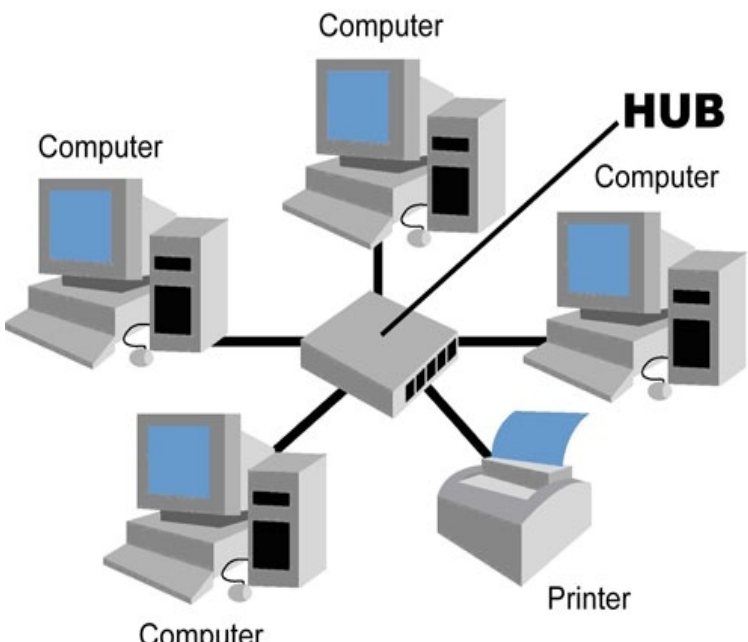
Chapter 11
Basics of Computer Network

A Computer Network is formed by connecting two or more than two computing devices with each other with the help of any medium. The connecting medium may be wired or wireless such as coaxial cable, twisted pair, fiber optic cables etc. The computing devices may be Computers, printer, scanner, mobile phones etc.



11.1 OBJECTIVES OF COMPUTER NETWORK

Transmission of Information

The basic goal of any computer network is to transmit information from one place to another. eg. Sending emails, File Transfer, display of content on web etc.

Resource sharing

A computer network facilitates *sharing of resources* which in turn reduces total cost of the network. It aims to provide program, data and hardware to everyone on the network without any regard to the physical location of the user as well as the resource.

High Reliability

Often the reliability of any computer network is appreciably high. It is generally achieved by replicating the data on two or more machines and in the case of unavailability (failure of hardware or any other reason), the other copies can be used.

Distributed Processing

A computer network also facilitates distributed processing of tasks with a variety of computer systems that deploy more than one computer (or processor) to run an application. It may also involve *parallel processing* in which a single computer uses more than one *CPU* in order to execute programs.

11.2 COMPONENTS OF COMPUTER NETWORK

- Computing devices such as Computer, Printer or Scanner etc.
- LAN Card
- Medium
- Software
- Switch or Hub

Computing Devices

These are the devices like **Computer, Printer or Scanner** which are used in various user applications.

LAN Card

A Network Interface Controller (NIC) is a computer hardware component which is used to connect a computing device to a network. It is also known as a network interface card, network adapter, LAN adapter or physical network interface. Earlier network interface controllers were commonly plugged into a computer bus

as extension but due to the low cost and ubiquity of the Ethernet the new computer systems have network interface built into the motherboard.

Medium

Generally medium is of two types:

A) Guided medium
B) Unguided medium

Guided Medium: In this type of medium the path from sender to receiver path is already known. eg. Copper cables, Fiber cables. Cable is a way of transmission media to transmit communication signals. The wired network topology uses various special type of cables to connect computers on a network, like:

i) **Twisted pair wire:** It is generally classified as Category 1, 2, 3, 4, 5, 5E, 6 and 7. Category 5E, 6 and 7 are called high-speed cables because of their capacity to transmit at the speed of 1Gbps or more.

ii) **Coaxial cable:** It provides high data transmission speed but it is more expensive than twisted-pair cable. It resembles like TV installation cable.

iii) **Fiber-optic cable:** Fiber-optic cable has highest data transmission rate cable as compared to the other cable types. It uses light beam

through glass bound fibers to transmit data at high speed. Its major disadvantage is its high cost.

Unguided medium: The path between sender to receiver is unknown in this type of medium. eg. of unguided media is air.

Software

A software is used to help set up, manage, and/or monitor computer networks. Various networking software applications are available to manage as well as monitor networks of all sizes ranging from a small home network to the largest enterprise level networks.

Switch or Hub

Hub is a device which acts like a distribution center and splits a network connection into multiple computers. On receiving a request from a computer, the network or a specific computer sends the request to the hub through a cable. On receiving the information, the hub will transmit it to the entire network. Now it is the responsibility of each computer in the network to check whether the broadcast data is for them or not. Currently Hubs are being replaced by Switches and Routers which prove to be more advanced communication devices as compared to Hubs.

11.3 ADVANTAGES AND DISADVANTAGES OF COMPUTER NETWORK

Advantages

- Any type of data can be transmitted very easily and quickly from one place to another on the network. The data may be pictures, sounds, or any other form of data.
- The expensive resources such as printers or phone lines to the internet can be shared by all the computers on the network without having the necessity to buy an individual peripheral for each computer.
- The same data can be accessed by everyone on the network thereby avoiding the problem where some users may have older information than others.

Disadvantages

- Initial network setup may be expensive and complicated.
- Security is a critical issue in networks. Since many different people have the ability to use information from other computers, security and integrity of data plays an important role. Also protection against hackers and viruses adds more complexity and expense.
- After set up, network maintenance is a full-time job which requires network administrators and technicians to be employed.

11.4 APPLICATION OF NETWORKS

Marketing and sales

Computer Networks are being widely used by the Marketing professionals for collecting exchange and analyzing data relating to customer needs and product development cycles. The extensive use of networks in Teleshopping, online reservation for railways, hotels, theatres, airlines etc. clearly mark the importance of Networks in Sales domain.

Financial services

With the increase in online banking activities which enable a user to transfer money without going to bank, the network plays an important role. Eg. Credit history searches, foreign exchange, investment services and electronic fund transfer (EFT),

Manufacturing

The prevalence of automation in many aspects of manufacturing, including the manufacturing processes itself augments the need of networks. Computer Aided Design (CAD) and computer Assisted manufacturing (CAM) are the two aspects

that uses network to provide essential services allowing multiple users to work simultaneously on a project.

Electronic Messaging

E-mails provide the most efficient means to transfer the messages between two and more users in a network. The information may be in the form of text, picture and audio or video.

Directory Services

It is used to speed up the world wide search operation by facilitating a list of files to be stored in central location E.g. Google, Britannica, Yahoo and many more search engines.

Information Services

The various information services like Bulletin Boards and data bank also use networks.

Electronic Data Exchange (EDI)

Computer Networks facilitate EDI thereby allowing business information such as purchase orders and services to be transferred without the use of paper.

Teleconferencing

It allows people at different locations to participate in any kind of discussion without the participant being in the same location. It includes:

- **Text Conferencing**: In this the participant communicates by typing through keyboard and computer monitors.

- **Voice Conferencing**: The participants at number of varied locations communicate simultaneously through using phones (talk).

- **Video Conferencing**: The participants enjoy the experience of talking as well as seeing each another.

Cellular Telephone

Enables wireless phone communication even while travelling through long distance.

11.5 LOCAL AREA NETWORK

A local area network (LAN) is a computer network interconnecting computers which lie within a limited area such as an office building, residence, school, university campus etc. and has its network equipment and interconnecting devices locally managed. Ethernet and Wi-Fi are amongst the two most common transmission technologies in use for local area networks. With the increasing demand and increased use of computers in universities and research labs in the late 1960s generated the need to provide high-speed interconnections between computer systems. Ethernet was developed at Xerox PARC in 1973–1975. The historical technologies include ARCNET, Token ring, and AppleTalk.

11.6 WIDE AREA NETWORK

A wide area network (WAN) may be defined as a telecommunications network or computer network extending over a large geographical area. Leased telecommunication circuits are often used to establish Wide area networks. The Internet may be considered a WAN. Various entities like business, education and government agencies use wide area networks to communicate data among buyers and suppliers, staff, students, clients from various geographical locations.

11.7 INTERNET

Brief history of Internet

Internet often called “network of networks”. Internet is an informal term for the world-wide communication network of computers. The internet is a means used to transmit information quickly between computers around the world. It is comprised of millions of smaller domestic, academic, business, and government networks and websites, which collectively carry many different kinds of information and services. United States by the "United States Department of Defense Advanced Research Projects Agency" (DARPA) developed the internet and it was first connected in October, 1969. It was then called ARPANET. ISP (Internet Service Providers) charge money to access the internet. But at the same time some services are free on the internet.

Future of the Internet

- The use of Internet will be so effortlessly interwoven into daily life of people that it will become invisible like flowing like electricity through machine.
- With the spread of the Internet global connectivity will be enhanced, fostering more positive relationships among societies.
- The Internet of Things, artificial intelligence and big data will make people more aware of their world and their own behavior.

- Implementation of augmented reality and wearable devices to monitor and give quick feedback on daily life and support personal health.
- The Internet will soon become “the Internets” and access, systems and principles will be renegotiated.

An Internet-enabled nation will bring new revolution in education and will spread more opportunities with the need of less money to be spent on buildings and teachers.

Applications of Internet

Search engine
It can be used to search anything and everything. Most popular search engines are Google and Yahoo.

Shopping
Shopping has become easier with the advent of internet. You can buy or sell online.

Communication
This is a major role of the internet. It helps people to communicate either with the use of social networking websites or through e mails. Even chatting is a major use of the internet.

Job search
Nowadays, many people search for their jobs online as it is quicker and there is a larger variety of job vacancies present.

Hobbies
Those who are having certain hobbies can try to improve on it by reading up on many aspects of their hobby.

Research
Research papers are present online which helps in the researcher doing a literature review.

Studying
Now right from kinder garden children are exposed to internet and computers. They find many useful things to learn on the internet (though with supervision). Up to doctorate level education people rely on internet for their education. Online educational books have even reduced the need for a library.

11.8 DIFFERENT WAYS TO ACCESS THE INTERNET

Internet access is the process that enables individuals and organizations to connect to the Internet using computer terminals and mobile devices, sometimes via computer networks. Once connected to the Internet, users can access Internet services, such as email and the World Wide Web. Internet accessing methods are broadly classified into two categories:

1. **Hardwired Broadband Access**
   i. Dial-up Access and Multilink dial-up
   ii. Integrated Services Digital Network (ISDN)
   iii. Leased lines
   iv. Digital subscriber line (DSL, ADSL, SDSL, and VDSL)
   v. Fiber to the home (FTTH) and Power line internet.

2. **Wireless Broadband Access**
   i. Satellite broadband
   ii. Mobile broadband
   iii. Wi-MAX (Wireless Microwave Access)
   iv. Wireless ISP

11.9 SERVICES ON INTERNET

The internet offers many useful things such as electronic mail, online chat, file transfer etc to name a few. The most used service on the internet is the World Wide Web (which is also called the "Web"). The Web contains websites, wikis, blogs, searches etc. Webpages on the internet can be seen and read by anyone (unless the page needs a password, or it is blocked). The second most widely used application of the internet is to send and receive e-mail. E-mail enjoys privacy since it is private and goes from one user to another. Instant messaging (such as AIM or ICQ) is similar to email, allowing two or more people to chat with each other much faster.

11.10 COMMUNICATION ON INTERNET

As discussed above, the World Wide Web, or the Internet, is a series of connected networks that connect computers across the world together. This network allows different kinds of communication methods. Voice over IP, or VoIP, refers to programs like Skype that allow people to communicate using audio and video over the Internet. Social media sites like Facebook are another example of Internet communication. These sites allow people to post messages and then respond to the messages over others in a long network from one computer to another. Internet

forums also facilitate communication by letting someone create a thread, which others then respond to in a long chain. Many websites such as blogs also allow people to post comments to communicate that way. Chat rooms are among some of the oldest examples of communication on the Internet along with forums. Today, most popular internet communication method is Instant Messaging for example WhatsApp, Facebook messenger, Hike etc. are example of popular instant messaging application. Even before graphic user interfaces, such as AOL, it was possible to communicate over the Internet in text form only when the Internet was mostly a collection of connected college and government computers.

11.11 INTERNET PROTOCOL

Internet Protocols are the set of rules to govern communications. Different applications have different protocols. Following are the various protocols with their functionality.

HTTP

HTTP is the Hyper Text Transfer Protocol. It is used to access web. HTTP functions as a request–response protocol in the client–server computing model. A web browser, for example, may be the client and an application running on a computer hosting a website may be the server. The client submits an HTTP request message to the server. The server, which provides resources such as HTML files and other content, or performs other functions on behalf of the client, returns a response message to the client. The response contains completion status information about the request and may also contain requested content in its message body.

FTP

FTP is the File Transfer Protocol. It is used to transfer file from local computer to remote computer or vice-versa. FTP is a client-server protocol that relies on two communications channels between client and server: a command channel for controlling the conversation and a data channel for transmitting file content. Clients initiate conversations with servers by requesting to download a file. Using FTP, a client can upload, download, delete, and rename, move and copy files on a server. A user typically needs to log on to the FTP server, although some servers make some or all of their content available without login, also known as anonymous FTP.

SMTP

Simple Mail Transfer Protocol (SMTP) is an Internet standard for electronic mail (email) transmission. Although electronic mail servers and other mail transfer agents use SMTP to send and receive mail messages, user-level client mail applications typically use SMTP only for sending messages to a mail server for relaying. For retrieving messages, client applications usually use either IMAP or POP3. SMTP communication between mail servers uses port 25. Mail clients on the other hand, often submit the outgoing emails to a mail server on port 587. For security, SMTP connections secured by SSL (Secure Socket Layer), known as SMTPS.

TELNET

Telnet is a protocol that allows you to connect to remote computers (called hosts) over a TCP/IP network (such as the Internet). Using telnet client software on your computer, you can make a connection to a telnet server (i.e., the remote host). Once your telnet client establishes a connection to the remote host, your client becomes a virtual terminal, allowing you to communicate with the remote host from your computer. In most cases, you'll need to log into the remote host, which requires that you have an account on that system. Occasionally, you can log in as guest or public without having an account. Telnet clients are available for all major operating systems. Such as Windows, Mac OS, Linux, UNIX etc. In most of the operating systems command line telnet are available To use, command line telnet client, go to their respective command lines (i.e., the Terminal application in Mac OS, the shell in Unix or Linux, or the DOS prompt in Windows), and then enter:

telnet host port

Replace *host* with the address of the service, and *port* with the port number on which the service runs (e.g., 80 for http).

11.12 INTRANET

An Intranet is a private network accessible only to an organization's staff. Generally a wide range of information and services from the organization's internal IT systems are available that would not be available to the public from the Internet. A company-wide intranet can constitute an important focal point of internal communication and collaboration, and provide a single starting point to access internal and external resources. In its simplest form an intranet is established with the technologies for local area networks (LANs) and wide area networks (WANs). There are several advantages of intranet as local area network or public network. Some of them are:

- Cost-effective
- Business operations and management
- Enhance collaboration
- Cross-platform capability
- Supports a distributed computing architecture
- Web publishing
- Built for one audience
- Every user has the ability to view the same information within the Intranet
- Immediate updates
- Time, Communication etc.

IMPORTANT POINTS

- A Computer Network is formed by connecting two or more than two computing devices with each other with the help of any medium.
- Network Interface Controller (NIC) is a computer hardware component which is used to connect a computing device to a network.
- A Wide Area Network (WAN) may be defined as a telecommunications network or computer network extending over a large geographical area.
- A Local Area Network (LAN) is a computer network interconnecting computers which lie within a limited area such as an office building, residence, school, university campus etc.
- Internet Protocols are the set of rules to govern communications.
- HTTP is the Hyper Text Transfer Protocol. It is used to access web.
- FTP is the File Transfer Protocol. It is used to transfer file from local computer to remote computer or vice-versa.
- Telnet is a protocol that allows you to connect to remote computers (called hosts) over a TCP/IP network (such as the Internet).
- An Intranet is a private network accessible only to an organization's staff.

Practice Questions

Objective type questions:

Q1. What is the port number that is used by SMTP when communicating?

A. 25 B. 35
C. 60 D. 80

Q2. What is the full form of DSL?

A. Digital Service Line B. Data Subscriber Line
C. Digital Subscriber Line D. Data Service Lookup

Q.3 Which one of the following use of wireless broadband?

A. Leased Lines
B. Mobile Broadband
C. Dial up Access
D. Fiber to the Home

Q.4 Which one of the following is a type of medium?
A. Switch
B. Guided Medium
C. LAN Card
D. Software

Very Short Answer type questions:

Q1. How computer network is formed?
Q2. What are the connecting mediums for computer networks?
Q3. What are the main computing devices used for networking?
Q4. What do you mean by transmission of information?
Q5. What is the main functionality of resource sharing?
Q6. What is distributed processing?
Q7. Write down the names of five computer network components?
Q8. What is guided medium?
Q9. Give example of guided medium?
Q10. Write down any two advantages of computer networks?
Q11. Write any four advantages of intranet?

Short answer type questions:

Q.1 What is Computer network? Explain with diagram.
Q.2 What are the main objectives of computer network?
Q.3 Describe various applications of networks?
Q.4 Describe various components of a computer network?
Q.5 What are pros and cons of a computer network?
Q.6 Explain in brief? (i.) LAN (ii.) WAN
Q.7 Define the term Internet? What are basic applications of Internet?
Q.8 What are the main services of Internet and Explain how communication is done through internet?
Q.9 Explain the term Internet Protocol (IP)? What are different internet protocol? Explain in brief.
Q.10 Define following:
i. TELNET
ii. Intranet

Essay type questions:

Q.1 Explain objectives of computer network and component of computer network in detail ?
Q.2 Explain Internet Protocol, Telnet, Intranet in detail ?

Answer key for objective type questions:

1. A
2. A
3. B
4. B