DATA COMMUNICATION AND NETWORKING

Lecture # 05

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Contents

Computer Networks

- A computer Network is a system in which a number of independent computers are linked together to share data and peripherals, such as files and printers.
- The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.
- All major businesses and governmental and educational institutions make use of computer networks

- Three very common types of networks includes:

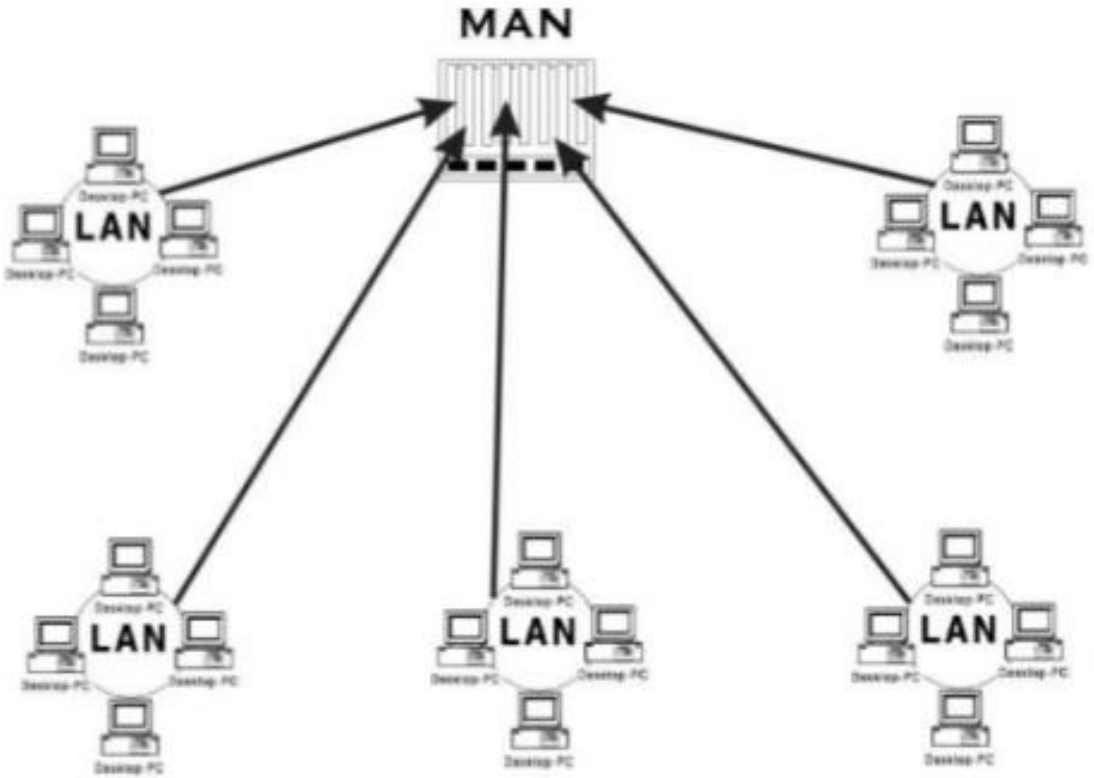
1. Local Area Network (LAN)
2. Metropolitan Area Network (MAN)
3. Wide Area Network (WAN)

Local Area Network (LAN)

- A Local Area Network (LAN) is a network that is confined to a relatively **small area**.
- Generally limited to a geographic area such as a writing lab, school, or building.
- Computers connected in the **100m distance** are called Local Area Network (LAN).

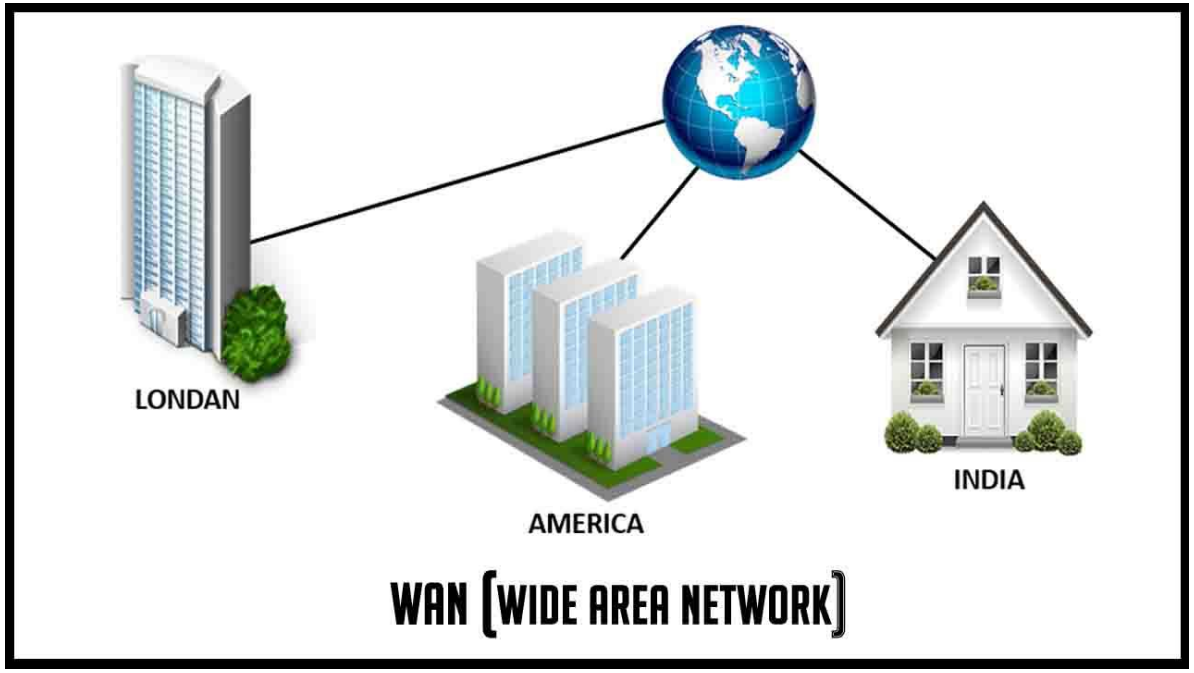
Metropolitan Area Network (MAN)

- A Metropolitan Area Network is a network that connects two or more Local Area Networks.
- MAN does not extend beyond the boundaries of the immediate town/city.



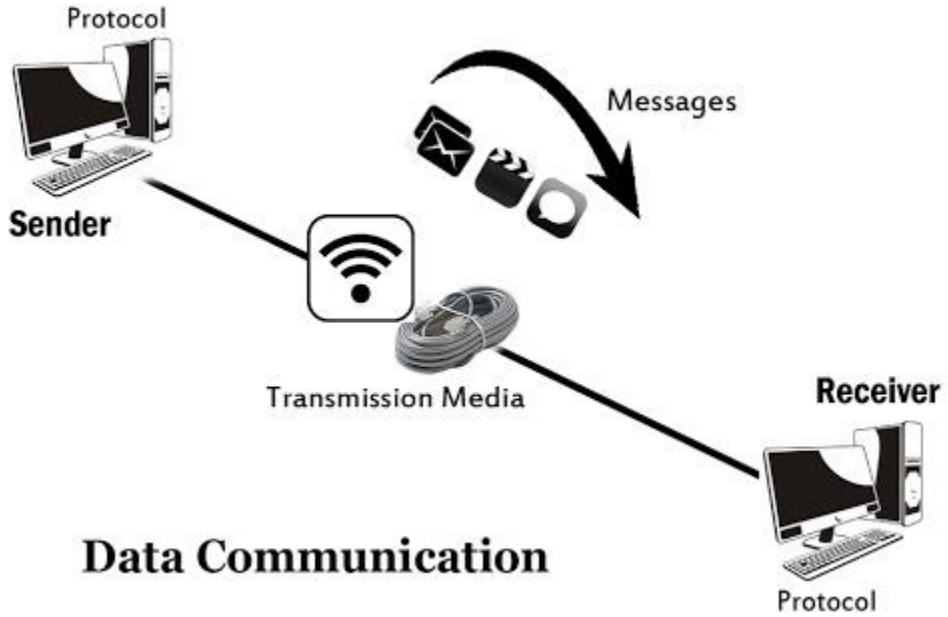
Wide Area Network (WAN)

- Wide Area Networks (WANs) connect networks in larger geographic areas, such as all cities of Pakistan or the World.
- WANs are used to connect LANs and other types of networks together so that users and computers in one location can communicate with users and computers in other locations.



Data Communication

- Data communication is a process of transferring data electronically from one place to another.
- Data can be transferred by using a different medium.
- Basic components of data communication are:
  - *Sender*
  - *Encoder*
  - *Medium*
  - *Decoder*
  - *Receiver*



Data Communication

Components

1. Sender – Sender is a device that sends a message. The message can consist of text, numbers, pictures etc. it is also called source or transmitter.
2. Encoder – The encoder is a device that converts digital signals in a form that can pass through a transmission medium.
3. Medium / Communication Channel – Medium is the physical path that connects sender and receiver. It is used to transmit data. The medium can be a copper wire, a fiber optic cable, microwaves etc. it is also called communication channel.
4. Decoder – The decoder is a device that converts the encoded signals into digital form. The receiver can understand the digital form of message. Sender and receiver cannot communicate successfully without encoder and decoder.
5. Receiver – Receiver is a device that receives the message. It is also called sink. The receiver can be a computer, printer or another computer-related device. The receiver must be capable of accepting the message.

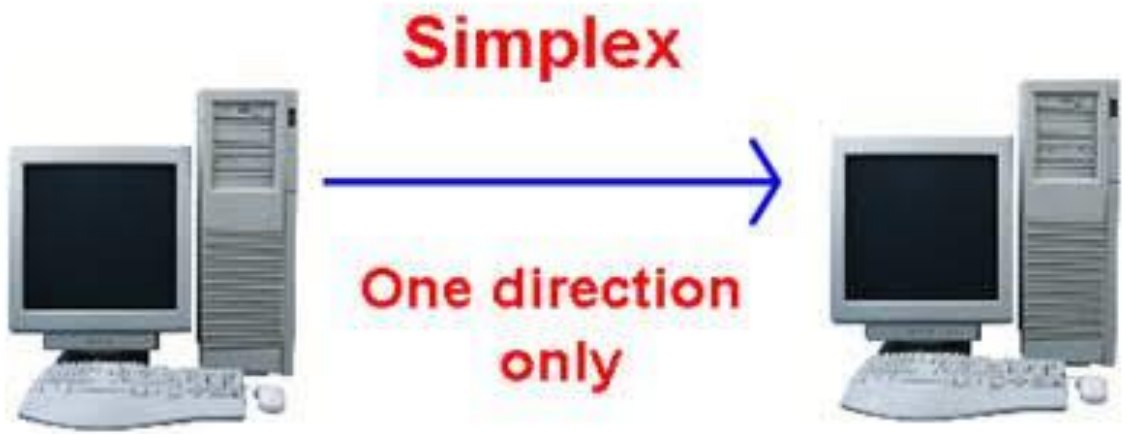
Modes of Data Communication

- Transmission mode means transferring of data between two devices.
- It is also known as the communication mode
- There are three types of transmission mode:-
  - *Simplex Mode*
  - *Half-Duplex Mode*
  - *Full-Duplex Mode*

1. 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

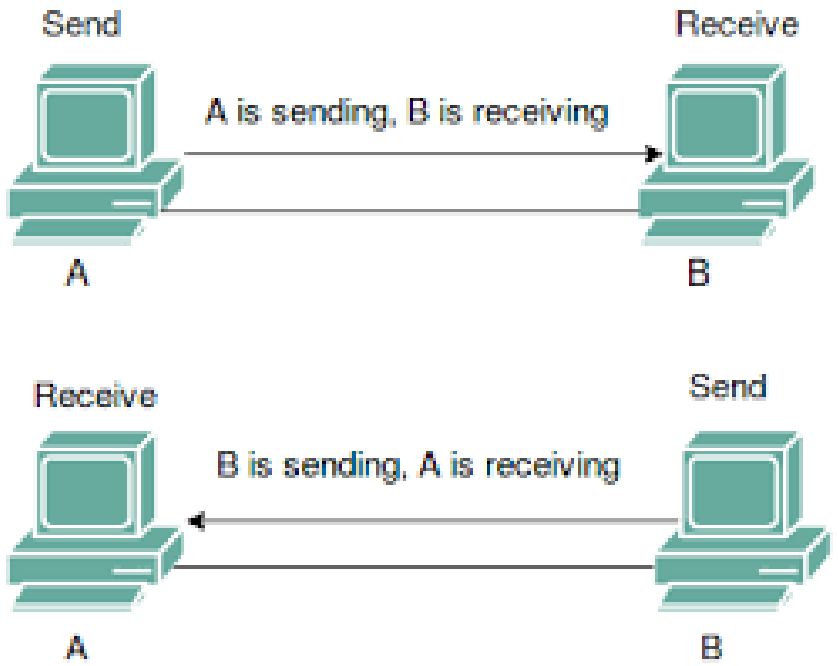
Example: Keyboard and traditional monitors.
The keyboard can only introduce input; the monitor can only give the output



2. Half-Duplex

- 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

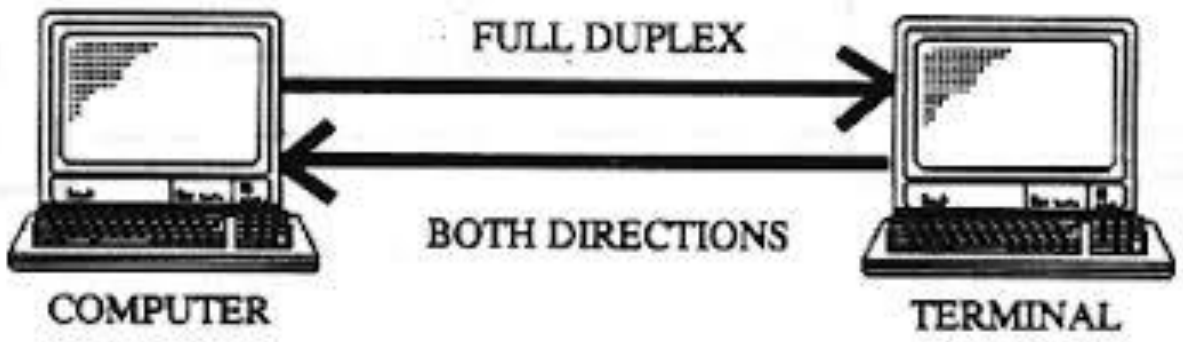
Example: Walkie-talkie in which message is sent one at a time and messages are sent in both the directions.



3. Full-Duplex

- In full-duplex mode, both stations can transmit and receive simultaneously.
- Full-duplex mode is used when communication in both directions is required all the time.

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.



Network Topology

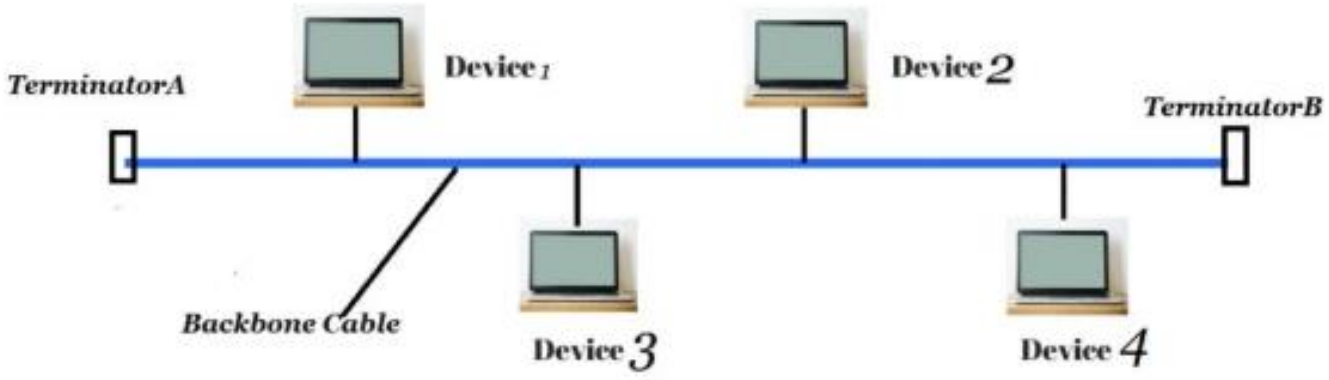
- Network topology is the arrangement of the elements of a communication network.
- Think of a topology as a network's virtual shape or structure.
- This shape does not necessarily correspond to the actual physical layout of the devices on the network.

Network topologies are categorized into the following basic types:

1. ***Bus*** 2. ***Ring*** 3. ***Star*** 4. ***Mesh***

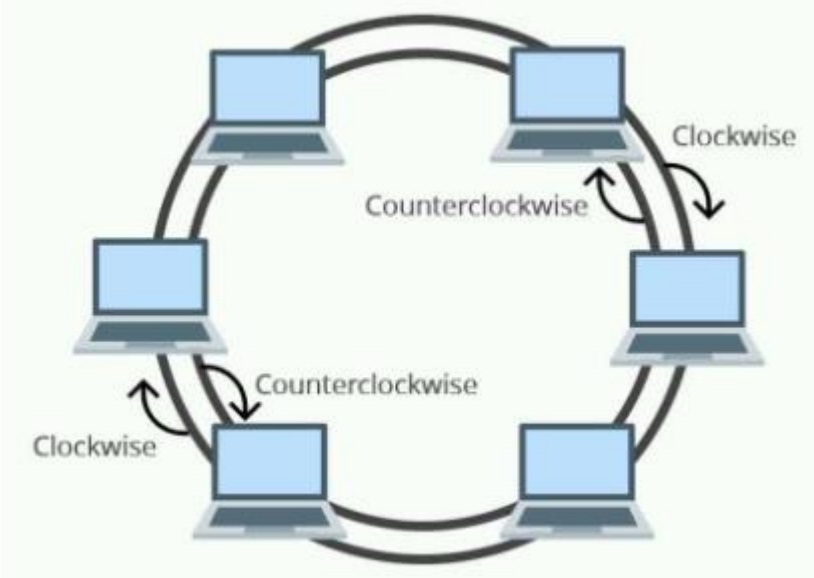
1. Bus Topology

- All the nodes are connected to a **single cable.**
- The cable to which the nodes connect is called a "**backbone**".
- Bus networks use a common backbone to connect all devices
- If the backbone is broken, the entire segment fails.
- A device wanting to communicate with another device on the network sends a broadcast message onto the wire that **all other devices see**, but only the intended recipient actually accepts and processes the message.



2. Ring Topology

- A ring network is a network topology in which each node connects to exactly two other nodes
- In a ring network, every device has exactly two neighbors for communication purposes.
- All messages travel through a ring in the same direction (either "clockwise" or "counterclockwise").
- A failure in any cable or device breaks the loop and can take down the entire network.

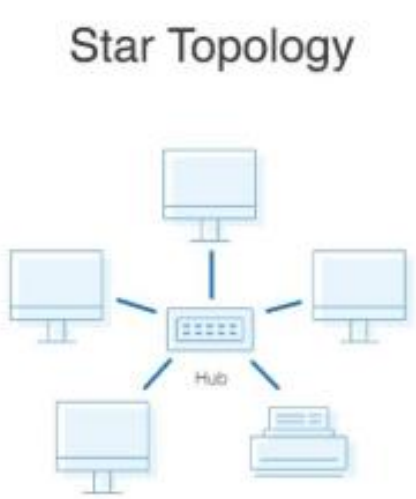


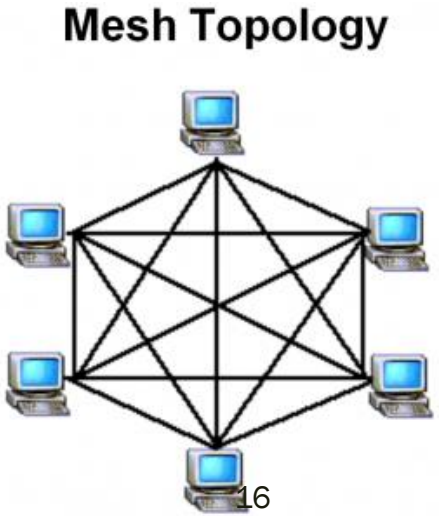
3. Star Topology

- A **star topology** is a **topology** for a Local Area **Network** (LAN) in which all nodes are individually connected to a central connection point, like a hub or a switch.
- Devices typically connect to the hub with Unshielded Twisted Pair (UTP) Ethernet.

4. Mesh Topology

- Mesh topology introduces the concept of routes.
- Messages sent on a mesh network can take any of several possible paths from source to destination.

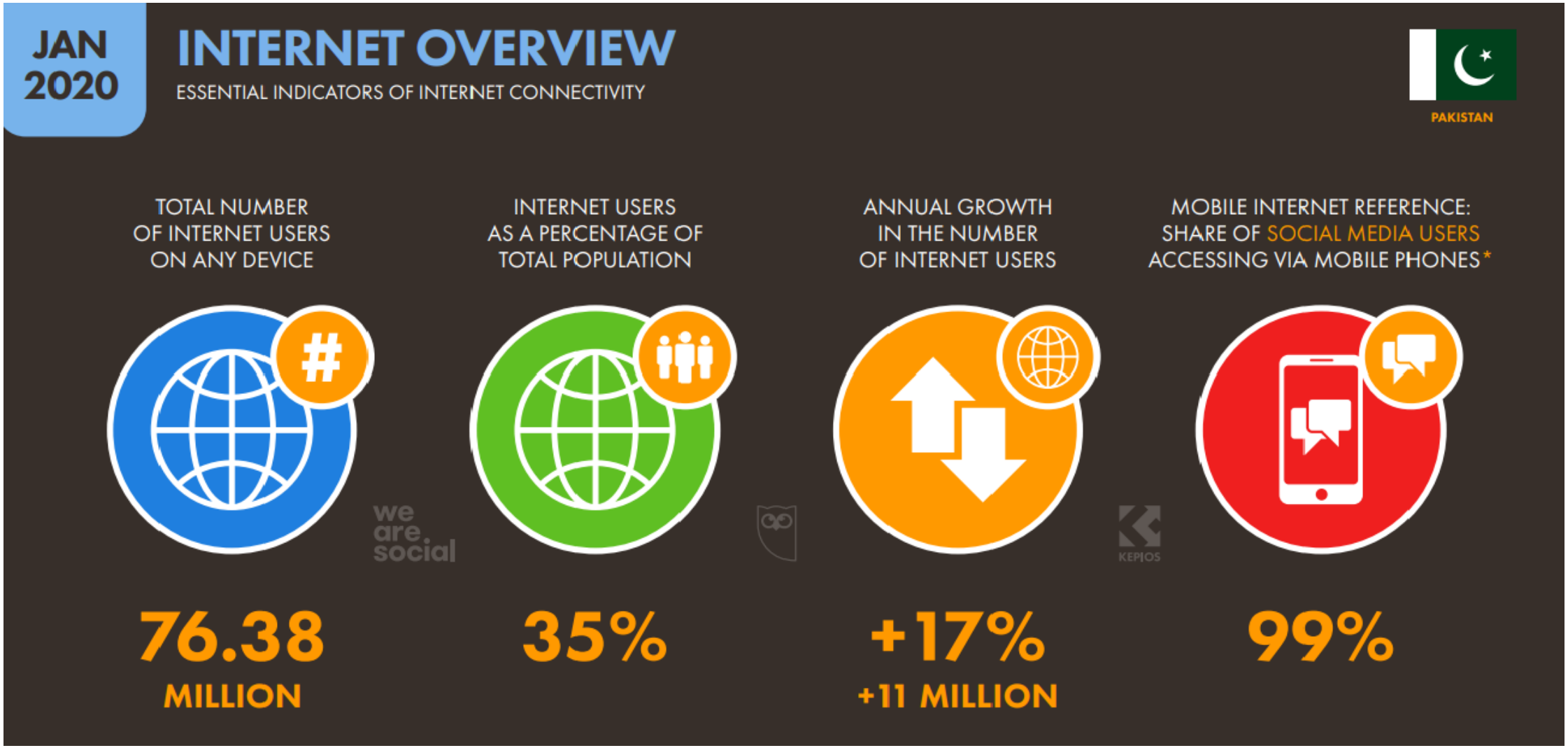




What is Internet?

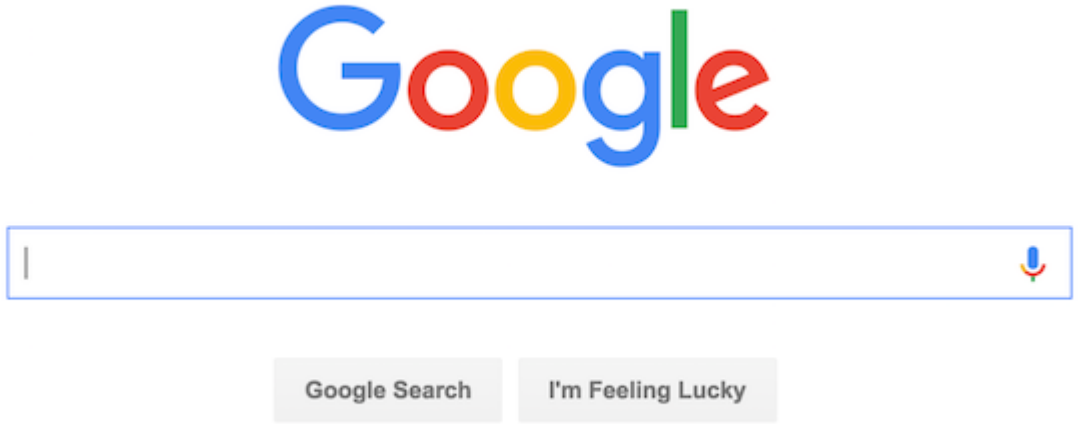
- The **Internet** is the biggest world-wide communication network of computers
- The Internet, sometimes called simply "the **Net**," is a worldwide system of computer networks - a network of networks in which users at any one computer can, if they have permission, get information from any other computer
- Internet is a global computer network providing a variety of information and communication facilities
- The **Internet** provides different online services. Some examples includes **Web** (a collection of billions of webpages that you can view with a web browser) and **E-mail** (the most common method of sending and receiving messages online)

Internet penetration in Pakistan as of 2020



Google ?

- **Google** is an Internet search engine.
- It uses a proprietary algorithm that's designed to retrieve and order search results to provide the most relevant and dependable sources of data possible
- Officially **Google** has not a **full form**. It is generated from a word "googol" which means a huge number.



Web & Web Browsers

- A **website** (also written as **web site**) is a collection of web pages and related content that is identified by a common domain name and published on at least one web server.
- All publicly accessible websites collectively constitute the World Wide Web (WWW)
- Some famous web browsers are: Google chrome, Mozilla Firefox, Internet Explorer, Opera etc.

What is E-mail?

- **Electronic mail** (**email** or **e-mail**) is a method of exchanging messages ("mail") between people using electronic devices
- It uses the **@** sign to link the user name with a destination server.
- Some famous free email service providers are:
  - **Gmail:** Most **Popular Email** Service Provider. Gmail is the most used & **best** free **email** service around the globe.
  - **Outlook.com**. Outlook.com is **famous** free **email** service from Microsoft.
  - **Yahoo Mail.** Yahoo **Mail** is another **popular** web-based free **email** service.

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”The expert in anything was once a beginner.”