

DATA COMMUNICATION AND OPTICAL FIBRE

classmate

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(data communication → dc)

⇒ components of data communication =

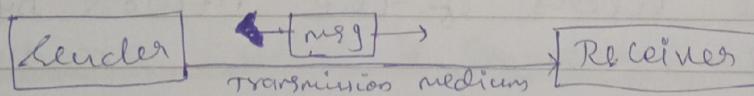
- 1) msg.
- 2) ~~center~~
- 3) receiver
- 4) Transmission medium → It is the physical path by which a msg travels from ~~center~~ to receiver.
eg → Twisted pair ~~wire~~, coaxial cable, fibre optic ~~wire~~ & radio waves.
- 5) protocol → It is a set of rules that governs data communication.

* Set of rules (protocols)

rule 1
rule 2
rule n

Set of rules (protocols)

rule 1
rule 2
rule n



⇒ ~~Network~~ Network → It is a set of devices connected by communication links.

A node can be a comp, printer, / any other device capable of sending / receiving data generated by other nodes on the network.

⇒ Components of network =

- 1) server → They are the comp that hold

Shared files, programs & network os.

- * Servers 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 ~~that~~ as data files, printer accessed program & email

⑤ Network Interface card (NIC) =

It prepares (formats) & sends data, receives data & controls data flow b/w the comp & network.

⑥ Shared printers & other peripherals =

They are hardware resources provided to the users of the network by server

⑦ Local os = It allows personal comp to access files, point to a local printer & use 1/more storage devices that are located on the comp.
e.g. → windows

⇒ Network os (NOS) =

The NOS runs on server that allows the comp to communicate over the network.

Hubs forwards request from others.

- * Hub = It is a device that splits ~~that to~~ a network connection into multiple comp.
 - It is like a distribution center.
 - When a comp ~~sends~~ ^{gets} info ~ from a network / a specific comp, it sends the request to the hub through a network connection.
 - Hub will receive the request & ~~sends~~ transmit it to the entire network.

- * Switch = It is like a hub but built-in with advanced features.
 - It connects devices together on a comp network, process & forward data to the destination device.

- * Router = It is a networking device that forwards data packets b/w diff~ comp networks.

=> Network cables & connectors =

- * cable is 1 transmission media that can transmit communication signals. There are several t. media types including coaxial cable, fibre optic cable, wireless connections, etc

* Repeater =

- It is a communication device that connects 2 segments of the network ~~of~~ connection

- used to extend the network connection length to enlarge networks.
- WAN contains many repeaters.

* Bridge =

- It interconnects 2 networks using same technology.
- It is more sophisticated than a repeater.
- Sometimes it is necessary to divide networks into subnets to reduce the amount of traffic on each larger subnet / for security reason.

* modem =

It is a device that modulates an analog carrier signals (sound) to encode digital info, & that also demodulates such a ^{carrier} signal to decode the transmitted info.

eg → used when a comp communicates with another comp over a telephone network.

* wap (wireless access point) =

- They are a transmitter & receiver device used for wireless LAN (WLAN) radio signals.
- It is typically a repeater network device with a built-in antenna, transmitter & adaptor.
- It ~~is~~ also typically has several ports allowing ~~the~~ a way to expand the

network to support additional clients.

→ **protocols** = (P)

- * communication b/w comp on a network are defined by protocols.
- * Network (P) are formal standards & policies comprised of rules, procedures & formats that define communication b/w 2 or more devices over a network.
- * Network comps run a series of protocols
→ (P) stack.

→ **Firewall** =

- * It is a networking device either hardware / software based that controls access to the network.
- * This control access is designed to protect data & resources from outside threats.

⇒ **Network Criteria** =

- a) **performance** = it can be measured in many ways -
 - * **Transit time** (msg delivery time)
 - * **Response time** (querying & response time)
- **Transit time** is the amount of time required for a msg to travel from 1 device to another.
- **Response time** is the elapsed time

data of transmit → transmission media

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b/p an enquiry & a response.

D) Reliability =

- a. of a network depends on accuracy, freq. of failure.
- C) Security = It includes protect from unauthorized access.

⇒ ~~Protocol~~ Network standards & (?) =

* Elements of protocols =

a) Syntax = Refers to the str / format of the data, meaning the order in which they are presented.

b) Semantics = The word s. refers to the meaning of each section of bits.

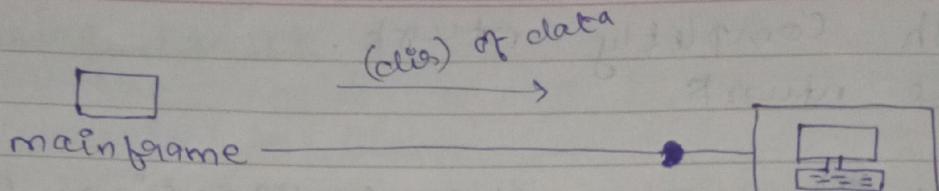
c) Timing = refers to 2 characteristics :
when data should be sent & how fast they can be send.

⇒ Channel transmission modes =

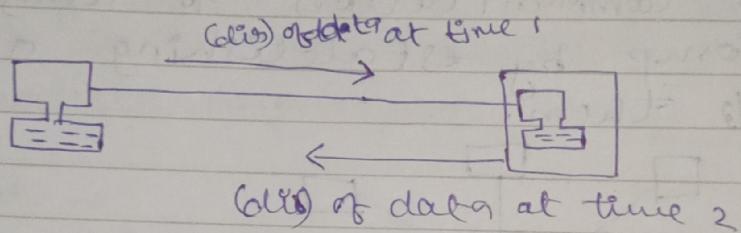
3 types of c.t. modes →

a) Simplex = Communication is unidirectional, as on 1 way street only 1 of the 2 devices on a link can transmit the other can only receive.

• Keyboards & traditional monitors are eg of s. devices.

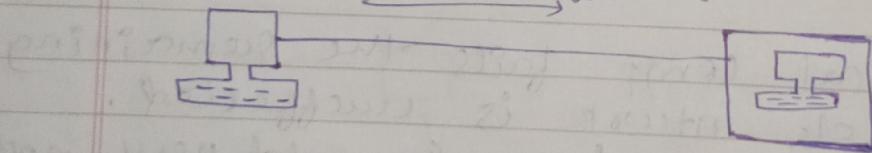


b) Half duplex = Here, each station can both transmit & receive data.



c) Full duplex = Here both stations can transmit & receive simultaneously.

(dis) of data all the time.



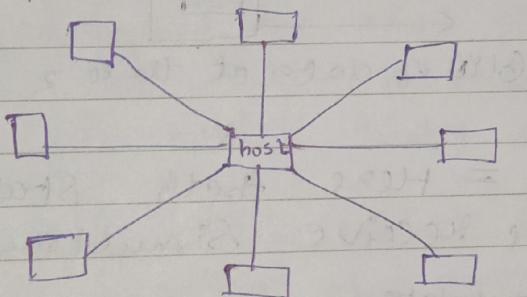
=> Network Topologies = (T)

- * Term topology refers to the way in which the individual comp. → nodes of a network are linked together.
- * Diff types of (T) are -

- 1) Star network =
- 2) Ring network
- 3) Bus network
- 4) Completely connected network.

- 5) mesh completely network.
 6) Tree network

1) Star (N) = The star configuration of network consist of a central node \rightarrow host, to which all other nodes are connected by a single path, the routing (R) is performed by the central comp, which centrally controls communication b/w any 2 local comp by establishing a logical path b/w them.



Adv

- * If any local comp fails the remaining portion of network is unaffected.
- * It is easy to modify & add new nodes to a star network without disturbing the rest of network.

Disadv

- * The system if the central comp fails the entire network fails.
- * Each device requires its own cable segments.
- * Installation & configuration is difficult.

2) Ring network =

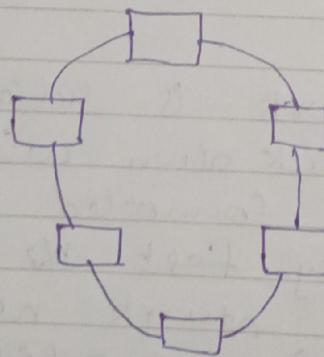
- * All the nodes in a network are connected in a closed circle of cable (i.e.) the configuration is a ring arrangement of communicating nodes & there is no controlling in the network.

* Adv →

- * A ring is relatively easy to install & reconfigure.
- * Link failure can be easily found as each device is connected to its immediate neighbours only.

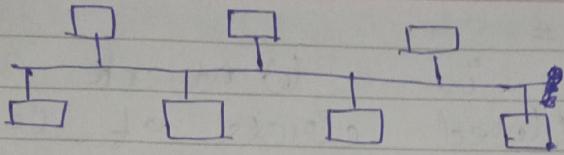
* Disadv →

- * Max ring length & no. of devices is limited.
- * Adding / removing nodes disrupts the network.



3) Bus network =

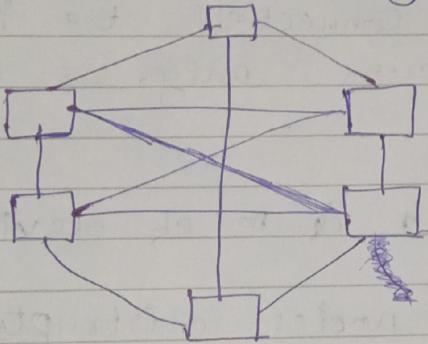
- * Here, nodes share a single common channel.
- * Each node has a unique address.
- * All nodes will receive a msg, & it only the address node will respond.



~~Data is signals~~

4) Completely connected network =

- * Has separate physical link for connecting each node to any other node



Adv →

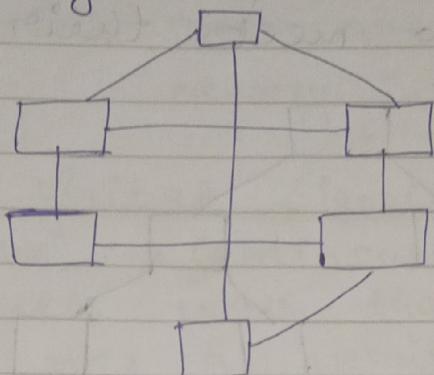
- * This type of network is reliable, -
As any line break down will affect only common of the connected comp.
- * Common is very fast b/w any 2 nodes.
- * Each node of network need not have individual routing capability.

This is adv →

- * It is the most expensive system from the point of view of line cost.
- * Large amount of cabling & higher I/O ports required.
- * Difficult in installation.
- * Difficult to reconfigure.

5) mesh network =

- * Here, each node is connected more than 1 node to provide alternative routes in case the node is either down or the node is busy.



Adv →

- * Dedicated links b/w nodes ensure optimum data ~~usage~~ rate & less traffic prob.
- * Better privacy & security.
- * Failure of any will not cause failure of entire network.
- * Point to point links makes fault identification & fault isolation easy.

Disadv →

- * Large amount of cabling & I/O ports required.
- * Difficulty in installation.
- * Difficult to configure.

6) Tree network =

$$(Star + Bus = Tree(N))$$

- * Also → hierarchical Topology / tree topology.
- * It is a combination of bus & star topologies.

- * Term analog data refers to info that's contin.
- * Digital data refers to info that has discrete states.

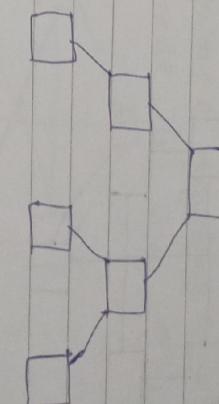
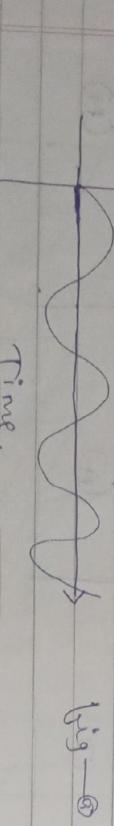
* Analog → e.g. → Sound.

* Digital → e.g. → Data are stored comp memory in the form of 0 & 1's.

b) Analog to Digital Signals =

* Analog Signal → continuously varying electro magnetic wave that can carry info propagated over a variety of media.

value



Adv →

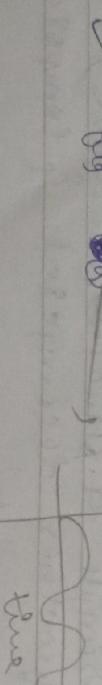
- * point to point wiring for individual segments.
- * Supported by ~~several~~ hardware & software vendors

Disadv →

- * If the backbone line breaks the entire segments goes down.
- * More difficult to configure if wire than other topologies.
- * overall length of each segment is limited by the type of cabling used.

⇒ Data to Signal =

a) Analog to Digital Data =

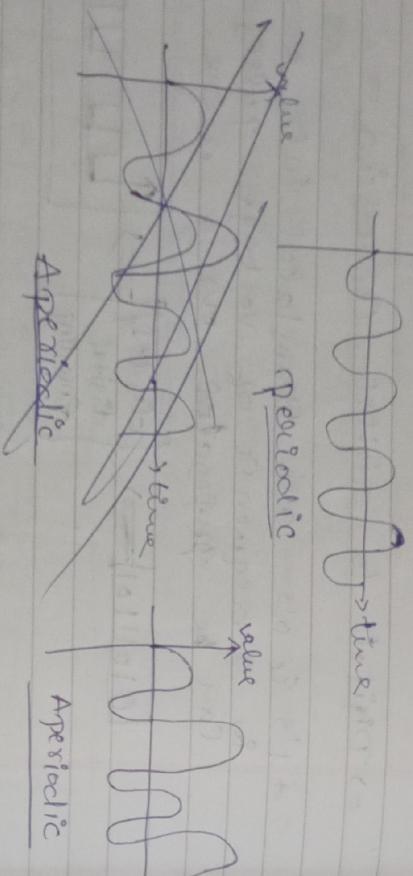


- * It consists of GPS at config cables connected to a linear bus back bone cable.
- * It allows for the expansion of an existing network to enable to configuration a network to meet their needs.

- can be decomposed to multiple sinewaves.
 * True height of a signal \rightarrow Amplitude
 * freq exposure to the no. of cycles in 1 sec.
 * period & freq are inverse of each other.
 * A periodic signals changes constantly without creating a pattern.

value.

(have order)

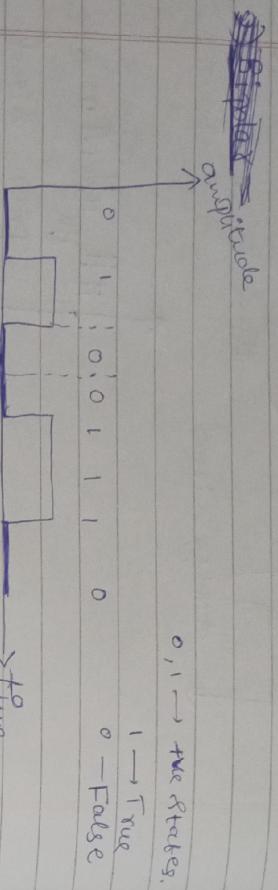


- \rightarrow Digital Signals =
- * Digital data is always discrete, always contains representation of any data/info.
 - * bit interval refers to the time taken to send a single bit.
 - * Bit rate refers to the no. of bits interval as per sec. now of bits send in 1sec.
 - * Comp., CD's, DVD's are true eg.

 \rightarrow Analog Signals =

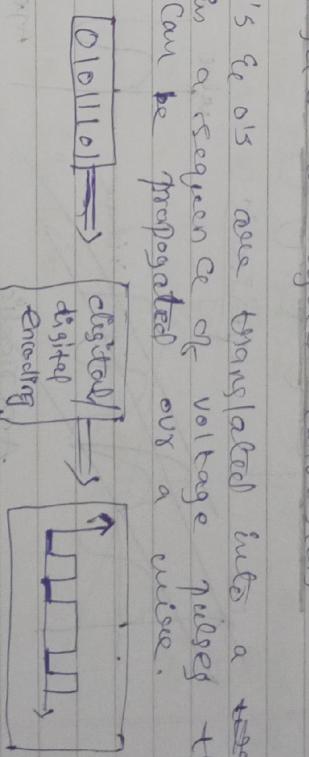
- * microphones, loudspeakers, headphones are the analog devices.
- * It is a continuous wave form that changes over time.
- * Both analog & digital signals can be periodic / aperiodic.
- * In a periodic signal, a pattern is repeated over same time interval.
- * A single full pattern \rightarrow cycle. Eg. wave taken for one cycle \rightarrow periodic
- * It can be simple / composite.
- * Simple a. signals \rightarrow (sin wave) cannot be further decomposed if composite owing

usually 1 & 0 occur is represented by 0 & 1 voltage.

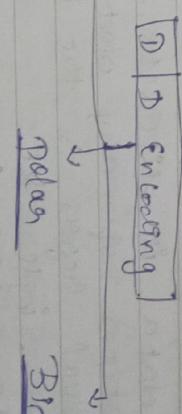


⇒ Digital to digital conversion =

* It's code are translated into a sequence of voltage pulses that can be propagated over a wire.



* 3 methods D → D conversion are available.

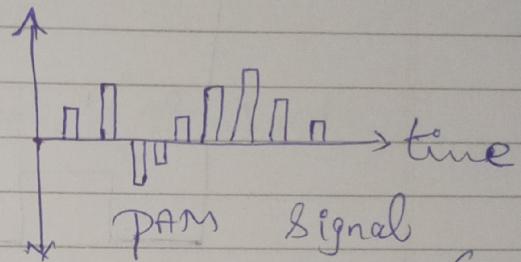
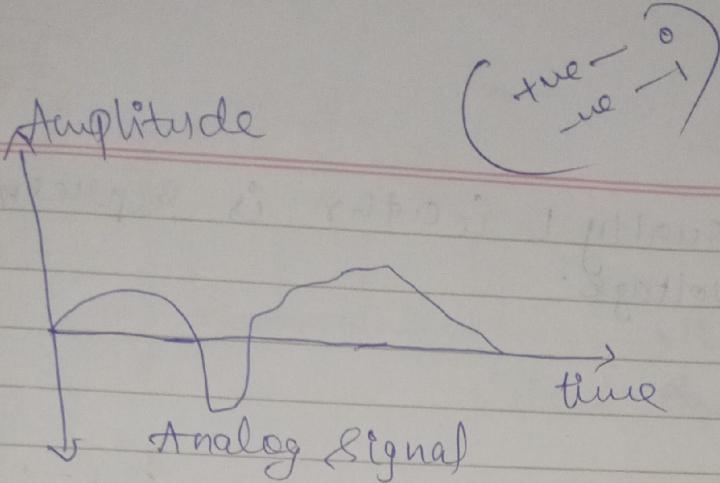


Polar

Bipolar

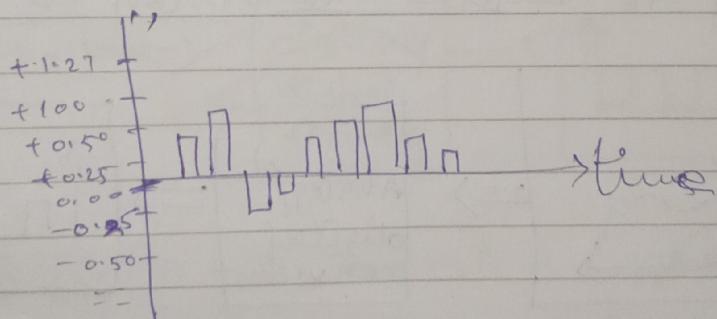
* Conversion steps →
1) Amplitude of the analog signal is measured at equal intervals → Sampling
To generate a series of pulses, thus process → Pulse Amplitude Modulation (PAM)

1) Unipolar = *polarity of a pulse represents whether it is true or false.
* unipolar Encoding uses only 1 polarity (e.g either true or false voltage represents 1 of the 2 binary states,



- 2) Next process of pulse code modulation (PCM) which includes the following procedure -
- Integral values in a specific range are assigned to the PAM pulses.

This process → Quantization



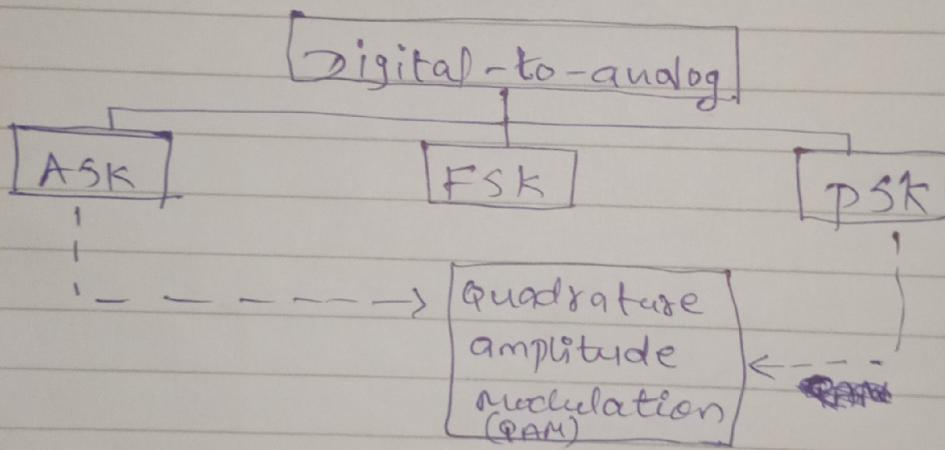
- each value is converted to binary equivalent. (no. of bits depends on the level of precision needed) Here we use 8 bits, 7 bits for magnitude & 8th bit for sign (+ve → 0, -ve → 1)

- Binary bits are converted to digital signals using any digital-to-digital conversion technique.



⇒ Digital to analog Conversion :-

- * Some transmission media like optical fibres & unguided media will only propagate analog signals.
- * There are 3 modulating techniques -
- 1) Amplitude Shift keying (ASK)
- 2) Frequency " " (FSK)
- 3) Phase " " (PSK).



(1) ASK :

Here, the amplitude of the carrier signal is varying to create signal elements both freq & phase remains constant while the amplitude changes.