Assignment 1

-190010008

1.

Logical Address: It is a 32-bit IP address that is not embedded in the network card but is assigned to it to route between networks. This type of address operates at the Network Layer of the OSI Model. These addresses are created and used in protocols like IP (Internet Protocol) and IPX (Internetwork Packet Exchange). It is generated by the CPU from the perspective of a program.

Physical Address: It is also called a MAC address(Media Access Control) which identifies a device to other devices on the same local network. It is assigned to the device at the factory. Every device must have a unique MAC address. It is the hardware-level address used by the Ethernet interface to communicate on the network.

Mapping: The user program generates the logical address and thinks that the program is running in this logical address, but the program needs physical memory for its execution, therefore, the logical address must be mapped to the physical address by MMU (Memory Management Unit) before they are used. Physical Address identifies a physical location of required data in memory. The user never directly deals with the physical address but can access its corresponding logical address. Since the user only deals with the logical address, mapping is crucial to retrieve the location of code/data in RAM.

Protocols: The Address Resolution Protocol (ARP) is a protocol used by the Internet Protocol specifically IPv4, to map IP network addresses to the hardware addresses used by a data link protocol. The RARP (Reverse ARP) does the contrary.

2.

Let the distance between the 2 IITs be xm.

Time taken by sound to travel 10 m in air = $\frac{10}{330}\ secs$

Time taken by sound to travel x m in the cable = $\frac{x}{(2.3\times10^{8})}\ secs$

Equating both the times we get the value of x :

$$\frac{x}{(2.3\times10^{8})} = \frac{10}{330}$$

$$x = 6.969 \times 10^{6}\ m$$

$$x \approx 7 \times 10^{6}\ m = 7000\ Km$$

3.

Analogy to packet switching:
In a packet-switching communications network, the component that is analogous to the container is a constant-size packet (preferably of short length) that can be used for the transport of information.

$$Container \rightarrow Constant\ \ Size\ Packet$$

$$Train\ car,\ trucks,\ ships \rightarrow\ Transmission\ systems\ and\ networks$$

Just like how train cars, trucks, and ships are designed to carry standard containers; similarly, various types of transmission systems and networks can be designed to transmit packets of standard size in a network.

Advantages of standard-size information containers:
It is easier to create and decode standard-size network packets than those of distinctive length network packets, thus providing less end-to-end delay. The scheduling of transfer of packets along routers is also made much simple comparatively.

4.

Establishing a video game network:
We know that a video game involves interaction between a player(user) and servers across a network. So to support an interactive video game over a communications network, the network, whether connection-oriented or connectionless, must provide real-time delivery of the player's commands to the server, and of the server's responses to the player.

Requirements for connection-oriented networks:
In a connection-oriented network, the connections between the player and the servers must transmit the flow of commands and responses throughout the game with very little delay to play an interactive video game.

Requirements for connectionless networks:
In a connectionless network, the user commands may be transmitted to the servers with variable delay, out-of-sequence, or not at all. The responsibility for ensuring the ordered and correct delivery of game commands lies on the user’s network software. Also, in-time delivery of commands cannot be assured here.

5.

The TCP layer entity uses the port number to determine which application programs the packets belong to. In the TCP connection setup process, it is very convenient to have a unique well-known port number, otherwise, some protocol or procedure would be required to find the desired number. Also, if the port number matches then there will be a clash of client requests/operations about the same port.

6.

How big files are transferred:
Suppose end system A wants to send a large file to end system B.
The following steps to end System A creates packets from the file at a very high level:

- The file is divided into chunks.
- A packet is created by attaching a header to the chunks.
- Each packet maintains an address of the destination.

Determining the link to forward packets:

The following information in the packet is used by the switch to determine the link to which the packet is forwarded:

- The switch uses the destination address.
- It is easy to find which packet is forwarded to which switch using the header.

Packets Switching on the Internet:

The following method of packet switching on the Internet is analogous to driving from one city to another and asking for directions along the way:

- Each packet maintains an address of the destination.
- When the packet reaches a switch, it displays an outgoing link which tells the path to forward the packet.

7.

Little's formula states that:

$$N = a \times d$$

Let,

- **N** denote the average number of packets in the buffer plus the packet being transmitted
- **a** denote the rate of packets arriving at the link
- **d** denote the average total delay $(d_{queue} + d_{trans})$

Given:

- the buffer contains **10 packets**
- the average packet queuing delay is **10 ms**
- the link's transmission rate is **100 packets/sec**

Therefore,

$$d_{queue} = 10\,ms$$
$$R = 100\,packets/sec$$

To find: The average packet arrival rate i.e. **a**, assuming there is no packet loss.

Use the formula:

$$d_{trans} = L/R$$

where L is for 1 packet.
So we get,

$$d_{trans} = \frac{1\,packet}{100\,packets/sec}$$
$$d_{queue} = 10\,ms$$

Therefore,

$$d = 10ms + 10ms = 20ms$$

If the 1st packet being transmitted is not considered:

$$N = 10$$

Substituting the value of d in Little's Formula, we get:

$$10\,packets = a \times 0.02\,secs$$

$$a = \frac{10\,packets}{0.02\,secs} = 500\,packets/sec$$

So average packet arrival rate is **500 packets/sec**.

If the 1st packet being transmitted is considered:

$$N = 11$$

Substituting the value of d in Little's Formula, we get:

$$11\,packets = a \times 0.02\,secs$$

$$a = \frac{11\,packets}{0.02\,secs} = 550\,packets/sec$$

So average packet arrival rate is **550 packets/sec**.

8.

No. A connection is identified only by its sockets and a pair of ports are uniquely set up for ONE connection only. So, once a socket is formed and the connection is established via a 3-way handshake, the segments will go back and forth between these ports, therefore a new connection not possible. Thus, (1,p) ↔(2,q) is the only possible connection between those two ports.