COMPUTER COMMUNICATIONS

ASSIGNMENT-1

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1. Explain about TCP/IP Model?

A. TCP/IP → Transmission Control Protocol/Internet Protocol

→ Implementation of OSI reference model.

→ OSI is a reference where as TCP/IP is implementation of OSI reference model.

→ It is having "4" layers. They are: i) Application Layer (Session, Presentation)
ii) Transport Layer
iii) Internet Layer
iv) Host-to-Network (Data Link, Physical)

Host-to-Network Layer:

→ This is a combination of both data link layer & physical layer.

→ This layer is used for physical transmission of data.

→ It also defines a protocol (set of rules) to connect host. These rules should follow by transmiting the data from source to destination that protocol definition should be

done to connect the host. This protocol may be diff. from host-to-host (or) Network-to-Network.

Internet Layer:

→ This layer is nothing but a network layer in OSI model.

Functions of Internet Layer are:

1. Packets Delivery --- Delivery packets from source to destination
2. Routing --- Packets will be routed from source to destination. And also we use some algorithm for routing
3. Congestion Control --- Manage data flow

The main protocol in internet layer is IP (Internet Protocol). It also response to transmit the packets independently.
→ Packets may not be recieved in the order that they have send.

Transport layer:

→ The main function of this layer is "Segmenting, splitting of data.

Segmenting: Dividing data based on bandwidth

→ It also decides to send the data either in single path (or) multiple parallels paths.

Application Layer:

→ This is the combination of both session & presentation layer.

→ It acts as an interface b/w host & services provided by transport layer.

→ It includes high-level protocols. They are:

→ TELNET – Two Way Communication

→ FTP – File Transfer Protocol

→ SMTP – Mail Transfer Protocol

→ DNS – Domain Name Service

Layer	Protocols			
Application Layer	TELNET	FTP	SMTP	DNS
Transport Layer	TCP		UPP	
Internet Layer	IP			
Host-to-Network Layer	ETHERNET	FRAME RELAY	TOKEN RING	

Protocol Stack

2. What is Transmission Media. Explain briefly?

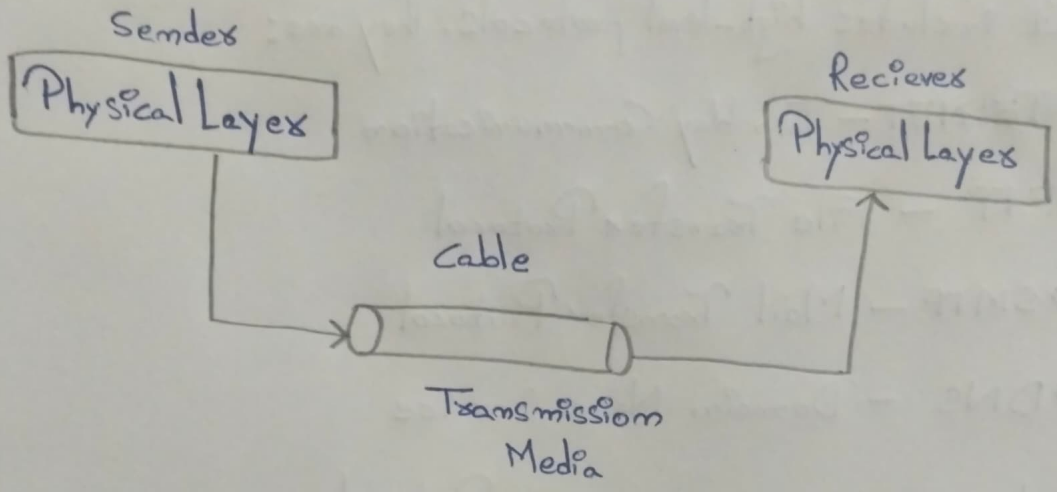
A. Transmission Media means that the data transmits from source to destination.

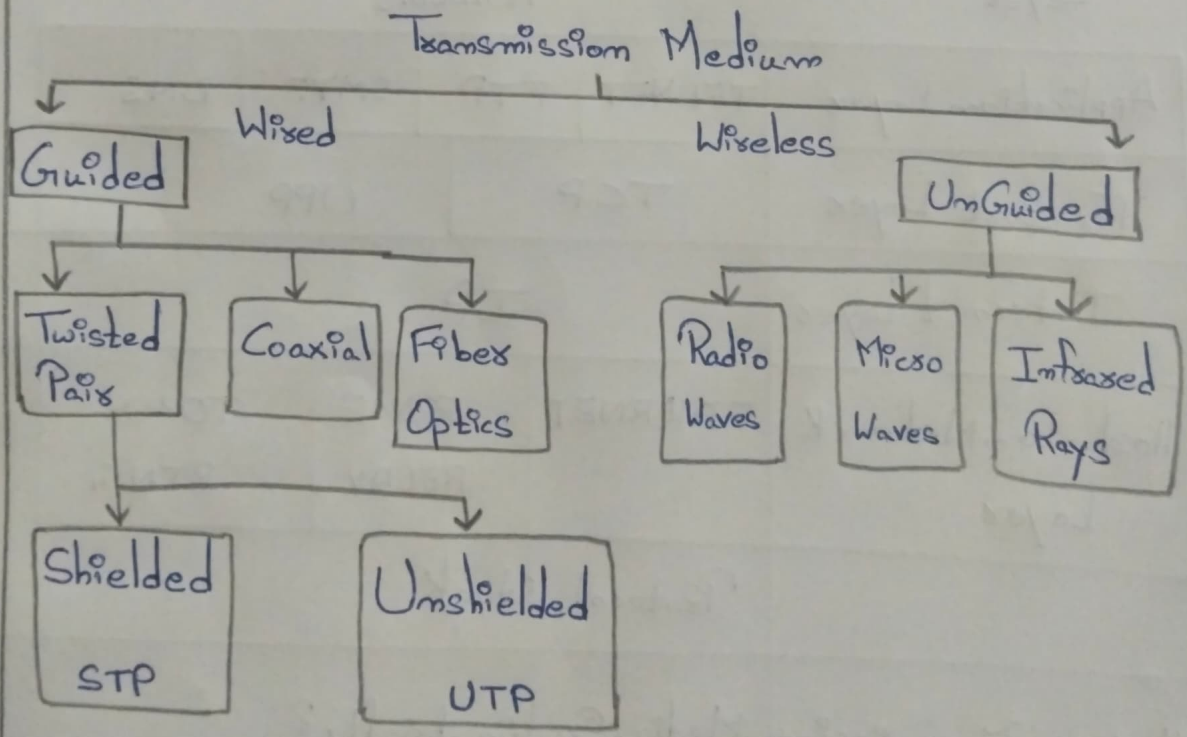
→ Data will be transmitted from 1 system to another system through the transmission media.

→ Transmission Media can be divided into two types. Those are

i) Guided -- Wired

ii) UnGuided -- Wireless

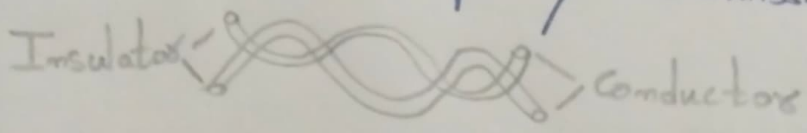




Twisted Pair Cable:

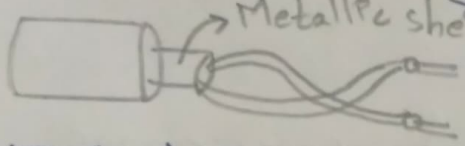
→ Consists of two insulated copper wires arranged in spiral pattern to minize the electro-magnetic interference b/w adjacent pairs.

→ Used for low frequency transmission medium.

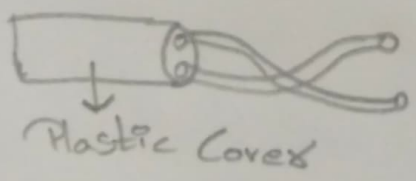


→ It is divided into two types. They are:

:) STP (Shielded Twisted Pair) --- The pair is wrapped with metallic sheild to insulate the pair from electro-magnetic interface.



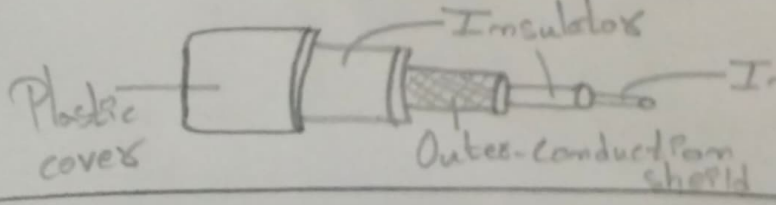
:)) UTP (Unshielded Twisted Pair) --- Each wire is insulated with plastic wrap but pair is encased in an outer covering.



Coaxial Cable:

→ Used for cable T.V, LAN's & telephone cables

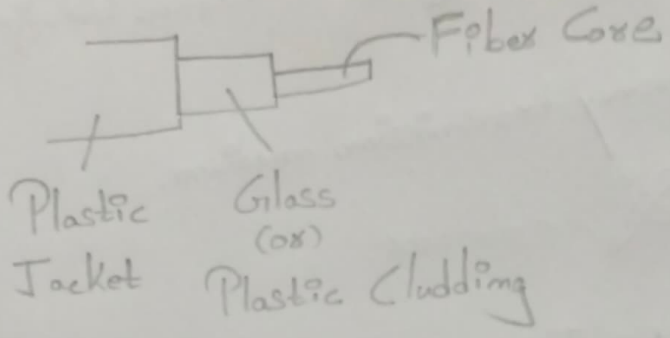
→ It has an inner conductor surrounded by braided mesh



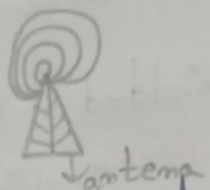
Fiber Optic Cable:

→ Used for long distance lines

→ It's a new transmission medium used by telephone company



Radio Waves:



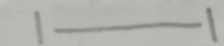
→ Frequency b/w 3KHz to 1 GHz

→ Used for multicast comm. & can penetrate through walls.

Micro-Waves:

→ Used for unicast comm. & for higher frequency ranges.

→ Uses directional antenas.



point-point communication

Infrared Rays/Waves:

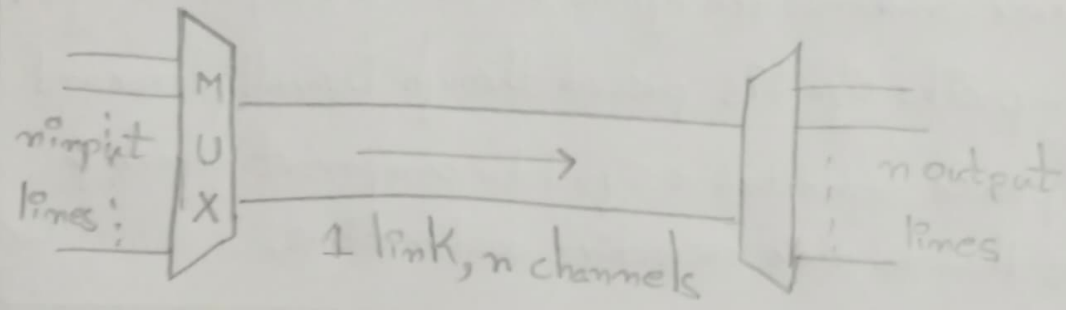
→ Used for short-range comm. in a closed area using line of sight propogation.

→ One of the most secure modes of comm.

"Due to short range"

Q. Explain Multiplexing?

A.



Multiplexing is a technique used to combine & send multiple data streams over a single medium. The process of combining the data streams is known as multiplexing and hardware used for multiplexing is known as a multiplexer.

Multiplexing is achieved by using a device called Multi-plexer (MUX) that combines n input lines to generate a single output line. Multiplexing follows many-to-one, i.e., n input lines and one output line.

Demultiplexing is achieved by using a device called Demultiplexer (DEMUX) available at receiving end. DEMUX separates a signal into its component signals (one input & n outputs). Therefore, we can say that demultiplexing follows the one-to-many approach.

Multiplexing technique is widely used in telecommu-nications in which several telephone calls are carried through a single wire.

The "n" input lines are transmitted through multiplexer. multiplexer combines the signals to form a composite signal. The composite signal is passed through Demultiplexer and demultiplexer separates a signal to component signals & transfers them to their respective destinations.

4. Explain Hamming Code Algorithm?

A. Hamming code is an error-correcting code used to ensure data accuracy during transmission or storage. Hamming code detects & corrects the errors that can occur when data is moved or stored from sender to receiver. The simple & effective method helps improve the reliability of communi-cation systems & digital storage. It adds extra bits to the original data flowing the system to detect & correct single-bit errors.

Algorithm of Hamming Code:

Step-1: Write the bit positions starting from 1 in binary form. (1, 10, 11, 100, etc.)

Step-2: All the bit positions that are a power of 2 are marked as parity bits (1, 2, 4, 8, etc).

Step-3: All the other bit positions are marked as data bits.

Step-4: Each data bit is included in a unique set of parity

bits, as determined its bit position in binary form:

a) Parity bit 1 covers all bits positions whose binary representation includes a 1 in the least significant position (1, 3, ...etc)

b) Parity bit 2 covers all bits positions whose binary representation includes a 1 in the second position from least significant bit (2, 3, 6, ... -etc)

c) In general, each parity bits covers all bits where the bitwise AND of the parity position & bit position is non-zero.

Step-5: Since we check for even parity set a parity bit to 1 if the total no. of ones in positions it checks is odd. Set a parity bit to 0 if the total no. of ones in positions it check is even.

Eg: Given message is 1010

Sol: 1010 is even parity

message bits = $m = 4$

$$2^p \geq m + p + 1$$

Use Trial & Error Method:

✗ $p = 0 \Rightarrow 2^0 \geq 4 + 0 + 1$

$1 \geq 5$

✓ $p = 3 \Rightarrow 2^3 \geq 4 + 3 + 1$

$8 \geq 8$

parity = 3

Let it be $P_1, P_2, P_3 \Rightarrow$ Total message $= m + p = 4 + 3 = 7$

7 6 5 4 3 2 1

m_4 m_3 m_2 P_3 m_1 P_2 P_1

1 0 1 P_3 0 P_2 P_1

m_3 m_1
1 0 1 0
m_4 m_2

	P3	P2	P1
	4	2	1
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

$P_1 \Rightarrow 1, 3, 5, 7$

P_1 0 1 1 → even

So, $P_1 = 0$

$P_2 \Rightarrow 2, 3, 6, 7$

P_2 0 0 1

Odd

So, $P_2 = 1$

$P_3 \Rightarrow 4, 5, 6, 7$

P_3 1 0 1

Even

So, $P_3 = 0$

$P_3 P_2 P_1 = 0\,(1)\,0$

↓

2nd bit Error

1 0 1 0 0 (1) 0

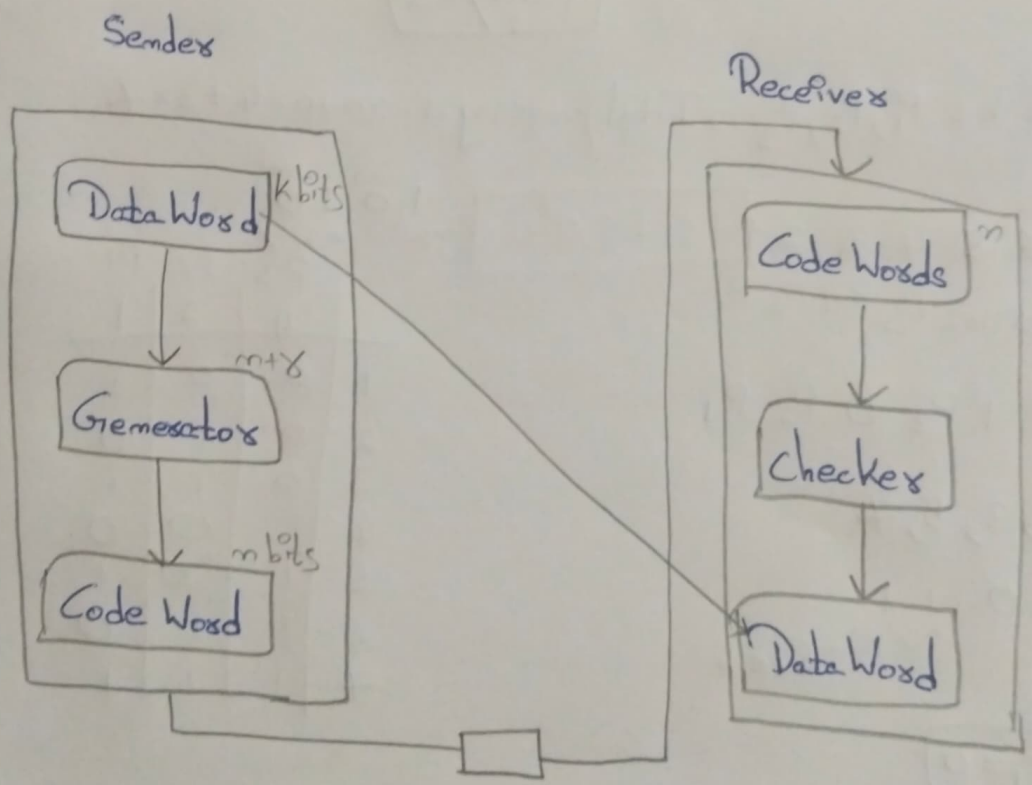
↓

$\Rightarrow$ 1010000 Answer

According to hamming code, the message is 1010000.

Q. What is Block Code? Explain with Example.

A. Block code refers to a method of encoding data into fixed-size blocks before transmission. Block codes are primarily used for error detection and correction during data transmission over unreliable networks. In block coding, the original data is divided into smaller blocks of bits and redundancy bits (known as parity/error-correcting bits) are added to each block. This ensures that if errors occur during transmission, the receiver can detect those errors.



Data Word	Code Word
00	000
01	011
10	101
11	110

The best example of block code is hamming code.

Eg: Give message is 1010

Sol: 1010 is even parity

message bits = m = 4

$2^p \geq m+p+1$

Use Trial & Error Method:

$p=0 \Rightarrow 2^0 \geq 4+0+1$

$1 \geq 5$ ✗

$p=3 \Rightarrow 2^3 \geq 4+3+1$

$8 \geq 8$ ✓

parity = 3

Let it be $P_1, P_2, P_3 \Rightarrow$ Total message $= m+p = 4+3 = 7$

7 6 5 4 3 2 1

m_4 m_3 m_2 P_3 m_1 P_2 P_1

1 0 1 P_3 0 P_2 P_1

$P_1 \Rightarrow 1, 3, 5, 7$

P_1 0 1 1 → Even

So, $P_1 = 0$

$P_2 \Rightarrow 2, 3, 6, 7$

P_2 0 0 1 Odd

So, $P_2 = 1$

$P_3 \Rightarrow 4, 5, 6, 7$

P_3 1 0 1 Even

So, $P_3 = 0$

1 (m_3) 0 1 (m_1)

(m_4) (m_2)

	P_3 4	P_2 2	P_1 1
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
7	1	1	1

$P_3 P_2 P_1 = 0\,(1)\,0$

↓ 2nd bit error

$1\,0\,1\,0\,0\,(1)\,0$

$\Rightarrow \boxed{1\,0\,1\,0\,0\,0\,0}$ Answer

6. Explain about OSI Model?

A. OSI → Open System Interconnect

→ OSI model is based on proposal developed by the ISO (International Standards Organization) as a first step toward international standardization of the protocols used in various layers.

→ ISO created "7" layer architecture which is used to transmit data from one system to another system. They are:

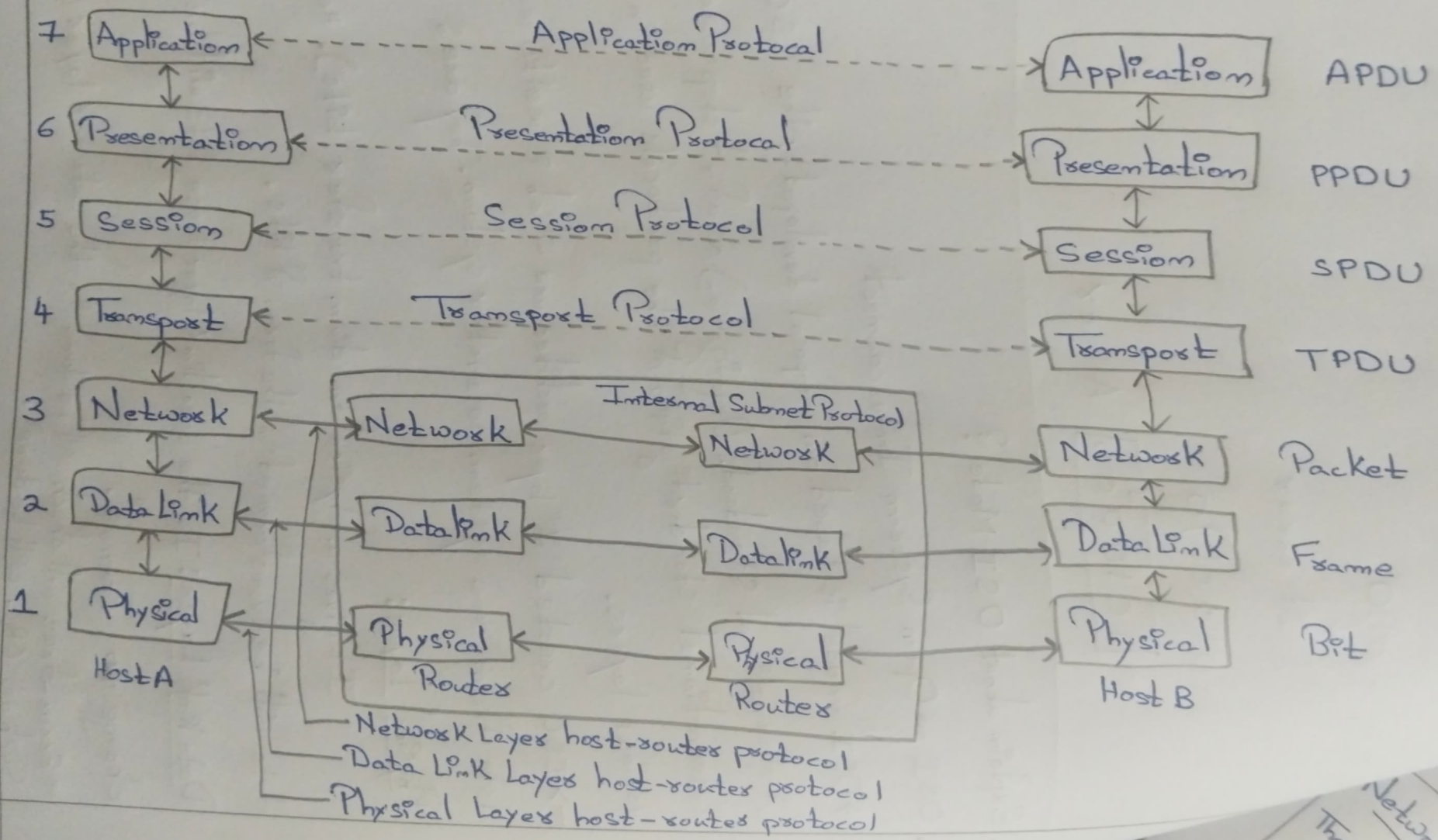
Physical Layer:

It gives a physical medium transfer "bits". Here data will be transformed in the form of bits.

Data link Layer: In the data link layer those bits will be change to "Frames".

→ Error-free will check will be done in the data link layer (Such as CRC will be done).

Layers:


7 Application
Application Protocal
Application
APDU
6 Presentation
Presentation Protocal
Presentation
PPDU
5 Session
Session Protocol
Session
SPDU
4 Transport
Transport Protocol
Transport
TPDU
3 Network
Internal Subnet Protocol
Network
Network
Network
Packet
2 Data Link
Data Link
Data Link
Data Link
Frame
1 Physical
Physical
Physical
Physical
Bit
Host A
Router
Router
Host B
Network Layer host-router protocol
Data Link Layer host-router protocol
Physical Layer host-router protocol

Network Layer: Here, frames will be converted into "packets". These packets will be move from source to destination (routing).

Transport Layer: Using protocols reliable messages will be transfered.

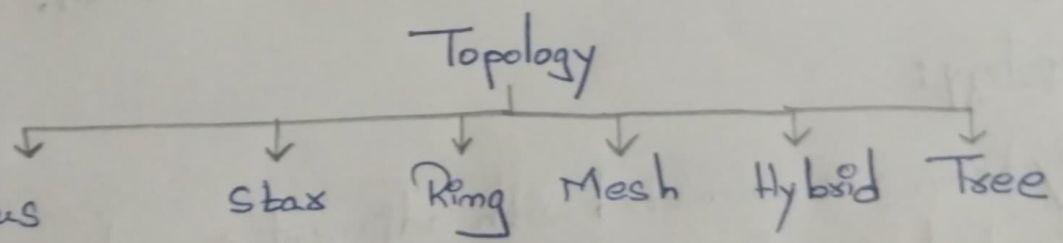
Session Layer: Session means "some time period". Establishing and terminating of session will be created.

Presentation Layer: Data compression, encoding (or) encryption.

Application Layer: In this layer, various services will be provided directly to the users.

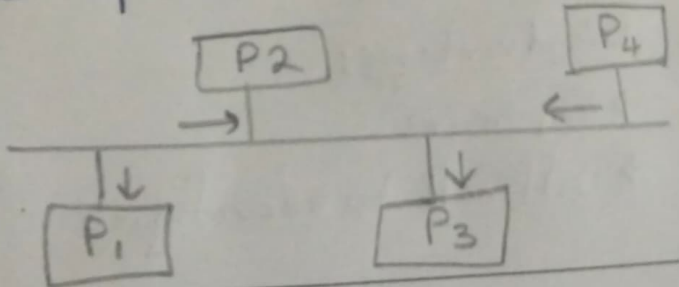
7. What is Topology?

A. Topology can be defined as arranging computers in a network. Here are few types of that.



Bus Topology:

→ All the computers will be connected only through one cable.



Drawbacks:

→ No security

→ Collision

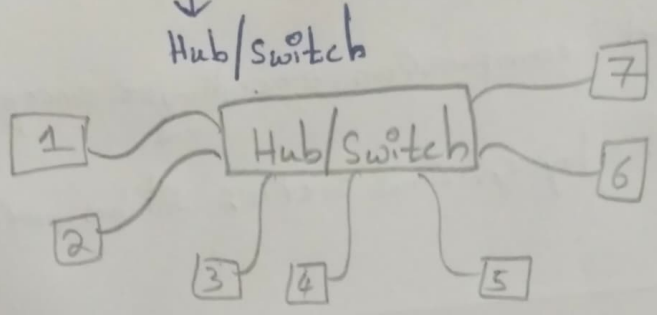
Advantages:

→ Less expensive

→ Installation is easy

Star Topology:

→ Centralized device & all computers will be connected to this device.



Advantages:

→ Less Expensive.

→ If switch then more security.

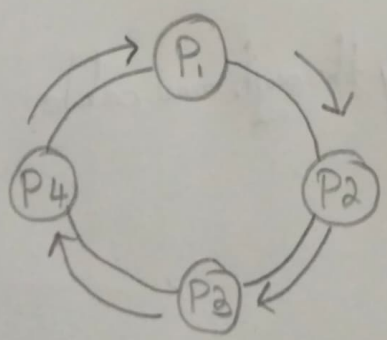
Drawbacks:

→ If the centralized device fail, network will fail.

Ring Topology:

→ The systems are connected with adjacent computers.

→ Unidirected flow of data.



Advantages:

→ No collision

Disadvantages:

→ Expensive

→ Difficult to reconfigure

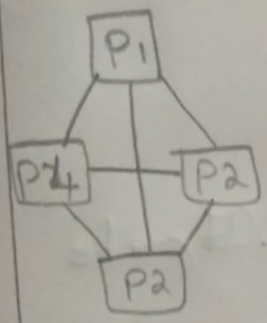
Mesh Topology:

→ Every system is connected to all systems.

→ Bi-directional.

$$\frac{n(n-1)}{2}$$ → Links no.

No. of systems



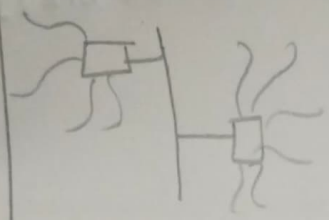
Disadvantages:

→ Expensive

→ Difficult to reconfigure

Tree Topology:

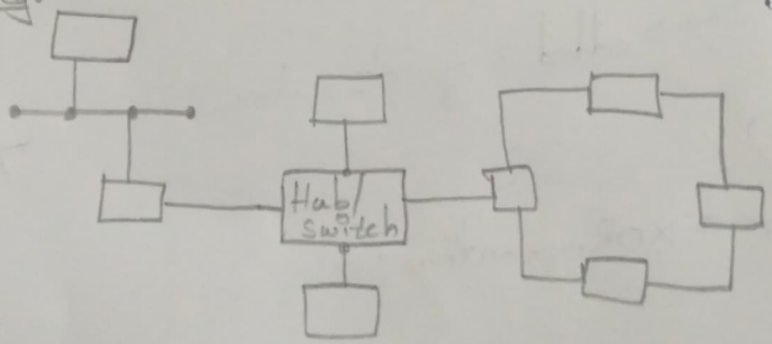
→ Combination of bus & star topology.



Hybrid Topology:

→ Combination of multiple topologies.

Eg:



Disadvantages:

→ Very Expensive

→ Difficult to reconfigure.

8. Explain CRC Method?

A. CRC stands for Cyclic Redundancy Check is a redundancy errors technique used to determine the errors.

We have to consider: i) Data
ii) CRC Generator
iii) CRC bits
iv) Division (XOR)

→ CRC is very easy to implement in hardware. It can be analyzed mathematically.

CRC Generator:

→ With the help of this generator, we can find CRC bits.

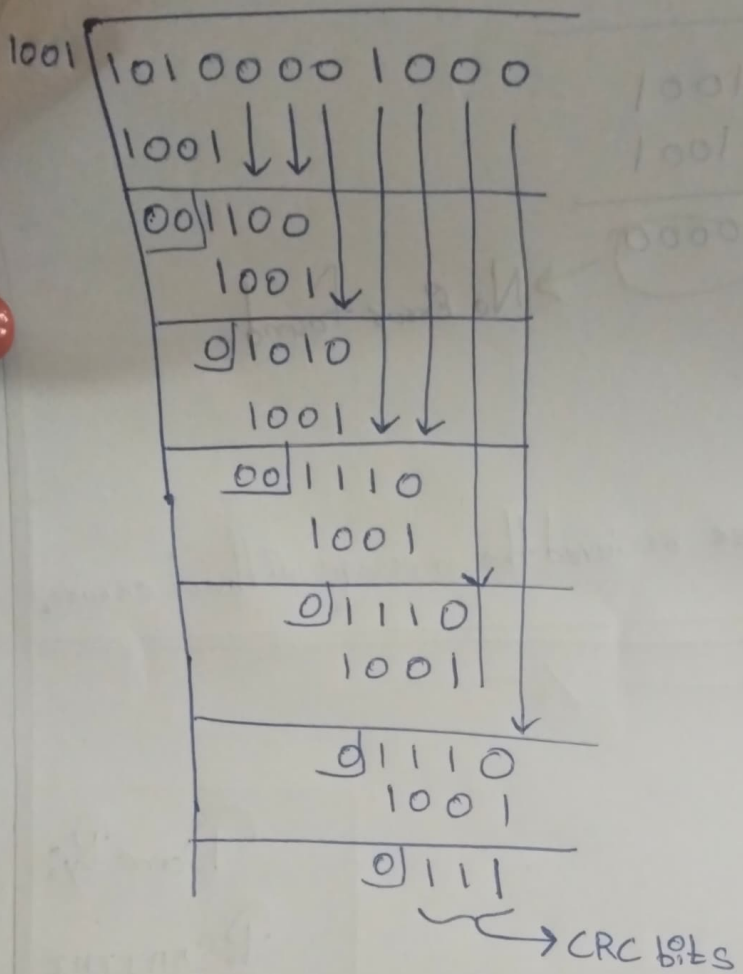
CRC bits will be (n-1)

Eg: Original data ⇒ 10100001

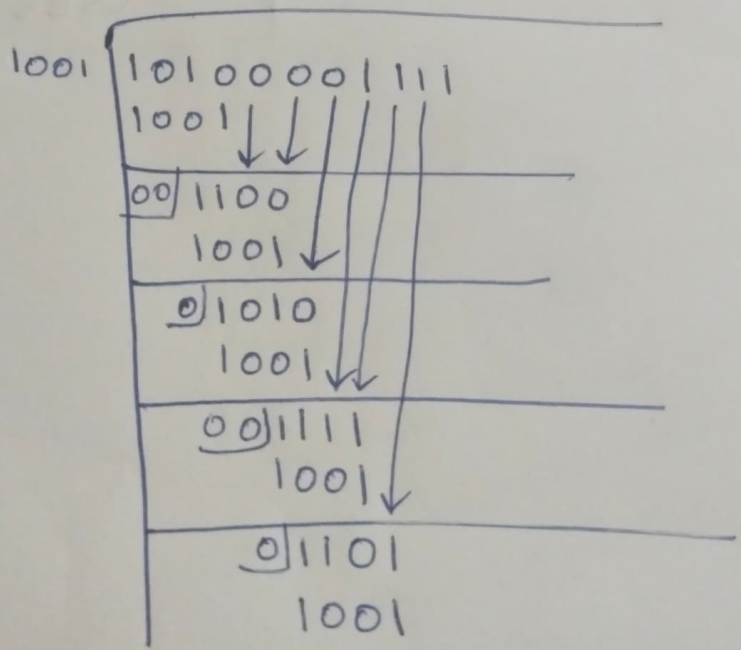
Generator: 1001 ⇒ n=4 ⇒ n-1 = (3) ← CRC bits

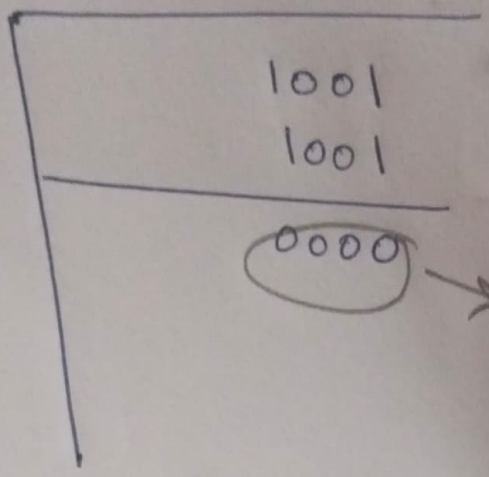
⇒ 10100001000 ← added 3 zero's extra

0+0 = 0
1+1 = 0
0+1 = 1
1+0 = 1
→ XOR operation



So, sender sends 10100001111.





∴ The recievers recieved the message without errors.

— X —

Done By:
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