2.0 INTRODUCTION

Today, Computer networks form the backbone of most enterprises big or small around the world. Computer networks allow people remote to the computer to access the information available to that computer. Computer networks are being used to provide resource sharing between systems separated from a few feet to thousands of kilometres. This technology is leading many corporations to take advantage of the reduced price and increased performance in the workplace. In the first unit of this block, we have discussed about the data communication, in this unit we will discuss networking and how it plays an important role in information exchange. Impact of networking be it LAN or WAN and data communication has been felt across the globe, in various sectors such as education, medicine, transport, etc. This trend of information sharing in most sophisticated manner has completely revolutionised the concept of communication. It brings with it increased access to people in different fields.

2.1 OBJECTIVES

At the end of the unit, you would be able to:

- define LAN and WAN
- define topology and its characteristics
- define a Network Interface Unit (NIU) and communication architecture
- list and distinguish devices used in WAN
- understand and define the trends and impact of data communication and networking in various fields
- describe E-Mail and EDI
- explain the term Internet
- describe present scenario of networking in India.

2.2 NETWORK CONCEPT AND CLASSIFICATION

Communication using computer has brought a revolution in the world of Information Technology, particularly in the field of personal computer. We have always heard of networking or the term network. A network is a way or means of transmitting or receiving (exchange) information from one or more sources.

As an example, car salesmen, after years in the business, have developed a network of associates. When the car salesman needs to locate a car to make a sale, the car salesman calls out to his network to retrieve information on the location of the car. Employment agents also develop a network. Their customers become their networks. Employment agents will frequently keep in touch with their clientele for possible openings or to locate a candidate for an opening. Without the capability of networking, these two people would have a difficult time. It is the same in computing. Networks provide the means for locating and transporting information.

In computing networks, the origin of the information request utilises the services of a network to locate and return the information. This is done with addresses. In the two previous examples of the car salesman and the employment agent, a telephone number can be considered the address of their associate or client. Addresses in computer networking are used in the same manner. These addresses identify the network resource. There are two popular architectures for networking - hierarchical and peer.

Peer networking does not need pre-defined network addressing. Instead, each resource on the network is seen as a peer. Each network resource is a peer to the other network resources. When a new network resource joins the network it introduces itself and notifies its peer of any other network resources that it knows about - peer networks are open and share network information.

The entire computer network can be classified into two board categories (However, elaborate categorisation exists). They are:

(a) LAN (Local Area Network)

(b) WAN (Wide Area Network)

2.3 LOCAL AREA NETWORK (LAN)

As number of systems grows within an organisation, a need is felt for sharing expensive resource and exchanging data and information between systems. This need of information exchange and resource sharing within an organisation has resulted in development of Local Area Network or LAN.

A LAN is a data communication network, which connects many computers or workstations (computers terminal, printer etc.) and permits exchange of data and information among them, within a localised area, typically confined to a building, or a cluster of buildings. The distance between two communication points connected on the same LAN channels, is usually upto 02-05 kms.

LANs are not rigidly defined but tend to share most of all of the following characteristics:

(a) All the connected devices in the network share the transmission media.

(b) Each device connected in the network can either operate standalone or in the network.

(c) Area covered is small.

(d) Data transfer rates are high, usually 1Mbps-100 Mbps. (Million of bits per second)

(e) Each device connected in the network can communicate with any other device in network.

(f) Cost of setting up the network is usually low.

2.3.1 LAN Topology

A network topology refers to the physical layout of the network in which all the devices are connected. This includes all the hardware that makes up the network. The points of connection to the network by the stations are called Nodes or link stations. There are several types of topographical design and strategies used to implement LAN. The majority of these are based on three types of topologies:

(a) Star

(b) Bus

(c) Ring

Each topology has its advantages and disadvantages.

Star Topology

A star topology is shown in Figure 1. In this topology, a number of stations are connected directly to a central station or controller. Communications on the connecting links between the stations and the central station of a star topography can be bi-directional and are point-to-point. A station on this type of network passes an information frame to the central controller, which then forwards the information to the destination station. The central controller manages and controls all communications between stations on the network.

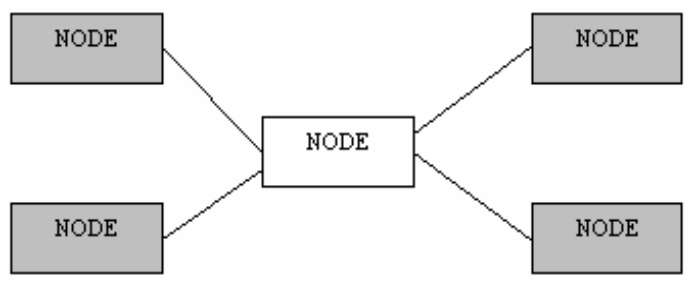


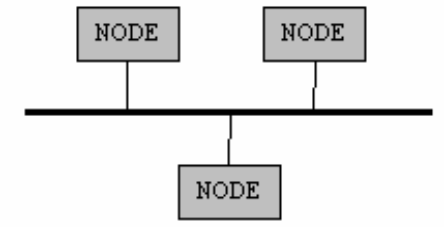
Figure 1: Star Network

Failure of a station on a star network is easy to detect and can be removed from the network. However, failure of the central controller will disable communication throughout the whole network.

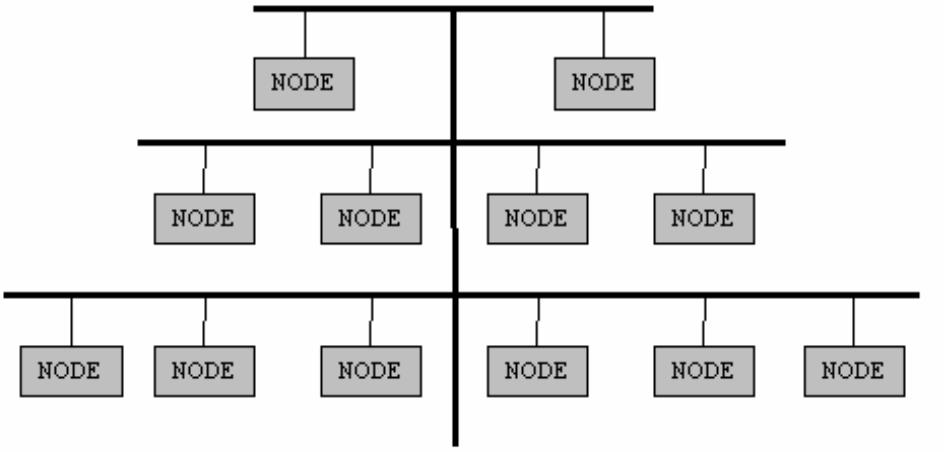
Bus Topology

A bus topology is shown in Figure 2. All stations are connected to a single communication line. This single communication line is referred to as a bus. Information frames originating at a station are propagated away from the station in both directions on the bus. - Each station on the bus interrogates the information frame destination address field for its own address. If the destination field does not match the station's address, the station discards the information frame back on to the bus. If the destination address matches the station address, it accepts the information frame and processes the frame.

An extension to the bus topology is tree topology and is depicted in Figure 2. Tree topology extends the branches of the bus topology allowing more stations to access the bus.



(a)



(b)

Figure 2: (a) Bus Network (b) Tree Network

On a bus or tree network, there is no central point for management and control. These functions are distributed to each station on the bus. A break in the bus can be difficult to locate but limits the range of communications between stations that traverse the broken point.

Ring Topology

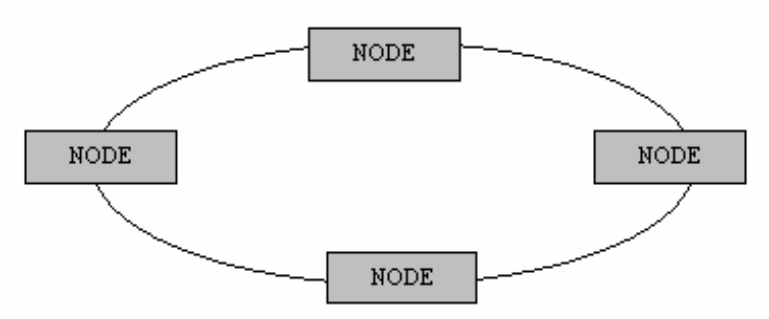


Figure 3: Ring Network

A ring topology is shown in figure 3. Local area networks that have each station attached to an adjacent station using point-to-point links form a physical ring. Each station attached and active to the ring regenerates the information frame, then re-transmits the information frame on the ring. The ring itself is logically circular and the information travels in one direction.

Failure of a station in a ring topology disrupts the ring because the information frame is not regenerated. Additions or deletions of stations to the ring can be disruptive, if the changes are not managed properly.

2.3.2 LAN Access Method

A discipline must be imposed on devices connected to the network to ensure a controlled access to the media. Access methods are the means or ways by which stations actually gain the use of the common channel to transmit messages. The right to transmit is an issue only in broadcast where workstations share a single channel.

Many techniques have been proposed, but two of these are commonly used

(i) Carrier-Sense Multiple Access with Collision Detection (CSMA/CD)

(ii) Token passing

CSMA/CD

CSMA/CD access method is used with bus networks. The bus operates in a Multiple Access (MA) mode. A node is allowed to transmit on the bus, if it senses that the medium is free (carrier sense). Occasionally two or more nodes may simultaneously sense that the medium is free and begin to transmit. This creates a collision, as the contents of transmitted information frames will collide resulting in corruption of the information frame. This collision is detected (collision detect) by the transmitting node. The two (or more) nodes involved then wait for a further short random time interval before trying to retransmit a frame once again.

Token Passing

Another way of controlling access to a shared medium is by the use of a control (permission) token. The control token is passed from one node to another according to a defined set of rules understood and adhered to by all nodes. A node may transmit a frame when it is in possession of the token and after it had transmitted the frame, it passes the token to the next device in a predetermined sequence.

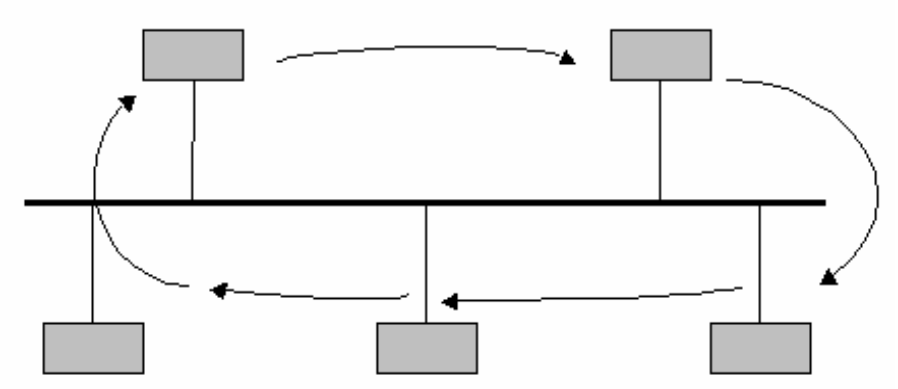


Figure 4: Token bus

In token passing, a logical ring of all nodes connected to the physical medium is first established and a single token is generated; the control token passes from one node to another traversing the logical ring. The token keeps on circulating the logical ring until it is received by a node waiting to send a information frame. After receipt of the token, waiting station transmits the waiting frames on the physical medium after which it passes the control token to the next node in the logical ring.

For token passing, the physical medium need not be a ring topology, it can be used to control access to a bus network also.

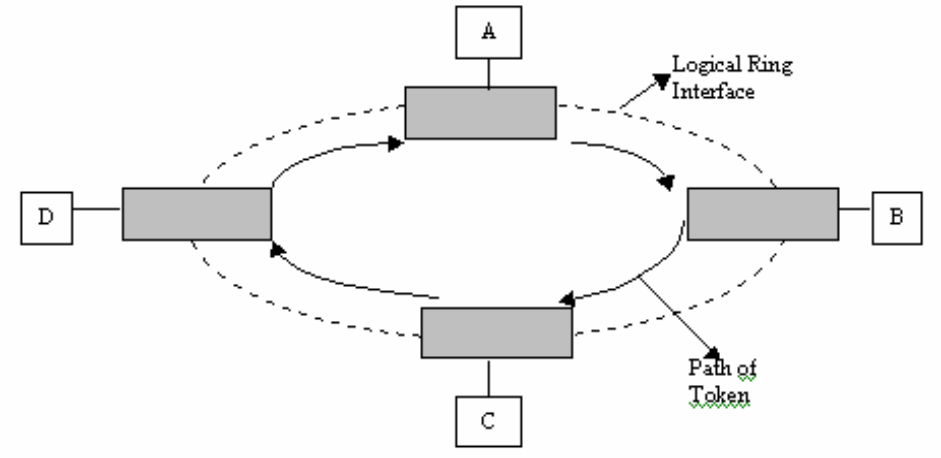


Figure 5: Ring Token

2.3.3 Communication Architecture For Networks

The task of achieving data communication is a Herculean one. Instead of using entire data communication as a single module, the task is broken into various subtasks. And each subtask operates separately by different layers of the communication architecture.

Systems that follow the OSI (Open System Interconnecting) standard are said to be open to one another at different layers and thus called open systems. The communication architecture specifies independent layers that contain modules for performing defined functions. The architecture defines the functions of the module and relationship between them. Each layer in an open system, which communicates with its equal in another open system by using protocols defined in OSI standard.

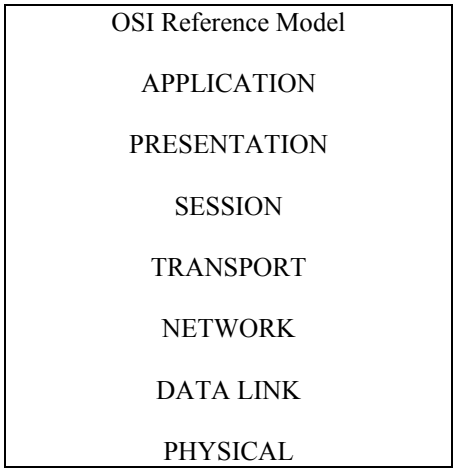


Figure 6: Seven layers of the OSI reference model

The OSI reference model was accepted by ISO as an international standard in 1983. The details on these layers will be dealt with in later courses. However, a brief introduction of these layers is presented here.

Application Layer:

This layer supports semantic exchanges between applications existing in open systems. This layer also provides access to the lower OSI functions and services.

Presentation Layer:

This layer concerns itself with the representation of the data to the end user or application. This includes data conversions and code translation (e.g. ASCII to EBCDIC).

Session Layer:

This layer provides the mechanism for organising and structuring interaction between applications and/or devices.

Transport Layer:

This layer is responsible for transparent and reliable transfer of data. The lower layers handle the attributes of the transfer medium.

Network Layer:

This layer is the agent for establishing connections between networks. The standard also includes operational control procedures for inter-network communications as well as routing information through multiple networks.

Datalink Layer:

This layer provides the functions and protocols to transfer data between network resources and to detect errors that may occur in the physical layer.

Physical Layer:

This layer defines the mechanical, electrical, functional and procedural standards for the physical transmission of data over the communications medium.

As we have seen communication architecture is a common set of rules that define the rules on which all connected nodes in a network should communicate with each other. The communication architecture defines two kinds of relationship between functional modules, interfaces and protocols.

Interfaces are rules for communicating or exchanging information between dissimilar modules are process, whereas protocols are rules for communication between similar types of modules or process.

The following figure explains the difference between interface and protocols.

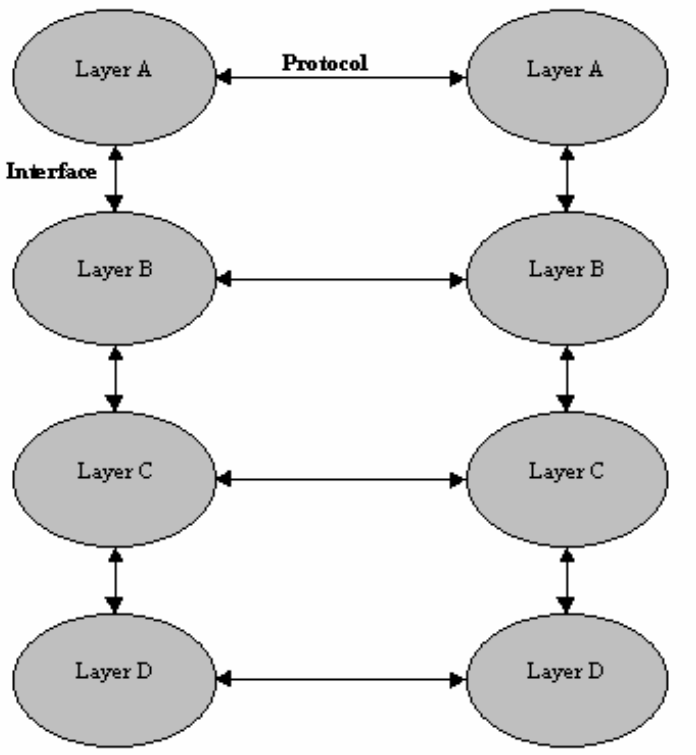


Figure 7: Interfaces and Protocols

2.3.4 LAN Hardware and Software

As we have seen so far, to realise a LAN process, several functions are to be performed. These are so specialised in nature that they require hardware specially built for such purpose. Here we will discuss briefly the basic hardware components of LAN, these are:

(a) Transmission channel

(b) Network Interface Unit (NIU)

(c) Servers

(d) Workstations

(a) Transmission Channel

Generally following four types of channels are used for data communication in a LAN. These are already discussed in section 1.5.3.

(b) Network Interface Units (NIU)

Network interface units connect each device in the LAN network to shared transmission device. It contains the rules or logic to access the LAN. NIU is also used to implement LAN protocols and for device attachments. Its function depends on the type of topology used in LAN. In microcomputers, NIU may be installed as an add-on card.

(c) Servers

One of the major benefits of implementation of LAN is sharing expensive resources such as storage devices, printer etc. This is achieved through providing servers on the LAN. It is a dedicated computer, which controls one or more resources. This contains both hardware and software interface for LAN. Three major categories of servers used in LANs are:

(i) File Server

(ii) Printer Server

(iii) Modem Server

In a networking file server is used to share storage space for files. Besides providing storage space for files in a LAN environment, it is used for taking periodical backup, and also to provide gateway to other servers within and between LANs.

Similarly printer server is used to handle printing works of all workstation connected in the network.

In LAN environment also modem is required to get connected to other network or simply to use a telephone. A modem server is used to share few telephone lines and modems by all connected workstations in a network.

2.3.5 LAN Software/Operating System

As the name suggests, LAN Operating System is required to operate on the LAN system, manage the tremendous work load with a number of various types of server attached to it. It has basically two-aspect (i) Server software (ii) workstation software. As in case of other multi-user operating systems, LAN operating system also facilitates the

sharing of expensive resources such as printer, storage space etc. among all LAN users, provides security for data and permits connection to other networks.

There are various types of LAN operating system for example Novel Netware, WINDOWS NT, etc.

2.4 WIDE AREA NETWORK

As the name suggests, WAN spread across countries and continents, satellites being one of the transmission media.

A Wide Area Network or WAN, is a network that links separate geographical locations. A WAN can be a public system such as the Public Switched Telephone Network (the PSTN) or one of the various packet switched services provided by the public telecommunication authorities. WANs can also use most other types of circuit including satellite networks, ISDN, Value Added Networks (VANs/VADs).

The network can be a private system made up from a network of circuits leased from the local Telephone Company or set up using public systems as virtual private networks. A Virtual Private Network is one which operates in the same way as a private network but which uses public switched services for the transmission of information.

The main distinguishing feature between a WAN and LAN is that, the LAN is under the complete control of the owner, whereas the WAN needs the involvement of another authority like the Telephone Company. LANs are also able to handle very high data transfer rates at low cost because of the limited area covered. LANs have a lower error rate than WANS.

2.4.1 Communication Switching Techniques

In a WAN, two computing devices are not connected directly. A network of switching nodes provides a transfer path between the two devices. The process of transferring data blocks from one node to another is called data switching.

There are three switching techniques commonly employed, and these are:

1. Circuit Switching

In circuit switching there is a dedicated communication path between the sending and receiving devices. The dedicated path is a connected sequence of links between switching nodes. A conventional telephone network, where a dedicated path is set between the caller and the called party for the duration of a telephone call is an example of circuit switching.

Communication viz. circuit switching involves three steps:

Circuit establishment; data transfer; and circuit termination

Circuit switching is mainly used for voice telephone network, but is not all that effective for data communication networks, as channel capacities are not fully utilised, as data communication equipments do not generate data continuously.

2. Message Switching

Message switching is an alternative switching technique, where it is not necessary to establish a dedicated path between the sending and receiving devices. In Message Switching, the sending device appends the destination address to the message and passes it to the network; the message is then passed through the network from one node to another till it reaches the intended destination. Each switching node receives a message, stores it briefly and then transmits it to the next node. Examples of a message are electronic mails, computer files, telegrams and transaction queries and responses. A complete exchange may consist of several messages.

The basic disadvantage of message switching is the variable delay at intermediate switching nodes.

3. Packet Switching

Packet Switching combines the advantages of message and circuit switching. Packet Switching is functionally similar to message switching, in which data is transmitted in block, stored by the first switching node it meets in the network and is forwarded to the next and subsequent downstream nodes until it reaches the destination. The length of data block is limited in a packet switching network. Typical maximum length of packets is between 128 bytes to 4096 bytes. There are two approaches to packet switching

*** Datagram**
*** Virtual circuit**

In datagram approach, each packet is treated independently and may follow a different path through the network. Packets may be re-ordered, dropped or delivered in wrong sequence. The communication protocols provide the error recovery and sequencing of packets at the receiving device.

In virtual circuit approach, a fixed logical path through the network from the sender to the receiver is established before any packets are sent. This path remains unchanged for the duration of the session. This is quite like circuit switching, but no resources are reserved along the path. Packets are buffered at intermediate nodes awaiting transmission.

2.4.2 WAN Devices/Hardware

The switching techniques utilise the routing technology for data transfer. Routing is responsible for searching a path between two computing devices that wish to communicate and for forwarding the data packets on this path. Devices such as bridges, router and gateways provide this routing function.

1. Bridges

Bridges are used to connect two LANs that use identical LAN protocols over a wide area. The bridge acts as an address filter which picks up packets from one LAN that are intended for a destination on another LAN and passes these packets on the network. Bridges operate at the data link layer (layer 2) of the OSI model. As all devices use the same protocols, the amount of processing required at the bridge is minimal. If the distance between the two LANs is large, the user would require two identical bridges at either end of the communication link.

Besides a point-to-point link, the intervening communication facility can be a network such as a wide area packet switching network in such cases the bridges need to add X.25 link layer header and trailer.

2. Routers

Routers can be used to connect networks that may not be similar. Routers provide connectivity between two LANs or two WANs over large geographical distances. Routers operates at the network layer (layer 3).of the OSI model. All routers participate in a routing protocol to access the network topology, and based on this information routers compute the best route from a sender to the receiver.

For large Wide Area Networks spanning thousands of kilometers, the normal practice is to put network routers at suitable locations to minimise link costs for leased lines and provide adequate reliability from link failures. Networks and other system are then connected to the nearest router.

3. Gateways

Gateways are used to connect two dissimilar LANs. The term gateways and routers are used interchangeably, though there is a subtle difference between the two. A router operates at the network layer (layer 3) of the OSI model, whereas a gateway operates on, the application layer (layer 7) of the OSI model. A gateway is required to convert data packets from one protocol format to another before forwarding it, as it connects two dissimilar networks.

While discussing the WAN devices we referred to X.25; what is it? X.25 is a set of recommendation by International Telegraph and Telephone Consultative Committee for packet switched network. You can refer to further readings for more details.

2.4.3 Types of Wide Area Networks

The essential purpose of Wide Area Networks, regardless of the size or technology used, is to link separate locations in order to move data around. A WAN allows these locations to access shared computer resources and provides the essential infrastructure for developing widespread distributed computing systems.

We will now discuss the different types of WAN, which are commonly used.

1. Public Networks

Public Networks are those networks which are installed and run by the telecommunication authorities and are made available to any organisation or individual who subscribe it. Examples include Public Switched Telephone Networks (PSTN), Public Switched Data Networks (PSDN), Value Added Services (VANs/VADs) and the Integrated Services Digital Networks (ISDN). We would be discussing the main features of these services.

Public Switched Telephone Network (PSTN)

The features of the PSTN are its low speed, the analog nature of transmission, a restricted bandwidth and its widespread availability. As PSTN is designed for telephones, modems are required when it is used for data communication.

The PSTN is most useful in wide area data communication systems as an adjunct to other mechanisms. It is seldom advisable to use PSTN as the sole communications medium for building a network system. Costs are high, as data connections last for a considerable time. Also, the links set up are unreliable and can terminate without warning.

PSTN connections are usually easy to obtain at short notice, and are widely available and cover almost every location where people live and work. PSTN is most useful for occasional user or as backup to private circuits. It is also used for facsimile (FAX) machines.

Public Switched Data Networks (PSDN)

The term PSDN covers a number of technologies, although currently it is limited to Public Packet Switched Networks available to the public. The main features of all PSDNs are their high level of reliability and the high quality of the connections provided. They can support both low and high speeds at appropriate costs.

Like the PSTN, a PSDN is very useful and adjunct to a private network for backup and occasional access purposes. It can also be used to link computer systems and networks of one organisation to several other organisations. PSDN is very popular for connecting public and private mail systems to implement electronic mail services with other companies.

Value Added Services (VANs/VADs)

In Value Added Services, the provider of such services must process, store and manipulate the data that is carried on the network, that is, add value to it. The technique can be used in specific types of business in which it is advantageous to be able to share information with other companies in the same line.

Electronic Data Interchange (EDI) is one area for Value Added Services in which two trading partners exchange trading documents such as purchase orders, invoices, transportation etc. using electronic means. In India, Videsh Sanchar Nigam Ltd. is a service provider.

Integrated Services Digital Network (ISDN)

The ISDN is a networking concept providing for the integration of voice, video and data services using digital transmission media and combining both circuit and packet switching techniques. The motivating force behind ISDN is that telephone networks around the world have been making a transition towards utilising digital transmission facilities for many years.

Users in shops or small offices can use their digital connection to Telephone Company for transmitting both voice and data over the same twisted pair cable which connects their telephone. As information from the telephone /PC/Stereo/TV/PABX are all seen as bit streams by the networks switch, they can be switched and transported by the same network.

2. Private Networks

The basic technique used in all forms of private WAN is to use private (or more usually leased) circuits to link the locations to be served by the network. Between these fixed points the owner of the network has complete freedom to use the circuits in any way they want. They can use the circuits to carry large quantities of data or for high speed transmissions.

Check Your Progress

1. Which of the following networking solution is suitable for networking within a building?

(a) WAN
(b) LAN
(c) MAN
(d) None of the above

2. Data transfer rate for LAN is normally:

(a) 1-100 Mbps

(b) l-2 Mbps
(c) 1-10 Mbps
(d) None of the above

3. Which of the following topology share a single channel on which all stations can receive and transmit data?

(a) LAN
(b) BUS
(c) TREE
(d) None of the above

4. In which topology data packet is removed by the source destination

(a) RING
(b) BUS
(c) STAR
(d) None of the above

5. Which of the following LAN access method uses the right to transmission by a special bit pattern?

(a) CSMA/CD
(b) RING topology
(c) Token Passing
(d) None of the above

6. Which of the following topology is least affected by removal/addition of workstations?

(a) RING
(b) STAR
(c) BUS
(d) None of the Above

7. Protocol is used to communicate between

(a) similar module
(b) dissimilar module
(c) both (a) and (b)
(d) None of the above

8. The maximum length of a data packet in packet switching methods is

(a) 1 bytes
(b) 128-4096 bytes
(c) 10 MB
(d) None of the above

9. Which of the following takes a fixed logical path through network in packet switching method?

(a) Datagram
(b) Virtual circuit
(c) LAN topology

(d) None of the above

10. Which of the following is used to connect two LANs using same LAN protocols over a wide area?

(a) Router
(b) Bridges
(c) Gateways
(d) None of the above

2.5 FEW APPLICATIONS

Networking revolution has swept the country and slowly but steadily more and more enterprises are beginning to rely more on various form of electronic data exchange.

2.5.1 E-Mail (Electronic Mail)

E-Mail system is basically used for sending message electronically to individuals or group of individuals in an inter and intra office environment. It requires networks to connect them. In the world of information technology E-Mail is consider to be first experience and exposure to the field of data communication and networking.

But an E-Mail system can do more than just send message back and forth. Applications that will be build on the messaging infrastructure include multimedia mail, database access, document sharing, fax routing, scheduling etc. The most promising areas are workflow, deviation support, task automation information routing etc.

Every day E-Mail vendors coming up with their new version of E-Mail system. Let us discuss few important aspect of a good E-Mail systems.

The E-Mail should contain the feature to compose and send messages easily. Message editing and the ability to easily send attachments that can be quickly opened and read by the recipient are important to improve productivity and use of an E-Mail system.

(a) Automatic differentiation of text created when typing, from initial message.

An e-mail system should provide support for OLE object linking and embeddings which allows user to incorporate graphics, sound and text into in message.

Attaching a file or object to an E-Mail message is the faster way to route information to a workgroup.

One of the advantages of E-Mail is that it gives users the ability to review, respond to a file, and discard incoming message quickly. E-Mail is fast becoming more than just a way to route electronics notes. It is becoming an important communication medium and infrastructure for workgroup applications that make it easier for people to work together.

2.5.2 EDI

Electronic Data Interchange is the inter-organisational exchange of business documentation in structured, machine-processable form.

EDI is often viewed as simply a way of replacing paper documents with electronic documents, and replacing traditional methods of transmission such as mail, phone, or in-person delivery with electronic transmission. However, EDI is actually a way of replacing manual data entry with electronic data entry.

The purpose of EDI is not to eliminate paper, but rather to eliminate processing delays and data re-entry.

Electronic data interchange can be used to electronically transmit documents such as purchase orders, invoices, shipping notices, receiving advices, and other standard business correspondence between trading partners. EDI can also be used to transmit financial information and payments in electronic form. When used in this application, EDI is usually referred to as EFT, Electronic Funds Transfer.

What is Application-To-Application EDI?

Figure shows the use of EDI in place of traditional methods for the transmission of a purchase order between a buyer and seller and demonstrates the key concept behind EDI. Once data are entered into the buyer's computer system, the same data are electronically entered into the seller's, computer, without the need for rekeying or re-entry. This is normally referred to as application-to- application EDI. When EDI is fully integrated with application programs, not only do data flow electronically between trading partners without the need for rekeying, data also flow electronically between internal applications of each of the trading partners.

The repeated rekeying of identical information in the traditional paper-based method business communication creates a number of problems that can be eliminated or significantly reduced through the usage of EDI. These problems include-

* Increased time
* Low accuracy
* High labour charges
* Increased uncertainty

EDI has become a major means of business communications among large companies in the U.S. EDI can do, for communications between unrelated companies, what Electronic Funds Transfer (EFT) has done for transactions between large financial organisations-substitute electronic transactions for paper ones.

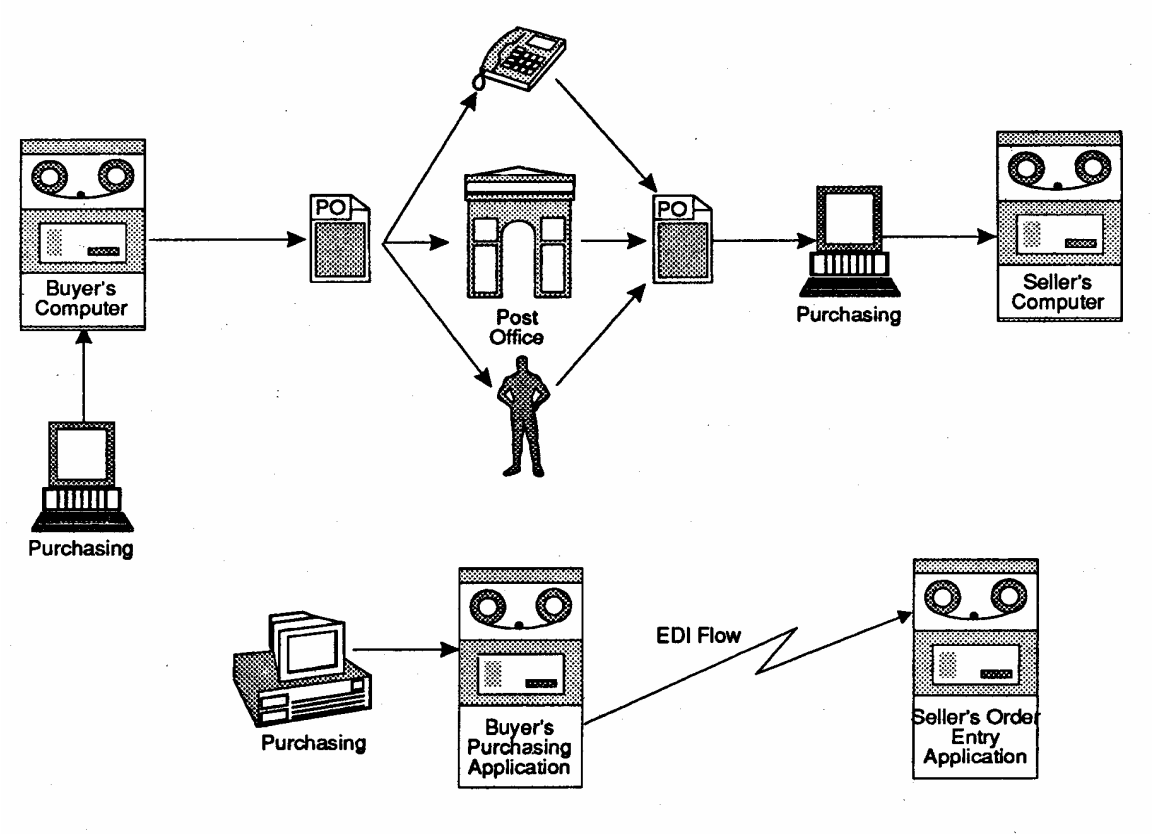


Figure 8: EDI vs. traditional methods

EDI consists of standardised electronic message formats (called transaction sets) for common business documents such as Request for Quotation, Purchase order, Purchase Change Order, Bill of Lading, Receiving Advice, Invoice, and similar documents. These electronic transaction sets enable the computer in one company/organisation to communicate with the computer in another company/organisation without actually producing paper documents. The human effort required to read, sort and physically transport such documents is eliminated. The documents just mentioned, for which standard EDI formats are either in existence or under development, constitute about 85% of the official communications associated with commercial transactions between business, government educational institutions, and non-profit establishments in U.S. and most of the industrialised world.

To take full advantage of EDI's benefits, a company must computerise its basic accounting records. Trading partners are individual organisations that agree to exchange EDI transactions. EDI cannot be undertaken unilaterally but requires the co-operation and active participation of trading partners. Trading partners normally consist of an organisation's principal suppliers and wholesale customers. Large retail stores, because they transact business with a large number of suppliers, were among the early supporters of, and participants in EDI.

Benefits of EDI

The use of EDI eliminates many of the problems associated with traditional information flow.

* The delay associated with order making are eliminated, time required to re-enter data is also eliminated.
* Since data is not repeatedly keyed, the chances of error are reduced.
* As data is not re-entered at each step in the process, labour costs can be reduced.
* Because time delays are reduced, there is more certainty in information flow.

The other advantage in the use of EDI is that it generates the functional acknowledgement whenever an EDI message is received, and it is electronically transmitted to the sender. This acknowledgement states that the message is received.

Therefore, the core concept of EDI is that data are transferred electronically in machine processable form, i.e the EDI message can be immediately processed by receiving computer without, any human intervention, or interpretation or rekeying.

Therefore, EDI is most suited in the areas where any of the following characteristics exist:

* Handles a large volume of repetitive standard action.
* Operates on very tight margin.
* Faces strong competition requiring significant productivity improvements.
* Operates under time constraints.

EDI eliminates the paper documents associated with common business transactions. Consequently, the handling, filing, and transportation necessitated by the existence of the paper documents are also eliminated. Electronic documents (messages) can be duplicated and routed (transmitted) instantly to anyone in the organisation with a need to see them. Where a hard copy of a document is desired or required by law, a paper copy can be produced. Space that normally would be occupied by files of multiple paper copies can be devoted to more productive use and the manual filing operations eliminated entirely.

All of the above benefits result in a more efficient operation and usually provide identifiable cost savings to the company that implements EDI. In addition, eliminating the time required for the preparation and physical movement of paper documents speeds up the entire process of information transfer between companies.

These benefits are so compelling that companies must soon adhere to EDI standards if they expect to sell to large U.S. organisations such as Fortune 1000 companies, where the volume of these documents is always burdensome. The alternative will be to send paper documents to a third party (service bureau) where the document is converted to an EDI message acceptable to the addressed company. Such service bureaus are already in operation in U.S.A. It is this kind of computerisation which is forcing India as country to adopt EDI technology for international transactions.

2.6 NETWORKING SCENARIO

We have seen what electronic data communication is and how its plays a crucial role in the success of organisations. Its impact has been felt across in globe, let us take a look at some of the networks.

2.6.1 Internet

Internet is the world's largest networks, originated out of a US department of defence funded project. It is a unique collection of networks with vast proportions of its own kind. It has evolved into one of the technologies greatest democracies, permitting the passage of all kinds of information exchange with full freedom. The first result of the project funded by US defence department for a fault tolerant networking system, is Arparet, which in terms become the largest, the most potent aid definitely most uncontrollable force in the world.

The networks or computers operating in different platform are connected to Internet by a common protocol known as TCP/IP Transmission control protocol/Internet protocol. Internet provides the following services.

(a) Global Electronic Mail

As we have already discussed e-mail permits user to send and receive messages electronically to an individuals or a group. Internet mail makes delivery of area of message more wide and reliable.

(b) USENET-Views and News

Views and News or USENET is the BBS (Bulletin Board Service) of Internet. The messages in this BBS are organised into thousands of News groups, which cover specific areas of interest.

(c) TELNET-Remote Login

Telnet allows an Internet user to access a remote host. After properly connecting and logging into the remote host, the use can enter data, run programs or do any other operation.

(d) FTP-File Transfer Protocol

It permits an Internet user to move or transfer a file from one computer to another even if they are running on different platform (or operating system). The files may have data, graphics, text etc.

(e) Navigators-Information Servers

More than 1000 new users are joining Internet each month making it a global information ocean. This also makes difficult to find any thing specific on Internet. There are several powerful tools used on Internet for searching information. These information-tracking utilities are means to develop easy method of discovering, locating, and retrieving information on various objects freely available on Internet. Some of the well-known utilities are Gopher, Archie, Hytelnet, WAIS, and WWW. The WWW out of these is the most popular and have resulted in the massive growth of Internet resources. You can obtain more information on Internet in further readings.

2.6.2 BITNET (Because-Its Time Network)

City University of New York and University of Yale established BITNET basically to exchange information between universities. The basic series provided by BITNET are:

(a) exchange of electronic messages (datafile)

(b) electronic student admission

(c) remote job entry and storing research information

A counterpart of BITNET in India is ER Net, which is established for educational and research purposes.

2.6.3 CompuServe

CompuServe is a commercial network based in US. It uses telephone lines and microwave for communication. CompuServe user can easily communicate with each other, around the world. Following are the services offered by CompuServe

(a) Electronic Mail box for message transfer

(b) Bulletin Board Services

(c) News report alongwith report on sports and weather

(d) Information on computer hardware and software.

2.6.4 ISDN (Integrated Services Digital Network)

ISDN is basically used for Communication of both data and voice. ISDN was first launched in Singapore in 1990. It has the following features:

(a) transmission and processing of digital data

(b) processing of various types of information data, voice, video etc.

(c) electronic mail box

(d) tele-conferencing

(e) telefax, videofax, etc.

2.6.5 NICNET

NICNET is a satellite-based nationwide network of NIC (National Information Centres). The basic idea of interviewing NICNET is to extract data from each village, district and city of India. It consists of earth of stations in almost all districts, state capitals, regions and NIC headquarter in Delhi. The basic objectives of NICNET are:

(a) To help government in better planning administration

(b) To help government maintain communication in times of national emergencies and natural disasters.

In India, many other Government owned network exist.

2.7 OPEN INDENT QUESTIONS AND ACTIVITIES

1. Explore whether there is any E-Mail service provider in your town and if so obtain the rates for various services. Make a comparison with charges for similar work if it had been done through Ordinary mail, Speed post, International Air mail or through Fax.

2. Explore with some business organisations to which you have access, whether they are aware of EDI. If so, are they contemplating moving towards it?

3. If you find that not many businesses are aware of the potential of EDI, what would you attribute this to ?

4. Try to visit an organisation within your reach and find whether they are connected to a National or International network?

2.8 SUMMARY

In this unit you learned about networking concept and its utilisation. It also explained various kind of networking such as LAN and WAN. It defines what is LAN, its topology, hardware and software for LAN, and also talked about WAN in details. You have also been conveyed the functions of E-Mail and Electronic Data Inter-change. The difference between the two has to be appreciated. Some description of the various standards that exist as well as their need in case of EDI was presented. A brief description of some of the well known networks both in India and abroad were presented.

2.9 MODEL ANSWERS

Check Your Progress

1. (b) 2. (a) 3. (b) 4. (a) 5. (c) 6. (a) 7. (a) 8. (b) 9. (b) 10. (b)

2.10 FURTHER READINGS

1. Andrew S. Tanenbaum, Computer Networks, Third Edition, Prentice-Hall of India
2. William Stalling, Data and Computer Communication, Prentice-Hall of India