

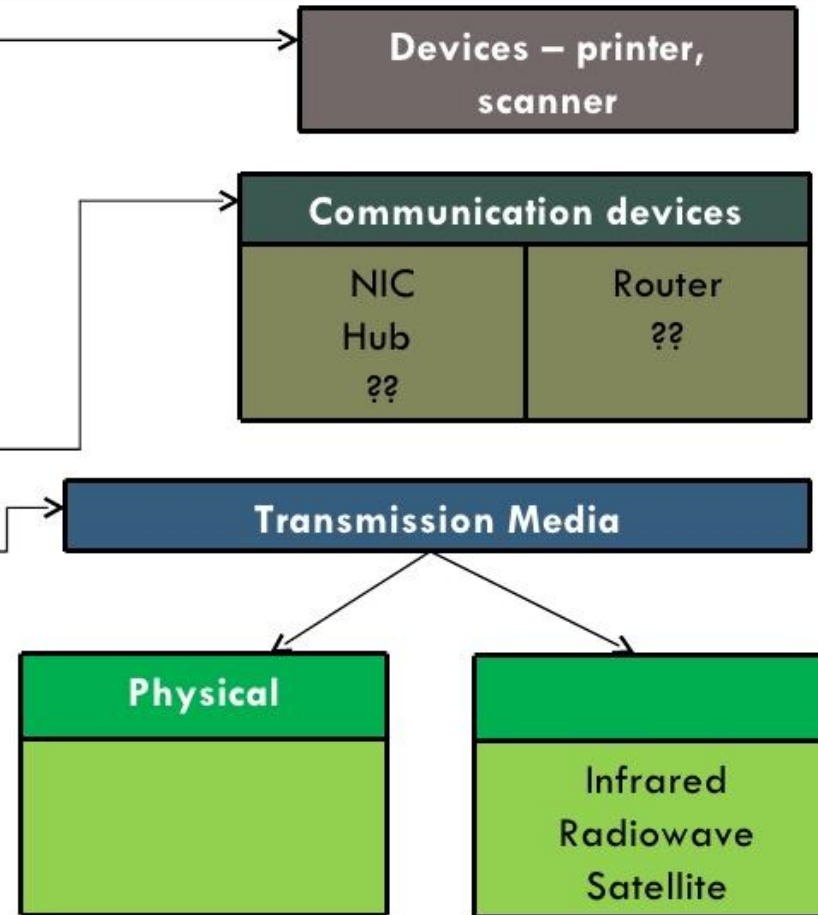
Introduction to Computer Networks

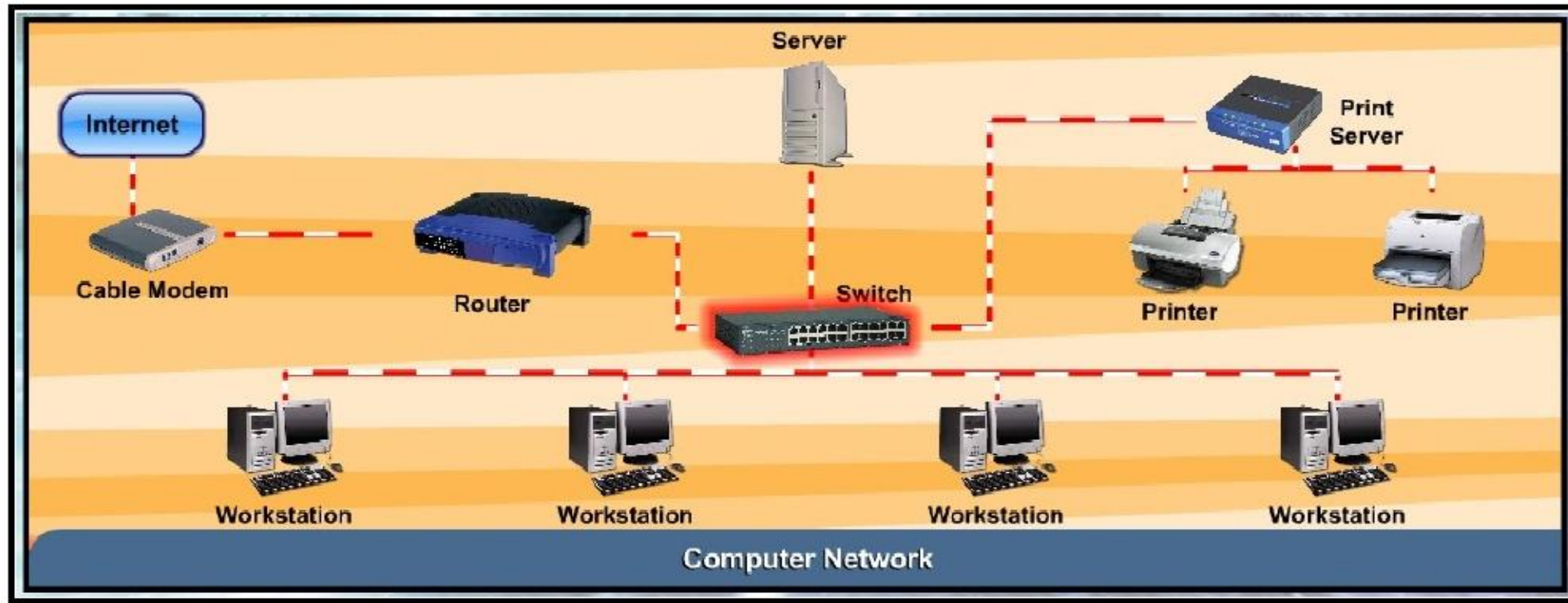
Textbook / References

1. “Behrouz A Forouzan” - Data Communications and Networking.
2. “Behrouz A Forouzan” – TCP/IP protocols suite
3. “D. Comer”- Internetworking with TCP/IP
4. “Kurose Ross”-Computer Networking A Top-Down Approach

Definition of Computer Networks

A computer network is a collection of **computers** and **devices** connected together via **communication devices** and **transmission media**. For examples it may connect computers, printers and scanners.





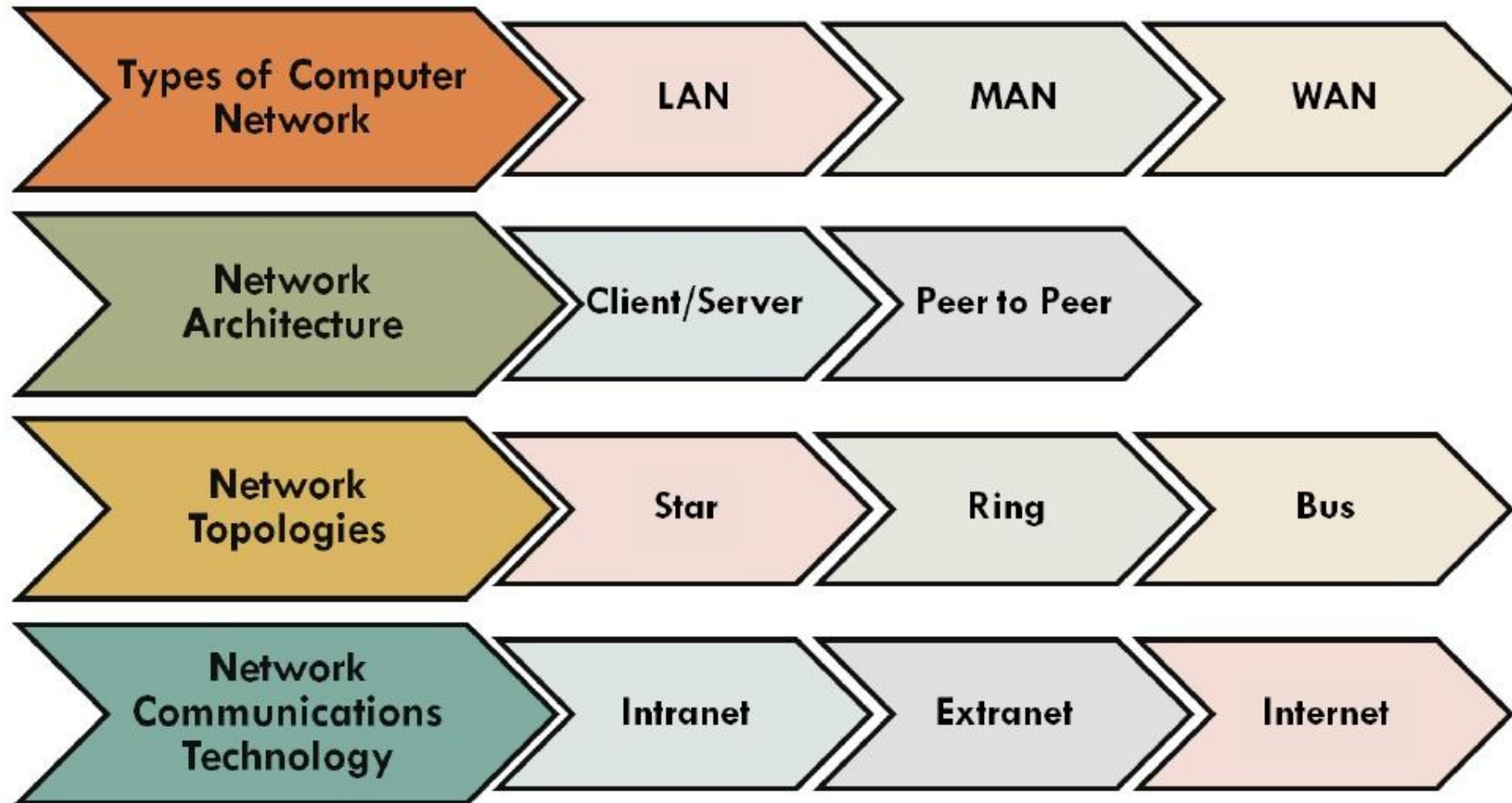
Definition of Communication

Communication describes a process in which two or more computer or **devices** transfer data, instructions and information.



The Importance/Advantage of Computer Networks

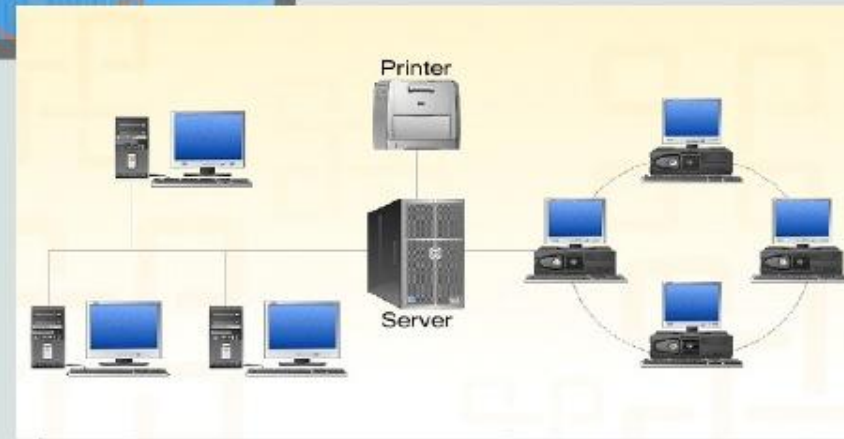
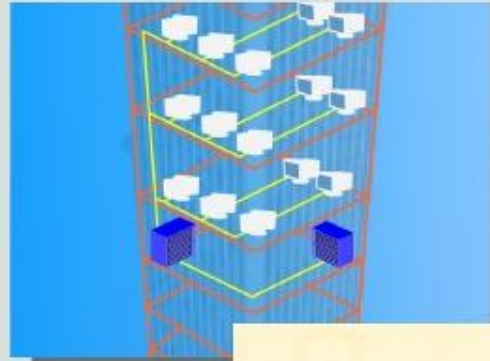
- s Sharing of **devices** such as printer and scanner
- a Sharing of **program**/software
- a Sharing of **files**
- ' Sharing of **data**
- a Sharing of **information**
- ' Sharing of **single high-speed internet connection**
- d Can access server centered **database**
- B **Better communication** using internet services such as email, mailing list and Internet Relat Chat (IRC)



Types of Computer Networks

Local Area Network (LAN)

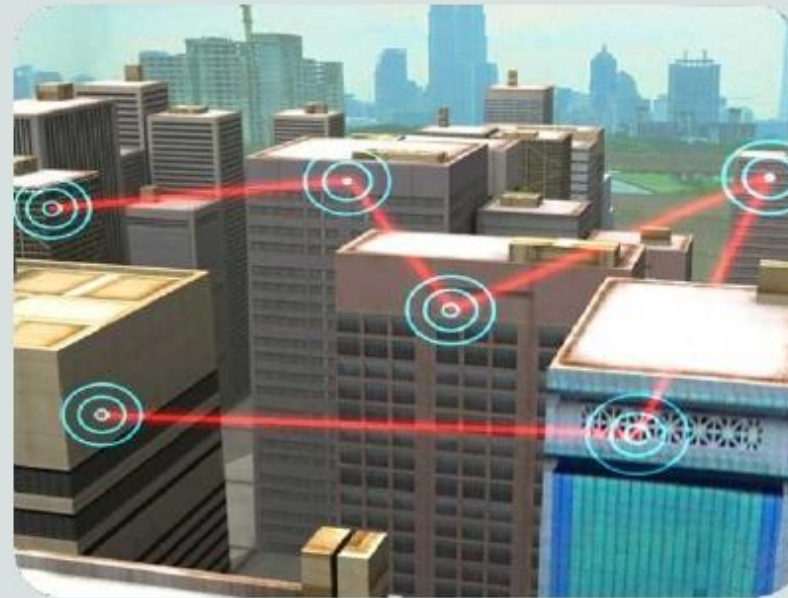
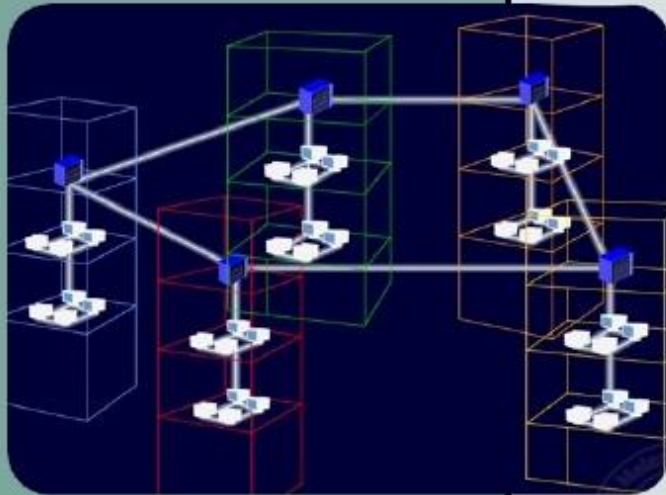
A local area network is a network that connects computers and device in **a limited geographical area** such as a **home**, school **computer laboratory**, office building



Metropolitan Area Network (MAN)

A metropolitan area network (MAN) is a high speed network that connects local area networks **in a metropolitan area** such as **city or town** and handles bulk of communication activity across the region

A MAN typically includes one or more LAN but covers a smaller geographic area than a WAN

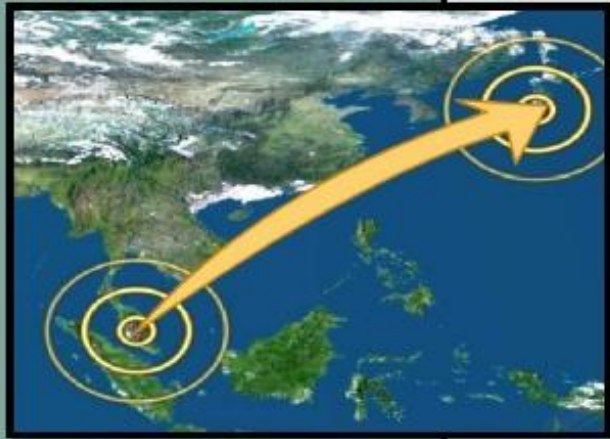


Wide Area Network (WAN)

A wide area network is a network that **covers a large geographical area** such **country or the world**

WAN combines many types of media such as telephone lines, cables and radio wave. A WAN can be one large network or can consist of two or more LANs connected together

The internet is the worlds largest WAN

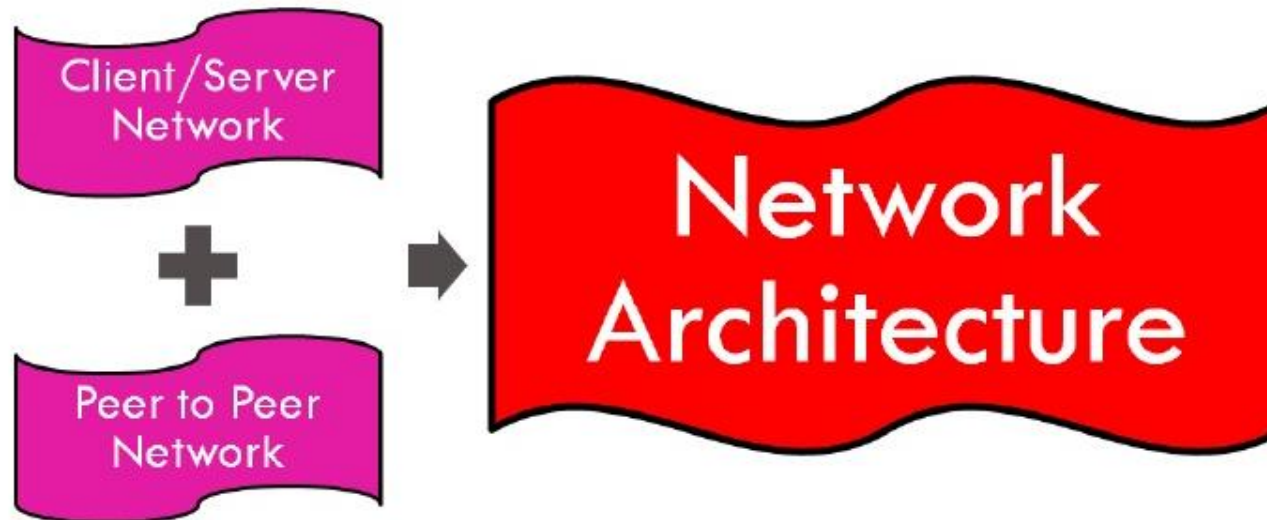


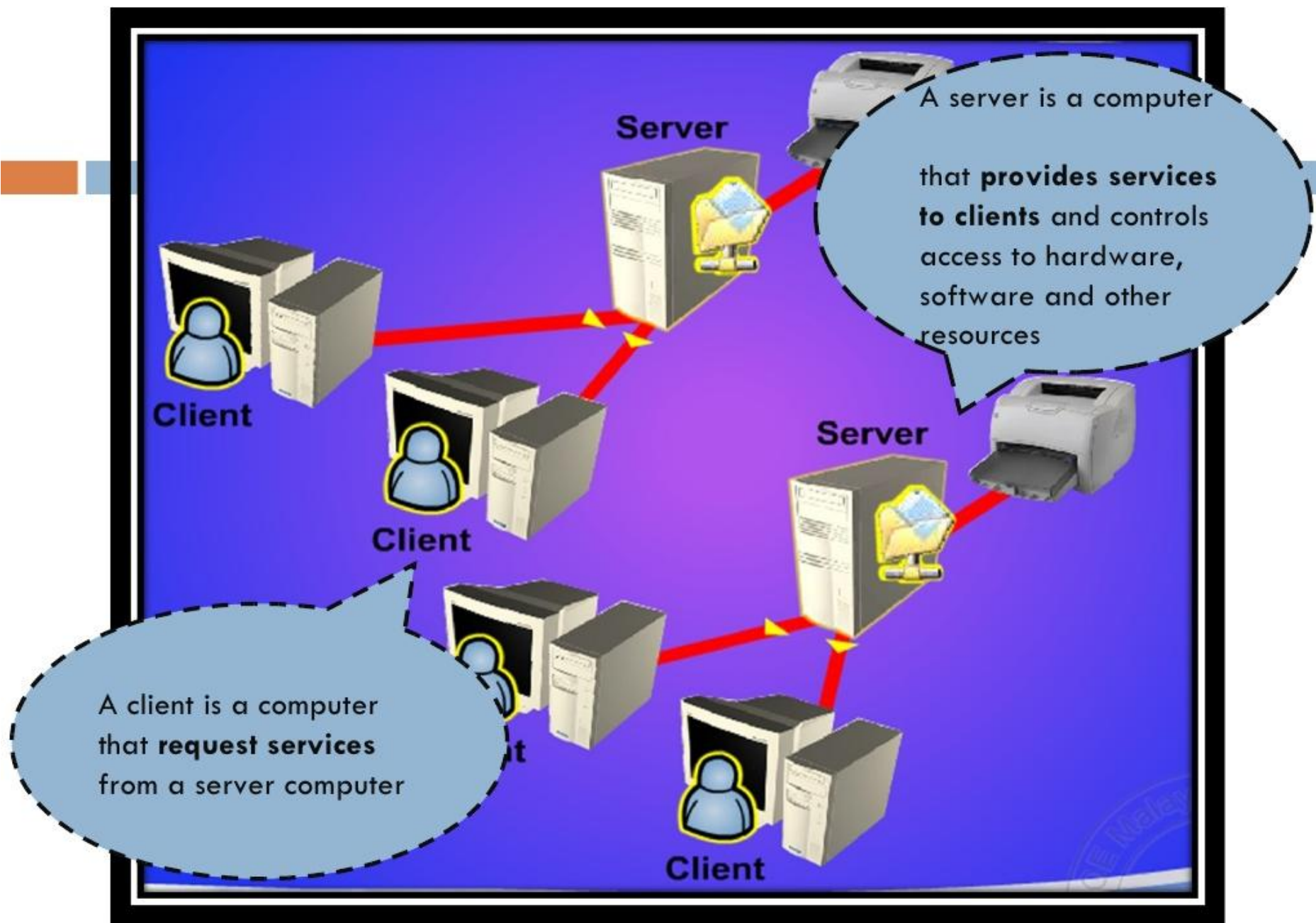
Differentiate between the types of Computer Networks

Different	LAN	MAN	WAN
Cost	Low optic	High	Higher
Network Size	Small	Larger	Largest
Speed	Fastest	Slower	Slowest
Transmission Media	Twisted-pair	Twisted-pair Fibre-optic cables	Fiber optic Radio wave Satellite
Number of Computers	Smallest	Large	Largest

Network Architecture

- **Network architecture** is the overall **design of a computer network** that describes how a computer network is configured and what strategies are being used.
- It is mainly focuses on the function of the networks.
- It is also known as **network model** or **network design**.
- Two main network architecture:





Client/Server

On a client/server network, one computer act as **a server** that provides services and the other computers (**client**) on the network request services from the server.

A server is a computer that controls access to the hardware, software and other resources on the network and provides a centralized storage area for program.

A client is a computer that request services from a server computer.

Peer-to-Peer

Peer-to-peer is a simple, inexpensive network that typically connects fewer than 10 computers. All computers in the network have **equal** capabilities to use the **resources** (hardware, software, data and file) available on the network. With peer-to-peer networks, there is **no central server**.

The Differences between Client/Server and Peer-to-Peer

Client/Server

- 1) Server has to control ability while client's don't
- 2) Higher cabling cost
- 3) It is used in small and large networks
- 4) Easy to manage
- 5) Install software only in the server while the clients share the software
- 6) One powerful computer acting as server

Peer-to-Peer

- 1) All computers have equal ability
- 2) Cheaper cabling cost
- 3) Normally used in small networks with less than 10 computers
- 4) Hard to manage
- 5) Install software to every computer
- 6) No server is needed

NETWORK TOPOLOGY

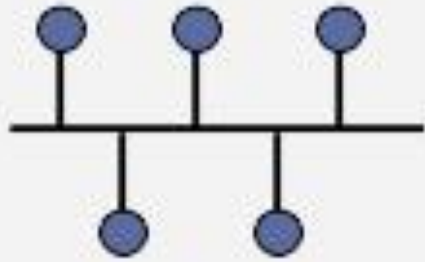
Topology

Topology refers to the **layout** of connected devices on a network.

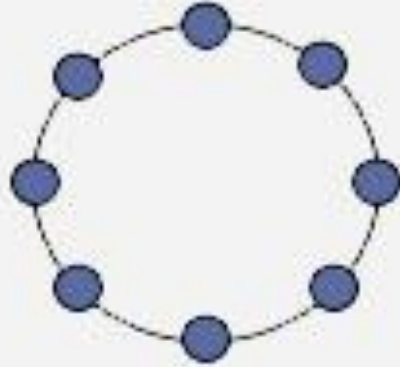
Here, some logical layout of topology.

- **Mesh**
- **Star**
- **Bus**
- **Ring**

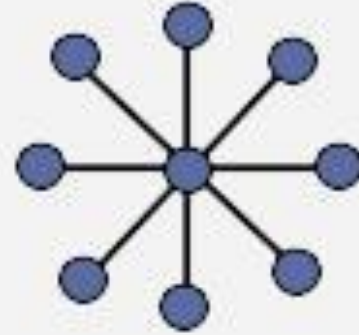
Network Topology



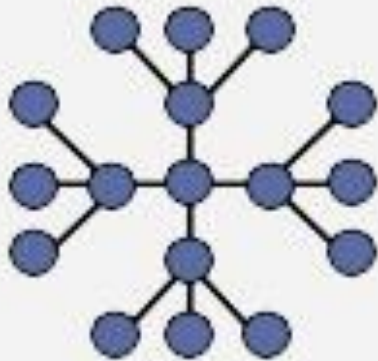
Bus



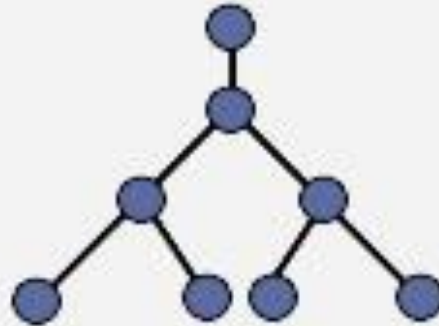
Ring



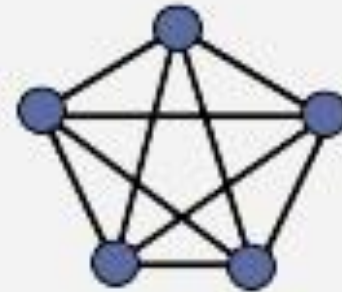
Star



Extended Star



Hierarchical



Mesh

Mesh Topology

Here every device has a **point to point** link to every other device.

Node 1 node must be connected with **$n-1$** nodes.

A fully connected mesh can have **$n(n-1)/2$** physical channels to link **n** devices.

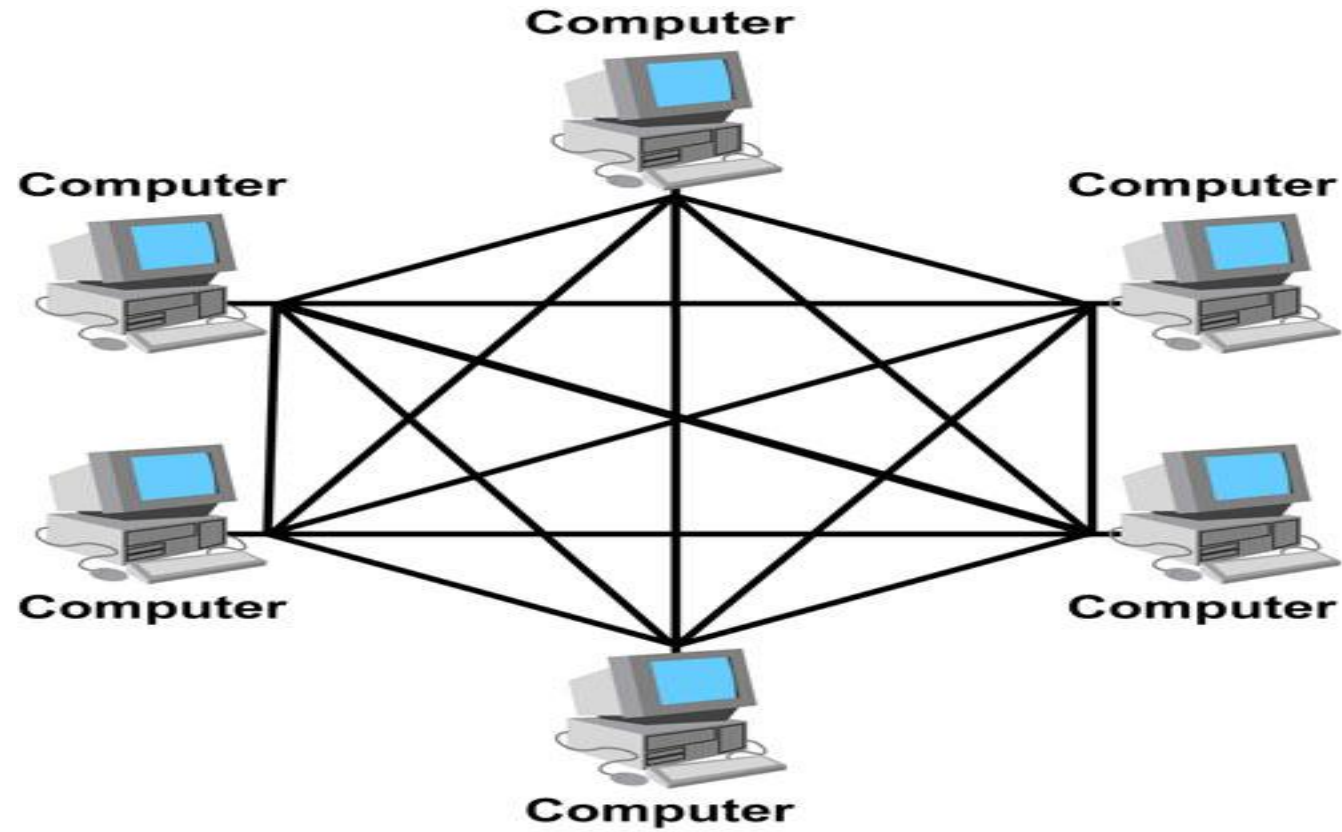
It must have **$n-1$** I/O ports.

Mesh Topology

Advantages:

1. They use dedicated links so each link can only carry its own data load. So **traffic problem** can be avoided.
2. It is robust. If **any one link get damaged** it cannot affect others.
3. It gives privacy and security.(Message travels along a dedicated link)
4. Fault identification and fault isolation are easy.

Mesh Topology



Mesh Topology

Disadvantages:

1. The amount of **cabling** and the number of **I/O ports** required are very large. Since every device is connected to each devices through dedicated links.
2. The sheer bulk of wiring is larger then the available space.
3. Hardware required to connected each device is highly expensive.

Mesh Topology

Applications:

1. Telephone Regional office.
2. WAN.(Wide Area Network).

Star Topology

Here each device has a dedicated point-to-point link to the central controller called “Hub”(Act as a Exchange).

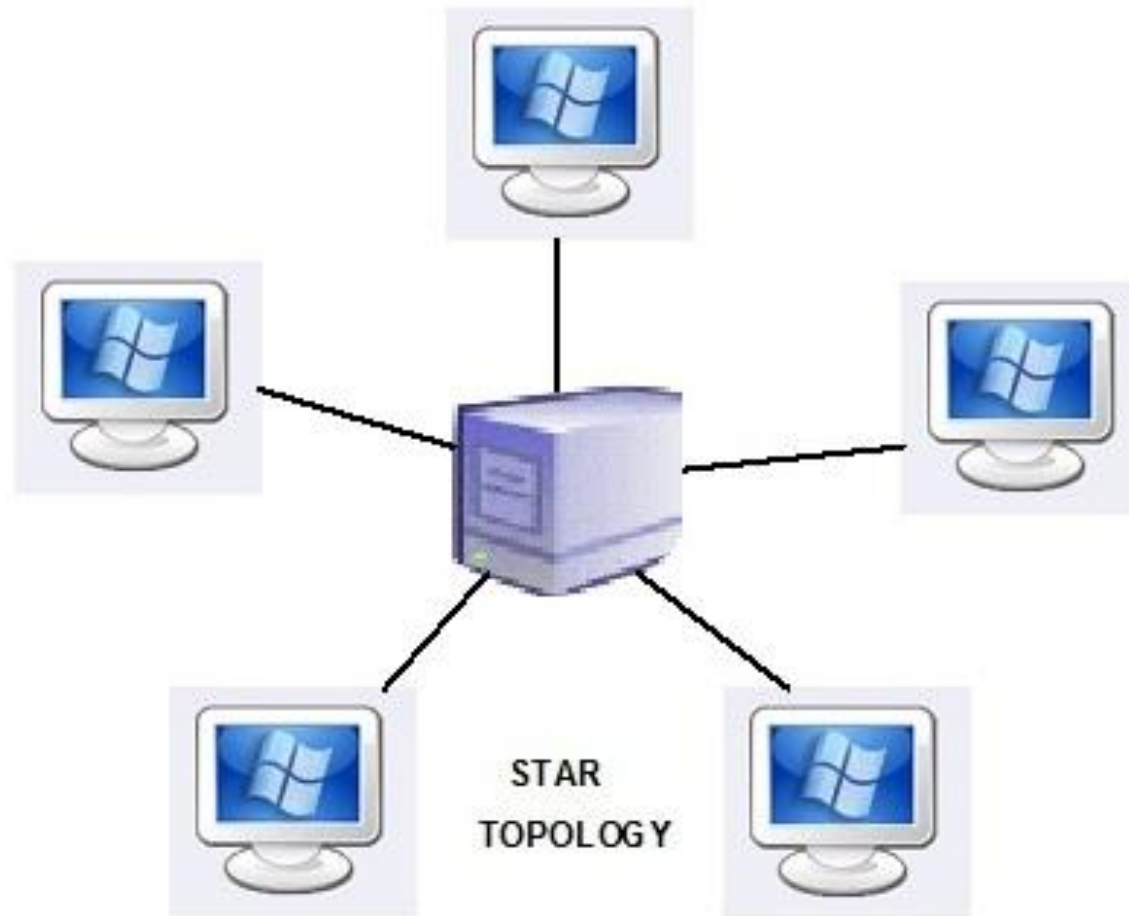
There is no direct traffic between devices.

The transmission are occurred only through the central “hub”.

When device 1 wants to send data to device 2; First sends the data to hub. Which then relays the data to the other connected device.

Star Topology

STAR TOPOLOGY:



Star Topology

Advantages:

1. Less expensive than mesh since each device is connected only to the hub.
2. Installation and configuration are easy.
3. Less cabling is needed than mesh.
4. Robustness.(if one link fails, only that link is affected. All other links remain active)
5. Easy to fault identification & to remove parts.
6. No disruptions to the network when connecting(or) removing devices.

Star Topology

Disadvantages:

1. Even it requires less cabling then mesh when compared with other topologies it still large.(Ring or bus).
2. Dependency(whole n/w dependent on one single point(hub). When it goes down. The whole system is dead.

Applications

Star topology used in Local Area Networks(LANs).

High speed LAN often used STAR.

Bus Topology

A bus topology is multipoint.

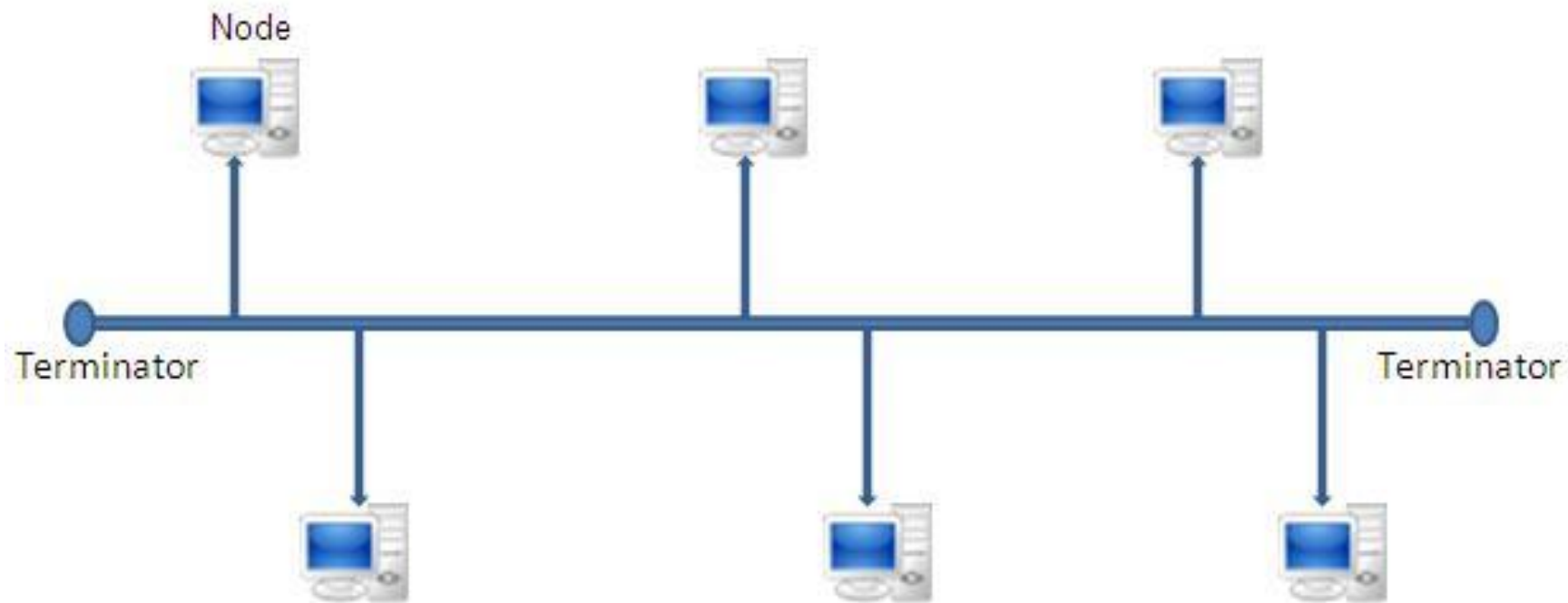
Here one long cable act as a backbone to link all the devices are connected to the backbone by drop lines and taps.

Drop line- is the connection b/w the devices and the cable.

Tap- is the splitter that cut the main link.

This allows **only one device to transmit at a time.**

Bus Topology



Bus Topology

A device want to communicate with other device on the n/ws sends a broadcast message onto the wire all other devices see.

But only the intended devices accepts and process the message.

Bus Topology

Advantages:

1. Ease of installation
2. Less cabling

Disadvantages:

1. Difficult reconfiguration and fault isolation.
2. Difficult to add new devices.
3. Signal reflection at top can degradation in quality.
4. If any fault in backbone can stops all transmission.

Bus Topology

Applications:

Most computer motherboard.

Ring Topology

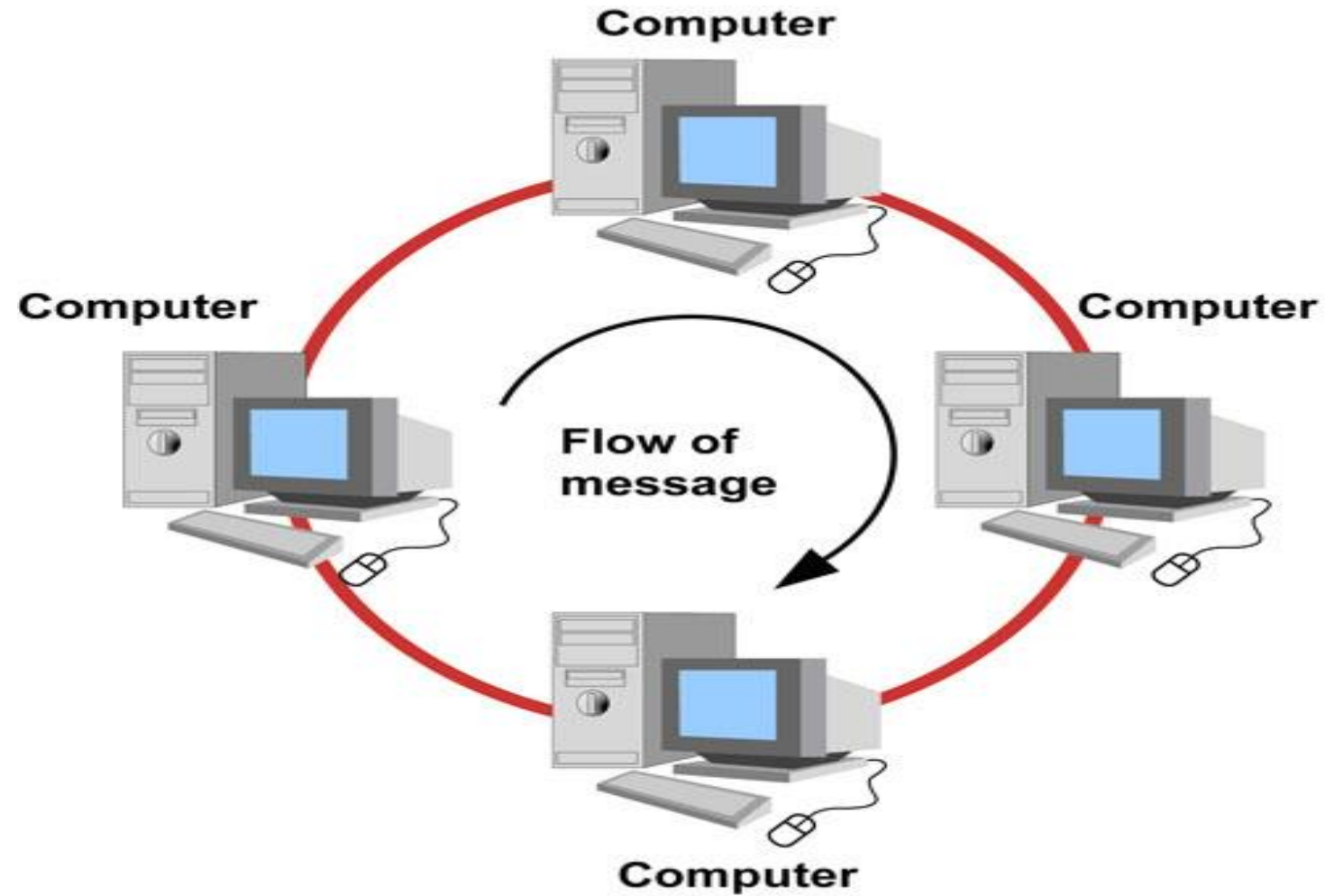
Here each device has a dedicated connection with two devices on either side.

The signal is passed in one direction from device to device until it reaches the destination and each device have **repeater**.

When one device received signals instead of intended another device, its repeater then **regenerates** the data and passes them along.

To add or delete a device requires changing only two connections.

Ring Topology



Ring Topology

Advantages:

1. Easy to install.
2. Easy to reconfigure.
3. Fault identification is easy.

Disadvantages:

1. Unidirectional traffic.
2. Break in a single ring can break entire network.

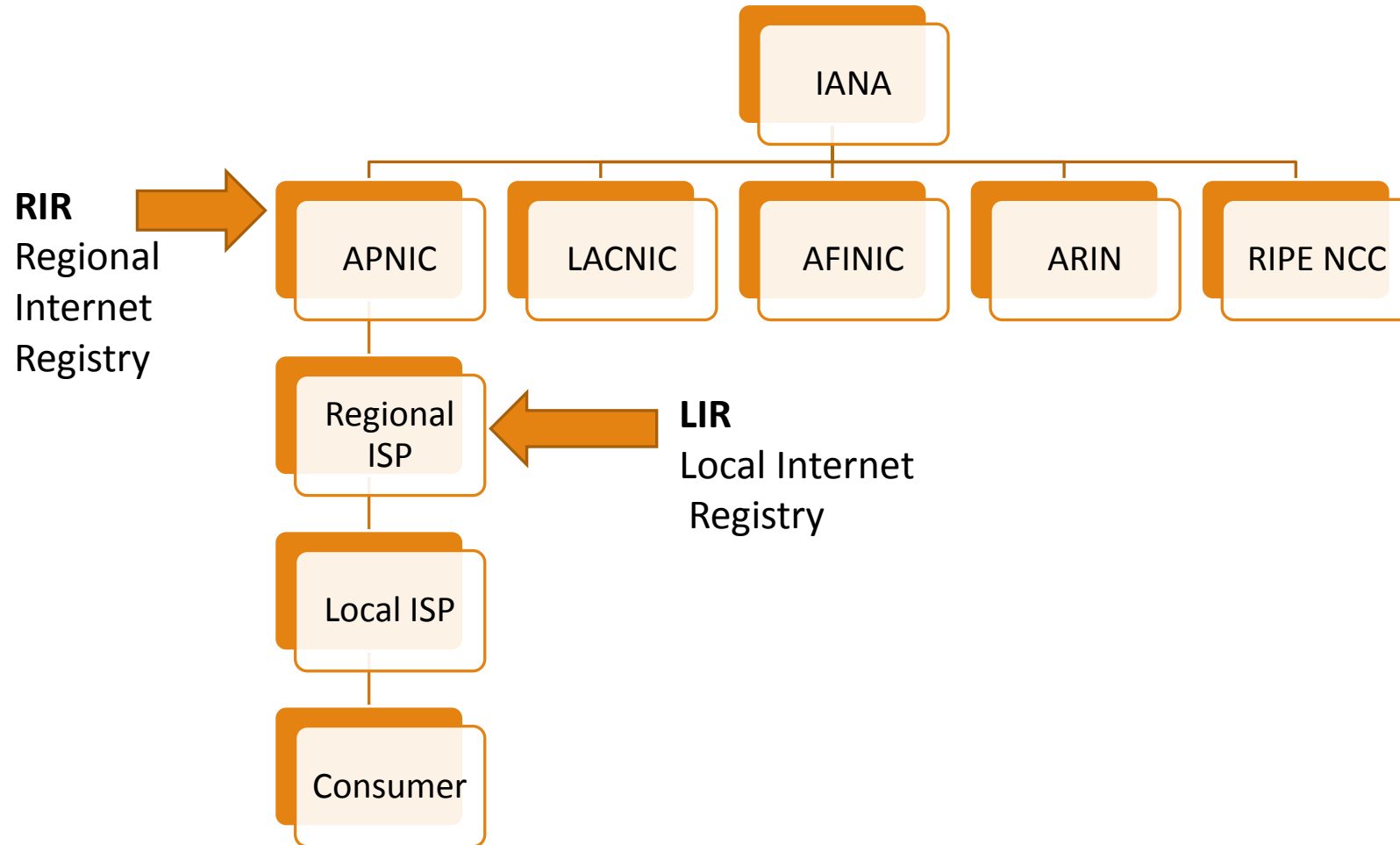
Ring Topology

Applications:

Ring topologies are found in some office buildings or school campuses.

Today high speed LANs made this topology **less popular**.

Hierarchy of Internet

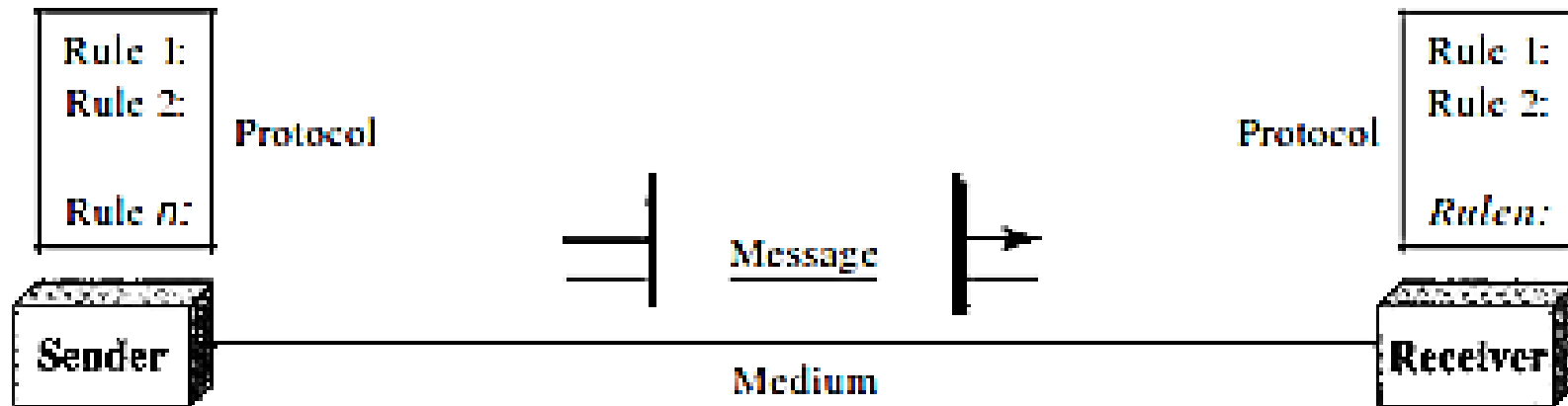


IANA =Internet Assigned Numbers Authority

APNIC= Asia-Pacific Network Information Centre

Basic Data Communication

- Data communications are the exchange of data between two devices via some form of transmission medium such as a wire cable. For data communications to occur, the communicating devices must be part of a communication system made up of a combination of hardware (physical equipment) and software (programs).



Basic Data Communication cont.

A data communications system has five components:

1. **Message:** The message is the information (data) to be communicated. Popular forms of information include text, numbers, pictures, audio, and video.
2. **Sender:** The sender is the device that sends the data message. It can be a computer, workstation, telephone handset, video camera, and so on.
3. **Receiver:** The receiver is the device that receives the message. It can be a computer, workstation, telephone handset, television, and so on.
4. **Transmission medium:** The transmission medium is the physical path by which a message travels from sender to receiver. Some examples of transmission media include twisted-pair wire, coaxial cable, fiber-optic cable, and radio waves.
5. **Protocol:** A protocol is a set of rules that govern data communications. It represents an agreement between the communicating devices. Without a protocol, two devices may be connected but not communicating, just as a person speaking French cannot be understood by a person who speaks only Japanese.