COMPUTER NETWORKS
UNIT -2

What Is Connection-Oriented Service?What Is Connection-Less Service?

Connection-Oriented Service

Connection-oriented is a means of transmitting data in which the devices at the end points use a preliminary protocol to establish an end-to-end connection before any data is sent.

A good connection-oriented service can often deliver more quality than large bandwidth. It can be a circuit-switched connection or a virtual circuit connection in a packet-switched network.

Advantages of Connection-Oriented Service

- It is a reliable connection service.
- Duplication of data packets does not arise.
- Cases of congestion do not arise.
- Data packets sequencing is guaranteed.
- Suitable for long connections.

Disadvantages Of Connection-Oriented Service

- Resource allocation is mandatory before communication.
- The speed of connection is slower. There is much time taken for establishing and relinquishing the connection.
- No alternative ways to continue with communication incase of network congestion or router failures.

Connection-Oriented Services Characteristics

1. Connection-oriented service is related to the telephone system.It is implemented either using circuit witching or VCs.
2. All the packets between sender and destination follow the same path.
3. It is comparatively slower to connection-less service.
4. Congestion is not possible in connection-oriented service.
5. It is suitable for long and steady communication.
6. Resource allocation is necessary.
7. Bandwidth requirement is higher in connection-oriented service.

8. TCP is an example of connection-oriented protocol.

Connection-Less Service

A connectionless service is a way of transmitting data communication between two terminals where the sender sends data packets to its destination without establishing a connection to the destination. A good example of connectionless systems is LANs.

In connectionless transmissions, the service provider usually cannot guarantee that there will be no loss, error insertion, mis-delivery, duplication or out-of-sequence delivery of the packets.I

Advantages of Connectionless Service

- There are usually low overheads involved.
- It is to broadcast or multicast messages to multiple recipients.
- No circuit setup. Therefore, it takes a fraction of a minute to establish connection.
- It has alternative path of data transmission in case of router failures.

Disadvantages Of Connectionless Service

- It is susceptible to network congestion.
- It is not a reliable connection as possibility of loss of packets, wrong deliver or duplication is high.
- Each data packet needs lengthy fields

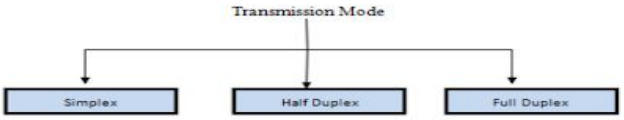
Connection-Less Services Characteristics

1. Connection-less service is related to the postal system.It is implemented using packet switching.
2. Not necessary all packets transmitting between sender and receiver follows the same path.
3. There is no delay due to absence of established connection phase.
4. It is faster when compared to connection-oriented.
5. It is suitable for bursty transmissions.It is not possible to re-transmit the lost data bits.
6. There is no concept of signaling.
7. Resource allocation is not necessary.
8. Bandwidth requirement is low in connection-less services.
9. UDP is an example of a connection-less protocol.

2)What are different transmission modes?

Transmission mode refers to the mechanism of transferring of data between two devices connected over a network. It is also called **Communication Mode**. These modes direct the direction of flow of information. There are three types of transmission modes. They are:

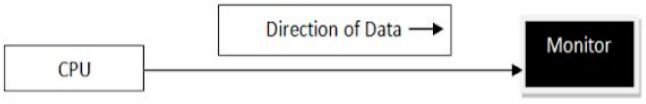
1. Simplex Mode
2. Half duplex Mode
3. Full duplex Mode



SIMPLEX Mode

In this type of transmission mode, data can be sent only in one direction i.e. communication is unidirectional. We cannot send a message back to the sender. Unidirectional communication is done in Simplex Systems where we just need to send a command/signal, and do not expect any response back.

Examples of simplex Mode are loudspeakers, television broadcasting, television and remote, keyboard and monitor etc.

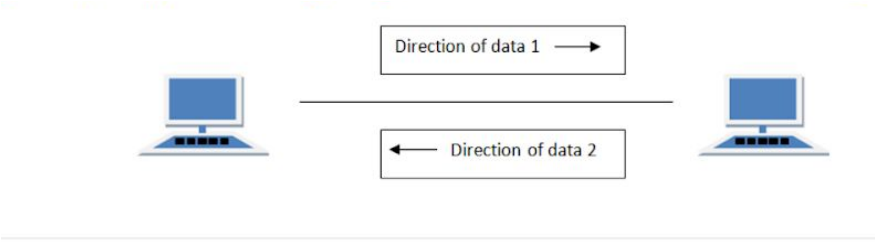


HALF DUPLEX Mode

Half-duplex data transmission means that data can be transmitted in both directions on a signal carrier, but not at the same time.

For example, on a local area network using a technology that has half-duplex transmission, one workstation can send data on the line and then immediately receive data on the line from the same direction in which data was just transmitted. Hence half-duplex transmission implies a bidirectional line (one that can carry data in both directions) but data can be sent in only one direction at a time.

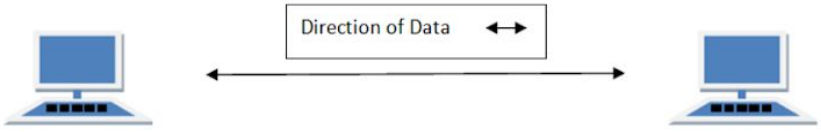
Example of half duplex is a walkie- talkie in which message is sent one at a time but messages are sent in both the directions.



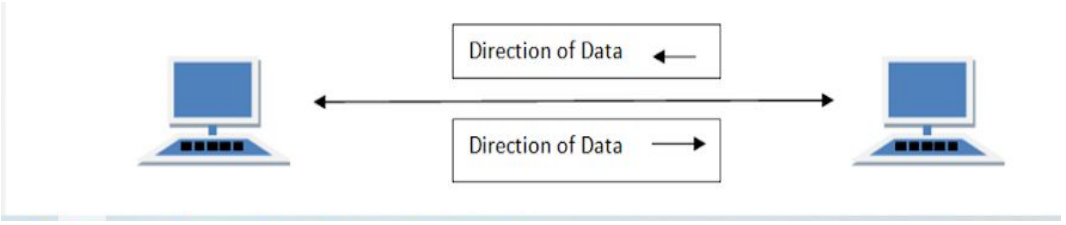
FULL DUPLEX Mode

In full duplex system we can send data in both the directions as it is bidirectional at the same time in other words, data can be sent in both directions simultaneously.

Example of Full Duplex is a Telephone Network in which there is communication between two persons by a telephone line, using which both can talk and listen at the same time.



In full duplex system there can be two lines one for sending the data and the other for receiving data.



3)What are the services provided by physical layer?

The physical layer is the first and lowest layer of the Open System Interconnection Model (OSI Model.)

This layer plays with most of the network's physical connections—wireless transmission, cabling, cabling standards and types, connectors and types, network interface cards, and more —as per network requirements.

The physical layer does not deal with the actual physical medium (like copper, fiber, etc.)

The physical layer provides the following services:

- **Modulates the process of converting a signal from one form to another so that it can be physically transmitted over a communication channel.**
- **Bit-by-bit delivery.Bit synchronization for synchronous serial communications.**
- **Line coding, which allows data to be sent by hardware devices that are optimized for digital communications**
- **Circuit switching and multiplexing hardware control of multiplexed digital signals.**
- **Signal equalization to ensure reliable connections and facilitate multiplexing.**
- **Forward error correction/channel coding such as error correction code.**
- **Bit interleaving to improve error correction.**
- **Auto-negotiation.**
- **Transmission mode control.**

Examples of protocols that use physical layers include:

- **Digital Subscriber Line.**
- **Integrated Services Digital Network.**
- **Infrared Data Association.**
- **Universal Serial Bus (USB.)**
- **Bluetooth.**
- **Controller Area Network.**
- **Ethernet.**

4)Explain and differentiate FDM,WDM,TDM?

Multiplexing Definition

Multiplexing is a technique which combines multiple signals into one signal, suitable for transmission over a communication channel such as coaxial cable

The multiplexing technique divides the communication channel into several logical sub-channels. Each logical sub-channel is dedicated to an individual signal.

Multiplexing is done by using a device called Multiplexer or MUX. The multiplexer combines n input lines to generate one output line.

Applications of Multiplexing

1. Communication system

2. Computer memory

3. Telephone systems

4. TV broadcasting

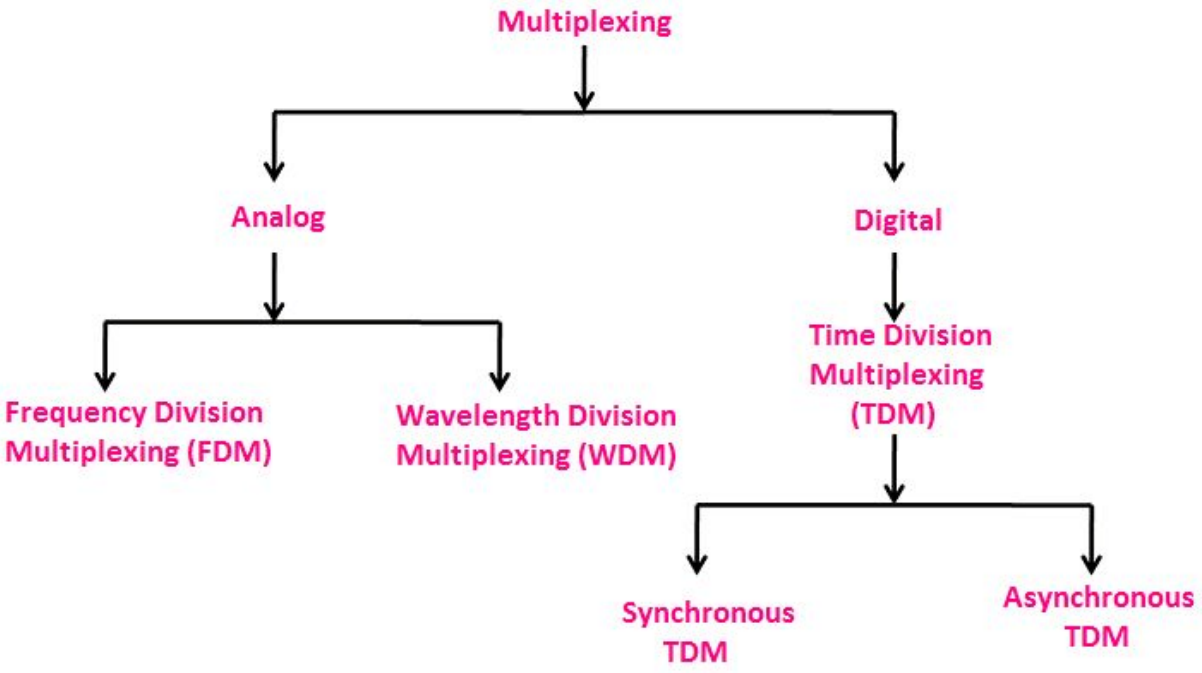
5. Telemetry

6. Satellites

Types of Multiplexing

Multiplexing is mainly classified into two types:

- **Analog multiplexing**
- **Digital multiplexing**



Analog multiplexing is again classified into two types:

- Frequency Division Multiplexing
- Wavelength Division Multiplexing

In digital multiplexing, the Time Division Multiplexing is the most popular technique. The time division multiplexing is again classified into two types:

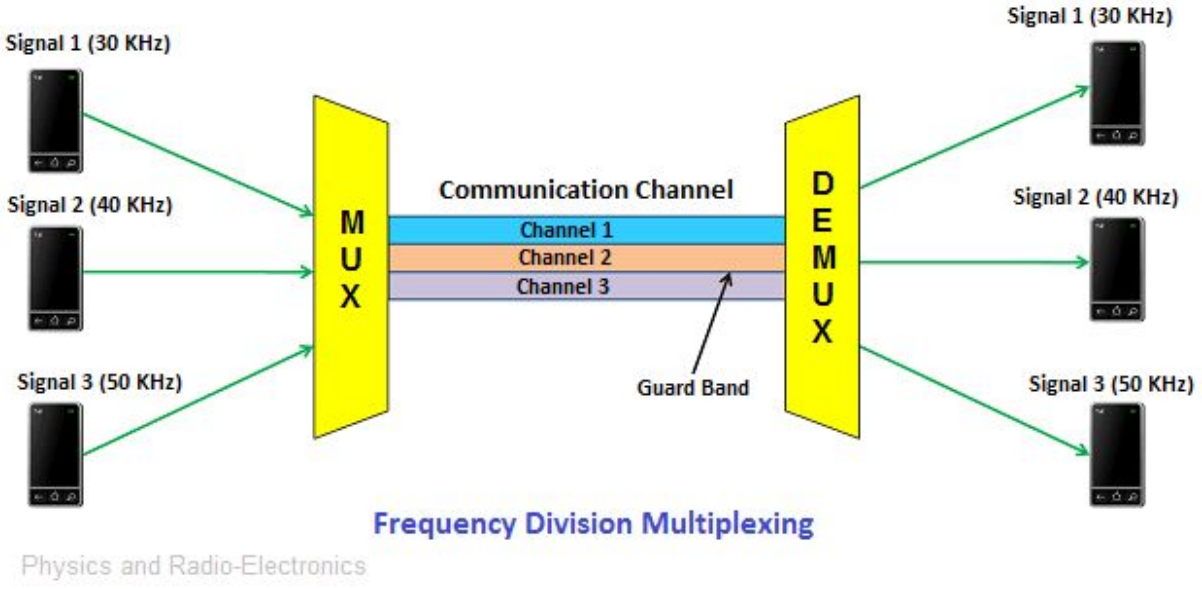
- Synchronous TDM
- Asynchronous TDM

Frequency Division Multiplexing

Frequency division multiplexing is an analog technique. It is the most popular multiplexing technique. We use this technique

extensively in TV and radio transmission. This technique combines multiple signals into one signal and transmitted over the communication channel.

In this technique, the bandwidth of the communication channel should be greater than the combined bandwidth of individual signals.



Advantages of Frequency Division Multiplexing (FDM)

1. It transmits multiple signals simultaneously.

2. In frequency division multiplexing, the demodulation process is easy.

3. It does not need Synchronization between transmitter and receiver.

Disadvantages of Frequency Division Multiplexing (FDM)

It needs a large bandwidth communication channel.

Applications of Frequency Division Multiplexing (FDM)

1. Frequency division multiplexing is used for FM and AM radio broadcasting.

2. It is used in first generation cellular telephone.

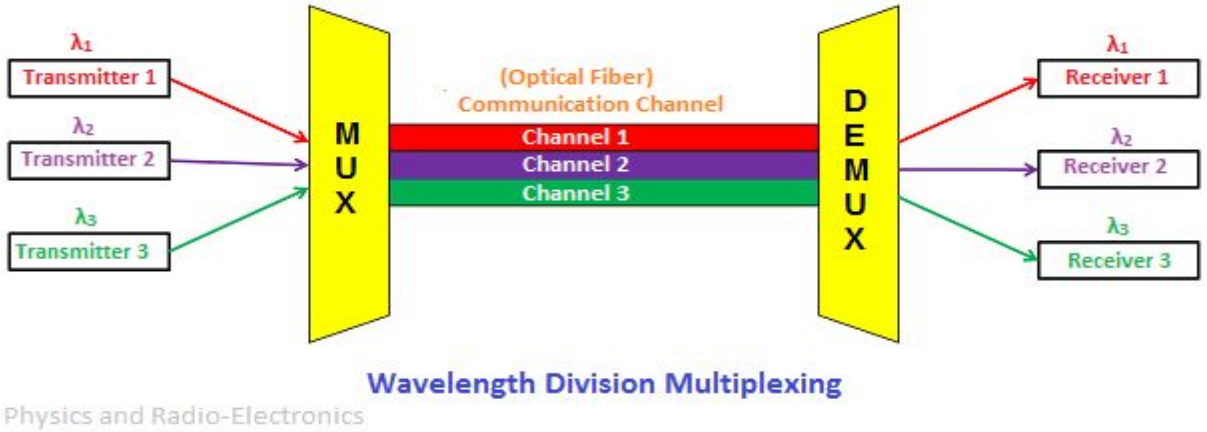
3. It is used in television broadcasting.

Wavelength Division Multiplexing

Wavelength division multiplexing is an analog technique. It is the most important and most popular method to increase the capacity of an optical fiber. We know that wavelength and frequency are inversely proportional to each other

In wavelength division multiplexing, optical signals are transmitted through fiber optic cables.

Wavelength division multiplexing is a technology in which multiple optical signals of different wavelengths or colors are combined into



Advantages of Wavelength Division Multiplexing (WDM)

1. WDM allows transmission of data in two directions simultaneously

2. Low cost

3. Greater transmission capacity

4. High security

Time Division Multiplexing

Time Division Multiplexing is a technique in which multiple signals are combined and transmitted one after another on the same communication channel.

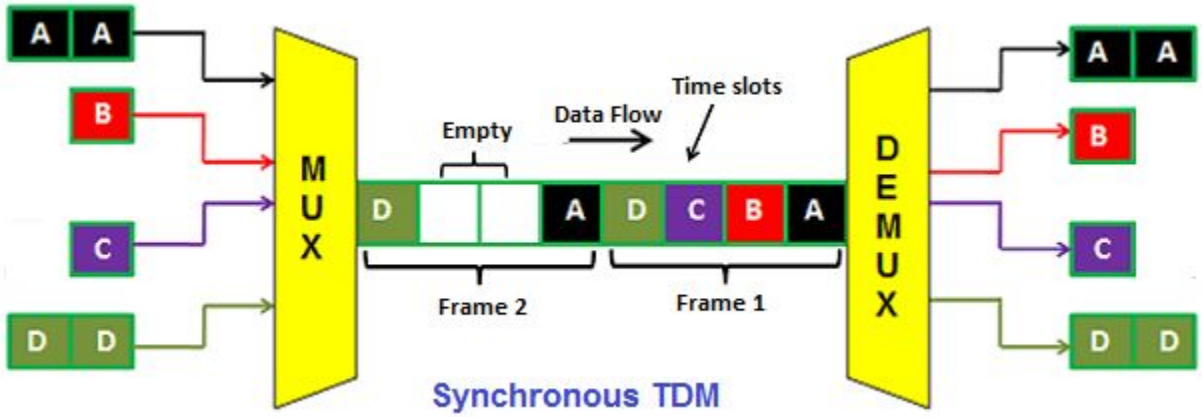
Types of TDM (Time Division Multiplexing)

Time Division Multiplexing is mainly classified into two types:

- Synchronous TDM (Time Division Multiplexing)
- Asynchronous TDM (Time Division Multiplexing)

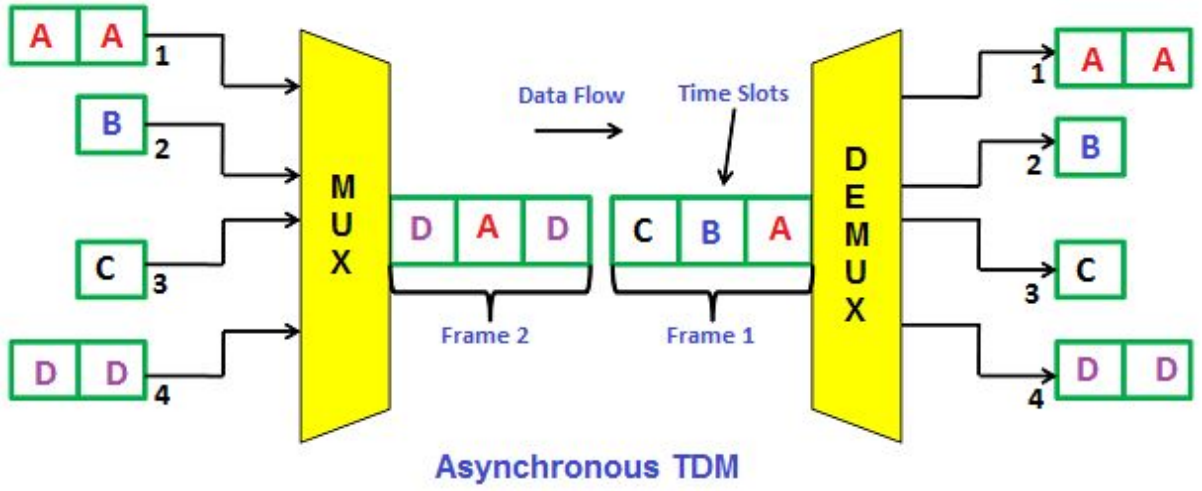
Synchronous TDM (Time Division Multiplexing)

In synchronous time division multiplexing, each device is allotted with a fixed time slot, regardless of the fact that the device has any data to transmit or not. The device has to transmit data within this time slot. If the device does not have any data to send then its time slot remains empty.



Asynchronous TDM (Time Division Multiplexing)

In Asynchronous time division multiplexing, the time slots are not fixed (I.e. time slots are flexible). The asynchronous TDM is also known as statistical time division multiplexing.In synchronous TDM, the number of time slots is equal to the number of devices.



Advantages of Time Division Multiplexing (TDM)

1. Full bandwidth is utilized by a user at a particular time.

2. The time division multiplexing technique is more flexible than frequency division multiplexing.

3. In time division multiplexing, the problem of crosstalk is very less.

Disadvantages of Time Division Multiplexing (TDM)

In time division multiplexing, synchronization is required.

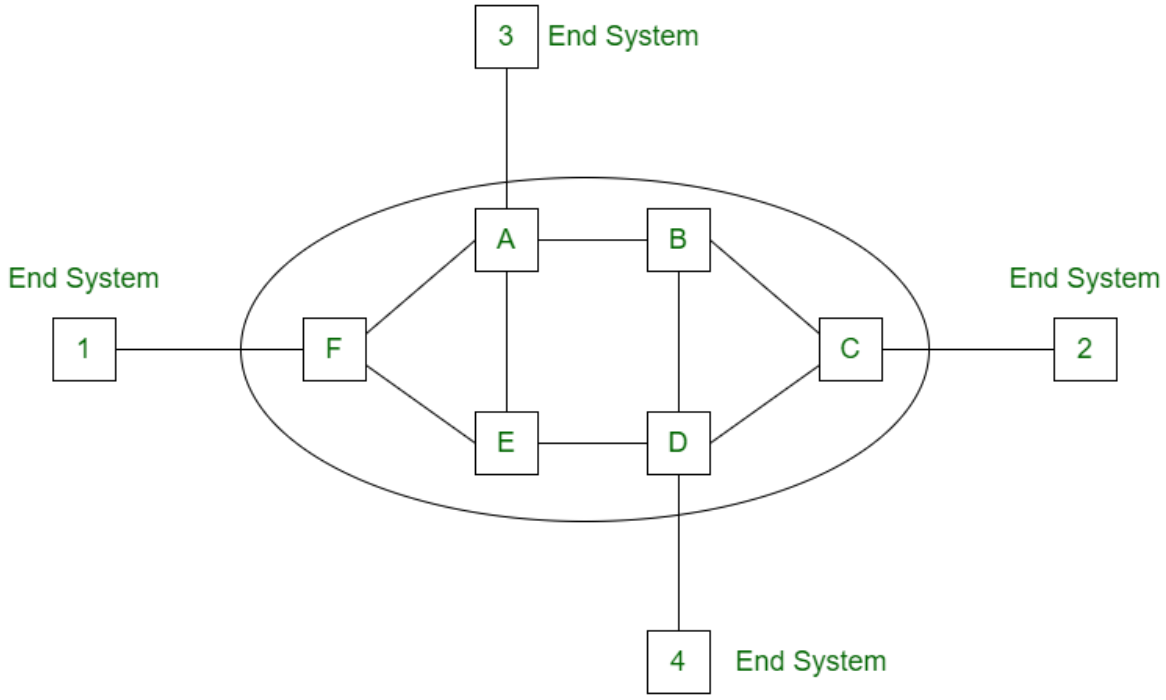
Compare FDM, WDM, and TDM

FDM	WDM	TDM
1. The communication channel is divided by frequency.	1. The communication channel is divided by wavelength.	1. The communication channel is divided by time.
2. Analog technique.	2. Analog technique.	2. Digital technique.
3. Synchronization is not required.	3. Synchronization is not required.	3. Synchronization is required.
4. It requires complex circuitry at the transmitter and receiver.	4. It requires complex circuitry at the transmitter and receiver.	4. It does not require complex circuitry.

5. In FDM, the problem of crosstalk is severe.	5. In WDM, the problem of crosstalk is severe.	5. In TDM, the problem of crosstalk is not severe.
6. The channel bandwidth is effectively used.	6. The channel bandwidth is effectively used.	6. The channel bandwidth is wasted.
7. FDM stands for Frequency Division Multiplexing.	7. WDM stands for Wavelength Division Multiplexing.	7. TDM stands for Time Division Multiplexing

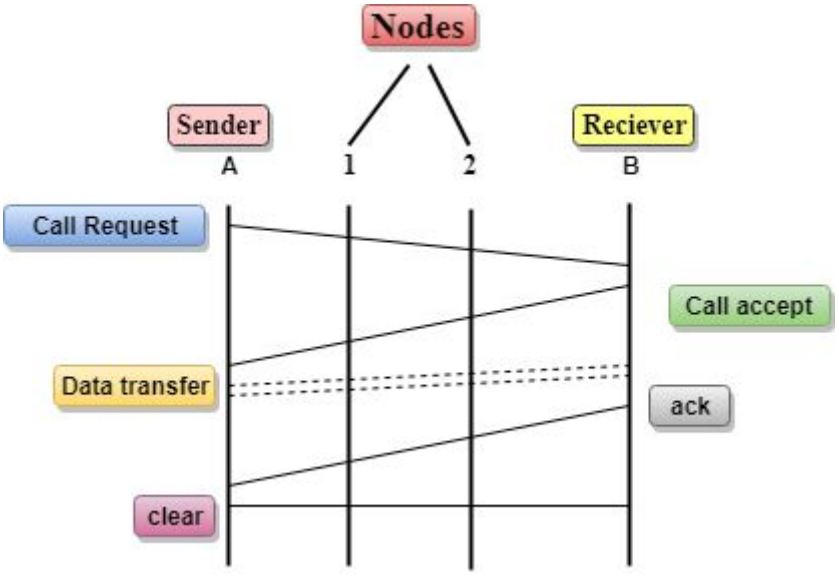
5)explain how virtual circuit switching works

Virtual Circuit is the computer network providing connection-oriented service. It is a connection-oriented network. In virtual circuit resource are reserve for the time interval of data transmission between two nodes. This network is a highly reliable medium of transfer. Virtual circuits are costly to implement.



Working of Virtual Circuit:

- **In the first step a medium is set up between the two end nodes.**
- **Resources are reserved for the transmission of packets.**
- **Then a signal is sent to sender to tell the medium is set up and transmission can be started.**
- **It ensures the transmission of all packets.**
- **A global header is used in the first packet of the connection.**
- **Whenever data is to be transmitted a new connection is set up**



- **In the above diagram, A and B are the sender and receiver respectively. 1 and 2 are the nodes.**
- **Call request and call accept packets are used to establish a connection between the sender and receiver.**
- **When a route is established, data will be transferred.**
- **After transmission of data, an acknowledgment signal is sent by the receiver that the message has been received.**
- **If the user wants to terminate the connection, a clear signal is sent for the termination.**

Congestion Control in Virtual Circuit:

Once the congestion is detected in virtual circuit network, closed-loop techniques is used. There are different approaches in this technique:

- **No new connection –**
  No new connections are established when the congestion is detected. This approach is used in telephone networks where no new calls are established when the exchange is overloaded.
- **Participation of congested router invalid –**
  Another approach to control congestion is allow all new connections but route these new connections in such a way that congested router is not part of this route.
- **Negotiation –**
  To negotiate different parameters between sender and receiver of the network, when the connection is established. During the set up time, host specifies the shape and volume of the traffic, quality of service and other parameters.

Advantages of Virtual Circuit:

1. **Packets are delivered to the receiver in the same order sent by the sender.**
2. **Virtual circuit is a reliable network circuit.**
3. **There is no need for overhead in each packet.**
4. **Single global packet overhead is used in virtual circuit.**

Disadvantages of Virtual Circuit:

1. **Virtual circuit is costly to implement.**
2. **It provides only connection-oriented service.**
3. **Always a new connection set up is required for transmission.**