What is the need of layered structure in OSIRM?

- **Modularity:** Each layer can be developed and maintained independently of the other layers. This makes it easier to add new features or fix bugs without affecting the rest of the system.
- **Abstraction:** The layers provide a layer of abstraction between the user and the underlying hardware. This makes it easier for users to interact with the system without having to worry about the details of how it works.
- **Scalability:** The layered structure makes it easy to scale the system by adding new layers or by increasing the capacity of the existing layers.
- **Security:** The layered structure can be used to improve the security of the system by isolating different components from each other.

How many minimum number of redundant bits are necessary for error detection and error correction?

The minimum number of redundant bits necessary for error detection is $d + 1$ and for error correction is $2d + 1$, where d is the number of bits that can be corrupted

For example, to detect a single-bit error, you need $d + 1 = 1 + 1 = 2$ redundant bits.

For example, to correct a single-bit error, you need $2d + 1 = 2 * 1 + 1 = 3$ redundant bits.

Explain Back Off procedure.

The backoff procedure works as follows:

1. When a device wants to transmit data, it first listens to the network to see if it is clear. If the network is clear, the device can transmit its data.
2. If the network is not clear, the device waits for a random amount of time before trying again. The amount of time that the device waits is exponentially increasing, meaning that it will wait for a longer time each time it fails to transmit its data.
3. The device continues to wait for a random amount of time and retry transmitting its data until it is successful.

Advantages: simple to implement, effective in reducing collisions, fair to all devices on the network.

Disadvantages: increase the latency of the network, inefficient if there are a lot of collisions, vulnerable to denial-of-service attacks.

Define the terms latency and throughput.

- **Latency** is the time it takes for a packet to travel from one point to another in a network. It is measured in milliseconds (ms).
- **Throughput** is the amount of data that can be transferred in a given amount of time. It is measured in bits per second (bps) or bytes per second (Bps).

What are the drawbacks of stop and Wait ARQ?

- **Low throughput:** Stop-and-Wait ARQ can only send one packet at a time, which means that the throughput is limited by the round-trip time (RTT) of the network.
- **High latency:** The sender must wait for an acknowledgment before sending the next packet, which can add latency to the transmission.
- **Vulnerable to errors:** If an acknowledgment is lost, the sender will not know that the packet was not received, and will retransmit the packet. This can lead to unnecessary retransmissions and wasted bandwidth.

Explain the design issues of Network layer.

- **Routing:** The network layer must be able to route packets efficiently between hosts. This requires a routing algorithm that can find the shortest path between two hosts, and that can adapt to changes in the network topology.
- **Error handling:** The network layer must be able to handle errors that occur in the network. This includes errors such as packet loss, corruption, and duplication.
- **Congestion control:** The network layer must be able to control congestion in the network. This is important to prevent the network from becoming overloaded and to ensure that packets are delivered in a timely manner.
- **Security:** The network layer must be able to provide security for packets. This includes protecting packets from eavesdropping, tampering, and denial-of-service attacks.

Given the IP address 156.23.10.78, what is the Default Mask, Network ID, Host Id and the CLASS of the address.

Field	Value
IP address	156.23.10.78
Class	B
Default subnet mask	255.255.0.0
Network ID	156.23
Host ID	10.78

Define Slotted Aloha.

Slotted Aloha is a random access protocol that is used to transmit data over a shared channel. The channel is divided into discrete time slots, and only one station is allowed to transmit data in each time slot. This helps to reduce the probability of collisions, which occur when two or more stations transmit data at the same time.

Slotted Aloha is a simple and efficient protocol, but it has a low throughput.

Working:

1. The channel is divided into time slots.
2. Each station listens to the channel to see if it is clear.
3. If the channel is clear, the station transmits its data in the next time slot.
4. If the channel is not clear, the station waits for the next time slot.

Differentiate between FDMA and FDM.

FDMA stands for **Frequency Division Multiple Access.** It is a channel access method that divides the available frequency spectrum into multiple channels, and each user is assigned a single channel. This allows multiple users to share the same physical medium, such as a cable or a radio frequency band, without interfering with each other.

FDM stands for **Frequency Division Multiplexing.** It is a multiplexing technique that combines multiple signals into a single signal by assigning each signal to a different frequency band. This allows multiple signals to be transmitted over the same physical medium without interfering with each other.

What are the advantages of Computer Network?

- **Resource sharing:** Computer networks allow users to share resources, such as printers, scanners, and software. This can save businesses money and improve productivity.
- **Communication:** Computer networks allow users to communicate with each other, regardless of their physical location. This can improve collaboration and productivity.
- **Information sharing:** Computer networks allow users to share information, such as files, documents, and databases. This can improve access to information and decision-making.
- **Remote access:** Computer networks allow users to access files, applications, and other resources remotely. This can improve flexibility and productivity.
- **Scalability:** Computer networks can be scaled to meet the needs of businesses of all sizes. This makes them a cost-effective solution for businesses that are growing.
- **Reliability:** Computer networks can be made highly reliable by using redundant components and fault-tolerant systems. This can help to ensure that businesses can continue to operate even if there is a failure in the network.

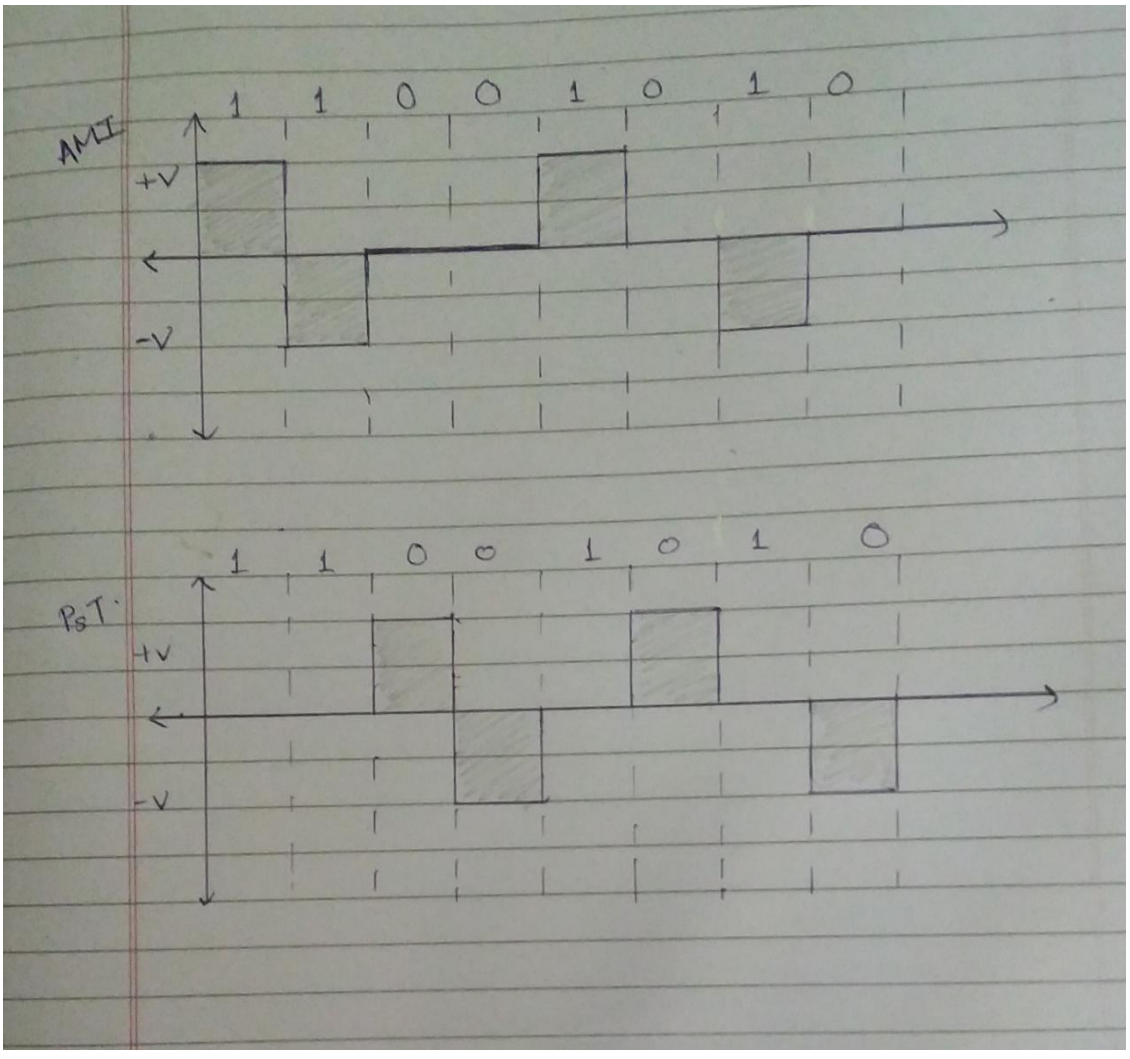
Explain the structure of OSIRM and compare it with TCP/IP model

What are the benefits of using OPTICAL FIBRES?

- **High bandwidth:** Optical fibers can carry much more data than copper cables. This is because they use light to transmit data, which is a much higher frequency than electricity.
- **Longer distances:** Optical fibers can transmit data over much longer distances than copper cables. This is because they are not as susceptible to attenuation, which is the loss of signal strength over distance.
- **Immunity to interference:** Optical fibers are immune to electromagnetic interference (EMI). This means that they are not affected by noise from other electronic devices.
- **Lightweight and flexible:** Optical fibers are much lighter and more flexible than copper cables. This makes them easier to install and to work with.
- **Security:** Optical fibers are more secure than copper cables. This is because they are difficult to tap into, and the data that is transmitted is encrypted.

Explain the concept of Pseudo ternary and AMI technique used for digital data transmission. Explain by considering 11001010 as the data bits.

- **Alternate Mark Inversion (AMI) –** A neutral zero voltage represents binary 0. Binary 1's is represented by alternating positive and negative voltages.
- **Pseudoternary –** Bit 1 is encoded as a zero voltage and the bit 0 is encoded as alternating positive and negative voltages i.e., opposite of AMI scheme.



Write a short note on Telephone Systems

The telephone system is a network of interconnected telephone exchanges that allows people to communicate with each other over long distances. The telephone system is often used to provide voice over IP (VoIP) services. VoIP is a technology that allows voice calls to be transmitted over the Internet.

VoIP is a cost-effective alternative to traditional telephone service, and it offers a number of advantages, such as:

- **Lower call costs:** VoIP calls are typically much cheaper than traditional telephone calls.
- **Greater flexibility:** VoIP calls can be made from anywhere with an Internet connection.
- **Improved quality:** VoIP calls can offer better sound quality than traditional telephone calls.

Some benefits of using telephone system are:

- **Wide coverage:** The telephone system has a wide coverage area, so it can be used to connect people in different parts of the world.
- **Reliable:** The telephone system is a reliable way to communicate, even in areas with poor Internet connectivity.
- **Inexpensive:** The cost of making telephone calls has decreased significantly in recent years.

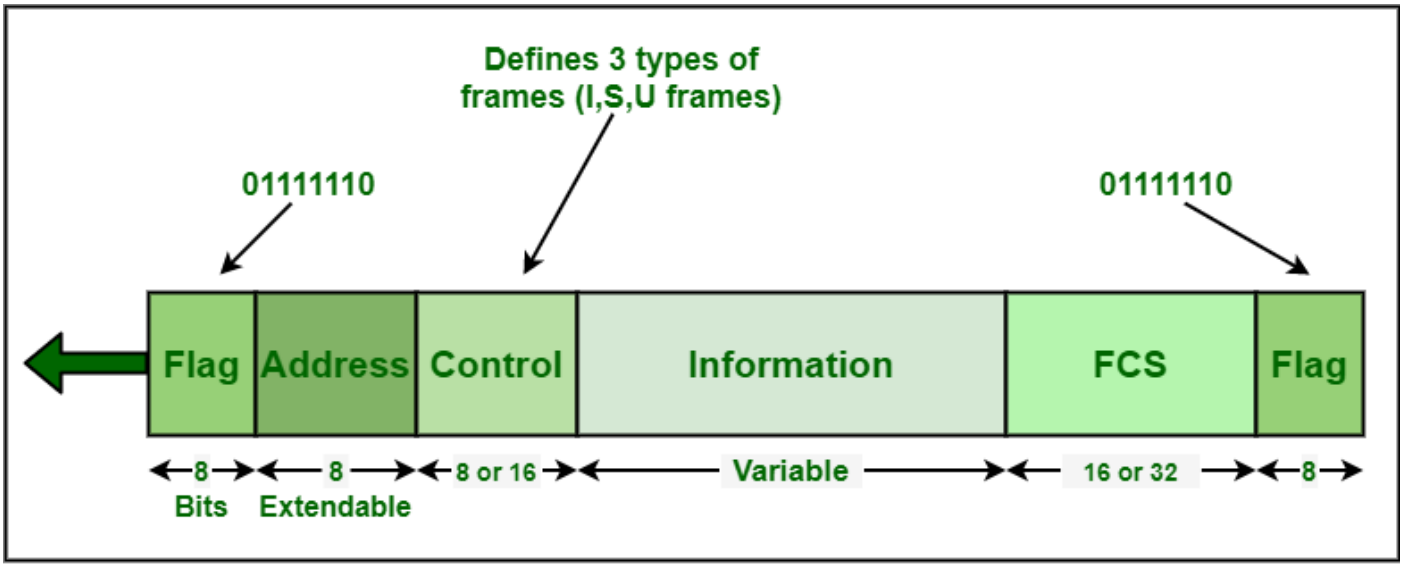
Explain the concept of Selective Repeat ARQ. Why the size of window is 2^{n-1} ?

- Selective Repeat ARQ is an error-control protocol that allows the sender to resend only the frames that have been lost or damaged.
- It works by using a sliding window, where the sender maintains a window of frames that have been sent but not yet acknowledged.
- The size of the window is typically 2^n-1, where n is a positive integer.
- The size of the window is typically chosen to be a power of 2 because this makes it easy to implement the sliding window protocol.
- Selective Repeat ARQ is more efficient and reliable than Go-Back-N ARQ, but it is also more complex to implement and more sensitive to out-of-order frames.

Explain the frame formats of I,S and U frames of HDLC protocol

The HDLC (High-Level Data Link Control) protocol is a bit-oriented data link layer protocol that is used to provide reliable data transfer between two nodes. HDLC frames are used to encapsulate data and control information.

The frame format for I, S, and U frames in HDLC is as follows:



Basic Frame Structure

- **Flag:** The flag is a 8-bit sequence that marks the beginning and end of the frame. The bit pattern of the flag is 01111110.
- **Address:** The address field identifies the destination and source of the frame. The address field may be from 1 byte to several bytes.
- **Control:** The control field contains information about the type of frame and the control information. The control field is 1 or 2 bytes long.
- **Data:** The data field contains the user data that is being transferred. The length of the data field may vary from one frame to another.
- **FCS:** The FCS (Frame Check Sequence) is a 16-bit checksum that is used to detect errors in the frame.

Frame type	Description
I-frame	Information frame. Carries user data and control information.
S-frame	Supervisory frame. Used for flow and error control.
U-frame	Unnumbered frame. Used for miscellaneous functions, such as link management.

What do you mean by channel allocation problem?

The channel allocation problem is the problem of assigning a channel to each user in a wireless network. The goal is to maximize the number of users that can be served while minimizing interference between users.

There are two main types of channel allocation problems:

- **Static channel allocation:** In static channel allocation, the channels are allocated to users once and for all. This is a simple solution, but it is not very flexible. If the traffic patterns change, the channels may not be allocated efficiently.
- **Dynamic channel allocation:** In dynamic channel allocation, the channels are allocated to users on a need-basis. This is a more flexible solution, but it is also more complex. The channels must be allocated in a way that minimizes interference and maximizes the number of users that can be served.

Explain the technique used in Channelization (in Multiple Access Methods).

There are three main types of channelization techniques:

- **Frequency-division multiple access (FDMA):** In FDMA, the available bandwidth is divided into multiple channels, and each user is assigned a single channel. This is the simplest type of channelization, but it is not very efficient because it wastes bandwidth.
- **Time-division multiple access (TDMA):** In TDMA, the available time is divided into multiple slots, and each user is assigned a single slot. This is more efficient than FDMA because it does not waste bandwidth. However, it can be more complex to implement.
- **Code-division multiple access (CDMA):** In CDMA, each user is assigned a unique code. The codes are used to spread the user's signal across the entire bandwidth. This allows multiple users to transmit simultaneously without interfering with each other. CDMA is the most efficient type of channelization, but it is also the most complex to implement.

What are the devices used at different layers of OSIRM?

Application layer: Web servers, email servers, file servers, application gateways.

Presentation layer: Terminal emulators, file transfer protocols, data compression protocols.

Session layer: Gateways, load balancers, application servers, session border controllers (SBCs).

Network layer: Routers, gateways, network address translation (NAT) devices.

Transport layer: Firewalls, load balancers, transport protocols.

Data link layer: Bridges, switches, wireless access points (WAPs), media access control (MAC) address filters.

Physical layer: Repeaters, hubs, network interface cards (NICs), cables.

Explain the frame format of IEEE 802.3 MAC sublayer

The frame format consists of the following fields:

- **Preamble:** The preamble is a 7-byte pattern of alternating 0's and 1's. It is used to synchronize the sender and receiver of the frame.
- **Start of frame delimiter (SFD):** The SFD is a 1-byte pattern of 10101011. It marks the beginning of the frame.
- **Destination address:** The destination address is a 6-byte field that identifies the recipient of the frame.
- **Source address:** The source address is a 6-byte field that identifies the sender of the frame.
- **Length/Type:** The length/type field is a 2-byte field that indicates the length of the data field or the type of frame.
- **Data:** The data field is a variable-length field that contains the data being transmitted.
- **Cyclic redundancy check (CRC):** The CRC is a 4-byte field that is used to detect errors in the frame.

Write short notes on the following:

(a) Distance Vector Routing

Distance vector routing is a routing algorithm that uses the distance to a destination as the metric to determine the best route. The distance is usually measured in hops, which is the number of routers a packet has to pass through to reach its destination.

Some of the most common distance vector routing protocols include:

- RIP (Routing Information Protocol)
- IGRP (Interior Gateway Routing Protocol)
- EIGRP (Enhanced Interior Gateway Routing Protocol)

(b) Forwarding Techniques

Forwarding techniques are used to determine how to forward packets to their destination. There are two main types of forwarding techniques:

- **Static forwarding:** Static forwarding uses a pre-configured table to determine how to forward packets. This table is usually manually created by an administrator.
- **Dynamic forwarding:** Dynamic forwarding uses a routing protocol to determine how to forward packets. This allows the routing table to be updated automatically as the network topology changes.

Some of the most common forwarding techniques include:

- OSPF (Open Shortest Path First)
- BGP (Border Gateway Protocol)

- EIGRP (Enhanced Interior Gateway Routing Protocol)

(c) How to create a routing table?

A routing table is a table that contains information about all the known networks and how to reach them. It is used by routers to determine how to forward packets to their destination.

To create a routing table, you need to know the following information about each network:

- The network address
- The subnet mask
- The next hop router
- The metric

The steps to create a routing table are:

1. Gather the information about the known networks.
2. Enter the information into the router's configuration.
3. Save the configuration.