GWPC, BIKANER
MODEL PAPER
EL-309

Q.1 Explain X.25.

Ans. *X.25* is a standard for WAN communications that defines how connections between user devices and network devices are established and maintained. X.25 was recommended as the desired protocol by the International Consultative Committee for Telegraphy and Telephony (CCITT) called the International Telecommunication Union (ITU) since 1993. X.25 is designed to operate effectively regardless of the type of systems connected to the network. It is typically used in the packet-switched networks (PSNs) of common carriers, such as the telephone companies.

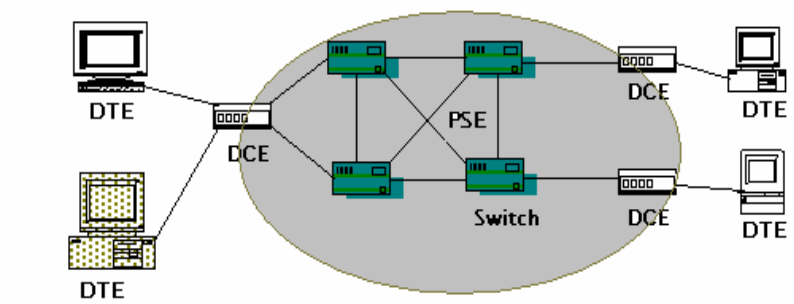
X.25 network devices fall into three general categories.

1. Data terminal equipment (DTE)
2. Data circuit-terminating equipment (DCE)
3. Packet-switching exchanges (PSE)

Data terminal equipment (DTE**)** devices are end systems that communicate across the X.25 network. They are usually terminals, personal computers, or network hosts, and are located on the premises of individual subscribers.

Data communication Equipments (DCEs) are communications devices, such as modems and packet switches that provide the interface between DTE devices and a PSE.

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.



The Packet assembler/disassembler (PAD) is a device commonly found in X.25 networks. The PAD is located between a DTE device and a DCE device and it performs three primary functions: buffering (storing data until a device is ready to process it), packet assembly, and 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. Finally, the PAD disassembles incoming packets before forwarding the data to the DTE.

Session Establishment - X.25 sessions are established when one DTE device contacts another to request a communication session. It’s up to the receiving DTE whether to accept or refuse the connection. If the request is accepted, the two systems begin full-duplex communication. Either DTE device can terminate the connection.

Virtual Circuits-The X.25 is a packet-switched virtual circuit network. A *virtual circuit* is a logical connection created to ensure reliable communication between two network devices. A virtual circuit denotes the existence of a logical, bidirectional path from one DTE device to another across an X.25 network. Physically, the connection can pass through any number of intermediate nodes, such as DCE devices and PSEs. Virtual circuits in X.25 are created at the network layer such that multiple virtual circuits (logical connections) can be multiplexed onto a single physical circuit (a physical connection). Virtual circuits are demultiplexed at the remote end, and data is sent to the appropriate destinations.

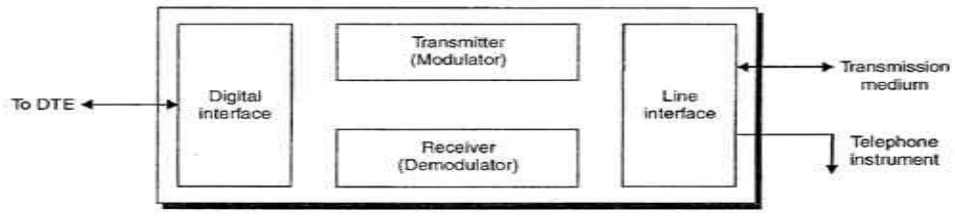
Two types of X.25 virtual circuits exist: switched and permanent. *Switched virtual circuits (SVCs)* are temporary connections used for sporadic data transfers. *Permanent virtual circuits (PVCs)* are permanently established connections used for frequent and consistent data transfers.
The X.25 protocol suite maps to the lowest three layers of the OSI reference model.

Physical layer**:** Deals with the physical interface between an attached station and the link that attaches that station to the packet-switching node. X.21 is the most commonly used physical layer standard.
• Frame layer**:** Facilitates reliable transfer of data across the physical link by transmitting the data as a sequence of frames. Uses a subset of HDLC known as Link Access Protocol Balanced (LAPB), bit oriented protocol.
• Packet layer**:** Responsible for end-to-end connection between two DTEs. Functions performed are:

- Establishing connection
- Transferring data
- Terminating a connection
- Error and flow control
- With the help of X.25 packet layer, data are transmitted in packets over external virtual circuits.

Q.2 Define Modem. Explain its working.

Ans. Modem is abbreviation for Modulator – Demodulator. Modulator converts information from digital mode to analog mode at the transmitting end and demodulator converts the same from analog to digital at receiving end. When an analog facility is used for data communication between two digital devices called Data Terminal Equipment (DTE), modems are used at each end. DTE can be a terminal or a computer. The modem at the transmitting end converts the digital signal generated by DTE into an analog signal by modulating a carrier. This modem at the receiving end demodulates the carrier and hand over the demodulated digital signal to the DTE.



Building blocks of a modem

Types of Modems

• Modems can be of several types and they can be categorized in a number of ways.

• Categorization is usually based on the following basic modem features:

1. Directional capacity: half duplex modem and full duplex modem.

2. Connection to the line: 2-wire modem and 4-wire modem.

3. Transmission mode: asynchronous modem and synchronous modem.

Onboard Modem - Modem built onto the computer motherboard. These Modems cannot be removed, but can be disabled through a Jumper or CMOS Setup.

Internal Modem - Modem that connects to a PCI slot inside a newer desktop computer or ISA slot on an older computer.An internal modem is used inside of the computer and connects directly to the I/O BUS. The internal modem does not require a separate power supply as it gets it's power from the computer's internal BUS nor does an internal modem require a serial port or connecting cables to that port. Internal modems are a little more difficult to install than external modems and an available ISA slot must be present to install it into the computer.

External Modem - Modem within a box that connects to the computer externally, usually the Serial Ports or USB port. An external modem connects to a serial port on the PC and requires the use of a connecting cable between the PC and modem, a power connection and of course a place to put the modem itself. external modems can be easily moved from one computer to another and the lights on the modem itself can aid in the diagnosis of any problems. An external modem can easily be reset by turning it off.

Q.3 Explain OSI Reference Model.

Ans. The main concept of OSI is that the process of communication between two endpoints in a telecommunication network can be divided into seven distinct groups of related functions, or layers. Each communicating user or program is at a computer that can provide those seven layers of function.

The OSI layers may be summarised by:

Physical layer: Provides electrical, functional, and procedural characteristics to activate, maintain, and deactivate physical links that transparently send the bit stream; only recognises individual bits, not characters or multicharacter frames.

Data link layer: Provides functional and procedural means to transfer data between network entities and (possibly) correct transmission errors; provides for activation, maintenance, and deactivation of data link connections, grouping of bits into characters and message frames, character and frame synchronisation, error control, media access control, and flow control.

Network layer: Provides independence from data transfer technology and relaying and routing considerations; masks peculiarities of data transfer medium from higher layers and provides switching and routing functions to establish, maintain, and terminate network layer connections and transfer data between users.

Transport layer: Provides transparent transfer of data between systems, relieving upper layers from concern with providing reliable and cost effective data transfer; provides end-to-end control and information interchange with quality of service needed by the application program; first true end-to-end layer.

Session layer: Provides mechanisms for organising and structuring dialogues between application processes; mechanisms allow for two-way simultaneous or two-way alternate operation, establishment of major and minor synchronisation points, and techniques for structuring data exchanges.

Presentation layer: Provides independence to application processes from differences in data representation that is, in syntax; syntax selection and conversion provided by allowing the user to select a "presentation context" with conversion between alternative contexts.

Application layer: Concerned with the requirements of application. All application processes use the service elements provided by the application layer. The elements include library routines which perform interposes communication, provide common procedures for constructing application protocols and for accessing the services provided by servers which reside on the network.

The communications engineer is concerned mainly with the protocols operating at the bottom four layers (physical, data link, network, and transport) in the OSI reference model. These layers provide the basic communications service. The layers above are primarily the concern of computer scientists who wish to build distributed applications programs using the services provided by the network.

"Hop-by-Hop" "Network-wide" and "End-to-End" Communication

The two lowest layers operate between adjacent systems connected via the physical link and are said to work "**hop by hop**". The protocol control information is removed after each "hop" across a link (i.e. by each System) and a suitable new header added each time the information is sent on a subsequent hop.

The network layer (layer 3) operates **"network-wide"** and is present in all systems and responsible for overall co-ordination of all systems along the communications path.

The layers above layer 3 operate "**end to end"** and are only used in the End Systems (ES) which are communicating. The Layer 4 - 7 protocol control information is therefore unchanged by the IS in the network and is delivered to the corresponding ES in its original form. Layers 4-7 (if present) in Intermediate Systems (IS) play no part in the end-to-end communication.