Maximum packet size for the transmit (Tx) and receive (Rx) directions, when the *State* field is set to "OPEN".
WinSize Tx/Rx	Window size for the transmit (Tx) and receive (Rx) directions, when the *State* field is set to "OPEN".
Throughput Tx/Rx	Through-put class for the transmit (Tx) and receive (Rx) directions, when the *State* field is set to "OPEN".

Example To display status information about X25C interface 0, use the command:

```
show x25c=0 state
```

Related Commands

create x25c
set x25c
show x25c
show x25c counter

show x25c tcpkeepalive

Syntax

```
SHOW X25C TCPKEEPALIVE
```

Description This command displays the parameters for the TCP Keepalive feature.

Figure 12-26: Example output from the SHOW X25C TCPKEEPALIVE command

```
X.25 keep alive parameters for TCP
------------------------------------------
Transmit interval (TXINT) ..... 5
Fail number (FAILNUMBER) ..... 2
------------------------------------------
```

Table 12-22: Parameters in the output of the SHOW X25C TCPKEEPALIVE command

Parameter	Meaning
Transmit interval (TXINT)	Seconds between sending ACK packets to the other end of the TCP connection.
Fail number (FAILNUMBER)	Number of times an ACK can be sent without receiving a reply before the link is brought down.

Example To display the TCP Keepalive parameters, use the command:

```
show x25c tcpkeepalive
```

Related Commands set x25c tcpkeepalive

show x25t

Syntax `SHOW X25T[=x25-interface] [{CIRCUIT|COUNT}]`

where *x25-interface* is the number of the X.25 DTE logical interface, from 0 to 7

Description This command displays information about the specified X.25 DTE interface. If the interface is not specified, information about all X.25 DTE interfaces is displayed (Figure 12-27 on page 12-90, Table 12-23 on page 12-90). The **circuit** parameter displays details of X.25 circuits (Figure 12-28 on page 12-92, Table 12-24 on page 12-92). The **count** parameter displays X.25 DTE counters (Figure 12-29 on page 12-93, Table 12-25 on page 12-93).

Figure 12-27: Example output from the SHOW X25T command

```
------------------------------------------------------------------------------
X.25 DTE Interface: 0

Over:              LAPB4              DTE address:
Packet modulus:        8              Max channels:  128
DTE role:        DYNAMIC              Number PVCs:   499

LIC:        500     LTC:    1500     LOC:      2500
HIC:       1000     HTC:    2000     HOC:      3000
Incoming:   500     Twoway:  500     Outgoing:  500

Timers
Restart    T20:  180   R20:    1    Win Rotate   T25:   60   R25:    0
Call Req   T21:  200                Interrupt    T26:  180
Reset Req  T22:  180   R22:    1    Reject       T27:   60   R27:    0
Clear Req  T23:  180   R23:    1    Registration T28:  300   R28:    0
Win Status T24:   60

Default call parameters: 0

Receive window:    2               Transmit window:    2
Receive data:    128               Transmit data:    128
------------------------------------------------------------------------------
```

Table 12-23: Parameters in the output of the SHOW X25T command

Parameter	Meaning
X.25 DTE instance	The number of the X.25 logical interface.
Over	The Layer 2 entity used by this X.25 interface.
DTE address	The DTE address for this X.25 interface.
Packet modulus	The modulus of packet sequence numbers.
Max channels	The maximum number of channels supported.

Table 12-23: Parameters in the output of the SHOW X25T command (continued)

Parameter	Meaning
DTE role	The operational mode of the X.25 interface; either DCE, DTE, or DYNAMIC.
Number PVCs	The number of channels reserved for PVCs.
LIC	The lowest incoming channel number.
LTC	The lowest two-way channel number.
LOC	The lowest outgoing channel number.
HIC	The highest incoming channel number.
HTC	The highest two-way channel number.
HOC	The highest outgoing channel number.
Incoming	The number of incoming call channels available.
Twoway	The number of twoway call channels available.
Outgoing	The number of outgoing call channels available.
T20	The value in seconds of the restart timer.
R20	The value of the restart retransmission counter.
T21	The value in seconds of the call timer.
T22	The value in seconds of the reset timer.
R22	The value of the restart request retransmission counter.
T23	The value in seconds of the clear timer.
R23	The value of the clear request retransmission counter.
T24	The value in seconds of the optional window timer.
T25	The value in seconds of the window rotation timer.
R25	The value of the window rotation counter.
T26	The value in seconds of the interrupt timer.
T27	The value in seconds of the reject response timer.
R27	The value of the reject retransmission counter.
T28	The value in seconds of the registration timer.
R28	The value of the registration counter.
Default call parameter	The index of the default call parameter set for this interface.
Receive window	The reception window size for the default call parameter set.
Transmit window	The transmission window size for the default call parameter set.
Receive data	The maximum packet size for reception for the default call parameter set.
Transmit data	The maximum packet size for transmission for the default call parameter set.

Figure 12-28: Example output from the SHOW X25T CIRCUIT command

```
X.25 DTE Instance: 0     Circuits
--------------------------------------------------------------------------------
Channel: 1
Comment: Call to head office

Type:                          PVC
Status:                        pvc
Call Parameters:                 0
Established Time:                0
Octets Received:                 0    Octets Sent:                0
Data Packets Received:           0    Data Packets Sent:          0
Interrupts Received:             0    Interrupts Sent:            0
Remote Resets:                   0    Provider Resets:            0

Timer            T22          T25          T26
Timeouts:          0            0            0
--------------------------------------------------------------------------------
```

Table 12-24: Parameters in the output of the SHOW X25T CIRCUIT command

Parameter	Meaning
X.25 DTE instance	The number of the X.25 DTE logical interface.
Channel	The channel number.
Comment	A description of the call.
Type	The channel type: either "PVC" or "SVC".
Status	The status of the call.
CPar	The index of the call parameter set for this channel.
Estab Time	The time that the call was established.
Octets Received	The number of octets received on this channel.
Octets Sent	The number of octets transmitted on this channel.
Data Packets Received	The number of PDUs received on this channel.
Data Packets Sent	The number of PDUs transmitted on this channel.
Interrupts Received	The number of interrupt requests received.
Interrupts Sent	The number of interrupt requests sent.
Remote Resets	The number of calls on this channel reset by this DTE.
Provider Resets	The number of calls on this channel reset by the provider.
T22 timeouts	The number of times a timeout occurred for the reset timer on this channel.
T25 timeouts	The number of times a timeout occurred for the window rotation timer on this channel.
T26 timeouts	The number of times a timeout occurred for the Interrupt timer on this channel.

Figure 12-29: Example output from the SHOW X25T COUNT command

```
X.25 DTE instance: 0     Counters

Data Packets Received:          0    Data Packets Sent:          0
Interrupts Received:            0    Interrupts Sent:            0
Calls Received:                 0    Calls Attempted:            0
Calls Refused:                  0    Calls Failed:               0
Remote Resets:                  0    Provider Resets:            0
Clear Call Received:            0
Restarts Received:              0
Protocol Errors:                0

Incoming Circuits:              0
Outgoing Circuits:              0
Twoway Circuits:                0

Timer Timeouts
Restart Request T20:            0    Clear Request T23:          0
Call Request    T21:            0    Win Rotation T25:           0
Reset Request   T22:            0    Interrupt T26:              0

Retrys Exceeded:                0
```

Table 12-25: Parameters in the output of the SHOW X25T COUNT command

Parameter	Meaning
X.25 DTE instance	The number of the X.25 logical interface.
Data Packets Received	The number of data packets received.
Data Packets Sent	The number of data packets transmitted.
Interrupts Received	The number of interrupt requests received.
Interrupts Sent	The number of interrupt requests sent.
Calls Received	The number of incoming calls received.
Calls Attempted	The number of outgoing calls made.
Calls Refused	The number of incoming calls refused.
Calls Failed	The number of outgoing calls the failed.
Remote Resets	The number of times an incoming call was reset by this DTE.
Provider Resets	The number of times an incoming call was reset by the network provider.
Clear Call Received	The number of clear call requests received.
Restarts Received	The number of restart requests received.
Protocol Errors	The number of data packets received that contained protocol errors.
Incoming	The number of incoming call channels available.
Twoway	The number of twoway call channels available.
Outgoing	The number of outgoing call channels available.
T20 timeouts	The number of times a timeout occurred for the restart timer.
T21 timeouts	The number of times a timeout occurred for the call timer.
T22 timeouts	The number of times a timeout occurred for the reset timer.
T23 timeouts	The number of times a timeout occurred for the clear timer.

Table 12-25: Parameters in the output of the SHOW X25T COUNT command

Parameter	Meaning
T25 timeouts	The number of times a timeout occurred for the window rotation timer.
T26 timeouts	The number of times a timeout occurred for the Interrupt timer.
Retrys Exceeded	The number of times the retry counter was exceeded.

Examples To display the counters for X.25 DTE interface 1, use the command:

```
show x25t=0 count
```

Related Commands

create x25t
destroy x25t
set x25t
reset x25t

show x25t cpar

Syntax `SHOW X25T CPAR[=call-index]`

where *call-index* is the index of the call parameters to display

Description This command displays a set of call parameters for X.25 (Figure 12-30 on page 12-94, Table 12-26 on page 12-95). If the call parameter index is specified, that call parameter entry is displayed, otherwise all call parameter entries are displayed. The call parameters must already exist.

Figure 12-30: Example output from the SHOW X25T CPAR command

```
X.25 DTE call parameters

Index:   1    References:   0
Receive window:    2     Transmit window:    2
Receive data:    128     Transmit data:    128
User data: 80 00 00 00 08 00
NUI string: bt_test_host

Index:   2    References:   3
Receive window:    2     Transmit window:    2
Receive data:    128     Transmit data:    128
User data: 80 00 00 00 81 37
NUI string:
```

Table 12-26: Parameters in the output of the SHOW X25T CPAR command

Parameter	Meaning
Index	Index of the call parameter set.
References	Number of PVCs and X.25 DTE logical interfaces defined that reference this call plus the number of calls in progress using this call parameter set.
Receive window	Reception window size for this call parameter set.
Transmit window	Transmission window size for this call parameter set.
Receive data	Maximum packet size for reception for this call parameter set.
Transmit data	Maximum packet size for transmission for this call parameter set.
User data	Value to be used in the user data field of a call request for this call parameter set.
NUI string	Network User Identification to be used for this call parameter set.

Examples

To display the configuration of all X.25 DTE call parameter sets, use the command:

```
show x25t cpar
```

Related Commands

add x25t cpar
create x25t
delete x25t cpar
set x25t
set x25t cpar