INTRODUCTION TO VIRTUAL CIRCUIT AND X.25

Virtual Circuit:

virtual Circuits is a connection between two network devices appearing like a direct and dedicated connection but it but is actually a group of logic circuit resources from which specific circuits are allocated as needed to meet traffic requirements in a packet switched network. In this case, the two network devices can communicate as though they have a dedicated physical connection. Examples of networks with virtual circuit capabilities include X.25 connections, Frame Relay and ATM networks.

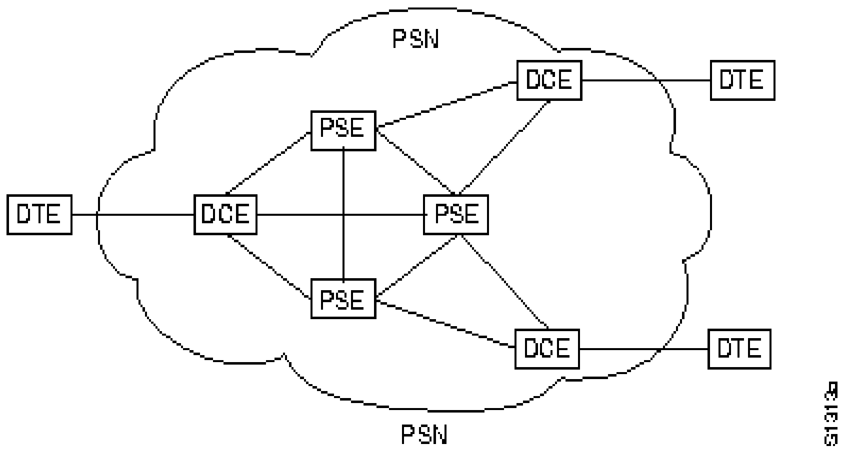
Virtual circuits can be either permanent, called Permanent virtual Circuits (PVC), or temporary, called Switched Virtual Circuits (SVCs).

A Permanent Virtual Circuit (PVC) is a virtual circuit that is permanently available to the user. A PVC is defined in advance by a network manager. A PVC is used on a circuit that includes routers that must maintain a constant connection in order to transfer routing information in a dynamic network environment. Carriers assign PVCs to customers to reduce overhead and improve performance on their networks.
A switched virtual circuit (SVC) is a virtual circuit in which a connection session is set up dynamically between individual nodes temporarily only for the duration of a session. Once a communication session is complete, the virtual circuit is disabled.

X.25:

A packet-switching protocol for wide area network (WAN) connectivity that uses a public data network (PDN) that parallels the voice network of the Public Switched Telephone Network (PSTN). The current X.25 standard supports synchronous, full-duplex communication at speeds up to 2 Mbps over two pairs of wires, but most implementations are 64-Kbps connections via a standard DS0 link.

X.25 defines a telephone network for data communications. To begin communication, one computer calls another to request a communication session. The called computer can accept or refuse the connection. If the call is accepted, the two systems can begin full-duplex information transfer. Either side can terminate the connection at any time.
The X.25 specification defines a point-to-point interaction between *data terminal equipment* (DTE) and *data communication equipment* (DCE). DTEs (terminals and hosts in the user's facilities) connect to DCEs (modems, packet switches, and other ports into the PDN, generally located in the carrier's facilities), which connect to *packet switching exchanges* (PSEs, or simply *switches*) and other DCEs inside a PSN and, ultimately, to another DTE. The relationship between the entities in an X.25 network is shown in Figure .



Because X.25 was designed when analog telephone transmission over copper wire was the norm, X.25 packets have a relatively large overhead of error-correction information, resulting in comparatively low overall bandwidth. Newer WAN technologies such as frame relay, Integrated Services Digital Network (ISDN), and T-carrier services are now generally preferred over X.25. However, X.25 networks still have applications in areas such as credit card verification, automatic teller machine transactions, and other dedicated business and financial uses.

How It Works

The X.25 standard corresponds in functionality to the first three layers of the Open Systems Interconnection (OSI) reference model for networking. Specifically, X.25 defines the following:

- The physical layer interface for connecting data terminal equipment (DTE), such as computers and terminals at the customer premises, with the data communications equipment (DCE), such as X.25 packet switches at the X.25 carrier's facilities. The physical layer interface of X.25 is called X.21bis and was derived from the RS-232 interface for serial transmission.
- The data-link layer protocol called Link Access Procedure, Balanced (LAPB), which defines encapsulation (framing) and error-correction methods. LAPB also enables the DTE or the DCE to initiate or terminate a communication session or initiate data transfer. LAPB is derived from the High-level Data Link Control (HDLC) protocol.
- The network layer protocol called the Packet Layer Protocol (PLP), which defines how to address and deliver X.25 packets between end nodes and switches on an X.25 network using permanent virtual circuits (PVCs) or switched virtual circuits (SVCs). This layer is responsible for call setup and termination and for managing transfer of packets.

An X.25 network consists of a backbone of X.25 switches that are called packet switching exchanges (PSEs). These switches provide packet-switching services that connect DCEs at the local facilities of X.25 carriers. DTEs at customer premises connect to DCEs at X.25 carrier facilities by using a device called a packet assembler/disassembler (PAD). You can connect several DTEs to a single DCE by using the multiplexing methods inherent in the X.25 protocol. Similarly, a single X.25 end node can establish several virtual circuits simultaneously with remote nodes.

An end node (DTE) can initiate a communication session with another end node by dialing its X.121 address and establishing a virtual circuit that can be either permanent or switched, depending on the level of service required. Packets are routed through the X.25 backbone network by using the ID number of the virtual circuit established for the particular communication session. This ID number is called the logical channel identifier (LCI) and is a 12-bit address that identifies the virtual circuit. Packets are generally up to 128 bytes in size, although maximum packet sizes range from 64 to 4096 bytes, depending on the system.

Disadvantages of X.25

Prior to Frame Relay, some organizations were using a virtual-circuit switching network called X.25 that performed switching at the network layer. For example, the Internet, which needs wide-area networks to carry its packets from one place to another, used X.25. And X.25 is still being used by the Internet, but it is being replaced by other WANs. However, X.25 has several drawbacks:

- X.25 has a low 64-kbps data rate. By the 1990s, there was a need for higher- data-rate WANs.

- X.25 has extensive flow and error control at both the data link layer and the network layer. This was so because X.25 was designed in the 1970s, when the available transmission media were more prone to errors. Flow and error control at both layers create a large overhead and slow down transmissions. X.25 requires acknowledgments for both data link layer frames and network layer packets that are sent between nodes and between source and destination.

- Originally X.25 was designed for private lise, not for the Internet. X.25 has its own network layer. This means that the user's data are encapsulated in the network layer packets of X.25. The Internet, however, has its own network layer, which means if the Internet wants to use X.25, the Internet must deliver its network layer packet, called a datagram, to X.25 for encapsulation in the X.25 packet. This doubles the overhead.

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