'Assignment - 1'

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Ans. to the question no – 01

There are 4 layers in TCP/IP model. Their functionality, protocols, PDUs, special tasks are given below:

1. Network interface: This layer is equivalent to the combination of the physical and data-link layer of OSI model. some of the functionalities are:

I) framing: it divides the stream of bits into data units called frames.

2) flow control: it controls the flow of the data.

3) Error control: Detects and retransmit lost frames.

4) Data rate: determines the transmission rate.

5) Physical topology: defines how devices are connected

Protocol

At the network interface layer, TCP/IP does not define any specific protocol. It supports all the standards proprietary protocols.

PDUs

In network interface layer primary data units is called 'frame'.

2. Internet: This layer is equivalent to the Network layer of OSI model.

functionalities

i) Logical addressing: Assigns unique address also known as IP address to devices.

ii) Routing: when independent links are connected to create a large network, routers or switches route the packets to final destination.

Protocol

at internet layer, TCP/IP supports the internetwork protocol (IP) which uses four protocols, ARP, RARP, ICMP, IGMP.

i) ARP: The address resolution protocol (ARP) is used to associate IP address with MAC address.

ii) RARP: The Reverse Address Resolution protocol is used to allow a user discover its IP address given it knows it's MAC address.

iii) ICMP: The Internet Control Message protocol (ICMP) is used by hosts and gateways to send notification of datagram problems.

iv) IGMP: The Intenet Group Message Protocol (IGMP) is used to facilitate simultaneous transmission of message to a group of receipents.

PDUs

The primary data unit in this layer is called 'packet' or more precisely 'Datagram'.

3) Transport: This layer is equivalent to the transport layer of OSI model.

functionalities

i) Segmentation and Reassembly: a message is divided into transmittable segments.

ii) Flow control: checks the flow of the data.

iii) Error control: determines error and controls it.

Protocol

Traditonally, the transport layer has two protocols.

i) TCP: The Transmission Control Protocol provides full transport layer services to application.

ii) UDP: The User datagram Protocol (UDP) is a process-to-process protocol that is simpler than TCP.

PDUs

The primary data units in UDP is 'datagram' and in TCP is 'segments'.

4) Application: This layer is equivalent to the application, session and presentation layers of OSI model.

functionalities

i) Translation: changes the data into a common format between sender and receiver.

ii) Dialog control: allows two systems to enter into a dialog.

iii) File transfer, access and management: allows a user to access files in a remote host, retriev, mange and control files in a remote control locally.

Protocols: There are many protocols in this layer. Some of them are:

i) HTTP: Hyper text transfer protocol

ii) FTP: File transfer protocol

iii) DNS: Domain name system

PDUs

The primary data unit in this layer is 'data'.

Ans. to the question no-02

If the physical destination address on the MAC address is corrupted and the computers are connected on bus topology, the frame will be lost and expected receiver will not receive the frame.

However, if they are connected in connection-oriented method, the sender thus will not receive the acknowledgement (ACK) and will be notified that the frame has not received by sender.

Ans. to the ques. no-03

The session layer of the OSI model resembles this procedure.

'Synchronization' is a responsibility of OSI model in session layer. It allows a process to add checkpoints or synchronization points to a stream of data. The main purpose of this mechanism is to enable both parties resume their communication from a checkpoints rather than from the beginning. for example, if I'm downbading a 1GB file and after downloding 700 MB my connection drops, this process allows me to resume my downloading from 700 MB again after connection restores rather than downloding from the beginning.

Ans to the question no-4

a) application layer

b) Data-Link layer and Transport layer

c) Physical layer

Ans. to the question no-5

a)

given,

average signal power = 1533 W

average noise power = 3 W

$$\therefore \quad SNR = \frac{1533}{3} = 511$$

and bandwith = 1MHz = 1×10^6 Hz

$$\therefore \text{ capacity} = \text{bandwith} \times \log_2(1+SNR)$$

$$= 1 \times 10^6 \times \log_2(1+511)$$

$$= 9 \times 10^6 = 9 \text{ Mbps}$$

So, theoretical maximum capacity is 9Mbps. (Ans:)

(b)

$$\text{Bitrate} = 9 \times 10^6 \times \frac{75}{100} = 6.75 \times 10^6 \text{ bps}$$

So, $\text{Bitrate} = 2 \times \text{bandwith} \times \log_2 L$

$$\Rightarrow \log_2 L = \frac{6.75 \times 10^6}{2 \times 1 \times 10^6}$$

$\Rightarrow \log_2 L = 3.375$

$\therefore L = 2^{3.375}$

$\Rightarrow L = 10.374$

$\therefore L \approx 16$ levels

we used 16 levels as it is an integer and is a power of 2. So, 16 signal levels are required.

Ans. to the que. no-06

There are total 3 LANs in the given topology.

firstly,

PC0, PC1 and PC2 connected to switch1, which is connected to R1.

Secondly,

PC4 and PC3 to switch2 connection and then to R3 connection

thirdly,

PC5 and PC6 are connected to switch0 and then connected to R2.

The 1st hop that data has to go from PC1 is R1.

Ans. to the que. no-7

1. internet layer
2. Network interface layer
3. Application layer
4. Transport layer
5. Network interface layer
6. Application layer

Ans. to the ques. no-08

Given, a nonperiodic composite signal with frequency from 10 to 30 KHz. The peak amplitude for the lowest and highest signal is 10 V and 30v for the 30KHz signal. Below is the frequency spectrum:

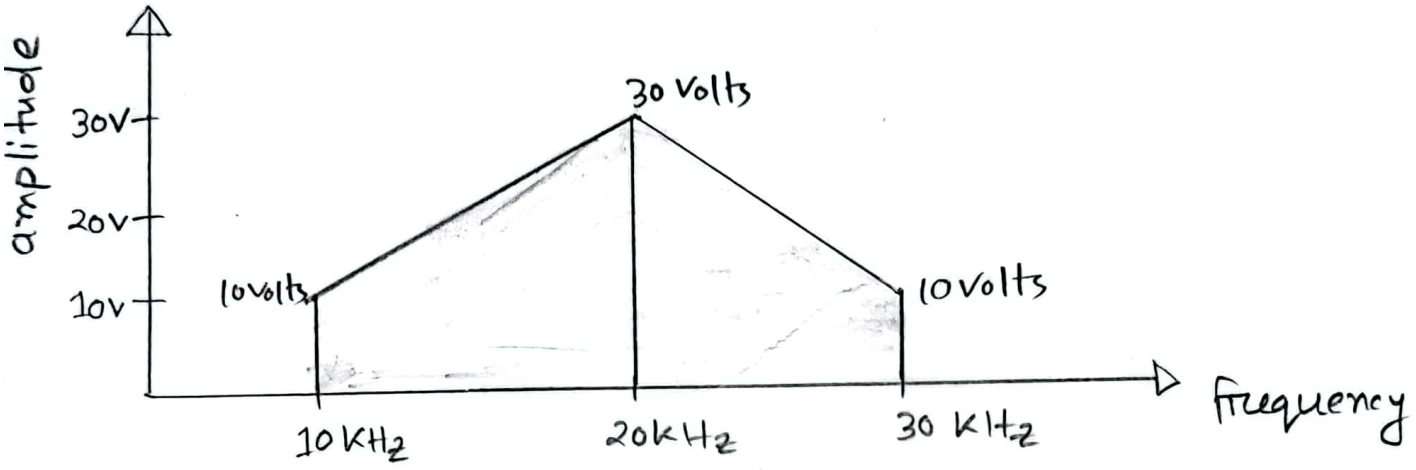


figure: frequency spectrum

Ans. to the que. no-09

(a)

$$\text{Bitrate} = \frac{108 \times 10^9 \times 8}{8 \times 60 \times 60} = 30 \times 10^6 \text{ bps}$$

$$\text{bandwith} = 13\text{ MHz} - 800\text{ KHz}$$

$$= (13 \times 10^6 - 800 \times 10^3)\text{ Hz}$$

$$= 12.2 \times 10^6 \text{ Hz}$$

So,

$$\text{BitRate} = 2 \times \text{Bandwith} \times \log_2 L$$

$$\Rightarrow \log_2 L = \frac{\text{BitRate}}{2 \times \text{Bandwith}} = \frac{30 \times 10^6}{2 \times 12.2 \times 10^6}$$

$$\Rightarrow L = 2^{\frac{30 \times 10^6}{2 \times 12.2 \times 10^6}}$$

$$\Rightarrow L = 2.345$$

$$\Rightarrow L \approx 4$$

we took the value that is an integer and is a power of 2. So, 4 voltage levels are needed.

(b)

given, noise power = $30\,mW = 30 \times 10^{-3}\,W$

So, signal power = $20 \times 30 \times 10^{-3}\,W$

$$\therefore SNR = \frac{20 \times 30 \times 10^{-3}}{30 \times 10^{-3}}$$

$$= 20$$

Now,

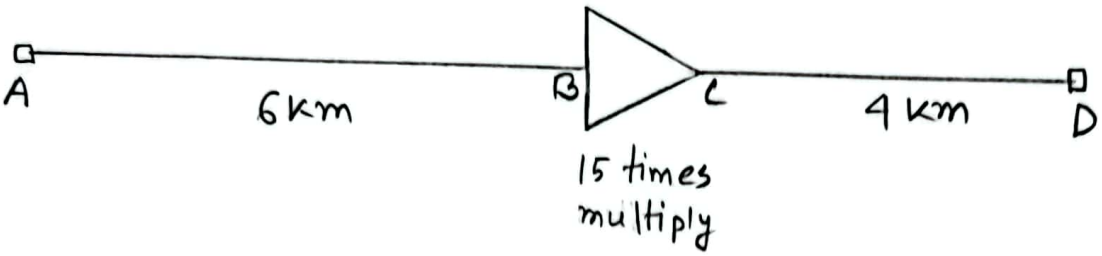
$$\text{capacity} = \text{bandwith} \times \log_2(1 + SNR)$$

$$\Rightarrow \text{capacity} = 12.2 \times 10^6 \times \log_2(21)$$

$$\Rightarrow \text{capacity} = 53.586\ \text{Mbps}$$

So, the capacity is 53.586 Mbps. (Ans.)

Ans. to the que. no - 10



given, the source power is 20 W.

So, $P_1 = 20\ W$

$\therefore P_2 = P_1 - (3 \times 6)$

$= 20 - 18$

$= 2\ W$

from A to B,

$$dB_{AB} = 10 \log_{10}\left(\frac{2}{20}\right)$$

$$= -10\ dB$$

Now, from B to C,

$$P_3 = 2 \times 15 = 30\ W$$

$$\therefore dB_{BC} = 10 \log_{10}\left(\frac{30}{2}\right)$$

$$= 11.76\ dB$$

Now, from C to D,

$$P_4 = P_3 - (4 \times 3)$$

$$= 30 - 12$$

$$= 18 \text{ W}$$

$$\therefore \quad dB_{CD} = 10 \log_{10}\left(\frac{18}{30}\right)$$

$$= -2.22 \text{ dB}$$

Finally, $dB_{total} = -10 + 11.76 - 2.22$

$$= -0.46 \text{ dB}$$

So, the signal is attenuated. (Ans.)