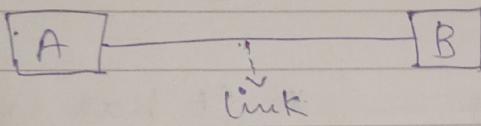


## Basics of Data Communications

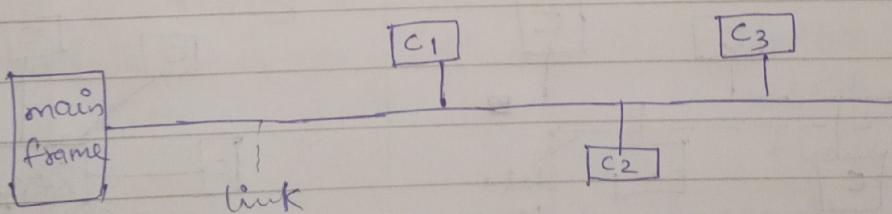
⇒ Line Configuration = (L.C)

- \* It is a method of connecting 2/ more communicating devices to a link.
- \* 2 L.C -
  - a) Point-to-point =
    - \* There are many connections b/w 2 comp.
    - \* When a packet is sent, it first travels from source to many intermediate comp, then reaches to destination.



b) Multipoint =

- \* Also → multidrop configuration.
- \* In this connection 2 /more devices share a single link.



\* 2 types -

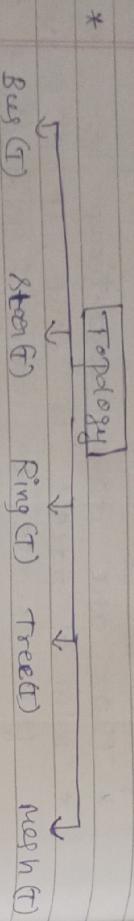
- (i) Spatial sharing → If several devices can share the link simultaneously
- (ii) Time sharing → If users must take turns using the link.

Prob. Compantark connected → node (workstation)

troubleshooting = process of identifying & solving problems that occurs within compantark

## ⇒ Network Topologies =

- \* Topology = It is a specific physical / logical arrangement of the elements of a (n) network (elements → nodes / comp.)



### (1) Bus (T) =

- \* All comp / network nodes are connected to a common (co) medium.
- This medium is a shared wire → Bus
- \* eg →

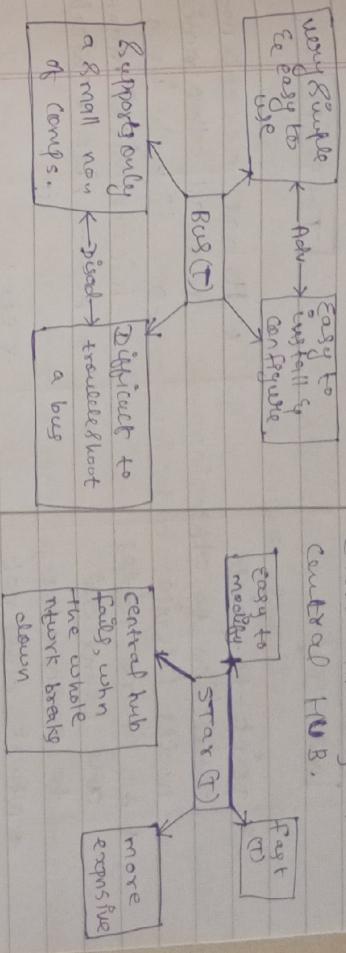
### (2) Star (T) =

- \* It has a server at its center to which all other workstations are connected through a separate path.
- \* eg →

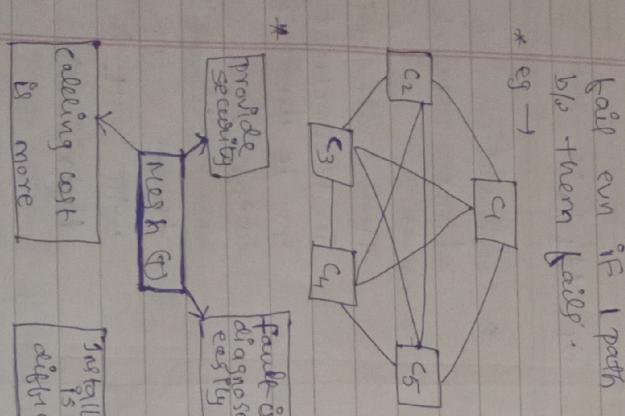
### (3) Ring (T) =

- \* Comp are connected to each other in a closed loop by a single co cable.
- \* transmission is unidirectional
- \* Data is transferred in a sequential manner (i.e. bit by bit).
- \* eg →

### (4) Hybrid (T) =



- \* transmission of data is bi-directional.
- \* only 1 comp can send data on the cable at a time, while 2 comp (co)ing, 911 other comp's remain in receiving comp. wait.
- \* may be combination of tree or star or mesh.

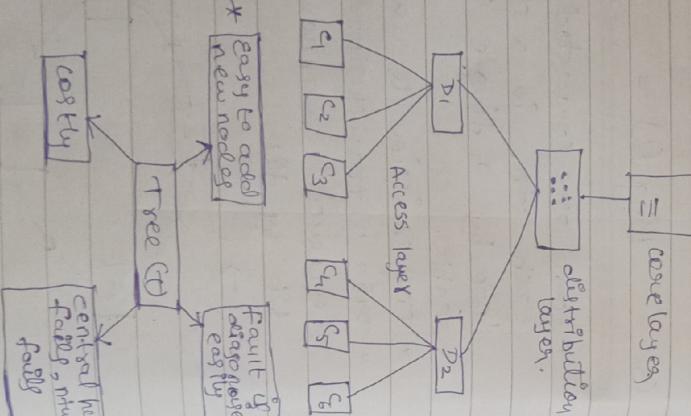


- \* Point-to-point connection to other nodes/devices
- \* All network nodes are connected to each other.
- \* Network does not

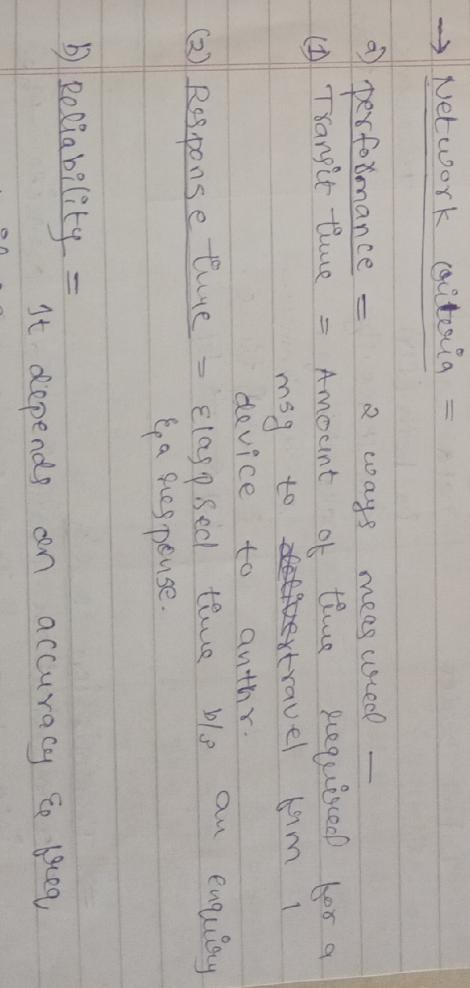
- \* It has a root node and all other nodes are linked in a hierarchical manner
- \* Also → hierarchical

(i).

- \* eg → HTTP, IP | TCP.
- \* defines what is communicated, how is communicated.
- \* eq who is communicated.
- \* (P) defines - [elements of (P)]
- a) Syntax = (what)
- b) Semantics = (how)
  - defining the set of data to be communicated.



- \* e.g. → HTTP, IP, TCP
- \* defines what is communicated, how is communicated
- \* Refers to what is communicated.
- \* who is communicating.
- a) defn - [elements of wpt]
- Syntax = (what)
- b) Semantics = (how)
  - Defining the set of data to be communicated.
  - Specifies interpretation of data that is being sent.
  - Specifies interpretation of data that is being sent.
  - (analysis)
- c) Timing = (when)
  - Refers to transmission rate & durations.
  - dot command will complete a network → (P).



- \* eg → HTTP, IP | TCP.
- \* defines what is communicated, how is communicated.
- \* eq who is communicating.

\* (P) defines — [elements of (P)]

\* Syntax = Defining the set of data to be communicated.

b) Semantics = Specified interpretation of data that is being sent.

c) Timing = (when) before the transmission rate ie duration.

\* common b/w comp on a network → (P).

→ Network Criteria =

- a) performance = 2 ways measured —
- (1) transit time = Amount of time required for a msg to travel from 1 device to another.
- (2) Response time = delay sec time b/w our enquiry & a response.

b) reliability = It depends on accuracy eq freq

→ channel transmission modes = (3 types)

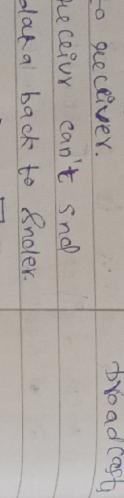
Transmission mode

Def

eg.

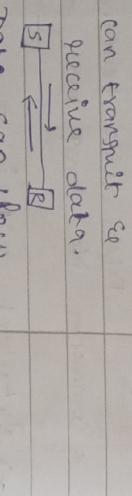
1) Simplex.

Data can only flow  
in 1 dir, from sender  
to receiver.  
receiver can't send  
data back to sender.



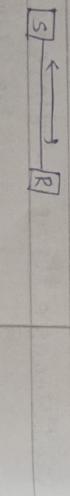
2) Half Duplex

Data can flow in  
both dir, but only  
1 dir at a time.  
Both sides can receive  
and transmit eq  
receive data.



3) Full Duplex

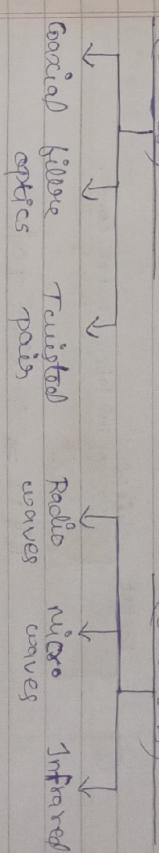
Data can flow  
in both (dir)  
simultaneously  
allowing for  
2-way commu  
in real time.



Transmission media

Guided media  
(wired)

unguided media  
(unguided)



I  
Guided media =

- \* physical medium through which the signal is transmitted
- \* Also → Bounded Media [Bounded, touch or包围着 certain media (wired)]

(a) Twisted pair

Telephone cable.

(b) Fiber optics

- \* Physical medium made up of cables twisted with each other.
- \* 2 wire 26 AWG dimension (diameter)  $\times$  2000 ft length
- \* It is cheap as compared to other transmission media.
- \* Easy installation & long range from  $\rightarrow$  3.5 KHz
- \* consist of 2 insulated cu wires in spiral pattern
- \* fiber is high temp.
- \* commonly used t. media  $\rightarrow$  TV [Twisted pair box]  $\rightarrow$  BLK wire
- \* contain 2 strand parallel to each other, twist name.
- \* uses the concept of reflection of light through a core made up of glass (plastic core & surrounded by a less dense glass) plastic coating  $\rightarrow$  cladding
- \* core can be uni (dir) bi (dir)

- => Transmission media =
- \* communication channel that carries the info from sender to receiver.
  - \* Data is transmitted through electromagnetic signals (carry data over long distance at high speed)
  - \* It is a physical path by transmitter & receiver in data commu

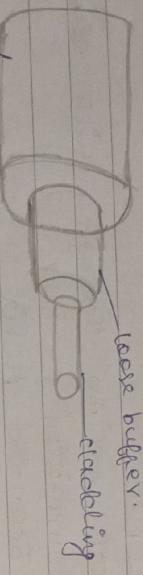
① Insulators

$\text{big} := \Rightarrow \text{Twisted pairs}$

Tacket shield insulator centre cond.

$\text{big : 2} \Rightarrow$  Coaxial Pairs

۱۷



outer jacket

Unguided media =

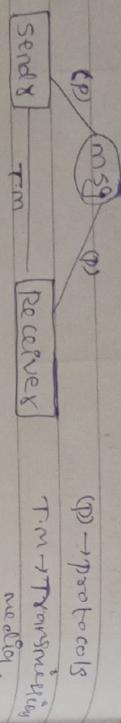
- \* Transmits electromagnetic waves without using any physical medium (wireless)
- \* Also → Unbounded media.

6

$\Rightarrow$  Data communication = Exchange of data b/w 2 or more networked

or connected devices.

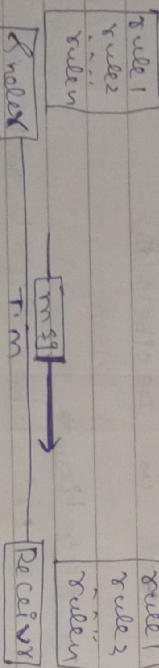
eg  $\rightarrow$



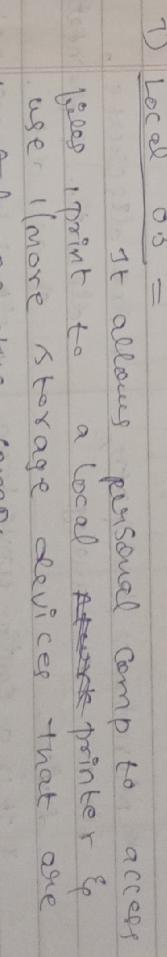
$\rightarrow$  Components of data commu =

- 1) msg
- 2) Sender  $\rightarrow$  person who shared info w/ another person / grp.
- 3) Receiver  $\rightarrow$  they are their audience on that occasion.
- 4) Transmission media  $\rightarrow$  physical path by which a msg travels from sender to receiver.  
eg  $\rightarrow$  Twisted pair wires, coaxial cables.
- 5) protocols  $\rightarrow$  set of rules that governs data commun.

Set of rules ( $\Phi$ )



Set of rules ( $\Phi$ )



$\Rightarrow$  Network =

- \* Set of devices connected by commun. links.
- \* A node can be a comp, printer, any other device capable of sending / receiving data generated by other nodes on the network.

$\Rightarrow$  Encoding & Modulating =

- \* (E) & (M) are 2 imp processes in data commun. that are used to convert digital data into a form that can be transmitted over a commun. channel.
- \* (E)  $\rightarrow$  process of connecting digital data into a specific code for transmission.
- $\rightarrow$  components of network =
- 1) Servers = they are comp. that hold shared files, programs etc at work o.s.

They provide access to network resources to all the users of the network.

2) Clients =

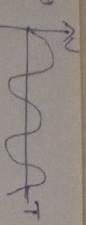
clients / workstations are comp. that access & use the network & shared network resources.

3) transmission media.

4) Shared data = Are the data that file servers provide clients. Such as data files, printers, email & accessed progrms.

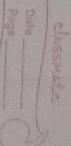
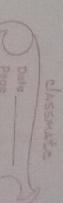
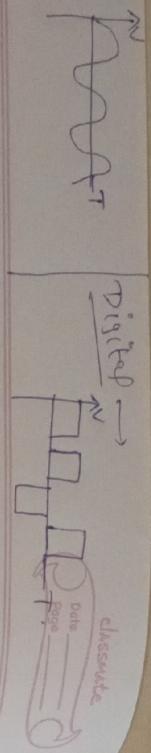
5) NIC = It prepares & sends data, receives data & controls data flow b/w the comp & network.

6) Shared printer & other peripherals = They are hardware resources provided to the users of the network by the servers.

Analog  $\rightarrow$  

Digital  $\rightarrow$  

Digital  $\rightarrow$  



- \* (M)  $\rightarrow$  process of superimposing the encoded digital signal onto a carrier wave.

- \* carrier wave is a high freq. signal that can travel over the transmission channel.

$\rightarrow$

3 types (M) techniques used in data communication

a) Amplitude (M) (AM)

b) Freq. (M) (FM)

c) Phase (M) (PM)

- \* Data can be either in analog / digital.

\*

Data

Digital

Analog

A

D

A

M

(M)

F

(F)

E

C

B

D

A

M

(M)

F

(F)

E

C

B

D

A

M

(M)

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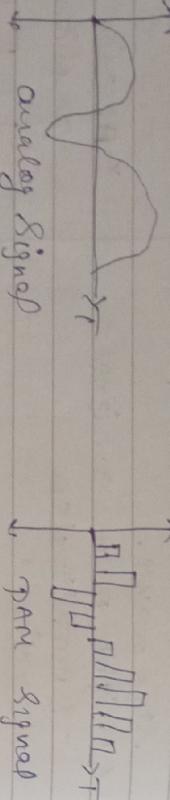
M

(M)

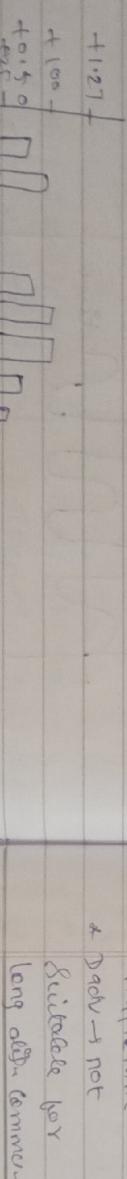
F

Conversion steps =

- 1) Amplitude of analog signal is measured at equal intervals  $\rightarrow$  Sampling to generate a series of pulses, thus process  $\rightarrow$  Pulse Amplitude Modulation (PAM).

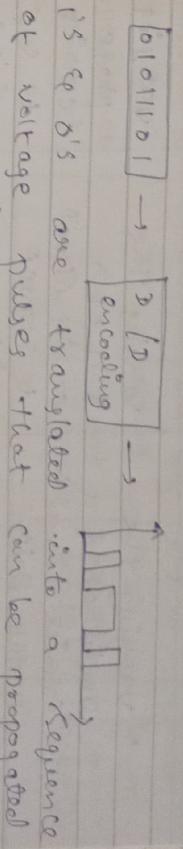


a) Unipolar	Bipolar	(c) Bipolar
* uses only 1 voltage level to represent 0 or 1.	* uses 2 voltage levels to represent 0 or 1.	* uses 3 voltage levels to represent 0 or 1.
* low Signal	* moderate Signal.	* High Signal.
* Adv -> easy to implement	* Adv -> suitable for long dist. comm.	* Adv -> suitable for long dist. comm.
* Draw -> not suitable for long dist. comm.	* Adv -> separate clock signal	* Adv -> separate clock signal



Digital to Digital Conversion

Digital to Digital conversion =



- \* is 0's are translated into a sequence of voltage pulses that can be propagated over a wire.

- b) each value is converted to binary equivalent more we use 8 bits  $\rightarrow$  7 bits for may 8th bit for sign bit (we have 2 methods for conversion)
- c) binary bits are converted to digital signals using any digitization technique:

- a) ASK (Amplitude Shift Keying)
- b) FSK (freq S. k)
- c) PSK (Phase S. k)

# MAC (Media Access Control) → network architecture

unique  
DTE  
Data  
Page

## (a) ASK.

- \* varying frequency
- \* varying amplitude of a carrier signal to represent digital data.
- \* Signal representation is in amplitude form
- \* Bandwidth is high
- \* Noise immunity is low
- \* Application: Remote control

## (b) FSK.

- \* varying the frequency of a carrier signal to represent digital data.
- \* Signal representation is in phase.
- \* Bandwidth is low
- \* Noise immunity is high
- \* Application: Blue tooth, wireless modems

## (c) PSK.

- \* varying the phase of a carrier signal to represent digital data.
- \* Signal representation is in phase.
- \* Bandwidth is low
- \* Noise immunity is high
- \* Application: Satellite TV

⇒ Networking Devices =

- 1) Hub
  - 2) Switch
  - 3) Bridge
  - 4) Repeater
  - 5) Router
- 1) LAN
  - 2) WAN

- 1) Hub
  - 2) Switch
  - 3) Bridge
  - 4) Repeater
  - 5) Router
- 1) LAN
  - 2) WAN
- \* Shoreline connects devices in a network to separate network amplifiers
  - \* Segments of signals in a network to forward data
  - \* provide faster internet speeds than dial-up (m)
  - \* used for high speed internet connections.

- ⇒ DTE - DCE Interface =
- \* DTE (Data Terminal Equipment) refers to any device that originates (or carries) data like comp / printer.

## (d) Modem =

- \* Device that converts digital signals from a computer / other device into analog signals that can be transmitted over a telephone line, cable / fiber commun medium.
- \* Types –
  - a) Dial-up (m) [Digital Telephone Line]
  - b) DSL (m) [Digital Subscriber Line]
  - c) wireless (m)
  - d) satellite (m)

## (e) ISDN (m) [Integrated Services Digital Network]

- \* cable (m) =
- \* used to provide internet access over a cable television network.
- \* typically connected to the cable network through a coaxial cable, which is the same type of cable used to deliver cable TV signals.

## (f) DSL (m)

- \* provide faster internet speeds than dial-up (m)

## (g) Data

- \* Data (Data Terminal Equipment) refers to any device that originates (or carries) data like comp / printer.

## (h) Page

\* DCE (Data circuit-Terminating Equipment) refers to any device that provides a path for data to travel b/w DTEs like modem / switch.

## DTE

- \* originates / receives data
- \* Typically located at the end of communication circuit.
- \* Sends & receives data signals
- \* eg → comp, printers
- \* may be connected to DCE

## DCE

- provides a path for data to travel b/w DTE
- Typically located at the middle of communication circuit.
- Regenerates & amplifies data signals.
- eg → modems, switches
- Always connected to a communication network.