# Computer Networks

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**Lect_1**

# Network Fundamentals

## Network:

❑ It is a group of components connected together to provide a service.


▪ The core of networks was in the American armed forces (DOD department of defence model).

▪ DOD developed by DARPA (it is the authority responsible for the researches in the American army)

# Network Fundamentals

- The Defense Advanced Research Projects Agency (DARPA) is a research and development agency of the United States Department of Defense responsible for the development of emerging technologies for use by the military. Originally known as the Advanced Research Projects Agency (ARPA), the agency was created on February 7, 1958, by President Dwight D. Eisenhower in response to the Soviet launching of Sputnik 1 in 1957.
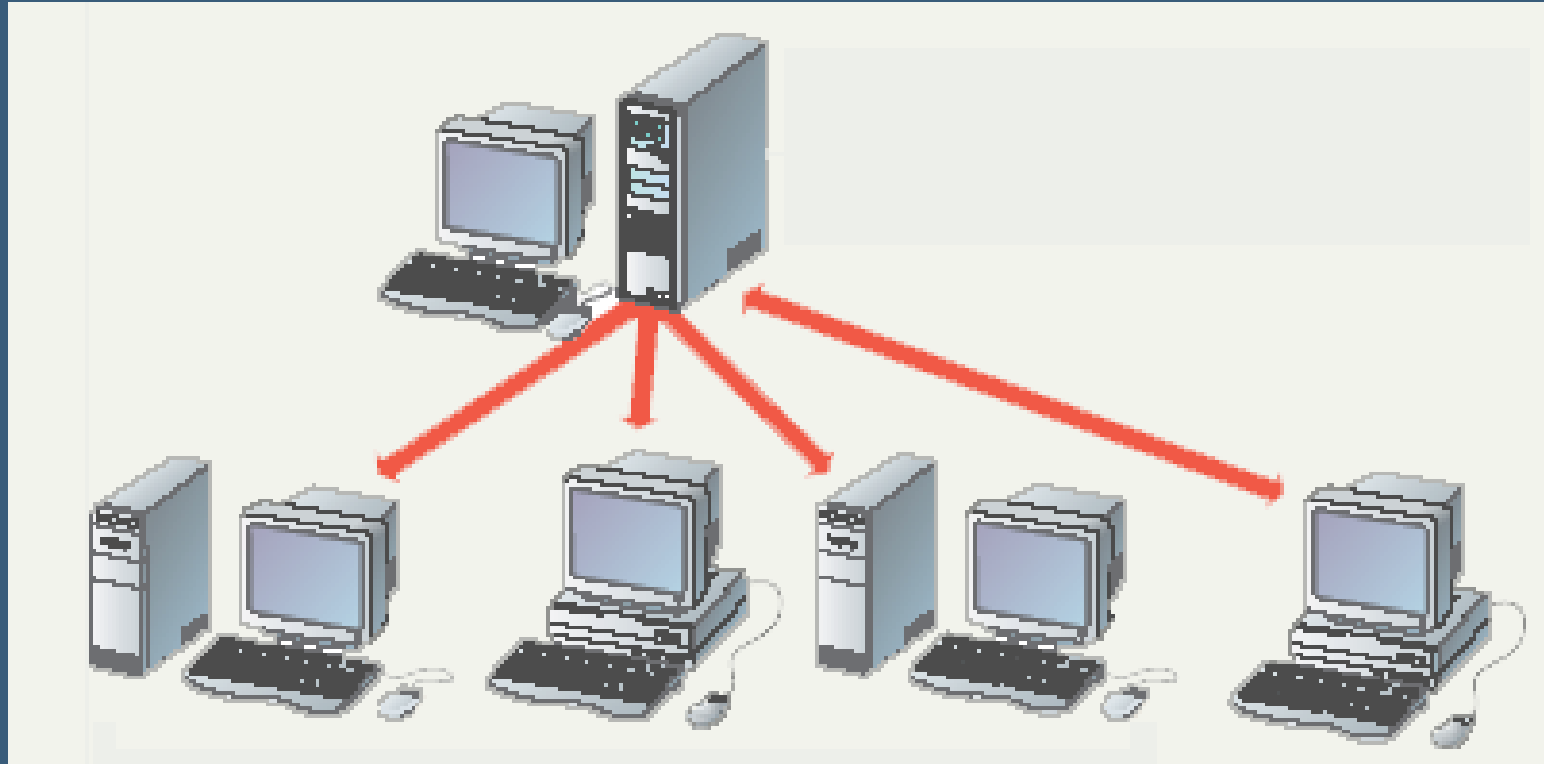
**Defense Advanced Research Projects Agency**



Headquarters in Ballston in Arlington County, Virginia in 2022

| Agency overview | |
|---|---|
| Formed | February 7, 1958; 67 years ago (as ARPA) |

# Importance of Networks

❑Easy access and sharing of files, information and data.

# Importance of Networks

❑ Easy sharing of expensive devices and network resources (i.e., printers, scanners …etc)

❑ Modern Technologies (VOIP, Video, Smell, Games, IOT ….etc)

## (Live Over IP network)

# Network Components

1. End Devices
- Such as computers, printers, mobiles, IP camera, IP televisions (i.e., smart television) etc.
- End devices are the main component, because it is the source of network applications.
- Network applications are the services that can be done with remote devices such as:
  - HTTP (Hyper Text Transfer Protocol), it is responsible for browsing of remote servers such google, facebook, etc.
  - FTP (File Transfer Protocol), it is responsible for upload and download   of files.
    o There are many servers (called file servers) responsible for upload and download services such as: 4 share, file share, rapid share, mega upload, and google drive
  - SMTP (Simple Mail Transfer Protocol), it is used to sent electronic mails.
  - POP3 (Post Office Protocol), it is user to retrieve e - mail
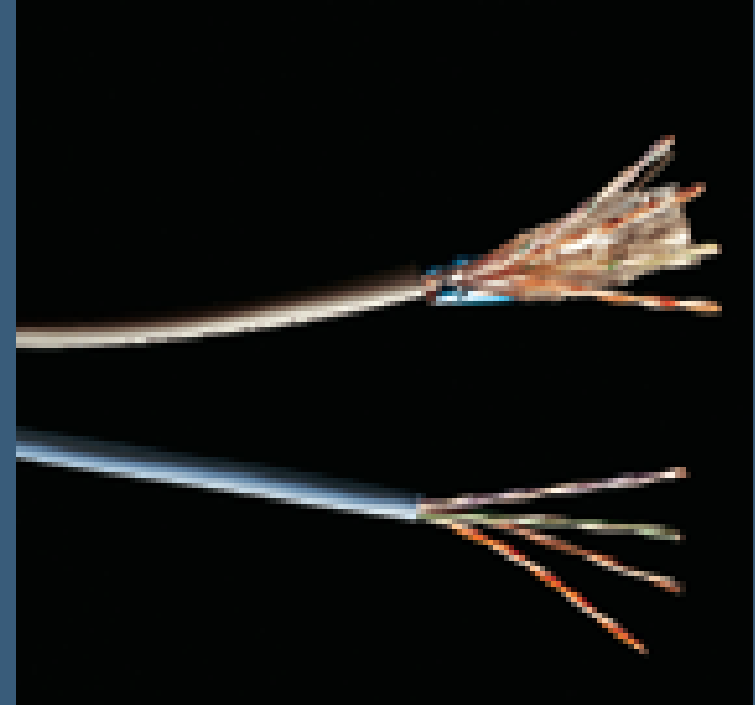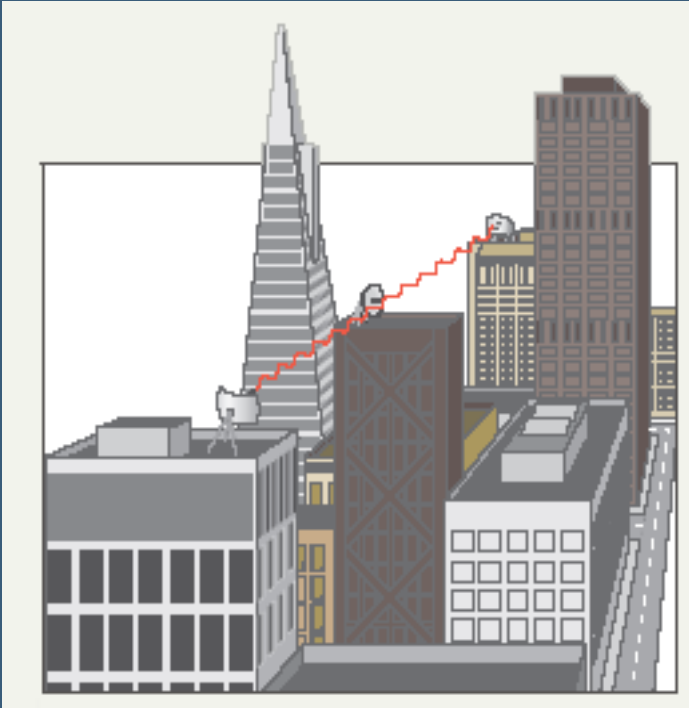
# Network Components

- There many other protocols.
- All these protocols already exist with operating systems, which is responsible for calling the required protocol according to the required service.

2. Intermediate Devices(Network Devices)

   - Devices that interconnect different computers together, network devices are as follow:

   ➢ Repeater, Hub, Bridge, Switch, gateway, Router, NIC (Network Interface Card), wireless access point, Firewall, IDS (Intrusion Detection System), IPS (Intrusion Prevention System).

   ➢ Intermediate devices are made by network companies such as:
   Cisco, Juniper, Huawei, Avaya, HP, Alcatel, ZTE, etc.

# Network Components

3. Connectivity
   - Media that physically connect the computers and network devices
       ➢ Cables (Cooper or Fiber)
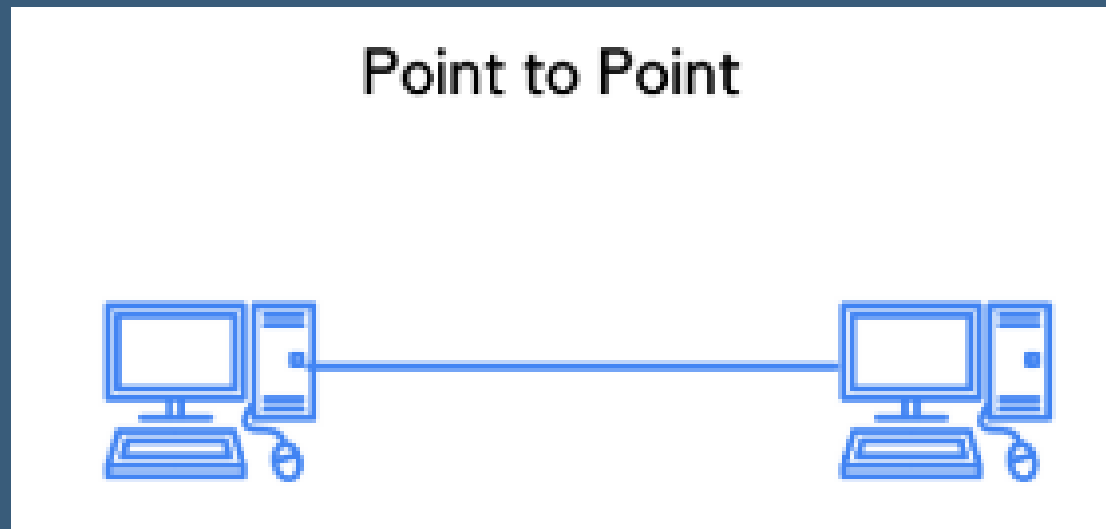       ➢ Wireless (Data transmitted through the air)

# Network Topologies

- Network topologies means how components are connected together.
1. Point - to – Point
    - Used when the network consists of two computers only.
    - One send data, only one will receive.
    - This method used when you want to connect two router with each other.



Point to Point
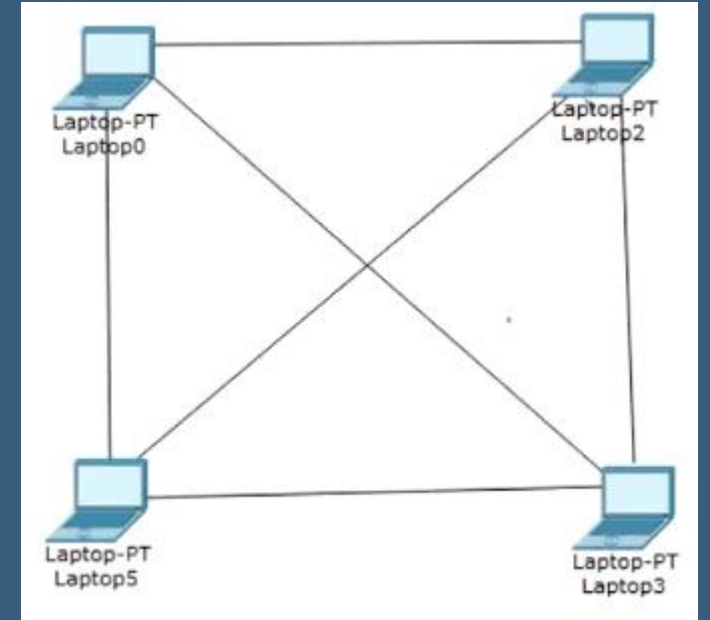
# Network Topologies

2. Ring Topology

    - connects all nodes in a closed loop on which messages travel in one direction

    -This topology designed by IBM company.

    - In this topology when computer A need to send data to computer E, A send data to B then B send data to C then C send data to D then D send data to E.
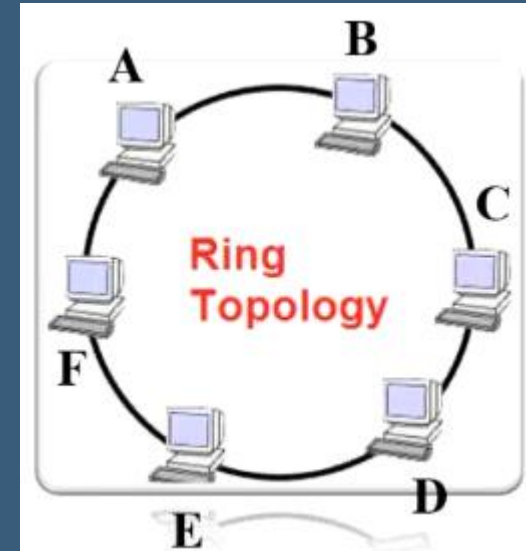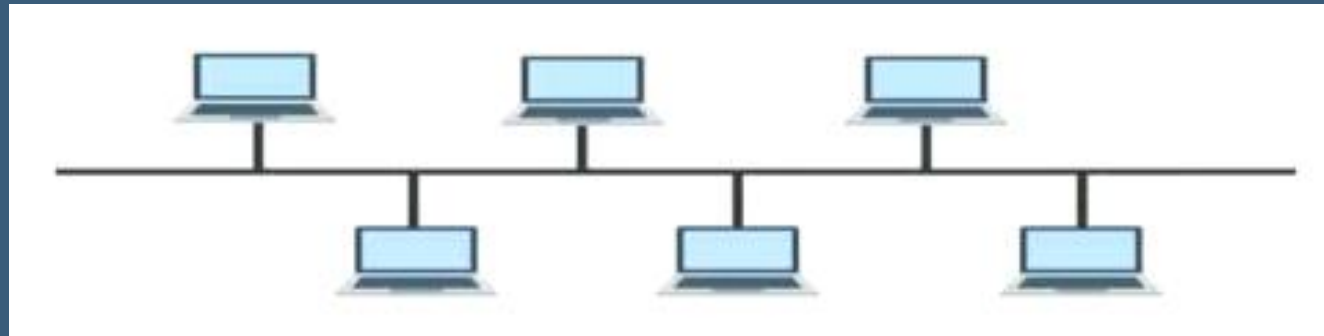
# Network Topologies

3. Mesh Topology
   - In this topology all devices connected to each other through all possible paths.
   - In this topology we used many number of cables and NIC cards.
   - No of cables = n (n – 1)/2
   where n is the number of devices
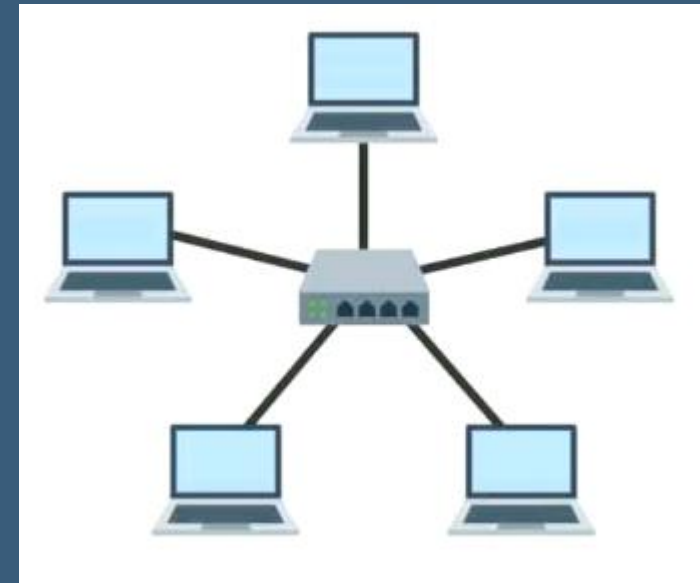
# Network Topologies

4. Bus Topology

- In this topology all components are connected to main cable called Bus, when A want to send data to computer D, all computer can receive the data.
- One send data, all receive.
- All devices discard the message except the required device.
- In this topology when more than one device send data, collision may occur.
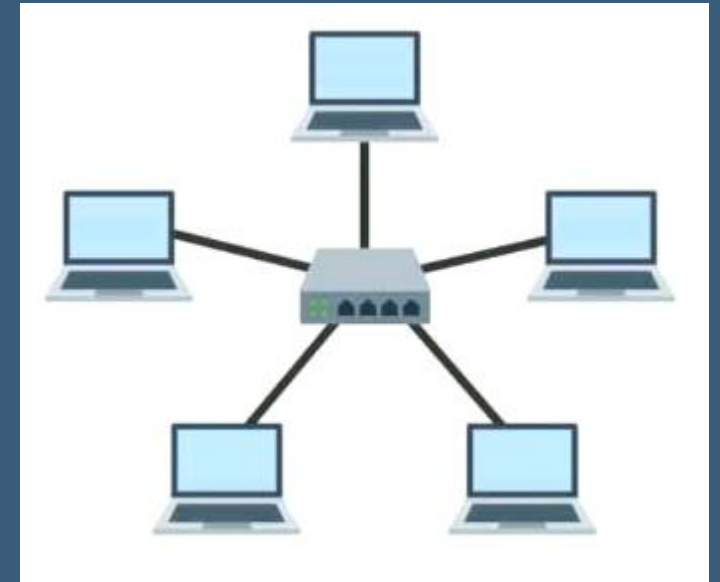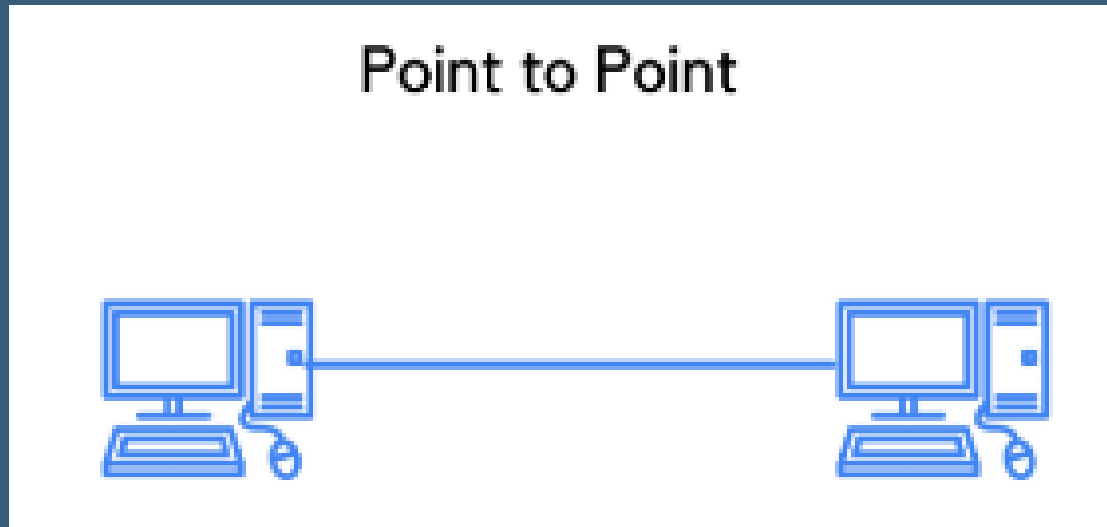
# Network Topologies

5. Star Topology
   - In this topology the Bus cable is replaced with centralized device that manage transfer of data between the devices
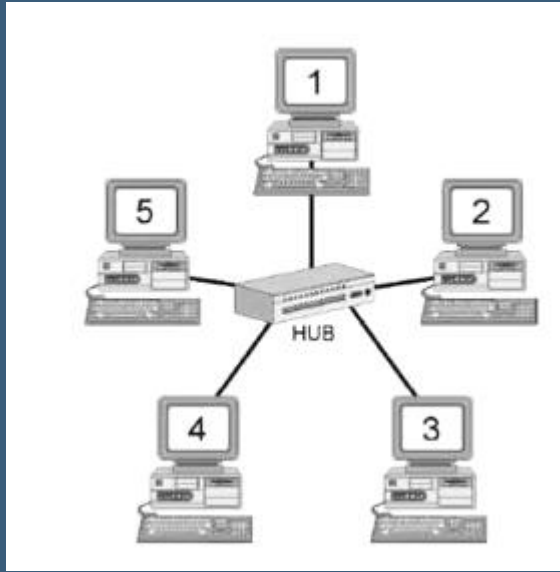   - The centralized device is called switch.

# Network Topologies

- The most common devices are:
    1. Point – to – Point topology in case of two devices.
    2. Star topology in case of multi devices.



Point to Point

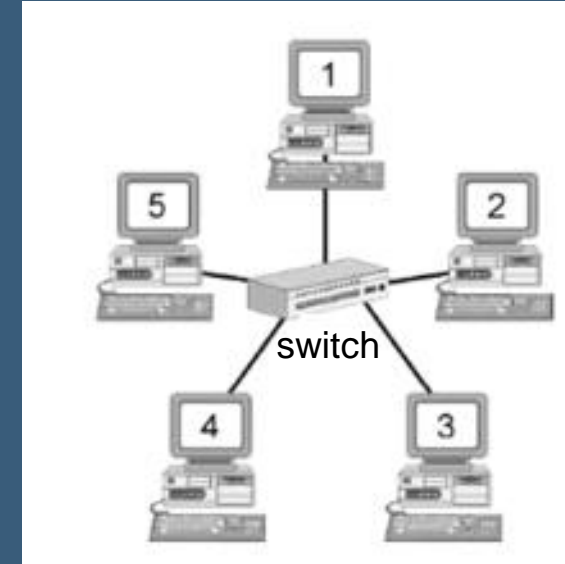# Network Topologies

- Physical topology vs logical topology



    - Physical topology:- Star

    - Logical topology:- Bus

                                            - Physical topology:- Star

                                            - Logical topology:- point to point

- Logical means how components of network communicate internally.

# Network Types

1.  Local Area Network (LAN)
    - It is a group of components that are connected together to provide a service within local area.
    - The computers are geographically close together.
2.  Metropolitan Area Network (MAN)
    - It is group of LANs within the same city.
    - In this case service provider must exist as a partner to connect different LANs with each others.
3.  Wide Area Network (WAN)
    - It is group of LANs between cities, countries and continents.
    - The biggest WAN is the internet, it sometimes called public WAN.
    - If branches of big company connected together it is called private WAN, sometimes called Enterprise WAN.
    - One of the biggest companies that provide private WAN technology is orange company (exist in France).
    - Te-data is an example of the companies that provide the service of private WAN and public WAN

# Network model

- It is a group of concepts that will be make a device know how to send data hop by hop(step by step) & then end to end
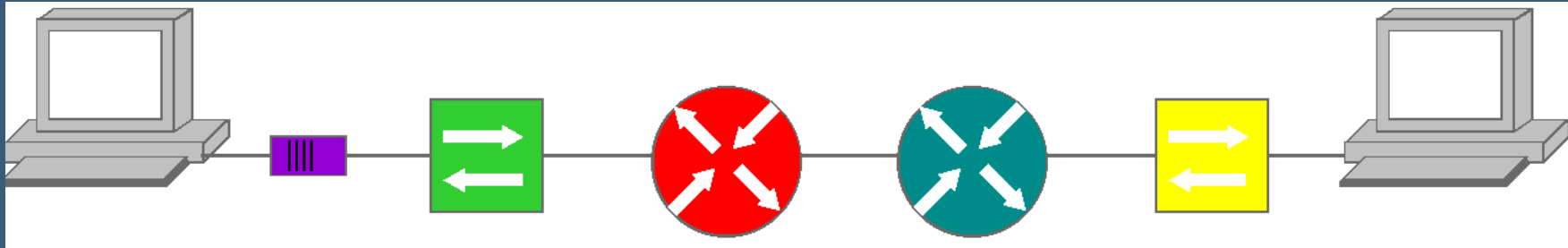


- All devices must have operating system

- Operating system for end devices :windows , Linux, Mac, iOS (i refers to ipad, ipod iphone),….

- For intermediate devices : IOS (Internetwork Operating System)

# Network Model

- When we install any operating system (for end devices or intermediate device ), Network model must install with it i.e. any operating system have the network model.

- A networking model, sometimes also called either a networking architecture or networking blueprint, refers to a comprehensive set of documents.

  - ➢ Individually, each document describes one small function required for a network; collectively, these documents define everything that should happen for a computer network to work.

  - ➢ Some documents define a protocol, which is a set of logical rules that devices must follow to communicate. Other documents define some physical requirements for networking. For example, a document could define the voltage and current levels used on a particular cable when transmitting data.

# Network Model

- If the operating system install on any device without the network model, this device can't connect with other devices.
- Network models such as:
    1. OSI (Open System Interconnection) was the common network model developed by ISO (The International Organization for Standardization)
    2. DOD (Department of  Defense) is developed by DARPA, after that it called TCP/IP model. Nowadays TCP/IP is the common model on all operating systems.

# Network Model

- History Leading to TCP/IP
- Once upon a time, networking protocols didn't exist, including TCP/IP. Vendors created the first networking protocols; these protocols supported only that vendor's computers..
- For example, IBM published its Systems Network Architecture (SNA) networking model in 1974. Other vendors also created their own proprietary(ملكية خاصة) networking models.
- Although vendor-defined proprietary networking models often worked well, having an open, vendor-neutral networking model would aid competition and reduce complexity.
- The International Organization for Standardization (ISO) took on the task to create such a model, starting as early as the late 1970s, beginning work on what would become known as the Open Systems Interconnection (OSI) networking model.
- A second, less-formal effort to create an open, vendor-neutral, public networking model supported from a U.S. Department of Defense (DoD) contract. Researchers at various universities volunteered to help further develop the protocols surrounding the original DoD work. These efforts resulted in a competing open networking model called TCP/IP.

# Network Model

- History Leading to TCP/IP
  - During the 1990s, companies began adding OSI, TCP/IP, or both to their enterprise networks. However, by the end of the 1990s, TCP/IP had become the common choice, and OSI fell away.
  - Here in the twenty-first century, TCP/IP dominates. Proprietary networking models still exist, but they have mostly been discarded in favor of TCP/IP.
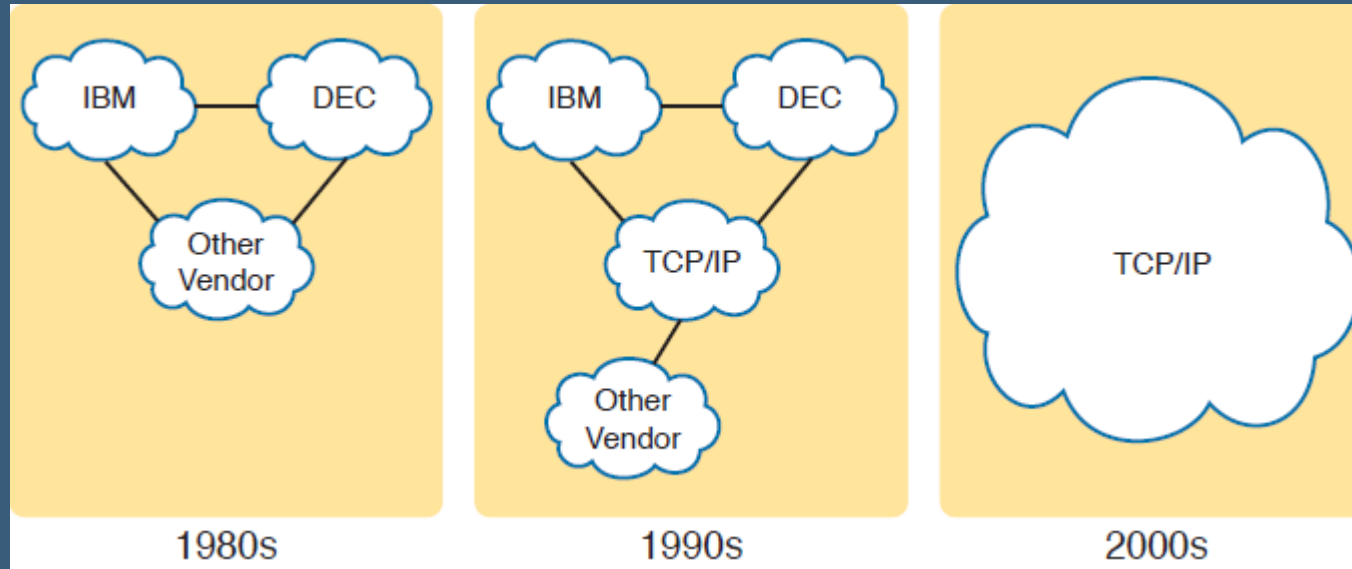
# THANK YOU

For any questions feel free
to contact me by mail
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