

COMPUTER SCIENCE-XII

UNIT- II COMPUTER NETWORKS-10 MARKS

Network : A network is an interconnected collection of autonomous computers.

Autonomous means no computers on the network start, stop or control another.

Need for Networking :

1. To share computer files, data and peripherals.
2. To improve communication speed.
3. To reduce cost of transfer.
4. Reliability: A file can have copy of 2 or more different machine, so one of them is unavailable the other copies can be used.

Evolution of networking :

1. **ARPANET** : (Advanced Research Project Agency Network); The computer network was jointly designed by ARPA and Department Of Defence (DOD) of USA in 1969 and was called ARPANET. It was an experimental project which connected few computers of some of the reputed universities of USA and DOD. It allowed access and use of computer resource sharing projects.
2. **INTERNET** : It is network of networks i.e. it is a worldwide networks of computer networks.
3. **INTERANET** : It is an interconnected network within one organization that uses web technologies for sharing information internally.
4. **Inter space** : It is a client/Server software program that allows multiple users to communicate online with real-time audio, video and text chat in dynamic 3D environments.

Data communication Terminologies :

1. **Data channel/Communication Channel/Transmission Media** :

The medium through which data are transferred from one location to another.

Different communication media are :

- | | | |
|------------------------|---|----------------|
| (i) Twisted pair cable | } | Guided Media |
| (ii) Coaxial cable | | |
| (iii) Optical Fiber | | |
| (iv) Ethernet cable | | |
| (v) Radio Wave | } | Unguided Media |
| (vi) Micro Wave | | |
| (vii) Satellite | | |
| (viii) Infrared | | |

Measuring Capacity Of Communication Media

- 1) **Baud** : It describes the rate of change of signal on the line i.e. how many times (per second) the signal changes its pattern. (1 baud =1 bps (bits per second))
- 2) **Band width** : It is the difference between the highest and lowest frequencies of the

transmission channel.

- a. In digital system , Band width is data speed in bps In analog system, it is measured in Hertz.

3) **Data transfer Rate** : It represents the amount of data transferred per second by a communication channel. It is measured kbps(killo bits per second),Kbps(killo bytes per second),mbps, Mbps, gbps, Tbps.

Elementary Terminology of Networks :

1. **Nodes(Work stations)** : It refers to the computers that are attached to a network and are seeking to share the resources of the network.
2. **Server** : It is a computer that facilitates the sharing of data, software and hardware resources on the network
3. **Network Interface Unit(NIU)** : It is an interpreter that helps establish communication between the server and workstations.(It is also called NIC(Network interface card) or TAP (Terminal Access Point))

Switching Techniques : are used for transferring data across networks.

- 2 types of switching techniques :
1. Circuit Switching
 2. Packet switching

Circuit Switching : In this technique ,first the complete physical connection between two computers is established and then data are transmitted from the source computer to the destination computer. This technique provides end to end connection between computer before any data can be sent. It is designed for voice communication.

Packet Switching : In this technique, messages are broken into packets and send across the network and they are collected and assembled at the destination. In this technique, the data access time is less because the packets are stored in the main memory.

(OR)

In packet switching, a fixed size of data packet that can be transmitted across the network is specified and then the data packets are sent through switching stations to the final destination. All the packets are stored in the main memory instead of disk. As a result accessing time of packets is reduced.

Transmission Media :

I. Wired communication media

1. **Twisted pair cable** : It consists of two identical wires wrapped together in a double helix. It is used for telephone wiring

Merits :

1. It is very simple.
2. It is easy to install and maintain.
3. It is physically flexible.
4. It has light weight.
5. It can be easily connected.

6. It is very inexpensive (i.e. cheap).

Demerits

1. Low Bandwidth
2. Easily pickup noise signals
3. It is incapable carrying a signal over long distance without the use of repeaters.(100 meter limit)

2. **Coaxial cable :** It contains two conductors that are parallel to each other.

Merits :

1. The data transmission of coaxial cables are better than of twisted pair cable.
(Higher band width)
2. They are used in cable networks and long distance telephone lines.
3. They are used for broadband transmission.
4. Offer higher bandwidth up to 400 Mbps

Demerits :

1. More expensive than twisted pair cable
2. They are not compatible with twisted pair cables

3. **Optical Fibers :**

Merits :

1. High bandwidth
2. Noise resistance
3. Zero electrical interference and complete electrical isolation.
4. Information is travelling on a modulated light beam.
5. They are used for broadband transmission where several channels are handled in parallel.
6. It is a secure transmission,
7. It is suitable for harsh industrial environments.

Demerits:

1. High cost (i.e. most expensive)
2. Difficult to install
3. Difficult for solder
4. Connection losses are common problem
5. Connecting two fibers together is a difficult process.

Ethernet Cable : An Ethernet cable is used on a wired networks. It connect devices within a local area network like PC's, routers and switches within a local area network. These cables are limited by length and durability. If a network cable is too long or of poor quality, it won't carry a good network signals

II. Wireless communication media

Radio Wave :

Merits :

1. Radio wave transmission offers mobility.

2. It is cheaper than other media
3. It offers freedom from land owners right.
4. It penetrate the buildings.
5. It is omnidirectional.
6. It is used for long distance communication.

Demerits :

1. It is an insecure communication.
2. It is susceptible to weather effects like rains, thunder, storms etc.

Micro Wave : it is an electromagnetic wave in the frequency range of about 1 to 300 GHz. It transmits voice and data at 45 Mbps through the atmosphere. It is unidirectional.

Merits :

1. It is used to wide band communication system(telephone system, television transmission)
2. It is cheaper
3. Easy of communication
4. It offers freedom from land owner right.
5. It can communicate over oceans.

Demerits :

1. It is an insecure communication.
2. It cannot penetrate walls.
3. It has high cost of design, implementation and maintenance.
4. It has limited bandwidth allocation.
5. The signal strength may be reduced due to setting of antenna.
6. It is susceptible to weather effects like rains, thunder, storms etc.

Satellite :

Merits :

1. It covers large area.
2. It is useful for sparsely populated areas.
3. It is a commercial attractive.
4. It is a secure communication.

Demerits :

1. Very high cost
2. High atmospheric losses above 30 GHz limit carrier frequencies.

Note : The other communication Media are Infrared, Laser, Bluetooth, WIFI and Ethernet Cable(are connect network devices such as MODEM, Router and adapters)

Infrared Waves :

Infrared waves, with frequencies from 300 GHz to 400 GHz, can be used for short-range communication. They have high frequencies and cannot penetrate walls.

NETWORK DEVICES:

1. **MODEM** (Modulator-Demodulator) :Modulator convert a digital signal to analog

signal and demodulator convert an analog signal into digital signal.

A Modem is a computer peripheral that allows to connect and communicate with other computers via telephone lines.

2. **RJ-45 (Registered Jack -45)** It is an 8 wire connector which is used to connect computers on the local area network.
3. **Ethernet card(LAN card)** : It is a hardware device that helps in connection of nodes within a network.
4. **Hub** : It is a hardware device used to connect several computers together.

Two types of Hub :

- (i) **Active Hub**: It provide path for the data signals and strengthen the signals before sending to their destination. They are called **repeaters**.
 - (ii) **Passive Hub**: They have nothing to do with modifying the signals.
5. **Switch** : A switch is a device that is used to segment networks into different sub networks called subnets or LAN segments.
 6. **Repeater** : It is a device that amplifies a signal being transmitted on the network. It is used for long distance transmission (i.e. above 70 meters)
 7. **Bridge**: It is device that is used to connect two networks using in same topology and same protocols.
 8. **Router** : It is a device that is used to connect two networks using same topology and different protocols.
 9. **Gateway**: It is a device that is used to connect dissimilar network (i.e. different topology and different protocols)

TYPES OF NETWORK : There are 4 types of networks.

1. Local Area Network(LAN)
2. Metropolitan Area Networks(MAN)
3. Wide Area Network(WAN)
4. Personal Area Network(PAN)

LAN : Small computer networks that are confined to a localized area (e.g. an office, a building or a factory University Campus) are known as LANs. The key purpose of LAN is to serve its users in resource sharing. **Properties** :

- a) Diameter is not more than 10 Kms.
- b) Use multi-access channels
- c) Rate of transmission is high
- d) Highly reliable(low error rates)

WAN: The network spread across the countries is known as WANs. A WAN is a group of computers that are separated by large distances and tied together. (Example : Internet)

Properties :

- a) Span entire countries
- b) Use point-to-point link except satellite network
- c) Rate of data transmission is slow.

- d) Owned by multiple organization.
- e) Low reliability(high error rates)

MAN : These are the networks that link computer facilitates within the city or town.(ie. Maximum 20 Kms of Diameter).It is in between LAN and WAN. It is a network that covers an entire city but uses LAN technology.

Example : An organization can have multiple branches in the same city, One being the headquarter building and other being normal offices in the same city.

PAN : It is the interconnection of information technology devices within the range of an individual person i.e. within a range of 10 meters. Example : Wifi, Hotspot, Bluetooth

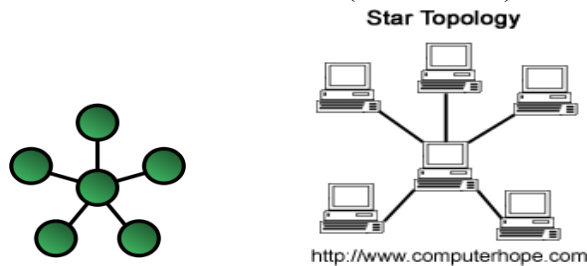
NETWORK TOPOLOGIES :

The pattern of interconnection of nodes in a network is called the topology.

Types of topologies : 1. Star Topology 2. Bus(Linear) Topology 3. Tree Topology

STAR TOPOLOGY

It consists of a central node (Hub of Star) to which all other nodes are connected by a single path.



Advantages of Star topology :

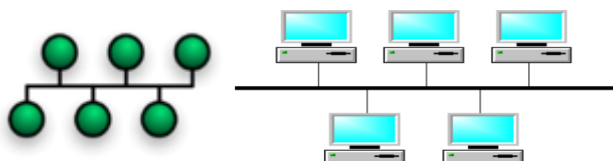
- i) Easy of service
- ii) One device per connection(fast speed)
- iii) Faults are easily detected and isolated.
- iv) Simple access protocols(any given connection involves only the central node)
- v) It allows several types of cable in the same network.
- vi) Failure of a single system will not bring down the entire network

Disadvantages of Star topology :

- i) Long cable length and more cabling cost.
- ii) Difficult to expand
- iii) Central node dependency(if hub fails then the entire network will fail)

BUS TOPOLOGY (LINEAR TOPOLOGY)

It consists of a single length of the transmission medium(normally co-axial cable) on to which the various nodes are attached.



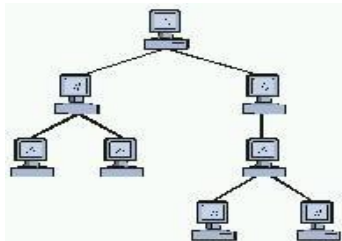
Advantages :

- i) Short cable length and less cabling cost.(i.e. less installation cost)
- ii) Resilient Architecture
- iii) Easy to Extend

Disadvantages :

- i) Fault diagnosis is difficult.
- ii) Fault isolation is difficult.(if a node is faulty on the bus , it must be rectified at the point where the node is connected to the network)
- iii) Repeater configuration
- iv) Only a single message can travel at a time.
- v) When a message from 2 nodes come on the line, a collision occurs.
- vi) A break or short circuit in the cable can halt the whole network.

TREE TOPOLOGY : A variation of bus topology is the tree topology. The shape of the network is that of an inverted tree with the central root branching and sub branching to the extremities of the network.



Advantages :

- i) Easy to extend
- ii) Very good for office automation
- iii) Stimulates(control) hierarchical flow of data

Disadvantages:

- i) Long cable length and more cabling cost
- ii) Root dependency
- iii) If an intermediate node is faulty, all the nodes after that node not work.

COMMUNICATION PROTOCOLS :

A protocol means the rules that are applicable for a network. It defines standardized formats for data packets, techniques for detecting and correcting errors and so on.

(OR)

A protocol is a formal description of message formats and the rules that two or more machines must follow to exchange those messages.

Types of protocols :

1. **HTTP(Hyper Text Transfer Protocol)** : is the set of rules for transferring hypertext (i.e. text, graphic, image, sound, video etc) on WWW (world wide web)
2. **FTP(File Transfer Protocol)** is a standard for the exchange of files across Internet.
It is used to transfer files from one network/system to another network/system. It goes by the

name ftp followed by address of another site and press enter.

3. **TCP/IP(Transmission Control Protocol/Internet Protocol)** : is a collection of protocols that govern the way data travels from one machine to another across network.
TCP is used breaking of data in various packets. IP is used to decide the contents of packets
 4. **PPP/SLIP(Point to Point Protocol/Serial Line Internet Protocol)** : It is a communication protocol used to connect computers to remote networking services including Internet service providers.
It is used to establish a direct connection between two nodes. It is used to connect the Home PC to the server of ISP through high speed MODEM. It allows a computer to use the TCP/IP protocol and to be connected directly to the Net using standard voice telephone line and high speed MODEM.
 5. **VOIP(Voice Over Internet Protocol)** : It is a technology that enables voice communications over the internet through the compression of voice into data packets that can be transmitted over data networks and then converted back into voice at the other end.
It refers to a way to carry telephone calls over an IP data network
6. **POP(post office protocols)** : It is used to receive e-mail from a remote server over a TCP/IP connection.
 7. **POP3(Post Office protocol version 3)**: It allow an e-mail client to download an e-mail server.
 8. **SMTP(Simple Mail transfer Protocol)** : It is used when e-mail is delivered from an e-mail client to an e-mail server.

(OR)

It is used when email is delivered from one e-mail server to another.

9. **Remote login(Telnet)** :Telnet is a network protocol used on the internet or on the local area network to provide by directional interactive text, orientated communication facility using a virtual terminal connection.

Telnet is the internet facility that facilitates remote login. It means to connect the network at remote station without any network.

10. **Video Conferencing Protocol : (H.323 and SIP)** : H.323 is a standard that specifies the components, protocols and procedures that provide multimedia communication services (i.e. real time audio, video, and data communications) over packet based networks including Internet.

SIP(Session Initiation Protocol) is used to establish, modify and terminate VOIP telephone calls.

11. **Chat Protocol IRC(Internet Relay Chat)** : It is a simple, text-based conferencing protocol, involving a number of users spread across a number of interconnected servers.

INTRODUCTION TO WEB SERVICES :

1. **WWW(World Wide Web)** : It is a set of protocol that allows to access any document

on the net through a naming system based on Uniform Resource Locator(URL)

2. **Web pages** : It is a document containing single unit of information that is available via WWW.
(or)
A document that uses HTTP is called a Web Page.
3. **Website** : It is a collection of web pages belonging to a particular person or organisation. Example : www.nvmdg.com
4. **Web Browser** : It is a software used for browsing the web pages.
Examples of web browsers are : Internet Explorer, Netscape Navigator, Safari, Chrome, Firefox, Opera, Mosaic
5. **Web Server** : It is a WWW server that responds to requests made by web browsers.
6. **Web Hosting** : It is a service that allows organizations and individuals to post a website or web page onto the internet.
7. **Domain Name System(DNS)**: The characters based naming system by which servers are identified is known as domain name system. (or) It is the way to identify and locate computers/servers connected to the internet.
eg. Of Domain IDs are .com, .in, .gov, .org, .co(companies), .biz(business), .int, .net
8. **URL(Uniform Resource Locator)** : It specifies the distinct address for each resources on the internet. An internet address is a character based is called a Domain Name.
It defines 4 things : Method : //Host : Port/Path
Example : HTTP ://WWW.google.com is URL and Google.com is a Domain Name
9. **HTML(Hyper Text Markup Language)** : It is a language used to create documents on the World Wide Web.
(OR)
It is the language used to create web pages. It defines the structured and layout of a Web document by using a variety of tags and attributes.
10. **XML(eXtensible Markup Language)** is a markup language that defines a set of rules for encoding documents in a format which is both human-readable and machine-readable. It is defined by the W3C's XML 1.0 Specification and by several other related specifications, all of which are free open standards.(It is a markup language for documents containing structured information.)

Write the Full form of the following :

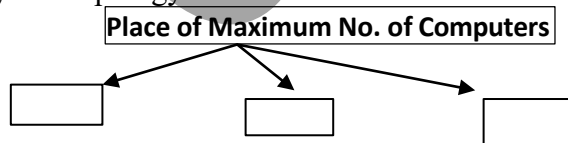
1. ARPANET : Advanced Research Project Agency Network
2. NIU : Network interface Unit
3. bps : bits per second
4. Bps : Bytes per second
5. PAN :Personal Area Network
6. LAN : Local Area Network
7. MAN : Metro Politian Area Network
8. WAN : Wide Area Network
9. MODEM : Modulator and Demodulator
10. RJ45 : Registered Jack 45
11. HTTP : Hypertext Transfer Protocol

12. HTTPS : Hyper Text Transfer Protocol Secure
13. FTP : File Transfer Protocol
14. TCP/IP : Transmission Control Protocol/ Internet Protocol
15. PPP : Point to Point Protocol
16. POP : post Office Protocol
17. SMTP : simple Mail Transfer Protocol
18. IRC : Internet Relay Chat
19. VoIP : voice over Internet Protocol
20. SMS : Short Message Services
21. Wi-Fi : Wireless Fidelity
22. URL : Uniform Resource Locator
23. HTML : Hyper Text Markup Language
24. XML : eXtensible Markup language
25. WWW : World Wide Web

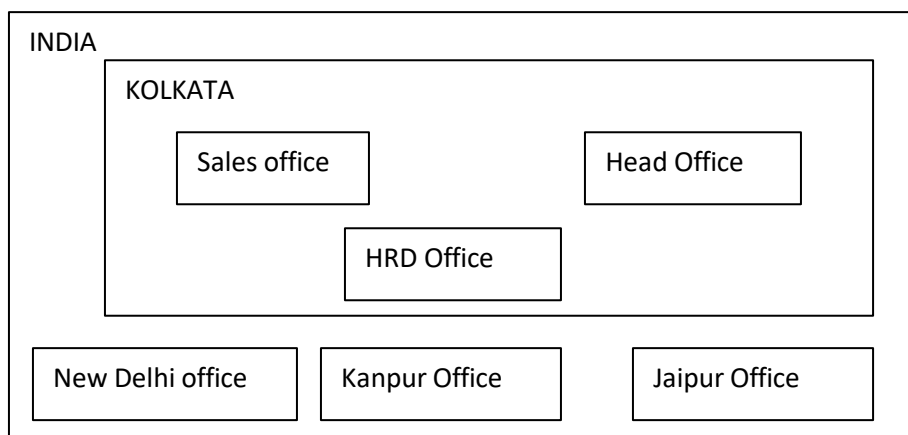
NOTE : (For Case Studies Questions)

1. SERVER/MODEM : will be installed at the place that contains maximum number of computers.
2. HUB/SWITCH : will be installed at each Blocks/Building/Offices
3. REPEATER : will be installed in the cable layout when distance is more than 70 meters
4. Types of Network : PAN : Distance up to 10 meters
 LAN : Distance up to 10 Kilo Meters
 MAN: Distance up to 20 Kilo Meters in the same city
 WAN : Different cities(Entire Country/World)
5. Name the technology/Media/Communication Channel :
 For LAN/MAN : Economical ----- ☐ Twisted Pair Cable/Ethernet Cable
 For Fast/High Speed/Secure ----- ☐ Optical Fiber Cable

 For WAN : Economical----- ☐ Radio Wave
 For Fast/High speed/Secure ----- ☐ Satellite
6. Cable Layout/Topology :



(Q.1) BAJAJ AUTO LTD , is planning to start their offices in four major cities in INDIA. The company has planned to set up their head office in KOLKATA in three locations and have named as “Sales office”, Head office” and “HRD office”. The company’s regional offices are



located at New Delhi, Kanpur and Jaipur. A rough layout of the same is as follows :

Distances between these offices is as follows :

Place From	Place To	Distance
Head office	Sales office	300 meter
Head office	HRD office	150 meter
Head office	New Delhi office	1500 KM
Head office	Kanpur office	1200 KM
Head office	Jaipur office	1700 KM

The Number of Computers install in each of their offices are :

Head office	250 computers
Sales office	50 computers
HRD Office	75 computers
New Delhi Office	150 computers
Kanpur Office	100 computers
Jaipur Office	60 computers

(i) Suggest the network type (out of LAN, MAN,WAN) for connecting each of the following set of their offices :

- Head office and Sales Office
- Head office and New Delhi Office

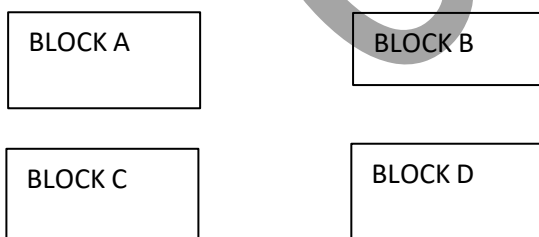
(ii) Which device will you suggest to be procured by the company for connecting all the computers within each of their offices out of the following devices ?

- MODEM
- Switch/Hub
- Repeater

(iii) Suggest a cable /wiring layout for connecting the company's local offices located in KOLKATA

(iv) Name the communication media will you suggest to be produced by the company for connecting their local offices in KOLKATA for fast communication

(Q.2) Knowledge Supplement Organisation has set up its new center at Mangalore for its office and web based activities. It has 4 blocks of buildings as shown in the diagram below:



Center to center distances between various blocks

BLOCK A TO BLOCK B 50 M
 BLOCK B TO BLOCK C 150 M
 BLOCK C TO BLOCK D 25 M
 BLOCK A TO BLOCK D 170 M
 BLOCK B TO BLOCK D 125 M
 BLOCK A TO BLOCK C 90 M

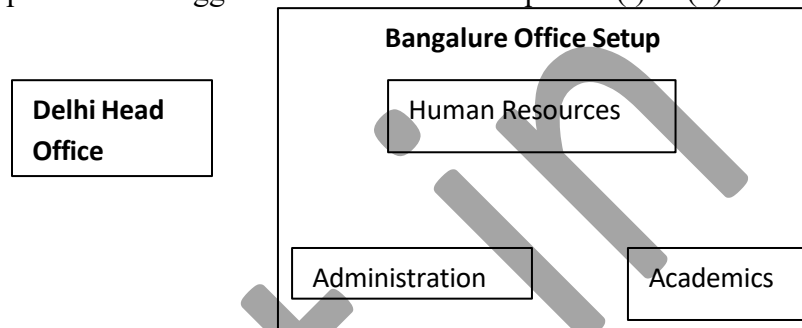
NUMBER OF COMPUTERS

BLOCK A 25
 BLOCK B 150
 BLOCK C 60
 BLOCK D 20

- 1) Suggest a cable layout of connections between the blocks and topology.
- 2) Suggest the most suitable place (i.e. block) to house the server of this organization with a suitable reason.
- 3) Suggest the placement of the following devices with justification
 - (i) Repeater
 - (ii) Hub/Switch
- 4) The organization is planning to link its front office situated in the city in a hilly region where cable connection is not feasible, suggest an economic way to connect it with reasonably high speed?

(Q.3) G.R.K. International Inc. is planning to connect its Bengaluru office setup with its Head Office in Delhi. The Bengaluru Office G.R.K. International Inc. is spread across an area of approx. 1 Square Killometer, consisting of 3 blocks : Human Resource, Academic and Administration.

You as a network expert have to suggest answers to the five queries (i) to (v) raised by them.



Shortest distances between various Blocks :

Human Resources to Administration	200 m
Human Resources to Academics	60 m
Academics to Administration	150 m
Delhi Head Office to Bengaluru office Setup	2000 km

The Number of Computers installed at various blocks are as follows :

BLOCK	No. of Computers
Human Resources	55
Administration	60
Academics	200
Delhi Head Office	30

- (i) Suggest the network type (out of LAN, MAN, WAN) for connecting each of the following set of their Offices :
 - Delhi Head office and Administration Office
 - Human Resources Office and Academics office
- (ii) Which device will you suggest to be procured by the company for connecting all the computers within each of their offices out of the following devices ?
 - (a) MODEM
 - (b) Switch/Hub
 - (c) Repeater
- (iii) Suggest a cable /wiring layout among the various blocks within the Bengaluru Office Setup for connecting the Blocks.
- (iv) Suggest the most suitable in the Bengaluru Office Setup, to host the Server. Give a suitable reason with your suggestion.
- (v) Suggest the most suitable media to provide secure, fast and reliable data connectivity between Delhi Head Office and the Bengaluru Office Setup.