23ITT204 - COMPUTER NETWORK

UNIT 3 - NETWORK LAYER

SWITCHING : PACKET SWITCHING

Packet Switching in the Network Layer: Efficient Data Delivery

Exploring the fundamental mechanism that powers modern internet communication and data transmission across global networks.

CORE CONCEPTS

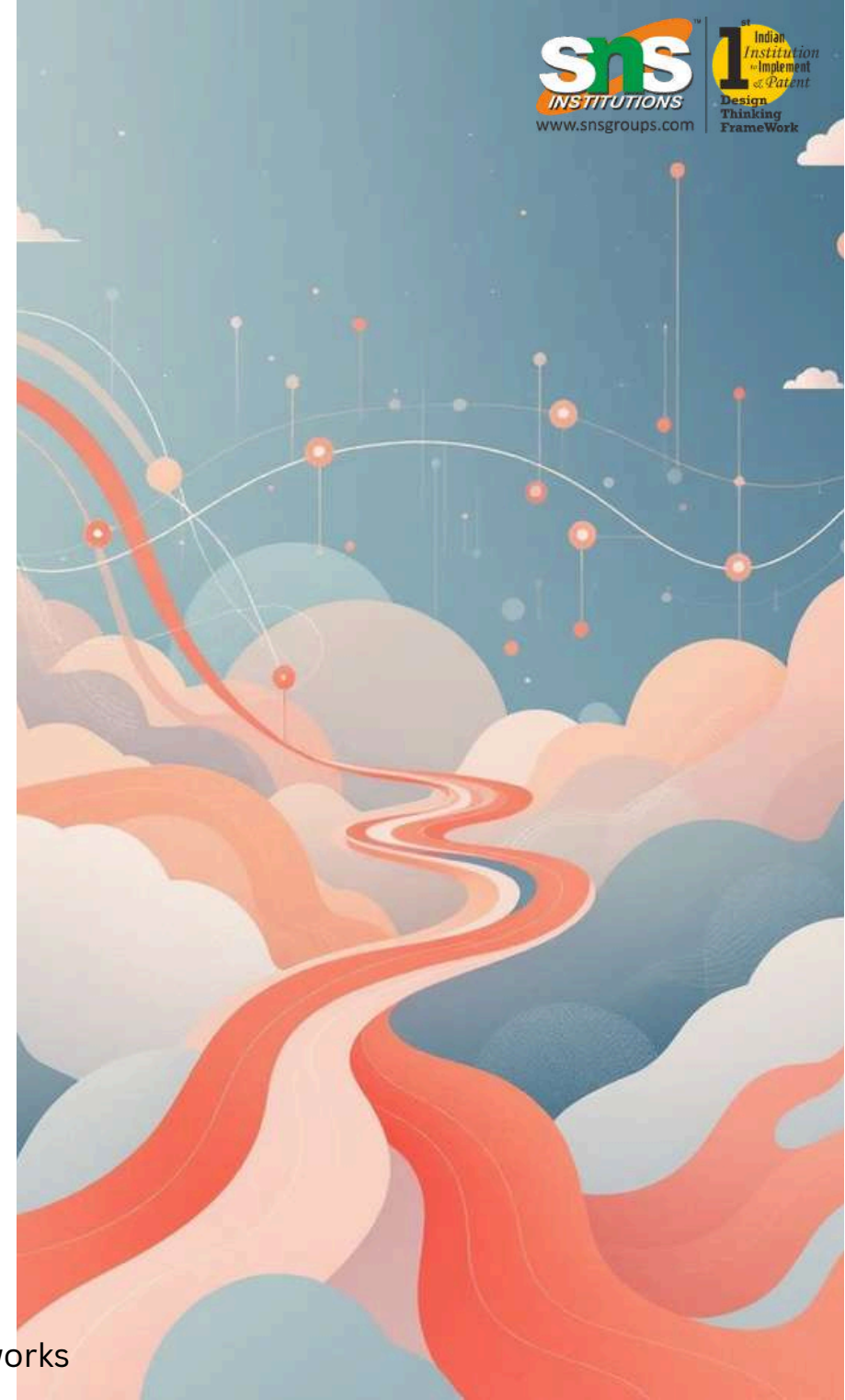
What is Packet Switching?

Packet switchingrevolutionizes data transmission by breaking information into small, manageable units called **packets**. Each packet contains a header with control information (source, destination, sequence number) and a payload carrying the actual data.

These packets travel independently through the network using a **store-and-forward** mechanism. Routers receive, temporarily store, and forward packets along optimal paths. Remarkably, packets may take different routes based on network conditions, yet all converge at the destination where they're reassembled into the original message.

Analogy

Think of sending a letter as multiple postcards. Each postcard (packet) may take a different postal route, but they all arrive at the same address to be reassembled in the correct order.



SWITCHING METHODS

Types of Packet Switching

Connection-Oriented(VirtualCircuit)

A logical path is established before data transfer begins, creating a virtual dedicated channel through the network.

- Packets follow the same predetermined route
- Arrive in order using sequence numbers
- Guaranteed delivery and predictable performance
- Examples: X.25, Frame Relay, ATM, MPLS

Connectionless (Datagram)

Each packet is routed independently without any pre-established path, offering maximum flexibility.

- No setup phase required
- Packets may arrive out of order
- Destination handles reordering and reassembly
- Example: Internet Protocol (IP)

TRADE-OFFS

Why Packet Switching Matters: Advantages & Challenges

Efficient Resource Use

Nodedicated path needed bandwidth shared dynamically among users,maximizing network utilization.

1

2

High Reliability

Fault-tolerant design automatically reroutes packets around failed links, ensuring continuous communication.

3

Cost-Effective Scalability

Perfect for bursty, diverse traffic patterns without expensive dedicated infrastructure.

The Challenges

Out-of-Order Delivery

Packets arriving via differentroutes require sequence numbers and reassembly logic at the destination.

Variable Delays

Queuing, processing,and routing introduce unpredictable latency4 challenging for real-time applications.

Increased Complexity

Network nodesmust make sophisticated routing decisions dynamically, requiring advanced hardware and algorithms.

> Packet switching is the backbone of modern networks, enabling flexible, robust communication that adapts to changing conditions and demands.