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COMMUNICATION AND COMPUTER NEWORK

4.1 INTRODUCTION

Today computer is available in many offices and homes and therefore there is a need to share data and programs among various computers. With the advancement of data communication facilities, the communication between computers has increased and thus it has extended the power of computer beyond the computer room. Now a user sitting at one place can communicate with computers of any remote sites through communication channel. The aim of this lesson is to introduce you to various aspects of communication and computer network.

4.2 OBJECTIVES

After going through this lesson you would be in a position to:

- explain the concept of data communication
- identify different components of computer network
- define types of network
- explain communication protocols
- differentiate between Internet and Intranet,
- appreciate the use of satellite communication.
- explain the utility of EDI, E-commerce, voice messaging and teleconferencing

4.3 DATA COMMUNICATION

We all are acquainted with some sorts of communication in our day to day life. For communication of messages we use telephone and postal communication systems. Similarly data and information from one computer system can be transmitted to other systems across wide geographical areas. Thus data transmission is the movement of information using some standard methods. These methods include electrical signals carried along a conductor, optical signals along an optical fiber and electromagnetic waves.

Suppose a manager has to write several letters to various clients. First he has to use his PC and Word Processing package to prepare the letter. If the PC is connected to all the client's PCs through networking, he can send the letters to all the clients within seconds. Thus irrespective of geographical areas, if PCs are connected through communication channel, the data and information, computer files and any other program can be transmitted to other computer systems within a short time. The modern form of communication like e-mail and Internet is possible only because of computer networking.

Basic Elements of a Communication System

The following are the basic requirements for working of a communication system.

1. A *sender* (source), which creates the message to be transmitted.
2. A *medium* that carries the message.
3. A *receiver* (sink), which receives the message.

In data communication four basic terms are frequently used. They are

- **Data:** A collection of facts in raw form that become information after processing.
- **Signals:** Electric or electromagnetic encoding of data.
- **Signaling:** Propagation of signals across a communication medium.
- **Transmission:** Communication of data achieved by the processing of signals.

(a) Communication Protocols

You may be wondering how do the computers send and receive data across communication links. The answer is data communication soft-

ware. It is this software that enables us to communicate with other systems. The data communication software instructs computer systems and devices as to how exactly data is to be transferred from one place to another. The procedure of data transmission in the form of software is commonly called protocol.

The data transmission software or protocols perform the following functions for efficient and error free transmission of data.

1. **Data sequencing:** A long message to be transmitted is broken into smaller packets of fixed size for error free data transmission.

2. **Data routing:** It is the process of finding the most efficient route between source and destination before sending the data.

3. **Flow control:** All machines are not equally efficient in terms of speed. Hence the flow control regulates the process of sending data between fast sender and slow receiver.

4. **Error control:** Error detection and recovery is one of the main function of communication software. It ensures that data are transmitted without any error.

(b) Data Transmission Modes

Based on the direction of transmission, there are three ways for transmitting data from one point to another.

1. **Simplex:** In simplex mode the communication can take place only in one direction. The receiver receives the signal from the transmitting device. This mode of flow of information is Unidirectional. Example: Radio, T.V., Pager transmission.

2. **Half-duplex:** In half-duplex mode the communication channel is used in both directions, but one direction at a time. Thus a half-duplex line can alternately send and receive data. Example is the wireless communication.

3. **Full-duplex:** In full duplex mode, the communication channel is used in both directions at the same time. Use of full-duplex line improves the efficiency as the line turn around time required in half-duplex arrangement is eliminated. Example of this mode of transmission is the telephone line.

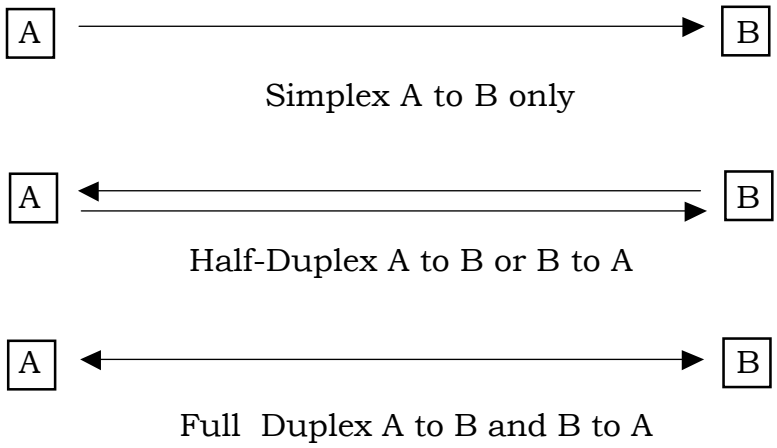

Fig. 4.1: Simplex, Half-duplex and Full-Duplex

(c) Digital and Analog Transmission

Data is transmitted from one point to another point by means of electrical signals that may be in digital and analog form. So one should know the fundamental difference between analog and digital signal. The transmission pattern, which is in continuous waveform, is analog signal. It varies over a continuous range with respect to sound, light and radio waves. On the other hand, a digital signal may assume only discrete set of values within a given range. (Fig. 4.2 and 4.3) Examples are computer and computer related equipment. Analog signal is measured in Volts and its frequency in Hertz (Hz). A digital signal is a sequence of voltage represented in binary form. When digital data are to be sent over an analog form the digital signal must be converted to analog form. So the technique by which a digital signal is converted to analog form is known as modulation. And the reverse process, that is the conversion of analog signal to its digital form, is known as demodulation. The device, which converts digital signal into analog, and vice-versa is known as Modem.

(d) Asynchronous and Synchronous Transmission

Data transmission through a medium can be either asynchronous or synchronous. In asynchronous transmission data is transmitted character by character as you go on typing on a keyboard. Hence there are irregular gaps between characters in transmission. However, it is cheaper to implement, as you do not have to save the data before sending. On the other hand, in the synchronous mode, the saved data is transmitted block by block. Each block can contain many characters. Synchronous transmission is well suited for re-

mote communication between a computer and related devices like card reader and printers.

Fig. 4.2 : Analog Signal

Fig. 4.3 : Digital Signal

(e) Communication Media

Following are the major communication channels used today.

1. **Twisted-Wire Pair:** Twisted wire pairs are commonly used in local telephone communication and for short distance digital data communication. These are usually made up of copper and the pair of wires is twisted together. Data transmission speed is

normally 9600 bits per second in a distance of 100 meter. They are affected by noise. They get weakened over long distances and therefore need to be boosted.

2. **Coaxial Cables:** Coaxial cable is a group of specially wrapped and insulated wires that are able to transfer data at higher rate. They consist of a central copper wire surrounded by an insulation over which copper mesh is placed. They are used for long distance telephone lines and local area network for their noise immunity and faster data transfer.

3. **Microwave:** Microwave system uses very high frequency radio signals to transmit data through space. The transmitter and receiver of a microwave system should be in line-of-sight because the radio signal cannot bend. With microwave very long distance transmission is not possible. In order to overcome the problem of line of sight and power amplification of weak signal, repeaters are used at intervals of 25 to 30 kilometers between the transmitting and receiving end. This is a non-physical or un-guided communication media.

4. **Communication Satellite:** The problem of line-sight and repeaters are overcome by using satellites, which are the most widely used data transmission media in modern days. A communication satellite is a microwave relay station placed in outer space. INSAT-IB is such a satellite that is accessible from anywhere in India. In satellite communication, microwave signal is transmitted from a transmitter on earth to the satellite in space. The satellite amplifies the weak signal and transmits it back to the receiver. The main advantage of satellite communication is that it is a single microwave relay station visible from any point of a very large area. In microwave the data transmission rate is 16 giga byte per second. They are mostly used to link big metropolitan cities.

INTEXT QUESTIONS

1. Define communication protocol.

2. What is the difference between asynchronous and synchronous transmission?

3. State whether True or False.

   (a) The basic requirements for working of a communication system are sender, medium and receiver.

(b) Electric or Electromagnetic encoding of data is called Transmission.

(c) In full duplex the communication channel is used in both directions at the same time.

(d) Analog signal is measured in Volts and its frequency in Hertz.

(e) The technique by which a digital signal is converted to analog form is known as modulation.

4.4 COMPUTER NETWORK

A computer network is an interconnection of various computer systems located at different places. In computer network two or more computers are linked together with a medium and data communication devices for the purpose of communicating data and sharing resources. The computer that provides resources to other computers on a network is known as server. In the network the individual computers, which access shared network resources, are known as workstations or nodes.

Computer networks may be classified on the basis of geographical area in three broad categories.

1. Local Area Network (LAN)
2. Metropolitan Area Network (MAN)
3. Wide Area Network (WAN)

(a) Local Area Network

Network used to interconnect computers in a single room or rooms within a building or nearby buildings is called Local Area Network (LAN). LAN transmits data with a speed of several megabyte per second (10^6 bytes per second). The transmission medium is normally coaxial or twisted-pair cables. This usually spans about 0-5 kms and is generally a private network owned by an organization. For example: Office LAN, Hospital LAN, Campus-wide LAN, etc.

LAN links computers through software and hardware in the same area for the purpose of sharing information. Usually LAN links computers within a limited geographical area and are therefore connected by a cable. Addition of a new computer in the network therefore requires cabling to be done. People working in LAN get more capabilities in data processing, work processing and other informa-

tion exchange compared to stand-alone computers. Because of this information exchange capability most of the business and government organizations are using LAN.

Major Characteristics of LAN

- Each computer has the potential to communicate with any other computer of the network.
- High degree of interconnection between computers
- Easy physical connection of computers in a network.
- Inexpensive medium of data transmission
- High data transmission rate

Advantages

- The reliability of network is high because the failure of one computer in the network does not effect the functioning of other computers.
- Addition of new computer to network is easy.
- High rate of data transmission is possible.
- Peripheral devices like magnetic disk and printer can be shared by other computers.

Disadvantages

If the communication line fails, the entire network system breaks down.

Use of LAN

Following are the major areas where LAN is normally used

- File transfers and Access
- Word and text processing
- Electronic message handling
- Remote database access
- Personal computing
- Digital voice transmission and storage

(b) Metropolitan Area Network

The MAN is used to describe a network of computers spanning a metropolitan city usually 5-50 kms of range. A company having multiple offices in various parts of a city generally uses this type of network. Example is the Cellular or mobile Phone network.

(c) Wide Area Network

The term Wide Area Network (WAN) is used to describe a computer network spanning a regional, national or global area. For example, for a large company the head quarters might be at Delhi and regional branches at Bombay, Madras, Bangalore and Calcutta. Here regional centers are connected to head quarters through WAN. The distance between computers connected to WAN is quite large. Therefore the transmission medium used is normally telephone lines, microwaves and satellite links. Internet is an example of a WAN.

Characteristics of WAN

Followings are the major characteristics of WAN.

1. **Communication Facility:** For a big company spanning over different parts of the country the employees can save long distance phone calls and it overcomes the time lag in overseas communication. Computer conferencing is another use of WAN where users communicate with each other through their computer system.

2. **Remote Data Entry:** Remote data entry is possible in WAN. It means sitting at any location you can enter data, update data and query other information of any computer attached to the WAN but located in other cities or country. For example, suppose you are sitting at Madras and want to see some data of a computer located at Delhi, you can do it through WAN.

3. **Centralised Information**: In modern computerized environment you will find that big organizations go for centralized data storage. This means if the organization is spread over many cities, they keep their important business data in a single place. As the data are generated at different cities, WAN permits collection of this data from different sites and save at a single site.

Examples of WAN

1. **Ethernet:** Ethernet developed by Xerox Corporation is a famous example of WAN. This network uses coaxial cables for data trans-

mission. Special integrated circuit chips called controllers are used to connect equipment to the cable.

2. **Arpanet:** The Arpanet is another example of WAN. It was developed at Advanced Research Projects Agency of U.S. Department. This Network connects more than 40 universities and institutions throughout USA and Europe.

Difference between LAN and WAN

- LAN is restricted to limited geographical area of few kilometers, but WAN covers long distance and operates nationwide or even worldwide.
- In LAN, the computer terminals and peripheral devices are connected with wires and coaxial cables. In WAN there may or may not be a physical connection. Communication is done through telephone lines and satellite links.
- Cost of data transmission in LAN is less because the transmission medium is owned by a single organization. In the case of WAN the cost of data transmission is very high because the transmission medium used is hired, either telephone lines or satellite links.
- The speed of data transmission is much higher in LAN than in WAN. The transmission speed in LAN varies from 0.1 to 100 megabyte per second. In case of WAN the speed ranges from 1800 to 9600 byte per second (bps).
- Few data transmission errors occur in LAN compared to WAN. It is because in LAN the distance covered is negligible.

4.5 NETWORK TOPOLOGY

The term topology in the context of communication network refers to the way the computers or workstations in the network are linked together. According to the physical arrangement of workstations and nature of work, there are three major types of network topology. They are bus topology, star topology and ring topology.

(a) Bus Topology

In bus topology all workstations are connected to a single communication line called bus. In this type of network topology there is no central server and all the computers can talk or communicate to all other systems connected to the cable. Transmission from any station

travels the length of the bus in both directions and can be received by all workstations. The advantage of the bus topology is that

- It is quite easy to set up.
- If one station of the topology fails it does not affect the entire system.

The disadvantage of bus topology is that any break in the bus is difficult to identify and addition of more computers (nodes) slows down the network performance.

Fig. 4.4 : Bus Topology

(b) Star topology

In star topology a number of workstations (or nodes) are directly linked to a central server (see, Fig.4.5). Any communication between stations in a star LAN must pass through the central server. There is bi-directional communication between various nodes. The central server controls all the activities of the nodes. The advantages of the star topology are:

- It offers flexibility of adding or deleting of workstations from the network.
- Breakdown of one station does not affect any other device on the network.

The major disadvantage of star topology is that failure of the central node disables communication throughout the whole network.

Fig. 4.5: Star Topology

(c) Ring Topology

In ring topology each station is attached to nearby stations on a point-to-point basis so that the entire system is in the form of a ring. In this topology data is transmitted in one direction only. Thus the data packets circulate along the ring in either clockwise or anticlockwise direction. The advantage of this topology is that any signal transmitted on the network passes through all the LAN stations. The disadvantage of ring network is that the breakdown of any one station on the ring can disable the entire system. The communication of data takes longer time as flow is only in one direction.

Fig. 4.6 : Ring Topology

INTEXT QUESTIONS

4. Differentiate between LAN, MAN and WAN.
5. What are the different types of network topology?
6. State True or False.
   (a) Networks used to interconnect computers in a single room, rooms within a building or buildings on one site are called Wide Area Network (WAN).
   (b) The term Wide Area Network (WAN) is used to describe a computer network spanning a regional, national or global area.
   (c) The speed of data transmission is much higher in WAN than in LAN.

4.6 INTERNET

The Internet is a network of networks. Millions of computers all over the world are connected through the Internet. Computer users on the Internet can contact one another anywhere in the world. If your computer is connected to the Internet, you can connect to millions of computers. You can gather information and distribute your data. It is very much similar to the telephone connection where you can talk with any person anywhere in the world.

In Internet a huge source of information is accessible to people across the world. Information in every field starting from education, science, health, medicine, history and geography to business, news, etc. can be retrieved through Internet. You can also download programs and software packages from anywhere in the world. Due to the tremendous information resources the Internet provides, it is now indispensable to every organization.

Origin of Internet

In 1969 Department of Defence (DOD) of USA started a network called ARPANET (Advanced Research Projects Administration Network) with one computer at California and three at Utah. Later on other universities and R & D institutions were allowed to connect to the Network. ARPANET quickly grew to encompass the entire American continent and became a huge success. Every university in the country wanted to become a part of ARPANET. So the network was broken into two smaller parts MILNET for managing military sites

and ARPANET (smaller) for managing non-military sites. Around 1980, NSFNET (National Science Foundation Network) was created. With the advancement of modern communication facilities, other computers were also allowed to be linked up with any computer of NSFNET. By 1990 many computers were looking up to NSFNET giving birth to Internet.

How Internet functions?

Internet is not a government organization. The ultimate authority of the Internet is the Internet Society. This is a voluntary membership organization whose purpose is to promote global information exchange. Internet has several million computers attached to it.

E-mail

E-mail stands for electronic mail. This is probably one of the fastest and most convenient ways of communicating. It is also fast becoming the cheapest mode of communication. The burden on the ever so popular khakhi uniform clad Postman has been reduced considerably with the availability of the E-mail facility to Indians in most cities and parts of the world.

All the Internet subscribers in India get the E-mail facility free with each subscription from their Internet Service Provider such as VSNL, MTNL, Satyam, etc. Thus all Internet subscribers in India have unique and separate E-mail address. This E-mail account can be accessed by the subscriber from anywhere in the world.

The facility of E-mail has several features that are of immense help to us. One can send common circulars/letters to all those clients or other recipients who have E-mail facilities. This would result in saving a lot of stationary as well as postage charges. By creating Address Books in the computer, one does not have to remember the E-mail addresses of others. Further a lot of time, energy and money can be saved by creating a Mailing List of all clients and using it to send common letters/notices/circulars. Another advantage of using E-mail is that as long as the sender has keyed the correct E-mail address of the addressee, the chances of the addressee not receiving the message without the sender being aware of this are remote. Also only the person to whom it has been sent can read the e-mail message. In addition, the transmission of messages to the server of the addressee is virtually instantaneous. Thus, E-mail beats the Postman and the Courier boy in the race by miles; E-mail transcends all time zones and barriers.

We can also send files created in any application such as say, a Word Processor or a Spreadsheet, or a Picture File as attachments with the E-mail messages. For example, if we have created a spreadsheet containing the computation of total Income of a client, then we can write a letter to him in E-mail and inform him that his computation is ready and also attach the spreadsheet and send it to him for verification. Of course, care must be taken to ensure that the attachments are not very large files; otherwise, the recipient's mailbox is likely to get jammed. Further, the recipient, to be able to open the file at his place, must also have the same application software in his computer. In certain cases, the recipient must also have the same version of the software that was used for preparing the attachment.

The E-mail software supplied with Internet connection comprises of some important and useful features, which are as follows:

Composing messages: With the help of the Internet Browsers, it is possible to compose messages in an attractive way with the help of various fonts. It is also possible to spell check the message before finalizing it.

Replying to the mail received: It is possible to reply to any mail received by merely using the "Reply" facility available on the Internet Browsers. This facility also allows one to send the same reply to all the recipients of the original message. This facility results in saving of a lot of time in terms of remembering addresses, typing the subject matter etc.

Address Book: This is an electronic form of Address Book wherein the following features can be saved: Name, full name, E-mail address, name of organization to which the person belongs, the designation of such person, telephone numbers, etc. When one has to send an E-mail, by merely typing the first name, for example, it would be possible to recall the E-mail address of the recipient. It is also possible to store addresses on the basis of categories. Thus, a group containing addresses of all clients, one has to merely type in the name of the category in place of the addresses. This would automatically send the letter to all persons listed in that category. This does away with the tedious task of retyping or reprinting the same letter again and again and putting the letters in envelopes, addressing and stamping the envelopes and finally, mailing the same.

Printing of messages: It is possible to print messages received as well as sent. Thus, if a person wants to keep a hard copy of any message, it would be possible for him to do so.

Offline Editing/Composing/Reading: One does not have to be connected to the Internet all the time to be able to read/edit/compose messages. This is a very important feature which many people do not make use of. Ideally, one should log into the Internet, download all the messages into one's own hard disk and then disconnect from the Internet. Once the user is offline, he should read all the messages that have been received. Even composing one's own messages, editing the same or replying to messages received ought to be done when one is off-line. This result in saving of Internet time as also helps in keeping telephone lines free. It is also possible to compose messages and save them as drafts so that at a later stage, the same can be edited or continued and then sent.

Forwarding of messages: It is possible to forward any message received from, say, Mr. A to Mrs. B without retyping the message.

Transfer of Data Files: An important use of the E-mail is the ability to send/receive data files to/from a client. For example, at the time of consolidation of accounts of a client, the data files containing final accounts of the branches of that client can be obtained via E-mail and after consolidation and finalization, the same can be sent back to the client's branches for closing entries etc. This would result in considerable saving of time, energy and money.

Greeting Cards: On the Internet, there are several sites which offer free greeting cards for thousands of occasions to anybody who wants to send greeting differently. To send an electronic greeting card, one has to simply visit a site offering this facility, select a card from amongst the several available, type in one's message, name and E-mail address of the recipient, name of the sender and with a simple click, send the card. The recipient is notified by E-mail that he has been sent a greeting card. He can then access the card by simply clicking on the web-site address of the site, which has provided the facility of the greeting card. Most such cards also come with animation i.e. music and video with movements. This makes the card extremely attractive, interesting and many times better than the traditional printed cards.

4.7 VOICE MESSAGING

Voice messaging is a new communication approach, which is similar to electronic mail except that it is audio message, rather than text messages that are processed. A sender speaks into a telephone rather typing, giving the name of the recipient and the message and the sender's voice signal is then digitized and stored. The system can then either delivers the message at a specified time in the future or the recipient can retrieve it from a database. The message is

converted back into its analog format when it is delivered or retrieved so that the recipient hears it as the original sender's voice on a telephone.

Voice messaging (or mail) requires a computer with an ability to store the audio messages in digital form and then convert them back in an audio retrieval. Each user has a voice mailbox in secondary storage, and special equipment converts the audio messages to and from the digital form. The main advantage of voice mail over electronic mail is that the sender does not have to type. Voice mail also makes it easy to include people in the firm's environment in a communication network.

Several types of voice messaging products and services are available. Some are standalone systems while others are integrated into PABX telephone exchange, etc.

4.8 ELECTRONIC DATA INTERCHANGE

The term electronic data interchange has many definitions. American National Standards Institute (ANSI) has defined it as:

Electronic Data Interchange (EDI) is the transmission, in a standard syntax, of unambiguous information of business or strategic significance between computers of independent organizations. The users of EDI do not have to change their internal databases. However, users must translate this information to or from their own computer system formats, but this translation software has to be prepared only once.

In simple terms, EDI is computer-to-computer communication using a standard data format to exchange business information electronically between independent organizations.

It is not a glamorous technology but EDI is helping many businesses cut the costs associated with shipping, receiving and maintaining paper communication.

The principle of EDI is simple. It is set of standards that define the way the paper forms should be rendered electronically. EDI can be used to send an invoice, for example, or an order form from one company to another. A sending computer, usually located at a customer's premises uses telecommunication technology to transfer order data instantly to the "receiving computer", usually located at the suppliers distribution center. Software on each company's computer translates the item into standard codes, so it would not matter if one company calls product a cog and the order calls the

same thing a sprocket, EDI will make sure that the right part is ordered. After the received order data is manipulated and formatted to match the order entry files, in the "order data base" of the supplier, the information is transferred into the database and appropriate error messages, and/or exception reports are generated. The "sending computer" stores the order and follows up on it. The "receiving computer" automatically transfers the data to the warehouse of the factory, the accounting and billing department, and the shipping department.

4.8.1 Advantages of EDI

(i) **Issue and receive orders faster:** Since most purchasing transactions are routine, they can be handled automatically, utilizing the staff for more demanding and less routine tasks.

(ii) **Make sales more easily:** Quotes, estimates, order entry and invoicing will proceed more smoothly and efficiently. Orders received electronically ensure that information is available immediately, so that an organization can respond faster and be more competitive.

(iii) **Get paid sooner:** Invoices received electronically can be reconciled automatically, which means they are earmarked for payment in one's trading partner's accounting department sooner. And, in turn, your own purchasing department is in a position to negotiate for better terms including faster payment.

(iv) **Minimise capital tied up in inventory:** For manufacturing organizations with a just-in-time (JIT) strategy, the right balance is crucial but every organization stands to benefit from reducing order lead times.

(v) **Reduce letters and memos**: Letters and memos do not follow rigid rules for formatting. They can be handled by an electronic mail system.

(vi) **Decrease enquiries**: Customers or suppliers can make direct on-line enquiries on product availability, or other non-sensitive information instead of consuming the staff's precious time.

(vii) **Make bulk updates of catalogues and parts listings**: One can provide updates of data files, such as catalogues to customers or part listings to franchisees.

EDI is vastly implemented in the trucking, marine shipping and air

cargo industries in developed countries. Implementation need not be expensive. All that a small firm needs to have is a personal computer, a modem and telephone line and the necessary software.

4.9 E-COMMERCE

Electronic Commerce or E-Commerce as it is popularly known is a natural development, which has followed in the footsteps of the Internet. The Internet is like a shop, which is permanently open, all 24 hours and all 365 days in a year. This makes the Internet the ideal place to do business in. In this kind of an electronic shop, there is no requirement of a shopkeeper or a cashier or a security guard. Further, the shop can be accessed by anybody in any part of the world. It also does away with the necessity of having an expensive piece of real estate and furnishing the same. All these attractive features have made the Internet an immensely popular place to set up shops.

In India, E-commerce is not as widely popular or prevalent as in the western countries. The main reason for this is that at present, it is not possible to make payments by credit card through the Internet. Once the credit card companies are in a position to offer the cardholders some kind of assurance about the security aspect of making payments via the Internet, the volcano of E-commerce will erupt with a force that will shake the entire Indian business scenario. Even today, there are already several outlets that have set up their own web sites and who accept purchase orders through the Internet. A popular super market in New Delhi, several cinema halls in Mumbai, numerous book shops in many cities are some such examples of businesses which have already started making use of Internet for commercial purposes. Thus, for example, one can book tickets of a film running at a particular cinema hall through the internet and then go to the hall a few minutes before the show, identify one's self and get the tickets without having to wait for hours in a queue.

E-commerce throws up several new challenges. The most important issue that is thrown up by such commerce is that of taxation. For taxation purposes, the first question that has to be addressed is where did the sale take place? Since there is no physical form of the place of business in case of E-commerce, it becomes difficult to determine the country/state/city from where the sale was concluded. Accordingly, jurisdictional disputes arise about the taxation of the same especially with respect to indirect taxes. Even the most advanced nations such as U.S.A, Japan, France, and U.K have not yet been able to satisfactorily solve this problem.

Similarly, another problem that arises is about the transaction escaping the tax net all together. Since there is no paper work involved and all the interaction between the buyer and the seller is done electronically, there is a possibility of the transaction being kept out of the books of account of either or both sides of the transaction. As auditors, Chartered Accountants would have to deal with this problem increasingly as E-commerce takes firm roots in India.

Another problem area of E-commerce is regarding fraud detection. E-commerce comes to us along with the in-built dangers of electronic crimes and frauds. Detection and Prevention of such frauds would be an area of great concern.

Some more areas where Charted Accountants would be called upon to lend their expertise would be:

(a) Internet web site security-web trust audit;

(b) Knowledge of encryption techniques;

(c) Attesting integrity of databases;

(d) Interpretation of new tax laws covering E-commerce.

4.10 THE INTRANET

The driving force behind the first data communication networks was the need to transmit data and information within the organization. This internal focus was then broadened to include the firm's business partners, such as customers and suppliers; eventually, the electronic data interchange (EDI) became a reality. Then, came the Internet, with its user-friendly protocol for retrieving information on an almost limitless number of topics from a seemingly limitless number of sources.

The success of the Internet in tapping into entirely new information sources, however, did not blind data communication experts to the potential for applying the technology to a more local level. If the Internet is good for communicating with individuals and organizations outside the firm's scope of operations, it should be good for internal communications as well. This is the reasoning that gave rise to the Intranet. Intranet is the use of the Internet Technology for communication within the firm and between the firm and those organizations and individuals with whom the firm does business.

4.11 TELECONFERENCING

The term teleconferencing refers to electronic meetings that involve people who are at physically different sites. Telecommunication technology system allows meeting participants to interact with one another without traveling to the same location. Three different types of teleconferencing exist: audio teleconferencing, video teleconferencing and computer conferencing.

4.11.1 Audio Conferencing

Audio conferencing is the use of voice communications equipments to establish an audio link between geographically dispersed persons, one that allows them to conduct a conference. The conference call was the first form of audio conferencing and is still in use. Some firms install more elaborate systems consisting of private, high-quality audio communications circuits that can be activated with the flip of a switch.

Audio conferencing does not require a computer. It only requires a two-way audio communications facility, as illustrated in figure below.

Audio conferencing is best suited for firms that are spread over a wide area. However, since it is a form of synchronous communication that requires all participants to be present at the same time, it is difficult to schedule conferences when time zones are far apart.

4.11.2 Video Conferencing:

Video conferencing is the use of television equipment to link geographically dispersed conference participants. The equipment provides both sound and picture. Like audio conferencing, video conferencing also does not necessarily require a computer.

With video conferencing, participants can see and hear each other. Generally, participants gather in relatively expensive, specially equipped rooms that can handle the complexities of simultaneous video and audio transmission.

There are three possible video conferencing configurations.

One-Way Video and Audio: Video and audio signals are sent from a single transmitting site to one or more receiving sites. This is a good way for a project leader to disseminate information to team members at remote locations.

One-Way Video and Two-Way Audio: People at the receiving sites can talk to people at the transmitting site, while everyone views the same video images.

Two-Way Video and Audio: The video and audio communications between all sites are two-way. Although this is the most effective of the electronically aided conferencing approaches, it can be the most expensive.

4.11.3 Computer Conferencing

A third form of electronic conferencing is computer conferencing. There is a fine line between this system and E-mail. Both use the same software and hardware. Two factors determine the application-Who uses the system, and the subject matter.

E-mail is available to anyone who has access to the network-and that includes practically everyone in the office. Also, the E-mail system can be used for any purpose. Computer conferencing, on the other hand, is the use of a networked computer that allows particular topic. Computer conferencing is more disciplined form of E-mail.

Unlike an audio conference, a computer conference group can consist of large number of participants. One of the largest computer conferences was formed within IBM to include anyone who had an interest in the IBM PC. Its members exceeded 40,000, and there were over 4,000 separate topic areas.

Computer conferencing differs from audio or video conferencing because it can be used within a single geographic site. A person can use computer conferencing to communicate with someone in the office next door. Such use would not be practical with audio or video.

INTEXT QUESTIONS

7. Differentiate between Internet and Intranet
8. Define the following terms briefly:
   (a) E-mail
   (b) EDI
   (c) Teleconferencing

4.12WHAT YOU HAVE LEARNT

In this lesson we discussed the importance and modes of communication through computers. Computers can communicate with one another through computer networking. There are three types of computer network: LAN, MAN and WAN. We discussed about the physical arrangements of computer and peripherals in network topology. There are three types of network topology: star topology, bus topology and ring topology. Also we discussed about Internet and Intranet, E-mail, Voice messaging, EDI, E-Commerce and Teleconferencing.

4.13 TERMINAL QUESTIONS

1. Define computer Network. What are its main objectives?
2. Differentiate between analog and digital transmission of data.
3. Explain in brief different communication media.
4. Differentiate between
   (a) Simplex and Full-duplex transmission
   (b) Audio and Video conferencing

4.14 KEY TO INTEXT QUESTIONS

1. The data communication software instructs computer systems and devices as to how exactly data is to be transferred from one place to another. The procedure of data transmission in the form of software is commonly called protocol.
2. In asynchronous transmission data is transmitted character by character as you go on typing on a keyboard. On the other hand, in the synchronous mode, the saved data is transmitted block by block.
3. (a) True (b) False (c) True (d) True (e) True
4. LAN is a private network restricted to limited geographical area. MAN is restricted to a city (5-50 km range), whereas WAN covers great distance usually a country or the world. In LAN the computer terminals and peripheral devices are connected with wires and coaxial cables whereas in WAN communication is done through telephone lines and satellite links. The speed of data transmission is much higher in LAN than in MAN or WAN.

5. There are three major types of network topology. They are star topology, bus topology and ring topology.

6. (a) False (b) True (c) False

7. The Internet is a network of networks Information in every field starting from education, science, health, medicine, history, and geography to business, news, etc, can be retrieved through Internet. Intranet is the use of Internet technology for communication within the firm and between the firm and those organization and individuals with whom the firm does business.

8. (a) E-mail stands for electronic mail. Through e-mail we can transfer data anywhere in the world within seconds.

   (b) EDI stands for Electronic Data Interchange. In simple terms, EDI is computer to-computer communication using a standard data format to exchange business information electronically between independent organizations.

   (c) It refers to electronic meetings that involve people who are at physically different sites.