

## Switching

Circuit-switched Networks  
Datagram Networks  
Virtual Circuit Networks

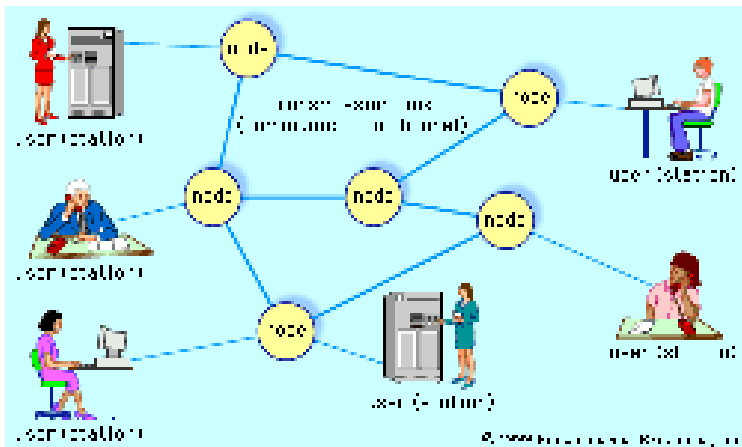
## Group members

Fiza Tarar	19010819-017
Aqeel Hassan	19010819-022
M. Tayyab	19810819-010
Ch. Ishtiaq	19010819-020
Ehsan Afzal	19010819-008

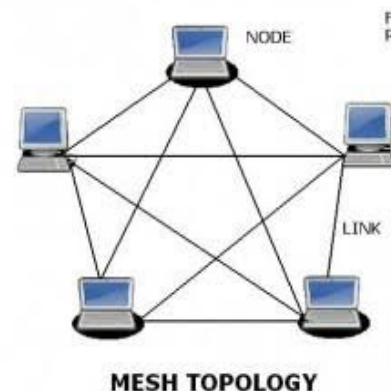
# Switching

- ▶ A network is a set of connected devices. Whenever we have multiple devices, we have the problem of how to connect them to make one-to-one communication possible.
- ▶ The solution is switching.
- ▶ A switched network consists of a series of interlinked nodes, called switches.

## Solution



## Problem

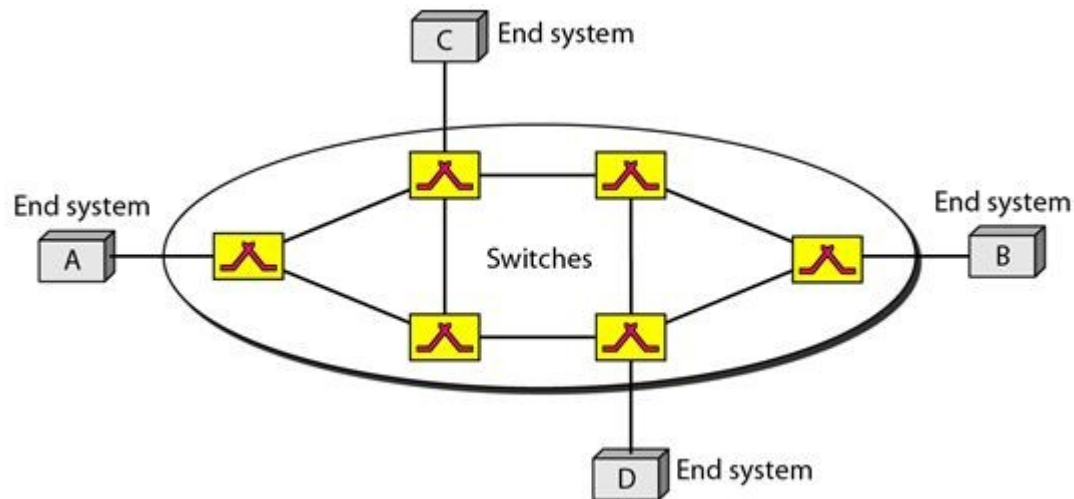


For N Nodes No of links  
Required is  $N(N-1)/2$

Computer =  $N = 5$   
Using above  
formula =  $N(N-1)/2$   
Links =  $5(5-1)/2$   
 $= 5(4)/2$   
 $= 20/2$   
 $= 10$

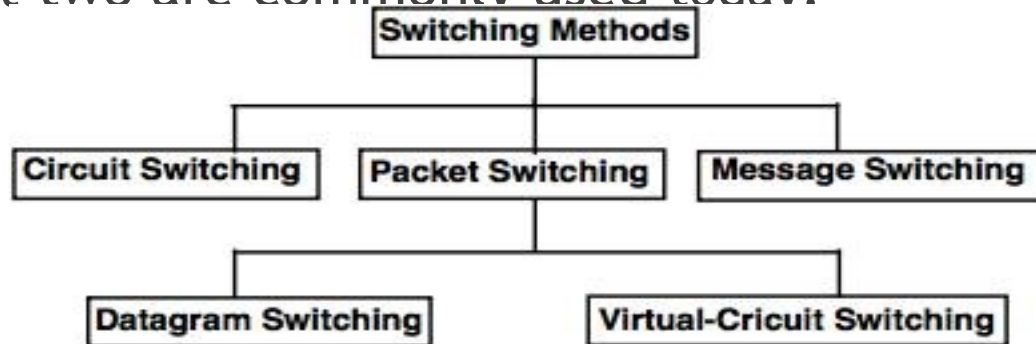
# Switching Network

- ▶ A Computer network in which connectivity is provided by using numbers of switches.
- ▶ A fully switched network uses only switches for connecting all devices used in that network.



# Switching Network Types

- ▶ Traditionally, three methods of switching have been discussed:
- ▶ 1.circuit switching
- ▶ 2.packet switching
- ▶ i. Virtual circuit
- ▶ ii.Datagram
- ▶ 3.message switching.
- ▶ •The first two are commonly used today.



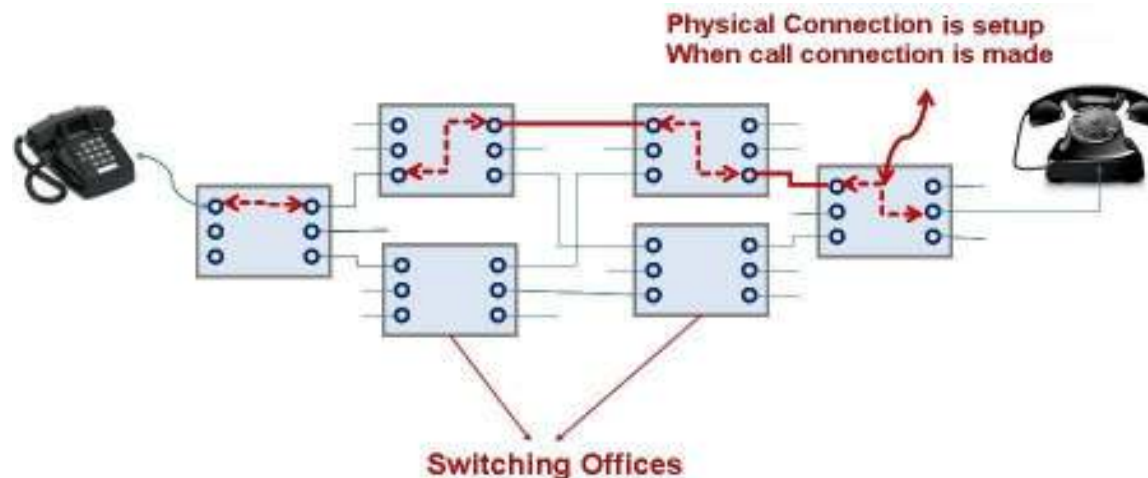
Types of Switching

# Switching and TCP/IP Layers

- ▶ Switching takes place at several layers of the TCP/IP protocol suite:
- ▶ 1.at the physical layer it is circuit switching. There is no exchange of packets at PL. The switches at PL allow signals to move in one path or another.
- ▶ 2.at the data-link layer we can have packet switching. However, the packet can mean frame or cells here. Packet switching is done normally using Virtual Circuit Approach.
- ▶ 3.at the network layer we can have packet switching. Here, either a virtual circuit or datagram approach can be used. Internet uses datagram approach.
- ▶ 4. Switching at Application Layer :
- ▶ we can have only message switching at AL. It is done by exchanging messages like email etc. So such communication can be called as message switched communication. As such there is no concept of message switched Network.

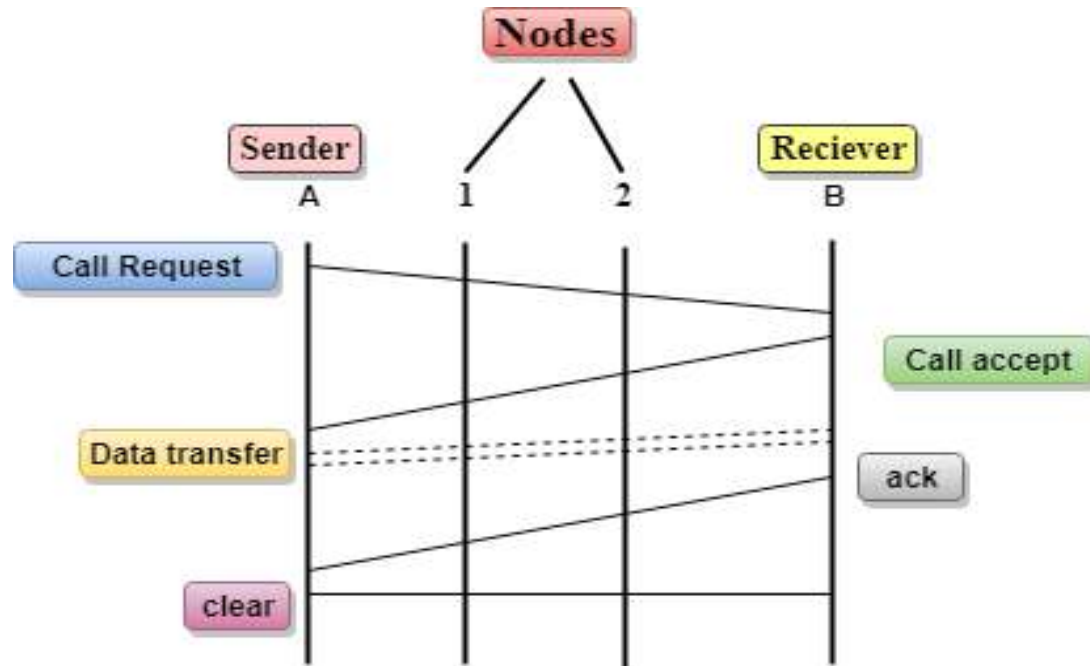
# Circuit switching

- ▶ Circuit switching is used in public telephone network but it is used for data transmission also along with voice communication.
- ▶ Voice communication is efficient but data communication is not that efficient.
- ▶ In this method a dedicated path is established between two computer using one or more switch.



# Three Phases of Circuit Switching

- ▶ The actual communication in a circuit switched network requires three phases:
- ▶ 1. connection setup
- ▶ 2. data transfer
- ▶ 3. connection teardown





# Certain issues in circuit switching

- ▶ Efficiency - low, because of resources remain dedicated through out the connection
- ▶ Delay - despite low efficiency there is very low delay in transmission.
- ▶ Since connection is dedicate so only time taken in connection establishment.

# Pros and Cons

- ▶ Advantages

- ▶ Dedicated transmission

- ▶ No delay in transmission

- ▶ Disadvantages

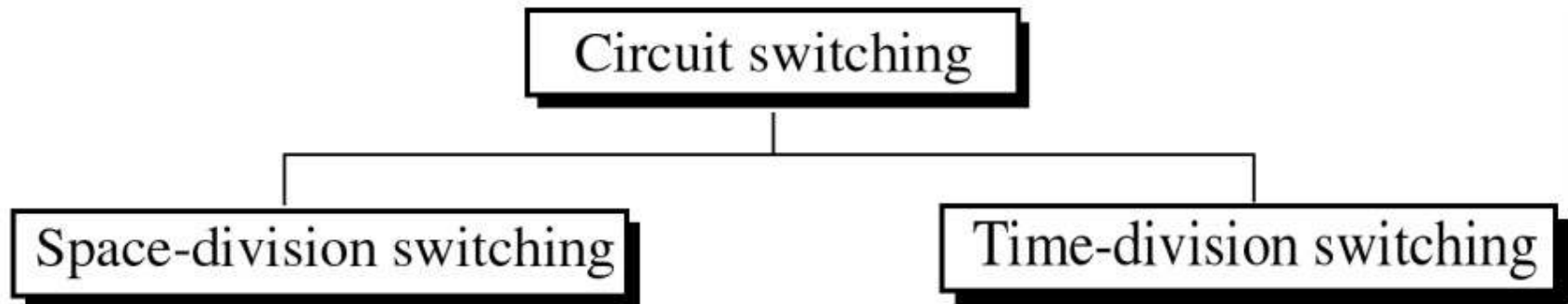
- ▶ Because of dedicated connection other devices waste time in waiting

- ▶ Dedicated connection will consume all bandwidth - Sometimes it may take long time to establish a connection

- ▶ Applications - Public Switched Telephone Network (PSTN)

# Circuit Switching Types

- ▶ There are two types of circuit switch
  1. Space division switching
  2. Time division switching



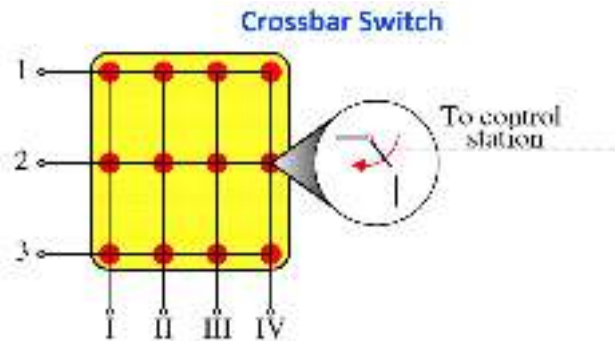
# Space Division Switching

- ▶ In space division switching,
- ▶ the paths in the circuit are separated from each other.
- ▶ This technology is used in both analog & digital networks.
- ▶ It uses following switches for connection:
  1. Cross bar switch
  2. Multistage switch

# Cross bar switch

## Multistage switch

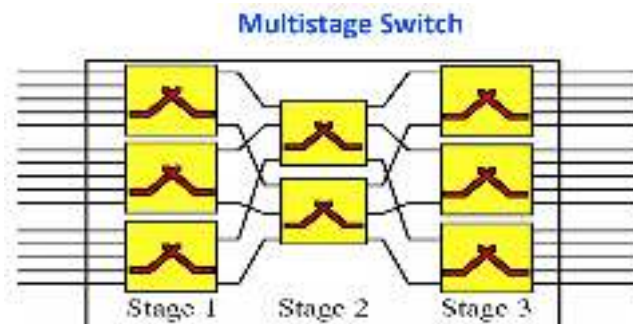
### Cross bar switch



A cross bar switch connects  $n$  input lines to  $m$  output lines

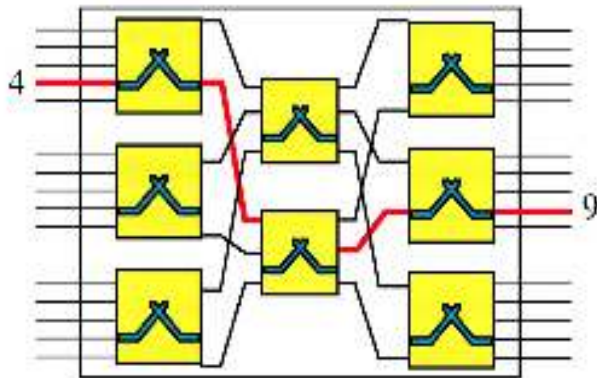
in a grid using micro switches (transistor) at each cross point

### Multistage switch



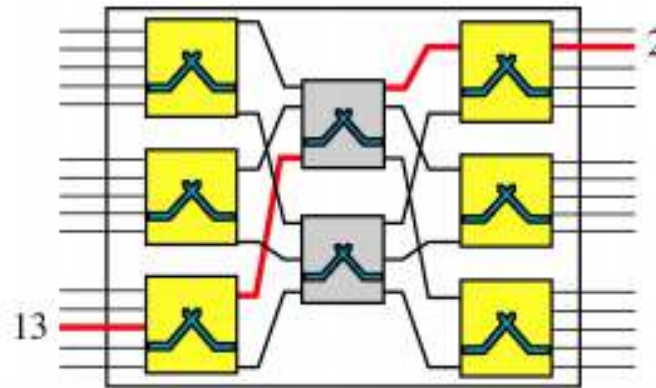
# Example of Multistage switch

Switching Path Using Multistage Switch



4 connected to 9

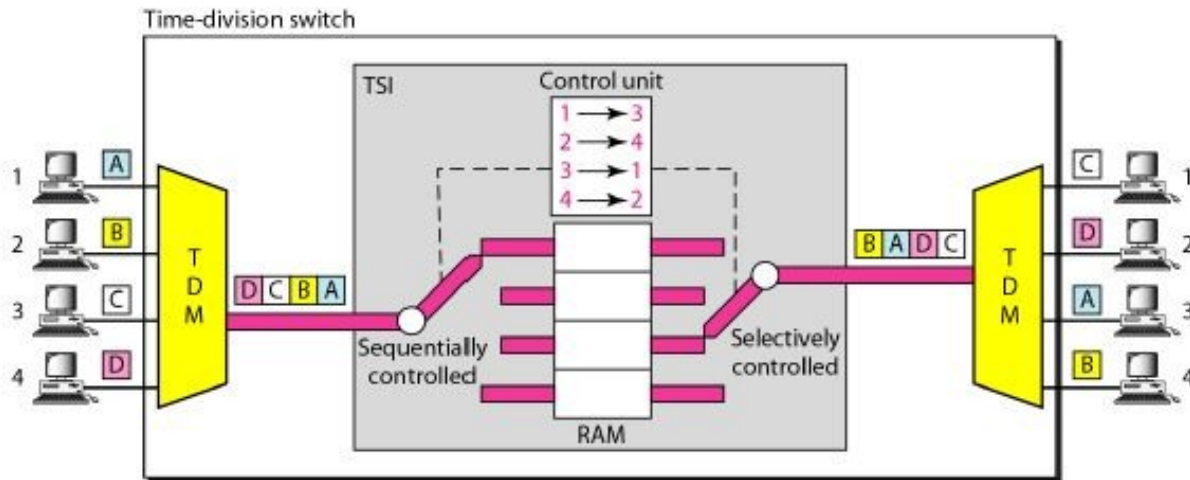
Switching Path Using Multistage Switch



13 connected to 2

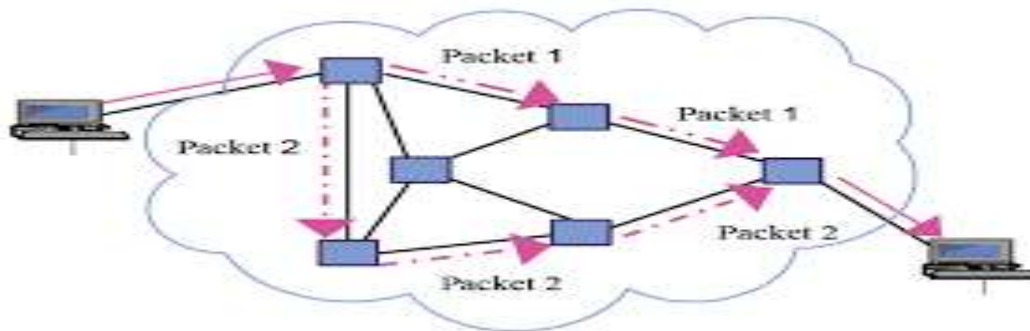
# 1. Time Division Switching

- In time division uses time division multiplexing(TDM) inside a switch. The most popular technology is called time slot interchange(TSI).



# Packet Switching

- ▶ Packet switching is a connectionless network switching technique. Here, the message is divided and grouped into a number of units called packets that are individually routed from the source to the destination.
- ▶ Packet-Switched networks were designed to overcome the *weaknesses* of Circuit-Switched networks since circuit-switched networks were not very effective for small messages.



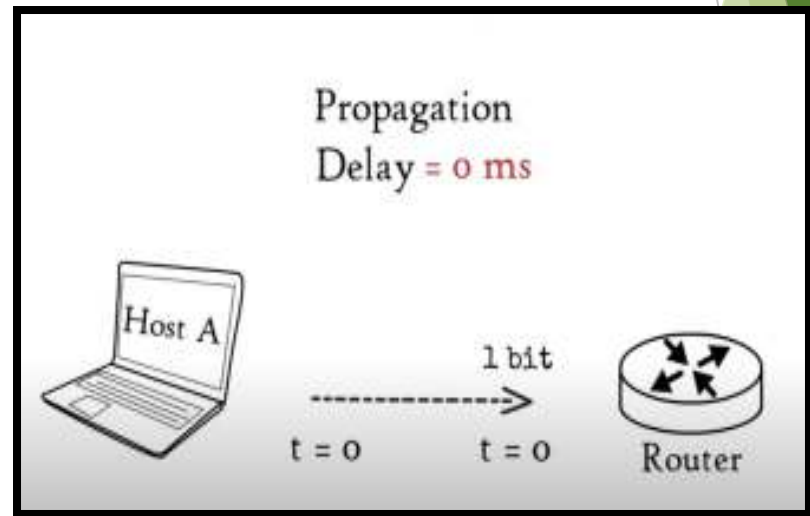
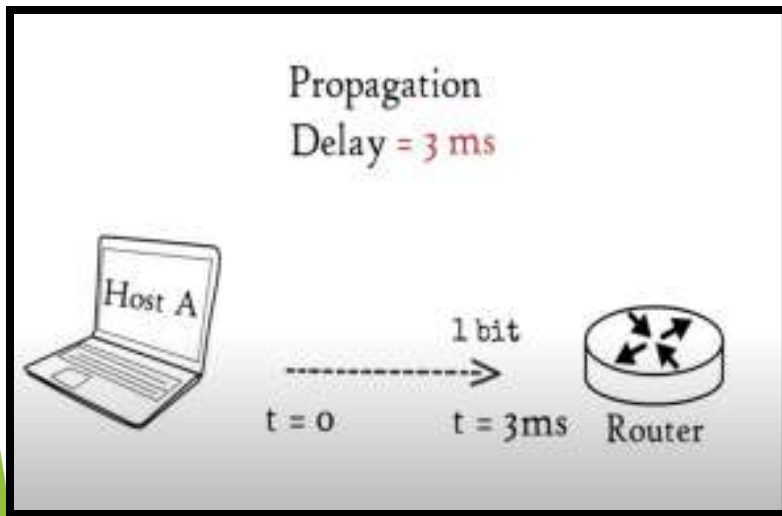


# Store And Forward Technique

- ▶ Packet Switching uses **Store and Forward** technique while switching the packets; while forwarding the packet each hop first store that packet then forward. This technique is very beneficial because packets may get discarded at any hop due to some reason.

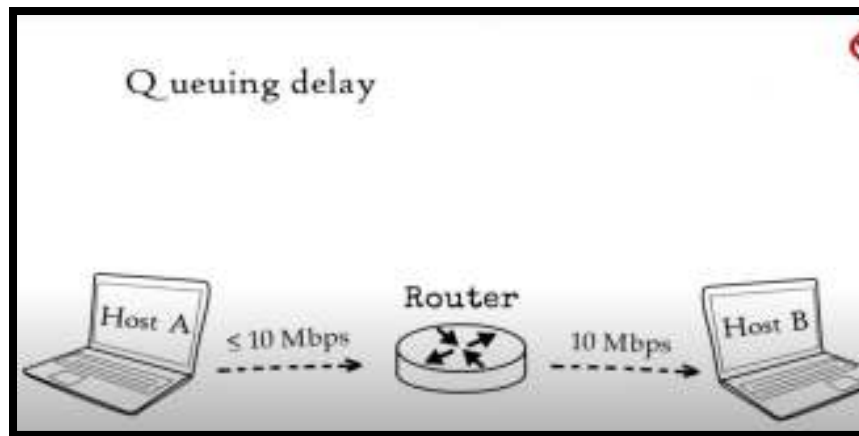
# Propagation delay:

- Time taken by the first bit to travel from sender to receiver end of the link. In other words, it is simply the time required for bits to reach the destination from the start point.

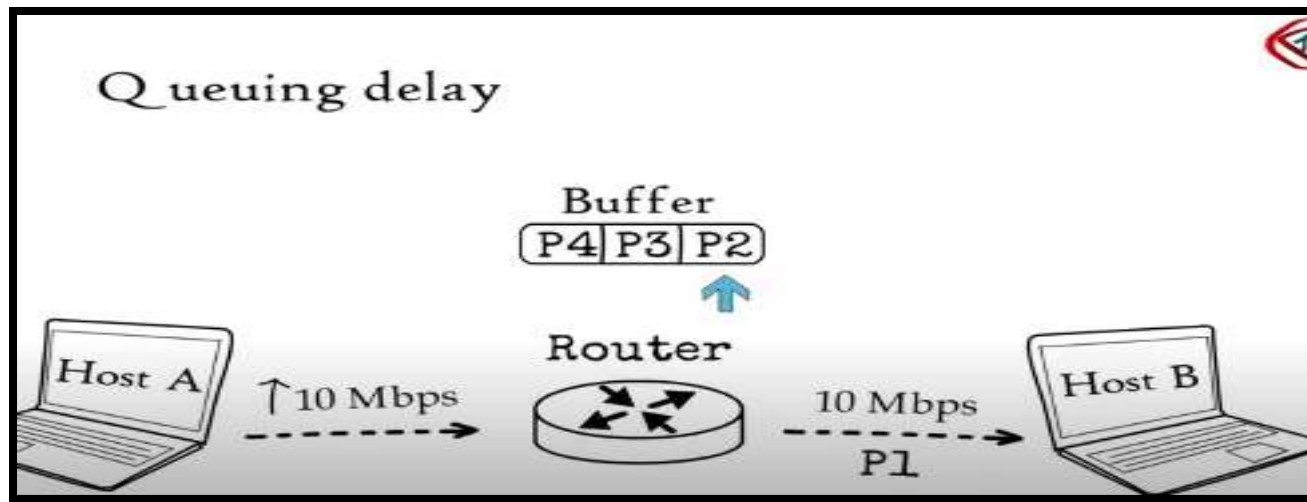


# Queuing Delay :

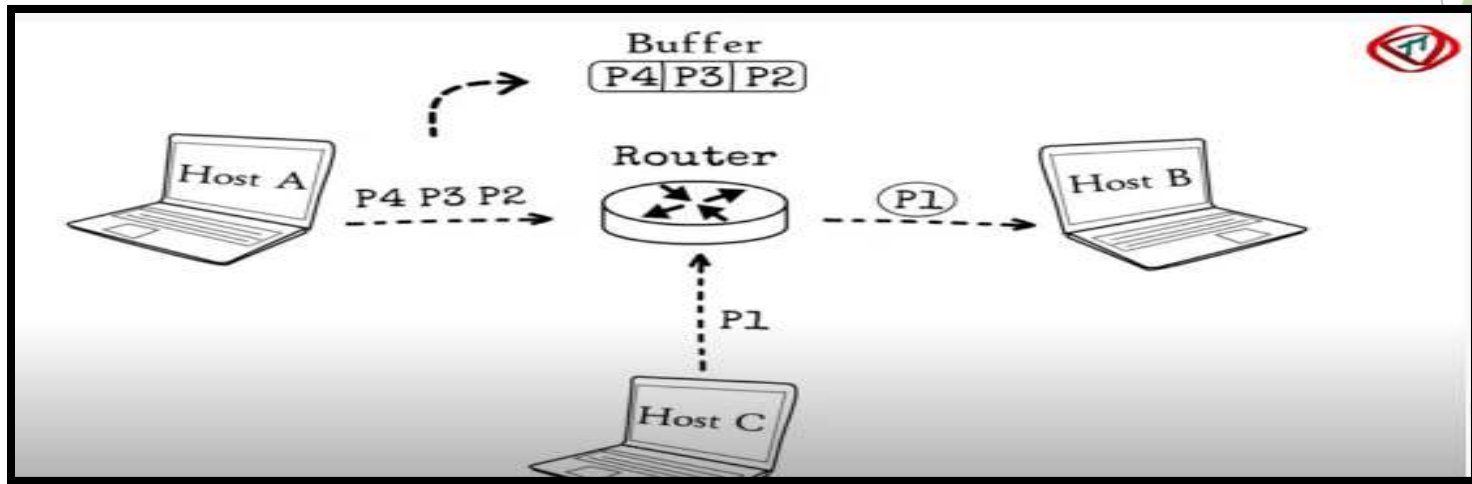
- Suppose the host A is sending a file to host B via a packet switch. The router is sending data to host B at transmission rate of 10mbps till host A transmission rate is  $< 10\text{mbps}$  no queuing will occur.



- In Case host A transmission rate exceeds 10mbps at this moment incoming packets have to wait in buffer present in router and form a que. The time till when the incoming packets waits in the que for transmission is called queuing delay.

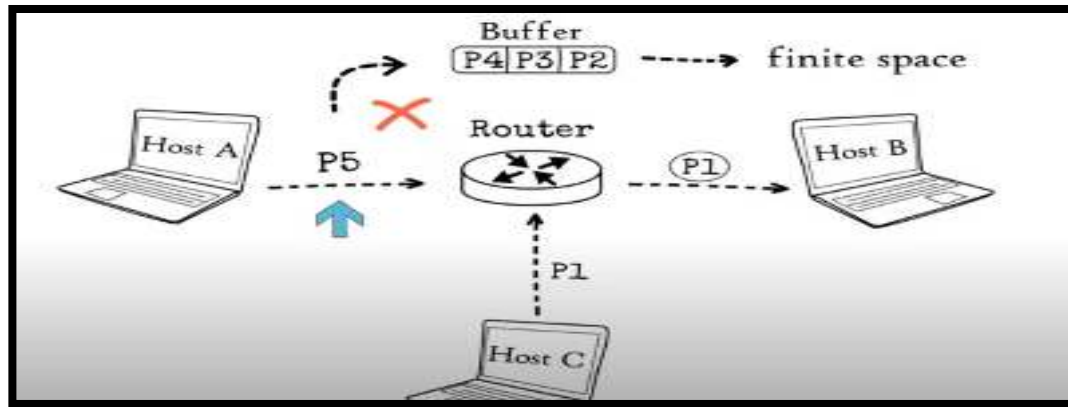


- ▶ Queuing delay also occurs when host A sending packets to router but router is busy in sending packets receiving from host C the packets receive from host A will que in buffer till the previous transmission is over.



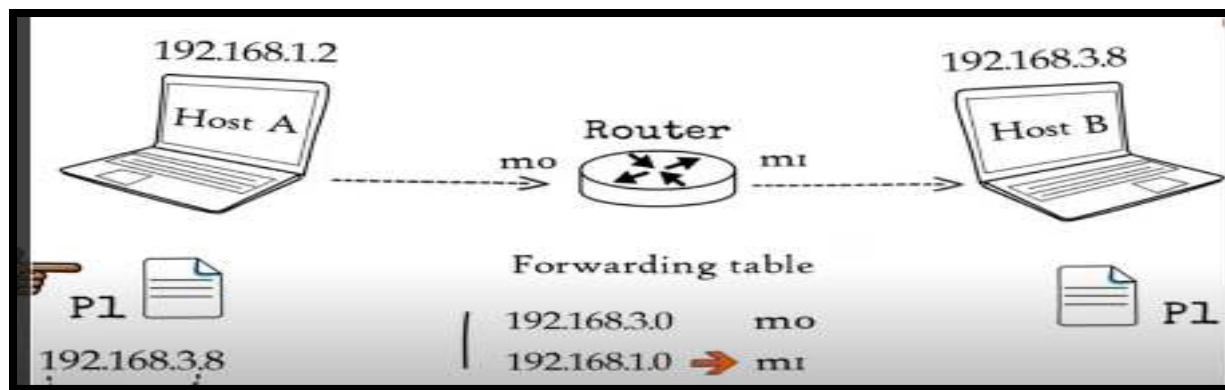
# Packet Loss

- ▶ When buffer have finite space the cases may occur when incoming packets may find the buffer completely fill. In such cases either the incoming packet or present in buffer drop. It is called packet loss.



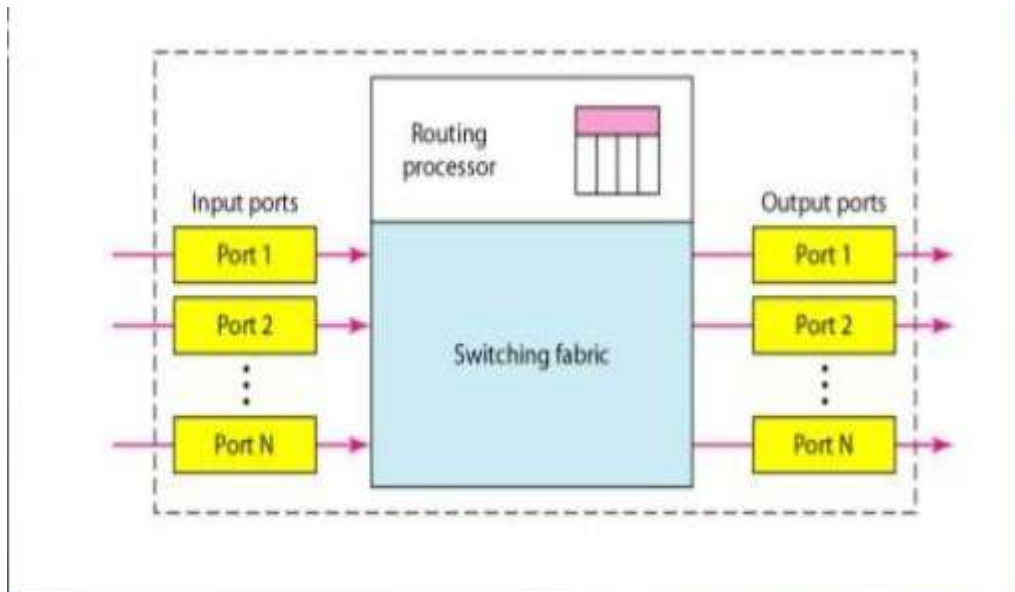
# How packet switches know to which communication link incoming packets will be forward

- ▶ On internet every device has unique address known as IP Address. When host A send a packet to host B. It maintains the IP Address of host B in the packet.
- ▶ Every router have a routing table. It matches the portion of IP Address over network address to the router link interface. When a router receives a packet it matches the prefix of the packets destination address with the entries present in routing table and forward packet to corresponding address.



# 1. Structure of Packet switches

- ▶ Switch structure has four components
- ▶ Input port
- ▶ Output port
- ▶ Routing port
- ▶ Switching port





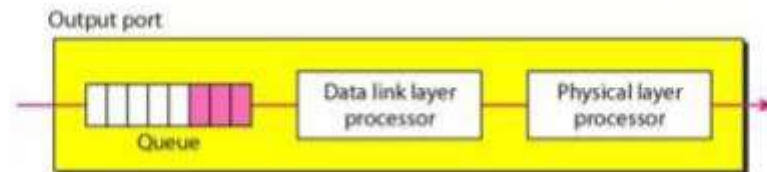
# 1. Input ports

- ▶ An input port perform the physical and data-link function.
- ▶ Bits are constructed from received signal.
- ▶ Packets are de-capsulated from frame.
- ▶ Errors are detected and corrected.
- ▶ Packet is now ready to be routed by network.
- ▶ In addition to physical-layer processor and data link .
- ▶ Processor the input buffers to hold the packet.



# 1. Output ports

- ▶ Output performs the same as input functions but in reverse order.
- ▶ First the outgoing packets are queued, then packet is encapsulated in frame.
- ▶ Finally the physical layer functions are applied to frame create the signal to be sent on line.



# Routing Processor

- ▶ The routing processor performs the functions of network layer
- ▶ Destination address is used to find the address of next hop.
- ▶ Routing processor searches form Routing table.

# Switching Fabrics

- ▶ Packet switch is to move packet from input to output
- ▶ queue.
- ▶ Speed affects the size of input/output queue.
- ▶ Overall delay in packet delivery
- ▶ Input port stored packet in memory
- ▶ Output port retrieve packet from memory

.

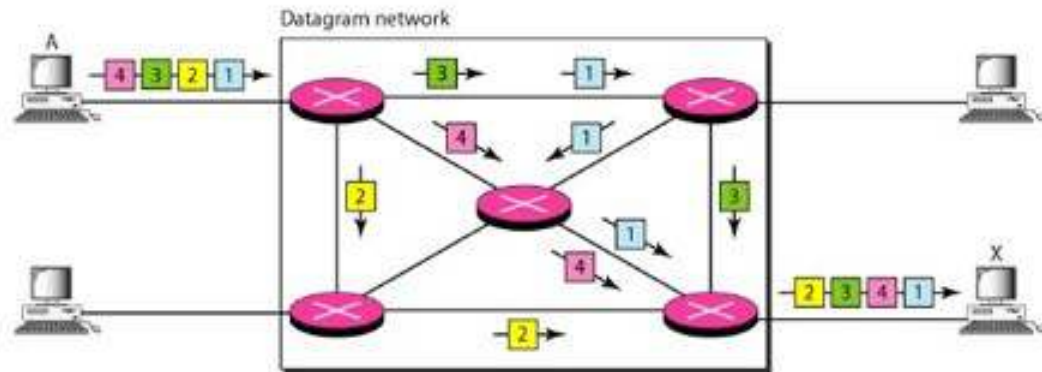
# What is datagram?

- ▶ A datagram is a basic transfer unit associated with a packet-switched network. Datagram are typically structured in header and payload sections. Datagram provide a connectionless communication service across a packet-switched network.

# Example of datagram

- ▶ The most common datagram network is the Internet which uses the IP network protocol. Two examples of this are the Transmission Control Protocol (TCP), and the Trivial File Transfer Protocol (TFTP)

Diagram of datagram



# Explanation of Datagram

- ▶ **Connectionless:**
- ▶ Packet switching may be classified into connectionless packet switching, also known as datagram switching. In connectionless mode each packet is labeled with a destination address, source address, and port numbers.
- ▶ **No Reservation:**
- ▶ In a packet-switched network, there is no resource reservation; resources are allocated on demand. In a datagram network, each packet is treated independently of all others.
- ▶ **Out of order:**
- ▶ Datagram packet switching, the individual packets which form a data stream may follow different paths between the source and the destination. As a result, the packets may arrive at the destination out of order.

# Explanation of Datagram

- ▶ **High overhead:**
- ▶ The time it takes to transmit on a packet-switched network. Each packet requires extra bytes of format information that is stored in the packet header, which combined with the assembly and disassembly of packets reduce the overall transmission speed of the raw data.
- ▶ **Packet loss:**
- ▶ Packet loss occurs when one or more packets of data travelling across a computer network fail to reach their destination. Packet loss is either caused by errors in data transmission, typically across wireless networks
- ▶ Using datagram transmission, each packet is treated as a separate entity and contains a header with the full information about the intended recipient. The most common datagram network is the Internet which uses the IP network protocol.



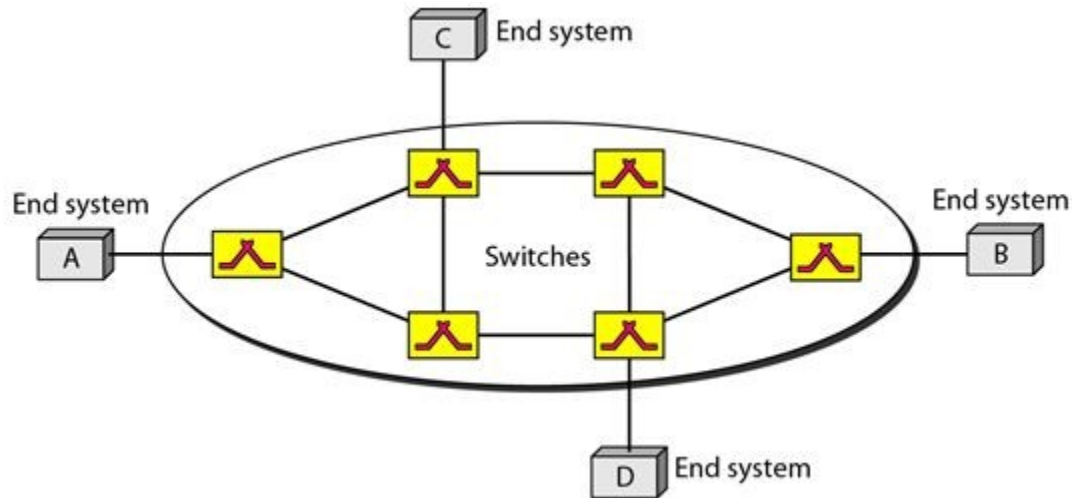
# Virtual circuit network

- ▶ A virtual circuit is a cross between a circuit switched network and datagram network.
- ▶ It has characteristics of both.
- ▶ There are three phases in virtual circuit network.
  - ▶ 1.Data Transfer phase
  - ▶ 2.Setup Phase
    - ▶ I. Setup request
    - ▶ II. Acknowledgement
  - ▶ 3.Tear down phase

# Virtual circuit characteristics

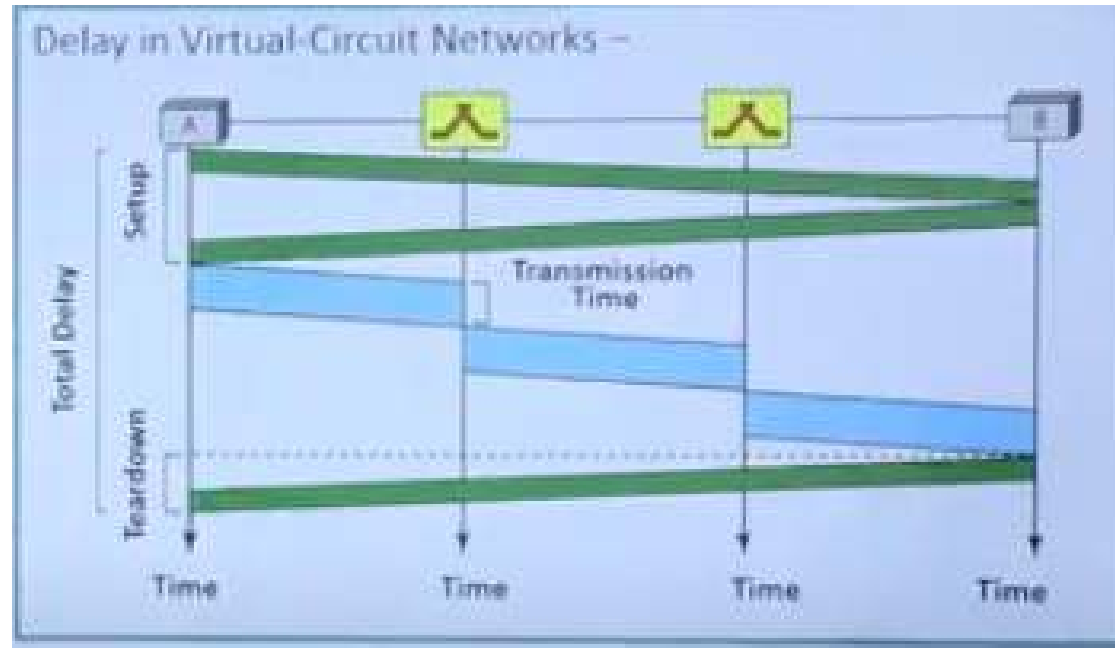
- ▶ Connection oriented
- ▶ Reservation
- ▶ Follow the same order
- ▶ No packet loss
- ▶ Efficient
- ▶ Costly

# Virtual circuit diagram



In VC all packets belonging to the same source and destination  
Travel the same path, but the packets may arrive at the destination  
With different delays .

# Virtual circuit diagram



Thank you