Chapter 6: X.25

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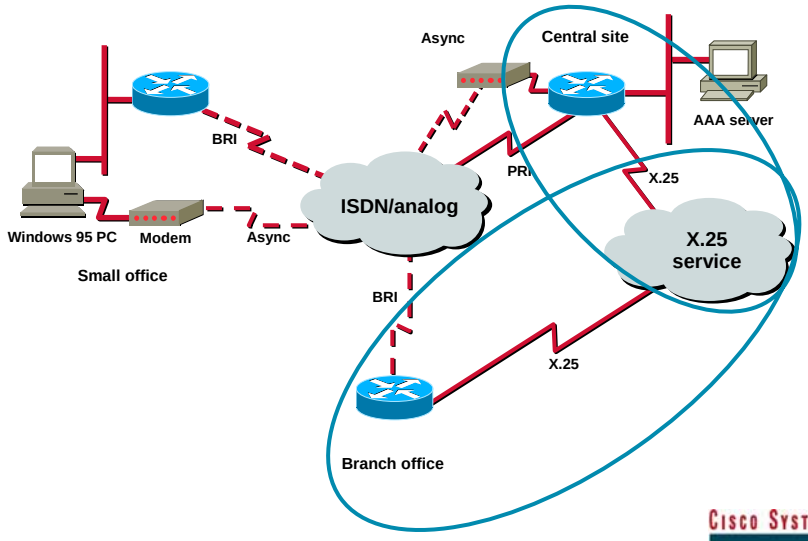
Objectives

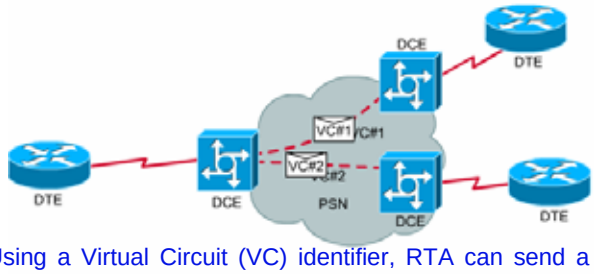
Upon completion of this chapter, you will be able to perform the following tasks:

- **Configure an X.25 WAN connection**
- **Assign X.121 addresses to router interfaces and map higher-level addresses to X.25 addresses**
- **Verify X.25 configuration in the router**

Chapter Activities



An Introduction to X.25

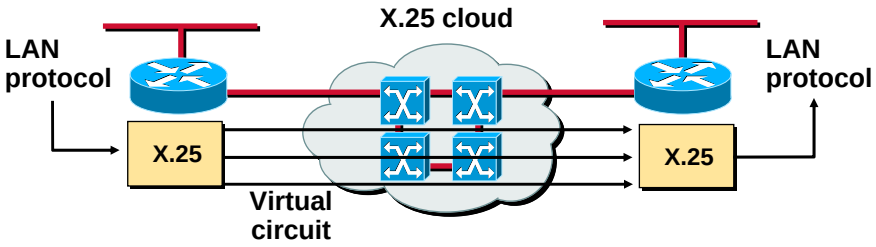


◆Using a Virtual Circuit (VC) identifier, RTA can send a packet to RTB or RTC using the same physical interface connect to a PSN.

◆PSNs use shared transmission facilities to provide customers with cost-effective WAN services. Before PSNs were widely available, customers could either choose a dialup connection or a dedicated one. Both types of connections can be inefficient for applications that involve bursty, intermittent transfers of data.

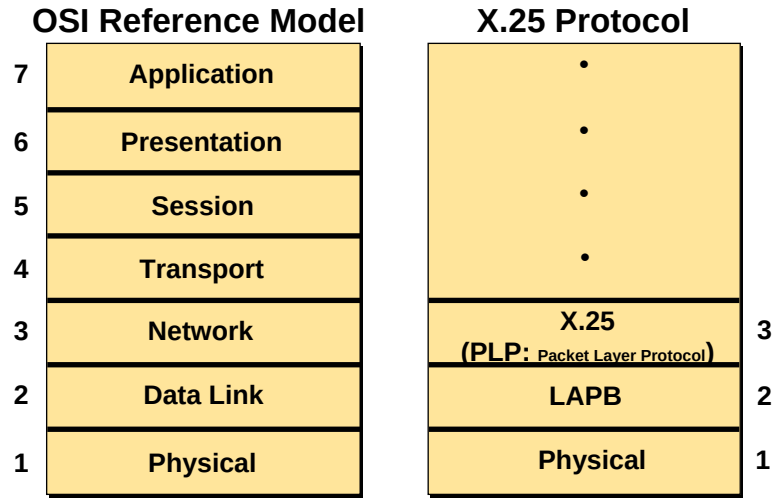
◆Applications like e-mail, Telnet, and HTTP typically result in bursts of traffic rather than steady streams of data. In other words, data is only sent after a user clicks the mouse or types a character. The bottom line is that the link may be idle for much of the time when using these applications.

An Introduction to X.25

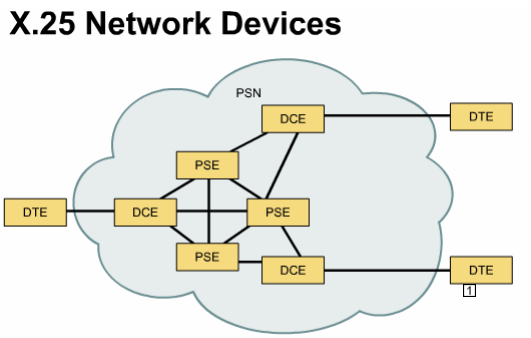


- IP
- AppleTalk
- Novell IPX
- Banyan VINES
- XNS
- DECnet
- ISO-CLNS
- Compressed TCP
- Bridging

X.25 Protocol Stack



X.25 Network Devices

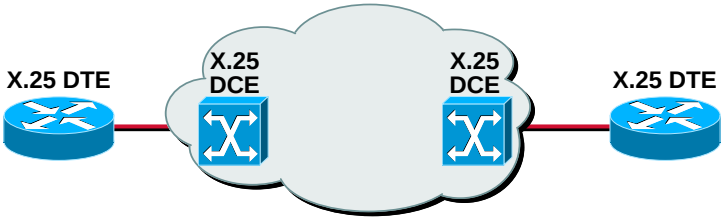


An X.25 network typically includes a DTE, DCE, and PSE.

◆X.25 network devices fall into three general categories:
- Data terminal equipment (DTE)
- Data circuit-terminating equipment (DCE)
- Packet switching exchange (PSE)

◆DTE devices are end systems that communicate across the X.25 network. They are usually terminals, routers, or network hosts, and are located on the premises of individual subscribers.
◆DCE devices are communications devices such as modems and packet switches. They provide the interface between DTE devices and a PSE. X.25 DCEs are typically located in the carrier's facilities. The X.25 protocol implements virtual circuits between the X.25 DTE and X.25 DCE.
◆PSEs are switches that compose the bulk of the carrier's network. They transfer data from one DTE device to another through the X.25 PSN.
Figure illustrates the relationships between the three types of X.25 network devices.

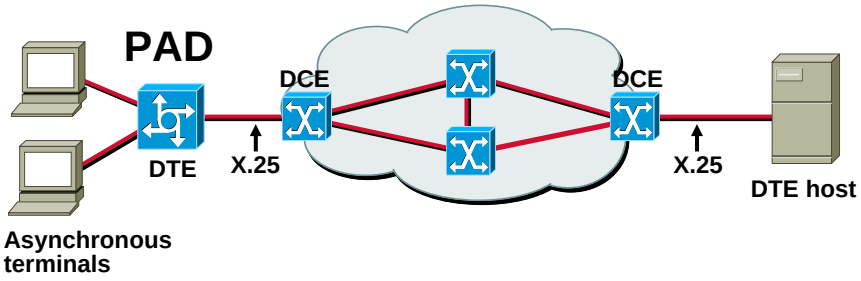
X.25 DTE and DCE



- X.25 DTE—Usually a subscriber's router or PAD
- X.25 DCE—Usually a PDN's switch or concentrator

Identifying the PAD

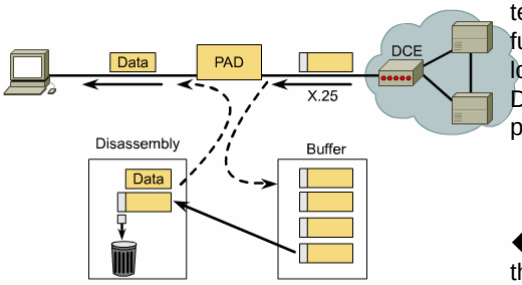
Public data network (PDN)



- **PAD collects data and outputs it into X.25 packets**

Identifying the PAD

X.25 PAD



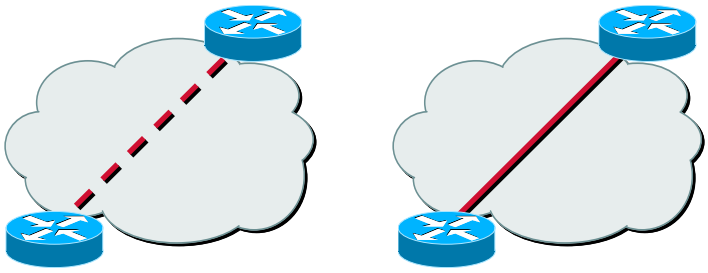
The X.25 PAD buffers, assembles, and disassembles data packets.

◆The packet assembler/disassembler (PAD) is a device commonly found in X.25 networks. PADs are used when a DTE device, such as a character-mode terminal, is too simple to implement the full X.25 functionality. The PAD is located between a DTE device and a DCE device, and it performs three primary functions:

- *buffering*
- *packet assembly*
- *packet disassembly*

◆The PAD buffers data sent to or from the DTE device. It also assembles outgoing data into packets and forwards them to the DCE device. This operation includes adding an X.25 header. Finally, the PAD disassembles incoming packets before forwarding the data to the DTE. This includes removing the X.25 header.

X.25 Virtual Circuits

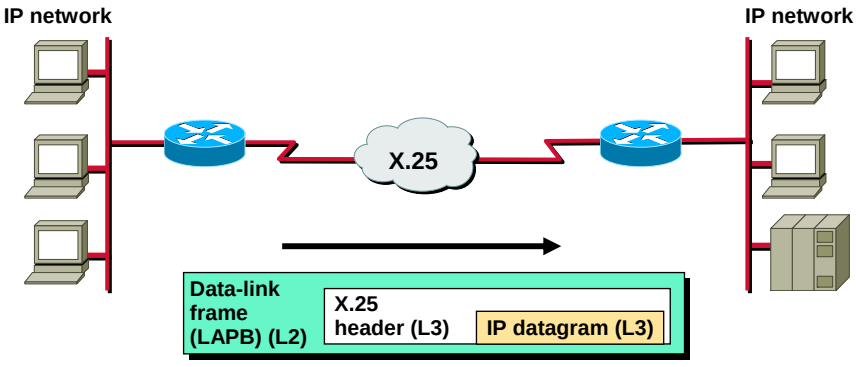


Switched virtual circuits (SVCs)

Permanent virtual circuits (PVCs)

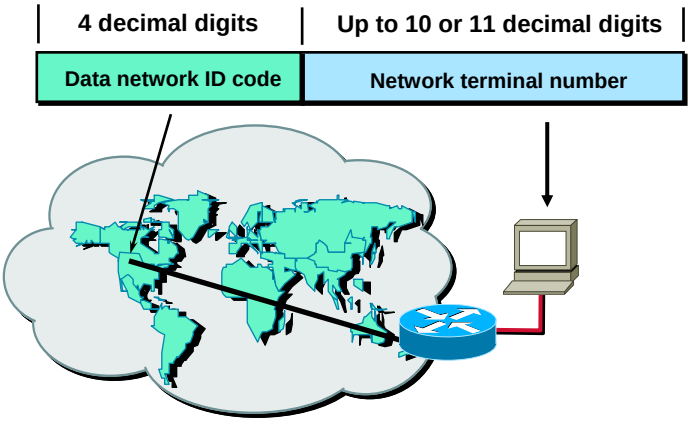
- Numbering for up to 4095 VCs per X.25 interface

X.25 Encapsulation



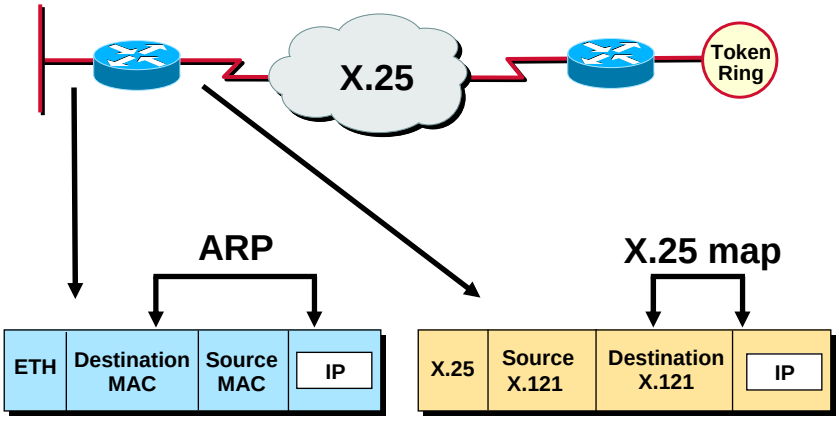
- Protocol datagrams are reliably carried inside LAPB frames and X.25 packets

X.25 (X.121) Addressing Format

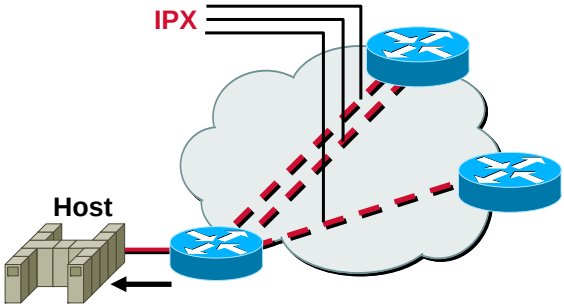


- Addressing set by service provider

X.25 Address Resolution, Protocol(ARP)

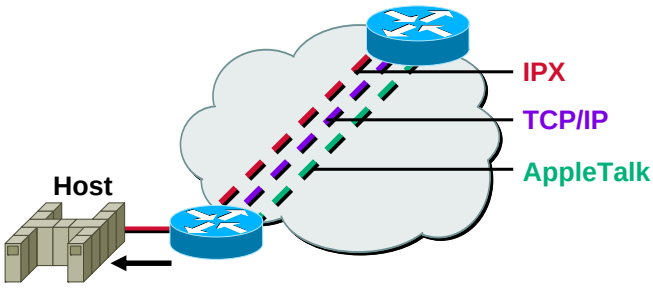


SVC Usage



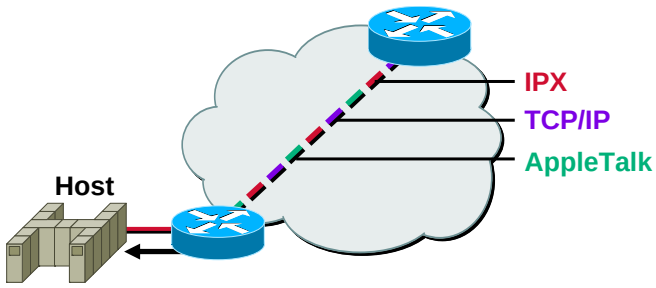
- SVCs may be combined to improve throughput for a particular protocol

Single-Protocol Virtual Circuits



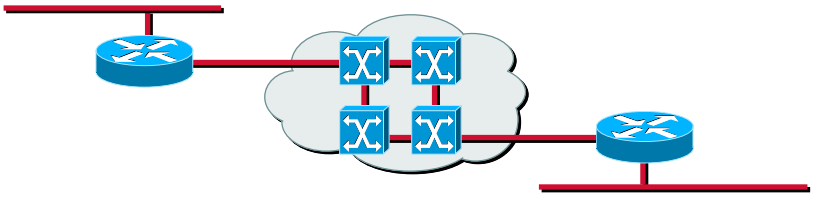
- Each network-layer protocol is associated with its own virtual circuit

Multiprotocol Virtual Circuits



- Multiple protocols are carried within a virtual circuit to a single destination
- A maximum of nine protocols may be mapped to a host

X.25 Configuration Tasks



- Interface configuration
  - Select X.25 DTE or DCE encapsulation
  - Configure parameters for X.25 network attachment
  - Map protocol address to X.121 address
  - Additional configuration steps

Configuring X.25 SVCs—Steps 1 and 2

Step 1

```
Router(config-if)#encapsulation x25 [dte | dce]
```

- **Defines encapsulation type**

Step 2

```
Router(config-if)#x25 address x.121-address
```

- **Establishes interface address**

Configuring X.25 SVCs—Step 3

```
Router(config-if)#x25 map protocol address x.121-address [options]
```

- **Specifies how a single protocol reaches a destination**

or

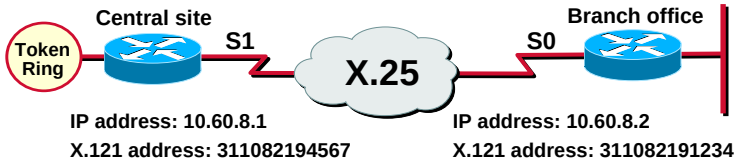
```
Router(config-if)#x25 map protocol address [protocol2 address2]*
x.121-address [options]
```

- **Specifies how multiple protocols reach a single destination using one SVC**

Configuring X.25 SVC Example

Central site

```
Central(config)#interface serial 1
Central(config-if)#encapsulation x25
Central(config-if)#x25 address 311082194567
Central(config-if)#ip address 10.60.8.1 255.255.248.0
Central(config-if)#x25 map ip 10.60.8.2 311082191234 broadcast
```



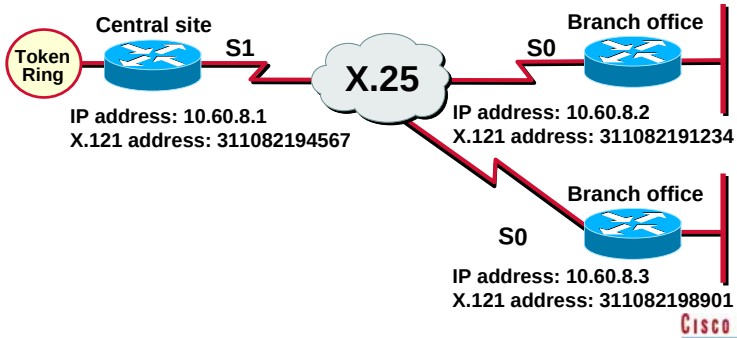
Branch office

```
Branch(config)#interface serial 0
Branch(config-if)#encapsulation x25
Branch(config-if)#x25 address 311082191234
Branch(config-if)#ip address 10.60.8.2 255.255.248.0
Branch(config-if)#x25 map ip 10.60.8.1 311082194567 broadcast
```


Configuring X.25 SVC Example

Central site

```
Central(config)#interface serial 1
Central(config-if)#encapsulation x25
Central(config-if)#x25 address 311082194567
Central(config-if)#ip address 10.60.8.1 255.255.248.0
Central(config-if)#x25 map ip 10.60.8.2 311082191234 broadcast
Central(config-if)#x25 map ip 10.60.8.3 311082198901 broadcast
```



Configuring X.25 PVCs—Steps 1 to 3

Step 1

```
Router(config-if)#encapsulation x25 [dte | dce]
```

- **Defines encapsulation type**

Step 2

```
Router(config-if)#x25 address x.121-address
```

- **Establishes interface address**

Step 3

```
Router(config-if)#x25 pvc circuit protocol address
[protocol2 address2]* x.121-address [options]
```

- **Specifies how protocols reach a destination using a PVC**

Configuring X.25 PVC Example

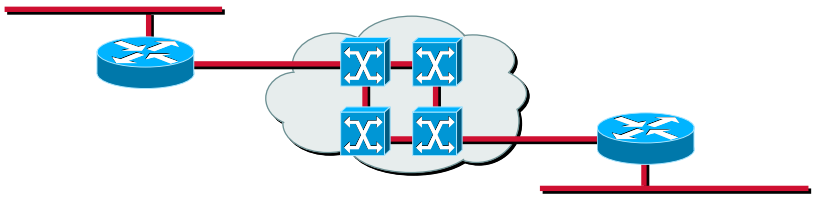
Central site

```
Central(config)#interface serial 1
Central(config-if)#encapsulation x25
Central(config-if)#x25 address 311082194567
Central(config-if)#ip address 10.60.8.1 255.255.248.0
Central(config-if)#x25 pvc 4 ip 10.60.8.2 311082191234 broadcast
```

Branch office

```
Branch(config)#interface serial 0
Branch(config-if)#encapsulation x25
Branch(config-if)#x25 address 311082191234
Branch(config-if)#ip address 10.60.8.2 255.255.248.0
Branch(config-if)#x25 pvc 3 ip 10.60.8.1 311082194567 broadcast
```

Additional X.25 Configuration Tasks



- Configure interface for X.25 Layer 3 parameters
  - Virtual circuits
  - Packet size
  - Window size
  - Window modulus

Configuring X.25 VC Ranges

	Range	Default	Command
PVCs	1–4095		x25 pvc *circuit*
SVC Incoming only	1–4095	0	x25 lic *circuit*
	1–4095	0	x25 hic *circuit*
SVC Two-way	1–4095	1	x25 ltc *circuit*
	1–4095	1024	x25 htc *circuit*
SVC Outgoing only	1–4095	0	x25 loc *circuit*
	1–4095	0	x25 hoc *circuit*

Configuring X.25 Packet Sizes

```
Router(config-if)#x25 ips bytes
```

- Specifies default incoming packet size

```
Router(config-if)#x25 ops bytes
```

- Specifies default outgoing packet size

Configuring Window Parameters

```
Router(config-if)#x25 win packets
```

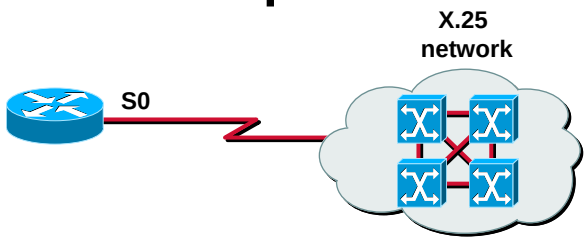
```
Router(config-if)#x25 wout packets
```

- Specifies default unacknowledged packet limits

```
Router(config-if)#x25 modulo modulus
```

- Defines packet-level window counter limit

Additional X.25 Configuration Options Example



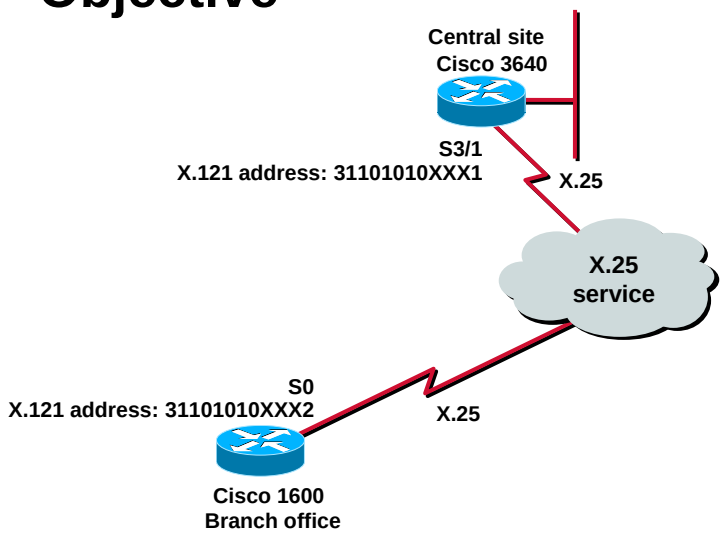

```
Router(config)#interface serial 0
Router(config-if)#encapsulation x25

Router(config-if)#x25 address 311082198756
Router(config-if)#x25 ips 1024
Router(config-if)#x25 ops 1024
Router(config-if)#x25 win 7
Router(config-if)#x25 wout 7
```


Verifying X.25 Configuration

```
CentralA#sh int s 3/1
Serial3/1 is up, line protocol is up
Hardware is CD2430 in sync mode
Internet address is 10.140.1.1/24
MTU 1500 bytes, BW 128 Kbit, DLY 20000 usec, rely 255/255, load 1/255
Encapsulation X25, loopback not set
X.25 DTE, address 311010100101, state R1, modulo 8, timer 0
Defaults: idle VC timeout 0
cisco encapsulation
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
RESTARTs 1/0 CALLs 0+0/0+0/0+0 DIAGs 0/0
LAPB DTE, state CONNECT, modulo 8, k 7, N1 12056, N2 20
T1 3000, T2 0, interface outage (partial T3) 0, T4 0
VS 5, VR 3, tx NR 3, Remote VR 5, Retransmissions 0
Queues: U/S frames 0, I frames 0, unack. 0, reTx 0
IFRAMEs 5/3 RNRs 0/0 REJs 0/0 SABM/Es 0/1 FRMRs 0/0 DISCs 0/0
Last input 00:00:29, output 00:00:29, output hang never
Last clearing of "show interface" counters never
Queueing strategy: fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
<Output Omitted>
```

Laboratory Exercise: Visual Objective



Summary

After completing this chapter, you should be able to perform the following tasks:

- **Configure an X.25 WAN connection**
- **Assign X.121 addresses to router interfaces and map higher-level addresses to X.25 addresses**
- **Verify X.25 configuration in the router**

Review Questions

- **Explain the difference between an X.25 DTE and DCE.**
- **Assume you want an IP connection over an X.25 link. What must you do to map the network layer address to the X.121 address?**
- **How can you limit traffic by lowering the amount of acknowledgements sent across the X.25 link?**