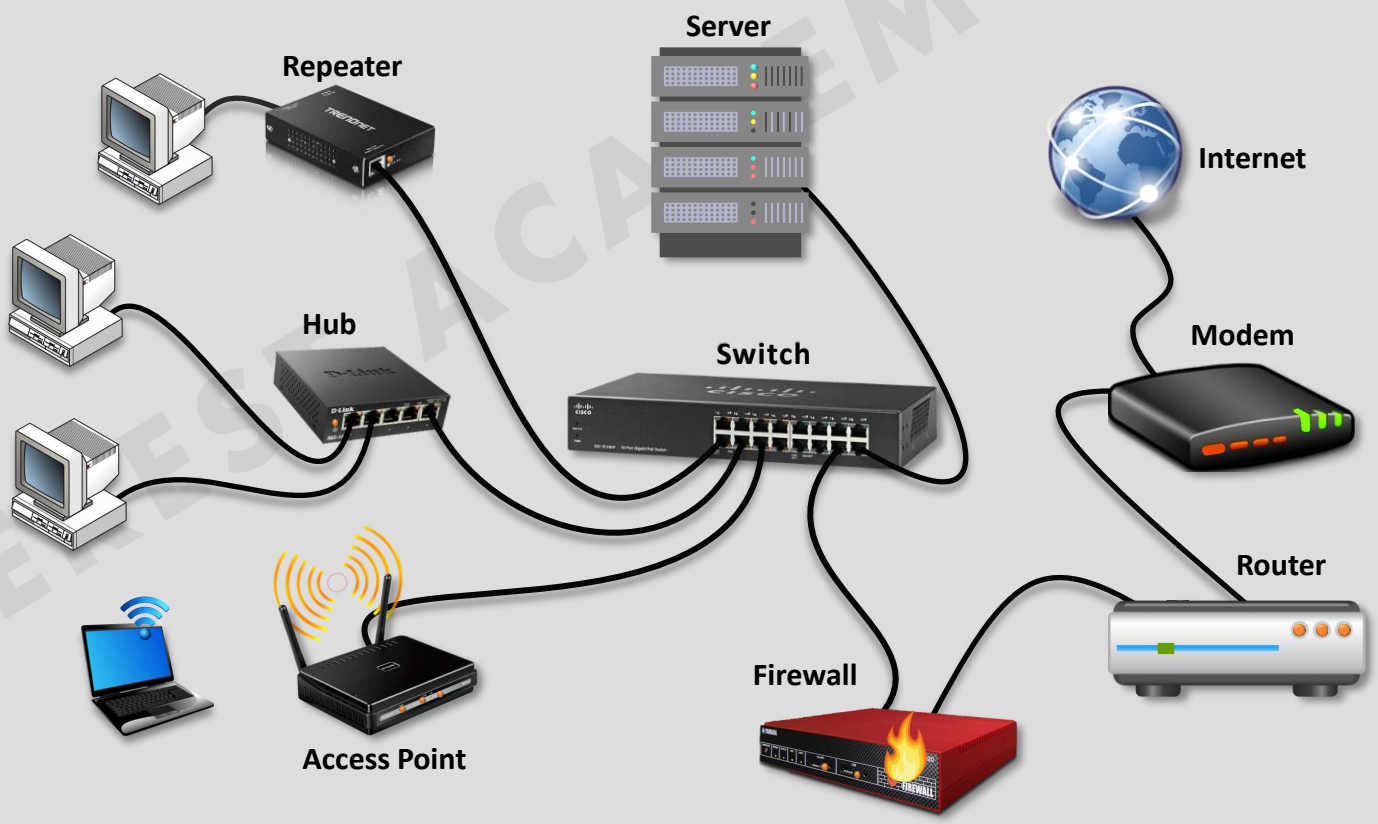
Network Devices

- **Network Devices** are electronic devices which are required for communication and interaction between devices on a computer network.

- Computer
- Server
- Repeater
- Modem
- Ethernet Hub
- Ethernet Switch
- Router
- Access Point
- Firewall

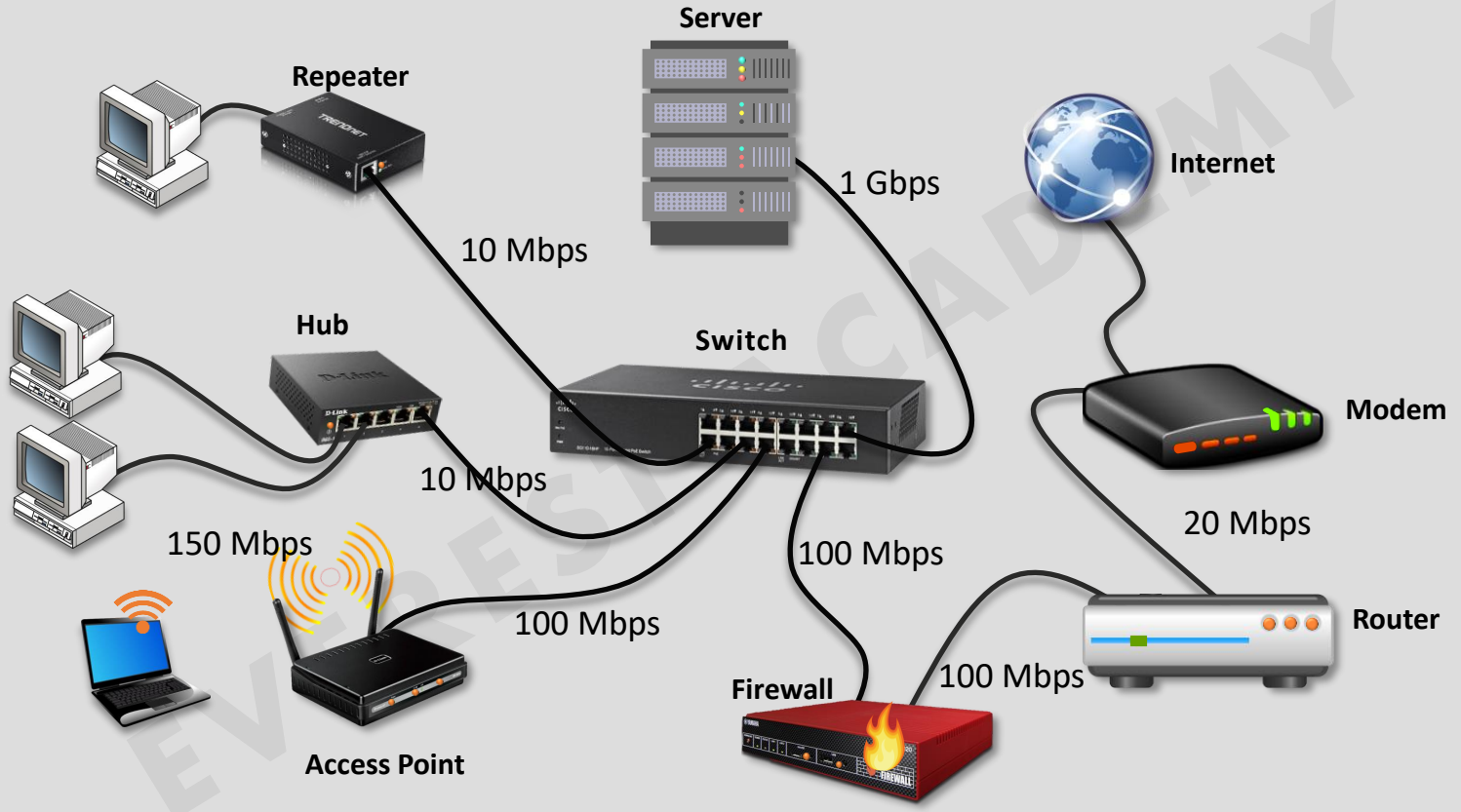


Data-Transfer Rate (DTR)

- **Data-transfer rate** is the average number of bits per second passing through a communication link between two network devices.

Bit Rates	
Bit (b) per second	1 bit/s or 1 bps
kilobit (K) per second	1 Kbit/s or 1 Kbps = 1000 bps
Megabit (M) per second	1 Mbit/s or 1 Mbps = 1000 Kbps
Gigabit (G) per second	1 Gbit/s or 1 Gbps = 1000 Mbps
Terabit (T) per second	1 Tbit/s or 1 Tbps = 1000 Gbps

Data-Transfer Rate (DTR)



Computer (Client)

- **A computer** is a system that runs a user-friendly operating system and desktop applications to perform a task.

- Operating Systems (OS)
  - **Windows 10**
  - **macOS**
  - **Linux**
- Desktop Applications
  - **MS Office**
  - **Photoshop**
  - **VLC**

Server

- **A Server** is dedicated computer for a specific purpose, It provide services and functionality to other computers.
- **A server** has a motherboard that supports many processors and uses special RAMs called ECC rams (Error correcting ram) for error checking and correction.
- **A Server** has redundant power supply contains two (or more) power supply units inside it.

Operating Systems (OS)

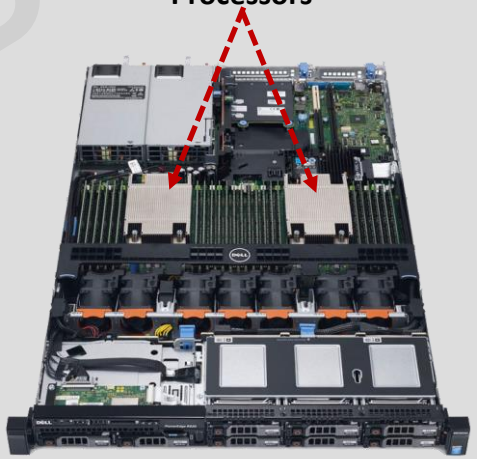
- **Windows Server 2019**
- **macOS Server**
- **Linux Server**

Services

- **Web service**
- **File Service**
- **Mail Service**
- **Database Service**

Tower Server

2 Powerful Processors

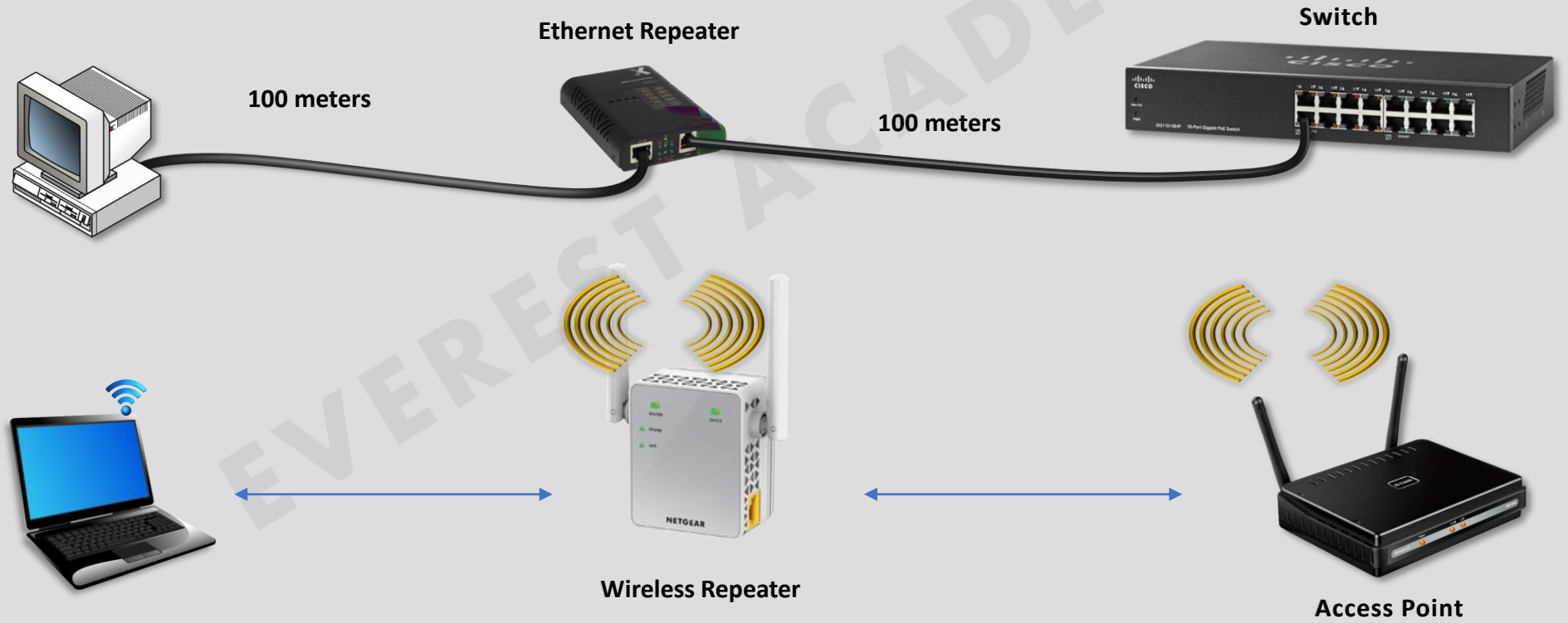


Rack Server

Hot Swappable Hard Drive

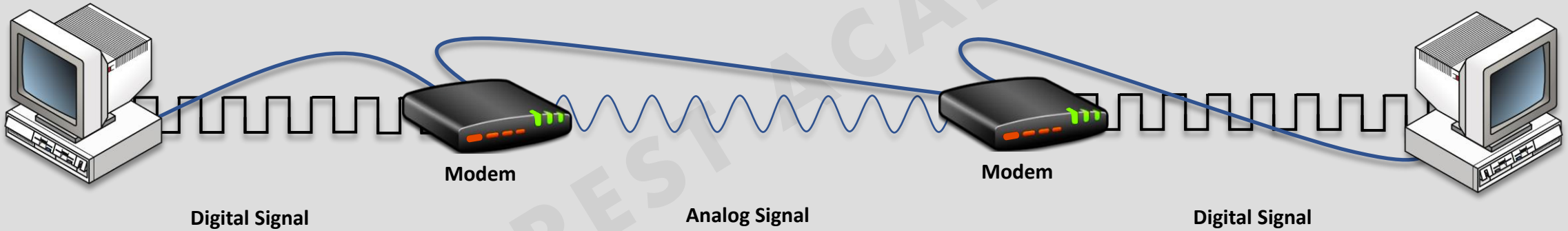
Repeater (deprecated)

- **Repeater** is an electronic device that receives a signal and retransmits it at a higher level or higher power, so that the signal can cover longer distances



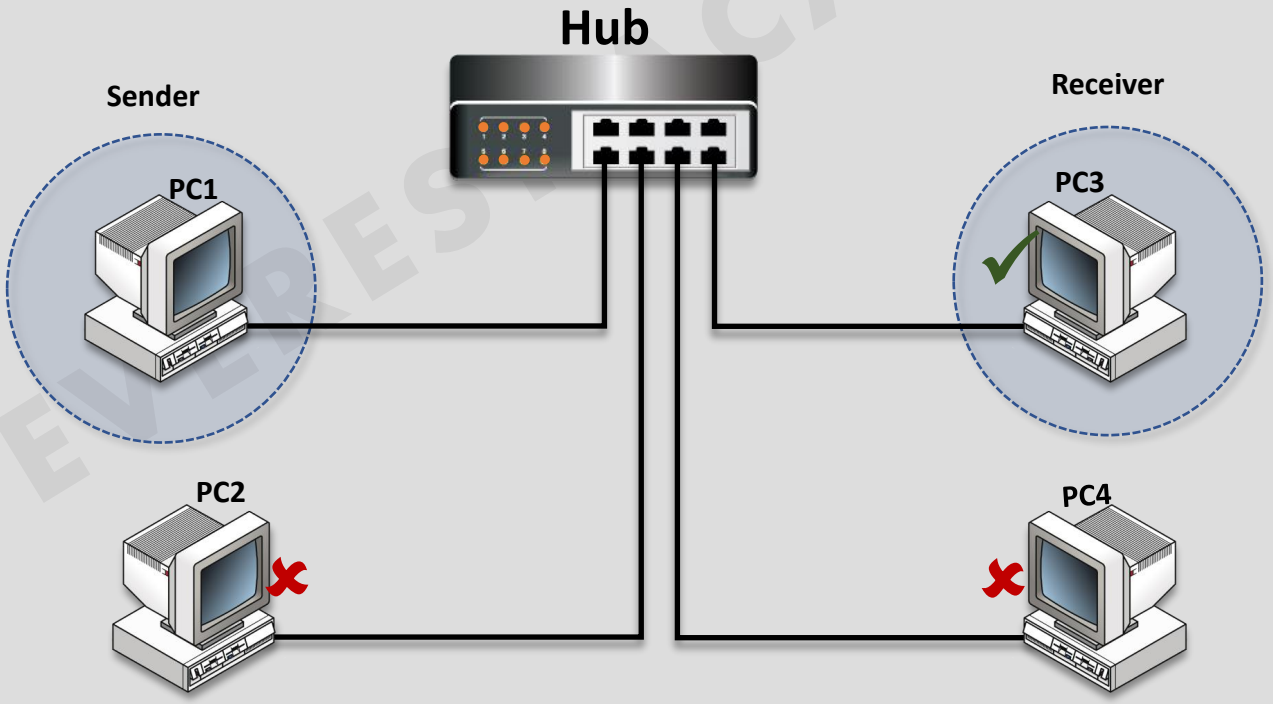
Modem

- **Modem** is short for “Modulator-Demodulator “ It converts or "modulates" an analog signal from a telephone or cable wire to digital data (1s and 0s) that a computer can recognize.



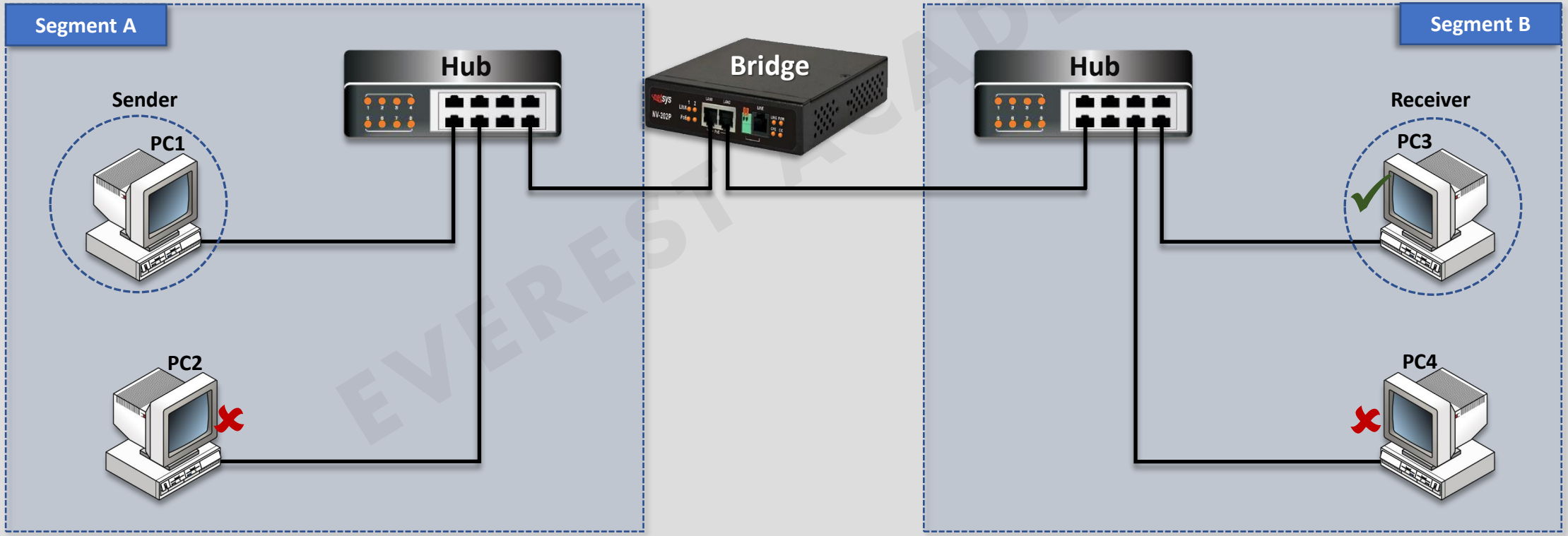
Ethernet Hub

- **A Hub** is a network hardware device for connecting multiple Ethernet devices together and making them act as a single network segment.
- **If a hub** receives a signal at any port it resend it out of every port except that port.
- **A Hub** works at the physical layer (layer 1).
- **A Hub** has been replaced by network switches .
- **A Hub** transfers data at a maximum of 10 Mb/sec.
- **A Hub** has multiple ports.

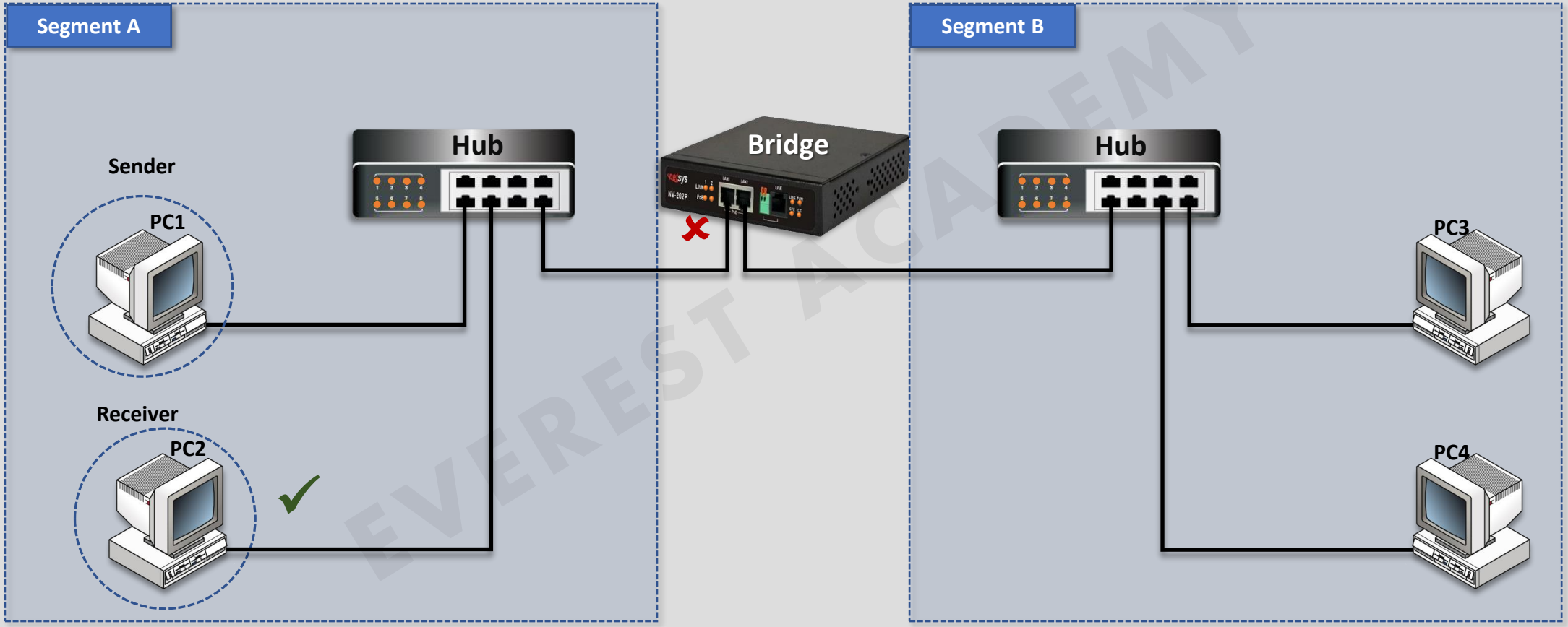


Ethernet Bridge

- **A network bridge** is a device that creates a single aggregate network from two network segments.
- **A bridge** works at the physical layer (layer 1) and the data link layer (layer 2).
- **A bridge** forwards the frame passed on the destination MAC address.

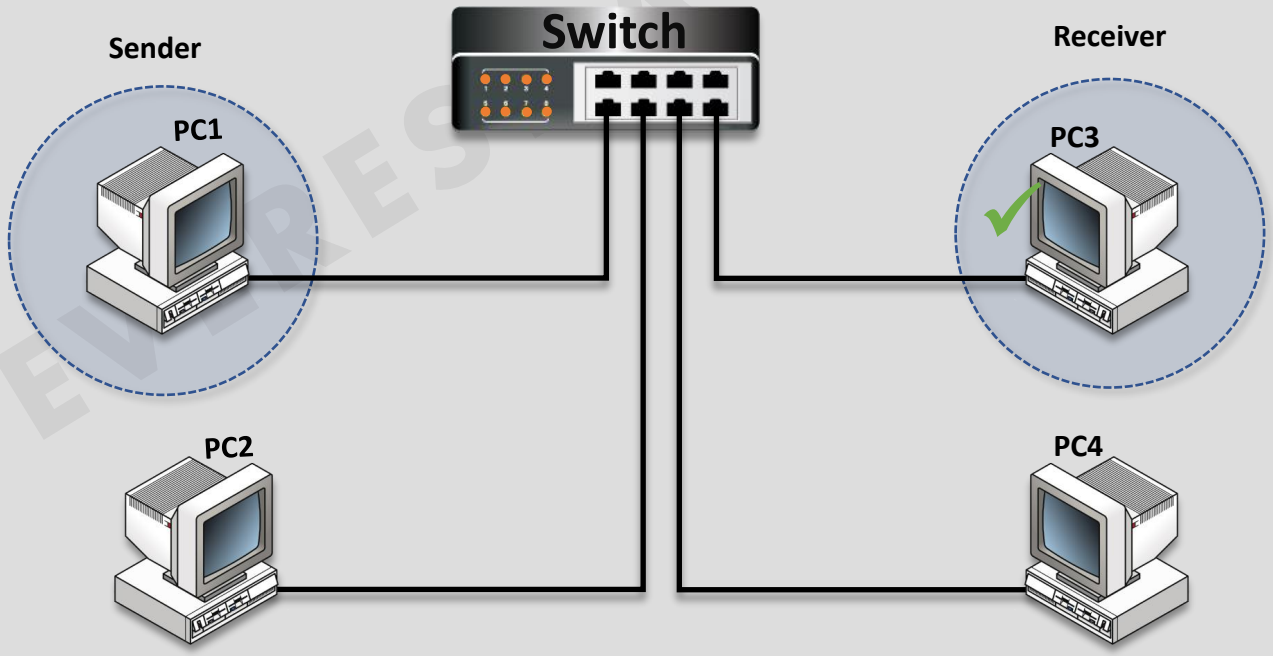


Ethernet Bridge



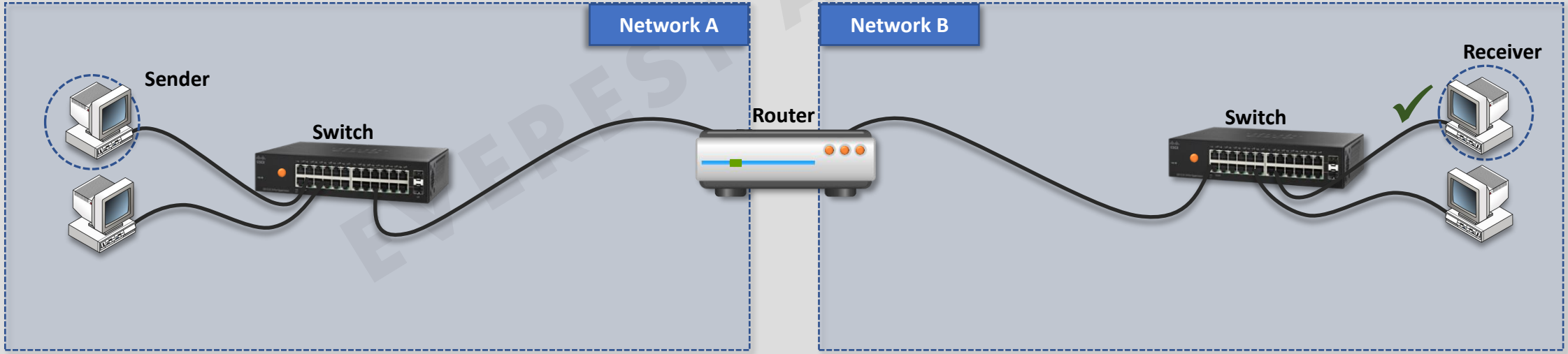
Ethernet Switch

- **Ethernet Switch** is a network hardware device for connecting multiple devices together.
- **Each port** of the ethernet switch is considered as a segment.
- **A switch** forwards the frame passed on the destination MAC address.
- **A switch** works at the physical layer (layer 1) and the data link layer (layer 2).
- **A switch** transfers data at a maximum of 10 Gb/sec.



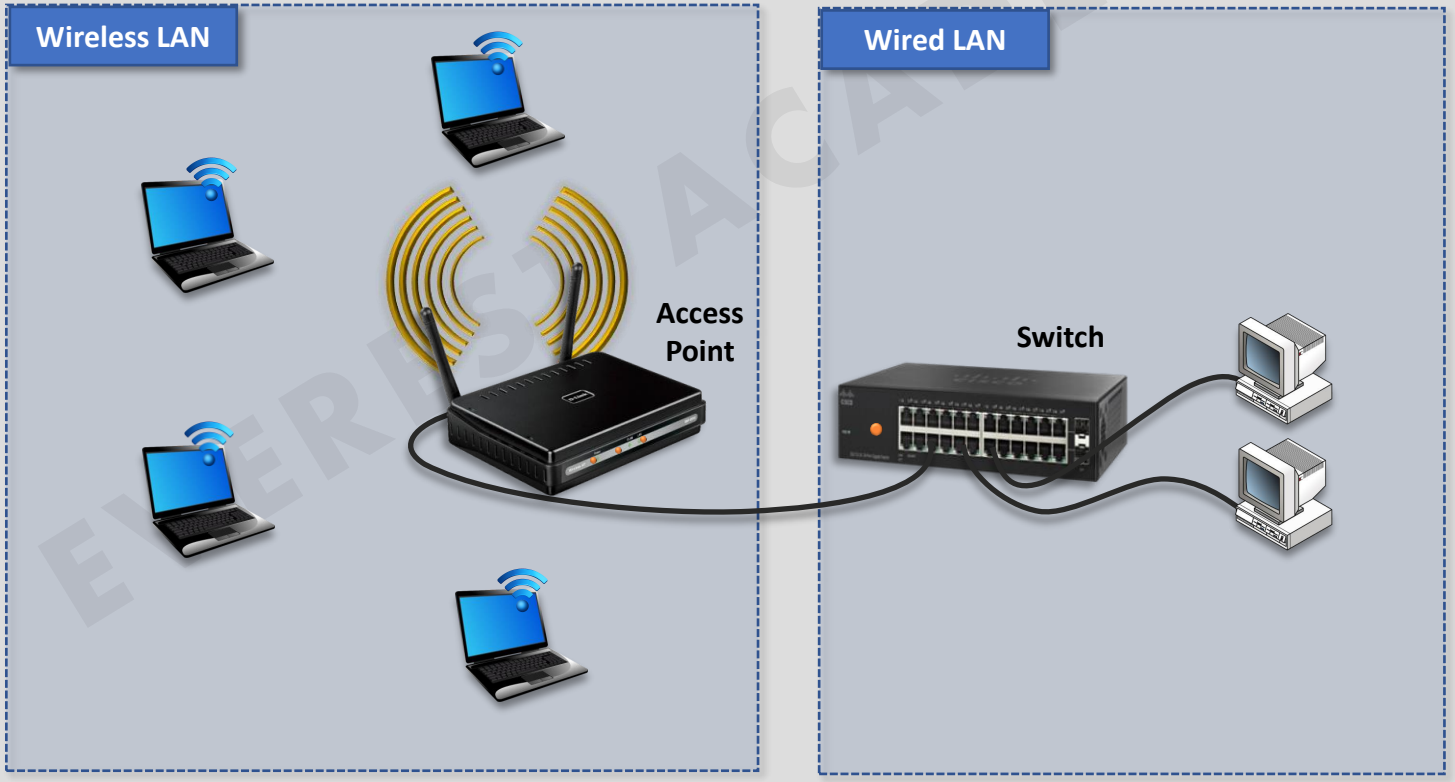
Router

- **A router** is a networking device that forwards data packets between different networks.
- **Each port** of the router is considered as a network.
- **A router** forwards the packet passed on the destination IP address.
- **A router** works at the physical layer (Layer 1), the data link layer (Layer 2) and the network layer (Layer 3).



Access Point

- **A access point (AP)** is a networking hardware device that allows wireless devices to connect together and communicate with a wired computer network .



Firewall

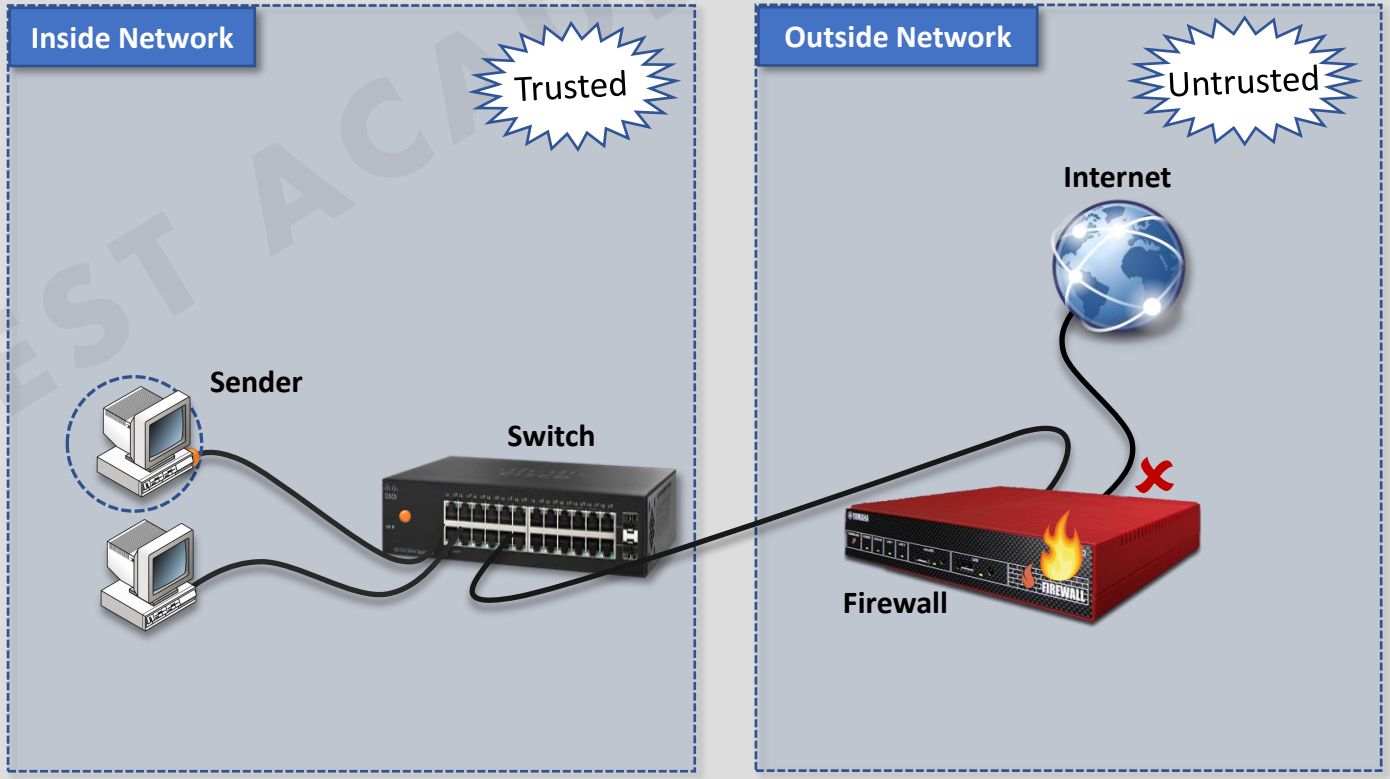
- **A firewall** is a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules.

- There are two types of firewalls :

1. Network-based Firewalls (Hardware).
2. Host-based Firewall (Software).

- A firewall filters data at :

1. Application layer .
2. Transport Layer.
3. Network Layer.



Network Interface Card (NIC)

- **Network Interface Card (NIC)** is a computer hardware component that connects a computer to a computer network.

Also known as :

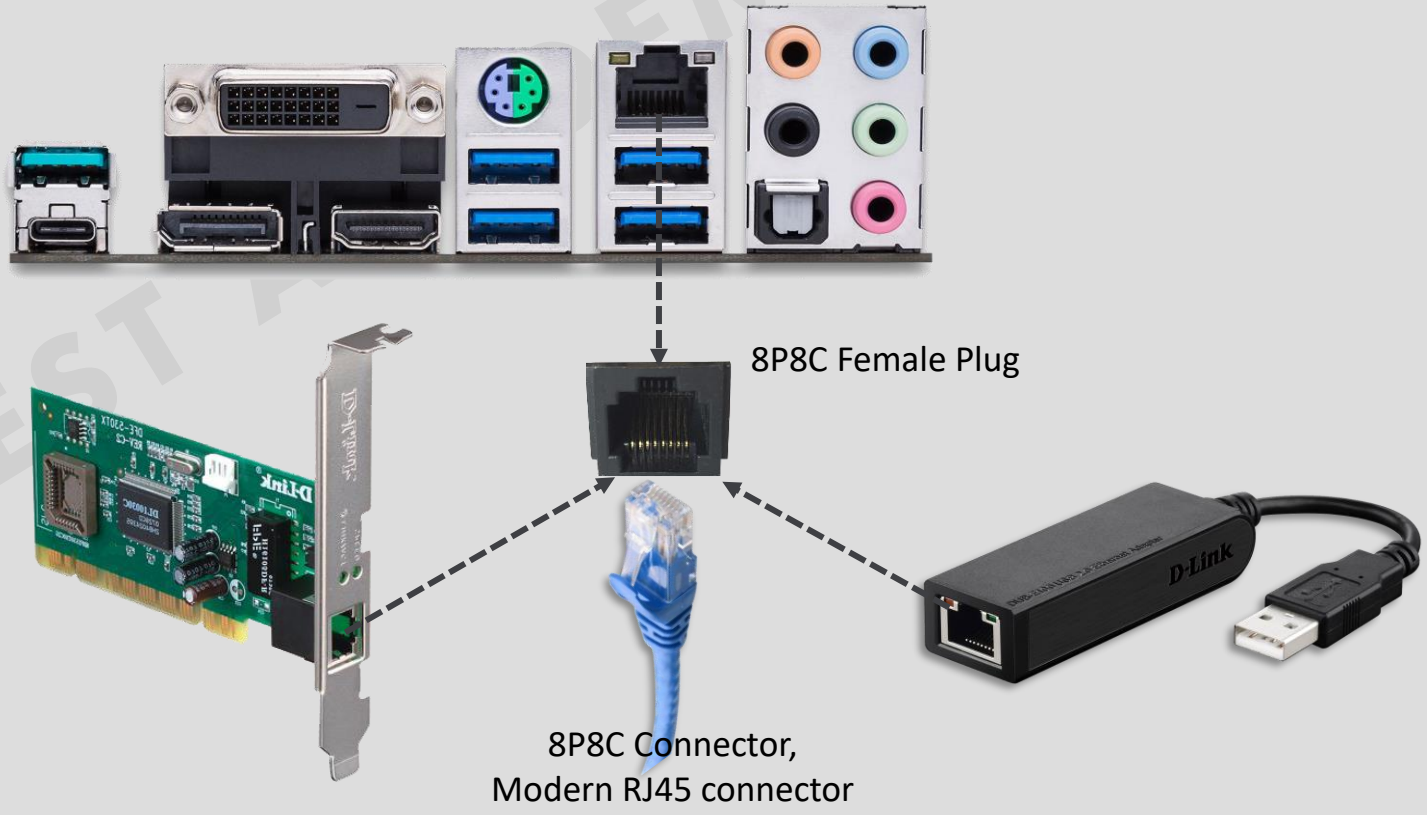
1. Network Interface Controller.
2. Network Adapter.
3. LAN Adapter .
4. Physical Network Interface .

There are many types of NIC :

1. Built-in to Motherboard.
2. PCI Adapter.
3. USB Adapter.

NIC Speed :

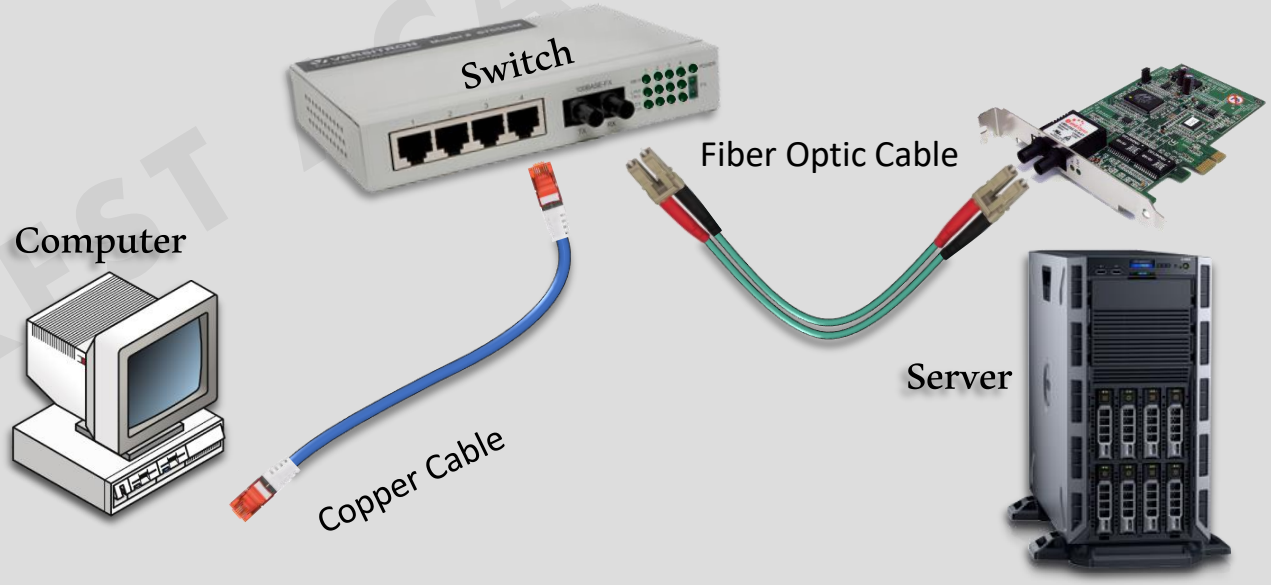
10/100/1000 Mbps



Fiber Network Interface Card

- **Fiber Network Interface Card** is connected to a fiber optic cable and used to connect servers with switches.

- Also known as :
  1. Fiber LAN card.
  2. Fiber Server Adapter.
- Fiber Network Interface Card Speed :
  1. 1000 Mbps (1 Gbps)
  2. 10 Gbps.
  3. 25 Gbps.
  4. 40 Gbps.



Wireless Network Interface Controller (WNIC)

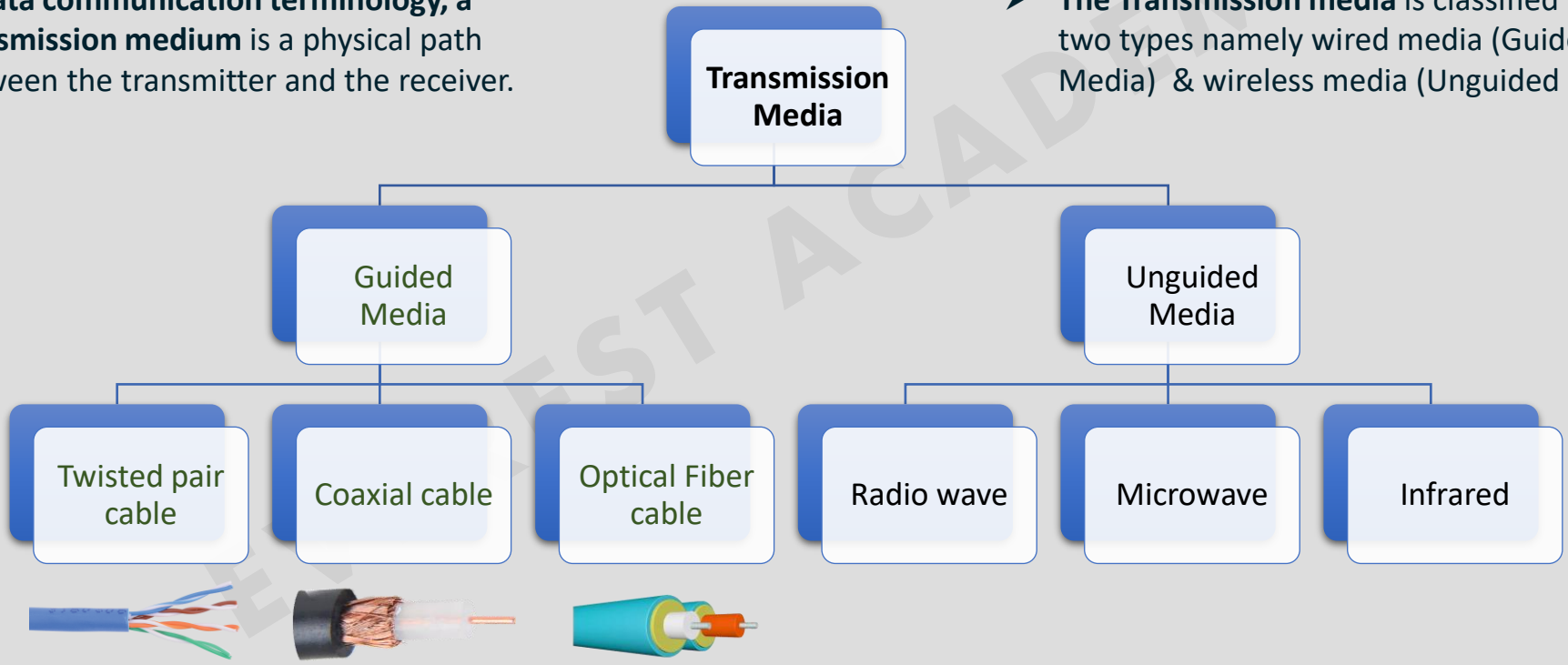
- **A wireless network interface controller (WNIC)** is a network interface controller which connects to a wireless radio-based computer network,

Data Transmission Media / Medium

- **A transmission medium** is the channel through which data is sent from one place to another.

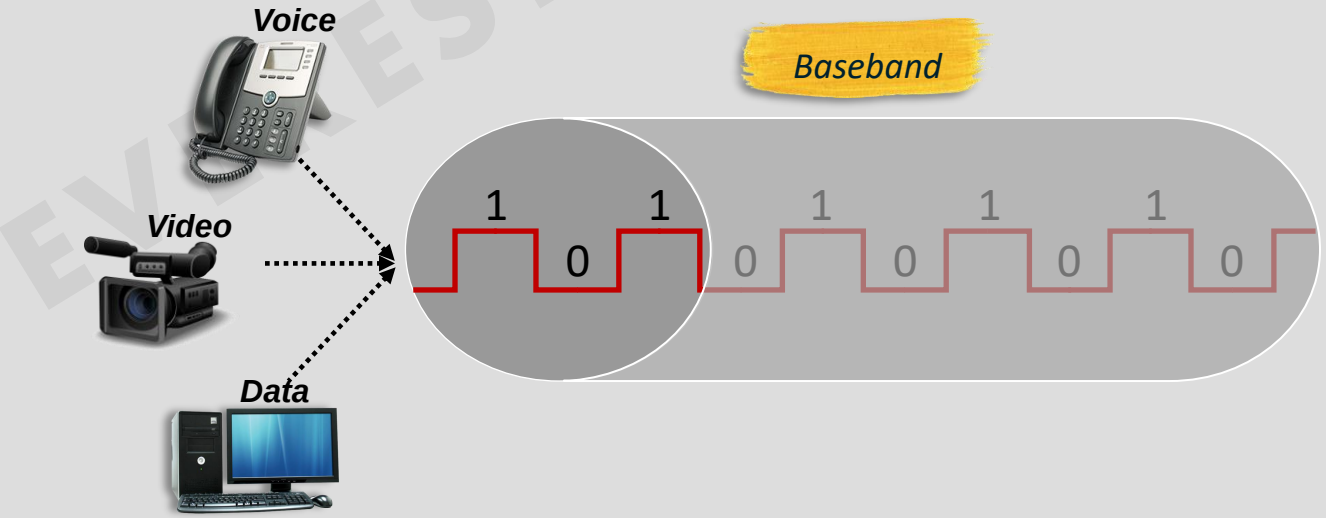
- **In data communication terminology, a transmission medium** is a physical path between the transmitter and the receiver.

- **The Transmission media** is classified into two types namely wired media (Guided Media) & wireless media (Unguided Media).



Baseband and Broadband

- **Baseband and Broadband** describe how data is transmitted between two nodes
- **Broadband technology** transmits multiple analog data signals simultaneously at the same time.
- **Baseband technology** transmits a single digital data signal at a time.
- **Baseband technology** uses digital signals. It sends binary values directly as pulses of different voltage levels. It can be regenerated using repeaters.
- **Baseband Technology** can send and receive data simultaneously using two separate electric circuits together.
- **Baseband technology** is mainly used in Ethernet networks using three cable media types; coaxial, twisted-pair and fiber-optic**.**
- **Baseband technology** uses Time Division Multiplexing (TDM) to combine the signals of multiple computers and send it simultaneously.



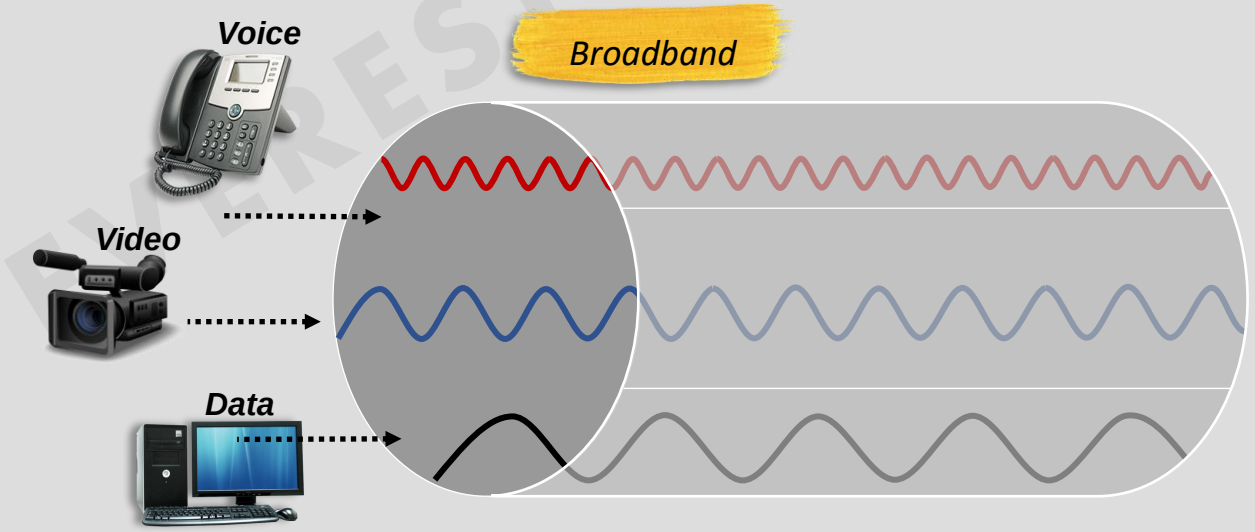
Baseband and Broadband

- **Broadband technology** uses analog signals in data transmission and a special analog wave known as the carrier wave. This technology mixes **voice**, **video** and **data** into the carrier wave and sends the carrier wave across the wire. It supports only unidirectional communication.

- **Broadband technology** can transmit data of multiple nodes simultaneously using Frequency Division Multiplexing (FDM).

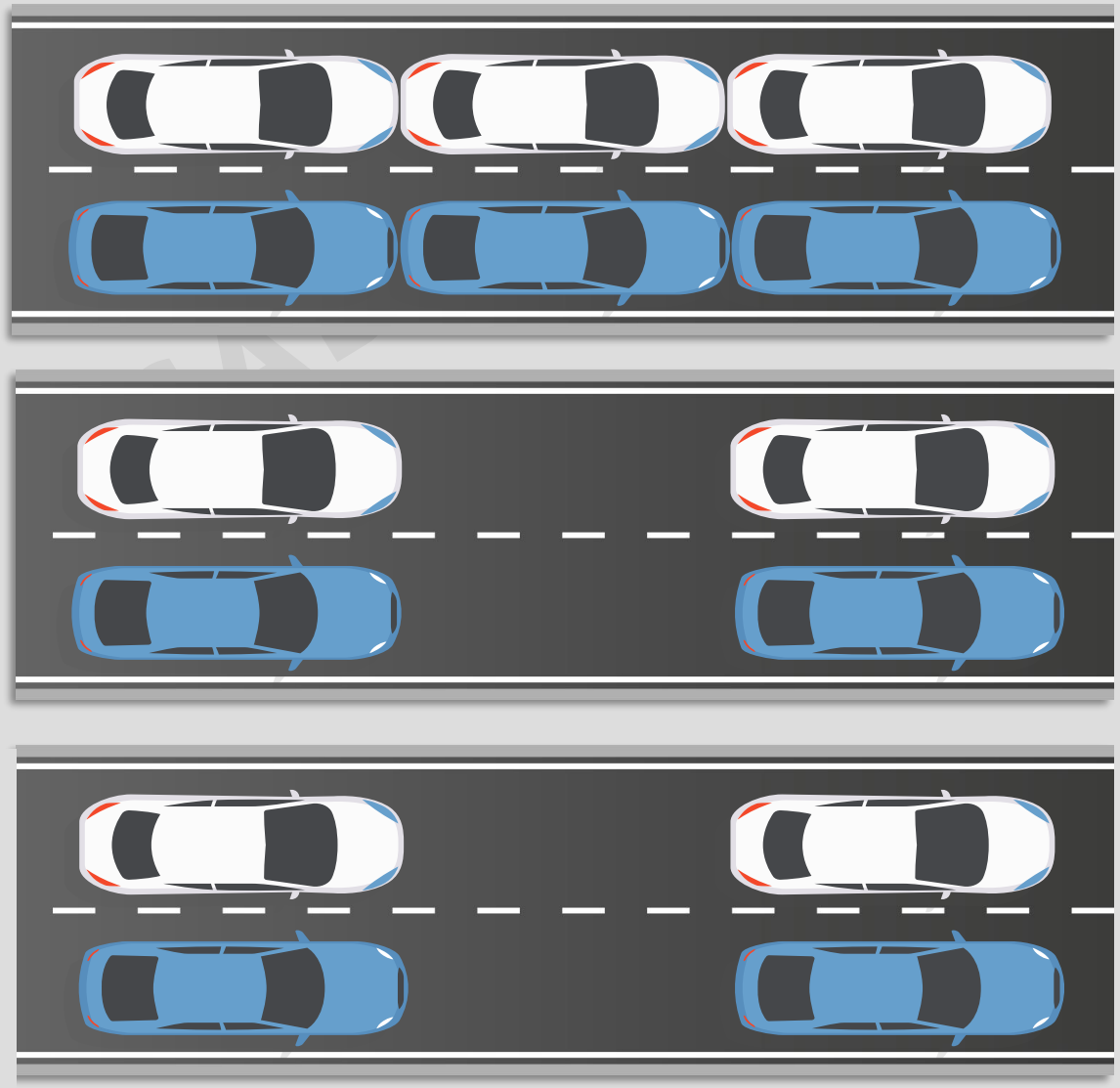
- **Broadband technology** uses amplifiers to regenerate analog signals in order to travel longer distances.

- **Broadband technology** is used in an environment that transmits voice, video, and data simultaneously. For example, Cable TV Networks, Radio stations, and Telephone companies (DSL Service Provider). Usually radio waves, coaxial, fiber-optic cables are used for broadband transmission.



Bandwidth, Throughput and Speed

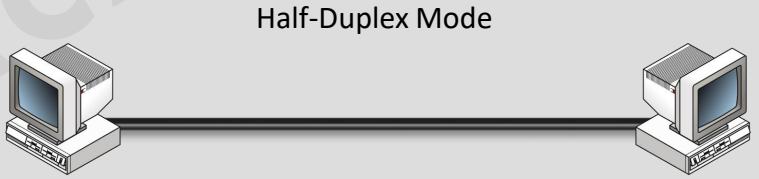
- **Bandwidth** is the maximum amount of the data that can be passed from one point to another within a given time (Unit : Bits/sec).
- **Throughput** is the actual amount of the data that is able to move through the media within a given time.
- **Speed** is the rate of data transfer across the transmission path within a given time.
- **Bandwidth** is a measurement of how much data can be transferred at a time while speed is a measurement of how fast things are done.



Transmission Modes

- **Simplex mode** : the communication is unidirectional, as on a one-way street. Only one of the two devices on the media can transmit, the other can only receive..

- **Half-duplex mode** : each station can both transmit and receive, but not at the same time. When one device is sending, the other can only receive, and vice versa.



- **Full-duplex mode :** both stations can transmit and receive simultaneously by using two physically separate transmission paths or by dividing the capacity between signals travelling in both directions.