BCA 312 Computer Networks

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Unit – I Principals of Data Communication

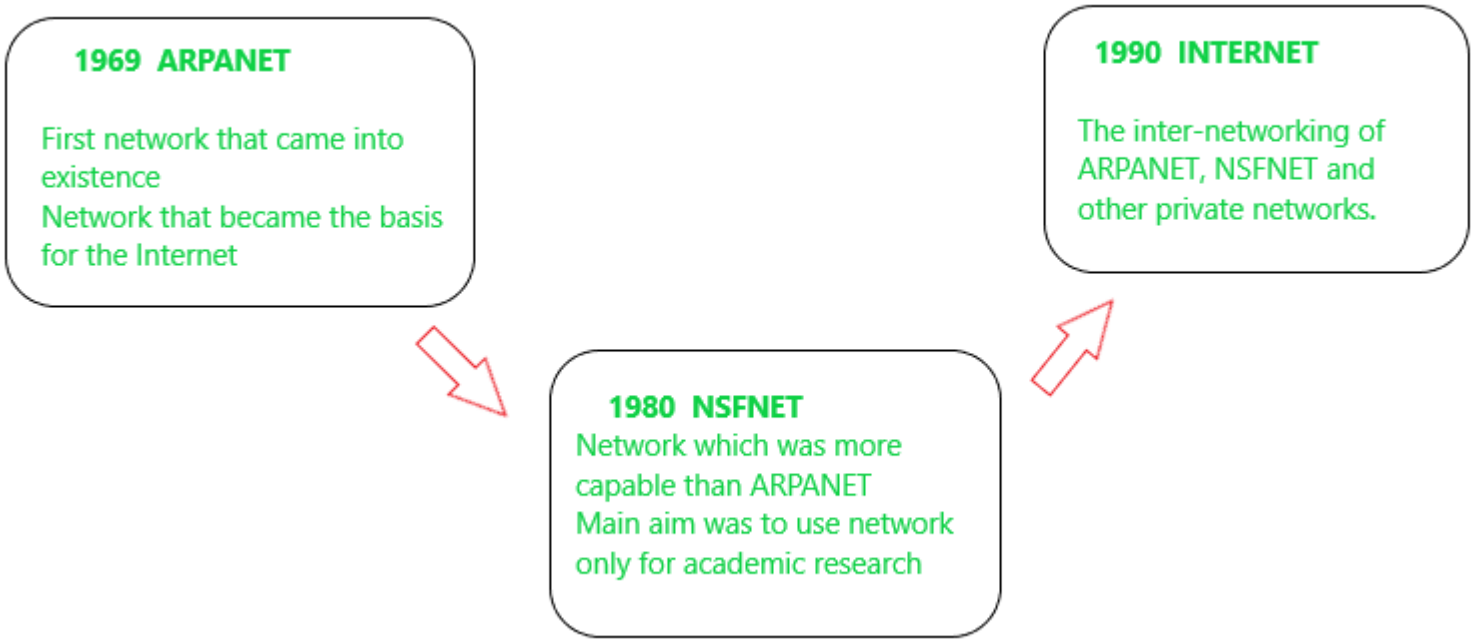
- Evolution of Computer Networks
- General features of a communication system
- Tasks of communication system

ARPANET (Advanced Research Project Agency Network):

ARPANET was the network that became the basis for the Internet. It was the first network that came into existence in 1969, which was designed and named by the Advanced Research Projects Agency (ARPA) and US Department of Defence (DoD). It was where a bunch of PCs were associated at various colleges and US DoD for sharing of information and messages and playing long separation diversions and associating with individuals to share their perspectives.

NSFNET (National Science Federation Network):

In mid 80's another federal agency, NSFNET (National Science Federation Network) created a new network which was more capable than ARPANET and became the first backbone infrastructure for the commercial public Internet. Its main aim was to use network only for academic research and not for any kind of private business activity. Later, many privately owned businesses with their very own private systems joined with ARPANET and NSFNET to make more capable and wide network, the Internet.


1969 ARPANET
First network that came into existence
Network that became the basis for the Internet
1980 NSFNET
Network which was more capable than ARPANET
Main aim was to use network only for academic research
1990 INTERNET
The inter-networking of ARPANET, NSFNET and other private networks.

Internet

In the Internet, which is a network of networks, came into existence. The internet has evolved from ARPANET. The internet is a globally connected network system that utilizes TCP/IP to transmit information. It allows computers of different types to exchange information and is known as internet.

Features of Communication System

- **Communication speed**.
- File sharing.
- Back up and Roll back is easy.
- **Software** and **Hardware** sharing.
- **Security**.
- Scalability.
- **Reliability**.

Tasks of Communication System

The Internet is the financially communications method on the planet, in which the following services are instantly available:

- Email
- Web-enabled audio/video conferencing services
- Online movies and gaming
- Data transfer/file-sharing, often through File Transfer Protocol (FTP)
- Instant messaging
- Internet forums
- Social networking
- Online shopping
- Financial services

Thank you

Transmission Modes in Computer Networks

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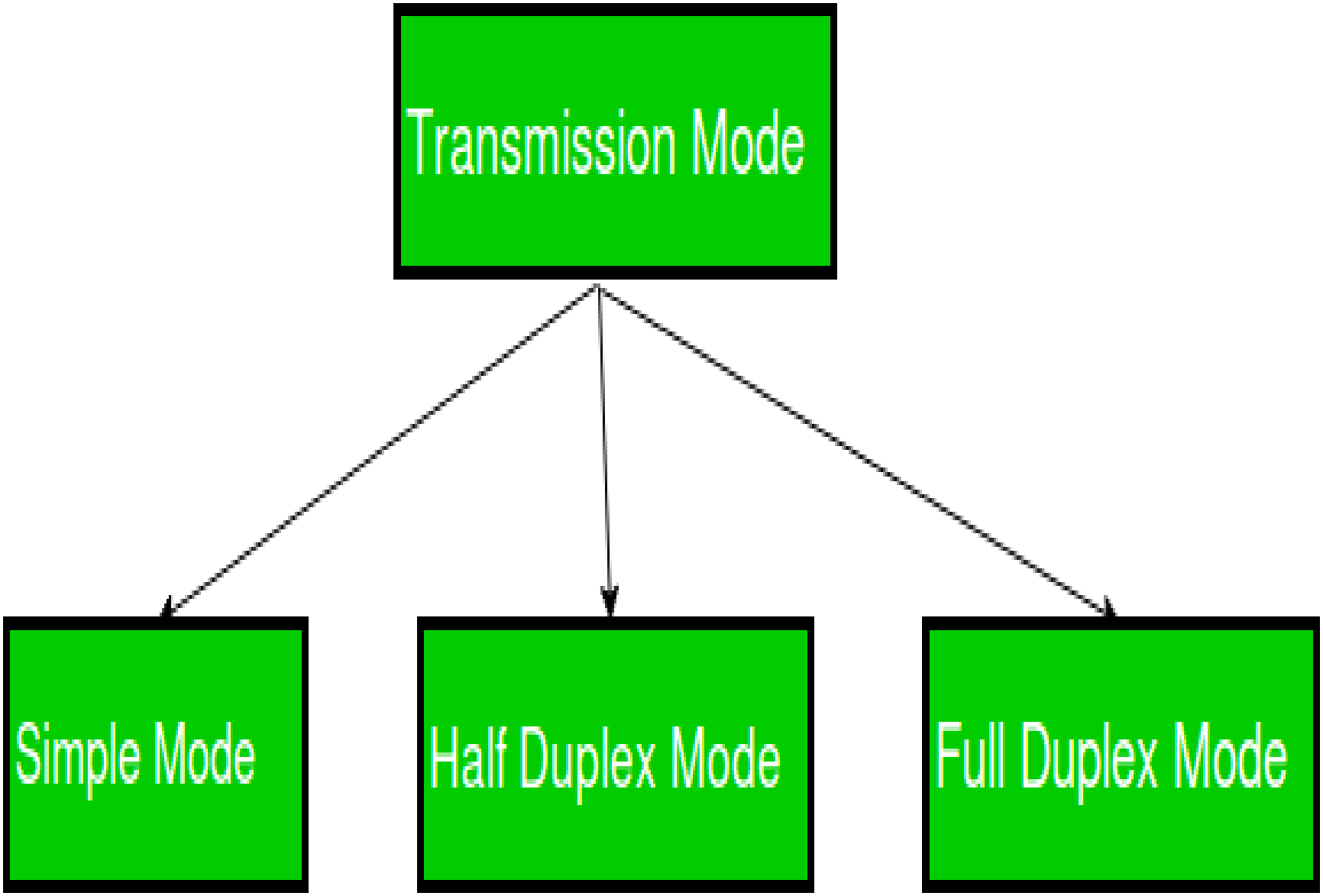
Transmission mode means transferring of data between two devices. It is also known as communication mode. Buses and networks are designed to allow communication to occur between individual devices that are interconnected. There are three types of transmission mode:-

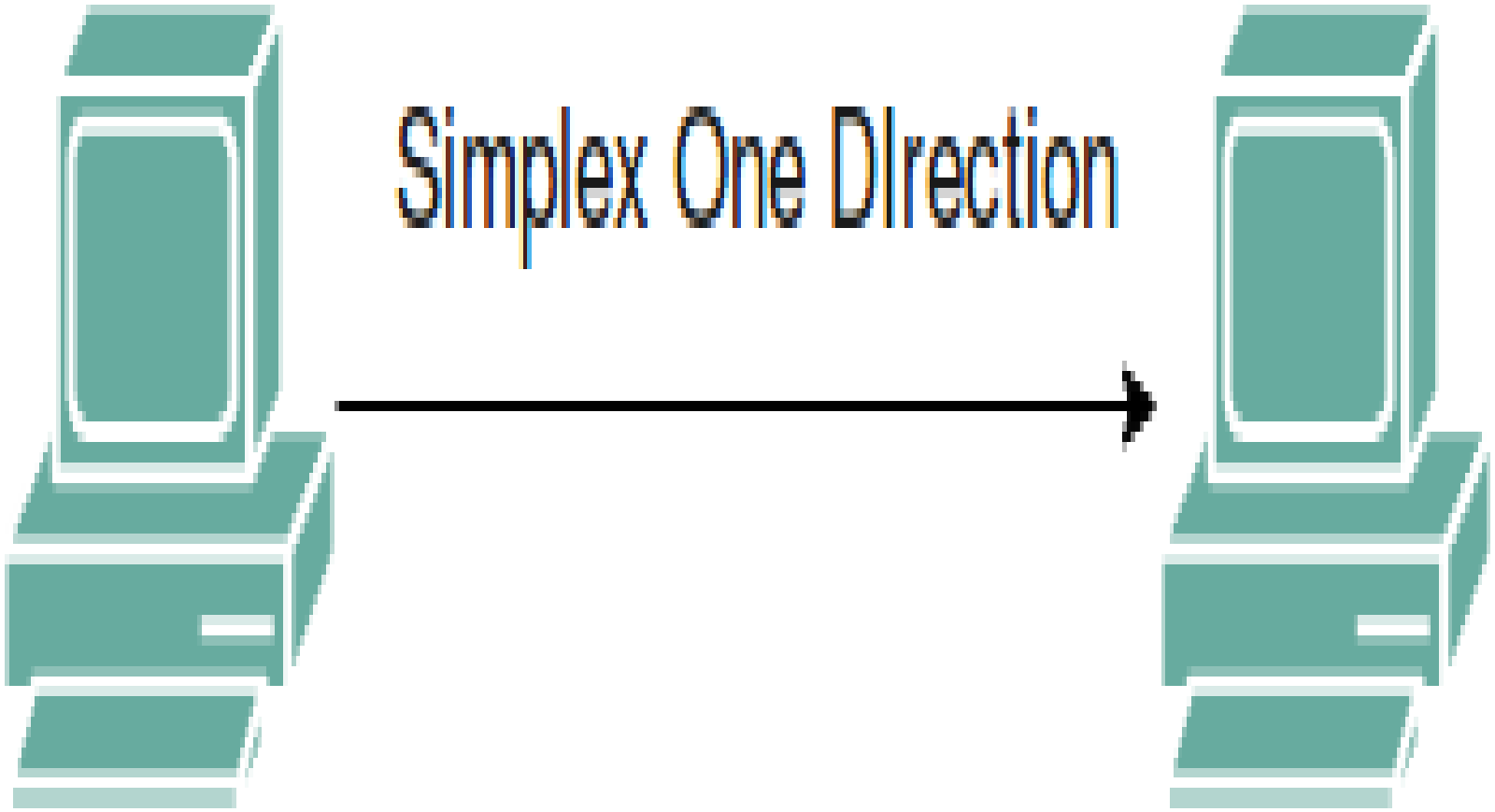
- Simplex Mode
- Half-Duplex Mode
- Full-Duplex Mode


Transmission Mode
Simple Mode
Half Duplex Mode
Full Duplex Mode

Simplex Mode

In Simplex mode, the communication is unidirectional, as on a one-way street. Only one of the two devices on a link can transmit, the other can only receive. The simplex mode can use the entire capacity of the channel to send data in one direction.

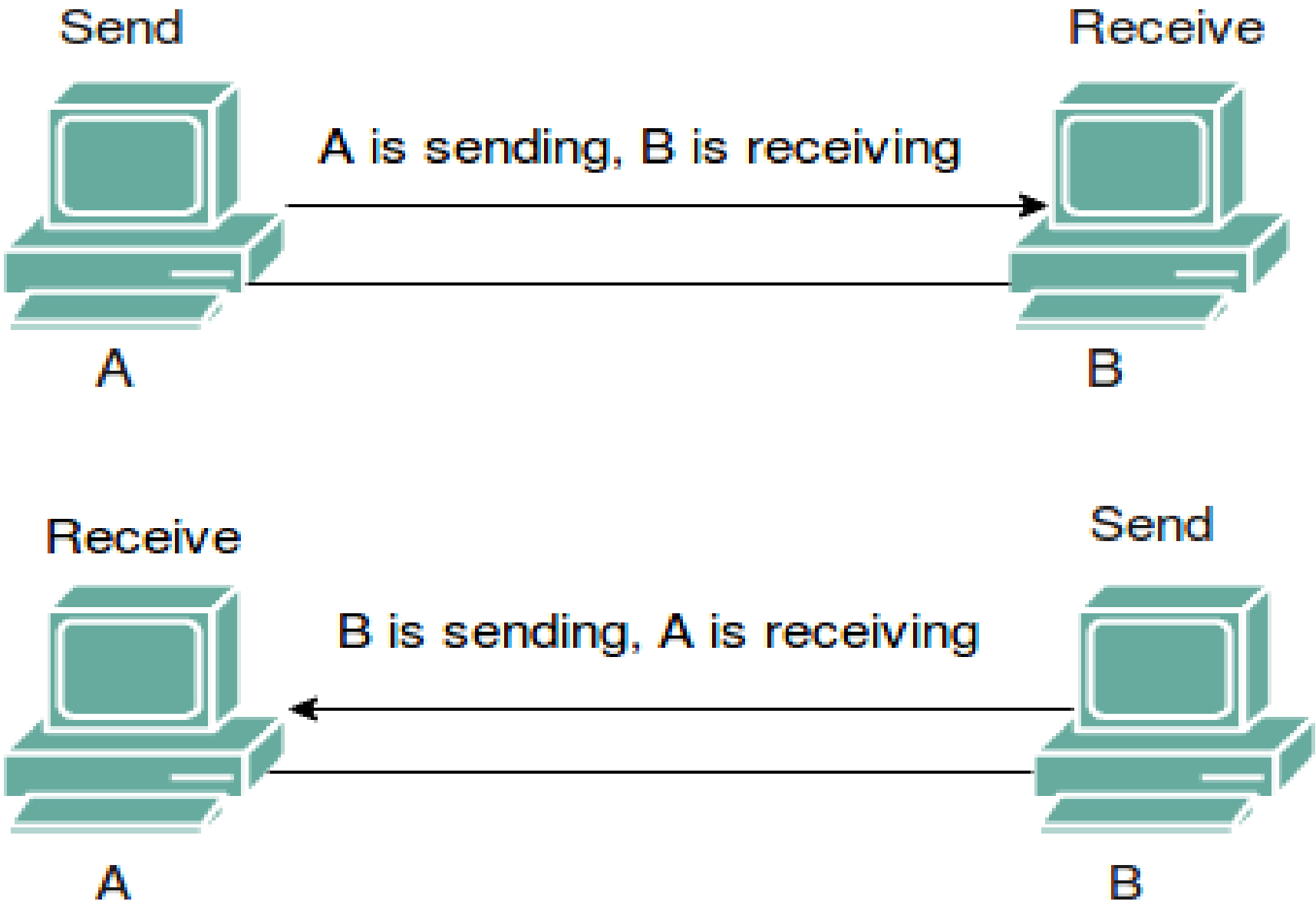
Example: Keyboard and traditional monitors. The keyboard can only introduce input, the monitor can only give the output.


Simplex One DIrection

Half-Duplex Mode

In 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. The half-duplex mode is used in cases where there is no need for communication in both direction at the same time. The entire capacity of the channel can be utilized for each direction.

Example: Walkie- talkie in which message is sent one at a time and messages are sent in both the directions.


Send
Receive
A is sending, B is receiving
A
B
Receive
Send
B is sending, A is receiving
A
B

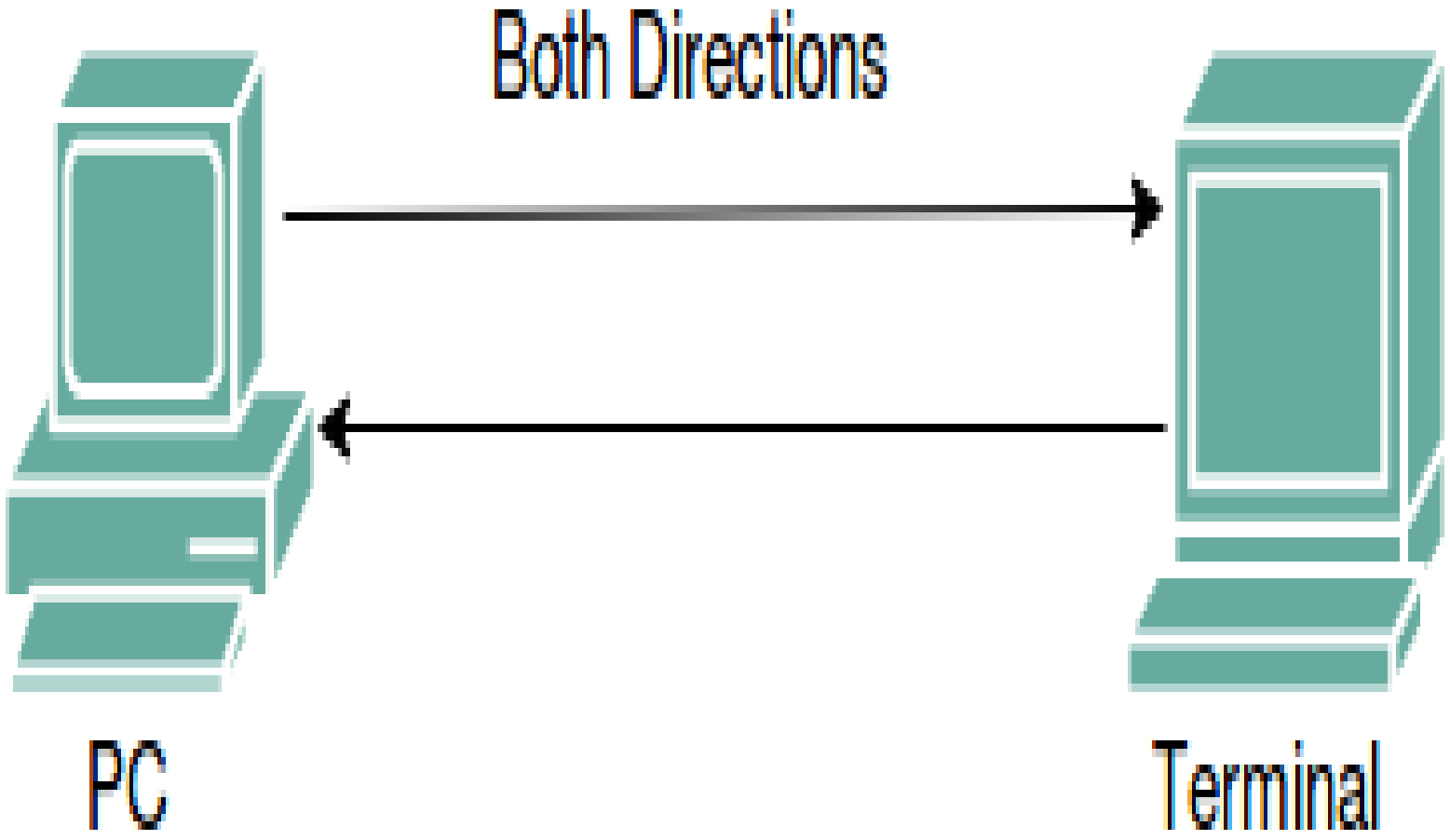
Full-Duplex Mode

In full-duplex mode, both stations can transmit and receive simultaneously. In full_duplex mode, signals going in one direction share the capacity of the link with signals going in other direction, this sharing can occur in two ways:

- Either the link must contain two physically separate transmission paths, one for sending and other for receiving.
- Or the capacity is divided between signals travelling in both directions.

Full-duplex mode is used when communication in both direction is required all the time. The capacity of the channel, however must be divided between the two directions.

Example: Telephone Network in which there is communication between two persons by a telephone line, through which both can talk and listen at the same time.


Both Directions
PC
Terminal

Thank You

Types of Networks

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NETWORK TYPES

- LAN (Local Area Network)
- MAN (Metropolitan Area Network)
- WAN (Wide Area Network)
- PAN (Personal Area Network)
- SAN (System/Storage Area Network)
- CAN (Campus Area Network)
- VPN (Virtual Private Network)
- EPN (Enterprise Private Network)

LAN (Local Area Network)

LANs are the most frequently discussed networks, one of the most common, one of the most original and one of the simplest types of networks. LANs connect groups of computers and low-voltage devices together across short distances (within a building or between a group of two or three buildings in close proximity to each other) to share information and resources. Enterprises typically manage and maintain LANs.

Using routers, LANs can connect to wide area networks (WANs) to rapidly and safely transfer data.

MAN (Metropolitan Area Network)

These types of networks are larger than LANs but smaller than WANs – and incorporate elements from both types of networks. MANs span an entire geographic area (typically a town or city, but sometimes a campus). Ownership and maintenance is handled by either a single person or company (a local council, a large company, etc.).

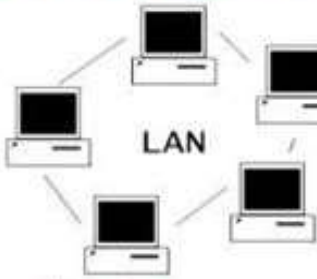
WAN (Wide Area Network)

Slightly more complex than a LAN, a WAN connects computers together across longer physical distances. This allows computers and low-voltage devices to be remotely connected to each other over one large network to communicate even when they're miles apart.

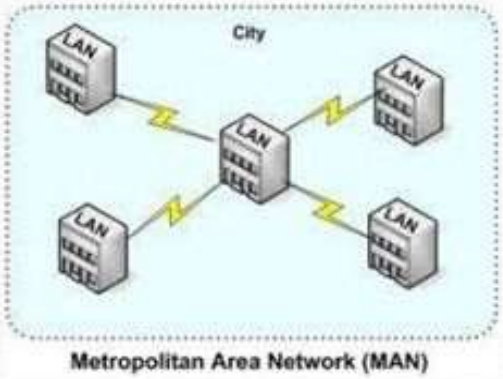
The Internet is the most basic example of a WAN, connecting all computers together around the world. Because of a WAN's vast reach, it is typically owned and maintained by multiple administrators or the public.

There are different types of network:

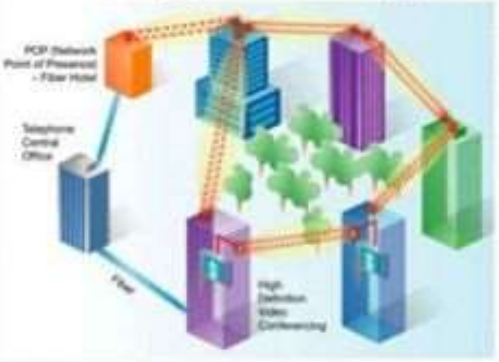
- LAN(Local Area Networking)
- WLAN(Wireless Local Area Networks)
- WAN(Wide Area Networks)
- MAN(Metropolitan Area Networks)
- CAN(Campus Area Networks)



WAN



MAN



CAN

CAN (Campus Area Network)

Larger than LANs, but smaller than metropolitan area networks (MANs, explained below), these types of networks are typically seen in universities, large K-12 school districts or small businesses. They can be spread across several buildings that are fairly close to each other so users can share resources.

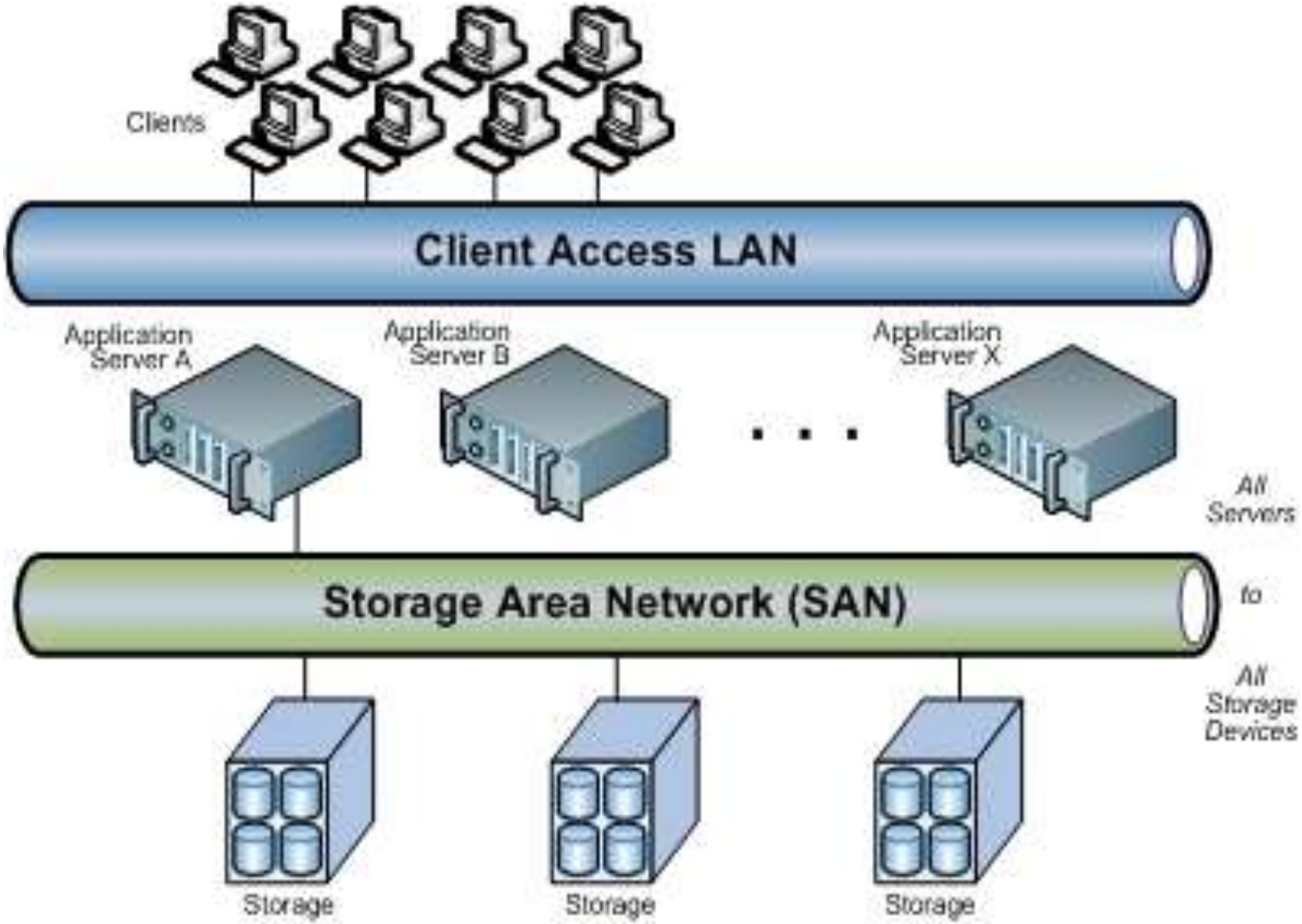
PAN (Personal Area Network)

The smallest and most basic type of network, a PAN is made up of a wireless modem, a computer or two, phones, printers, tablets, etc., and revolves around one person in one building. These types of networks are typically found in small offices or residences, and are managed by one person or organization from a single device.


Printer
Desktop
Laptop
PDA
Mobile

SAN (Storage Area Network)

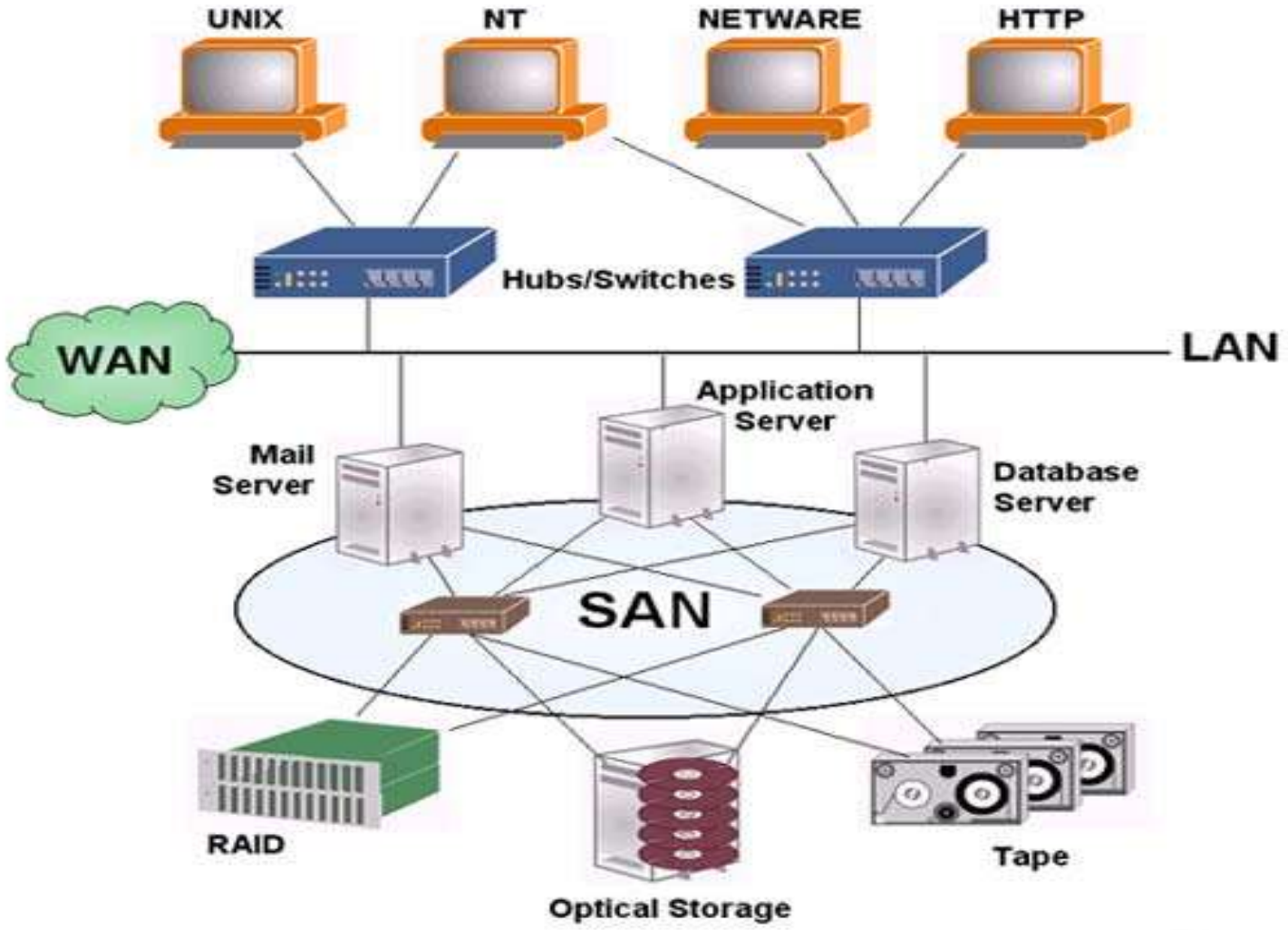
As a dedicated high-speed network that connects shared pools of storage devices to several servers, these types of networks don't rely on a LAN or WAN. Instead, they move storage resources away from the network and place them into their own high-performance network. SANs can be accessed in the same fashion as a drive attached to a server. Types of storage-area networks include converged, virtual and unified SANs.


Clients
Client Access LAN
Application Server A
Application Server B
Application Server X
All Servers
to
Storage Area Network (SAN)
All Storage Devices
Storage
Storage
Storage

SAN (System Area Network)

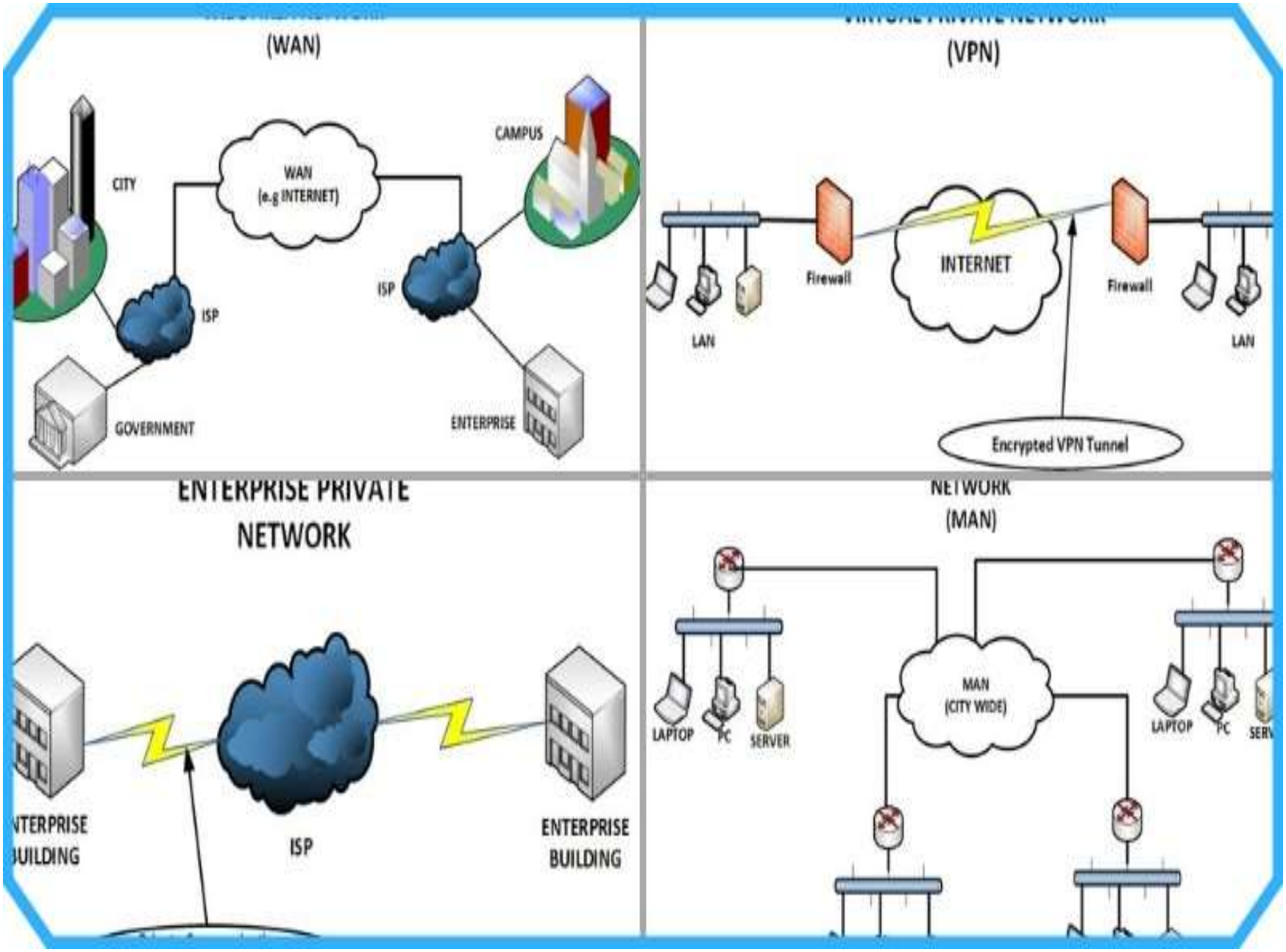
This term is fairly new within the past two decades. It is used to explain a relatively local network that is designed to provide high-speed connection in server-to-server applications (cluster environments), storage area networks (called “SANs” as well) and processor-to-processor applications. The computers connected on a SAN operate as a single system at very high speeds.

Storage Area Networks



VPN (Virtual Private Network)

By extending a private network across the Internet, a VPN lets its users send and receive data as if their devices were connected to the private network – even if they're not. Through a virtual point-to-point connection, users can access a private network remotely.


(WAN)
CITY
WAN
(e.g INTERNET)
CAMPUS
ISP
ISP
GOVERNMENT
ENTERPRISE
(VPN)
Firewall
INTERNET
Firewall
LAN
LAN
Encrypted VPN Tunnel
ENTERPRISE PRIVATE
NETWORK
ISP
ENTERPRISE
BUILDING
NETWORK
(MAN)
LAPTOP
PC
SERVER
MAN
(CITY WIDE)
LAPTOP
PC

EPN (Enterprise Private Network)

These types of networks are built and owned by businesses that want to securely connect its various locations to share computer resources.

Thank You

Digital Signal & Carrier Waves

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Definition

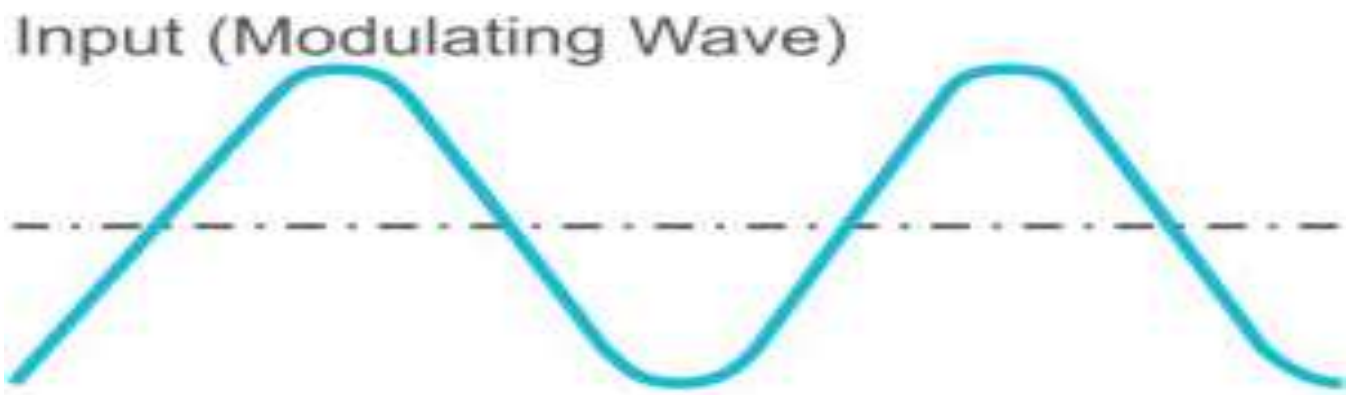
Anything that carries information can be called as **signal**. It can also be defined as a physical quantity that varies with time, temperature, pressure or with any independent variables such as speech signal or video signal.

The process of operation in which the characteristics of a signal Amplitude, shape, phase, frequency, etc. undergoes a change is known as signal processing.

Frequency of an RF channel is best understood as the frequency of a carrier wave.

A carrier wave is a pure wave of constant frequency, a bit like a sine wave. By itself it doesn’t carry much information that we can relate to (such as speech or data).


Carrier


Input (Modulating Wave)

To include speech information or data information, another wave needs to be imposed, called an **input signal**, on top of the **carrier wave**. This process of imposing an input signal onto a carrier wave is called **modulation**. In other words, modulation changes the shape of a carrier wave to somehow encode the speech or data information that we were interested in carrying. Modulation is like hiding a code inside the carrier wave.

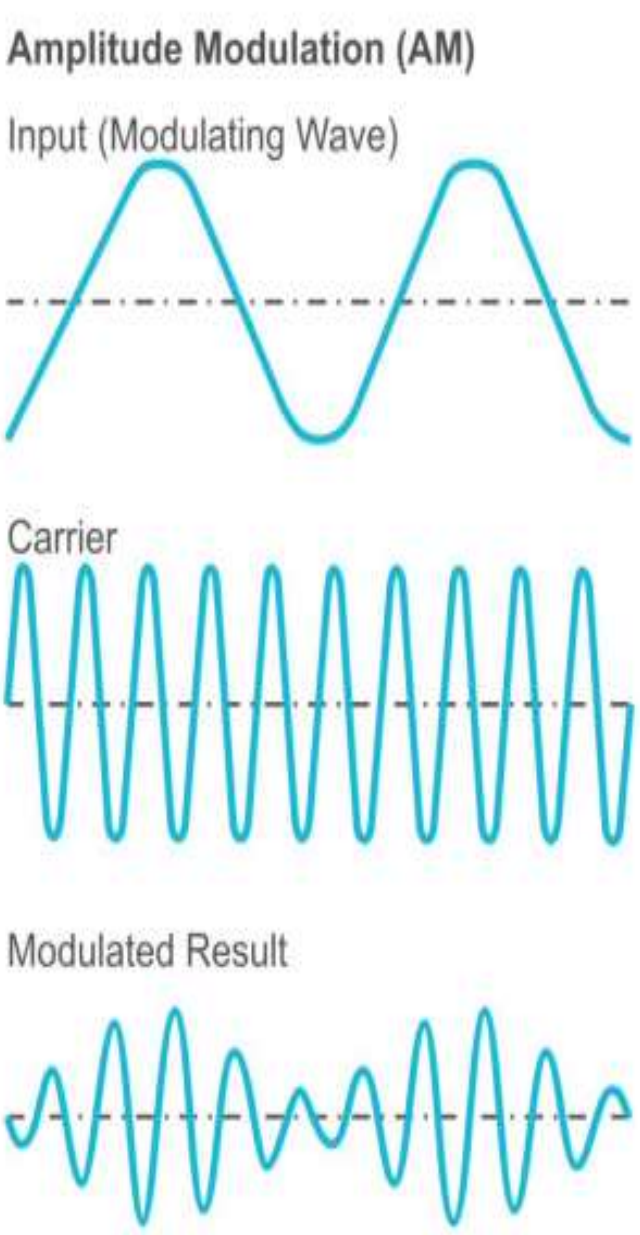
Any wave has three basic properties:

1) **Amplitude** – the height of the wave

2**) Frequency** – a number of waves passing through in a given second

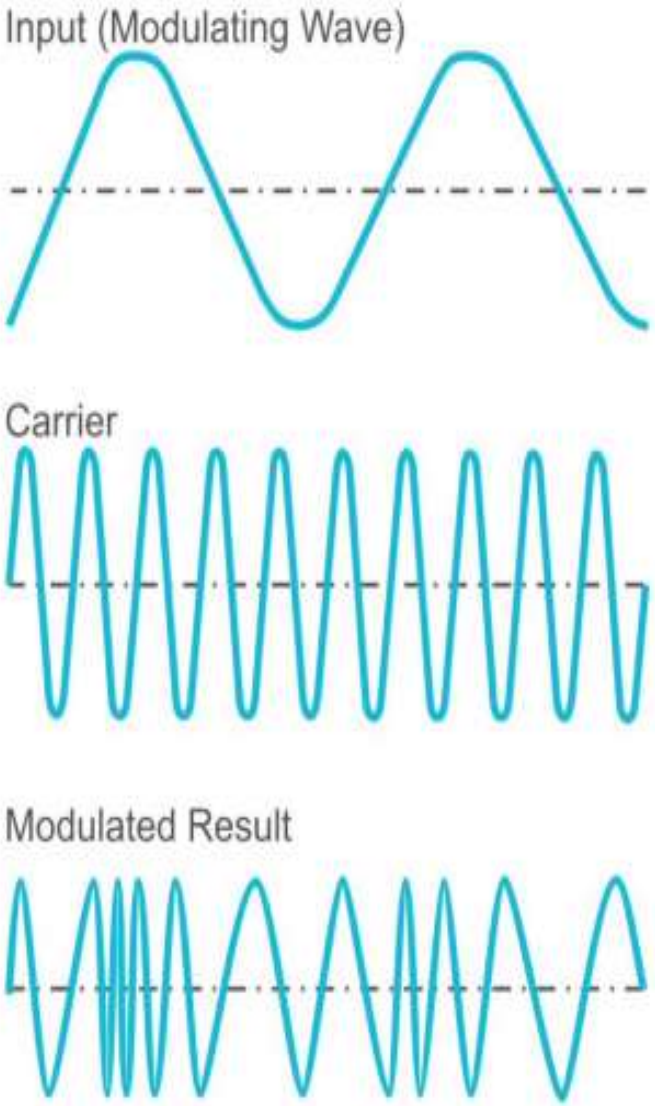
3) **Phase** – where the phase is at any given moment.

There are different strategies for modulating the carrier wave. First, a user can tweak the height of the carrier. If an input signal's height varies with the loudness of a user's voice and then adds this to the carrier, then the carrier's amplitude will change corresponding to the input signal that's been fed into it. This is called amplitude modulation or AM.


Amplitude Modulation (AM)
Input (Modulating Wave)
Carrier
Modulated Result

Frequency of an input signal can also be changed. If this input signal is added to the pure carrier wave, it will thereby change the frequency of the carrier wave. In that way, users can use changes of frequency to carry speech information. This is called frequency modulation or FM.

Frequency Modulation (FM)



These two strategies can be combined to create a third scheme. In fact, any strategy that combines an input signal with a carrier wave to encode speech or other useful information is called a modulation scheme.

Modulation schemes can be **analog or digital**.

An analog modulation scheme has an input wave that varies continuously like a sine wave. In digital modulation scheme, it's a little more complicated. Voice is sampled at some rate and then compressed and turned into a bit stream – a stream of zeros and ones – and this in turn is created into a particular kind of wave which is then superimposed on the carrier.

The input signals could be carried (without a carrier wave) by very low frequency electromagnetic waves.

This will need quite a bit of amplification in order to transmit those very low frequencies. The input signals themselves do not have much power and need a fairly large antenna in order to transmit the information.

In order to keep communication cheap and convenient and require less power to carry as much information as possible, carrier systems with modulated carriers are used.