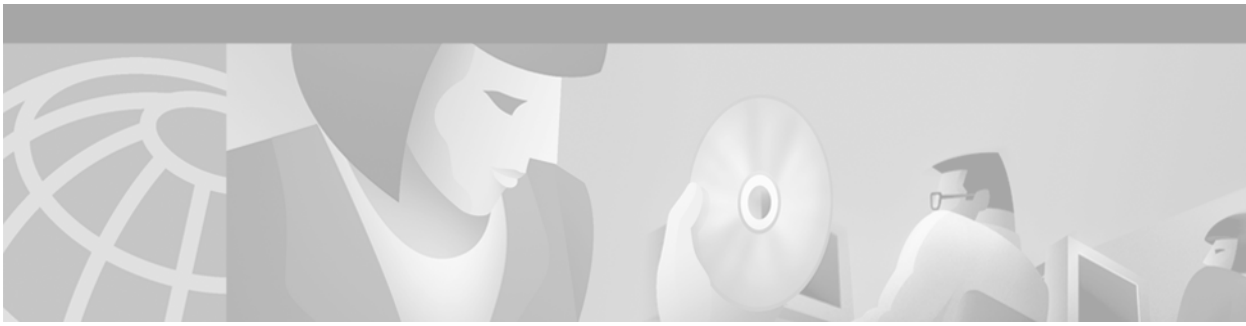

X.25 and LAPB Commands

Use the commands in this chapter to configure the following:

- Link Access Procedure, Balanced (LAPB)
- X.25 services (X.25, X.25 over TCP [XOT] and Connection-Mode Network Service [CMNS])
- Defense Data Network (DDN) X.25
- Blacker Front End (BFE).

X.25 provides remote terminal access and bridging. X.25 also provides encapsulation for the following protocols:

- IP
- DECnet
- Xerox Network Services (XNS)
- International Organization for Standardization (ISO) Connectionless Network Service (CLNS) AppleTalk
- Novell IPX
- Banyan VINES
- Apollo Domain

X.25 virtual circuits can be switched as follows:

- Between interfaces—for local routing
- Between two routers—for remote routing using X.25-over-TCP (XOT)
- Over nonserial media—for Connection-Mode Network Service (CMNS)

To translate between X.25 and another protocol, refer to the chapter "Configuring Protocol Translation and Virtual Asynchronous Devices" in the *Cisco IOS Terminal Services Configuration Guide*.

For X.25 and LAPB configuration information and examples, refer to the "Configuring X.25 and LAPB" chapter in the *Cisco IOS Wide-Area Networking Configuration Guide*.

access-class (X.25)

To configure an incoming access class on virtual terminals, use the **access-class** (X.25) line configuration command.

access-class *access-list-number* **in**

Syntax Description

access-list-number	An integer from 1 to 199 that you select for the access list.
in	Restricts incoming connections between a particular access server and the addresses in the access list.

Defaults

No incoming access class is defined.

Command Modes

Line configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

The access list number is used for both incoming Transmission Control Protocol (TCP) access and incoming packet assembler/disassembler (PAD) access.

In the case of TCP access, the access server uses the IP access list defined with the **access-list** command.

For incoming PAD connections, the same numbered X.29 access list is referenced. If you only want to have access restrictions on one of the protocols, you can create an access list that permits all addresses for the other protocol.

Examples

The following example configures an incoming access class on virtual terminal line 4. For information on the **line vty** command see the publication *Configuring the Route Processor for the Catalyst 8540 and Using Flash Memory Cards*.

```
line vty 4
 access-class 4 in
```

Related Commands

Command	Description
access-list	Configures the access list mechanism for filtering frames by protocol type or vendor code.
x29 access-list	Limits access to the access server from certain X.25 hosts.

bfe

This command is no longer supported.

clear x25

To restart an X.25 service or Connection-Mode Network Service (CMNS), to clear a switched virtual circuit (SVC), or to reset a permanent virtual circuit (PVC), use the **clear x25** privileged EXEC command.

clear x25 {**serial** *number* | {**ethernet** | **fastethernet** | **tokenring** | **fddi**} *number mac-address*} [*vc-number*] | [*dlci number*]

Syntax Description

serial *number*	Local serial interface being used for X.25 service.
ethernet | **fastethernet** | **tokenring** | **fddi** *number mac-address*	Local CMNS interface (Ethernet, Fast Ethernet, Token Ring, or FDDI interface) and MAC address of the remote device; this information identifies a CMNS service.
vc-number	(Optional) SVC or PVC number, in the range 1 to 4095. If specified, the SVC is cleared or the PVC is reset. If not specified, the X.25 or CMNS service is restarted.
dlci number	(Optional) When combined with a serial interface number, it triggers a restart event for an Annex G logical X.25 VC.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.2	This command was introduced. This command replaces the **clear x25-vc** command, which first appeared in Cisco IOS Release 8.3.
12.0(3)T	Annex G restart or clear options were added.

Usage Guidelines

This command form is used to disrupt service forcibly on an individual circuit or on all circuits using a specific X.25 service or CMNS service.

If this command is used without the *vc-number* value, a restart event is initiated, which implicitly clears all SVCs and resets all PVCs.

This command allows the option of restarting an Annex G connection per data-link connection identifier (DLCI) number, clearing all X.25 connections, or clearing a specific X.25 logical circuit number on that Annex G link.

Examples

The following example clears the SVC or resets the PVC specified:

```
clear x25 serial 0 1
```

The following example forces an X.25 restart, which implicitly clears all SVCs and resets all PVCs using the interface:

```
clear x25 serial 0
```

The following example restarts the specified CMNS service (if active), which implicitly clears all SVCs using the service:

```
clear x25 ethernet 0 0001.0002.0003
```

The following example clears the specified DLCI Annex G connection (**40**) from the specified interface:

```
clear x25 serial 1 40
```

Related Commands

Command	Description
clear xot	Clears an XOT SVC or resets an XOT PVC.
frame-relay interface-dlci	Assigns a DLCI to a specified Frame Relay subinterface on the router or access server.
show x25 context	Displays details of an Annex G DLCI link.
show x25 services	Displays information about X.25 services.
show x25 vc	Displays information about active X.25 virtual circuits.

clear x25-vc

This command is replaced by the **clear x25** command. See the description of the **clear x25** command earlier in this chapter for more information.

clear xot

To clear an X.25 over TCP (XOT) switched virtual circuit (SVC) or reset an XOT permanent virtual circuit (PVC), use the **clear xot** EXEC command.

clear xot remote *ip-address port* **local** *ip-address port*

Syntax Description

remote *ip-address port*	Remote IP address and port number of an XOT connection ID.
local *ip-address port*	Local IP address and port number of an XOT connection ID.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Each SVC or PVC supported by the XOT service uses a TCP connection to communicate X.25 packets. A TCP connection is uniquely identified by the data quartet: remote IP address, remote TCP port, local IP address, and local TCP port. This command form is used to forcibly disrupt service on an individual XOT circuit.

XOT connections are sent to TCP port 1998, so XOT connections originated by the router will have that remote port number, and connections received by the router will have that local port number.

Examples

The following command will clear or reset, respectively, the SVC or PVC using the TCP connection identified:

```
clear xot remote 10.1.1.1 1998 local 172.2.2.2 2000
```

Related Commands

Command	Description
show x25 services	Displays information pertaining to the X.25 services.

cmns enable

To enable the Connection-Mode Network Service (CMNS) on a nonserial interface, use the **cmns enable** interface configuration command. To disable this capability, use the **no** form of this command.

cmns enable

no cmns enable

Syntax Description

This command has no arguments or keywords.

Defaults

Each nonserial interface must be explicitly configured to use CMNS.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

After this command is processed on the LAN interfaces—Ethernet, Fiber Distributed Data Interface (FDDI), and Token Ring—all the X.25-related interface configuration commands are made available.

Examples

The following example enables CMNS on Ethernet interface 0:

```
interface ethernet 0
 cmns enable
```

Related Commands

Command	Description
x25 route	Creates an entry in the X.25 routing table (to be consulted for forwarding incoming calls and for placing outgoing PAD or protocol translation calls).

encapsulation lapb

To exchange datagrams over a serial interface using Link Access Procedure, Balanced (LAPB) encapsulation, use the **encapsulation lapb** interface configuration command.

encapsulation lapb [**dte** | **dce**] [**multi** | *protocol*]

Syntax Description

dte	(Optional) Specifies operation as a data terminal equipment (DTE) device. This is the default LAPB mode.
dce	(Optional) Specifies operation as a data communications equipment (DCE) device.
multi	(Optional) Specifies use of multiple local-area network (LAN) protocols to be carried on the LAPB line.
protocol	(Optional) A single protocol to be carried on the LAPB line. A single protocol can be one of the following: **apollo**, **appletalk**, **clns** (ISO CLNS), **decnet**, **ip**, **ipx** (Novell IPX), **vines**, and **xns**. IP is the default protocol.

Defaults

The default serial encapsulation is High-Level Data Link Control (HDLC). You must explicitly configure a LAPB encapsulation method.

DTE operation is the default LAPB mode. IP is the default protocol.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
10.3	The following keywords and argument were introduced: • **dte** • **dce** • **multi** • *protocol*

Usage Guidelines

LAPB encapsulations are appropriate only for private connections, where you have complete control over both ends of the link. Connections to X.25 networks should use an X.25 encapsulation configuration, which operates the X.25 Layer 3 protocol above a LAPB Layer 2.

One end of the link must be a logical DCE device, and the other end a logical DTE device. (This assignment is independent of the interface's hardware DTE or DCE identity.)

Both ends of the LAPB link must specify the same protocol encapsulation.

LAPB encapsulation is supported on serial lines configured for dial-on-demand routing (DDR). It can be configured on DDR synchronous serial and ISDN interfaces and on DDR dialer rotary groups. It is not supported on asynchronous dialer interfaces.

A single-protocol LAPB encapsulation exchanges datagrams of the given protocol, each in a separate LAPB information frame. You must configure the interface with the protocol-specific parameters needed—for example, a link that carries IP traffic will have an IP address defined for the interface.

A multiprotocol LAPB encapsulation can exchange any or all of the protocols allowed for a LAPB interface. It exchanges datagrams, each in a separate LAPB information frame. Two bytes of protocol identification data precede the protocol data. You need to configure the interface with all the protocol-specific parameters needed for each protocol carried.

Beginning with Cisco IOS Release 11.0, *multiprotocol* LAPB encapsulation supports transparent bridging. This feature requires use of the **encapsulation lapb multi** command followed by the **bridge-group** command, which identifies the bridge group associated with multiprotocol LAPB encapsulation. This feature does *not* support use of the **encapsulation lapb** *protocol* command with a **bridge** keyword.

Beginning with Release 10.3, LAPB encapsulation supports the priority and custom queueing features.

Examples

The following example sets the operating mode as DTE and specifies that AppleTalk protocol traffic will be carried on the LAPB line:

```
interface serial 1
 encapsulation lapb dte appletalk
```

Related Commands

Command	Description
bridge-group	Assigns each network interface to a bridge group.

encapsulation x25

To specify a serial interface's operation as an X.25 device, use the **encapsulation x25** interface configuration command.

encapsulation x25 [**dte** | **dce**] [**ddn** | **bfe**] | [**ietf**]

no encapsulation x25 [**dte** | **dce**] [**ddn** | **bfe**] | [**ietf**]

Syntax Description

dte	(Optional) Specifies operation as a data terminal equipment (DTE). This is the default X.25 mode.
dce	(Optional) Specifies operation as a data communications equipment (DCE).
ddn	(Optional) Specifies Defense Data Network (DDN) encapsulation on an interface using DDN X.25 Standard Service.
bfe	(Optional) Specifies Blacker Front End (BFE) encapsulation on an interface attached to a BFE device.
ietf	(Optional) Specifies that the interface's datagram encapsulation defaults to use of the Internet Engineering Task Force (IETF) standard method, as defined by RFC 1356.

Defaults

The default serial encapsulation is High-Level Data Link Control (HDLC). You must explicitly configure an X.25 encapsulation method.

DTE operation is the default X.25 mode. Cisco's traditional X.25 encapsulation method is the default.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
10.3	The following keywords were added: • **dte** • **dce** • **ddn** • **bfe** • **ietf**

Usage Guidelines

One end of an X.25 link must be a logical DCE device and the other end a logical DTE device. (This assignment is independent of the interface's hardware DTE or DCE identity.) Typically, when connecting to a public data network (PDN), the customer equipment acts as the DTE device and the PDN attachment acts as the DCE.

Cisco has long supported the encapsulation of a number of datagram protocols, using a standard means when available and a proprietary means when necessary. More recently the IETF adopted a standard, RFC 1356, for encapsulating most types of datagram traffic over X.25. X.25 interfaces use Cisco's traditional method unless explicitly configured for IETF operation; if the **ietf** keyword is specified, that standard is used unless Cisco's traditional method is explicitly configured. For details see the **x25 map** command.

You can configure a router attaching to the DDN or to a BFE device to use their respective algorithms to convert between IP and X.121 addresses by using the **ddn** or **bfe** option, respectively. An IP address must be assigned to the interface, from which the algorithm will generate the interface's X.121 address. For proper operation, this X.121 address must not be modified.

A router DDN attachment can operate as either a DTE or a DCE device. A BFE attachment can operate only as a DTE device. The **ietf** option is not available if either the **ddn** or **bfe** option is selected.

Examples

The following example configures the interface for connection to a BFE device:

```
interface serial 0
 encapsulation x25 bfe
```

Related Commands

Command	Description
x25 map	Sets up the LAN protocols-to-remote host mapping.

lapb interface-outage

To specify the period for which a link will remain connected, even if a brief hardware outage occurs (partial Link Access Procedure, Balanced [LAPB] T3 timer functionality), use the **lapb interface-outage** interface configuration command.

lapb interface-outage *milliseconds*

Syntax Description

milliseconds	Number of milliseconds (ms) a hardware outage can last without the protocol disconnecting the service.

Defaults

0 ms, which disables this feature.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

If a hardware outage lasts longer than the LAPB hardware outage period you select, normal protocol operations will occur. The link will be declared down, and when it is restored, a link setup will be initiated.

Examples

The following example sets the interface outage period to 100 ms. The link remains connected for outages equal to or shorter than that period.

```
encapsulation lapb dte ip
lapb interface-outage 100
```

Related Commands

Command	Description
lapb n1	Sets the maximum number of bits a frame can hold (LAPB N1 parameter).
lapb n2	Specifies the maximum number of times a data frame can be sent (LAPB N2 parameter).
lapb t1	Sets the retransmission timer period (LAPB T1 parameter).
lapb t2	Sets the explicit acknowledge deferral timer (LAPB T2 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.

lapb k

To specify the maximum permissible number of outstanding frames, called the *window size*, use the **lapb k** interface configuration command.

lapb k *window-size*

Syntax Description

window-size	Frame count. It can be a value from 1 to the modulo size minus 1 (the maximum is 7 if the modulo size is 8; it is 127 if the modulo size is 128).

Defaults

7 frames

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

If the window size is changed while the protocol is up, the new value takes effect only when the protocol is reset. You will be informed that the new value will not take effect immediately.

When using the Link Access Procedure, Balanced (LAPB) modulo 128 mode (extended mode), you must increase the window parameter k to send a larger number of frames before acknowledgment is required. This increase is the basis for the router's ability to achieve greater throughput on high-speed links that have a low error rate.

This configured value must match the value configured in the peer X.25 switch. Nonmatching values will cause repeated LAPB reject (REJ) frames.

Examples

The following example sets the LAPB window size (the k parameter) to 10 frames:

```
interface serial 0
 lapb modulo
 lapb k 10
```

Related Commands

Command	Description
lapb modulo	Specifies the LAPB basic (modulo 8) or extended (modulo 128) protocol mode.

lapb modulo

To specify the Link Access Procedure, Balanced (LAPB) basic (modulo 8) or extended (modulo 128) protocol mode, use the **lapb modulo** interface configuration command.

lapb modulo *modulus*

Syntax Description

modulus	Either 8 or 128. The value 8 specifies LAPB's basic mode; the value 128 specifies LAPB's extended mode.

Defaults

Modulo 8

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The modulo parameter determines which of LAPB's two modes is to be used. The modulo values derive from the fact that basic mode numbers information frames between 0 and 7, whereas extended mode numbers them between 0 and 127. Basic mode is widely available and is sufficient for most links. Extended mode is an optional LAPB feature that may achieve greater throughput on high-speed links that have a low error rate.

The LAPB operating mode may be set on X.25 links as well as LAPB links. The X.25 modulo is independent of the LAPB layer modulo. Both ends of a link must use the same LAPB mode.

When using modulo 128 mode, you must increase the window parameter k to send a larger number of frames before acknowledgment is required. This increase is the basis for the router's ability to achieve greater throughput on high-speed links that have a low error rate.

If the modulo value is changed while the protocol is up, the new value takes effect only when the protocol is reset. You will be informed that the new value will not take effect immediately.

Examples

The following example configures a high-speed X.25 link to use LAPB's extended mode:

```
interface serial 1
 encapsulation x25
 lapb modulo 128
 lapb k 40
 clock rate 2000000
```

Related Commands

Command	Description
lapb k	Specifies the maximum permissible number of outstanding frames, called the window size.

lapb n1

To specify the maximum number of bits a frame can hold (the Link Access Procedure, Balanced [LAPB] N1 parameter), use the **lapb n1** interface configuration command.

lapb n1 *bits*

Syntax Description

bits	Maximum number of bits in multiples of eight. The minimum and maximum range is dynamically set. Use the question mark (**?**) to view the range.

Defaults

The largest (maximum) value available for the particular interface is the default. The Cisco IOS software dynamically calculates N1 whenever you change the maximum transmission unit (MTU), the L2/L3 modulo, or compression on a LAPB interface.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The Cisco IOS software uses the following formula to determine the minimum N1 value:

*(128 (default packet size) + LAPB overhead + X.25 overhead + 2 bytes of CRC) * 8*

The Cisco IOS software uses the following formula to determine for the maximum N1 value:

*(hardware MTU + LAPB overhead + X.25 overhead + 2 bytes of CRC) * 8*

LAPB overhead is 2 bytes for modulo 8 and 3 bytes for modulo 128.

X.25 overhead is 3 bytes for modulo 8 and 4 bytes for modulo 128.

You need not set N1 to an exact value to support a particular X.25 data packet size. The N1 parameter prevents the processing of any huge frames that result from a "jabbering" interface, an unlikely event.

In addition, the various standards bodies specify that N1 be given in bits rather than bytes. While some equipment can be configured in bytes or will automatically adjust for some of the overhead information present, Cisco devices are configured using the true value, in bits, of N1.

You cannot set the N1 parameter to a value less than that required to support an X.25 data packet size of 128 bytes. All X.25 implementations must be able to support 128-byte data packets. Moreover, if you configure N1 to be less than 2104 bits, you receive a warning message that X.25 might have problems because some nondata packets can use up to 259 bytes.

You cannot set the N1 parameter to a value larger than the default unless the hardware MTU size is first increased.

The X.25 software accepts default packet sizes and calls that specify maximum packet sizes greater than those the LAPB layer supports, but negotiates the calls placed on the interface to the largest value that can be supported. For switched calls, the packet size negotiation takes place end-to-end through the router so the call will not have a maximum packet size that exceeds the capability of either of the two interfaces involved.

Caution The LAPB N1 parameter provides little benefit beyond the interface MTU and can easily cause link failures if misconfigured. Cisco recommends that this parameter be left at its default value.

Examples

The following example shows how to use the question mark (**?**) command to display the minimum and maximum N1 value. In this example, X.25 encapsulation has both the LAPB and X.25 modulo set to 8. Any violation of this N1 range results in an "Invalid input" error message.

```
router(config)# interface serial 1
router(config-if)# lapb n1 ?

<1080-12056> LAPB N1 parameter (bits; multiple of 8)
```

The following example sets the N1 bits to 16440:

```
router(config)# interface serial 0
router(config-if)# lapb n1 16440
router(config-if)# mtu 2048
```

Related Commands

Command	Description
lapb interface-outage	Partial LAPB T3 timer function that sets the time-length a link will remain connected during a hardware outage.
lapb n2	Specifies the maximum number of times a data frame can be sent (LAPB N2 parameter).
lapb t1	Sets the retransmission timer period (LAPB T1 parameter).
lapb t2	Sets the explicit acknowledge deferral timer (LAPB T2 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.
mtu	Adjusts the maximum packet size or MTU size.

lapb n2

To specify the maximum number of times a data frame can be sent (the Link Access Procedure, Balanced [LAPB] N2 parameter), use the **lapb n2** interface configuration command.

lapb n2 *tries*

Syntax Description

tries	Transmission count. It can be a value from 1 to 255.

Defaults

20 transmissions

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the N2 tries to 50:

```
interface serial 0
 lapb n2 50
```

Related Commands

Command	Description
lapb interface-outage	Partial LAPB T3 timer function that sets the time-length a link will remain connected during a hardware outage.
lapb n1	Sets the maximum number of bits a frame can hold (LAPB N1 parameter).
lapb t1	Sets the retransmission timer period (LAPB T1 parameter).
lapb t2	Sets the explicit acknowledge deferral timer (LAPB T2 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.

lapb protocol

The **lapb protocol** command has been replaced by the [*protocol* | **multi**] option of the **encapsulation lapb** command. See the description of the [*protocol* | **multi**] option of the **encapsulation lapb** command earlier in this chapter for more information.

lapb t1

To set the retransmission timer period (the Link Access Procedure, Balanced [LAPB] T1 parameter), use the **lapb t1** interface configuration command.

lapb t1 *milliseconds*

Syntax Description

milliseconds	Time in milliseconds. It can be a value from 1 to 64000.

Defaults

3000 ms

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The retransmission timer determines how long a transmitted frame can remain unacknowledged before the LAPB software polls for an acknowledgment. The design of the LAPB protocol specifies that a frame is presumed to be lost if it is not acknowledged within T1; a T1 value that is too small may result in duplicated control information, which can severely disrupt service.

To determine an optimal value for the retransmission timer, use the **ping** privileged EXEC command to measure the round-trip time of a maximum-sized frame on the link. Multiply this time by a safety factor that takes into account the speed of the link, the link quality, and the distance. A typical safety factor is 1.5. Choosing a larger safety factor can result in slower data transfer if the line is noisy. However, this disadvantage is minor compared to the excessive retransmissions and effective bandwidth reduction caused by a timer setting that is too small.

Examples

The following example sets the T1 retransmission timer to 2000 ms:

```
interface serial 0
 lapb t1 2000
```

Related Commands

Command	Description
lapb interface-outage	Partial LAPB T3 timer function that sets the time-length a link will remain connected during a hardware outage.
lapb n1	Sets the maximum number of bits a frame can hold (LAPB N1 parameter).
lapb n2	Specifies the maximum number of times a data frame can be sent (LAPB N2 parameter).

Command	Description
lapb t2	Sets the explicit acknowledge deferral timer (LAPB T2 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.

lapb t2

To set the explicit acknowledge deferral timer (the Link Access Procedure, Balanced [LAPB] T2 parameter), use the **lapb t2** interface configuration command.

lapb t2 *milliseconds*

Syntax Description

milliseconds	Time in milliseconds. It can be a value from 1 to 32000. Default is 0 ms (disabled) and the recommended setting.

Defaults

0 ms (disabled), which means that the software will send an acknowledgement as quickly as possible.

Command Modes

Interface configuration

Command History

Release	Modification
12.0	This command was introduced.

Usage Guidelines

The explicit acknowledge deferral timer determines the time that the software waits before sending an explicit acknowledgement. The acknowledgement is piggybacked with the data, unless there is no data and then an explicit acknowledgement is sent when the timer expires.

Caution It is usually not necessary (or recommended) to set the LAPB T2 timer, but if there is a requirement, it must be set to a value smaller than that set for the LAPB T1 timer; see the ITU X.25 specifications for details.

Related Commands

Command	Description
lapb interface-outage	Partial LAPB T3 timer function that sets the time-length a link will remain connected during a hardware outage.
lapb n1	Sets the maximum number of bits a frame can hold (LAPB N1 parameter).
lapb n2	Specifies the maximum number of times a data frame can be sent (LAPB N2 parameter).
lapb t1	Sets the retransmission timer period (LAPB T1 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.

lapb t4

To set the T4 idle timer, after which the Cisco IOS software sends out a Poll packet to determine whether the link has suffered an unsignaled failure, use the **lapb t4** interface configuration command.

lapb t4 *seconds*

Syntax Description

seconds	Number of seconds between receipt of the last frame and transmission of the outgoing poll.

Defaults

0 seconds

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Any non-zero T4 duration must be greater than T1, the Link Access Procedure, Balanced (LAPB) retransmission timer period.

Examples

The following example will poll the other end of an active link if it has been 10 seconds since the last frame was received. If the far host has failed, the service will be declared down after **n2** tries are timed out.

```
interface serial0
 encapsulation x25
 lapb t4 10
```

Related Commands

Command	Description
lapb interface-outage	Partial LAPB T3 timer function that sets the time-length a link will remain connected during a hardware outage.
lapb n1	Sets the maximum number of bits a frame can hold (LAPB N1 parameter).
lapb n2	Specifies the maximum number of times a data frame can be sent (LAPB N2 parameter).
lapb t1	Sets the retransmission timer period (LAPB T1 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.

service pad

To enable all packet assembler/disassembler (PAD) commands and connections between PAD devices and access servers, use the **service pad** global configuration command. To disable this service, use the **no** form of this command.

service pad [**cmns**][**from-xot**][**to-xot**]

no service pad [**cmns**][**from-xot**][**to-xot**]

Syntax Description

cmns	(Optional) Specifies sending and receiving PAD calls over CMNS.
from-xot	(Optional) Accepts XOT to PAD connections.
to-xot	(Optional) Allows outgoing PAD calls over XOT.

Defaults

All PAD commands and associated connections are enabled. PAD services over XOT or CMNS are not enabled.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3	The **cmns** keyword was added.

Usage Guidelines

The options **from-xot** and **to-xot** enable PAD calls to destinations that are not reachable over physical X.25 interfaces, but instead over TCP tunnels. This feature is known as PAD over XOT (X.25 over TCP).

Examples

If **service pad** is disabled, the EXEC **pad** command and all PAD related configurations, such as X.29, are unrecognized, as shown in the following example:

```
Router(config)# no service pad
Router(config)# x29 ?
% Unrecognized command
Router(config)# exit
Router# pad ?
% Unrecognized command
```

If **service pad** is enabled, the EXEC **pad** command and access to an X.29 configuration are granted as shown in the following example:

```
Router# config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# service pad
Router(config)# x29 ?
access-list       Define an X.29 access list
inviteclear-time  Wait for response to X.29 Invite Clear message
profile           Create an X.3 profile
```

```
Router# pad ?
WORD   X121 address or name of a remote system
```

In the following example, PAD services over CMNS are enabled:

```
! Enable CMNS on a nonserial interface
interface ethernet0
 cmns enable
!
!Enable inbound and outbound PAD over CMNS service
service pad cmns
!
! Specify an X.25 route entry pointing to an interface's CMNS destination MAC address
x25 route ^2193330 interface Ethernet0 mac 00e0.b0e3.0d62

Router# show x25 vc

SVC 1,  State: D1,  Interface: Ethernet0
     Started 00:00:08, last input 00:00:08, output 00:00:08

     Line: 0   con 0    Location: console Host: 2193330
      connected to 2193330 PAD <--> CMNS Ethernet0 00e0.b0e3.0d62

     Window size input: 2, output: 2
     Packet size input: 128, output: 128
     PS: 2  PR: 3  ACK: 3  Remote PR: 2  RCNT: 0  RNR: no
     P/D state timeouts: 0  timer (secs): 0
     data bytes 54/19 packets 2/3 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Related Commands

Command	Description
cmns enable	Enables the CMNS on a nonserial interface.
show x25 vc	Displays information about active SVCs and PVCs.
x29 access-list	Limits access to the access server from certain X.25 hosts.
x29 profile	Creates a PAD profile script for use by the translate command.

service pad from-xot

To permit incoming X.25 over TCP (XOT) calls to be accepted as a packet assembler/disassembler (PAD) session, use the **service pad from-xot** global configuration command. To disable this service, use the **no** form of this command.

service pad from-xot

no service pad from-xot

Syntax Description

This command has no arguments or keywords.

Defaults

Incoming XOT connections are ignored.

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

If **service pad from-xot** is enabled, the calls received using the XOT service may be accepted for processing a PAD session.

Examples

The following example prevents incoming XOT calls from being accepted as a PAD session:

```
no service pad from-xot
```

Related Commands

Command	Description
x25 route	Creates an entry in the X.25 routing table (to be consulted for forwarding incoming calls and for placing outgoing PAD or protocol translation calls).
x29 access-list	Limits access to the access server from certain X.25 hosts.
x29 profile	Creates a PAD profile script for use by the translate command.

service pad to-xot

To permit outgoing PAD sessions to use routes to an XOT destination, use the **service pad to-xot** global configuration command. To disable this service, use the **no** form of this command.

service pad to-xot

no service pad to-xot

Syntax Description

This command has no arguments or keywords.

Defaults

XOT routes pointing to XOT are not considered.

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Examples

If **service pad to-xot** is enabled, the configured routes to XOT destinations may be used when the router determines where to send a PAD Call, as shown in the following example:

```
service pad to-xot
```

Related Commands

Command	Description
x25 route	Creates an entry in the X.25 routing table (to be consulted for forwarding incoming calls and for placing outgoing PAD or protocol translation calls).
x29 access-list	Limits access to the access server from certain X.25 hosts.
x29 profile	Creates a PAD profile script for use by the translate command.

show cmns

Effective with Cisco IOS Release 11.3, this command is no longer available.

show x25 context

To view operating configuration status details of an X.25 link, use the **show x25 context** EXEC command.

show x25 context [**interface** *number* **dlci** *number*]

Syntax Description

interface *number*	(Optional) Specific logical X.25 virtual circuit interface.
dlci *number*	(Optional) Specific DLCI link.

Command Modes

EXEC

Command History

Release	Modification
12.0(3)T	This command was introduced.
12.1(5)T	This command was modified to display information about X.25 Failover.

Examples

The following is sample output from the **show x25 context** command:

```
Router# show x25 context

Serial1 DLCI 20
PROFILE DCE, address <none>, state R1, modulo 8, timer 0
      Defaults: idle VC timeout 0
        input/output window sizes 2/2, packet sizes 128/128
      Timers: T10 60, T11 180, T12 60, T13 60
      Channels: Incoming-only none, Two-way 1-1024, Outgoing-only none
      RESTARTs 1/0 CALLs 0+0/0+0/0+0 DIAGs 0/0
  LAPB DCE, state CONNECT, modulo 8, k 7, N1 12056, N2 20
      T1 3000, T2 0, interface outage (partial T3) 0, T4 0
      VS 7, VR 6, tx NR 6, Remote VR 7, Retransmissions 0
      Queues: U/S frames 0, I frames 0, unack. 0, reTx 0
      IFRAMEs 111/118 RNRs 0/0 REJs 0/0 SABM/Es 14/1 FRMRs 0/0 DISCs 0/0
```

The following is sample output from the **show x25 context** command when the X.25 Failover feature is configured. The "Fail-over delay" field appears when the primary interface has gone down and come back up again. The number of seconds indicates the time remaining until the secondary interface will reset.

```
Router# show x25 context

Serial1 DLCI 33
  PROFILE dxe/DCE, address 3032, state R1, modulo 8, timer 0
      Defaults:idle VC timeout 0
        input/output window sizes 2/2, packet sizes 128/128
      Timers:T20 180, T21 200, T22 180, T23 180
      Channels:Incoming-only none, Two-way 1-4095, Outgoing-only none
      RESTARTs 12/0 CALLs 5+4/0+0/0+0 DIAGs 0/0
      Fail-over delay:16 seconds remaining on Dialer0
  LAPB dxe/DCE, state CONNECT, modulo 8, k 7, N1 12056, N2 20
      T1 3000, T2 0, interface outage (partial T3) 0, T4 0
      VS 1, VR 1, tx NR 1, Remote VR 1, Retransmissions 0
```

```
Queues:U/S frames 0, I frames 0, unack. 0, reTx 0
IFRAMEs 97/88 RNRs 0/0 REJs 0/0 SABM/Es 55490/12 FRMRs 186/0 DISCs
```

Table 43 describes significant fields shown in the display.

Table 43 show x25 context Field Descriptions

Field	Description
address	Address to which the interface is connected.
state	State of the interface. Possible values are: R1- normal ready state R2 - DTE restarting state R3 - DCE restarting state If state is R2 or R3, the interface is awaiting acknowledgment of a Restart packet.
modulo	Modulo packet sequence numbering scheme.
timer	Interface timer value (zero unless the interface state is R2 or R3).
Defaults: idle VC timeout	Inactivity time before clearing VC.
input/output window sizes	Default window sizes (in packets) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
packet sizes	Default maximum packet sizes (in bytes) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
Timers	Values of the X.25 timers: T10 through T13 for a DCE device T20 through T23 for a DTE device
Channels	Virtual circuit ranges for this interface.
RESTARTs	Restart packet statistics for the interface using the format Sent/Received.
CALLs	(Number of successful calls sent + calls failed)/(calls received + calls failed)/(calls forwarded + calls failed). Calls forwarded are counted as calls sent.
DIAGs	Number of diagnostic messages sent and received.
Fail-over delay	Number of seconds remaining until secondary interface resets.

Related Commands

Command	Description
show x25 profile	Displays information about configured X.25 profiles.
show x25 vc	Displays information about active X.25 virtual circuits.
x25 profile	Configures an X.25 profile without allocating any hardware-specific information.

show x25 cug

To display information about all closed user groups (CUGs) or specific CUGs (defined by the local or network CUG number), use the **show x25 cug** EXEC command.

show x25 cug {**local-cug** *number* | **network-cug** *number*}

Syntax Description

local-cug	Locally significant CUG identifier.
number	Local CUG number (0 to 9999).
network-cug	Network translated CUG identifier.
number	Network CUG number (0 to 9999).

Command Modes

EXEC

Command History

Release	Modification
12.0(7)T	This command was introduced.
12.1(5)T	This command was modified to show information about CUG selection facility suppression.

Usage Guidelines

You must designate either the **local-cug** or the **network-cug** keyword with this command. Within these designations you can view all CUGs or a specific CUG defined by its local or network CUG identifier.

Examples

CUG Selection Facility Suppress Option Example

The following is sample output for the **show x25 cug** command when CUG selection facility is suppressed for all CUGs on serial interface 1/2 and for the preferential CUG on the X.25 profile named "cug".

```
Router# show x25 cug local-cug

X.25 Serial1/2, 2 CUGs subscribed with no public access
  CUG selection facility suppressed for all CUGs
  local-cug 100 <-> network-cug 10
  local-cug 1 <-> network-cug 11
PROFILE cug, 2 CUGs subscribed with incoming public access
  CUG selection facility suppressed for preferential CUG
  local-cug 0 <-> network-cug 0 , preferential
  local-cug 100 <-> network-cug 100
  local-cug 200 <-> network-cug 200
```

Local CUG Example

The following is sample output from the **show x25 cug local-cug** command, displaying information about all local CUGs on X.25 serial interface 0. Four CUGs have been subscribed to on serial interface 0, and they all have been configured for incoming and outgoing public access.

```
Router# show x25 cug local-cug
```

```
X.25 Serial0, 4 CUGs subscribed with incoming and outgoing public access
  local-cug 100 <-> network-cug 11
  local-cug 200 <-> network-cug 22
  local-cug 300 <-> network-cug 33
  local-cug 5000 <-> network-cug 55, preferential
```

Network CUG Example

The following is sample output from the **show x25 cug network-cug** command specifically for network number 33 showing that local CUG 300 is associated with it.

```
Router# show x25 cug network-cug 33

X.25 Serial1/2, 5 CUGs subscribed with no public access
  network-cug 33 <-> local-cug 300
```

Table 44 describes the fields shown in the display for the **show x25 cug** command.

Table 44 show x25 cug Field Descriptions

Field	Description
X.25 Serial 0	DCE interface with X.25 CUG service subscription.
local-cug	Local CUG details.
network-cug	Network CUG details.
preferential	Identifies which CUG, if any, is preferential. A single CUG listed for an interface is assumed to be preferential.

Related Commands

Command	Description
x25 subscribe cug-service	Enables and controls standard CUG behavior on an X.25 DCE interface.
x25 subscribe local-cug	Configures a DCE X.25 interface for a specific CUG subscription.

show x25 hunt-group

To display hunt groups and view detailed interface statistics and distribution methods, use the **show x25 hunt-group** EXEC command.

show x25 hunt-group [*name*]

Syntax Description

name	(Optional) Displays the specific hunt group named.

Command Modes

EXEC

Command History

Release	Modification
12.0(3)T	This command was introduced.
12.0(5)T	The command output status field was modified to include “unoperational” as a type of interface status.

Usage Guidelines

Use the **clear counters** or the **clear x25** commands in EXEC mode to clear the count of VCs in use in the “status” field and the number of bytes of data transmitted and received in the “traffic” field. Since the "uses" field is a hunt-group-specific counter, it will not be cleared using the **clear counters** or **clear x25** commands. The “uses” field is only cleared at boot time or when the hunt group is defined.

Examples

The following is sample output from the **show x25 hunt-group** command:

```
Router# show x25 hunt-group

   ID      Type      Target                    uses      status    traffic(out/in)
 ================================================================================
 HG1       rotary    Serial1                   2         next      1158/1691
                     Serial2                   2         next      1328/2146
                     xot 172.17.125.54         2         last_used 137/3154
                     xot 172.17.125.34         1         next      137/3154


 HG2       vc-count  Serial2                   4         5 VCs     6921/1364
                     Serial3                   2         1 VC      70/1259
```

Table 45 describes significant fields shown in the display.

Table 45 show x25 hunt-group Field Descriptions

Field	Description
ID	Hunt group name.
Type	Method of load balancing (rotary or vc-count).
Target	Range of interfaces that a call within the hunt group can go to.

Table 45 show x25 hunt-group Field Descriptions (continued)

Field	Description
uses	Total number of call attempts (failed plus successful) made to the interface.
status	State of interface at that moment. The status of an interface may be one of the following: • next—Interface will be used next for rotary distribution method. • last used—Interface was just used for rotary distribution method. • unavailable—Interface is shutdown. • full—All logical channels on the interface are in use. • # VC—(vc-count only) Number of VCs currently in use on the interface. • unoper— All VCs on the interface are unoperational.
traffic (out/in)	Number of data bytes transmitted through the interface.

Related Commands

Command	Description
clear x25	Restarts an X.25 or CMNS service, clears an SVC, or resets a PVC.
x25 hunt-group	Creates and maintains a hunt group.

show x25 interface

To display information about virtual circuits (VCs) that use an X.25 interface and, optionally, about a specified virtual circuit, use the **show x25 interface** EXEC command.

show x25 interface [**serial** *number* | *cmns-interface* **mac** *mac-address*]

Syntax Description

serial *number*	(Optional) Keyword **serial** and number of the serial interface used for X.25.
cmns-interface **mac** *mac-address*	(Optional) Local CMNS interface type and number, plus the MAC address of the remote device. CMNS interface types are Ethernet, Token Ring, or FDDI. The interface numbering scheme depends on the router interface hardware.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Examples

The following **show x25 interface** sample output displays X.25 information about VCs on serial interface 0:

```
Router# show x25 interface serial 0

SVC 1,  State: D1,  Interface: Serial0
  Started 00:13:52, last input 00:00:05, output never
  Connects 3334 <-> ip 3.3.3.4
  Call PID ietf, Data PID none
  Window size input: 7, output: 7
  Packet size input: 512, output: 512
  PS: 0  PR: 6  ACK: 1  Remote PR: 0  RCNT: 5  RNR: no
  P/D state timeouts: 0  timer (secs): 0
  data bytes 0/2508 packets 0/54 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
SVC 32,  State: D1,  Interface: Serial0.11
  Started 00:16:53, last input 00:00:37, output 00:00:28
  Connects 3334 <-> clns
  Call PID cisco, Data PID none
  Window size input: 7, output: 7
  Packet size input: 512, output: 512
  PS: 5  PR: 4  ACK: 4  Remote PR: 4  RCNT: 0  RNR: no
  P/D state timeouts: 0  timer (secs): 0
  data bytes 378/360 packets 21/20 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

show x25 map

To display information about configured address maps, use the **show x25 map** EXEC command.

show x25 map

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The **show x25 map** command shows information about the following:

- Configured maps (defined by the **x25 map** command)
- Maps implicitly defined by encapsulation permanent virtual circuits (PVCs) (defined by the encapsulating version of the **x25 pvc** command)
- Dynamic maps (from the X.25 Defense Data Network [DDN] or Blacker Front End [BFE] operations)
- Temporary maps (from unconfigured Connection-Mode Network Service [CMNS] endpoints)

Examples

The following is sample output from the **show x25 map** command:

```
Router# show x25 map

Serial0: X.121 1311001 <--> ip 172.20.170.1
  PERMANENT, BROADCAST, 2 VCS: 3 4*
Serial0: X.121 1311005 <--> appletalk 128.1
  PERMANENT
Serial1: X.121 2194441 cud hello <--> pad
  PERMANENT, windowsize 5 5, accept-reverse, idle 5
Serial1: X.121 1311005 <--> bridge
  PERMANENT, BROADCAST
Serial2: X.121 001003 <--> apollo 1.3,
         appletalk 1.3,
         ip 172.20.1.3,
         decnet 1.3,
         novell 1.0000.0c04.35df,
         vines 00000001:0003,
         xns 1.0000.0c04.35df,
         clns
  PERMANENT, NVC 8, 1 VC: 1024
```

The display shows that four maps have been configured for a router: two for serial interface 0, one for serial interface 1, and one for the serial interface 2 (which maps eight protocols to the host).

Table 46 describes fields shown in the display.

Table 46 show x25 map Field Descriptions

Field	Description
Serial0	Interface on which this map is configured.
X.121 1311001	X.121 address of the mapped encapsulation host.
ip 172.20.170.1	Type and address of the higher-level protocol(s) mapped to the remote host. Bridge maps do not have a higher-level address; all bridge datagrams are sent to the mapped X.121 address. Connectionless Network Service (CLNS) maps refer to a configured neighbor as identified by the X.121 address.
PERMANENT	Address-mapping type that has been configured for the interface in this entry. Possible values include the following: • CONSTRUCTED—Derived with the DDN or BFE address conversion scheme. • PERMANENT—Map was entered with the **x25 map** interface configuration command. • PVC—Map was configured with the **x25 pvc** interface command. • TEMPORARY—A temporary map was created for an incoming unconfigured CMNS connection.
BROADCAST	If any options are configured for an address mapping, they are listed; the example shows a map that is configured to forward datagram broadcasts to the mapped host.
2 VCs:	If the map has any active virtual circuits, they are identified.
3 4*	Identifies the circuit number of the active virtual circuits. The asterisk (*) marks the virtual circuit last used to send data. Note that a single protocol virtual circuit can be associated with a multiprotocol map.

show x25 profile

To view details of X.25 profiles on your router, use the **show x25 profile** command in EXEC mode.

show x25 profile [*name*]

Syntax Description

name	(Optional) Name of X.25 profile.

Command Modes

EXEC

Command History

Release	Modification
12.0(3)T	This command was introduced.

Examples

The following is sample output from the **show x25 profile** command, showing all profiles configured on the same interface. When the X.25 profile name is not specified, the output shows all configured profiles for that interface.

```
Router# show x25 profile

X.25 profile name:NetworkNodeA
  Number of references:2
  In use by:
      Annex G:Serial1 DLCI 20
      Annex G:Serial1 DLCI 30
  PROFILE DCE, address <none>, state R/Inactive, modulo 128, timer 0
      Defaults:idle VC timeout 5
        input/output window sizes 2/2, packet sizes 128/128
      Timers:T10 60, T11 180, T12 60, T13 60
      Channels:Incoming-only none, Two-way 1-128, Outgoing-only none
  LAPB DCE, modulo 8, k 7, N1 default, N2 20
      T1 3000, T2 0, interface outage (partial T3) 0, T4 0

X.25 profile name:NetworkNodeB
  Number of references:1
  In use by:
      Annex G:Serial1 DLCI 40
  PROFILE DTE, address 1111, state R/Inactive, modulo 8, timer 0
      Defaults:idle VC timeout 0
        input/output window sizes 2/2, packet sizes 128/128
      Timers:T20 180, T21 200, T22 180, T23 180
      Channels:Incoming-only none, Two-way 1-1024, Outgoing-only none
LAPB DTE, modulo 8, k 7, N1 default, N2 20
      T1 3000, T2 0, interface outage (partial T3) 0, T4 0
```

Table 47 describes significant fields shown in the display.

Table 47 show x25 profile Field Descriptions

Field	Description
Number of references	Number of X.25 connections using this profile.
In use by	Shows the interface and X.25 service using this profile.
address	Address to which interface is connected.
state	State of the interface. Possible values are R1 - normal ready state. R2 - data terminal equipment (DTE) restarting state. R3 - data communications equipment (DCE) restarting state. If state is R2 or R3, the interface is awaiting acknowledgment of a Restart packet.
modulo	Value that determines the packet sequence numbering scheme used.
timer	Interface timer value (zero unless the interface state is R2 or R3).
Defaults: idle VC timeout	Inactivity time before clearing virtual circuit (VC).
input/output window sizes	Default window sizes (in packets) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
packet sizes	Default maximum packet sizes (in bytes) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
Timers	Values of the X.25 timers: T10 through T13 for a DCE device. T20 through T23 for a DTE device.
Channels:	Virtual circuit ranges for this interface.

Related Commands

Command	Description
show x25 context	Displays details of an Annex G DLCI link.
show x25 vc	Displays information about active X.25 virtual circuits.
x25 profile	Configures an X.25 profile without allocating any hardware-specific information.

show x25 remote-red

This command is no longer supported.

show x25 route

To display the X.25 routing table, use the **show x25 route** EXEC command.

show x25 route

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	The **dns** keyword was added.

Examples

The following example shows output from the **show x25 route** command:

```
Router# show x25 route

# Match                      Substitute              Route To
1 dest ^1311001$                                     Serial0, 0 uses
2 dest ^1311002$                                     xot 172.20.170.10
3 dest 444                                           xot dns \0
4 dest 555                                           xot dns \0
```

Table 48 describes significant fields shown in the display.

Table 48 show x25 route Field Descriptions

Field	Description
#	Number identifying the entry in the X.25 routing table.
Match	The match criteria and patterns associated with this entry.
Route To	Destination to which the router will forward a call; X.25 destinations identify an interface; CMNS destinations identify an interface and host MAC address; XOT destinations either identify up to six IP addresses (#2), or the **x25 route** pattern for retrieving up to six IP addresses from the DNS (#3 and #4).

Related Commands

Command	Description
x25 route	Creates an entry in the X.25 routing table (to be consulted for forwarding incoming calls and for placing outgoing PAD or protocol translation calls).

show x25 services

To display information pertaining to the X.25 services, use the **show x25 services** EXEC command.

show x25 services

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command is the default form of the **show x25** command.

Examples

The following is sample output from the **show x25 services** command:

```
Router# show x25 services

X.25 software, Version 3.0.0.
  3 configurations supporting 3 active contexts
  VCs allocated, freed and in use: 7 - 0 = 7
  VCs active and idle: 4, 3
XOT software, Version 2.0.0.
  VCs allocated, freed and in use: 2 - 1 = 1
  connections in-progress: 0 outgoing and 0 incoming
  active VCs: 1, connected to 1 remote hosts
```

Related Commands

Command	Description
show x25 interface	Displays information about VCs that use an X.25 interface and, optionally, about a specified VC.
show x25 map	Displays information about configured address maps.
show x25 route	Displays the X.25 routing table.
show x25 vc	Displays information about active SVCs and PVCs.

show x25 vc

To display information about active switched virtual circuits (SVCs) and permanent virtual circuits (PVCs), use the **show x25 vc** EXEC command.

show x25 vc [*lcn*]

Syntax Description

lcn	(Optional) Logical channel number (LCN).

Command Modes

EXEC

Command History

Release	Modification
8.3	This command was introduced in a release prior to Release 8.3.

Usage Guidelines

To examine a particular virtual circuit number, add an LCN argument to the **show x25 vc** command.

This command displays information about virtual circuits. Virtual circuits may be used for a number of purposes, such as the following:

- Encapsulation traffic
- Traffic switched between X.25 services (X.25, Connection-Mode Network Service [CMNS] and X.25 over TCP/IP [XOT])
- PAD traffic
- QLLC traffic

The connectivity information displayed will vary according to the traffic carried by the virtual circuit. For multiprotocol circuits, the output varies depending on the number and identity of the protocols mapped to the X.121 address and the encapsulation method selected for the circuit.

Examples

Encapsulated Traffic Example

The following is sample output from the **show x25 vc** command used on an encapsulated traffic circuit:

```
Router# show x25 vc 1024

SVC 1024, State: D1, Interface: Serial0
 Started 0:00:31, last input 0:00:31, output 0:00:31
 Connects 170090 <-->
    compressedtcp 172.20.170.90
    ip 172.20.170.90
 Call PID multi, Data PID ietf
 Reverse charged
 Window size input: 2, output: 2
 Packet size input: 128, output: 128
 PS: 5 PR: 5 ACK: 4 Remote PR: 5 RCNT: 1 RNR: FALSE
 Window is closed
 P/D state timeouts: 0 Timer (secs): 0
  data bytes 505/505 packets 5/5 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Table 49 describes the fields shown in the sample output that are typical for virtual circuits.

Table 49 show x25 vc Field Descriptions

Field	Description
SVC *n* or PVC *n*	Identifies the type of virtual circuit (switched or permanent) and its LCN (also called its "virtual circuit number").
State	State of the virtual circuit (which is independent of the states of other virtual circuits); D1 is the normal ready state. See the International Telecommunication Union Telecommunication Standardization Sector (ITU-T)[1] X.25 Recommendation for a description of virtual circuit states.
Interface	Interface or subinterface on which the virtual circuit is established.
Started	Time elapsed since the virtual circuit was created.
last input	Time of last input.
output	Shows time of last output.
Connects...<-->..	Describes the traffic-specific connection information. See Table 50, Table 51, Table 52, and Table 53 for more information.
D-bit permitted	Indicates that the X.25 D-bit (Delivery Confirmation) may be used on this circuit (displayed as needed).
Fast select VC	Indicates that the Fast Select facility was present on the incoming call (displayed as needed).
Reverse charged	Indicates reverse charged virtual circuit (displayed as needed).
Window size	Window sizes for the virtual circuit.
Packet size	Maximum packet sizes for the virtual circuit.
PS	Current send sequence number.
PR	Current receive sequence number.
ACK	Last acknowledged incoming packet.
Remote PR	Last receive sequence number received from the other end of the circuit.
RCNT	Count of unacknowledged input packets.
RNR	State of the Receiver Not Ready flag; this field is true if the network sends a Receiver-not-Ready packet.
Window is closed	This line appears if the router cannot transmit any more packets until the X.25 Layer 3 peer has acknowledged some outstanding packets.
P/D state timeouts	Number of times a supervisory packet (Reset or Clear) has been retransmitted.
Timer	A nonzero time value indicates that a control packet has not been acknowledged yet or that the virtual circuit is being timed for inactivity.
Reassembly	Number of bytes received and held for reassembly. Packets with the M-bit set are reassembled into datagrams for encapsulation virtual circuits; switched X.25 traffic is not reassembled (displayed only when values are non-zero).
Held Fragments/Packets	Number of X.25 data fragments to transmit to complete an outgoing datagram, and the number of datagram packets waiting for transmission (displayed only when values are non-zero).
data bytes *m*/*n* packets *p*/*q*	Total number of data bytes sent (m), data bytes received (n), data packets sent (p), and data packets received (q) since the circuit was established.

Table 49 show x25 vc Field Descriptions (continued)

Field	Description
Resets *t*/*r*	Total number of Reset packets transmitted/received since the circuit was established.
RNRs *t*/*r*	Total number of Receiver Not Ready packets transmitted/received since the circuit was established.
REJs *t*/*r*	Total number of Reject packets transmitted/received since the circuit was established.
INTs *t*/*r*	Total number of Interrupt packets transmitted/received since the circuit was established.

1. The ITU-T carries out the functions of the former Consultative Committee for International Telegraph and Telephone (CCITT).

Table 50 describes the connection fields specific for encapsulation traffic.

Table 50 show x25 vc Encapsulation Traffic Field Descriptions

Field	Description
170090	The X.121 address of the remote host.
ip 172.20.170.90	The higher-level protocol and address values that are mapped to the virtual circuit.
Call PID	Identifies the method used for protocol identification (PID) in the Call User Data (CUD) field. Because PVCs are not set up using a Call packet, this field is not displayed for encapsulation PVCs. The available methods are as follows: • cisco—Cisco's traditional method was used to set up a single protocol virtual circuit. • ietf—The IETF's standard RFC 1356 method was used to set up a single protocol virtual circuit. • snap—The IETF's Subnetwork Access Protocol (SNAP) method for IP encapsulation was used. • multi—the IETF's multiprotocol encapsulation method was used.
Data PID	Identifies the method used for PID when sending datagrams. The available methods are as follows: • none—The virtual circuit is a single-protocol virtual circuit; no PID is used. • ietf—The IETF's standard RFC 1356 method for identifying the protocol is used. • snap—The IETF's SNAP method for identifying IP datagrams is used.

Locally Switched X.25 Traffic Example

The following is sample output from the **show x25 vc** command used on a virtual circuit carrying locally switched X.25 traffic:

```
Router# show x25 vc

PVC 1, State: D1, Interface: Serial2
  Started 0:01:26, last input never, output never
  PVC <--> Serial1 PVC 1, connected
  Window size input: 2, output: 2
  Packet size input: 128, output: 128
  PS: 0 PR: 0 ACK: 0 Remote PR: 0 RCNT: 0 RNR: FALSE
  P/D state timeouts: 0 Timer (secs): 0
  data bytes 0/0 packets 0/0 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0

SVC 5, State: D1, Interface: Serial2
  Started 0:00:16, last input 0:00:15, output 0:00:15
  Connects 170093 <--> 170090 from Serial1 VC 5
  Window size input: 2, output: 2
  Packet size input: 128, output: 128
  PS: 5 PR: 5 ACK: 4 Remote PR: 5 RCNT: 1 RNR: FALSE
  P/D state timeouts: 0 Timer (secs): 0
  data bytes 505/505 packets 5/5 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Table 51 describes the connection fields for virtual circuits carrying locally switched X.25 traffic.

Table 51 show x25 vc Local Traffic Field Descriptions

Field	Description
PVC <-->	Indicates a switched connection between two PVCs.
Serial1 PVC 1	Identifies the other half of a local PVC connection.
connected	Identifies connection status for a switched connection between two PVCs. See Table 54 for PVC status messages.
170093	Identifies the Calling (source) Address of the connection. If a Calling Address Extension was encoded in the call facilities, it is also displayed. If the source host is a CMNS host, its MAC address is also displayed.
170090	Identifies the Called (destination) Address of the connection. If a Called Address Extension was encoded in the call facilities, it is also displayed. If the destination host is a CMNS host, its MAC address is also displayed.
from Serial1	Indicates the direction of the call and the connecting interface.
VC 5	Identifies the circuit type and LCN for the connecting interface. VC indicates an SVC, and PVC indicates a PVC. If the connecting host is a CMNS host, its MAC address is also displayed.

Locally Switched X.25 Traffic Between PVCs and SVCs Example

The following is sample output from the **show x25 vc** command used on a virtual circuit carrying locally switched PVC to SVC X.25 traffic:

```
Router# show x25 vc

PVC 5,  State: D1,  Interface: Serial0
  Started 4d21h, last input 00:00:14, output 00:00:14
  Connects 101600 <--> 201700 from Serial2 VC 700
  D-bit permitted
  Window size input: 2, output: 2
```

```
  Packet size input: 128, output: 128
  PS: 5  PR: 5  ACK: 4  Remote PR: 5  RCNT: 1  RNR: no
  P/D state timeouts: 0  timer (secs): 0
  data bytes 1000/1000 packets 10/10 Resets 1/0 RNRs 0/0 REJs 0/0 INTs 0/0

SVC 700,  State: D1,  Interface: Serial2
  Started 00:00:16, last input 00:00:16, output 00:00:16
  Connects 101600 <--> 201700 from Serial0 PVC 5
  Window size input: 2, output: 2
  Packet size input: 128, output: 128
  PS: 5  PR: 5  ACK: 5  Remote PR: 4  RCNT: 0  RNR: no
  P/D state timeouts: 0  timer (secs): 103
  data bytes 500/500 packets 5/5 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Table 52 describes the connection fields for virtual circuits carrying locally switched X.25 traffic between PVCs and SVCs.

Table 52 show x25 vc Locally Switched PVC to SVC Traffic Field Descriptions

Field	Description
101600	Identifies the Calling (source) Address of the connection. If a Calling Address Extension was encoded in the call facilities, it is also displayed. If the source host is a CMNS host, its MAC address is also displayed.
201700	Identifies the Called (destination) Address of the connection. If a Called Address Extension was encoded in the call facilities, it is also displayed. If the destination host is a CMNS host, its MAC address is also displayed.
from Serial2	Indicates the direction of the call and the connecting interface.
VC 700	Identifies the circuit type and LCN for the connecting interface. VC indicates an SVC and PVC indicates a PVC. If the remote host is a CMNS host, its MAC address is also displayed.

Remotely Switched X.25 Traffic Example

The following is sample output from the **show x25 vc** command used on a virtual circuit carrying remotely switched X.25 traffic:

```
Router# show x25 vc

PVC 2, State: D1, Interface: Serial2
 Started 0:01:25, last input never, output never
 PVC <--> [172.20.165.92] Serial2/0 PVC 1 connected
 XOT between 171.20.165.91, 1998 and 172.20.165.92, 27801
 Window size input: 2, output: 2
 Packet size input: 128, output: 128
 PS: 0 PR: 0 ACK: 0 Remote PR: 0 RCNT: 0 RNR: FALSE
 P/D state timeouts: 0 Timer (secs): 0 Reassembly (bytes): 0
 Held Fragments/Packets: 0/0
 data bytes 0/0 packets 0/0 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0

SVC 6, State: D1, Interface: Serial2
 Started 0:00:04, last input 0:00:04, output 0:00:04
 Connects 170093 <--> 170090 from
 XOT between 172.20.165.91, 1998 and 172.20.165.92, 27896
 Window size input: 2, output: 2
 Packet size input: 128, output: 128
 PS: 5 PR: 5 ACK: 4 Remote PR: 5 RCNT: 1 RNR: FALSE
 P/D state timeouts: 0 Timer (secs): 0 Reassembly (bytes): 0
 Held Fragments/Packets: 0/0
 data bytes 505/505 packets 5/5 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Table 53 describes the connection fields for virtual circuits carrying remotely switched X.25 traffic.

Table 53 show x25 vc Remote X.25 Traffic Field Descriptions

Field	Description
PVC	Flags PVC information.
[172.20.165.92]	Indicates the IP address of the router remotely connecting the PVC.
Serial 2/0 PVC 1	Identifies the remote interface and PVC number.
connected	Identifies connection status for a switched connection between two PVCs. See Table 54 for PVC status messages.
170093	Identifies the Calling (source) Address of the connection. If a Calling Address Extension was encoded in the call facilities, it is also displayed.
170090	Identifies the Called (destination) Address of the connection. If a Called Address Extension was encoded in the call facilities, it is also displayed.
from	Indicates the direction of the call.
XOT between...	Identifies the IP addresses and port numbers of the X.25-over-TCP (XOT) connection.

Table 54 lists the PVC states that can be reported. These states are also reported by the **debug x25** command in PVC-SETUP packets (for remote PVCs only) as well as in the PVCBAD system error message. Some states apply only to remotely switched PVCs.

Table 54 X.25 PVC States

Status Message	Description
awaiting PVC-SETUP reply	A remote PVC has initiated an XOT TCP connection and is waiting for a reply to the setup message.
can't support flow control values	The window sizes or packet sizes of the PVC cannot be supported by one of its two interfaces.
connected	The PVC is up.
dest. disconnected	The other end disconnected the PVC.
dest interface is not up	The target interface's X.25 service is down.
dest PVC config mismatch	The targeted PVC is already connected.
mismatched flow control values	The configured flow control values do not match.
no such dest. interface	The remote destination interface was reported to be in error by the remote router.
no such dest. PVC	The targeted PVC does not exist.
non-X.25 dest. interface	The target interface is not configured for X.25.
PVC/TCP connect timed out	A remote PVC XOT TCP connection attempt timed out.
PVC/TCP connection refused	A remote PVC XOT TCP connection was tried and refused.
PVC/TCP routing error	A remote PVC XOT TCP connection routing error was reported.

Table 54 X.25 PVC States (continued)

Status Message	Description
trying to connect via TCP	A remote PVC XOT TCP connection is established and is in the process of connecting.
waiting to connect	The PVC is waiting to be processed for connecting.

show x25 xot

To display information for all X.25 over TCP (XOT) virtual circuits that match a given criterion, use the **show x25 xot** EXEC command.

show x25 xot [**local** *ip-address* [**port** *port*]] [**remote** *ip-address* [**port** *port*]]

Syntax Description

local *ip-address* [**port** *port*]	(Optional) Local IP address and optional port number.
remote *ip-address* [**port** *port*]	(Optional) Remote IP address and optional port number.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Examples

The following **show x25 xot** sample output displays information about all XOT virtual circuits:

```
Router> show x25 xot

SVC 11,  State: D1,  Interface: [10.2.2.2,1998/10.2.2.1,11002]
  Started 00:00:08, last input 00:00:08, output 00:00:08

  Line: 0   con 0    Location:  Host: 5678
  111 connected to 5678 PAD <--> XOT 2.2.2.2,1998

  Window size input: 2, output: 2
  Packet size input: 128, output: 128
  PS: 2  PR: 3  ACK: 3  Remote PR: 2  RCNT: 0  RNR: no
  P/D state timeouts: 0  timer (secs): 0
  data bytes 54/18 packets 2/3 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Related Commands

Command	Description
show x25 interface	Displays information about VCs that use an X.25 interface and, optionally, about a specified VC.
show x25 services	Displays information pertaining to the X.25 services.

x25 accept-reverse

To configure the Cisco IOS software to accept all reverse-charge calls, use the **x25 accept-reverse** interface configuration command. To disable this facility, use the **no** form of this command.

x25 accept-reverse

no x25 accept-reverse

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command causes the interface to accept reverse-charge calls by default. You can also configure this behavior for each peer with the **x25 map** interface configuration command.

Examples

The following example sets acceptance of reverse-charge calls:

```
interface serial 0
 x25 accept-reverse
```

Related Commands

Command	Description
x25 map	Sets up the LAN protocols-to-remote host mapping.

x25 address

To set the X.121 address of a particular network interface, use the **x25 address** interface configuration command.

x25 address *x121-address*

Syntax Description

x121-address	Variable-length X.121 address. It is assigned by the X.25 network service provider.

Defaults

Defense Data Network (DDN) and Blacker Front End (BFE) encapsulations have a default interface address generated from the interface IP address. For proper DDN or BFE operation, this generated X.121 address must not be changed. Standard X.25 encapsulations do not have a default.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

When you are connecting to a public data network (PDN), the PDN administrator will assign the X.121 address to be used. Other applications (for example, a private X.25 service), may assign arbitrary X.121 addresses as required by the network and service design. X.25 interfaces that engage in X.25 switching only do not need to assign an X.121 address.

Examples

The following example sets the X.121 address for the interface:

```
interface serial 0
 encapsulation x25
 x25 address 00000123005
```

The address must match that assigned by the X.25 network service provider.

x25 alias

To configure an interface alias address that will allow this interface to accept calls with other destination addresses, use the **x25 alias** interface configuration command.

x25 alias {*destination-pattern* | *x121-address-pattern*} [**cud** *cud-pattern*]

Syntax Description

destination-pattern	Regular expression used to match against the destination address of a received call.
x121-address-pattern	Alias X.121 address for the interface, allowing it to act as destination host for calls having different destination address.
cud *cud-pattern*	(Optional) Call user data (CUD) pattern, a regular expression of ASCII text. The CUD field might be present in a call packet. The first few bytes (commonly 4 bytes long) identify a protocol; the specified pattern is applied to any user data after the protocol identification.

Defaults

No alias is configured.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
11.2	This command was introduced. It replaces the functionality that was provided by the **alias** keyword of the **x25 route** command.

Usage Guidelines

Encapsulation, packet assembler/disassembler (PAD), and Qualified Logical Link Control (QLLC) calls are normally accepted when the destination address is that of the interface (or the zero-length address). Those calls will also be accepted when the destination address matches a configured alias.

Examples

An X.25 call may be addressed to the receiving interface; calls addressed to the receiving interface are eligible for acceptance as a datagram encapsulation, PAD or QLLC connection, and may not be routed. In the following example, serial interface 0 is configured with a native address of 0000123 and a destination alias for any address that starts with 1111123. That is, serial interface 0 can accept its own calls and calls for any destination that starts with 1111123.

```
interface serial 0
 encapsulation x25
 x25 address 0000123
 x25 alias ^1111123.*
```