

## Switching Techniques

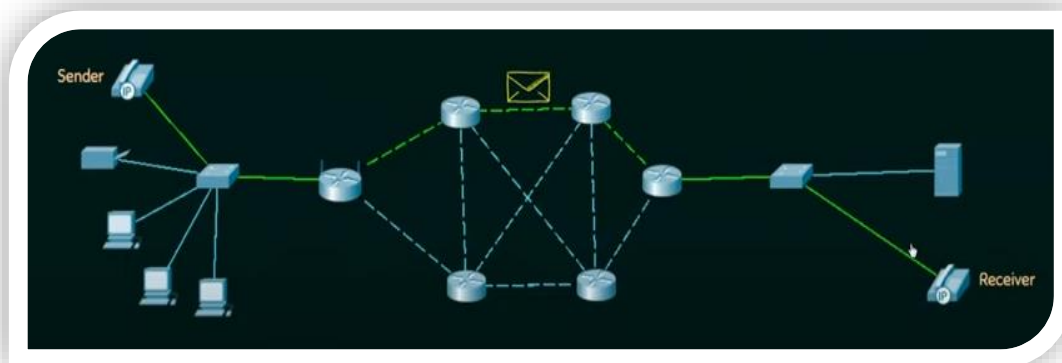
### Introduction

These are the three major methods of data transmission considered in computer networks: Packet Switching, Circuit Switching, Virtual Circuit Approach, Datagram Approach, Message Switching. Each methodology has a set of unique characteristics along with advantages and disadvantages that make it suitable for a wide range of application.

### Definitions

#### Circuit Switching:

- A dedicated path is established between the sender and receiver.
- Before data transfer, connection will be established first.
- Example: Telephone Network.
- Three phases in circuit switching:
  - Connection establishment.
  - Data transfer.
  - Connection Disconnection.



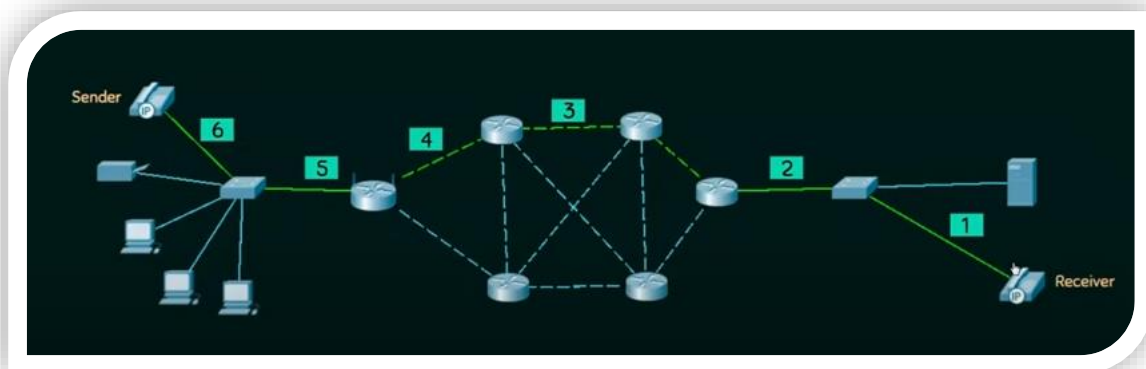
#### Packet Switching:

- The internet is a packet switched network.
- Message is broken into individual chunks called as packets.
- Each packet is sent individually.
- Each packet will have source and destination IP address with sequence number.
- Sequence numbers will help the receiver to:
  - Reorder the packets.
  - Detect missing packets and send acknowledgments.

### Types of packet switching:

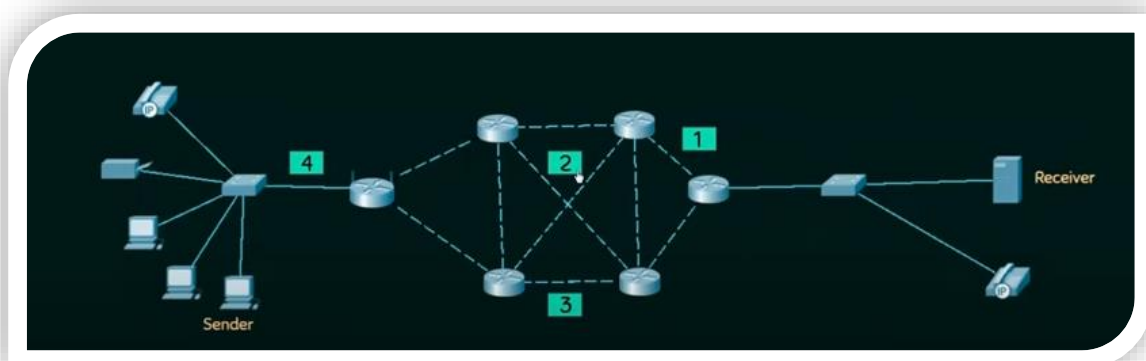
#### - Virtual Circuit Approach:

- is also known as connection-oriented switching.
- a preplanned route is established before the messages are sent.
- call request and call accept packets are used to establish the connection between sender and receiver.
- in this approach, the path is fixed for the duration of a logical Connection.



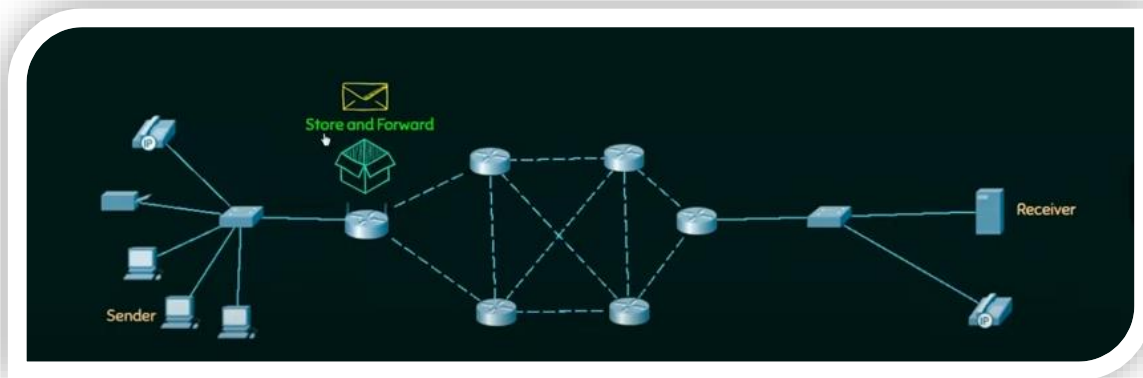
#### - Datagram Approach:

- Datagram packet switching is also known as connectionless Switching.
- Each independent entity is called as datagram.
- Datagrams contain destination information and the Intermediary devices uses this information to forward Datagrams to right destination.
- the path is not fixed.
- intermediate nodes take the routing decisions to forward the Packets.



### Message Switching:

- Store and forward mechanism.
- Message is transferred as a complete unit and forwarded using store and forward mechanism at the intermediary node.
- Not suited for streaming media and real-time applications.



### Distinguishing Features

Establishing a connection in circuit switching involves the need for a specific physical link prior to sending data. Both packet switching and virtual circuit switching do not necessitate a dedicated connection.

Data is continually transmitted over the established pathway in circuit switching for data transmission. In packet switching, information is separated into packets and sent individually. Data in virtual circuit switching is sent through a predefined path prior to transmission.

Resource Allocation: Circuit switching reserves resources solely for the entirety of the connection. Resources are allocated on demand in packet switching. Virtual circuit switching reserves resources for the entirety of the logical connection.

### Differences

Feature	Circuit Switching	Packet Switching	Virtual Circuit Switching
Connection Establishment	Dedicated physical path	No dedicated path	Logical path
Data Transmission	Continuous	Packets	Packets
Resource Allocation	Exclusive	Dynamic	For the duration of the logical connection
QoS	Guaranteed	Best-effort	Between circuit and packet
Efficiency	Less efficient	More efficient	More efficient than circuit, less efficient than packet

## How do I make "packet switching" but it works like "circuit switching"?

Through multi of steps:

- 1- **Establishing a Connection:** Before sending any data, set up a "virtual path" Through the network that will stay in place for the whole session.
- 2- **Reserving Resources:** Reserve network resources (like bandwidth) during the Connection to ensure smooth data flow.
- 3- **Keeping Packets in Order:** Assign numbers to the data packets to ensure they Stay in the correct sequence, just like in circuit switching where data flows Continuously.
- 4- **Guaranteeing Performance:** Use techniques to ensure the connection has good Quality, such as low delay and smooth data flow.
- 5- **Ending the Connection:** Once the data is transferred, free up the reserved resources And end the connection.

## How to merge packet switching with circuit switching to show virtual circuit?

Through multi of steps:

- 1- Setting up the Connection: Before sending data, a "virtual path" is created between the Sender and receiver, which reserves resources along the way. This is used by Technologies like ATM and Frame Relay.
- 2- Reserving Bandwidth: During setup, the network assigns a certain amount of bandwidth To the connection, ensuring smooth data flow without interference from other network Traffic.
- 3- Breaking Data into Packets: The data is split into small packets. These packets may take Different routes through the network but are directed to the same virtual path.
- 4- Keeping Packets in Order: Each packet gets a sequence number to maintain the correct Order when they reach the destination. Additionally, flow control helps manage how Fast packets are sent so the network or receiver isn't overwhelmed.
- 5- Ensuring Performance: Quality of Service (QoS) protocols are used to make sure the Connection remains reliable, with low delay, minimal data loss, and smooth Performance throughout.
- 6- Transmitting Data: During the data transfer, packets travel along the pre-set virtual path. Even though packets may switch individually, the reserved resources guarantee Consistent performance.
- 7- Ending the Connection: Once the data is transferred, the connection is closed, and the Reserved resources are released, making the bandwidth available for other users.

## Summary

In short, circuit switching, packet switching, and virtual circuit switching each have their own pros and cons. The method chosen is based on the particular needs of the application, like the requirement for ensured QoS, effectiveness, or adaptability.

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