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1CR18CS028

ASSIGNMENT - 1

1) Data communication is the exchange of data between two devices via some form of transmission medium such as a cable wire. Five components of data communication system are:

i) Message: It is information to be communicated
Eg:- text, audio
ii) Sender: The device that sends the data message Eg:- computer
iii) Receiver: The device that receives the message Eg:- computer, telephone
iv) Transmission medium: The physical path by which a message travels from sender to receiver
v) Protocol: It is a set of rules that govern data communication. It represent an agreement between the communicating devices.

2) OSI model was developed by ISO It has 7 layers as follows
i) Physical layer: It is responsible for the movement of bits from one node to another node. It defines the transmission rate, deals with synchronization of transmitter and receiver. It defines the topology used for connecting devices.
ii) Datalink layer: It is responsible for movement of data frames from one node to another. DLL receives and divides the stream of bits

from network layer into frames. DLL is responsible for flow control, error control and provides access control.

iii) Network layer: It is responsible for source to destination delivery of a packet. It is responsible for routing of packets. It is concerned with circuit, message or packet switching.

iv) Transport layer: It is responsible for process to process delivery of the entire message. Segmentation and reassembly - message is divided into segments, each segment has a sequence number.

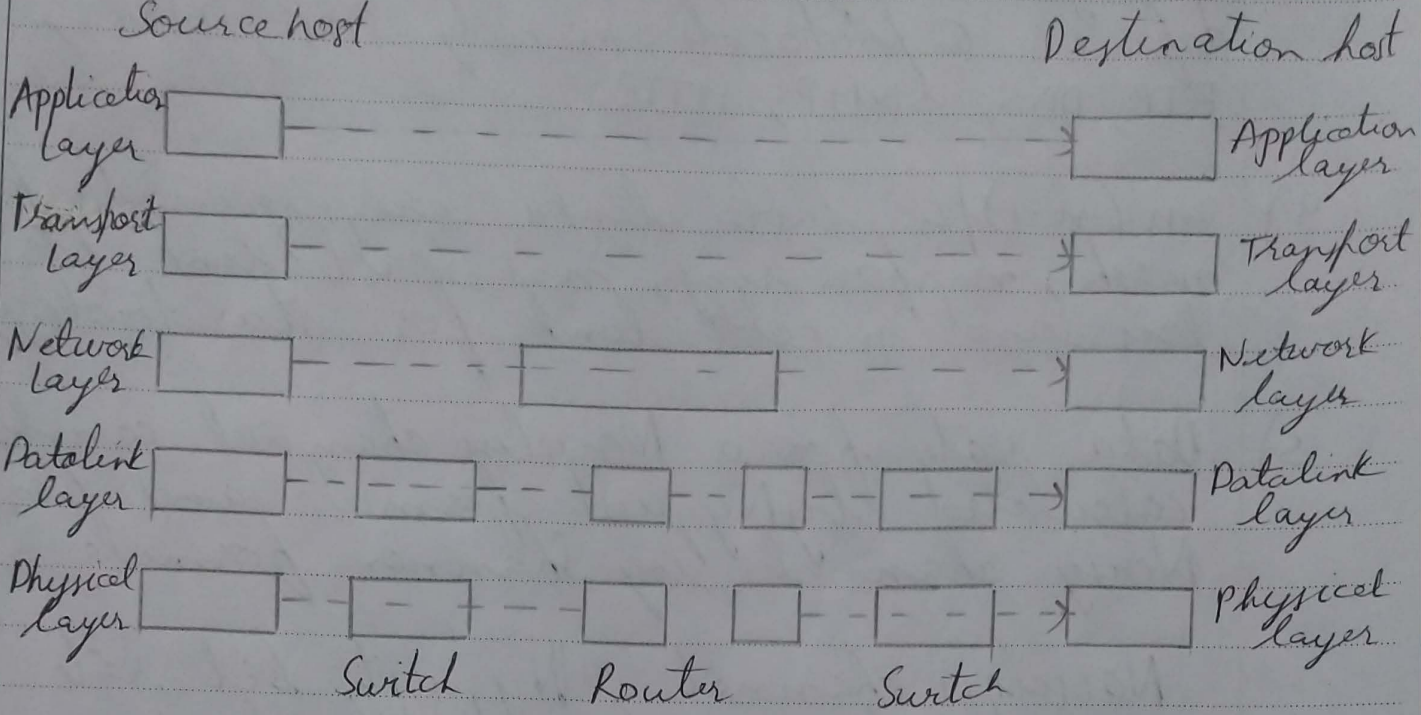
v) Session layer - It establishes, maintains and synchronize the interaction between two system. It allows the process to add check points to stream of data.

vi) Presentation layer: It is concerned with syntax and semantics of information exchange between two system. Translation, encryption and compression are the functions performed by this layer.

vii) Application layer - Main responsibility is to provide services to the user, enables the user to access network. Other responsibilities are mail services, directory services & file transfer.

3) i) Physical layer - It is responsible for movement of individual bits from one node to another. Two devices are connected by a transmission medium. It receives bits from

datalink layer level and sends through transmission media



ii) Data link layer :- It is responsible for moving frames from one node to another over a link. The link can be wired LAN/WAN or wireless LAN/WAN It gets the datagram from network layer, encapsulates the datagram in packet called frame and sends to physical layer.

iii) Network layer :- It is responsible for source to destination transmission of data It is responsible for routing the packets. TCP/IP defines 5 protocols namely IP, ARP, ICMP, IGMP, RARP.

iv) Transport layer :- It is responsible for delivery of a message from a process to another process. TCP/IP defines 3 protocols namely TCP, UDP, SCTP.

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3) Application layer :- The two application layer exchanges message between each other. TCP/IP defines 6 protocols namely SMTP, TELNET, FTP, DNS, SNMP, HTTP.

4) $n(n-1)/2$ cable links are required for mesh, n for ring, $n-1$ cable link for bus and n cable link for star topology.

5) Data rate for a Noiseless channel can be calculated by Nyquist formula and for Noisy channel by Shannon formula

Noiseless channel : Nyquist bit rate

Bit rate = $2 \times \text{bandwidth} \times \log_2 L$

where L is no of signal levels used to represent data

Noisy channel : Shannon capacity

Capacity / Bit rate = $\text{bandwidth} \times \log_2(1+\text{SNR})$

where SNR is the signal to noise ratio

Given

$BW = 1\text{ mHz}$

$SNR = 40\text{ db}$

$SNR_{dB} = 10 \log_{10} SNR$

$SNR = 10^{SNR_{dB}/10}$

$= 10^{40/10} = 10^4$

Shannon capacity $= 1 \times 10^{-3} \times \log_2(1+10^4)$

$= 13.287\text{ mbps}$

Given BW = 1 mHz L = 8

Nyquist bit rate = $2 \times BW \times \log_2 L$

$= 2 \times 1 \times 10^{-3} \times \log_2 8$

$= 6$ mbps

6) i) BW = 20 KHz, $SNR_{dB} = 40$

Shannon capacity = $BW \times \log_2 (1 + SNR)$

$= 20 \times 10^3 \times \log_2 (1 + 10^{SNR_{dB}/10})$

$= 20 \times 10^3 \times \log_2 (1 + 10^4)$

$= 265\,757$ Kbps

ii) BW = 200 KHz, $SNR_{dB} = 6$

Shannon capacity = $BW \times \log_2 (1 + SNR)$

$= 200 \times 10^3 \times \log_2 (1 + 10^{SNR_{dB}/10})$

$= 200 \times 10^3 \times \log_2 (1 + 10^{0.6})$

$= 463\,229$ Kbps

7) Standards are essential in creating and maintaining an open and competitive market for equipment manufacturers and in guaranteeing national and international interoperability of data and telecommunication technology and processes.

Standard organizations

1. International organization of Standardization (ISO)
2. American National Standards Institute (ANSI)
3. Institute of Electrical and Electronics Engineers (IEEE)
4. Electronic Industries Association (EIA)

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8) The performance of a network depends on the following factors:

i) Bandwidth: The term can be used in two different contexts with two different measuring values.

- Bandwidth in Hertz: It is the range of frequencies contained in a composite signal or the range of frequencies a channel can pass
- Bandwidth in Bits per second: The number of bits per second that a channel, a link or even a network can transmit

ii) Throughput: It is a measure of how fast we can actually send data through a network.

iii) Latency (Delay): It defines how long it takes for an entire message to completely arrive at the destination from the time the first bit is sent out from the source. It is made of 4 components

Latency = propogation time + transmission time + queing time + processing delay.

- Propogation Time: It is given by:-

Propogation time = Distance / Propogation speed.

Propogation speed depends on medium and frequency of the signal

- Transmission time: A time between the first bit leaving the sender and the last bit arriving at the receiver.

Transmission time = Message size / Bandwidth.

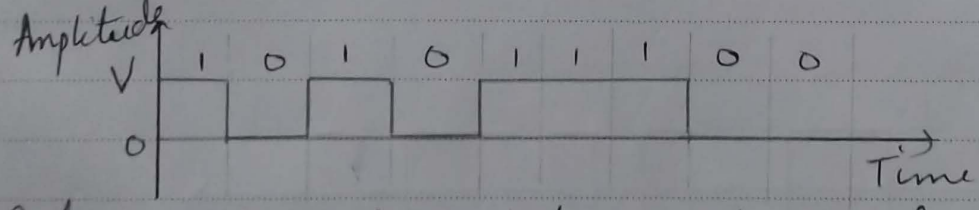
- Queuing time :- The time needed for each ~~instruction~~ intermediate or end device to hold the message before it can be processed. It is not fixed. It changes with the load imposed on the network.
- Processing delay :- Time taken to process packet header

iv) Bandwidth - Delay product :- The product of bandwidth and delay is the number of bits that can fill the link

v) Jitter :- Jitter is a problem if different packets of data encounter different delays and the application using the data at the receiver site is time-sensitive (for eg :- audio/video)

9) Line coding is the process of converting digital data to digital signals

Unipolar : NRZ (Non-Return to Zero) - the positive voltage defines bit 1 and zero voltage defines bit 0

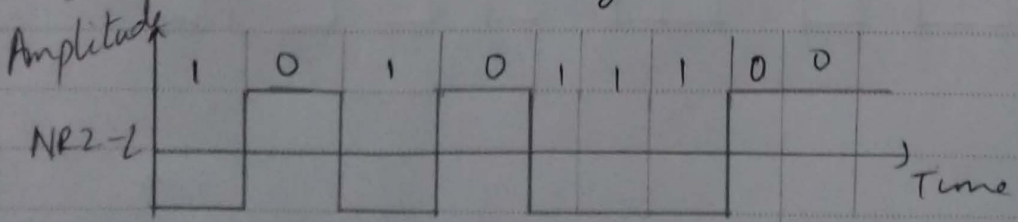


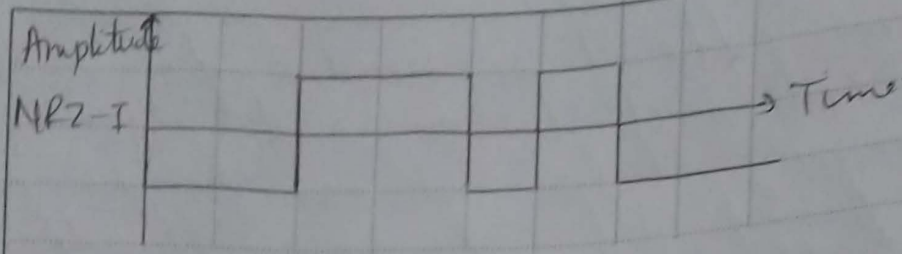
Polar : -V for bit 1 and +V for bit 0

(a) NRZ (Non Return to Zero)

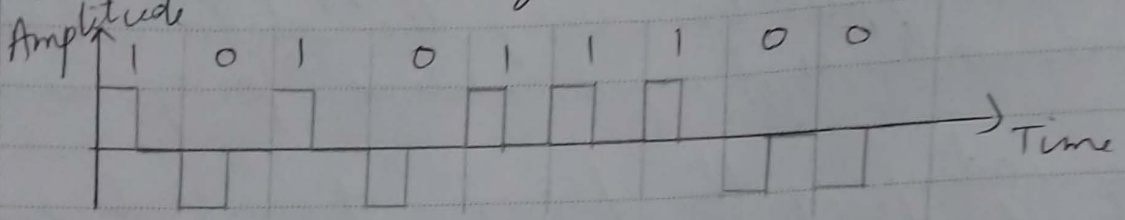
i) NRZ-L : +V for bit 0 and -V for bit 1

ii) NRZ-I :- No change for bit 0 & change for bit 1

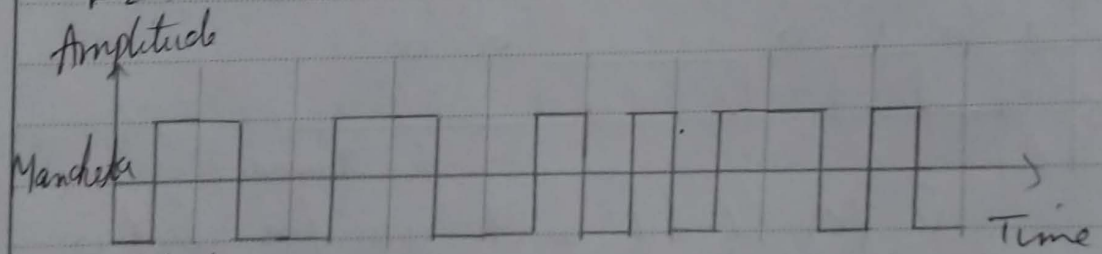


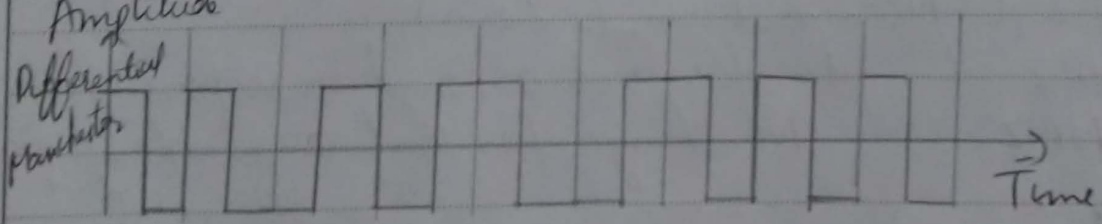


b) RZ (Return to Zero) - It uses 3 voltage positive, negative, zero.
* There is always a transition at the middle of the bit. Either
i) from high to zero (for 1) or
ii) from low to high (for 0)



Biphase : i) Manchester - combination of NRZ-L & RZ
ii) Differential Manchester - combination of NRZ-I & RZ





10) Three causes of impairements are:

i) Attenuation: As signal travels through the medium its strength decreases as distance increases. As distance increases, attenuation also increases. Eg:- Voice data becomes weak over the distance and loses its contents beyond a certain distance. Amplifiers are used to amplify the signal.

ii) Distortion: Distortion means that the signal changes its form or shape. It can occur in a composite signal made of different frequencies. Different signal components have different propagation speed through a medium, & different delays in arriving at final destination.

iii) Noise: It is defined as an unstable data. Noise is the external energy that corrupts a signal.
Induced noise - Noise from sources like motors and appliances.
Cross talk:- Effect of one wire on the other.
Impulse noise:- It comes from power lines, lightening etc.