

CHAPTER 1

NETWORKING AND OPEN STANDARDS

Brief Summary of the Chapter:

In this chapter we are going to study about computer Networks, associated terminology and related concept along with network devices.

Key Points of the Chapter:

- **Network:** A Computer Network is a number of computers (Usually called terminals interconnected by one or more transmission paths.
- **Need of Networking:**
 1. Resource Sharing
 2. File and data sharing.
 3. Data security and centralized security
 4. High Reliability :
 5. Communication Media
 6. High Speed
 7. Flexible working environment
 8. Cost factor
- **Application of Networks**
 1. Sharing of data, services and resources
 2. Access to remote database
 3. Communication facilities

a. Elementary Terminology of Networks :

1. **Nodes (Workstations):-** The term nodes refer to the computers that are attached to a network and are seeking to share the resources.
2. **Server:-** A computer that facilitates the sharing of data, software and hardware resources on the network
3. **Network Interface Unit (NIU) (MAC Address):-** A network interface unit is interpreter that helps in establishing the communication between the server and the client.
4. **IP Address:-** Every machine on a TCP bar IP Network has a unique identifying no. called an IP Address.
5. **Domain Name:-**It is a way to identify and locate the computers connected to the internet. It must be unique.

- a. **NETWORK TOPOLOGIES :** The term Network Topologies refer to the way in which the nodes of a network are physically connected together. The important network topologies are

1) Bus Topology or Linear Topology : In this topology a single length of the transmission medium is used onto which the various nodes are attached. The transmission from any station travels the length of the bus, in both directions and can be received by all other stations. The bus has a terminator at either end which absorbs the signal, removing it from the bus.

Characteristics:

- ☐ Short cable length and Simple wiring layout
- ☐ A single cable called trunk is used through which all data propagates and to which all nodes are connected
- ☐ Easy to extend
- ☐ There is no central point of failure on a bus because there is no hub.
- ☐ Entire network shuts down if there is break in the main cable.
- ☐ Terminators are required at both ends of the backbone cable.
- ☐ Difficult to identify the problem if the entire network shut down.
- ☐ Addition of nodes negatively affects the performance of the whole network.
- ☐ Only one computer can send messages at a time

2) Ring Topology: In a ring topology each node is connected to two and only two neighboring nodes. Data is accepted from one of the neighboring nodes and is transmitted onwards to another. Thus data travels only one direction.

- ☐ Every computer serves as a repeater to boost signals
- ☐ Short cable length.
- ☐ Suitable for optical fiber
- ☐ Difficult to add computers
- ☐ More expensive
- ☐ If one computer fails, whole network fails
- ☐ Data clashes can also occur if two machines send messages at the same time.

3) Star Topology: A star topology is designed with each node connected directly to the server via hub or switch. This topology is used in most existing information network. Data on a star network passes through the hub or concentrator before continuing to its destination.

- ☐ Easy to install and wire
- ☐ No disruptions to the network when connecting or removing devices.
- ☐ Easy to add new station as each station has direct cable connection to hub or switch.
- ☐ Depending on the intelligence of hub, two or more computers may send message at the same time
- ☐ One malfunctioning node does not affect the rest of the network.
- ☐ Required more cable length than a linear topology.
- ☐ All signals transmission through the hub; if down, entire network down

NETWORK DEVICES

1. MODEM(MODulator DEModulator) : Modem is a device that converts digital data originating from a terminal or computer to analog signals used by voice communication network such as the telephone system.

At one end, modems convert the digital pulse to audible tones and convert audio tones back to digital pulses at the other

2. RJ -45 Connector:

The RJ-45 is a single line jack for digital transmission over ordinary phone wire. It is a 8 wire connector which is commonly used to connect computers on the LAN(especially Ethernets).

RJ – short for Registered Jack – 45

3. **Ethernet Card or NIC or NIU:** A NIC (Network Interface card) is a computer circuit board or card that is installed in computer so that it can be connected to network. It is suitable for coaxial or twisted pair cables.
4. **Hub:** Hub is a device used to connect several computers together. It is a multi-port card. Hubs forward any data packets including e-mail, word processing documents or print request – they receive over one port from one workstation to all of their remaining ports
5. **Switches :** Switches are smart hubs that send data directly to the destination rather than everywhere within network. When the switch receives a packet, the switch examines the destination and source hardware address and compares them to a table of network segments and addresses. If the segments are the same the packet is dropped and if different then the packet is forwarded to the proper segments.
6. **Repeaters :** A repeater is a device that amplifies a signal being transmitted on the network. Since a signal loses strength as it passes along a cable, it is often necessary to boost the signal with this device. The repeater electrically amplifies the signal it receives and rebroadcasts it.
7. **Router:**
A device that works like a bridge but can handle different protocols, is known as router. It is used to separate different segments in a network to improve performance and reliability.

Solved Questions:

Q1. What is MAC Address?

Ans : In computer networking, a **Media Access Control address (MAC)** is a unique identifier assigned to most network adapters or network interface cards (NICs) by the manufacturer for identification, and used in the Media Access Control protocol sub-layer.

Q2. Write two advantages of networks.

Ans: Advantages: i) Data or information can be shared among the users.
ii) Fast communication can be achieved.

Q3. Write two disadvantages of networks.

Ans : Disadvantages of networks:

- i. Sophisticated Hardware and software technology is required.
- ii. Expensive to install network.

Q4. What is communication channel? Name the basic types of communication channels available.

Ans: What is communication channel? Name the basic types of communication channels available. Communication channels mean the connecting cables that link various workstations. There are 3 basic types of cables:

- Twisted Pair cables
- Coaxial cables
- Fiber-optic cables

Q5. Define a network.

Ans: A computer network is a system in which computers are connected to share information and resources.

Q6. What is IP address?

Ans A unique number consisting of 4 parts separated by dots, e.g. 165.113.245.2 Every machine that is on the Internet has a unique IP number - if a machine does not have an IP number, it is not really on the Internet.

Q7. What is domain name? How is it alternatively known?

Ans The unique name that identifies an Internet site. Domain Names always have 2 or more parts, separated by dots. The part on the left is the most specific, and the part on the right is the most general. E.g.: matisse.net

Q8. What are the various types of networks?

Ans : Network can be classified on the basis of their size, complexity and geographical spread. On the basis of geographical spread it can be classified as Local Area Network, Metropolitan Area Network and Wide Area Network.

Q9. What is the difference between MAN and WAN?

Ans : A **metropolitan area network (MAN)** is a large computer network that usually spans a city or a large campus.

WAN is a *network* that covers an area larger than a single building or campus such as across the cities or countries.

Q10. What is meant by Topology? Name some popular topologies.

Ans: Network topology is defined as the interconnection of the various elements (links, nodes, etc.) of a computer network. In computer networking, topology refers to the layout of connected devices.

- Bus topology
- Star topology
- Ring topology
- Tree topology
- Mesh topology

Q11. What are the similarities and differences between bus and tree topologies?

Ans: In bus topology each machine is connected to a single cable. Each computer or server is connected to the single bus cable through some kind of connector.

Tree topology is a network with the shape of an inverted tree in which a single link between two nodes.

Q12. What are the limitations of star topology?

Ans i) **Central node dependency:** In this topology central node is a controller of the network. If the central node fails, the entire network will be failed.

ii) **Difficult to expand:** The addition of a new node to a network involves a connection all the way to the central node.

Unsolved Questions:

1. What are the goals of network?
2. Write the applications of network?
3. What do you understand by domain name resolution?
4. What are communication channels? Discuss various channels available for networks?
5. Advantages and disadvantages of the followings :
 - i. optic fiber
 - ii. coaxial cables
 - iii. twisted pair cables
 - iv. radio waves
 - v. microwaves
 - vi. Satellites
6. Discuss and compare various types of networks?
7. Explain mostly used topologies.
8. What are hubs? What are its types?
9. What is the role of a switch in a network?
10. Discuss repeater.
11. What are common threats to network security?

12. What are denial of services attacks?
13. How can you prevent/ counter threats of network security?
14. When do you think, ring topology becomes the best choice for a network?
15. Write the two advantages and two disadvantages of star topology in network.
16. Write the disadvantages if twisted pair cables.
17. Define Hub.
18. Define switch.

Chapter 2

FREE AND OPEN SOURCE SOFTWARE

Brief Summary of the Chapter:

In this chapter we are going to discuss about various open source software and how they are different from software which are not open source.

Key Points:

Free Software: It means software is freely accessible, free to use, changed, improved, copied, and distributed without any payments.

Four kinds of freedom:

- ▶ Freedom to run the program for any purpose
- ▶ Freedom to redistribute copies.
- ▶ Freedom to study how the program works
- ▶ Freedom to improve the program and release your improvements to the public

Open Source Software:

Definition: The categories of software / programs whose Licenses do not impose many conditions.

Features:

1. Freedom to run and use the software
2. Modify the program
3. Redistribute copies of either original or modified program (without paying royalties to previous developers).

It can be freely used for modifications, but it does not have to be free of charge. Its source code is available.

Criteria for the distribution of open source software

1. Free distribution
2. Source code
3. Derived works
4. Integrity of the Author's Source code
5. No discrimination against fields of endeavor.
6. Distribution of License
7. License must not be specific to a product
8. License must not restrict other software.

FOSS (free and open software): Free software- no payments

Open source software- for technical progress

OSS and FLOSS

- ▶ OSS- Source code is available