



Configuring the Cisco PAD Facility for X.25 Connections

This chapter describes how to configure the internal packet assembler/disassembler (PAD) facility to make connections with remote devices over the X.25 protocol.

The following sections are provided in this chapter:

- Network Scenarios Using PADs
- Configure PAD Connections Using the Standard X.28 User Interface
- Configure PAD Connections Using Cisco's Legacy PAD User Interface
- Enable PAD Calls to an X.25 Host over an IP Network
- Configure PAD Subaddressing

For a complete description of the commands in this chapter, refer to the “PAD and X.25 Connection Setup Commands” chapter of the *Dial Solutions Command Reference*. To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

For a complete description of each X.3 parameter supported by the standard X.28 mode or Cisco's traditional PAD user interface, see the chapter “X.3 PAD Parameters” in the *Dial Solutions Command Reference*.

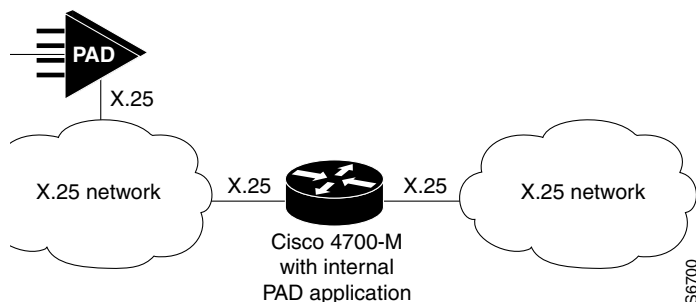
Network Scenarios Using PADs

PADs are configured to enable X.25 connections between network devices. A PAD is a device that receives a character stream from one or more terminals, assembles the character stream into packets, and sends the data packets out to a host. A PAD can also do the reverse. It can take data packets from a network host and translate them into a character stream that can be understood by the terminals. A PAD is defined by CCITT Recommendations X.3, X.28, and X.29.

Figure 86 shows a remote X.25 user placing a call through an X.25 switched network, to the internal PAD application on a Cisco 4700-M router, and to an X.25 host located inside a corporate data center.

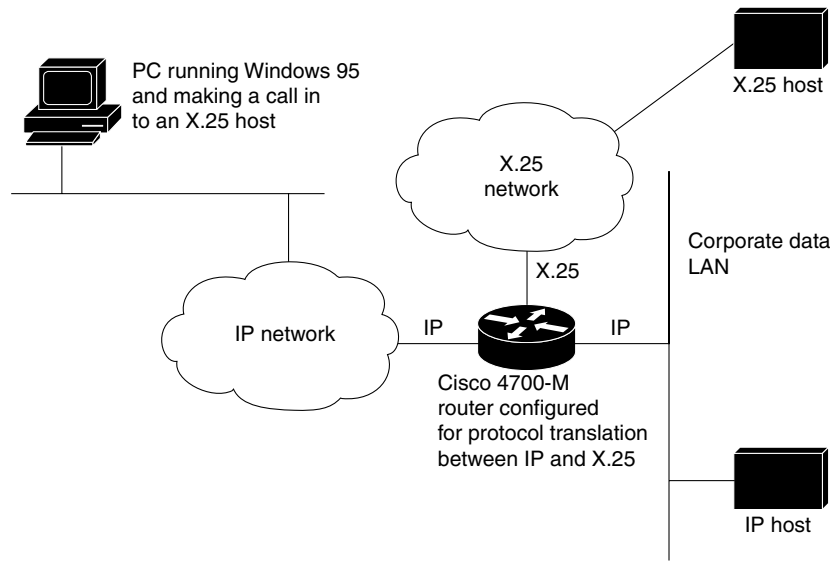
Figure 86 Standard X.25 Connection Between a Dumb Terminal and an X.25 Host

terminal
a connection
X.25 host



PADs can also be configured to work with a protocol translation application. Figure 87 shows an example of a remote PC placing an analog modem call to an IP network, connecting to a Cisco 4500-M router, allowing its IP packets to undergo an IP-to-X.25 protocol translation, which in turn communicates with an internal PAD device and establishes a connection with an X.25 host.

Figure 87 PC Dialing In to an X.25 Host Using Protocol Translation



Configure PAD Connections Using the Standard X.28 User Interface

The following sections describe how to use the X.28 standard user interface to make PAD connections:

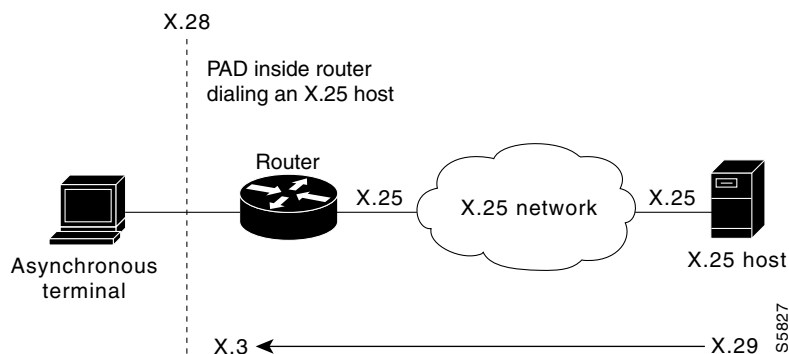
- X.28 Description
- Business Applications for X.28 Emulation
- X.28 Configuration Task List
- X.28 Emulation Examples

X.28 Description

X.28 emulation is the standard user interface between data terminal equipment (DTE) and a packet assembler/disassembler (PAD). The Cisco IOS software provides an X.28 user emulation mode, which enables you to interact with and control the PAD. During this exchange of control information, messages or commands sent from the terminal to the PAD are called PAD command signals. Messages sent from the PAD to the terminal are called PAD service signals. These signals and any transmitted data take the form of encoded character streams as defined by International Alphabet Number 5.

For asynchronous devices such as terminals or modems to access an X.25 network host, the device's packets must be assembled or disassembled by a PAD device. Using standard X.28 commands from the PAD, calls can be made into an X.25 network, X.3 PAD parameters can be set, or calls can be reset. X.3 is the ITU-T recommendation that defines various PAD parameters used in X.25 networks. There are 22 available X.3 PAD parameters to configure. X.3 PAD parameters are internal variables that define the operation of a PAD. For example, parameter number 9 is the crpad parameter. It determines the number of bytes to add after a carriage return. X.3 parameters can also be set by a remote X.25 host using X.29. (See Figure 88.)

Figure 88 Asynchronous Device Dialing In to an X.25 Host over an X.25 Network



Note Most Cisco routers have internal PAD devices.

Business Applications for X.28 Emulation

Cisco's new X.28 PAD implementation enables users to access X.25 networks or set PAD parameters using the X.28 standard user interface. This standard interface is common in many European countries and adheres to the X.25 International Telecommunication Union Telecommunication (ITU-T) standards.

The new X.28 interface is designed for asynchronous devices that require X.25 transport to access a remote or native asynchronous or synchronous host application. For example, dial-up users can use the X.28 interface to access a remote X.25 host. Banks implement Cisco routers to support back office applications, ATM, point of sales authorization devices, and alarm systems. These alarm devices are connected asynchronously to the same Cisco router and report alarm conditions to a remote alarm host for the dispatch of police. Cisco's X.28 PAD calls can be transported over a public packet network, a private X.25 network, the Internet, a private IP-based network, or a Frame Relay network. With this new service, Cisco now offers the flexibility to use the X.28 interface either directly or over a Cisco IOS application service such as protocol translation. The protocol translation VTY asynchronous application enables users to bidirectionally access an X.25 application with the PAD service or protocols such as Digital Equipment Corporation (DEC), local-area transport (LAT), and transmission control protocol (TCP).

X.28 Configuration Task List

The following optional tasks are described in this section:

- Set Access and Display Options
- Enter PAD Command Signals for X.25 Connections
- Set X.3 PAD Parameters for X.25 Connections

X.28 mode can be manually invoked with the **x28 EXEC** command, or it can be automatically invoked with the **autocommand** line configuration command. The **autocommand** command can be assigned to a particular line, range of lines, or user ID. When a user connects to the line using the autocommand feature, the user enters X.28 mode. If the **noescape** option is used with the autocommand feature, users cannot return to EXEC mode.

The default X.28 router prompt is an asterisk (*). Once you enter this mode, the standard X.28 user interface is available. From this interface, you can configure or use the PAD inside a Cisco router with X.3 parameters (see the “Set X.3 PAD Parameters for X.25 Connections” section), or you can access an X.25 network (see the “Enter PAD Command Signals for X.25 Connections” section).

Set Access and Display Options

To enter X.28 mode and set different access and display parameters, perform any of the following tasks beginning in EXEC mode:

Step	Command	Purpose
1	x28 escape <i>character-string</i>	Specify a character string to use to exit X.28 mode and return to EXEC mode. ¹
2	x28 nuicud	Specify the network user identification data to be placed in the call user data area of the call request packet. ²
3	x28 profile <i>file-name</i>	Specify using a user-configured profile of X.3 parameters. ³
4	x28 reverse	Reverse the charges of all calls dialed from the local router. The address of the destination device is charged for the call.
5	x28 verbose	Display detailed information about the X.25 call connection (for example, address of the remote DTE device and the facility block used).

1. If the **x28 noescape** command is configured, a user cannot return to EXEC mode.

2. Upon entering the **x28 nuicud** command, the network user identification (NUI) data will not be placed in the NUI facility of the call request. Instead it will be placed in the call user data field. If you configure the **x28 nuicud** command, reverse charging set by the **x28 reverse** command is disabled.

3. Profiles are created with the **x29 profile** EXEC command.

See the “X.28 Emulation Examples” section for actual sample X.28 configurations.

Enter PAD Command Signals for X.25 Connections

Many X.25-related functions can be performed from the PAD in X.28 mode. Table 19 lists the available PAD command signals that can be issued. However, only the following two most common tasks are described in this section:

- Connect to a Remote X.25 Device
- Clear a Connection to a Remote X.25 Device

In X.28 mode, you can set PAD command signals using standard or extended command syntax. For example, you can enter the **clr** command or **clear** command to clear a virtual call. A command specified with standard command syntax is merely an abbreviated version of the extended syntax version. Both syntaxes have the same functionality.

Table 19 Available PAD Command Signals

Standard Syntax	Extended Syntax	Description
break		Simulate an asynchronous break.
call		Place a virtual call to a remote device.

Table 19 Available PAD Command Signals (Continued)

<i>command-signal</i>		Specify a call request without using a standard X.28 command, which is entered with the following syntax: <i>facilities-x121-addressDcall-user-data</i> . The dash (-) and “D” are required keywords.
clr	clear	Clear a virtual call.
help		Display help information.
iclr	iclear	Request the remote device to clear the call.
int	interrupt	Send an Interrupt Packet.
par? par	parameter read	Show the current values of local parameters.
prof	profile <i>file-name</i>	Load a standard or named profile.
reset		Reset the call.
rpar?	rread	Show the current values of remote parameters.
rset?	rsetread	Set and then read values of remote parameters.
set		Change the values of local parameters. (See the “Set X.3 PAD Parameters for X.25 Connections” section.)
set?	setread	Change and then read the values of parameters.
stat	status	Request status of a connection.
selection pad		Set up a virtual call.

Connect to a Remote X.25 Device

To call an X.25 device using a local PAD signal command, perform the following steps beginning in EXEC mode:

Step	Command	Purpose
1	x28	Enter X.28 mode. An asterisk prompt will appear.
2	call <i>address</i>	Dial the address of the remote interface.

Note In X.28 mode, you can perform the same functions as the Cisco proprietary **pad** command. However, X.28 mode adds additional functionality such as setting X.3 PAD parameters with industry standard X.28 commands.

See the “X.28 Emulation Examples” section for a sample connection to a remote X.25 device.

Clear a Connection to a Remote X.25 Device

Once you connect to a remote X.25 device, you can clear the connection by performing the following steps beginning in EXEC mode:

Step	Command	Purpose
1	Ctrl-p	From the remote host, escape back to the local router.
2	clr	Clear the virtual call.

See the “X.28 Emulation Examples” section for a sample of how to clear a connection to a remote X.25 device.

Set X.3 PAD Parameters for X.25 Connections

To set an X.3 PAD parameter from a local terminal, perform the following steps beginning in EXEC mode:

Step	Command	Purpose
1	x28	Enter X.28 mode.
2	par	Display the current X.3 PAD parameters.
3	set parameter-number: new-value	Change the value of a parameter.
4	par	Verify that the new PAD parameter was set correctly.

See the “X.28 Emulation Examples” section for an example of how to set X.3 parameters for X.25 connections.

X.28 Emulation Examples

The following examples are provided:

- PAD Signal Examples
- Set X.3 PAD Parameters Examples
- X.25 PAD Parameter Profile Example
- Network User Identification Data Relocation Example
- X.25 Reverse Charge Call Example
- X.25 Call Detail Display Example

PAD Signal Examples

The following examples show two ways to make a call to a remote X.25 host over a serial line. The remote host’s interface address is 123456. In the first example, router-A calls router-B using the **pad 123456** EXEC command. The second example shows router-A calling router-B using the **call 123456** PAD signal command in X.28 mode. Both commands accomplish the same goal.

```

router-A# pad 123456
Trying 123456...Open

router-B> exit

[Connection to 123456 closed by foreign host]

router-A# x28

* call 123456
COM

router-B>
    
```

The following examples show two ways to clear a connection with a remote X.25 host. The first example shows router-A disconnecting from router-B using the **disconnect** command in EXEC mode. The second example shows router-B disconnecting from router-A using the **clr** command in X.28 mode.

```
router-A# pad 123456
Trying 123456...Open

router-B> <Enter the escape sequence (for example, press Shift-Ctrl-^~x).>

router-A# disconnect
Closing connection to 123456 [confirm]
router-A#

router-A# x28

* call 123456
COM

router-B> <Press Ctrl-p>
* clr

CLR CONF

*
```

Set X.3 PAD Parameters Examples

The following example configures parameter 9 from 0 to 1, which adds one byte after the carriage return. This setting is performed from a local terminal using the **set parameter-number: new-value** PAD command signal.

```
router-A# x28

* par
PAR 1:1 2:1 3:126 4:0 5:1 6:2 7:2 8:0 9:0 10:0 11:14 12:1 13:0 14:0 15:0 16:127 17:24
18:18 19:2 20:0 21:0 22:0

* set 9:1

* par
PAR 1:1 2:1 3:126 4:0 5:1 6:2 7:2 8:0 9:1 10:0 11:14 12:1 13:0 14:0 15:0 16:127 17:24
18:18 19:2 20:0 21:0 22:0

*
```

The following example shows how to change a local X.3 PAD parameter from a remote X.25 host using X.29 messages, which is a secure way to enable a remote host to gain control of local PAD. The local device is router-A. The remote host is router-B. The parameters listed in the ParamsIn field are incoming parameters, which are sent by the remote PAD. The parameters listed in the ParamsOut field are parameters sent by the local PAD.

```
router-A# pad 123456
Trying 123456...Open

router-B> x3 2:0
router-B>
router-A# show x25 pad

tty0, connection 1 to host 123456

Total input: 12, control 3, bytes 35. Queued: 0 of 7 (0 bytes).
```

```
Total output: 10, control 3, bytes 64.
Flags: 1, State: 3, Last error: 1
ParamsIn: 1:0, 2:0, 3:0, 4:0, 5:0, 6:0, 7:0,
          8:0, 9:0, 10:0, 11:0, 12:0, 13:0, 14:0, 15:0,
          16:0, 17:0, 18:0, 19:0, 20:0, 21:0, 22:0,
ParamsOut: 1:1, 2:0, 3:2, 4:1, 5:1, 6:0, 7:21,
           8:0, 9:1, 10:0, 11:14, 12:1, 13:0, 14:0, 15:0,
           16:127, 17:21, 18:18, 19:0, 20:0, 21:0, 22:0,
router-A#
```

X.25 PAD Parameter Profile Example

The following example modifies and loads an existing X.25 PAD parameter profile. It accesses the existing PAD profile *ppp*, changes its padding parameter (specified as 9) to a value of 2, and displays the new parameters using the **par** command in X.28 mode.

```
router-A# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
router-A(config)# x29 profile ppp 9:2
router-A(config)# end
router-A#
%SYS-5-CONFIG_I: Configured from console by console
router-A# x28 profile ppp

* par
  PAR 1:1 2:1 3:126 4:0 5:1 6:2 7:2 8:0 9:2 10:0 11:14 12:1 13:0 14:0 15:0 16:127 17:24
  18:18 19:2 20:0 21:0 22:0
```

Network User Identification Data Relocation Example

The following example sends an authentication message to a remote X.25 host using the **x28 nuicud** command in X.28 mode followed by the **Ncisc-123456** X.28 command. The network identifier is *N*. The network user password is *cisc*. The destination address of the remote device is *123456*. The ASCII representation of the user password appears in the call user data field, not in the data packet.

```
router-A# debug x25 event
X.25 special event debugging is on
router-A# x28 nuicud

* Ncisc-123456
COM

router-B>
02:02:58: Serial1: X.25 O P1 Call (16) 8 lci 20
02:02:58:   From(3): 222 To(3): 123456
02:02:58:   Facilities: (0)
02:02:58:   Call User Data (8): 0x01000000xxxxxxxx (pad)
02:02:58: Serial1: X.25 I P2 Call Confirm (5) 8 lci 20
02:02:58:   From(0): To(0):
02:02:58:   Facilities: (0)
```

X.25 Reverse Charge Call Example

The charges for all outgoing calls made from the local router can be reversed to the destination device using the **x28 reverse** command. To reverse the charges for only one outgoing call, use the **R- address** command, which is the standard X.28 reverse charge facility command.

```
router-A# x28 reverse

* exit
```

```
router-A# x28

* R-123456
COM
```

X.25 Call Detail Display Example

Each time a call is made to a remote device, you can specify that detailed information be displayed about the call and the destination device by entering the **x28 verbose** command. The following example shows reverse charging configured and call user data represented as *userdata*:

```
router# x28 verbose

* R-111*userdata

Called DTE Address : 3001
Facility Block      : R
Call User Data      :userdata
COM
```

Configure PAD Connections Using Cisco's Legacy PAD User Interface

The following sections describe X.3 PAD connection tasks:

- Make a PAD Connection
- Switch between Connections
- Exit a PAD Session
- Monitor X.25 PAD Connections
- Set X.3 PAD Parameters
- PAD Session Examples

Make a PAD Connection

To display information about packet transmission and X.3 PAD parameter settings and log on to a PAD, perform the following task in EXEC mode:

Step	Command	Purpose
1	show x25 pad	Display information about packet transmission and X.3 PAD parameter settings.
2	pad {x121-address hostname} [/cud text] [/debug] [/profile name] [/quiet message] [/reverse] [/use-map]	Log on to a PAD.

You can exit a connection and return to the user EXEC prompt at any point.

To open a new connection, first exit the current connection by typing the escape sequence (**Ctrl-Shift-6** then **x** [**Ctrl^x**] by default) to return to the EXEC prompt, then open the new connection.

Switch between Connections

You can have several concurrent sessions open and switch between them. The number of sessions that can be open is defined by the **session-limit** command, which is described in the “Configuring Modem Support and Asynchronous Devices” chapter of this publication and the “Modem Support and Asynchronous Devices Commands” chapter of the *Dial Solutions Command Reference*.

To switch between sessions by escaping one session and resuming a previously opened session, perform the following tasks:

Step	Command	Purpose
1	Ctrl-Shift-6 then x (Ctrl^x) by default	Escape the current connection, if you have one open, and return to EXEC mode.
2	where	From EXEC mode, list the open sessions. All open sessions associated with the current terminal line are displayed.
3	resume [<i>connection</i>] [<i>keyword</i>]	Make the connection.

The **Ctrl^x**, **where**, and **resume** commands are available with all supported connection protocols.

Exit a PAD Session

To exit a PAD session, enter the escape sequence (**Ctrl-Shift-6** then **x** [**Ctrl^x**] by default) and enter the **disconnect** command at the EXEC prompt. You can also log off the remote system by issuing the command specific to that system (such as **exit**, **logout**, **quit**, **close**, or **disconnect**).

Monitor X.25 PAD Connections

To display information about current open connections, perform the following task in user EXEC mode:

Command	Purpose
show x25 pad	Display information about X.25 PAD connections that are currently open.

The information includes packet transmissions, X.3 parameter settings, and the current status of virtual circuits.

Set X.3 PAD Parameters

To set X.3 PAD parameters, perform the following task in EXEC mode:

Command	Purpose
resume [<i>connection</i>] [/set parameter:value]	Set X.3 PAD parameters.
or x3 parameter:value	

The parameters are numbered from 1 through 18. See the “X.3 PAD Parameters” appendix of the *Dial Solutions Command Reference* for more information.

For an example of setting X.3 PAD parameters, see the next example.

PAD Session Examples

The following example starts a PAD session:

```
router> pad 123456789
Trying 123456789...Open
router2>
```

The following example illustrates how to reset the outgoing connection default for local echo mode on a router. The `/set` switch sets the X.3 parameters defined by parameter number and value, separated by a colon.

```
router> resume 3 /set 2:1
```

The following are examples of `show x25 vc` command output for PAD over CMNS, PAD to PAD over X25, and PAD over XOT connections:

```
router# show x25 vc
SVC 1, State: D1, Interface: Ethernet0
  Started 00:01:48, last input 00:01:48, output 00:01:48

  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

SVC 1024, State: D1, Interface: Serial1
  Started 00:00:07, last input 00:00:26, output 00:00:26

  Line: 0 con 0 Location: console Host: 2194443
  2191111 connected to 2194443 PAD <--> X25

  Window size input: 5, output: 5
  Packet size input: 128, output: 128
  PS: 0 PR: 0 ACK: 0 Remote PR: 0 RCNT: 0 RNR: no
  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 1, State: D1, Interface: [172.21.9.7,1998/172.21.9.11,11000]
  Started 00:06:48, last input 00:06:43, output 00:06:43

  Line: 0 con 0 Location: console Host: 219444001
  2191111 connected to 219444001 PAD <--> XOT 172.21.9.7,1998

  Window size input: 2, output: 2
  Packet size input: 128, output: 128
  PS: 5 PR: 4 ACK: 4 Remote PR: 5 RCNT: 0 RNR: no
  P/D state timeouts: 0 timer (secs): 0
  data bytes
```

The following is example output for the `show x25 pad` command:

```
router# show x25 pad

tty0 (console), connection 1 to host 2194440

Total input: 75, control 2, bytes 3168. Input Queued: 0 of 7 (0 bytes).
Total output: 50, control 2, bytes 52. Output Queued: 0 of 5.
Flags: 1, State: 3, Last error: 1
ParamsIn: 1:0, 2:0, 3:0, 4:0, 5:0, 6:0, 7:0,
          8:0, 9:0, 10:0, 11:0, 12:0, 13:0, 14:0, 15:0,
```

```

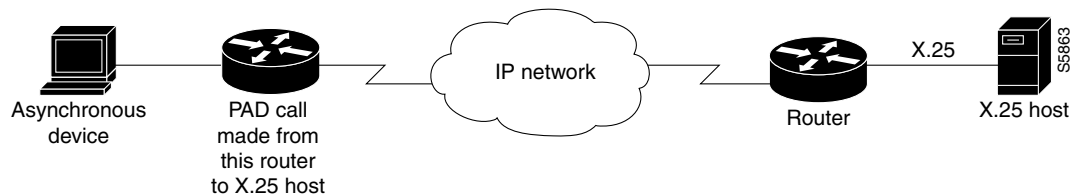
16:0, 17:0, 18:0, 19:0, 20:0, 21:0, 22:0,
ParamsOut: 1:1, 2:0, 3:2, 4:1, 5:1, 6:0, 7:21,
8:0, 9:0, 10:0, 11:14, 12:1, 13:0, 14:0, 15:0,
16:127, 17:21, 18:18, 19:0, 20:0, 21:0, 22:0,

tty18, Incoming PAD connection
Total input: 2, control 2, bytes 54. Input Queued: 0 of 7 (0 bytes).
Total output: 1, control 2, bytes 9. Output Queued: 0 of 5.
Flags: 1, State: 3, Last error: 1
ParamsIn: 1:1, 2:0, 3:2, 4:1, 5:0, 6:0, 7:21,
8:0, 9:0, 10:0, 11:14, 12:0, 13:0, 14:0, 15:0,
16:127, 17:21, 18:18, 19:0, 20:0, 21:0, 22:0,
ParamsOut: 1:1, 2:1, 3:2, 4:1, 5:0, 6:0, 7:4,
8:0, 9:0, 10:0, 11:14, 12:0, 13:0, 14:0, 15:0,
16:127, 17:21, 18:18, 19:0, 20:0, 21:0, 22:0,
    
```

Enable PAD Calls to an X.25 Host over an IP Network

PAD calls can be made to destinations that are not reachable over physical X.25 interfaces, but instead over TCP tunnels. PAD calls originating from a router on an IP link can reach an X.25 device. This feature is also known as PAD over XOT. The **service pad to-xot** command and **service pad from-xot** global configuration commands enable the PAD over XOT feature. Figure 89 shows PAD calls originating from a router in an IP network reaching a X.25 device.

Figure 89 PAD Dialing In to an X.25 Host over an IP Network



To allow PAD connections over XOT on the router, perform the following tasks beginning in privileged EXEC mode:

Step	Command	Purpose
1	configure terminal	Enter global configuration mode.
2	service pad [from-xot] [to-xot]	Specify outgoing PAD calls over XOT or incoming XOT to PAD connections.
3	x25 host name x121-address or x25 route x121-address xot x121-address	Depending on your application, specify an X.121 address for the host name of the router or an X.25 route pointing out over XOT. ¹

1. The X.121 address of the **x25 host** command serves as a source address or sink address for PAD over XOT connections that do not have an interface. Protocol translation can also be used with incoming PAD calls over XOT, which is configured with the **translate x25** command.

PAD XOT Examples

This section provides the following PAD over XOT configuration examples:

- Accept XOT to PAD Connections Example
- Accept XOT to Protocol Translation Example
- Initiate a PAD Call over an XOT Connection Example
- Address Substitution for PAD Calls over XOT Example

Accept XOT to PAD Connections Example

The following example enables connections from XOT to a local PAD. Because XOT is a TCP connection, the connection is not tied to an X.25 interface. An X.25 address must be configured for the host name of the router that is accepting the call. In this case, the router answers and clears an incoming PAD call through address 1234.

```
router(config)# service pad from-xot
router(config)# x25 host router-A 1234
```

Accept XOT to Protocol Translation Example

The following example accepts an incoming PAD call over XOT to address 12345. The router then translates the call and makes a TCP connection to the device called *puli*.

```
router(config)# service pad from-xot
router(config)# translate x25 12345 tcp puli
```

Initiate a PAD Call over an XOT Connection Example

The following example enables outgoing PAD to XOT connections from an asynchronous line or virtual terminal line. A route pointing out over XOT must be configured on the routing table to make a PAD call. This route can also be used for switching.

```
router(config)# service pad to-xot
router(config)# x25 route 1111 xot 2.2.2.2.
```

Address Substitution for PAD Calls over XOT Example

Whenever you have X25 synchronous or PAD devices attached to a router in a remote location that interconnects to a central site through an XOT network, you need to insert the X.121 calling address on the interfaces of the router that connects to the legacy devices (X25 or PAD). If you do not do this on the ingress router, the legacy devices cannot be differentiated when their calls reach the central site router.

Normally a PAD applies the originating interface's address (even if it is NULL) or the X25 host address (for XOT) as the source address of the call. To override this behavior and substitute the original X.121 source address, the PAD configuration needs to apply the `substitute-source` option of the `x25 router` command and append the appropriate sub address (if one is configured). If the incoming call is switched, PAD and subaddressing is irrelevant.

The following example performs address substitution for PAD calls over XOT. See the `x25 route` command for more information about address substitution.

```
router(config)# x25 route 1234 substitute-source 8888 xot 1.1.1.1
```

Configure PAD Subaddressing

In situations where the X.121 calling address is not sufficient to identify the source of the call, you can append a specified value to the calling address using the PAD subaddressing feature. PAD subaddressing allows you to create unique X.121 calling addresses by including either a physical port number or a value specified for a line as a subaddress to the X.121 calling address.

PAD subaddressing enables an X.25 host application to uniquely identify the source of an X.121 call. For example, in some bank security alarm applications, the central alarm host identifies the physical location of the alarm units from subaddressing information contained in the Call Request packet.

Prerequisites

Before you can configure PAD subaddressing, you need to configure your router or access server to support X.25. For more information, refer to the *Wide-Area Networking Configuration Guide*.

Configuration Tasks

To configure PAD subaddressing, you need to perform the following tasks:

- Identify the Line(s)
- Configure PAD Subaddressing

Identify the Line(s)

To identify the line(s) whose information will be appended to the X.121 calling address as the subaddress (and start the line configuration command mode), perform the following task in global configuration mode:

Command	Purpose
<code>line [aux console tty vty] line-number [ending-line-number]</code>	Identify the line(s) to be appended to the X.121 address as the subaddress.

Configure PAD Subaddressing

To create a unique X.121 calling address by adding either a physical port number or a numeric value for a line as a subaddress to the X.121 calling address, perform the following task in line configuration mode:

Command	Purpose
<code>x25 subaddress {line number}</code>	Configure PAD subaddressing.

Configuration Examples

The following example shows how to configure subaddressing on vty lines 10 through 20 by appending the line number as a subaddress to the X.121 calling address:

```
line vty 10 20
x25 subaddress line
```

The following example shows how to configure subaddressing on the first five tty lines by appending the value "09" as a subaddress to the X.121 calling address of the X.28 connection originating on these lines:

Configure PAD Subaddressing

```
line 1 5
x25 subaddress 9
autocommand x28
```

You can use the output from the **debug x25 event** and the **show line** commands to display information about PAD subaddressing. Once you have configured PAD subaddressing, the output from both of these commands changes to reflect the additional subaddress information.

The following example shows **debug x25 event** output, where the X.25 address is 12345 and the subaddress for tty line 3 is 09.

```
router# debug x25 event

Serial1: X.25 O P1 Call (14) 8 lci 1024
  From(7): 1234509 To(4): 6789
  Facilities: (0)
  Call User Data (4): 0x01000000 (pad)
Serial1: X.25 I P2 Call Confirm (5) 8 lci 1024
  From (0): to (0):
  Facilities: (0)
  PAD3: Call completed
```

The following example shows sample **show line** output for a router called enkidu, where line 18 has been configured for PAD subaddressing.

```
router# show line 18

Tty Typ Tx/Rx A Modem Roty AccO AccI Uses Noise Overruns
 18 VTY - - - - - 1 0 0/0

Line 18, Location: "enkidu", Type: " "
Length: 48 lines, Width: 80 columns
Baud rate: (TX/RX) is 9600/9600
Status: Ready, Connected, Active, No Exit Banner
Capabilities: Line usable as async interface, PAD Sub-addressing used
Modem state: Ready
```