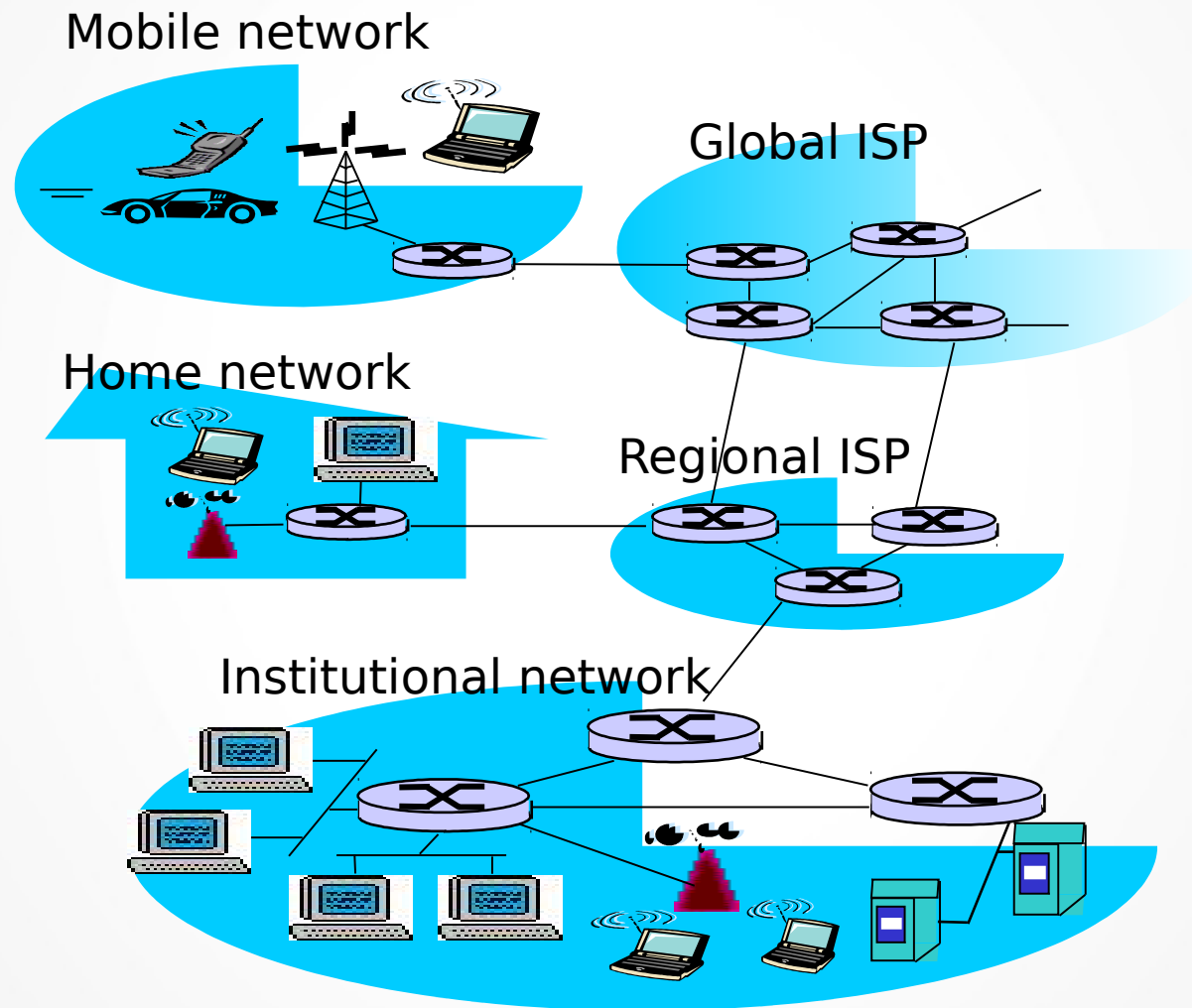


# Overview of Computer Networks

Manas Ranjan Lenka  
School of Computer Engineering,  
KIIT University

# Computer Networks

## Nuts-and-Bolts



# Computer Networks

## Nuts-and-Bolts

network edge:

- applications and hosts

access network:

- wired, wireless communication links

network core:

- interconnected routers

# Network edge

## ❖ end systems (hosts):

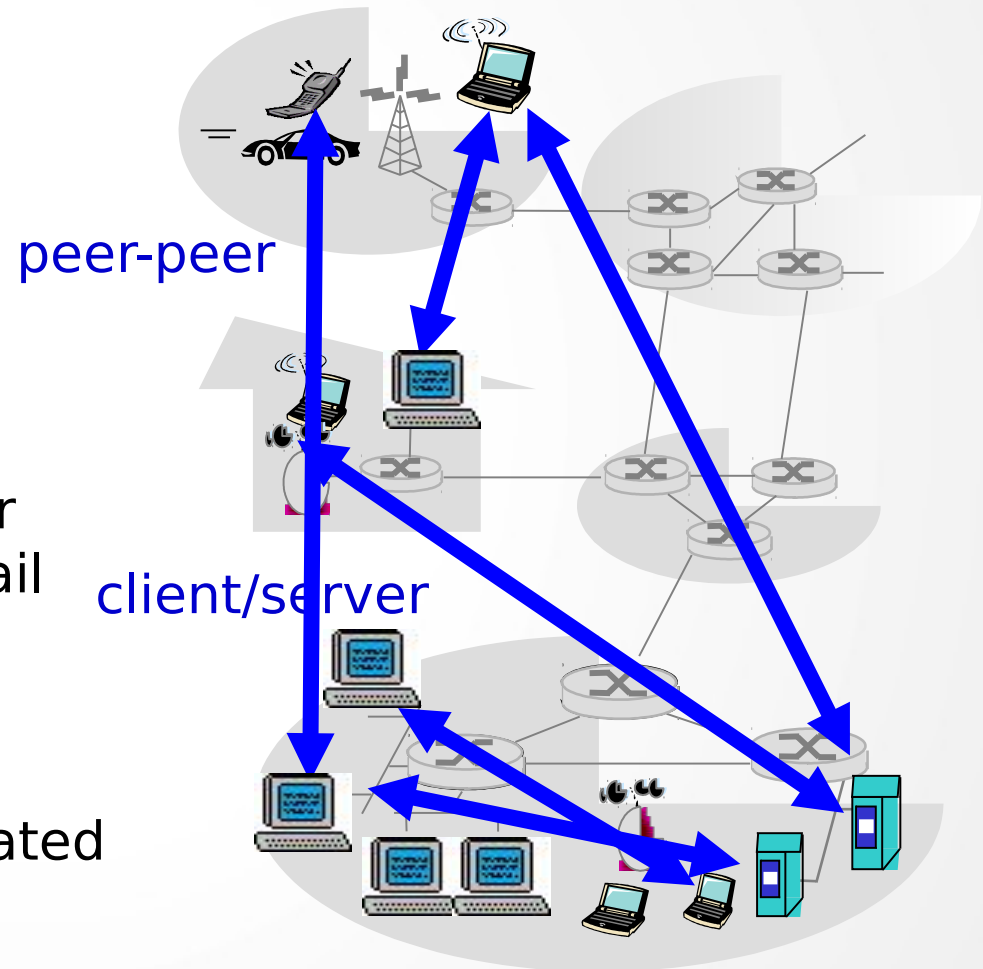
- run application programs
- e.g. Web, email
- at “edge of network”

## ❖ client/server model

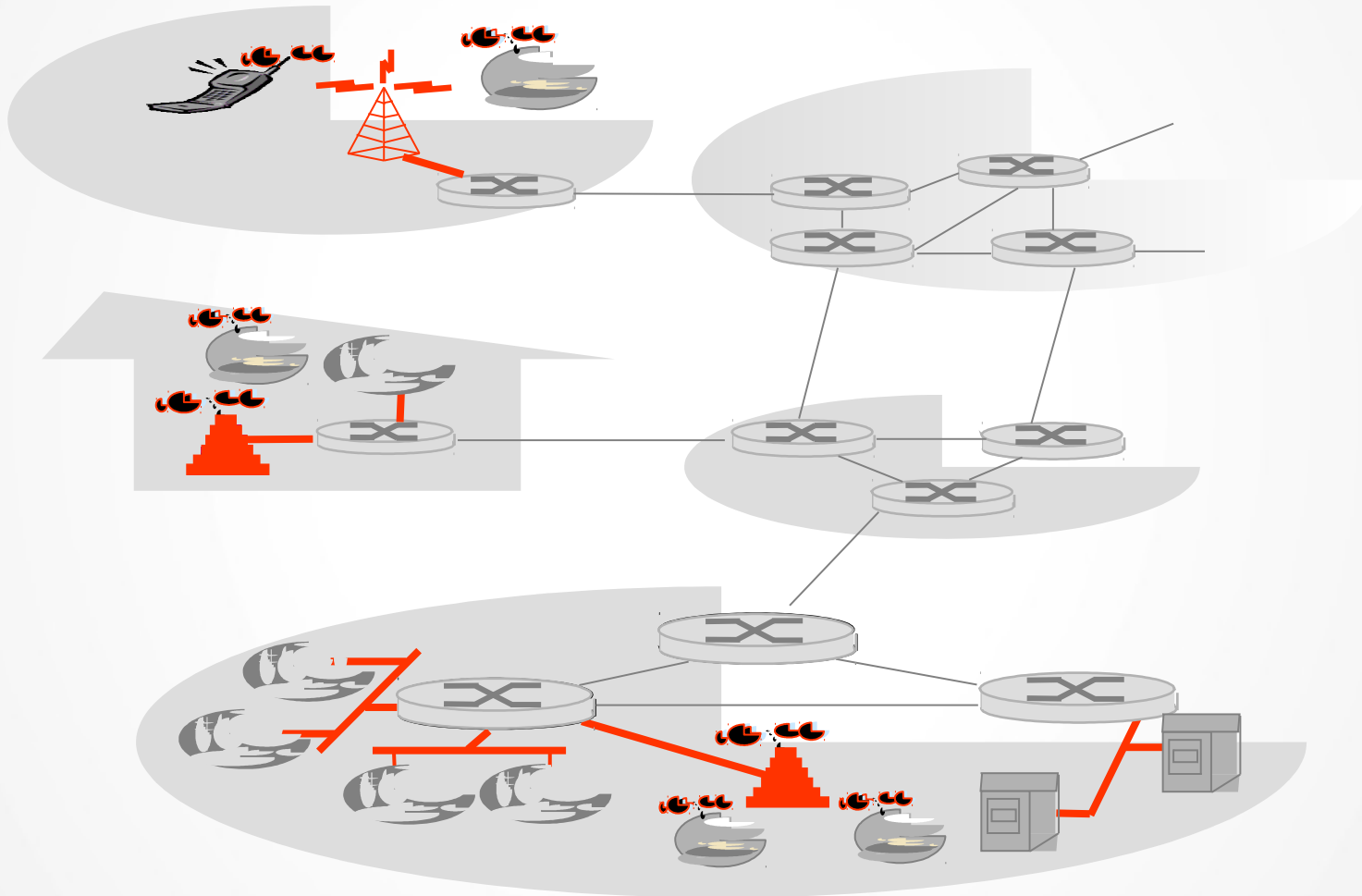
- client host requests, receives service from always-on server
- e.g. Web browser/server; email client/server

## ❖ peer-peer model:

- minimal (or no) use of dedicated servers
- e.g. Skype, BitTorrent

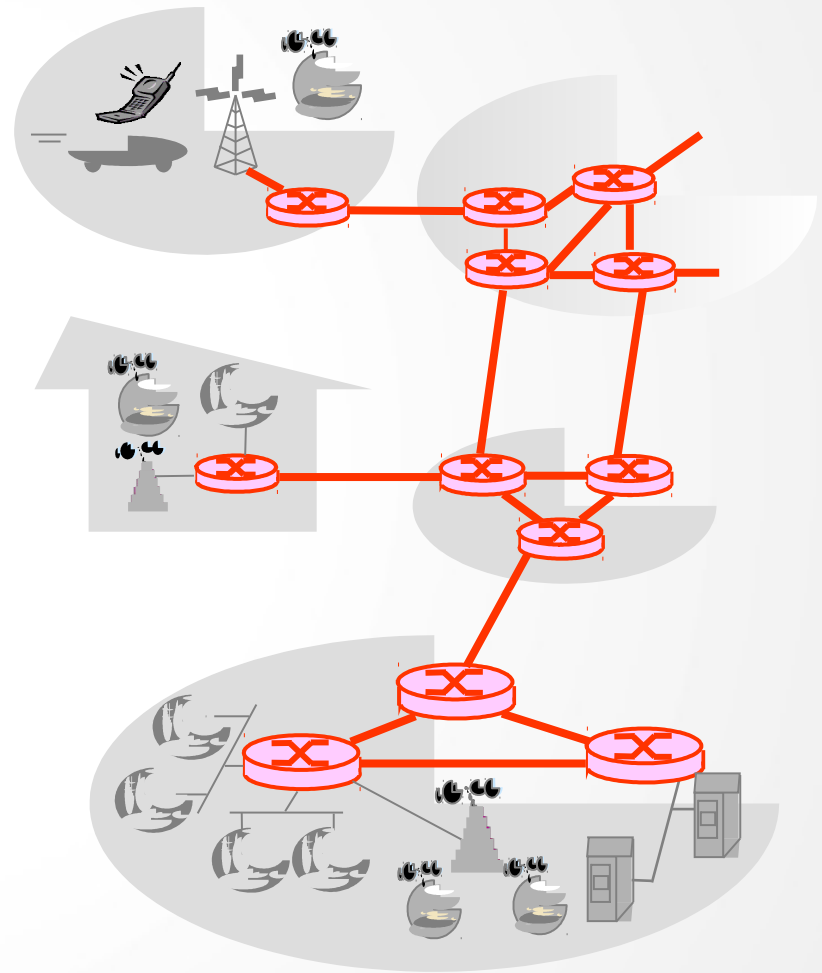


# Access network



# Network Core

- ❖ mesh of interconnected routers
- ❖ *the fundamental question:*  
how is data transferred through net?
  - **circuit switching:**  
dedicated circuit per call:  
telephone net
  - **packet-switching:** data  
sent through net in  
discrete “chunks”



# Computer Network - Types

Generally, networks are distinguished based on their **geographical Area**.

- Can be as small as distance between your mobile phone and its Bluetooth headphone.
- Can be as large as the Internet itself, covering the whole geographical world, i.e. the Earth.

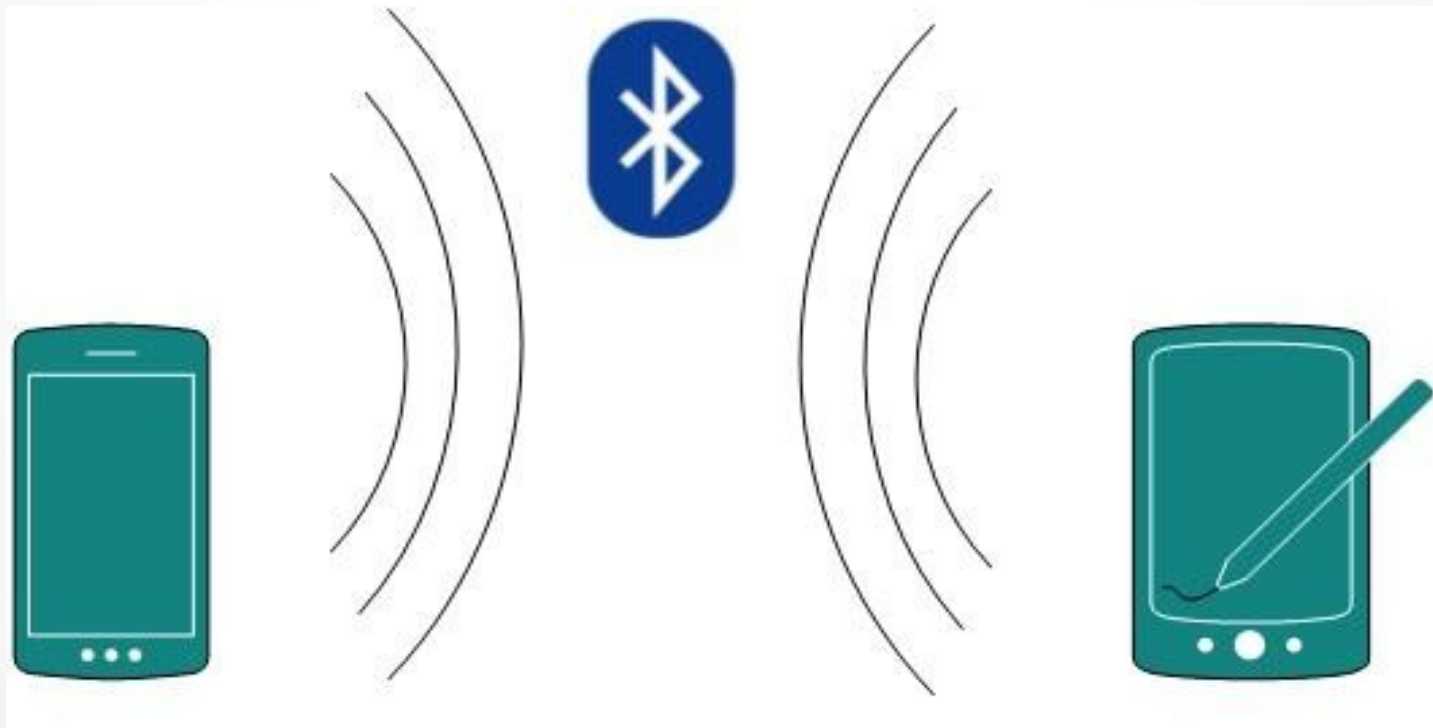
## Computer Network Types

- Personal Area Network (**PAN**)
- Local Area Network (**LAN**)
- Metropolitan Area Network (**MAN**)
- Wide Area Network (**WAN**)
- **Internet**

# Personal Area Network (PAN)

PAN, is smallest network which is very **personal to a user** which includes

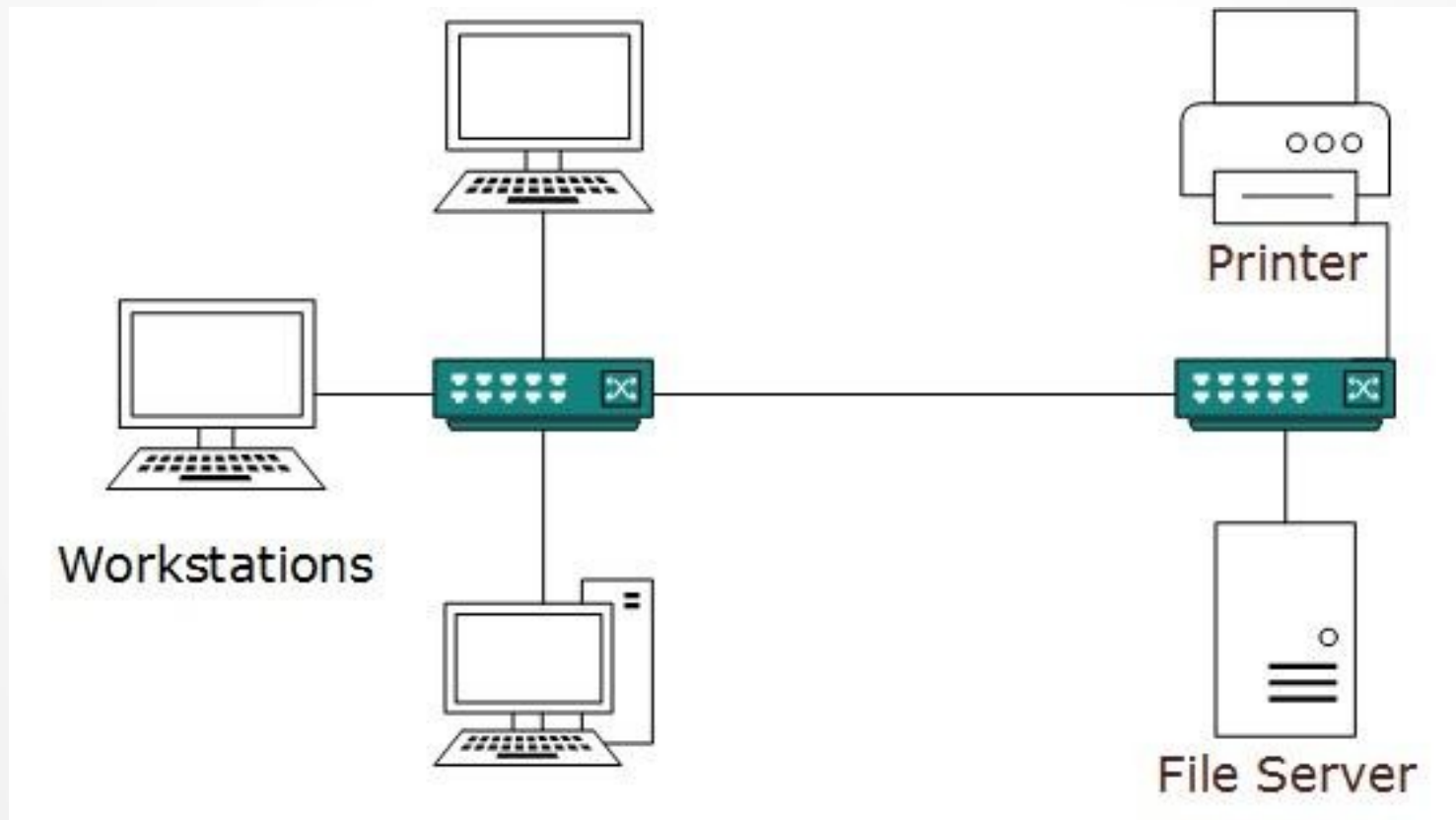
- wireless computer keyboard and mouse
- Bluetooth enabled headphones
- wireless printers and TV remotes





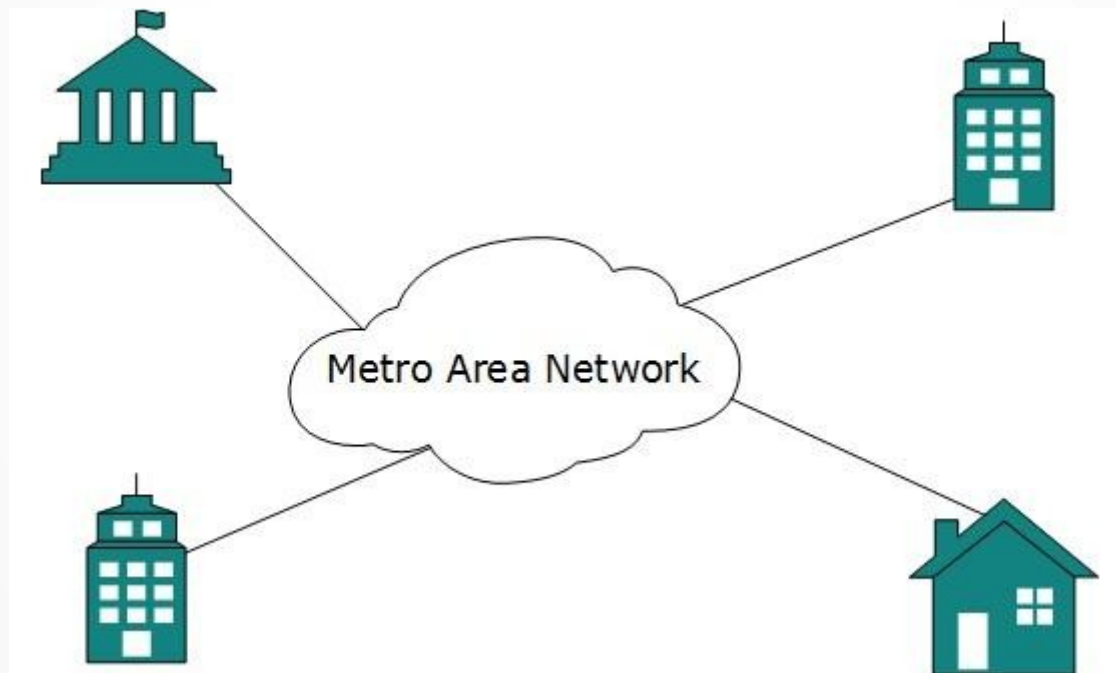
# Local Area Network (LAN)

- LAN, is spanned **inside a building** and operated under single administrative system.
- LAN provides a useful way of sharing resources between end users. Resources like Printers, File Servers, Scanners and internet is easy sharable among computers.
- Usually, Local Area Network covers an **organization's offices, schools, college/universities** etc



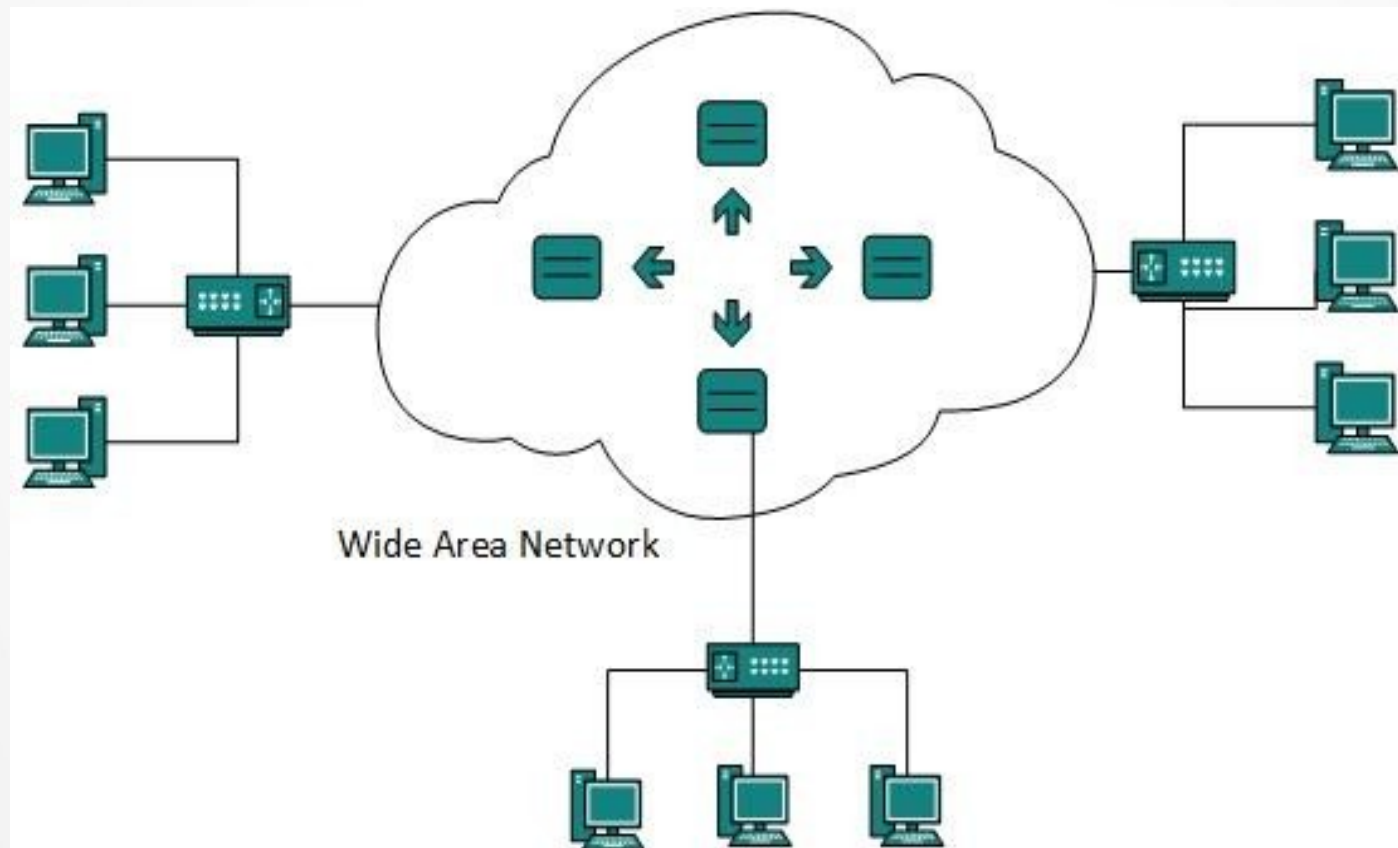
# Metropolitan Area Network (MAN)

- MAN, generally expands throughout a city such as **cable TV network**.
- This service enables its users to expand their Local Area Networks.
- For example, MAN can help an **organization to connect all of its offices in a City**.



# Wide Area Network (WAN)

- WAN, covers a wide area which may **span across a whole country**.
- These networks provides connectivity to MANs and LANs.
- Generally, **telecommunication networks** are Wide Area Network.



# Internet

- A **network of networks** is called internet.
- Internet connects all WANs and it can have connection to LANs and Home networks.
- Internet enables its users to share and access enormous amount of information worldwide.



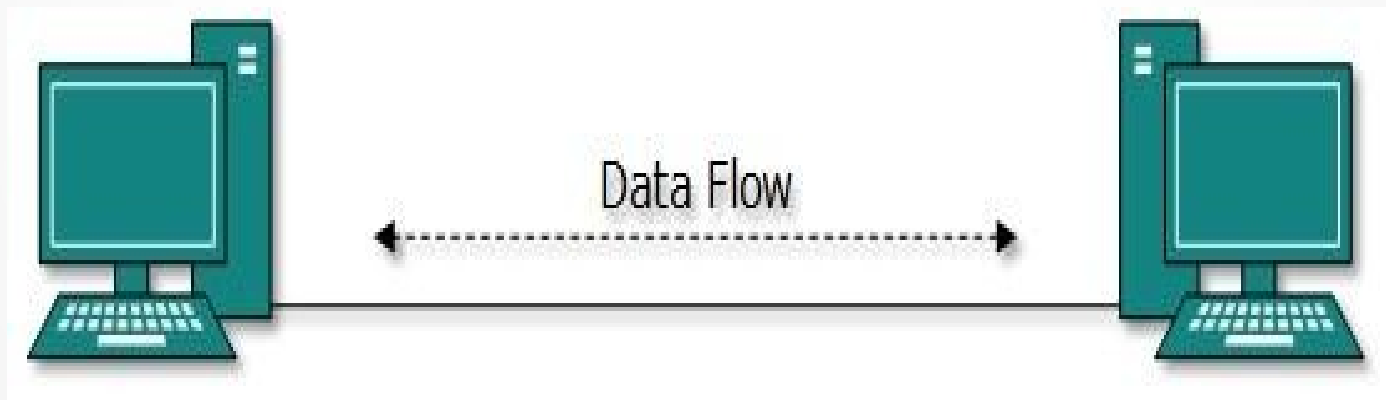
# Computer Network Topologies

A Network Topology is the way computer systems or network equipment connected to each other.

- Point-to-point
- Bus
- Star
- Ring
- Mesh
- Tree

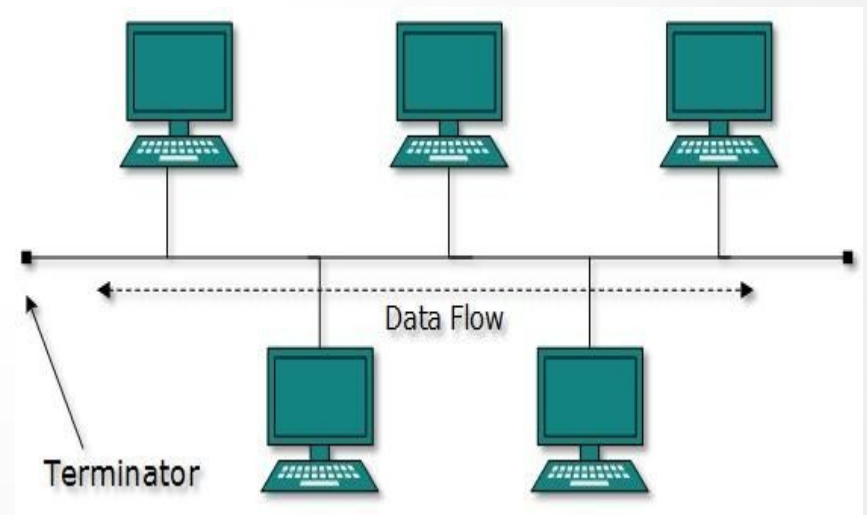
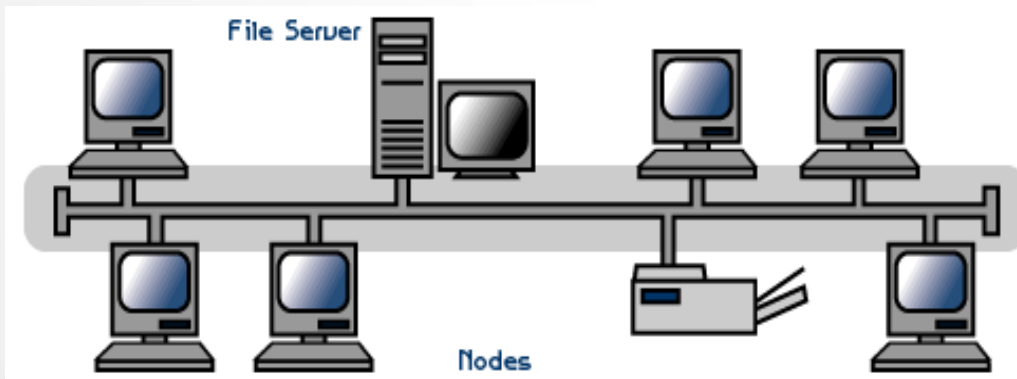
# Point-to-point

Point-to-point networks contains exactly two hosts (computer or switches or routers or servers) connected back to back using a single piece of cable.



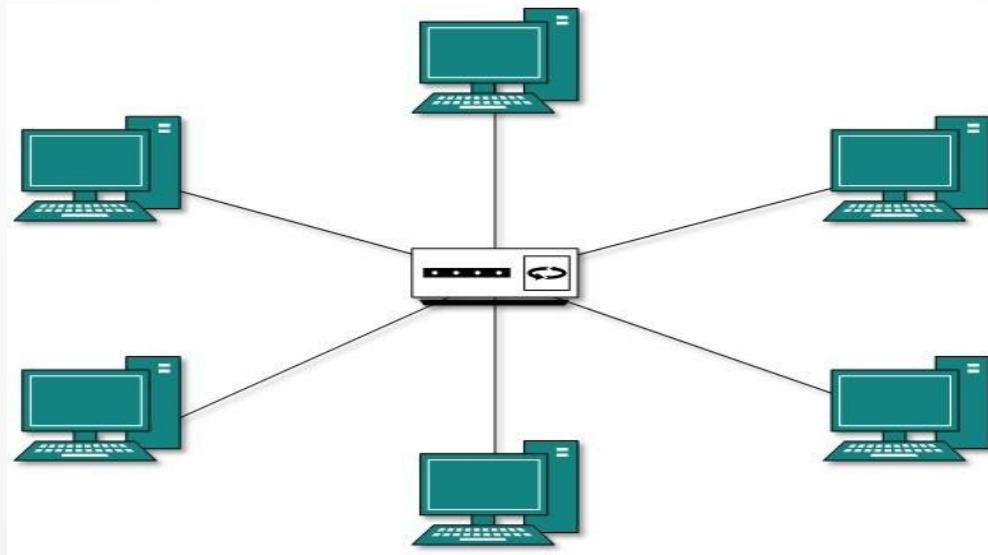
# Bus Topology

- All device share single communication line or cable.
- Failure of a device does not affect the others.
- Failure of the shared communication line make all other devices fail.
- Data is sent in only one direction and as soon as it reaches the extreme end, the terminator removes the data from the line.



# Star Topology

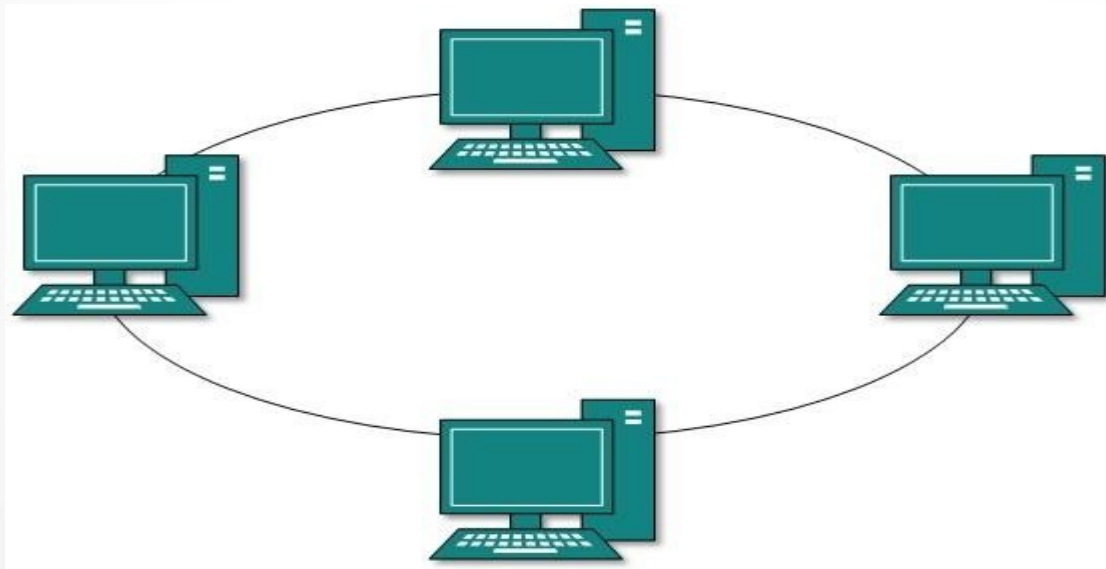
- All hosts are connected to a central device, known as Hub device, using a point-to-point connection.
- The hub device can be Layer-1 device (Hub / repeater) or Layer-2 device (Switch / Bridge) or Layer-3 device (Router / Gateway).
- Every communication happens between hosts, goes through Hub only.
- If hub fails, connectivity of all hosts to all other hosts fails.





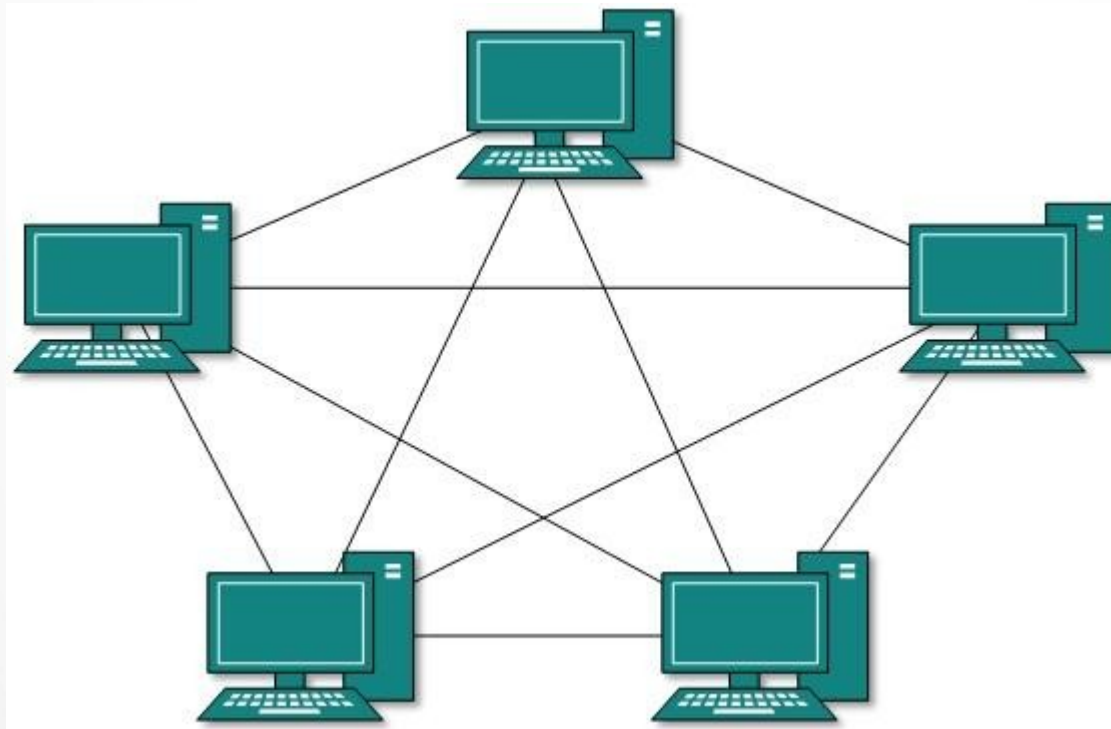
# Ring Topology

- Each host machine connects to exactly two other machines, creating a circular network structure.
- One host tries to communicate or send message to a host which is not adjacent to it, the data travels through all intermediate hosts.
- Failure of any host results in failure of the whole ring.



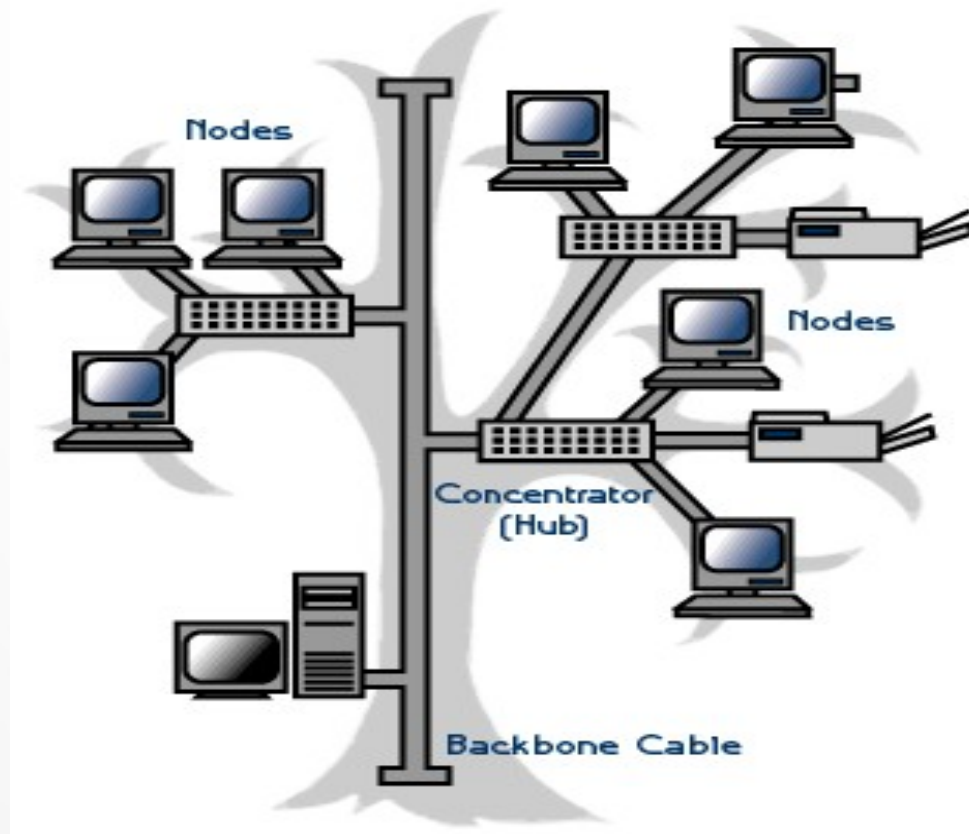
# Mesh Topology

- Hosts may have point-to-point connection to every other hosts (Full Mesh i.e. it provides the most reliable network structure among all network topologies.) or may also have point to point connection to few hosts only (partially Mesh).



# Tree Topology

- Also known as Hierarchical Topology is the most common form of network topology in use present day.
- A tree topology is essentially a combination of bus topology and star topology.



# Switching in Computer Networks

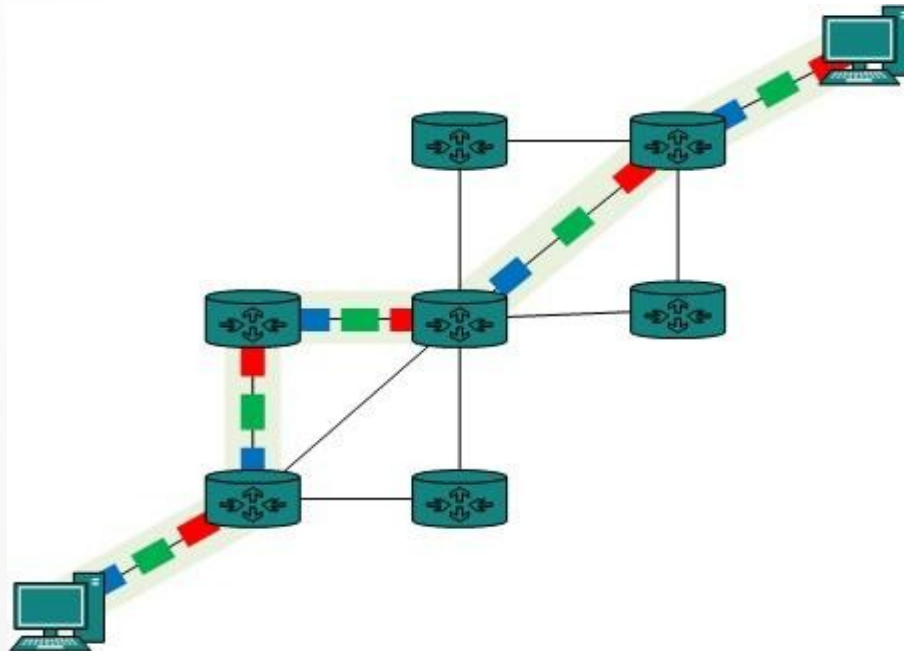
Switching is process to forward packets coming in from one port to another port leading towards the destination.

## Types of Switching

- Circuit Switching
- Message Switching
- Packet Switching

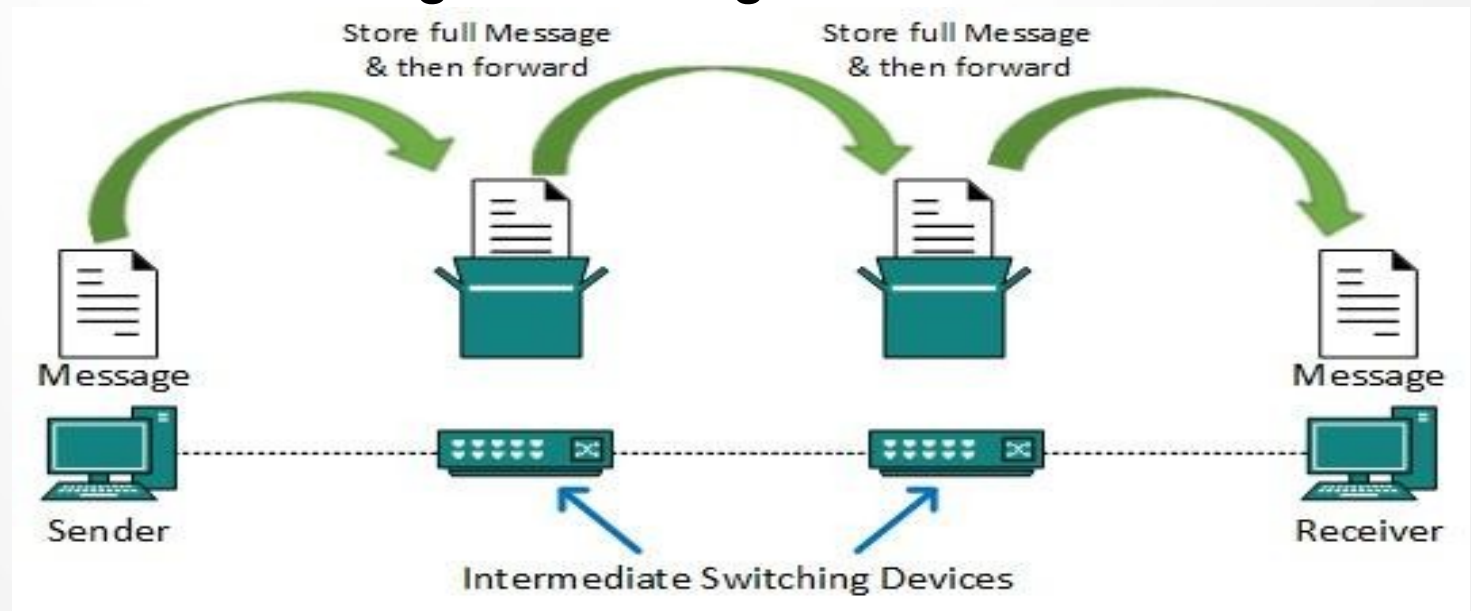
# Circuit Switching

- When two nodes communicate with each other over a dedicated communication path, it is called circuit switching.
- Circuit switching was designed for voice applications.
- Telephone is the best suitable example of circuit switching.



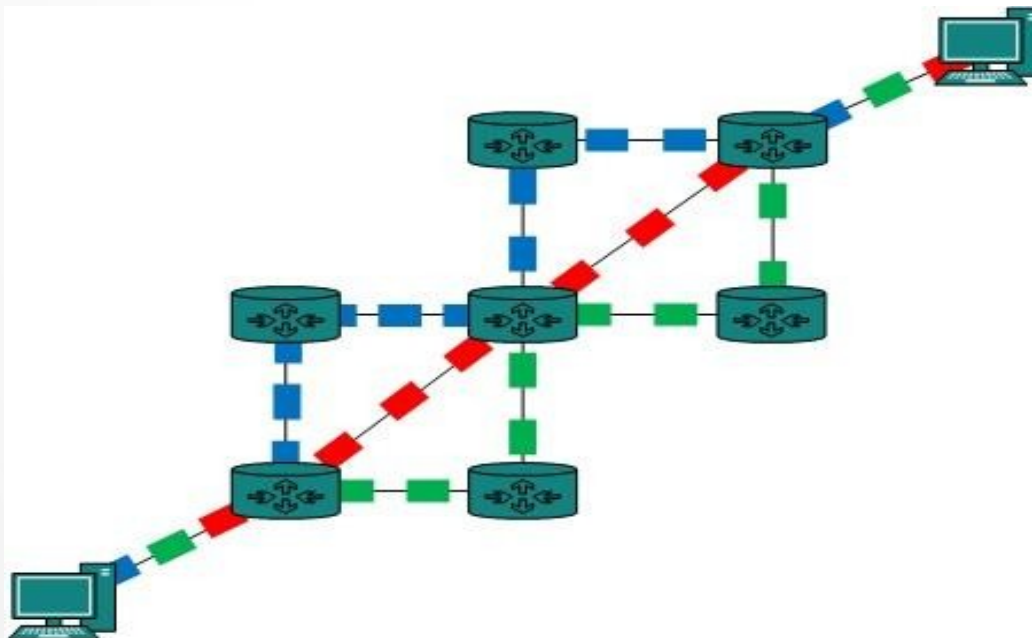
# Message Switching

- A switch working on message switching, first receives the whole message and buffers it until there are resources available to transfer it to the next hop. E-mail is an example of message switching.
- Every switch in transit path needs enough storage to accommodate entire message.
- Because of store-and-forward technique and waits included until resources available, message switching is very slow.



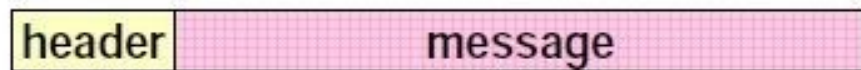
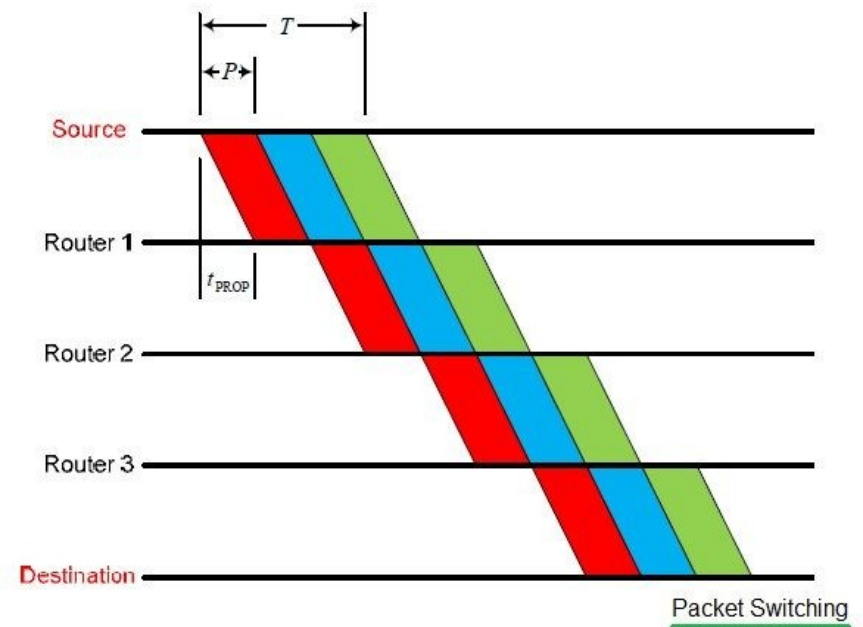
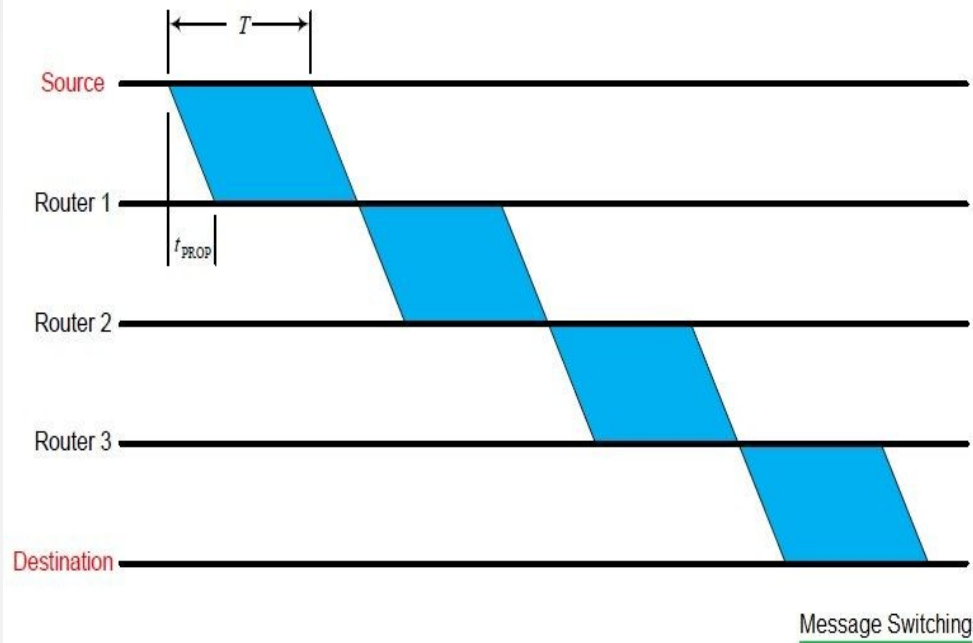
# Packet Switching

- The entire message is broken down into smaller chunks called packets.
- It is easier for intermediate networking devices to store smaller size packets and they do not take much resources either on carrier path or in the switches' internal memory.
- The internet uses packet switching technique.

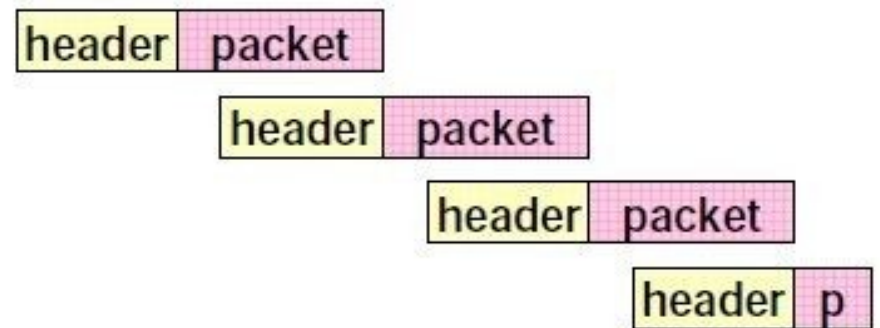




# Messages vs Packet Switching



Message Switching Datagram



Packet Switching-message is divided into small packets



# Messages vs Packet Switching

- Message switching overhead is lower compare to packet switching.
- Message switching has higher reliability (as one single datagram) and lower complexity. One single network path is used for the same.
- Packet switching is more complex as many packets generated by same node belonging to the same destination which may take different paths. The packets received out of order will need to be sequenced using sequence number embedded in the header part.
- Message switching takes more time compare to packet switching as entire message will be stored at each of the hop points till it is completely received.