Unit I :-

Introduction to Data Communications

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Date.

* Data Communications :-

Communication means sending & receiving data betn 2 people or nodes, where one acts as a sender & another is the receiver. Nodes are the computers that participate in the communications. More than 2 computers can be involved.

* Data :-

Data is unorganized facts and figures. It is raw, unstructured and lacks inherent meaning on it's own.

Example :- numbers, characters, symbols, text, images, audio recording, etc.

* Information :-

Data that has been processed, organized, structured to provide context & meaning. It is organized and carries context.

Example :-

A report summarising sales figures, A graph showing customer demographics, A news article or a weather forecast.

* Bandwidth :-

It is a difference between highest frequency and lowest frequency of the communication channel.

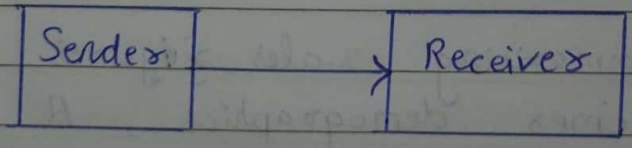
* Data Rate (Bit Rate) :-
Number of bits transmitted per second is called as data rate or bit rate.

* Components of DC :-

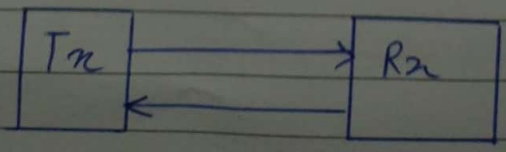
1) Message
2) Sender / Transmitter
3) Receiver
4) Medium / Channel
5) Protocols

* Types of Communication :-

1) Simplex Comm^n :-
i) In this comm^n, sender is transmitting its information & receiver will receive information.
ii) This is unidirectional comm^n.
iii) Ex :- TV, Radio, etc.



2) Half Duplex Comm^n :-
i) In this comm^n, both devices transmit its information on comm^n channel but one at a time.
ii) This is bidirectional Comm^n.
iii) Ex :- Email, Walkie-Talkie, etc.

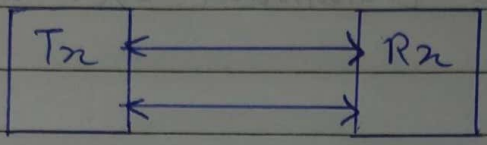


3) Full Duplex comm^n :-

i) In this comm^n, both devices (Tx & Rx) will transmit data at a time.

ii) This is bidirectional comm^n.

iii) Ex:- Mobile comm^n, video calls, satellite comm^n, etc



* Data Representation :-

** * Characteristics of Data Communication :-

1) Delivery :-
Data is delivered accurately & reliably to the intended receipent.

2) Accuracy :-
Data is transmitted accurately, without errors or corruption.

3) Timelineness :-
Data is delivered in a timely manner, meeting the requirements of the application.

4) Integrity :-
Data is protected from unauthorized access, modifications, or deletion.

5> Jitter :-
Variations in delay between packets, affecting real time applications.

6> Throughput :- (Data Rate / Bit Rate) :-
The amt. of data transmitted over a network in a given time

7> Latency :-
The time it takes for data to travel from sender to receiver.

* Data Representation :-
It refers to the format & structure of data being transmitted over a network. It's essential for ensuring that data is accurately interpreted by the receiving device.

* Types of DC :-

1> Analog :-
Continuous signal representing physical measurement.

2> Digital :-
Discrete signal representing binary data (0 & 1).

3> Text :-
Represented using character scheme, like, ASCII or unic code.

4) Numbers :-
Represented in binary, decimal, hexadecimals formats.

5) Images :-
Represented using px value, color depth, compration algorithm.

6) Audio :-
Represented using digital signal processing, sampling rates, compration algorithm.

7) Video :-
Represented using combination of Image & audio representation.

** * Network Topology :-
It refers to the physical or logical arrangement of devices, nodes within a network. It defines how devices communicate & exchange data.

* Types of Network Topologies :-

1) Bus topology :-
A single cable connects all devices.

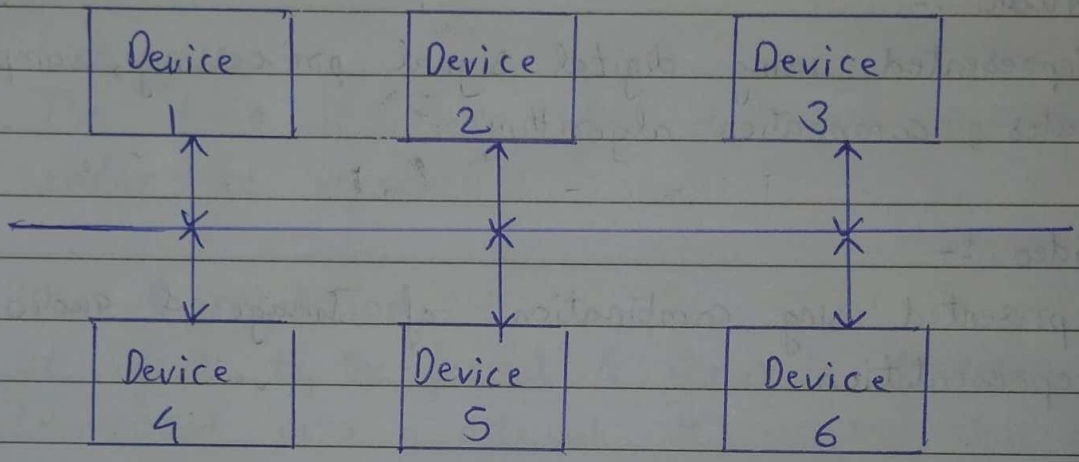
2) Star topology :-
Devices connects to a central hub or switch.

3) Ring topology :-
Devices form a circular configuration.

4) Mesh topology :-
Each device connects to every other device.

5) Hybrid topology :-
Combination of 2 or more topologies.

* Bus topology :- (Block Diagam)



Bus topology is a network configuration where all devices all connected to a single cable or backbone. Each device taps into the backbone to send and receive data.

* Advantages of Bus Topology :-

i) Simple installation
ii) Cost effective
iii) Easy to add devices.

* Disadvantages of Bus Topology :-

i) Signal degradation :-
Signal strength decreases as data travels along the

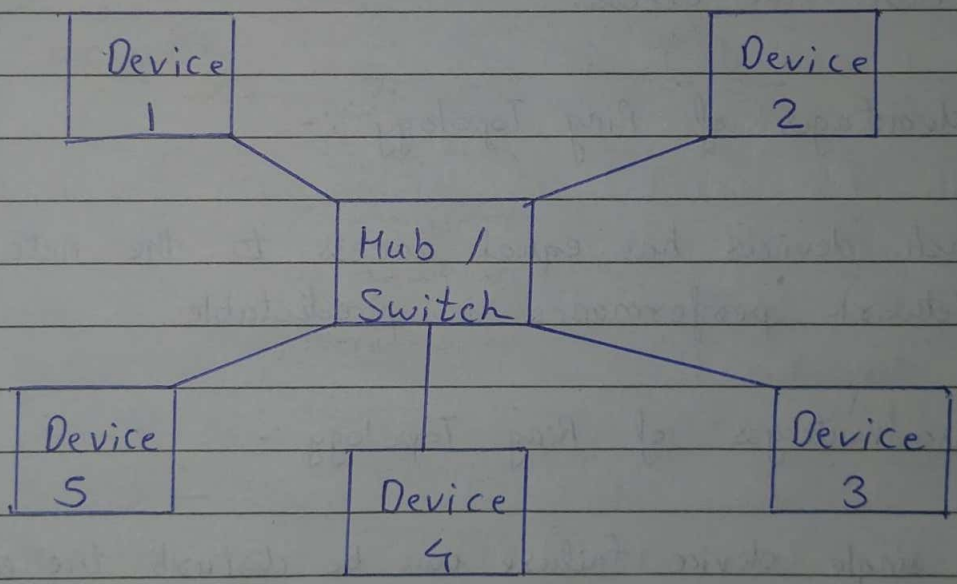
cable.

ii) Fault Tolerance :-
A single cable fault can bring down the entire network.

iii) Limited scalability :-
Limited no. of devices can be connected.

* ~~Applications~~ Star Topology :-
It is a network configuration where all devices connects to a central device, such as a hub or switch. Each device has a dedicated connection to the central device.

Block Diagram



* Advantages of Star Topology :-

i) Easy to install and configure ; Simple to setup & manage.
ii) Fault Tolerance : A single device failure will not affect the entire network.

iii) Easy to troubleshoot
iv) Scalability : Easy to add or remove device

* Disadvantages of Star topology :-

i) If the central device fails, entire network is affected.
ii) More cables are required compared to Bus topology.

* Ring Topology :-
  * Characteristics :-
1. Circular Configuration :- Devices form a close loop.
2. Unidirectional data flow
3. Token base access.

* Advantages of Ring Topology :-

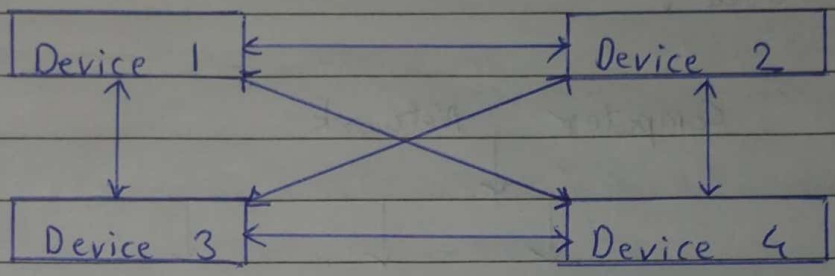
i) Each devices has equal access to the network.
ii) Network performance is predictable.

* Disadvantages of Ring Topology :-

i) A single device failure can be disturb the entire network.
ii) Fault can be hard to identify.
iii) Adding new device can be challenging.
iv) Time Consuming.

* Mesh Topology :-
Mesh Topology is network configuration where each device connect directly to every other device. This creates multiple path for data transmission.

Block Diagram :-



* Characteristics :-
1. Inter connected devices
2. Multiple paths
3. High Reliability.

* Advantages of Mesh Topology :-

i) A network is highly reliable due to multiple path.
ii) Device failure do not distrub the entire network.
iii) Data can be transmitted multiple path, making it harder to intercept.

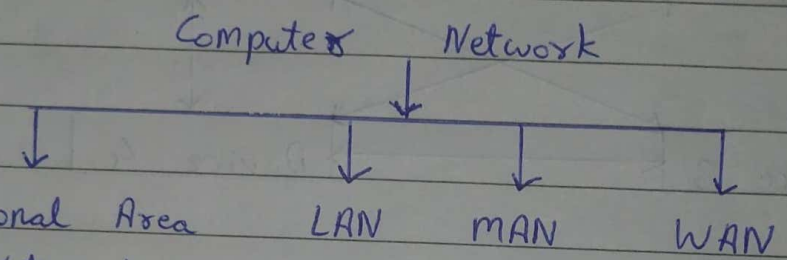
* Disadvantages of Mesh Topology :-

i) Complex installation ii) High cost

* ISM : Industrial scientific medical app.
* Piconet : n Bluetooth device (network)
* Scatternet : More than 1 piconet connection.

* Hybrid Topology :-
Hybrid Topology combines two or more different network Topology such as star, bus, ring, mesh.

* Computer Network Types :-
Generally network are distinguish based on their geographical area.



* Personal Area Network (PAN) :-
It is smallest network. This may include bluetooth enabled devices or infra-red enabled devices. PAN has connectivity range upto 10 metres. PAN may include ~~vario~~ wireless computer keyboard & mouse, bluetooth enabled headphones, wireless printers & TV remotes.

* Local Area Network (LAN) :-
A computer network spread inside a building & operated under single administrative system is generally termed as Local Area network. Usually, LAN covers an organization offices, schools, colleges or universities. The no. of systems connected in LAN may vary from atleast 2 to as much as 16 million. LAN provides a useful way of sharing the resources between end users.

The resources such as printers, file servers, scanners and internet.

* Advantages of LAN :-

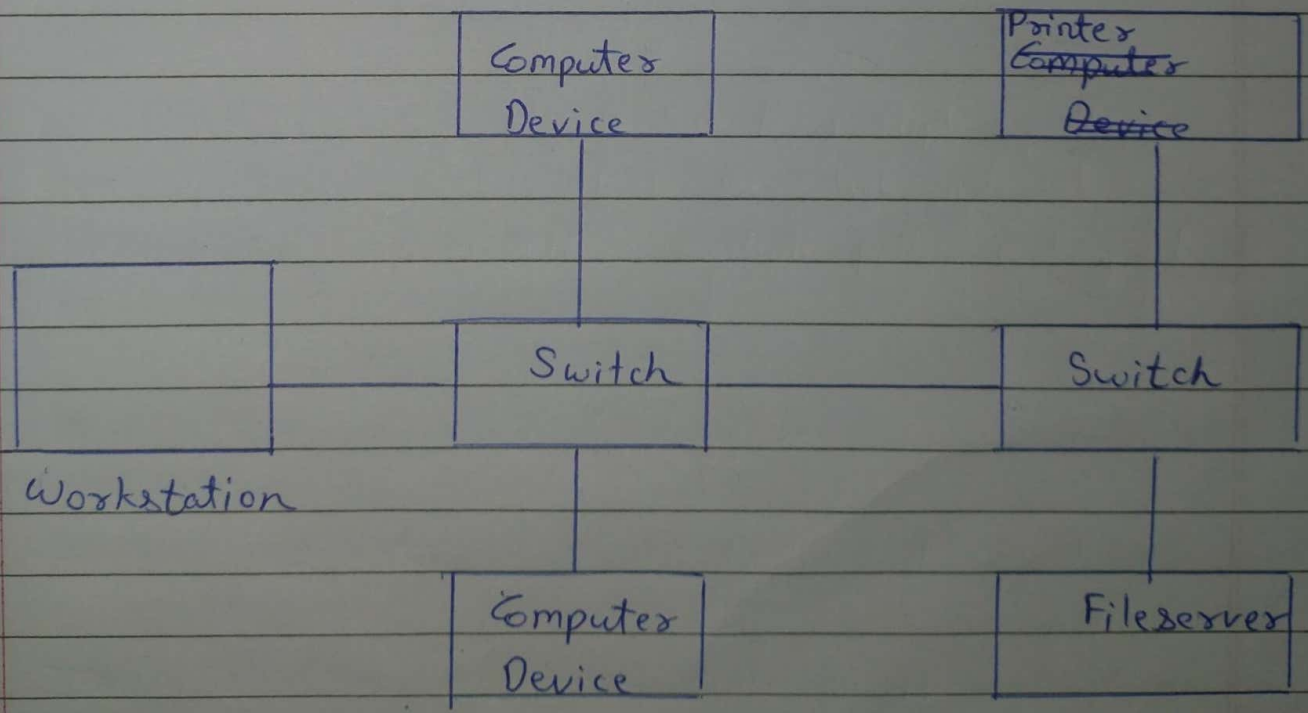
i) Privacy :-
LAN is a private network, thus no outside regulatory body controls it, giving it a privacy.

ii) High Speed :-
LAN offers a much higher speed around 100 MB/s.

iii) Supports Different transmission medium :-
~~Block diagram of LAN~~ : Ethernet cable (thin cable, thick cable and twisted pair), Fibre optics and wireless transmission.

iv) Inexpensive and Simple :-

Block Diagram of LAN :-

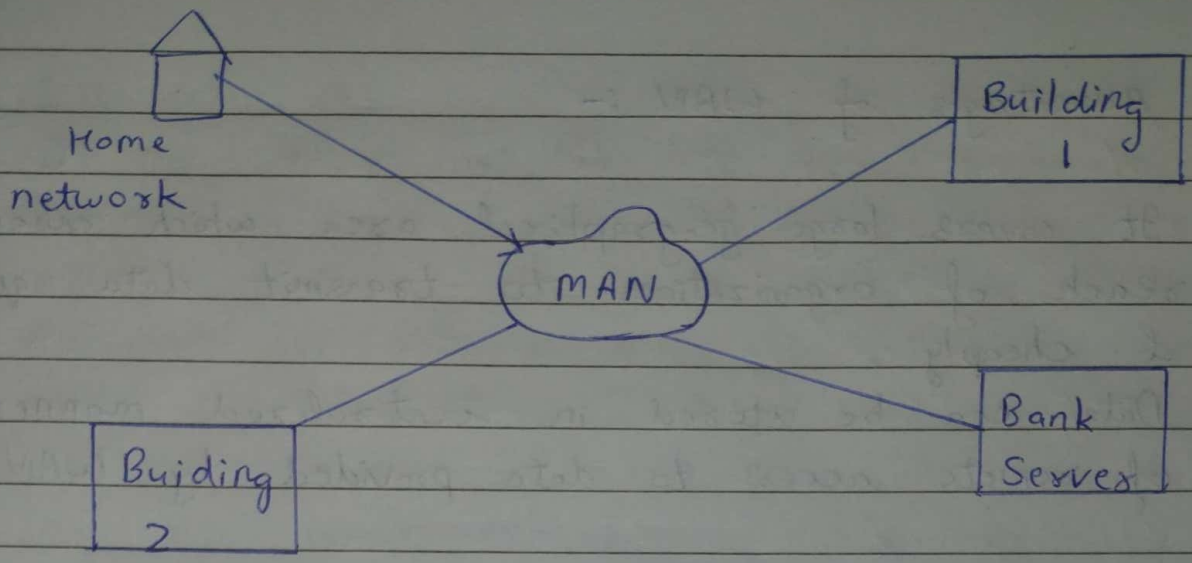


* Disadvantages of LAN :-

i) Initial setup is costly
ii) LAN Administrator can see and check personal data files as well as internet history of each & every LAN user. Hence, privacy of user are revolted.
iii) LAN are restricted in size & cover only a limited area.
iv) Since all the data is stored in single server computer. If it can be accessed by an unauthorized user, can cause a serious data security threat.

** ☆ MAN (Metropolitian Area Network) :-
The MAN generally expands throughout a city such as cable tv network. It can be in the form of ethernet, ATM or fiber distributed data interface. This MAN service enables it's users to expand their local area networks. For ex., MAN can help an organization to connect all of it's offices in the city. Backbone of MAN is high capacity & high speed fiber optics.

☆ Block diagram of MAN :-



* Advantages of MAN :-

i) MAN offers high speed connectivity in which the speed ranges from 10 - 100 mb/s.
ii) The security level in the MAN is high & strict as compared to WAN.
iii) It supports to transmit data in both direction.

* Disadvantages of MAN :-

i) MAN is hard to design & maintain.
ii) This network is highly expensive.
iii) It provides less fault tolerance.
iv) The data transfer rate in MAN is low when compared to LAN network.

☆ Wide Area Network (WAN) :-
WAN covers wide area which may span across provinces and even a whole country. Generally, telicommunication networks are WAN networks. This networks provide connectivity to MAN's and LAN's.

* Advantages of WAN :-

i) It covers large geographical area which enhances the reach of organizations to transmit data quickly & cheaply.

ii) Data can be stored in centralized manner because of remote access to data provided by WAN.

* Disadvantages of WAN :-

i) Traffic delay in WAN is very high.

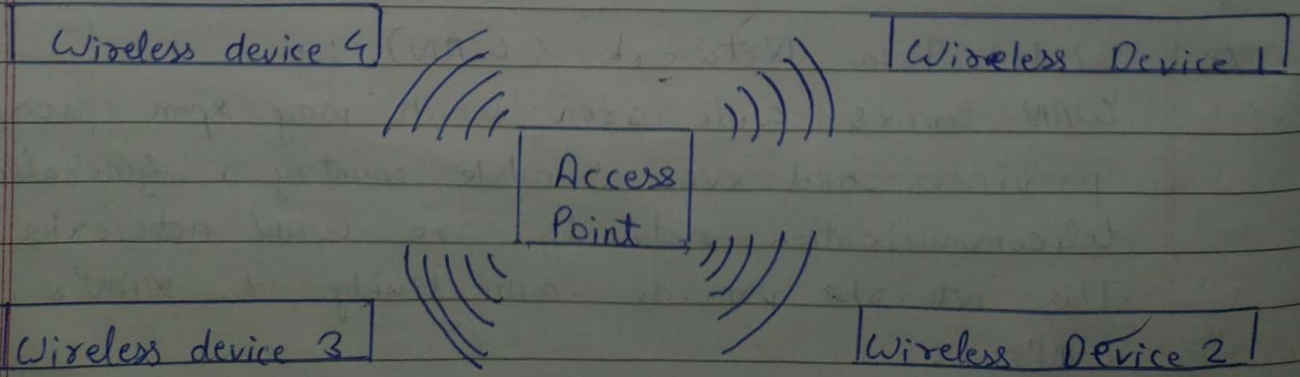
ii) The fault tolerance ability of WAN is very less.

iii) Noise & error are present in WAN.

iv) Data transfer rate is low in comparison to LAN because of large distance & high no. of connected systems within the network.

* Wireless LAN :-

W. LAN is a type of computer network that acts as a local area network but makes use of wireless network technology like WiFi. This network doesn't allow devices to communicate over physical cables like a LAN but allows devices to communicate wirelessly. Example :- Wifi.



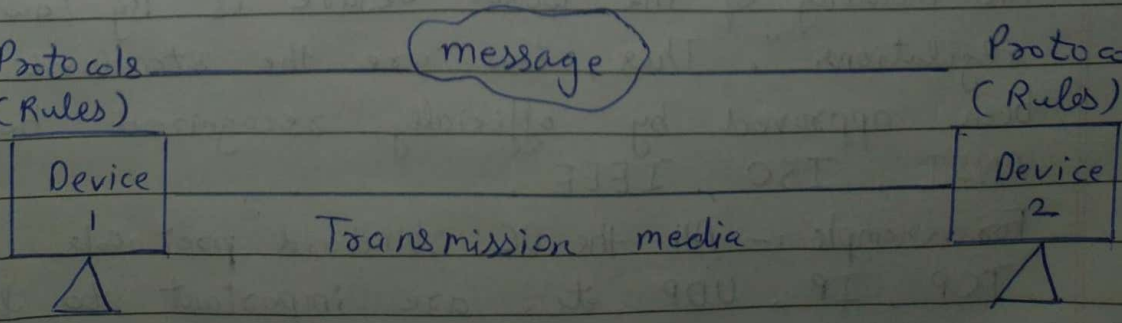
☆ Internetworks :-

A network of networks is called internetwork, or simply the internet. It is the largest network in existence on this planet. The internet hugely connects all WAN's & it can have connections to LAN's. Internet uses TCP/IP protocol & uses IP as it's addressing protocol. The internet uses very high speed backbone of fiber optics. It provides services such as :-

1) Websites
2) Emails
3) Instant messaging
4) Blogging
5) Social media
6) Resource sharing
7) Audio, video streaming.

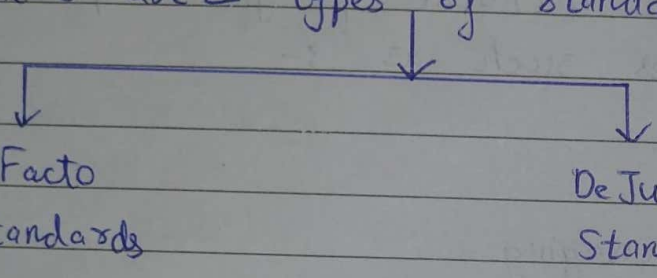
☆ Network Protocols :-

A protocol is a set of rules that determines how data is send & receive over a network. The protocol is just like a language that computers use to talk to each other. Protocol helps to make sure data moves smoothly & securely between devices on a network.



** ☆ Standards :-
Standards are the set of rules of DC that are needed for the exchange of information among devices. It is important to follow standards which are created by various standard organizations, like IEEE, ISO, ANSI, etc.

☆ There are 2 types of standards



1) DeFacto Standards :-
The meaning of the word DeFacto is "By Fact" or "By Convention". This are the standards that have not been approved by any organizations but have been adopted as standards because of their widespread use. Also sometimes these standards are often established by manufacturers.
Example :- Apple & Google are 2 companies that establish their own rules for their products which are different.

2) DeJure Standards :-
The meaning of the word DeJure is "By Law" or "By regulations". Thus, this are the standards that have been approved by officially recognized bodies like ANSI, ISO, IEEE.
For example :- All the DC standard protocols like SMTP, TCP, IP, UDP, etc. are important to follow the

same when we need them.

★ Request For Comment (RFC) :-
When defining the world of networking & internet protocols, an RFC is known as a Request For Comment. Essentially, an RFC is a type of technical document issued by The Internet Engineering Task Force (IETF) that describes specifications, procedures and standards in given internet technologies.