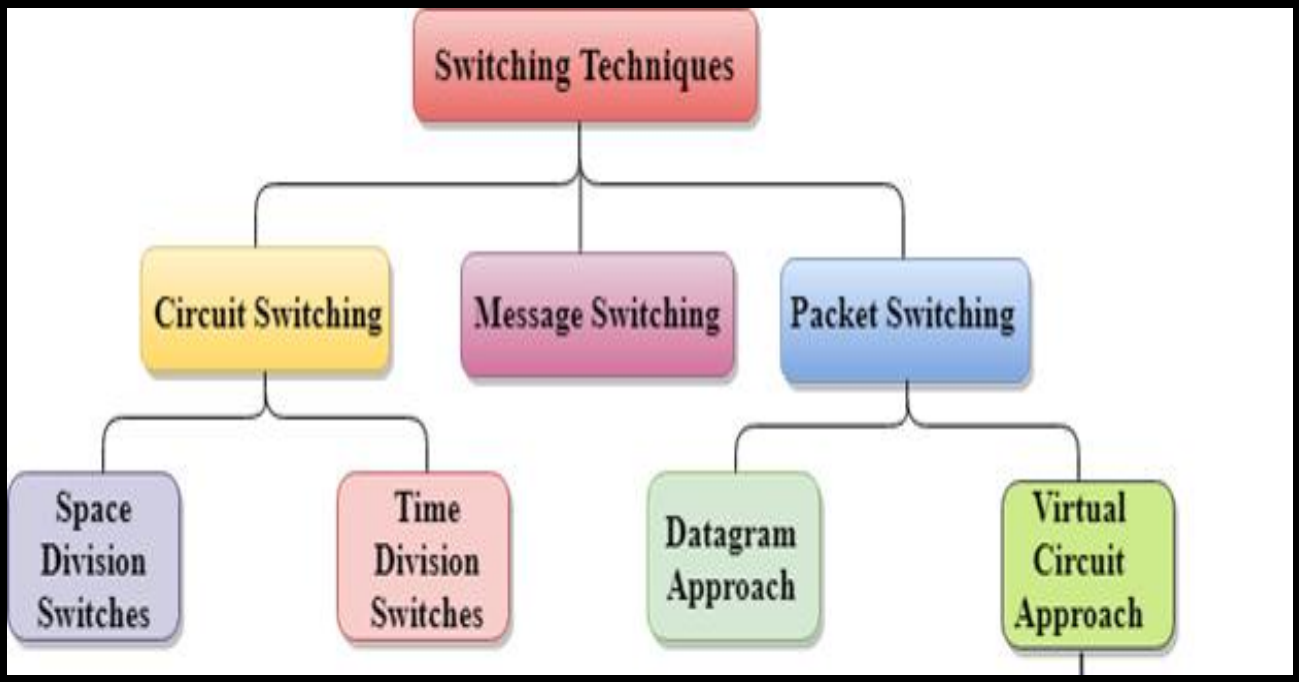
Switching:

The switching is a technique in computer network that will decide the best route for data transmission.

In large networks, there can be multiple paths from sender to receiver. Switching technique is used to connect the systems for making one-to-one communication.

Classification Of Switching Techniques



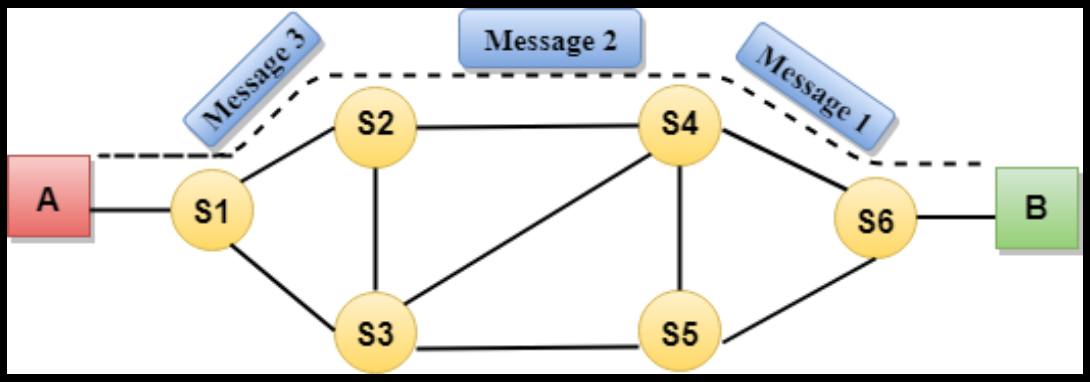
1. Circuit Switching:

- ✓ **Circuit Switching:** A technique that establishes a dedicated path between sender and receiver.
- ✓ **Connection Persistence:** The path remains active until the connection is terminated.
- ✓ **Functionality:** Operates like a telephone network, requiring an end-to-end path before communication.
- ✓ **Data Transfer Process:** Sender requests a connection → Receiver acknowledges → Dedicated path transfers data.

- ✓ **Usage:** Commonly used in public telephone networks for voice transmission.
- ✓ **Data Transfer:** Fixed data rate transmission.

Communication through circuit switching has 3 phases:

- Circuit establishment
- Data transfer
- Circuit Disconnect



Advantages Of Circuit Switching:

- In the case of Circuit Switching technique, the communication channel is dedicated.
- It has fixed bandwidth.

Disadvantages of Circuit Switching:

- **Delay:** Only occurs in data transmission speed after path establishment.
- **Connection Time:** Takes around 10 seconds to establish, delaying data transfer.
- **Costly:** Requires a dedicated path, making it more expensive.
- **Inefficient:** Wastes capacity if no data is transmitted after setup.
- **Exclusive Usage:** No other data can use the channel even when idle.

Switching Techniques: Space Division vs. Time Division

1. Space Division Switching:

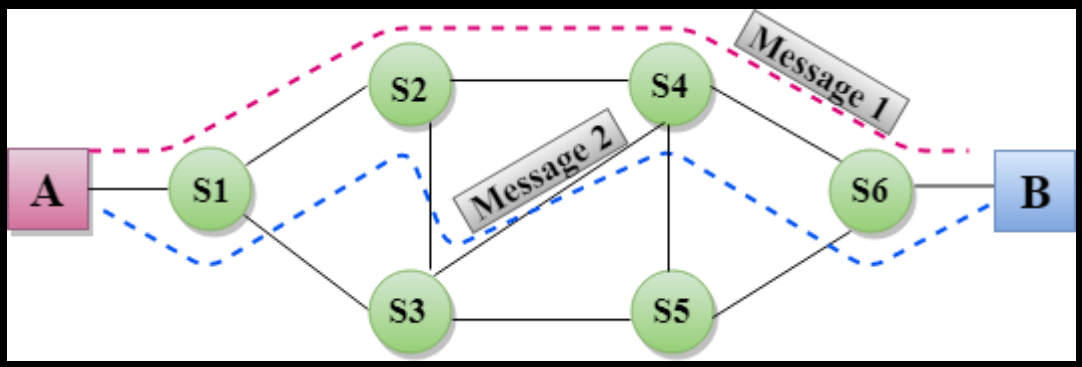
- Creates separate physical paths for each connection.
- Uses **crosspoint switches** (like tiny switches in a grid) to connect calls.
- Works for both **analog and digital** networks.
- Has two ways to control connections: **input-based** and **output-based**.
- **Pros:** Fast and instant connection.
- **Cons:** Needs more switches, which can cause blocking.

2. Time Division Switching:

- Breaks **digital** signals into small time slots.
- Multiple signals share the same path but at different **time intervals**.
- Also called **time multiplexing** (combining many signals into one data stream).
- Uses a **TSI (Time-Slot Interchange) switch**, which stores and reorders data.
- **Pros:** Efficient use of network paths.
- **Cons:** Requires storage and time synchronization.

2. Message Switching:

- **Technique:** Messages are transferred as complete units via intermediate nodes.
- **No Dedicated Path:** No fixed path between sender and receiver.
- **Dynamic Routing:** Messages are routed based on the destination address.
- **Efficient Routing:** Nodes determine the best route for message transfer.
- **Store and Forward:** Each node stores the message before forwarding it.



Advantages of Message Switching:

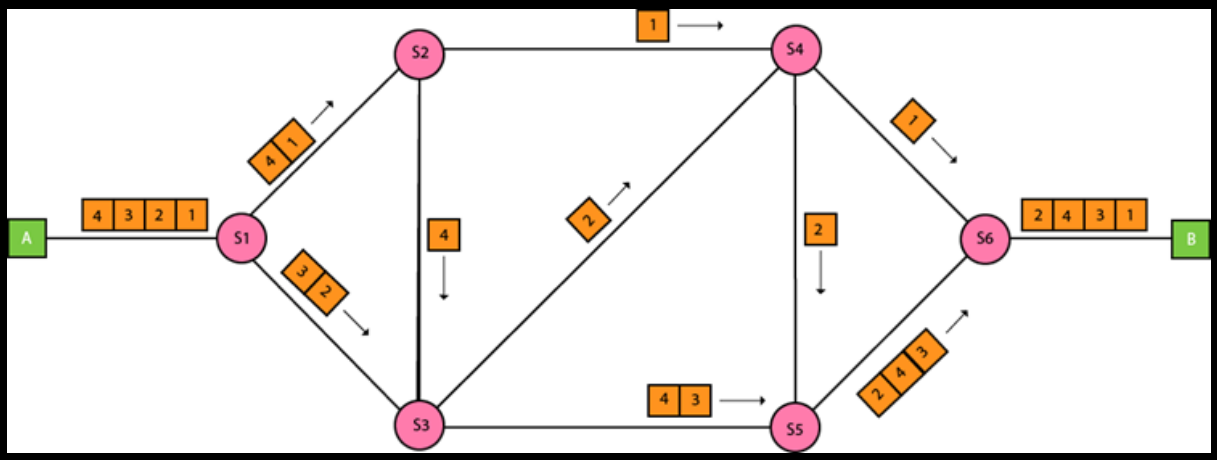
- **Efficient Bandwidth Usage:** Shared data channels improve efficiency.
- **Reduced Congestion:** Messages are temporarily stored in nodes.
- **Priority Control:** Message priority helps manage network traffic.
- **Flexible Message Size:** Supports data of unlimited size.

Disadvantages of Message Switching:

- **Storage Requirement:** Nodes need sufficient storage for messages.
- **Long Delays:** Storing and forwarding cause transmission delays.

3. Packet Switching:

- **Technique:** Message is divided into smaller packets and sent individually.
- **Packet Identification:** Each packet has a unique number for order tracking.
- **Header Information:** Contains source, destination, and sequence number.
- **Efficient Routing:** Packets take the shortest available path.
- **Reassembly:** Packets are reordered correctly at the destination.
- **Error Handling:** Missing or corrupted packets are requested for retransmission.
- **Acknowledgment:** Sent upon successful packet delivery.



Approaches of Packet Switching:

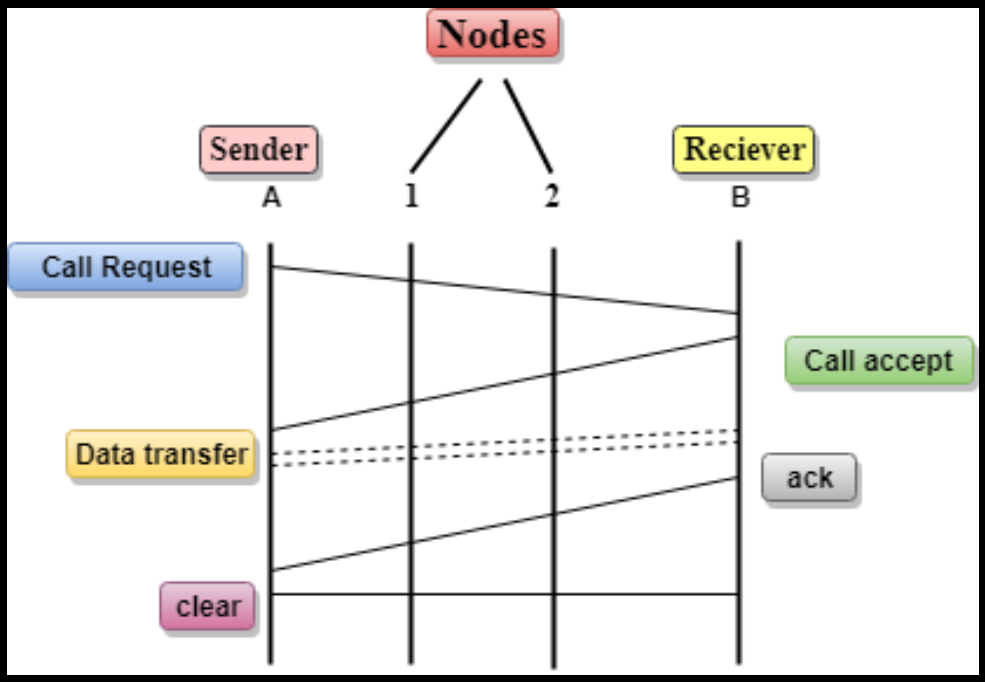
1. Datagram Packet Switching (Connectionless Switching):

- Packets (datagrams) are treated as independent entities.
- Each packet carries destination information for routing.
- No fixed path; routing decisions are made at intermediate nodes.
- Packets are reassembled in the correct order at the destination.

2. Virtual Circuit Switching (Connection-Oriented Switching):

- A preplanned route is established before data transmission.
- Uses call request and call accept packets to set up the connection.
- The path remains fixed for the duration of the logical connection.

Let's understand the concept of virtual circuit switching through a diagram: Virtual Circuit Switching Process:



1. **Connection Establishment:**
    - Sender (A) and receiver (B) communicate via intermediate nodes (1 and 2).
    - Call request and call accept packets set up the connection.
2. **Data Transmission:**
    - Once the route is established, data is sent along the fixed path.
3. **Acknowledgment:**
    - Receiver (B) sends an acknowledgment upon successful data reception.

4. **Connection Termination:**
    - If the sender or receiver wants to end communication, a clear signal is sent.