CHAPTER - 1

BACKGROUND STUDY AND REVISION

INTRODUCTION AND NECESSITY OF COMPUTER NETWORKING:

The first computer network was invented when ancient mathematicians connected their abacuses together with kite string so they could instantly share their abacus answers with each other. Over the years, computing networks became more and more sophisticated. Now, instead of string, networks use electrical cables, fiber-optic cables, or wireless radio signals to connect computers to each other. The purpose, however, has remained the same; sharing information and getting work done faster.

A network is nothing more than two or more computers connected to each other so that they can exchange information, such as e-mail messages or documents, or share resources, such as disk storage or printers. In most cases, this connection is made via electrical cables that carry the information in the form of electrical signals. But in some cases, other types of connections are used. For example:

- **Fiber-optic cables:** let computers communicate at extremely high speeds by using impulses of light.
- **Wireless networks:** let computers communicate by using radio signals, so the computers aren't restricted by physical cables.

Networks are all about sharing. Specifically, networks are about sharing three things:

- **Sharing Information:** Networks allow users to share information in several different ways. The most common way of sharing information in several different ways. The most common way of sharing information is to share individual files.
- **Sharing Resources:** Certain computer resources such as printers or hard drives; can be set up so that network users can share them. Sharing these resources can result in significant cost savings.
- **Sharing Applications:** One of the most common reasons for networking in many businesses is so that several users can work together on a single business application.

NETWORKS GOAL/MOTIVATION:

1. Resource Sharing:

The main goal of networking is "Resource sharing" and it is to make all programs, data and equipment available to anyone on the network without the regard to the physical location of the resource and the user.

2. Reliability:

A second goal is to provide high reliability by having alternative sources of supply. For example, all files could be replicated on two or three machines, so if one of them is unavailable, the other copies could be available.

3. **Cost Reduction:**

Another goal is saving money. Small computers have a much better price/performance ratio than larger ones. Mainframes are roughly a factor of ten times faster than the fastest single chip microprocessors, but they cost thousand times more. This imbalance has caused many system designers to build systems consisting of powerful personal computers, one per user, with data kept on one or more shared file server machines. This goal leads to networks with many computers located in the same building. Such a network is called a LAN (local area network).

4. **Performance:**

Another closely related goal is to increase the systems performance as the work load increases by just adding more processors. With central mainframes, when the system is full, it must be replaced by a larger one, usually at great expense and with even greater disruption to the users.

5. **Communication:**

Computer networks provide a powerful communication medium. A file that was updated or modified on a network can be seen by the other users on the network immediately.

Network Protocol:

Network protocols are the set of rules that governs data communication. Types of protocols are explained below:

1. **TCP (Transmission Control Protocol):**

When information is sent over the Internet, it is generally broken up into smaller pieces or "packets". The use of packets facilitates speedy transmission since different parts of a message can be sent by different routes and then reassembled at the destination. It is also a safety measure to minimize the chances of losing information in the transmission process. TCP is the means for creating the packets, putting them back together in the correct order at the end, and checking to make sure that no packets got lost in transmission. If necessary, TCP will request that a packet be resent.

2. **IP (Internet Protocol):**

Internet Protocol (IP) is the method used to route information to the proper address. Every computer on the Internet has to have its own unique address known as the IP address. Every packet sent will contain an IP address showing where it is supposed to go. A packet may go through a number of computer routers before arriving at its final destination and IP controls the process of getting everything to the designated computer. Note that IP does not make physical connections between computers but relies on TCP for this function. IP is also used in conjunction with other protocols that create connections.

3. **HTTP (Hyper Text Transfer Protocol):**

HTTP is a communication protocol. It defines mechanism for communication between browser and the web server. It is also called request and response protocol because the communication between browser and server takes place in request and response pairs. It uses port 80.

4. HTTPS(Hypertext Transfer Protocol over Secure Socket Layer):

HTTPS was first introduced by Netscape. HTTPS takes care of secure communication between a web server and web browser. HTTPS typically handles credit card transaction and other sensitive data. A Web page using this protocol will have https: at the front of its URL. It uses port 443.

5. FTP (File Transfer Protocol):

File Transport Protocol is a program that allows users and computers to send and receive large portions of data through a private or public network. It can also be used to send configuration files and software updates to network devices, such as switches and routers. FTP uses ports for communications and also uses encryption to protect the information being received and sent.

It uses port 20 for data transfer and port 21 for connection.

6. SMTP (Simple Mail Transfer Protocol):

SMTP is a TCP/IP protocol used in sending and receiving e-mail. However, since it is limited in its ability to queue massages at the receiving end, it is usually used with one of two other protocols POP3 or IMAP that let the user save the messages in a server mailbox and download them periodically from the server. In other words, users typically use a program that uses SMTP for sending e-mail and either POP3 or IMAP for receiving e-mail. On UNIX based systems, send mail is the most widely used SMTP server for e-mail. It uses port 25.

7. POP (Post Office Protocol):

POP is one of the most commonly used protocols used to receive e-mail on many e-mail clients. There are two different versions of POP: POP2 and POP3. POP2 was an early standard of POP that was only capable of receiving e-mail and required SMTP to send e-mail. POP3 is the latest standard and can send and receive e-mail only using POP, but can also be used to receive e-mail and then use SMTP to send e-mail.

POP3 is designed to delete mail on the server as soon as the user has downloaded it. However, some implementations allow users or an administrator to specify that mail be saved for some period of time. POP can be thought of as a "store-and-forward" service. It uses port 110.

8. IMAP (Internet Mail Access Protocol):

IMAP (Internet Message Access Protocol) is a standard email protocol that stores email messages on a mail server, but allows the end user to view and manipulate the messages as though they were stored locally on the end user's computing device(s). This allows users to organize messages into folders, have multiple client applications know which messages have been read, flag messages for urgency or follow-up and save draft messages on the server.

IMAP can be contrasted with another client/server email protocol, Post Office Protocol 3 (POP3). With POP3, mail is saved for the end user in a single mailbox on the server and moved to the end user's device when the mail client opens. While POP3 can be thought of as a "store-and-forward" service, IMAP can be thought of as a remote file server. It uses port 143.

9. UDP (User Datagram Protocol):

The User Datagram Protocol is one of the core members of the internet protocol suite. UDP uses a simple connectionless transmission model with a minimum of protocol mechanism. UDP provides checksums for data integrity, and port numbers for addressing different functions at the source and destination of the datagram. It has no handshaking dialogues, and thus exposes the user's program to any unreliability of the underlying network and so there is no guarantee of delivery, ordering, or duplicate protection. If error correction facilities are needed at the network interface level, an application may use the TCP or SCTP (Stream Control Transmission Protocol) which are design for this purpose.

10. Telnet:

Telnet (short for TErminal NETwork) is a network protocol used to provide a command line interface for communicating with a device. Telnet is used most often for remote management but also sometimes for the initial setup for some devices, especially network hardware like switches, access points, etc. Managing files on a website is also something Telnet is sometimes used for. Telnet is sometimes written in uppercase as TELNET and may also be misspelled as Telenet. It uses port 23.

11. DHCP (Dynamic Host Configuration Protocol):

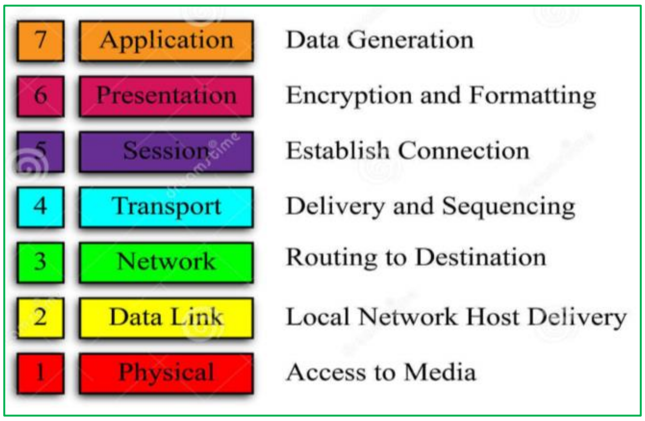
DHCP (Dynamic Host Configuration Protocol) is a protocol used to provide quick, automatic, and central management for the distribution of IP addresses within a network. DHCP is also used to configure the proper subnet mask, default gateway, and DNS server information on the device. It uses port 68.

Networking Model:

There are many different ways in which the network layers can be designed. The two most important network models are the Open Systems Interconnection Reference (OSI) model and the Internet model.

1. OSI Model:

Open System Interconnect is an open standard for all communication systems. OSI model is established by International Standard Organization (ISO). This model has seven layers:



7	Application	Data Generation
6	Presentation	Encryption and Formatting
5	Session	Establish Connection
4	Transport	Delivery and Sequencing
3	Network	Routing to Destination
2	Data Link	Local Network Host Delivery
1	Physical	Access to Media

Fig: Open System Interconnect Model

a. Application Layer:

This layer is responsible for providing interface to the application user. This layer encompasses protocols which directly interact with the user.

b. Presentation Layer:

This layer defines how data in the native format of remote host should be presented in the native format of host.

c. Session Layer:

This layer maintains sessions between remote hosts. For example, once user/password authentication is done, the remote host maintains this session for a while and does not ask for authentication again in that time span.

d. Transport Layer:

This layer is responsible for end-to-end delivery between hosts.

e. Network Layer:

This layer is responsible for address assignment and uniquely addressing hosts in a network.

f. Data Link Layer:

This layer is responsible for reading and writing data from and onto the line. Link errors are detected at this layer.

g. Physical Layer:

This layer defines the hardware, cabling wiring, power output, pulse rate etc.

2. Internet Model:

Internet uses TCP/IP protocol suite, also known as Internet suite. This defines Internet Model which contains four layered architecture. OSI Model is general communication model but Internet Model is what the internet uses for all its communication. The internet is independent of its underlying network architecture so is its Model. This model has the following layers:

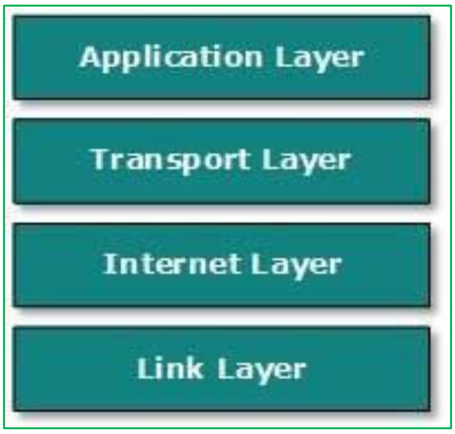


Fig: Internet Model

a. Application Layer:

This layer defines the protocol which enables user to interact with the network. For example, FTP, HTTP etc.

b. Transport Layer:

This layer defines how data should flow between hosts. Major protocol at this layer is Transmission Control Protocol (TCP). This layer ensures data delivered between hosts is in-order and is responsible for end-to-end delivery.

c. Internet Layer:

Internet Protocol (IP) works on this layer. This layer facilitates host addressing and recognition. This layer defines routing.

d. Link Layer:

This layer provides mechanism of sending and receiving actual data. Unlike its OSI Model counterpart, this layer is independent of underlying network architecture and hardware.

Application and Uses of Networks:

1. Communication:

It is used for sending and receiving message from one and other through network by using electronic mail. Some of the web sites providing this service are yahoomail.com Hotmail.com rediffmail.com etc.

2. Job Searches:

Getting information regarding availability of job in different sectors and areas. We can publish our resume in online for prospective job. Some of the web sites providing this service are naukri.com, monster.com, summerjob.com, recuritmentindia.com etc.

3. Finding Books And Study Material:

Books and other study material stored around the world can be easily located through network. Latest encyclopedias are available online.

4. Health And Medicine:

Network provide information and knowledge about field of health, medicine, people can have information about various disease and can receive help. Patient can be taken to virtual check room where they can meet doctors.

5. Travel:

One can use internet to gather information about various tourist place. It can be used for booking Holiday tours, hotels, train and flights. Some of the web sites providing this service are indiatravelog.com, rajtravel.com, makemytrip.com.

6. **Entertainment:**

One can download jokes, songs movies, and latest sports updates through network. Some of the web sites providing this service arecricinfo.com, movies.com espn.com

7. **Shopping:**

Network is also used for online shopping. By just giving accounts details we can perform the transaction. We can even pay our bills and perform bank related transaction.

8. **Stock Market Updates:**

We can sell or buy shares while sitting on computer through network. Several websites like ndtvprofit.com, moneypore.com, provide information regarding investment.

9. **Research:**

A large number of people are using computer network for research purposes we can download any kind information by using computer network.