IT 4505
Section 2

Packet Network Architectures

2.1 packet Switching

❑ *A packet is a pair of elements (addresses + data) where a source computer generates data in a packetized form and sends it to a destination computer.*

❑ *A* **computer network** *is a collation of computers and devices interconnected together via communication devices and transmission media.*

❑ *A popular example of a computer network is the Internet, which it self is a network of computer networks, and allows millions of users to send and receive information.*

2.1.1 Introduction to packet switching networks

- For transmission of data beyond a local area, communication is typically achieved by transmitting data from source to destination through a network of intermediate switching nodes.

- The switching nodes move the data from node to node until they reach their destination.

- The devices attached to the network may be referred to as *hosts.* The hosts may be computers, terminals, telephones, or other communicating devices, and each host has an address.

- We refer to the switching devices whose purpose is to provide communication as nodes. Nodes are connected to one another in some topology by transmission links.

- Each host attaches to a node, and the collection of nodes is referred to as a data communications network.

- *There are two types of Switching networks*
    1. *Circuit switching*
    2. *Packet Switching*
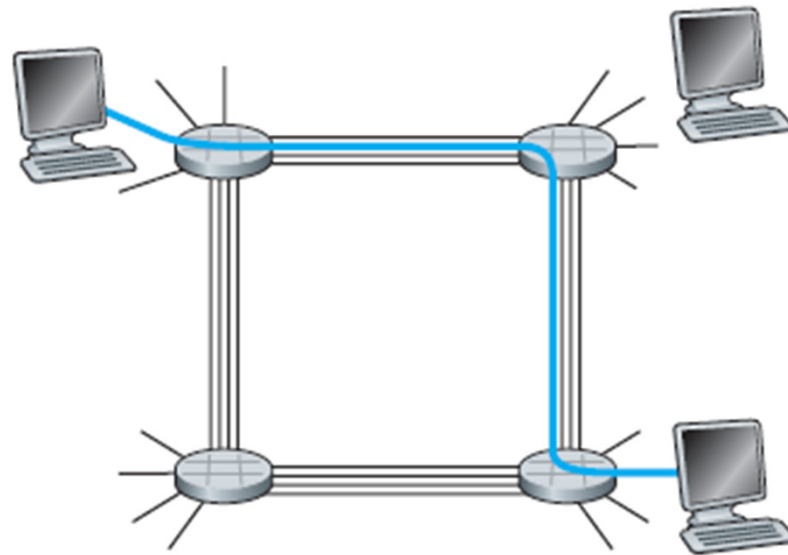
2.1.2 Circuit switching Vs Packet Switching

Introduction to packet switching cont.
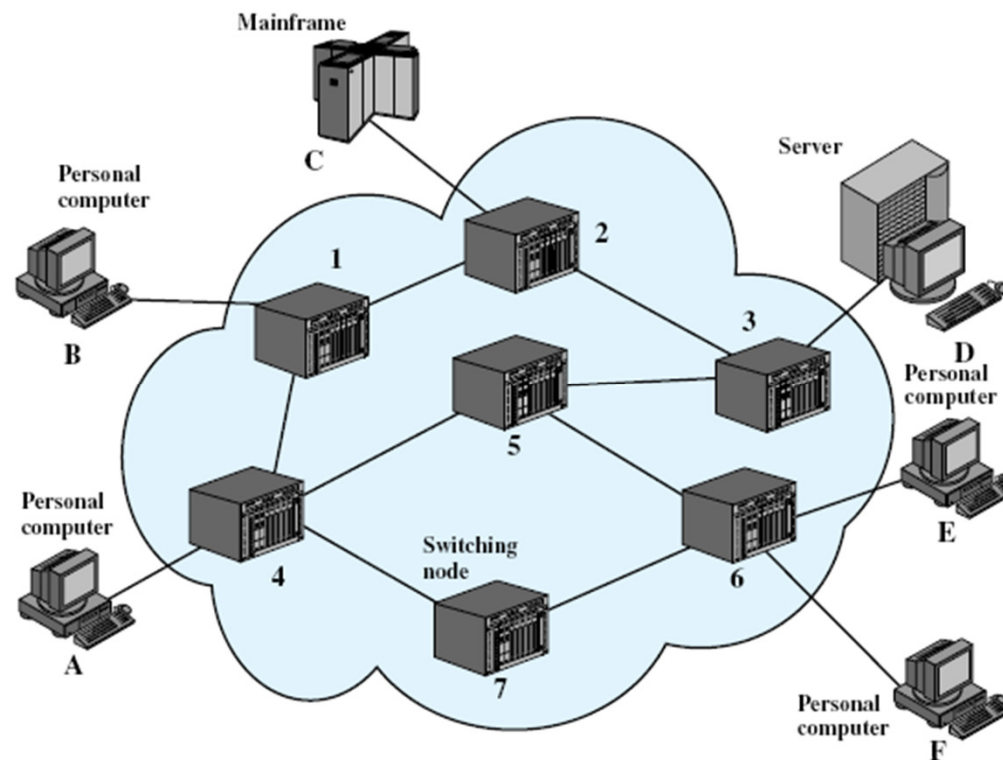
2.1.2 Circuit switching

- Communication via circuit switching implies that **there is a dedicated communication path between two stations**. That path is a connected sequence of links between network nodes.

- **There are three phases:**

  - Circuit establishment
  - Data transfer
  - Circuit disconnect

- Channel capacity must be reserved between each pair of nodes in the path.

- Circuit switching can be rather inefficient. Channel capacity is dedicated for the duration of a connection, even if no data are being transferred.

- The best-known example of a circuit-switching network is the public telephone network

- A key characteristic of circuit-switching networks is that resources within the network are dedicated to a particular call, for that duration.

- For a digital voice or video connection, a circuit switching channel can be used.

Circuit switching

A simple circuit-switched network consisting of four switches and four links

Packet switching

- In a typical user/host data connection much of the time, the line is idle. Thus, with data connections, a **circuit-switching approach is inefficient.**

- **Packet Switching networks :**
  - ✓ Data is transmitted in short packets each with an address label.
  - ✓ For long message, the message is broken up into a series of packets
  - ✓ Each packet contains a portion of the user's data source and destination address and some control information.
  - ✓ At each node, the packet is, stored briefly, and passed on to the next node**.**

- Two approaches are used to handle this stream of packets delivered to the intended destination
  - ✓ datagram approach(connection less service)
  - ✓ virtual circuit approach (Connection oriented service)

# Packet switching cont.
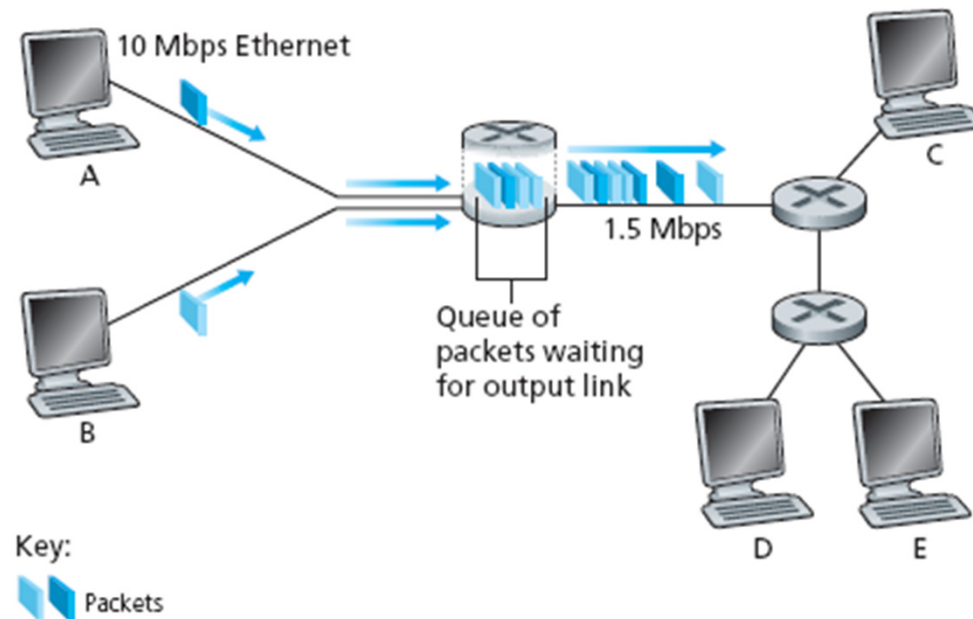
Packet switching

Packet switching cont.

- Link bandwidth utilization efficiency is greater. The randomly arriving packets are queued up and transmitted rapidly as possible over the link.

- packet-switching network can perform data-rate conversion.

- When traffic becomes heavy, packets are still accepted, but the delay in packet delivery increases.

- Priorities can be enforced in packet routing.

2.1.2.2 virtual circuit approach

- Can be "end to end" or "hop by hop" virtual circuit.

- Preplanned route is established between the nodes before packets are sent.

- All the packets follow the same logical route through the network.

- the main characteristic of the virtual circuit technique is that a pipe or a channel between hosts is set up prior to data transfer.

- The difference with the datagram approach is that the nodes do not need to make a routing decision for each packet.

Virtual circuit approach cont.
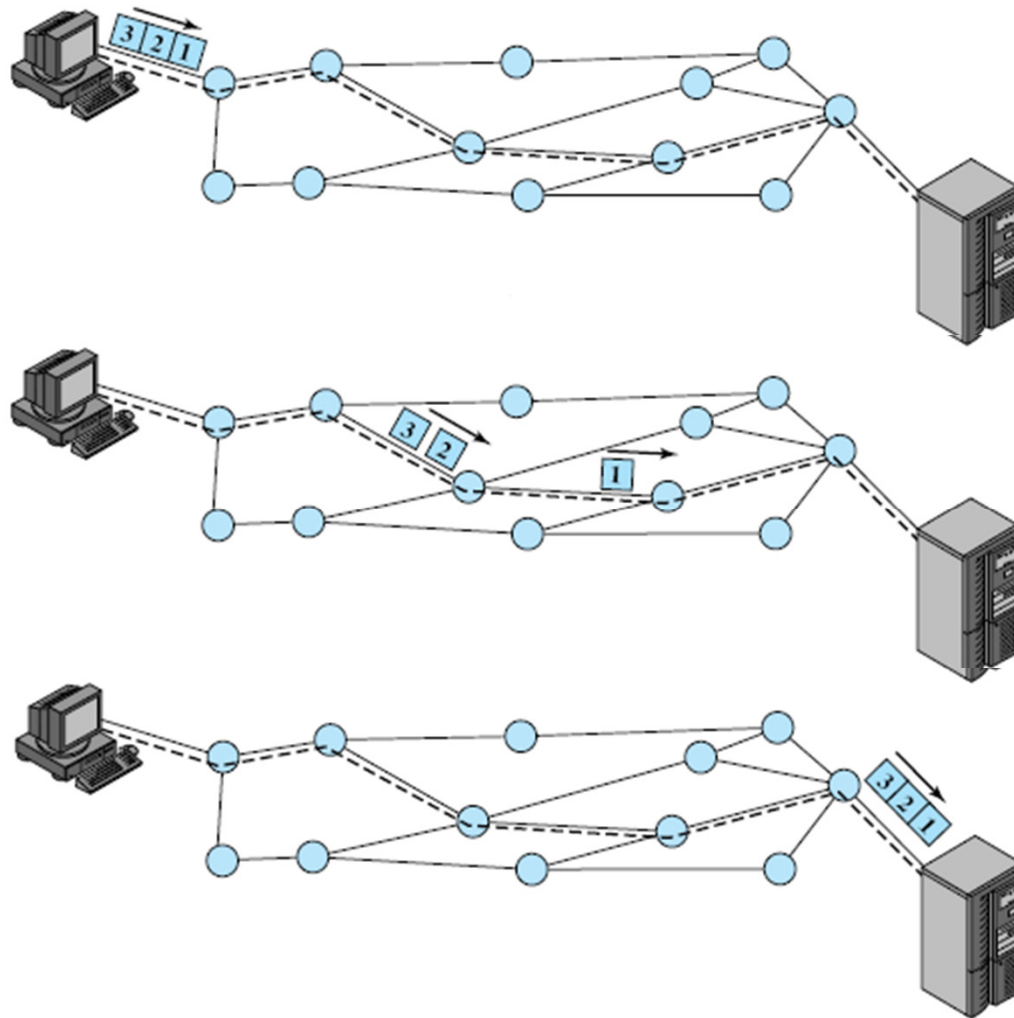
2.1.2.3 Datagram approach

- Each packet is treated independently, by the node.

- Packets, each with the same destination address, might not follow the same physical route.

- The exit node restores the packets to their original order before delivering them to the destination host.

- Since each packet chooses its own route, it is possible for a packet to be lost or abandoned in the network.

- The exit node or the destination detects the loss of a packet and decides how to recover it.

Datagram approach cont.