Computer Networks

Networks:

- A network is an interconnected collect" of autonomous computers.
- Autonomous means that no computer on the network can start, stop or control another.

Need for Networking / Advantages of networ

① → To share computer files.
- Networks provide a very effective method to share the files with different users.
- This increases efficiency of the computer systems connected in a network.

② → To share computer peripheral devices.
- When in a network some computer devices are expensive and need to be shared in a network. eg laser, printers, fax machines.

③ → To enable different computers to communicate with each other.

④ → To improve communicat" speed & accuracy.

⑤ → To reduce cost of data transfer.

Components of the Network

* **Node (Work Station)**
  - The different terminals which are attached to the network and share the resources of the network are called nodes.

* **Server**
  - We designate a particular node which is at a well-known and a fixed address to provide a service (to the network as a whole. The node providing the service is known as the server)

* **Network interface unit**
  - (The interpreter which helps in communication between the server & different nodes is called network interface unit.) It is a device that is attached to the server & all the work stations to maintain the connection between them.

Types of Networks

* **LAN (Local Area Network)**
  - (LAN's are privately owned network within a single building or campus of upto few kilometres) A LAN is useful for sharing resources like files, printers & other applications.

eg. ethernet LAN.

Advtgs

** Characteristics of LAN
— Data communication is @100 mbps ie due to short distance covered by LAN
— Error rates are much lower on LAN.
— It helps to share different computer peripheral devices.
— Total diameter is not more than 5 kms.

* MAN (Metropolitan Area Network)
— It is basically a bigger version of LAN & normally uses similar technology.
— It is typically owned & operated by a single entity such as government body or large corporations.

* Characteristics (same as above)

* WAN (Wide Area Network)
— WAN is spread over a large geographical area & uses a variety of commercial & private communication lines to connect computers.
eg. local telephone exchange is a part of WAN.
eg. Internet.
— The computers at each telephone exchange connect at other telephone exchanges to establish connections.

* Characteristics:

- (2) Error rates are much ~~lower on WAN~~ higher as compared to WAN.
- It covers a large area with lesser cost.
- With the help of WAN data can be entered or retrieved from remote areas with lesser cost with the help of satellites.
- WAN uses packet switching methods or message switching methods & uses optical fibre cable or satellite transmission.

* Switching Techniques
— Data communicat^{n} takes place betwn 2 devices that are diretly connected by some form of transmiss^{n} medium.

* There are 3 common switching techniques.

1. Ciscuit Switching:
— ✓ CS is a method of communicating in which a dedicated communicat^{n} path is established betwn 2 devices through 1/more intermediate switching nodes.
— ✓ This link is allocated for the durat^{n} of the communicat^{n} & no other processes can use that link during this period.
— This scheme is similar to that used in telephone systems.

2. Message Switching
— ✓ If 2 processes want to communicate a temporary link is established for the duration of 1 message transfer.
— Physical links are allocated for only short period.
— Each message is a block of data with system informat^{n} (The source, destinat^{n} & error correct^{n} nodes) allows the communicat^{n} network to deliver the message to the destinat^{n} correctly.

eg email

eg dialup connect through modem

* 3. Packet Switching.
- PS is a method of transmitting messages through a communicat" network in which long messages are subdivided into short packets.
- The packets are then transmitted as in Message Switching.
- It is a form of store & forward switching system in which messages are stored at the switch nodes & then transmitted onwards to their destinat".
- This system deletes the message from memory as soon as its correct receipt at the next node is acknowledged.
- The packets must be reassembled into messages as they arrive.

* Difference betwn
1. Circuit Switching & Packet Switching.
- CS reserves the required bandwidth in advance whereas the PS acquires and releases it as it is needed.
- CS is completely transparent while in PS switching parameters the carrier determines the basic
- PS usually base their charge on both the no. of bytes carried & the connect" time while in CS the charge is based on the distance & time & not the traffic.

2. Packet Switching & Message Switching
PS - In PS a fixed size of data packets can be transmitted across the network &

then the data packets are sent to switching stat" to the final destinat".
— All the packets are stored in the main memory & hence the time required to access the packets is reduced.
MS — The source computer sends message to the switching stat" which stores data in a buffer. It then looks for a free link to another switching station & sends data to that stat". This process continues until data is delivered to the destinat" computer.
— Both are called store & forward switching

* Advantages of Circuit Switching.
① — (It is simple & requires no special facilities) Hence suitable for long continuous transmissions, having a dedicated circuit continuously available
② — (Once the circuit is established, data is transmitted with no delay)
③ — full capacity of the circuit is available for exclusive use by a connected pair of nodes, transmiss" (time required to send a message can be known and garanteed)

* Disadvantages of CS.
① — (Before actual data transfer, a circuit btwn the 2 nodes has to be established

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Page No.:
Date: / /

(2) - (Network resources may be underutilised ∵ the circuit is dedicated to a pair of nodes, entire channel capacity is dedicated to them for entire durat" of connect".

(3) - It is uneconomical when connected with (expensive high speed transmiss" lines).

* Advantages of Message Switching.

1) - Unlike CS (no physical connect" betwn the source & destinat" is required)

2) - It uses channels very effectively bec they are used only when messages are transmitted.

* Disadvantages of MS.

1) - Each node must have sufficient storage to buffer messages.

2) - A message is delayed at each node hence (time taken to transmit the message is long).

* Advantages of Packet Switching.

1) - Packets are small & fixed size hence storage required during buffering is minimum.

2) - Transmiss" is very fast ∵ routing is done on packet basis.

* Disadvantages
- Due to the need to split the message in packets at source node, (the time to required to buffer each packet is long) also (it requires reassembling of the packets at destinat^n node). Hence overhead per packet is large.
- There is (no guarantee of how long it takes a message to travel from source to destinat^n); each packet is sent independently, depending upon the path available.

* Data Communicat^n Terminologies:
1. Data Transfer rate.
- A DTR is the amt of digital data that is moved from 1 place to another in a given time usually in a seconds time.

2. Baud.
- (It describes the rate of change of the signal on the line) that is how many times the signal changes its pattern per second

3. The Baud Rate.
- It the measure of the modulat^n rate, the no. of discrete signalling events per second.

4. Bit Rate.
- It is described as a data transfer rate expressed in bits per second.

- Kbps = 1000 bits per sec. 10^3
- mbps = 1000 Kbps. 10^6
- gbps = 1000 mbps. 10^9
- tbps = 1000 gbps. 10^{12}

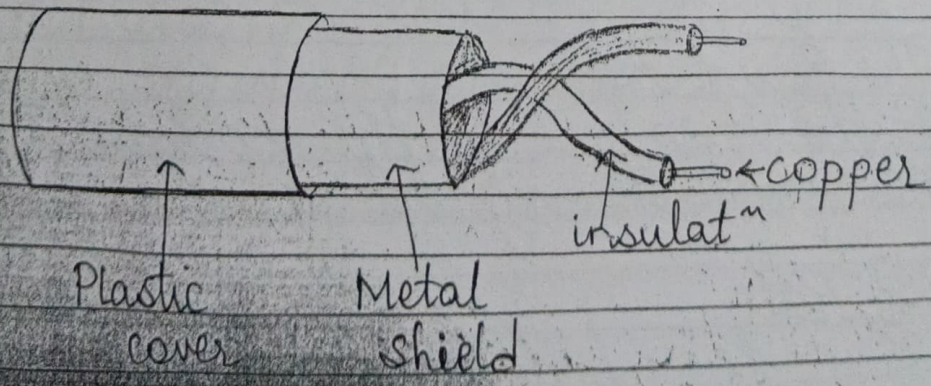
5. Bandwidth
- (The range of transmissⁿ frequencies) that can be carried on a communicatⁿ line is referred to as the bandwidth of the line. (betwn d source & destinatⁿ).

* Communication Channels (Transmissⁿ Media)
- There are 2 main types of cables used as a transmissⁿ media.
- They are :-

1. Wired Communicatⁿ (Guided Media)
2. Wireless " (Unguided Media)

① Wired Communicatⁿ. (GUIDED MEDIA)
- This media provides a channel from 1 device to another.

eg 1) * Twisted Pair Cable.

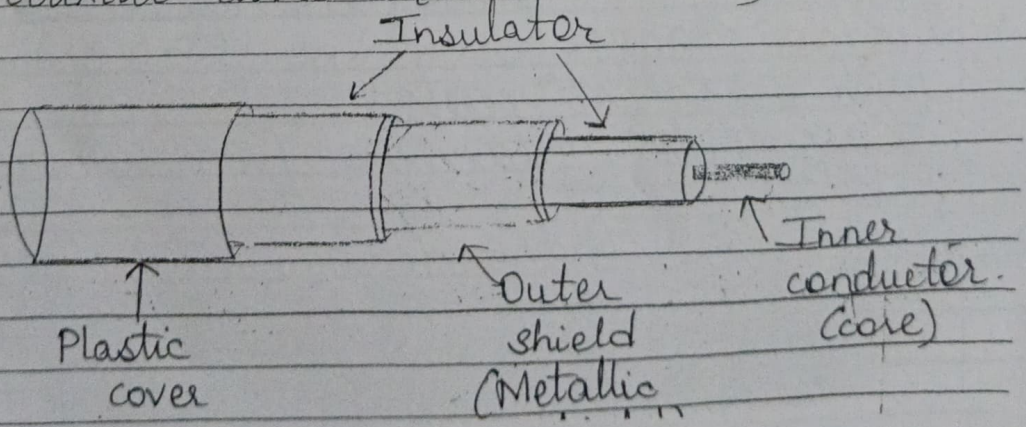


- It is a transmiss^n medium consisting of 2 insulated wires arranged in a regular spiral pattern.
- These characteristics helps to lower the cables susceptibility to noise from neighbouring cables / external sources called crosstalk.
- It supports 10 to 1000 mbps speed.

* Advantages.
① – reasonable cost.
② – easy to add extra network devices.
③ – high speed.
④ – easy to install because of low weight & easy connectivity.

* Disadvantages.
① – signals lose energy due to attenuation so repeaters are required.
② – bandwidth is low.
③ – high attenuation limits individuals 1000 metres.

2) * Coaxial Cable. (co-ax cable)



- Coaxial cable consists of a hollow outer cylindrical conductor that surrounds a single inner wire made of 2 conducting elements.
- One of these elements located in the center of the cable is a copper conductor. Surrounding the copper conductor is a layer of flexible insulation over this insulating material is a copper braid or metallic foil that acts both as the 2nd wire in the circuit & as a shield for the inner conductor.
- This 2nd layer helps to reduce the amount of outside interference & finally covering this sheild is the plastic jacket.
- It supports 10-100 mbps & is relatively inexpensive.

* Advantages
- Lower error rates.
- Greater channel capacity.
- Has a sufficient frequency range to support multiple channels which allows it to use in broadband systems.
4. Inexpensive
5. Easy to wire
6. " " expand

* Disadvantages
- high installation costs.
- susceptible to damage from lightning strikes.
- problems with the deployment architecture.

3) * Fibre Optic Cable.

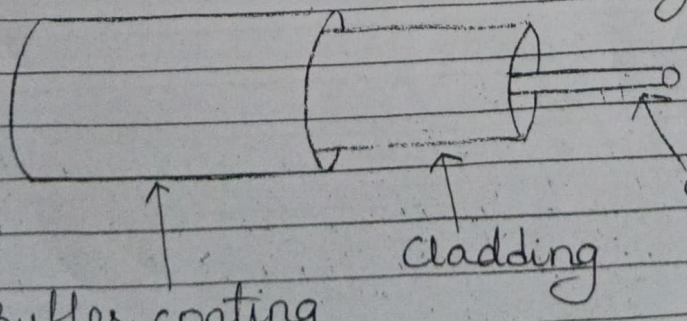
– Fibre Optics are long thin strands of pure glass fibres arranged in the form of bundles called Optical Cables & used to transmit light signals over long distances.

– It consists of 1) Core - Thin glass centre of the fibre where the light travels.
2) Cladding - Outer optical material surrounding the core that reflects the light back into the core.
3) Buffer Coating - Plastic coating that protects the fibre from damage & moisture.

– It is capable of transmitting data at over 100 gbps.

* Advantages

① – ✓ bandwidth is potentially very high.
② – ✓ Data transmiss" rate is high) multiple frequencies like signals can be used to carry massive amt of data.
t – ✓ very good transmiss" technology with no error rates & no interference
(1) – fibre optic cables are much thinner & lighter than metal wire



* Disadvantages.

① – (most expensive) type of cable, network hardware is also very expensive

② – (difficulty to install) these cables due to stiffness of the outer jacket & hardness to bend around corners.

③ – (special skilled trained ppl are required to install these cables)

② Wireless Communication (Unguided Media)
– WC transport electromagnetic waves without using a physical conductor.

eg 1) * Microwaves.
* Microwave is an electromagnetic wave in the frequency range of abt 2 – 40 gHz.
– The receivers for MW signals are usually disc-shaped antennas & usually installed in business locations.

* Advantage:

1) – The main advantage is that building towers is cheaper than laying say cable or fibre, low maintenance cost, low management cost.

* Disadvantage:

1) – The signals from antenna may split up transmit in different ways to different antenna which leads to reduce signal strength.

2) * Radio Waves.
- RW transmit music, conversations, pictures & data invisibly through the air often over few miles.
- RW like visible light, infrared, UV, X rays & gamma rays are electromagnetic waves that do travel through a vacuum.

* Advantages:
① - easy to generate.
② - travel over long distances.
③ - used for communicat" both indoors & outdoors.
④ - relatively inexpensive than wired mediums.

* Disadvantages:
① - subject to interference.
② - less secure mode of transmiss".

3) * Satellite Links.
- It is simply the communicat" of the satellite in space with large no. of Earth stations on the ground.
- Users are the ones to generate signals which is processed at the Earths stat" & then transmitted to the satellite to through diss ..... antennas

* Advantages:

① - The coverage area of the satellite exceeds that of the terrestial system.

② - Higher bandwidths are available for use.

③ - Transmission cost of a satellite is independent of the distance from the centre of coverage area.

* Disadvantages:

① - Launching satellites into orbit is costly.

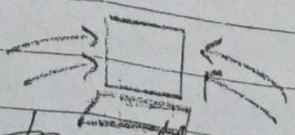
② - There is a larger propagation delay in satellite communication than in terrestial communication.

** Network Devices.

* 1) Modem.

✓ - It transforms a digital bit (DBS) into an analog signal (Modulator) and vice-versa (Demodulator)

✓ 2). Hub



- (It is a device used to collect signals from the input lines & broadcast them in various available connected (nodes around a network).

✓ 3) Repeater.

* - It is a device that connects 2 segments of your network cable.

- It regenerates the signals to proper amplitude & transmits them to the destined segments.

✓ 4) Bridge. LAN
- It is a device that connects 1 LAN to another LAN that uses the same protocol.

✓ * 5) Router.
- It is responsible for connecting 2 different networks using same protocol

✓ 6) Gateway.
- It is a device in the network responsible for connecting 2 different networks using different protocols).
- It can perform the necessary conversions so that the connected networks can communicate properly.

✓ 7) Switch.
- It is a network device which is used to interconnect the computers/devices on a network.

* * Network Topologies.

✓ * Topology
- The pattern of interconnection of nodes in a network is called as Topology.

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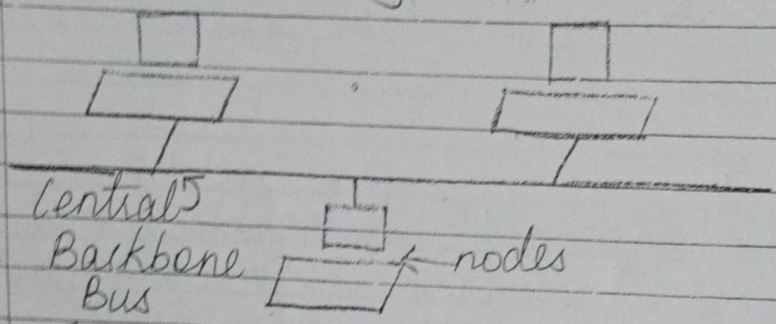
/ * Factors while choosing the Topology.
1. Cost.
2. Flexibility.
3. Reliability.

/ 1. The Bus Topology:



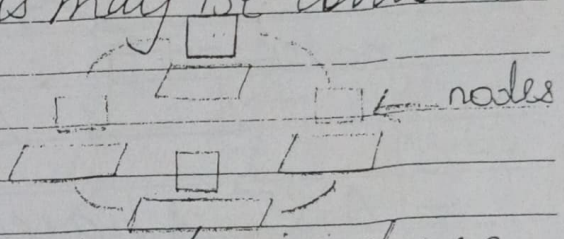
*/- The Bus topology is a series of nodes which are all connected to a backbone.
- Bus networks typically work well for smaller networks & used in smaller organisations.

** Advantages:
1)- Short cable length - because there is a single common data path connecting all nodes. This topology allows a very short cable length.
2)- Simple architecture.
3)- Easy to extract additional nodes can be connected to an existing bus network at any point along its length.

** Disadvantages:
1)- Fault Diagnosis is difficult.
2)- Fault Isolation is difficult - if the

fault in the node is detected the node can simply be removed but if the fault is in the network itself the entire network goes down.

(3) – Collisions may occur – each node of the network is directly connected to the central bus. This means that some way of deciding who can use the network at any given time must be decided at each node. This may use collision in the network.



[2] The Ring Topology:

– A ring topology is circular in shape & every node will have 1 node on either side of it.

– Data is accepted from 1 of the neighbouring nodes & is transmitted onwards to another.

– In a ring network all the messages travel either clockwise / anti-clockwise.

– After passing through each node it returns to the sending node.

– Any damage of the cable or device can result in the breakdown of the whole network.

* Advantages:

① – short cable length required.

② – suitable for optical fibres.

③ – no wiring closet space required.

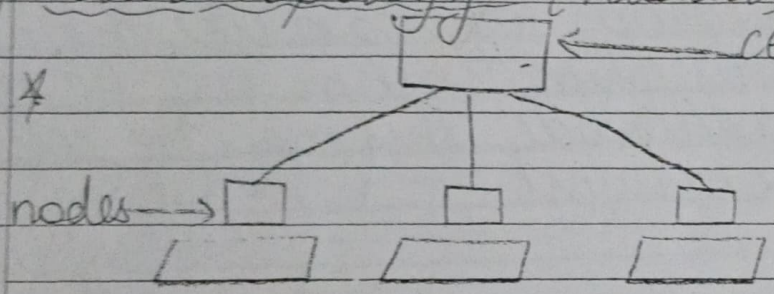
* Mesh Topology - Grp of nodes which are connected to each other. many types of connect^ns are possible in MP.

Page No. 17/12/19

** Disadvantages.

① - node failure causes the entire network to go down.
② - difficult to diagnose faults.
③ - network reconfiguration is difficult.

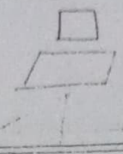
3. Star Topology (Radial)



- AST is based on a central node which acts as a hub.
✓ - All the computers in the ST are connected to a central device & the functionality of all these devices is different.
- In this case, multiple terminals are connected through a host computer.

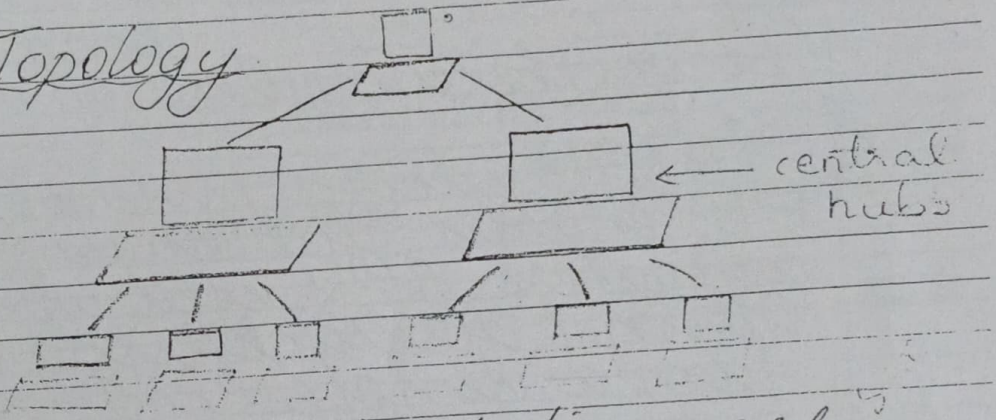
* Advantages
① - 1 device per connect^n - failure of a single connect^n typically involves disconnecting only one node
② - is of service.
③ - centralised control as problem diagnosis.
④ easy to install and wire

Every single node is connected to the other node & most used in WAN.



* * Disadvantages
- long cable length.
(2) — difficult to expand.
(3) — central node dependency - if the central node in a network fails the entire network goes down.

[4] Tree Topology



- combination of Bus & Star Topology
- A TT in which stations are attached to a shared transmission medium.
- Only the hub devices can connect directly with the tree & each hub functions as a root of a tree of network devices.

* Advantages:
(1) — easy to expand - because the tree is divided into sub-units it is easier to add new nodes to it.
(2) — fault isolation — it is possible to easily disconnect all the nodes of the network from the main structure making it easier to isolate a defective

* Disadvantages:
- dependent on the central hub – if the central hub develops a fault the entire network goes down.

* Definations:-
* Protocol
- A protocol is a set of rules that governs the communicat^ns betwn the computers on a network.

* FTP (File transfer protocol)
- FTP enables file sharing betwn the computers. It is used widely on the internet for transfering files to & fro from a remote host.

* HTTP (Hypertext transfer Protocol)
- HTTP is a set of rules/protocols that governs the transfer of hypertext betwn 2 or more computers.

* TCP/IP (Transmiss^ Control Protocol/ Internet Protocol)
- An internet connect^n is usually accomplished using international standards called tcp/ip.
- It is actually a collect^n of protocols that governs the way data travels from one machine to another across networks.

* WWW uses for transmission of protocols.

* TCP
1. Responsible for breaking data into IP packets before they are sent
2. Also responsible for reassembling the packets when they arrive.
3. Verifies that all the packets arrive at their destination.

* IP
1. Envelopes & addresses the data.
2. Enables the network to read the envelope & forward the data to its destination.
3. Defines how much data can fit in a single packet

→ * SMTP (Simple Mail Transfer Protocol)
- It is a protocol for sending email messages betwn servers.
- Most email systems that send mail over the internet use SMTP to send messages from 1 server to another.
- It is generally used to send messages from a mail client to a mail server. Firstly, it verifies the configuration of the computer from where the email is being sent and grants permission for the process. Secondly, it sends out the message & follows the successful delivery of the email. If the email cannot be delivered its returns to the

navneet.com
Page No.:
Date:

sender / bounces back.

* POP (Post office Protocol)
- It is a standard Protocol for retrieving emails.

* Basic Functions.
1. Reading email
2. Deleting / Removing email.
3. Handling email headers.

- It defines a no. of operations for how to access & store email on your server.

* Remote Login / Telnet.
- (1) Telnet is a protocol for remote computing on the internet.
- (2) It allows a computer to act as a remote terminal on another machine anywhere across the network.)
- (4) Remote Login means to connect the network at a remote station.
- (3) A telnet session is established by using a telnet client software. The user requests a session to be established with a remote host by providing its host name / ip address. The telnet client software locates the host over the network & establishes a remote login session to that host.

* Internet related terminologies

1. Internetworking - When more than 2 networks are connected & the data communicat" done across these networks is called as internetworking

2. URL (Uniform Resource Locater)
- The URL specifies the address of a file & every file on the internet has a unique address. It also provides an addressing scheme, which allows the browser to request any document or a web page located anywhere on the internet.

* 3. Web Server.
- A WS is simply a computer with an internet connect" that runs software design to send out HTML pages & other file formats.

4. Web Page.
- A WP is a single unit of informat" often called a document that is available over the WWW.

* 5. Web Browser.
- A WB is a client applicat" that requests, receives & displays HTML pages.

navneet.com
Page No.:
Date: / /

✓6. HTML
- It consists of a set of markup text which are used to describe web pages.

✓7. DHTML (Dynamic HTML)
- It is typically used to describe the combinat" of HTML, style sheets & scripts that allows the documents to be animated.

8. XML (Extended Markup Language)
- It is a specificat" for designing markup language.
- It is a standardised text format for representing structured info on the web.

✓9. Search Engine (google)
- A SE is a collect" of web pages put together in a single website where the users can enter the keyword listing all the websites & webpages consisting of that keyword.

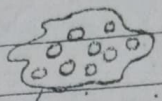
✓10. Internet (global sys inter computer use int protocol)
- It is a collection of different LANS.
- It is an example of WAN. to give users.

✓11. WWW
- It is an internet service based on a common set of protocols which allows a server computer to distribute documents

across the internet in a std way.

✓ 12. Website.
- It is a collection of web pgs belonging to a particular person/organisation.

✓ 13. Cookies.
- They are temporary files containing small bits of information that gets stored in the user's system (in the memory).
- They are placed on the system by the websites visited.



14. Fireball
- A fireball acts as a barrier between the company's network & public network effectively shielding company's computers from malicious activity & controlling the flow of data like (hacking)

15. Cracking.
- It is a method used to break into & violate the system's integrity of remote machines with malicious client having malicious intentions.

✓ 16. Hacking.
- It is a method used to create & modify system's software having unauthorised access.

Adv
- cost
- notifical

*Disadv
- Viruses
- Spam
- depends on network collis

navneet.com Page No.: Date: Items

* Apps of Network

*1. Email:
- An email / electronic mail is the transmission of messages across the network using internet.

2. E-commerce. Flipkart
- It refers to buying & selling of products or services over electronic systems such as internet & other computer networks.

3. ~~Chat~~ Chat Services. Whatsapp
- Chatting is talking to other people using the internet at the same time as that of the others.
- It involves exchange of text messages sent on the other user's address.

4. Use-Net. Blogs
- It is a wide world wide distributed discussion systems / forums which may consist of Newsgroup, Articles / Messages.

5. Video-conferencing.
- It means conducting a conference between 2/more participants at different sites by using a network to transmit audio & video data.

* Client - Server Model
- A server is a network device that provides services to client work stations, to designate a particular node which is at a well known, fixed address, to provide service to the network as a whole.
The node providing the service is known as the server & the nodes which use those services are called as clients of that server. This type of network is called as a CSM.

* Backbone Lines
- The interconnect" of several LANs are connected to each other by bridging them with a central line known as BL.

* ISP (Internet Service Provider)
- It refers to a company that provide internet services including personal & business access to the internet.

* Internet Addressing
- Systematic way to identify ppl, computers & internet resources.

* Firewall
- It establishes a barrier between a trusted, secure internal network and another network (eg. Internet) ie assumed not to be secured

extra

* Disadvantages of Internet

*1. Theft of Personal Information

- You may risk theft of name, add, credit card n. etc. People can access your account & use your personal details for their benefit

2. Virus - Threat.

- Internet users are often plagued by virus attacks on their systems. Virus programs may get activated if you click a seemingly harmless link. Computers connected to Internet are very prone to targeted virus attacks & may end up crashing.

3. Social Disconnect.

- More and more ppl are drifting apart from their friends & family. Even children play online games rather than going outdoors to play.

* Advantages of Internet

1. Faster Communication.

- speedy comm, reliable, fact of see to ppl other side of world, global friendship

2. Social Networking.

- facebk, twitter, find long lost friends, wok 4 job opp

3. Online Services.

- perform all [illegible] [illegible] [illegible] taxes, 4m home.

4. Entertainment.

- Surfing, games, videos, celebrity blogs