CHAPTER 1

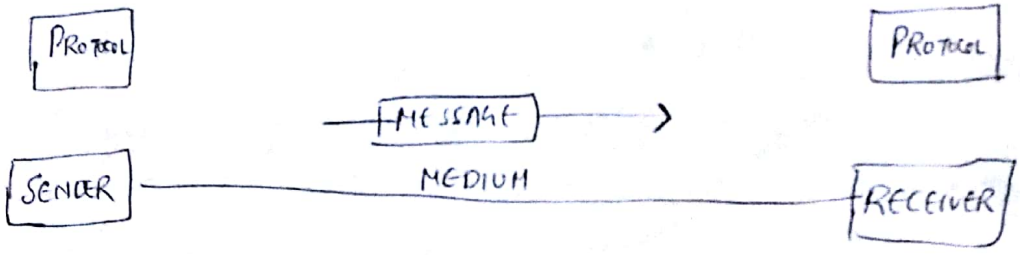
NETWORKING - Interconnection of two or more devices for sharing infor^n. Sharing can be local or remote.

DATA COMMUNICATION - Exchange of digital data b/w two devices via some form of transmission medium such as a wire cable.
For data communication to occur, the communicating devices must be part of a communication system made up of hardware & software.

For effective data communication, system depends on 4 Fundamental Characteristics

1. **Delivery** - data must be delivered to the correct destination
2. **Accuracy** - Accurate data should be delivered. No alteration in data
3. **Timeliness** - System must deliver data in a timely manner.
4. **Jitter** - refers to the variation in the Packet arrival time. uneven delay in the delivery

COMPONENTS OF DATA COMMUNICATION



a) **Message** - Message is the information (data) to be communicated. Can be text, numbers, Pictures, audio & video

b) **Sender** - is the device that sends the data message. It can be computer, workstation, telephone handset, video camera & so on

c) **Receiver** - is the device that receives the message

d) **Transmission medium** - is the physical path by which message travels from sender to receiver

Example - Twisted pair cable, Co-axial cable, fibre optic cable & radio waves

e) **Protocol** - is a set of rules that govern data communication

Data representation

① **TEXT** - Text is represented as a bit Pattern, a sequence of bits (0's or 1's)

② **Numbers** - also represented by bit Pattern.

③ **Images** - Images are also represented by bit Pattern. An image is composed of a matrix of Pixels where each pixel is a small dot.

After an image is divided into pixels, each pixel is assigned a bit Pattern

④ **Audio** - recording or broadcasting of Sound or Music. It is Continuous not discrete

⑤ **Video** - Moving Frames

DATA FLOW

Communication b/w Two devices can be simplex, half duplex or full duplex.

Simplex Mode – Communication is unidirectional only one of the two devices on a link can transmit, the other can only receive

Example – keyboards & monitors

b) Half duplex Mode – each station can both transmit & receive but not at the same time

when one device is sending, the other can only receive & vice versa

Example – Walkie-talkies

c) Full duplex Mode – (duplex) both stations can transmit & receive simultaneously

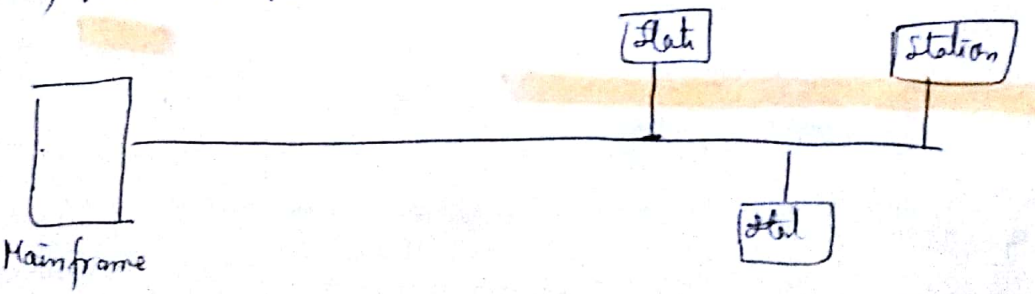
Example – Cell Phones

TYPES OF CONNECTIONS

① Point-to-Point – Provides a dedicated link b/w two devices. Most point-to-point connections use an actual length of wire or cable to connect the ends.

Example – Infrared control uses infrared waves to establish point to point connection b/w remote control & television

a) Point-to-Point

② 

Multipoint (Multi drop) connection is one in which more than two specific devices share a single link

Multipoint environment

SPATIAL
when several devices use link simultaneously

TIMESHARED
∴ If users take turns, it is time shared connection

NETWORK DEVICES

① HUB ② SWITCH ③ ROUTER

HUB - . It is a physical layer device . Works with broadcasting
. Works with shared bandwidth
(divided 100 mbps bandwidth equally to suppose 4 comp in equal range)
. Dummy device (does not learn MAC address)

SWITCH - It is a full duplex device it can receive & send simultaneously
. works with fixed bandwidth . Maintains MAC address

Earlier - To connect two computers Cross cable with Lan card was used but what if there are n no. of computers - SWITCH

Command used to check MAC address

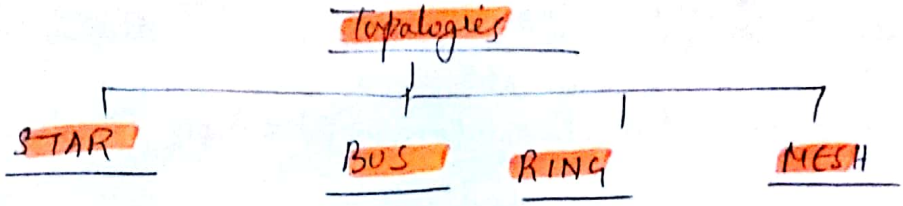
Switch # Sh Mac-add
Sh Mac-address-table

. Port type
8 Port, 16 Port, 24 Port, 48 Port

. operates on data link layer

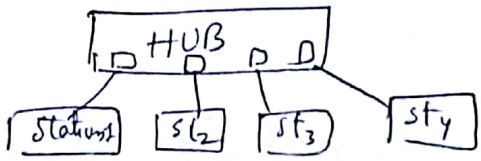
PHYSICAL TOPOLOGIES

- Refers to the way in which a n/w is laid out physically.
- The topology of a n/w is the geometric representation of the relationship of all the links & linking devices (nodes) to one another.



① **STAR TOPOLOGY** - each device has a dedicated point-to point link only to the central controller usually called a hub

- Devices are not directly linked with each other

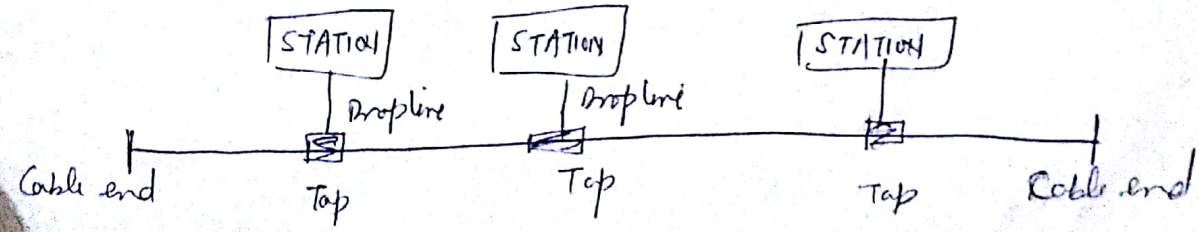


- less expensive than Mesh topology
- Each device needs only one link & one I/O Port.
- If one link fails, others are not effected.

Disadvantage - If hub goes down, the whole system is dead

Application area - used in high speed LANS

② **BUS TOPOLOGY** - It is a multipoint connection. one long cable acts as a backbone to link all the devices in a n/w



Tap - a connector

Dropline - connection running b/w device & main cable.

Advantage - (1) Ease of installation

(2) Less cabling than mesh or star topologies. only backbone cable stretches through entire facility.

Disadvantage - (1) Difficulty in reconnection & fault isolation

(2) Signal reflection at the taps can cause degradation of quality.

(3) Fault or break in bus cable stops all transmission.

Less Popular now

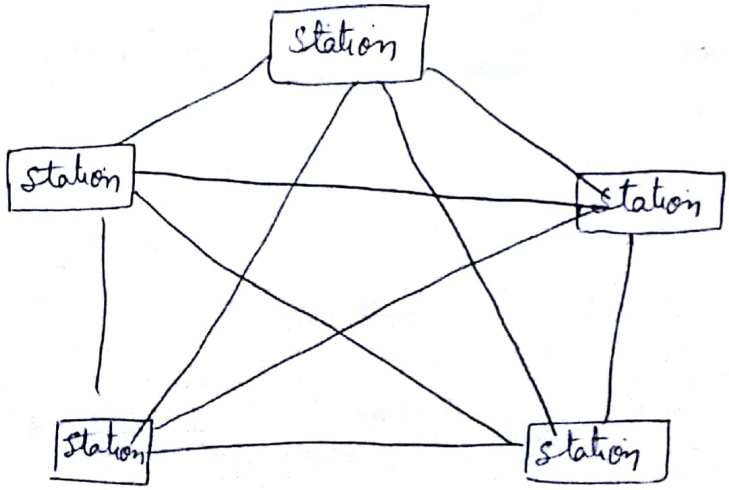
(3) MESH TOPOLOGY - Every device has a dedicated Point-to-point link to every other device.

↓ means that the link carries traffic only b/w the two devices it connects

To find the no, of physical links in a fully connected mesh n/w with n nodes

$$n(n-1)$$

$$\frac{n(n-1)}{2} \rightarrow \text{For duplex mode}$$



Advantages -

① Use of dedicated links guarantee that each connection can carry its own data load thus eliminating Traffic Problems

② Second, Mesh topology is robust, if one link becomes unusable, it does not Paralyze the entire System

③ Advantage of Privacy & Security when every message travels along a dedicated line, only the intended recipient sees it

④ Point to Point links make fault identification & fault isolation easy

Disadvantage

① Amount of cabling & no, of I/O Ports required.

② Installation & reconnection are difficult

③ Hardware requirement to connect each link (I/O Ports & Cables) can be expensive

Example - Connection of Telephone regional offices in which each regional office needs to be connected to every other regional office.

④ RING TOPOLOGY - . Each device has a dedicated point-to point connection with only the two devices on either side of it

. A Signal is passed along the ring in one direction from device to device, until it reaches its destination.

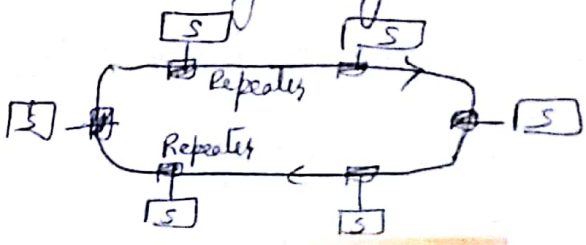
. Each device in the ring incorporates a repeater, for regenerating the bits & passes them along

Advantage – ① A ring is relatively easy to install & reconfigure. Each device is linked to only its immediate neighbours

② Fault isolation is simplified. If one device does not receive a signal within a specified period, it can issue an alarm. The alarm alerts the n/w operator to the problem & its location.

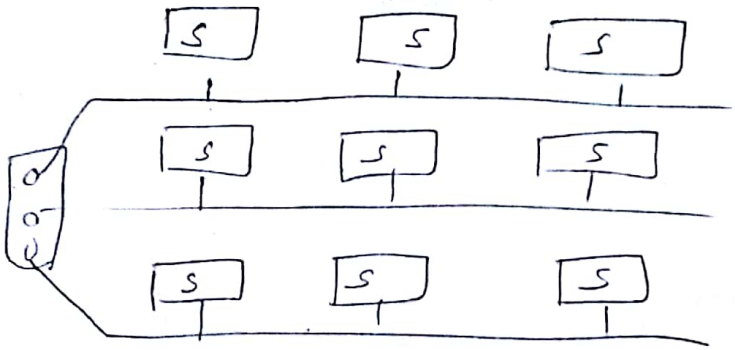
Disadvantage – ① Unidirectional traffic can be disadvantage

② A break in the ring (a disabled station) can disable the entire n/w. This weakness can be solved by using a dual ring or a switch capable.



HYBRID TOPOLOGY

(Combination of Star & Bus Topology)



PROTOCOLS & STANDARDS

RULES — agreed-upon rules (rules agreed by the sender & receiver)

Protocols – Set of rules that govern data communication. A Protocol defines what is communicated, how it is communicated & when.

KEY ELEMENTS OF A PROTOCOL

(1) **SYNTAX** - refers to the structure or format of data.

Example - In a simple Protocol might expect the first 8 bits of data to be the address of sender, the second 8 bits to be the address of the receiver & the rest of the stream to be the message itself

(2) **SEMANTICS** - meaning of each section of bits. Is the particular pattern interpreted & what action is taken based on that interpretation.

(3) **TIMING** - refers to two characteristics

- when data should be sent
- How fast they can be sent.

Example - If sender produces data at 100 MBPS but the receiver can process data at only 1 MBPS, the transmission will overload the receiver & some data will be lost.

STANDARDS

- Essential in creating & maintaining an open & competitive market for equipment manufacturers & in guaranteeing national & international interoperability of data & telecom technology
- Provide guidelines to manufacturers, vendors, govemnt agencies & other service providers to ensure kind of interconnectivity in marketplace.

Data Communication Standards Category

De-facto

Standards not approved but by an organized body but have been adopted as standards

De-jure

Standards that have been legislated by officially recognized body.

STANDARD ORGANIZATIONS

1. ISO – (International Organization for Standardization)

ISO is active in developing cooperation in the realms of scientific, technological & economic activity.

2. IEEE (Institute of Electrical & Electronic Engineering) – largest Professional engineering Society in the world.

It looks after the development & adaption of international standards for computing & communication

3. ANSI – (American national Standards institute) – Private & non Profit Corporation.