CHAPTER 1

Module 1

Introduction to Networking

Syllabus :

Introduction to computer network, Network application, Network software and hardware components (Interconnection networking devices), Network topology, Protocol hierarchies, Design issues for layers, Connection oriented and connectionless services, Reference models : Layer details of OSI, TCP/IP models, Communication between the layers.

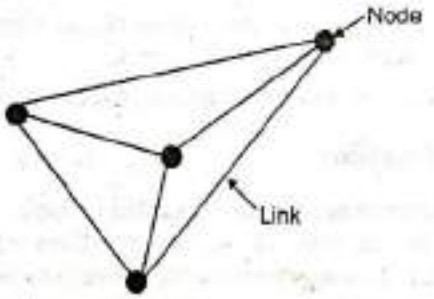
1.1 Introduction :

Network :

- Network is a broad term similar to "system". Network is a communication system which supports many users.
- In relation with the computers we can say that a "computer network" is a system which allows communication among the computers connected in the network.
- There are various ways of interconnecting the computers.

Protocol :

- For successful communication to occur, it is not enough for the "sender" to simply transmit the message and "assume" that the "receiver" will receive it properly.
- There are certain rules that must be followed to ensure proper communication.
- A set of such rules is known as a "protocol" of the data communication system.
- Many different protocols are used in the modern data communication system.
- The interconnection of one station to many stations is called as networking.
- A network is any interconnection of two or more stations that wish to communicate.
- **Node :** Each station in a communication network is called as a node. The nodes are connected in different way to each other to form a network.
- One of such networks is shown in Fig. 1.1.1.
- Many other forms of interconnections are possible. The most familiar network is the telephone system. It is the largest and most sophisticated network of all.



(G-13) **Fig. 1.1.1 : A simple communication network**

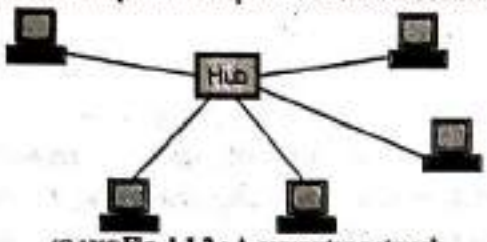
1.1.1 Introduction to Computer Networks :

- In context with the computers we can say that a "computer network" is a system which allows communication among the computers connected in the network.
- During 20th century the most important technology has been the information gathering, its processing and distribution.
- The computers and communications have been merged together and their merger had a very deep impact on the manner in which computer systems are organized.
- In the old model a single computer used to serve all the computational needs of an organization. But now it is replaced by a new model in which a large number of separate but interconnected computers do the job.
- Such systems are called as **computer networks.**
- Two computers are said to be interconnected if they exchange information. The connection between the separate computers can be done via a copper wire, fiber optics, microwaves or communication satellite.

Definition :

- A **computer network** is defined as the interconnection of two or more computers. It is done to enable the computers to communicate and share the available resources.

- As shown in Fig. 1.1.2, each node in a computer network is a computer, or a connecting device such as a hub, or a switch etc.
- The computers connected in a network share files, folders, applications and resources like scanners, web-cams, printers etc.
- The best example of a computer network is the Internet.



(G-1395)**Fig. 1.1.2 : A computer network**

- In a computer network we need to make use of hardware and software.
- The **hardware** consists of connecting cables, connectors, network connecting devices and the **software** consists of protocols, programs etc.
- This enables the systematic exchange of information between the computers connected in the network.
- There are various ways of interconnecting the computers.

Distributed system :

- A system with one control unit (master computer) and many slaves, or a large computer with remote printers and terminals is not called a **computer network, it is called a Distributed System.**
- In distributed system the existence of multiple autonomous computers is not visible to the user.
- With a computer network, the user has to conciously log onto a machine, submit jobs remotely, move files around etc. in short handle all the network management personally.
- With a distributed system nothing of this need to done explicitly, it all happens automatically because the system takes care of it without the users knowledge.
- Basically a distributed system is a software system built on top of a network. The software gives it a high degree of cohesiveness homogeneity and transparency to the system.

1.1.2 Need and Applications of Computer Network :

The computer networks are needed because of the following points :

1. For sharing the resources such as printers among all the users.
2. For sharing of expensive softwares and database.
3. To facilitate communication from one computer to the other.
4. To have exchange of data and information amongst the users, via the network.
5. For sharing of information over the geographically wide areas.
6. For connecting the computers between various buildings of an organization.
7. For educational purposes.

1.1.3 Components of a Computer Network :

Following are some of the important components of a computer network :

1. Two or more computers.
2. Cables (coaxial, twisted pair or fiber optic) as links between the computers.
3. A Network Interfacing Card (NIC) on each computer.
4. Switches or other suitable connecting device.
5. A software called network operating system.

1.2 Network Benefits :

- A network is supposed to provide its uses some unique capabilities, better than what the individual machines and their software can provide.
- The benefits provided by the network to the users can be divided into two categories as follows :
  1. Sharing 2. Connectivity

1.2.1 Sharing Information :

- Networking allows the users to access the data stored on other's computers.
- It is possible for every user to share his bit of information with the other users over the network.
- The information sharing can be in the form of exchange of data, chatting, sending E-mails, sharing video information, groups etc.
- It is also possible for the users to share the information about various products, movies, technical information, cooking, travel books on internet.
- Sharing of information via Internet has become very common now a days.
- The information which is to be shared or being shared should be shared centrally, it must be kept consistent and secured.
- The access to this stored information should be allowed only to the authorised users.
- Sharing of information eliminates the need of transferring files on CDs or pen drives etc.

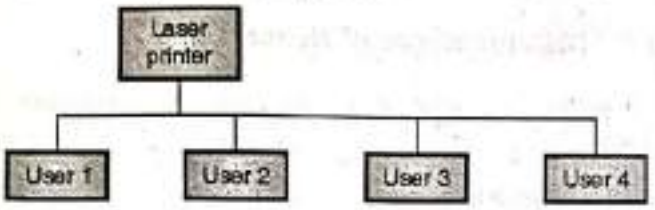
1.2.2 Sharing Resources :

Networks can allow its users to share various types of resources. We can broadly categorise the shared resources as follows :

1. Shared hardware resources
2. Shared software resources

1. Sharing of hardware resources :

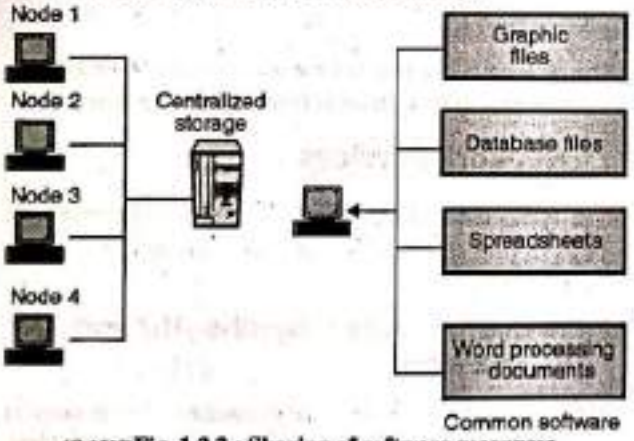
- A network allows its users to share the many hardware devices such as printers, modems, fax machines, CD ROM players etc.
- These resources are available to any one on the network irrespective of the physical location of the resource and the user.
- This will save the expenses on duplication of such hardware resources Fig. 1.2.1 shows a laser printer being shared by many users.



(G-1398)**Fig. 1.2.1 : Sharing of hardware resources**

2. Sharing of software resources :

- With every computer, we need to install some basic software's on each computer's hard disk.
- So each computer on the network will have to purchase a separate copy of each software required to be used. This will increase the cost to be incurred.
- In addition, installing software on each computer is time consuming and difficult.
- This problem can be overcome by using the concept of software resource sharing.
- In a network, we can centrally install and configure only one copy of each software and share it among rest of the computers.
- This actually saves a lot of time and cost Fig. 1.2.2 shows the principle of software sharing.



(G-1399)**Fig. 1.2.2 : Sharing of software resources**

1.2.3 Facilitating Centralized Management :

- The computer network facilitates centralized network management with respect to following :
  1. Management of software
  2. Maintenance of network
  3. Keeping the data back up
  4. Central network security
- All this is allowed by the **client – server** network.

1. Managing software :

- As discussed earlier, it is a very good idea to share the software resources, instead of installing a separate copy of software on each computer.
- It is possible to load all the important software on a single computer (server).
- All the other computers can make use of this centralized software as per their requirements.
- This reduces the expenses in buying the expensive software's for each individual computer. It also makes the virus checks easy.
- We can add new computers on the existing network without purchasing the software's again.
- Thus the network helps in maintaining a centralized software bank.

Maintenance of network :

- The second aspect in the centralized management is the maintenance of network.
- The centralized management allows quick and easy way to the routine maintenance of network.
- The client server networks are maintained centrally. It is an important but difficult job.
- A central administrator keeps track of the status of the network in respect of its speed, traffic, performance and security.
- Some of the network maintenance tools available to help the network maintenance are as follows :
  1. Protocol analyzer.
  2. Event viewer.
  3. Performance monitor.
  4. Network analyzer.
  5. Network management protocol.

Backing up data :

- In the process of data backup, data from computer system is copied from the disk to some other medium for keeping it safe.
- Taking back up periodically is important because it protects the data against any unpredictable, accidental loss of data due to system failure, computer viruses, or human error.
- But taking a backup of individual user's data separately is a time consuming and unorganized.
- Hence in a network, the users first save their important data on the central server and then the backup can be taken on the server data.