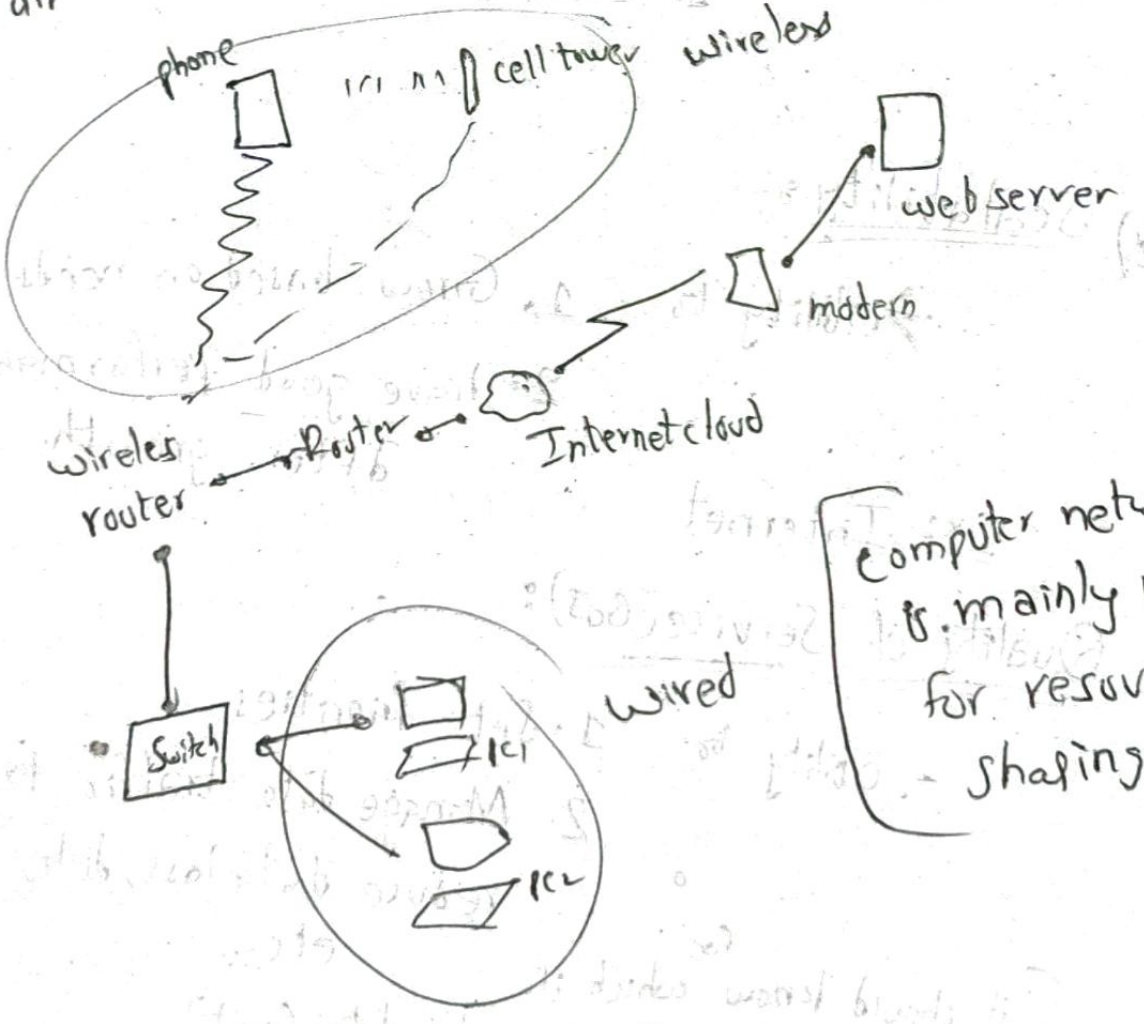
Computer Networks

Computer network:

- is a set of nodes connected by communication links

- A node can be computer, printer or any other device capable of send/reciere data generated by other nodes
- A communication link can be a wired link (or cable) or wireless link.
  - The link carries the information.
  - air



Computer network is mainly used for resource shaping.

END Devices

From above
PC's
Printer
Server
Tablet
phone

Intermediary nodes

Routes
cell phone towers

Lec-2

Basic characteristics of computer network :-

1) Fault Tolerance :-

ability to 1. continue working despite failures
2. Ensure no loss of service.

2) Scalability :-

→ ability to 1. Grow based on needs
2. have good performance after growth.

ex:- Internet

3) Quality of Service (QoS) :-

- ability to 1. Set Priorities
2. Manage data traffic to reduce data loss, delay etc...

(it should know for which it should send data first)

[In real time communication delays are not good like voice phone through internet.]

4) Security

- ability to prevent
  1) Unauthorized access
  2) Misuse
  3) Forgery
- ability to provide
  1) confidentiality
  2) Integrity
  3) Availability

[There should be no modification of data]

Lec-3

Network protocols and Communications (Part-1)

Data Communication

→ exchange of data b/w two nodes via some form of link (ex- cable) or medium.

data flow

1) Simplex
   - unidirectional communication
   ex:- keyboards → monitors

2) half duplex
   - send and recieve but not at same time
   ex:- walkie-talkies

3) full-duplex:-
   - send and recieve both direction communication can happen ↗
   ex:- Telephone.

Protocols

1) All communication schemes will have following things in common

(i) Source (or) sender
(ii) destination (or) recievers
(iii) channel (or) medium

Rules or protocols to govern all methods of communication.

is a set of rules, governs the data communication.

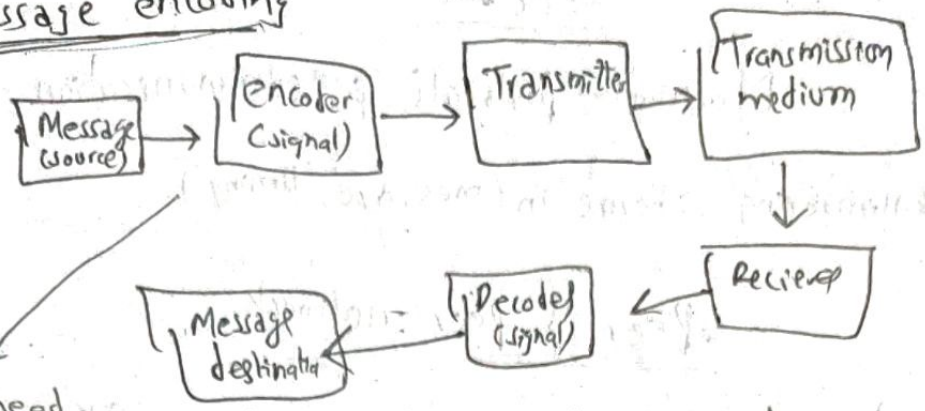
it determines
- what is communicated
- how is communicated
- when is communicated.

In human
1) Identifer, reciever
2) common language, grammer
3) speed & timing of delivery
4) Confirmation

Protocols in network communication.

elements of protocol
1) message encoding
2) message formatting and encapsulation
3) Message timing
4) Message size
5) Message delivary options

1. Message encoding



Y we need ?

because it can be wired → electrical
on air → waves

2. Message formatting and encapsulation:-

- Agreed format (like same language to understand)
- encapsulate the information to identify the sender and reciever rightly. (like adding ip address of its (source's, sender's) information & destination)

(mutually agree on one format)

3. Message size

humans break long messages into smaller parts

longer messages can be break into smaller units for transmission medium to handle.

4. Message Timing:-

Flow control, Respone Timeout.

⇒ likely

⇒ acknowledgement

Sender is very fast reciver is very low for confirmation it tell source how time it should wait for confirmation.

5. Message delivery options:-

1) Unicast — one sender → one reciver

2) Multicast — se → r r (to some of them)

3) Broadcast — s → r r r (to all participants)

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Network protocols & communication - 2

⇒ numbering scheme in (message timing)

Peer to peer network

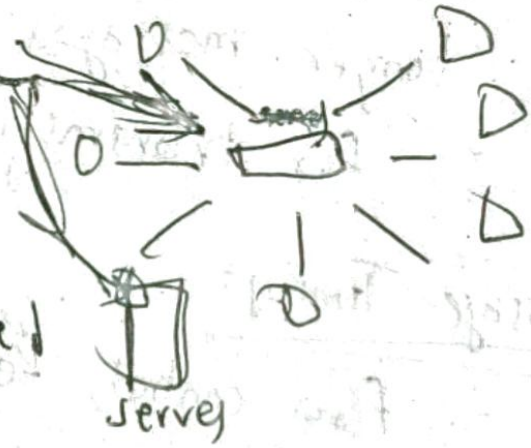
⇒ every node is called peer everyone are same no one are greater (or) less (equal level)

1) No centralized administration
2) All peers are equal
3) Simple sharing applications
4) not scalable

Only for lower data not for greater data.

client server network

1) centralised administration
2) Request-response model
3) Scalable
4) Server may be overloaded



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Components of computer network

1) Nodes → 1) End nodes (or devices)
   2) Intermidiary nodes
2) Media → also called link
3) Services

1) wired medium (Guided medium)
2) wireless medium (unguided media)

Ex: USB cable, Coaxil cable, straight through Ethernet cable, fiber optic cable, ethernet crossover cable.

- for audio/video
- connect different devices
- (universal serial bus) for pc to phone)
- data is carried in form of light waves
- Connect of same device

Wireless medium

1) Infrared (short range communication - TV - remote control)
2) Radio (Bluetooth, wifi)
3) Microwave (cellular system) → phone
4) satellite (long range communication - GPS)

3) Services

- email
- storage services
- file sharing
- online games
- World wide web
- Messaging

etc—

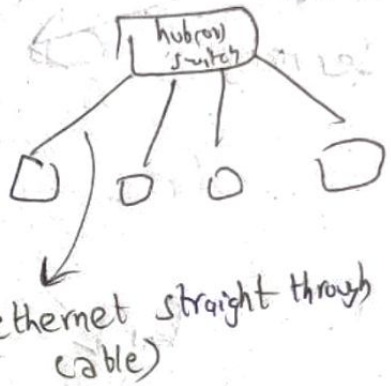
Lec-6

Classifications of computer networks

1) local Area Network (LAN)

a computer network restricted to limited area

that interconnects computers



(ethernet straight through cable)

- (i) wired LAN (ethernet)
- (ii) wireless LAN (wifi)

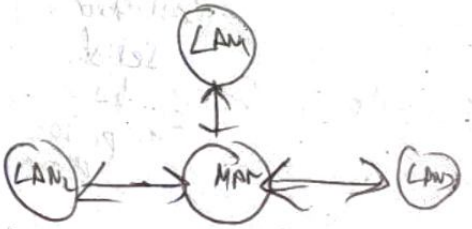
2) Metropolitan Area network (MAN):-

in geographic region (min two LAN's)

1) switches / hub
2) Routers / Bridges

↓

to connect two LAN's



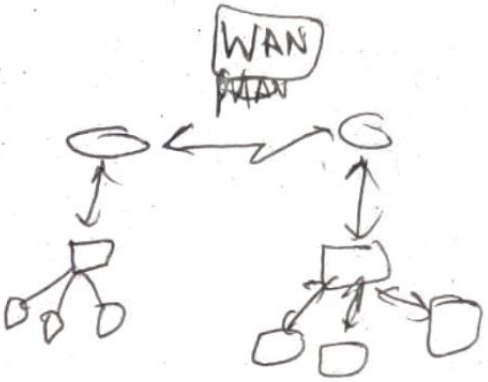
Eg: take as different branches of supermarket

3) Wide Area network (WAN):-

is a telecommunications network that

extents over a large geographical area

(an communication at a distance)



The Internet (wide wan)
(over countries)

New Trends

1) Bring your own Device (BYOD) → connect to office network, college
2) Online collaboration
3) Cloud computing.

Storage Area Network (SAN) :-

cloud computing

- on-demand availability of computer system resources, especially data storage and computing power without direct active management by user.

Lec-7

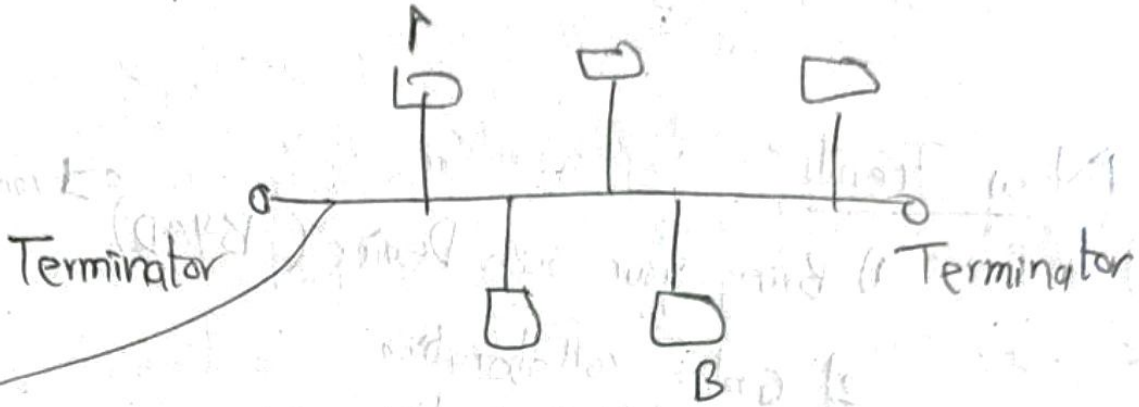
Network Topology

→ Arrangement of nodes of a computer network

Topology = Layout

- Physical Topology – Placement of various nodes (ex: ground floor, 1st floor)
- Logical Topology – Deals with the data flow in the network.

① Bus Topology



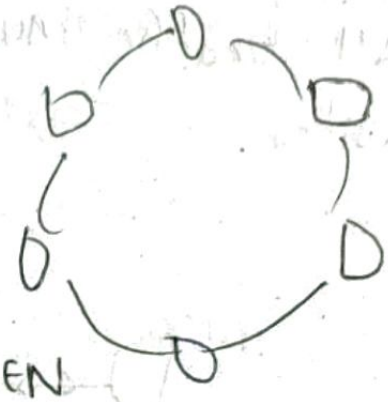
if A sends to B
but data is copied to all.

common transmission medium
(send ⇌ recieve (bidirectional))

Advantages	Disadvantages
1) less expensive (one wire)	Not fault tolerance (wire problem all off)
2) for temperory network.	limited cable length.
3) Node failures does not effect others	No security

② Ring Topology

- is a bus topolgy but in a closed loop
- Peer-to-Peer LAN topology
- Unidirectional
- Sending and recieving data Takes place with the help of TOKEN



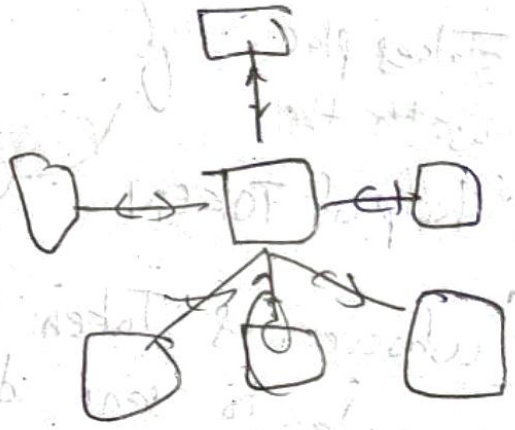
[whoever of Token this is the turn of that node to send data and then token goes to another node.]

Whoever holds Token Help should send data

Advantages	Disadvantages
1) Performance better than Bus topology	Unidirectional - single point of failure effects all.
2) Can cause bottleneck due to weak links	↑ in load - ↓ in performance
3) All nodes equal access	No security

3) Star Topology

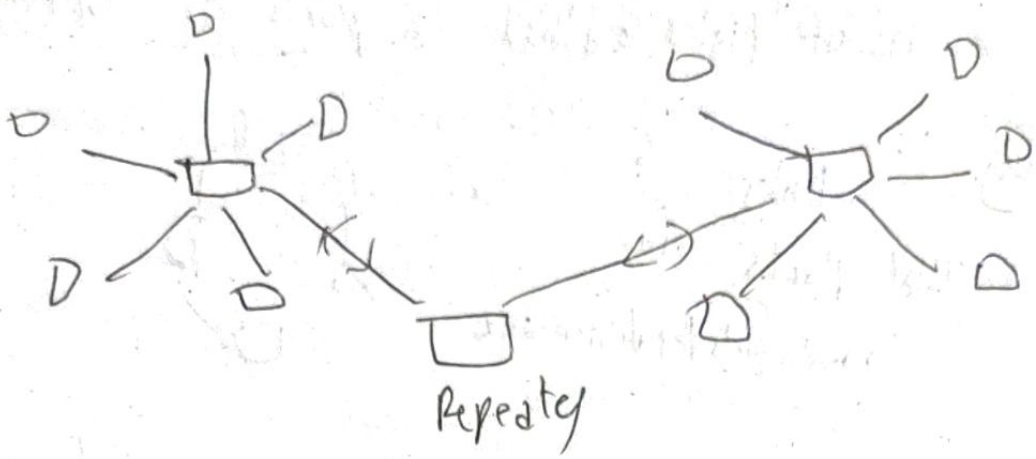
- Every node is connected to a central node called a hub (or) switch
- Centralised Management.
- All traffic must pass through hub (or) switch



Advantages	Disadvantages
1) easy to design and implement	single point of failure affects whole network
2) Centralized administration	Bottlenecks due to overloaded switch/hub
3) Scalable	increased cost due to Switch/hub

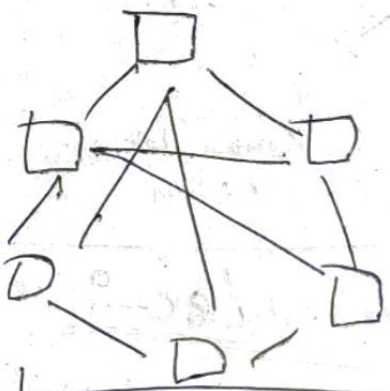
performance

4) Extended star topology



5) Mesh topology

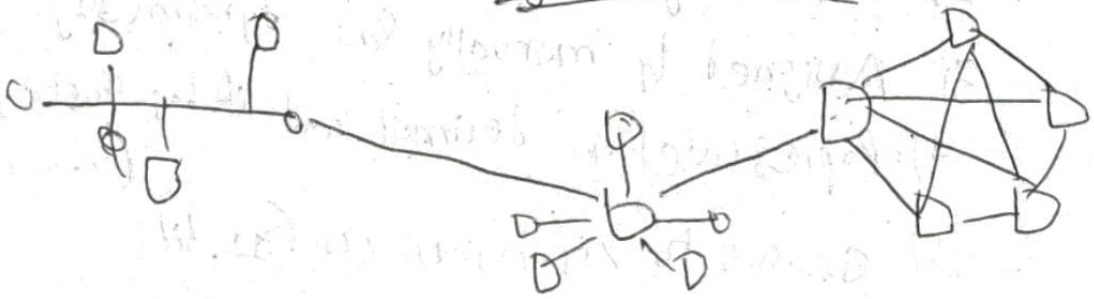
⇒ each node directly connected to every other nodes in the network.



⇒ ~~fault~~

Advantages	Disadvantages
1) Fault tolerance	Issues with broadcasting messages
2) Reliable	Expensive & impractical for large networks

Hybrid Topology



Questions (Lec-8)

no. of links (cables) & ports for Topology.

(Q) links = 6

Total Ports = 12

no. of ports les device = 2

(Q) Traffic problem can be minimized by using?

1) Star ✗ 2) bus ✗ 3) Ring ✗ 4) Mesh ✓

common Transmission medium

Lec-9

Ip Addressing

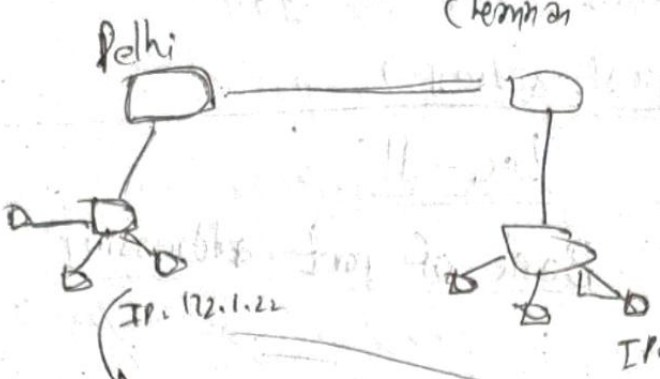
1) Ip stands for Internet protocol.

→ every node in computer network is identified with the help of IP address.

→ IPV4

1) logical address
2) can change based on location of device
3) Assigned by manually (or) dynamically.
4) Represented in decimal and it has 4octets (x.x.x.x)
5) 0.0.0.0 to 255.255.255.255 (32 bits)

Ex2-



if you want this pc to participate in chennai then u want to remove its IP address and give new IP address in chennai regions.

Ex:-

Valid	Invalid IP address
24.25.26.8	16.3.186.256
0.0.0.0	100.2.6.345.456
255.255.255.255	16.2e.45.67

Lec-10

Basic of MAC addressing

Media Access control

→ every node in the LAN is identified with the help of MAC address

→ IP = Location of person (32 bits, decimal) routers
MAC = name of person. (48 bits, hexadecimal, switch

Routers need IP address
Switches need ~~MAC address~~

→ Cannot be changed (unique) in hexadecimal

70-00-EP-84-00-FC (48 bits)

Separator = -, ., :

in windows ipconfig /all

(physical address)

Lec-11

Basic of port addressing

Analogy

Parcel

canada → [ ] → india

(full details)

Reaching our city = Reaching our network (IP add)

Reaching our apartment = Reaching our host (MAC addr)

Reaching right person = Reaching our right process (Port Address)

Port Address (or) Port number

- in a node many process are running
- Data which are sent/received must reach the right process
- every process is a node is uniquely identified by using port numbers
- Port = communication endpoint
- fixed port & dynamic port numbers (0 - 65535)
  - fixed port → 25, 80 etc.
  - dynamic port numbers → or assigned dyn_port_num = 62914

in windows → resmon (resource monitoring)

Before sending the data any node must

1) Attach source → IP, mac, Port addr
   destination → IP, mac, Port addr