FUNDAMENTAL OF COMPUTERS & EMERGING TECHNOLOGIES (KCA – 101)

Unit-II

Operating system

• An Operating System (OS) is an interface between a computer user and computer hardware. An operating system is a software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

Operating System - Functions

- Process Management
- I/O Device Management
- File Management
- Network Management
- Main Memory Management
- Secondary Storage Management
- Security Management
- Command Interpreter System
- Control over system performance
- Job Accounting
- Error Detection and Correction
- Coordination between other software and users
- Many more other important tasks

Types of Operating System

- Batch operating system
- Time-sharing operating systems
- Distributed operating System
- Network operating System
- Real Time operating System:
- There are two types of real-time operating systems.
- Hard real-time systems
- Soft real-time systems

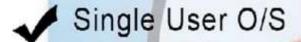
Operating System Generations

- oth Generation: The term oth generation is used to refer to the period of development of computing when Charles Babbage invented the Analytical Engine and later John Atanasoff created a computer in 1940.
- **First Generation** (1951-1956): The first generation marked the beginning of commercial computing including the introduction of Eckert and Mauchly's UNIVAC I in early 1951, and a bit later, the IBM 701.
- **Second Generation** (1956-1964): The second generation of computer hardware was most notably characterized by transistors replacing vacuum tubes as the hardware component technology.

- **Third Generation** (1964-1979): The third generation officially began in April 1964 with IBM's announcement of its System/360 family of computers. Hardware technology began to use integrated circuits (ICs) which yielded significant advantages in both speed and economy.
- Fourth Generation (1979 Present): The fourth generation is characterized by the appearance of the personal computer and the workstation. The component technology of the third generation, was replaced by very large scale integration (VLSI). Many Operating Systems which we are using today like Windows, Linux, MacOS etc developed in the fourth generation.

Classification

Classification of Operating System



■ Multi User O/S

■ Batch Process O/S

Multi Programming O/S

Timesharing O/S

✓ Multi Tasking O/S

Multi Process O/S

Distributed O/S

Real Time O/S

Command based and GUI based operating system

BASIS	COMMAND LINE INTERFACE(CLI)	GRAPHIC USER INTERFACE(GUI)
Definition	Interaction is by typing commands	Interaction with devices is by graphics and visual components and icons
Understanding	Commands need to be memorized	Visual indicators and icons are easy to understand
Memory	Less memory is required for storage	More memory is required as visual components are involved.
Working Speed	Use of keyboard for commands makes CLI quicker	Use of mouse for interaction makes it slow
Resources used	Only keyboard	Mouse and keyboard both can be used
Accuracy	High	Comparatively low
Flexibility	Command line interface does not change, remains same over time	Structure and design can change with updates https://ipwithease.com

Elements in Graphical User Interface

- Window: This is the element that displays the information on the screen. It is very easy to manipulate a window. It can be opened or closed with the click of an icon. Moreover, it can be moved to any area by dragging it around. In a multitasking environment, multiple windows can be open at the same time, all of them performing different tasks.
- There are multiple types of windows in a graphical user interface, such as container window, browser window, text terminal window, child window, message window etc.

- Menu: A menu contains a list a choices and it allows users to select one from them. A menu bar is displayed horizontally across the screen such as pull down menu. When any option is clicked in this menu, then the pull down menu appears.
- Another type of menu is the context menu that appears only when the user performs a specific action. An example of this is pressing the right mouse button. When this is done, a menu will appear under the cursor.

- **Icons:** Files, programs, web pages etc. can be represented using a small picture in a graphical user interface. This picture is known as an icon. Using an icon is a fast way to open documents, run programs etc. because clicking on them yields instant access.
- **Controls:** Information in an application can be directly read or influences using the graphical control elements. These are also known as widgets. Normally, widgets are used to display lists of similar items, navigate the system using links, tabs etc. and manipulating data using check boxes, radio boxes etc.

Tabs: A tab is associated with a view pane. It usually contains a text label or a graphical icon. Tabs are sometimes related to widgets and multiple tabs allow users to switch between different widgets. Tabs are used in various web browsers such as Internet Explorer, Firefox, Opera, Safari etc. Multiple web pages can be opened in a web browser and users can switch between them using tabs.

Elements of a command-line interface

- A command-line interface (CLI) is a text-based user interface (UI) used to run programs, manage computer files and interact with the computer. Command-line interfaces are also called command-line user interfaces, console user interfaces and character user interfaces.
- The components of the CLI display are the prompt, the cursor, the input (text you have typed in), and the output of your commands and programs.

Computer Network

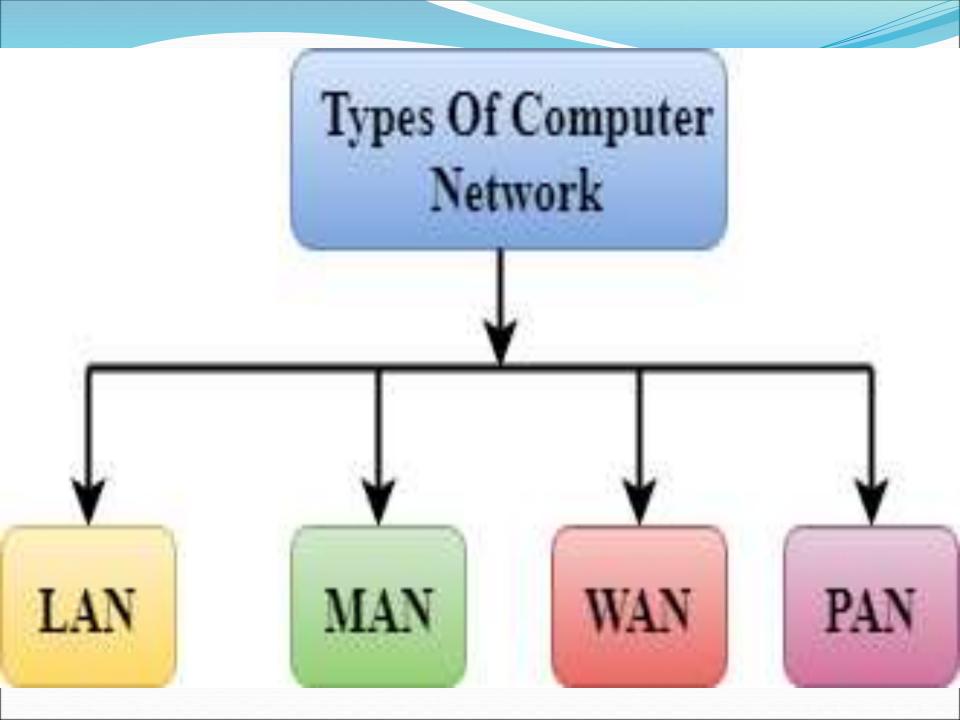
- A computer network is a set of devices connected through links. A node can be computer, printer, or any other device capable of sending or receiving the data. The links connecting the nodes are known as communication channels.
- Computer Network uses distributed processing in which task is divided among several computers. Instead, a single computer handles an entire task, each separate computer handles a subset.

Advantages of Distributed processing

- **Security:** It provides limited interaction that a user can have with the entire system. For example, a bank allows the users to access their own accounts through an ATM without allowing them to access the bank's entire database.
- **Faster problem solving:** Multiple computers can solve the problem faster than a single machine working alone.
- **Security through redundancy:** Multiple computers running the same program at the same time can provide the security through redundancy. For example, if four computers run the same program and any computer has a hardware error, then other computers can override it.

Computer Network Types

- A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data, and applications.
- A computer network can be categorized by their size.
 A computer network is mainly of four types:
- LAN(Local Area Network)
- PAN(Personal Area Network)
- MAN(Metropolitan Area Network)
- WAN(Wide Area Network)



LAN(Local Area Network)

- Local Area Network is a group of computers connected to each other in a small area such as building, office.
- LAN is used for connecting two or more personal computers through a communication medium such as twisted pair, coaxial cable, etc.
- It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and ethernet cables.
- The data is transferred at an extremely faster rate in Local Area Network.
- Local Area Network provides higher security.

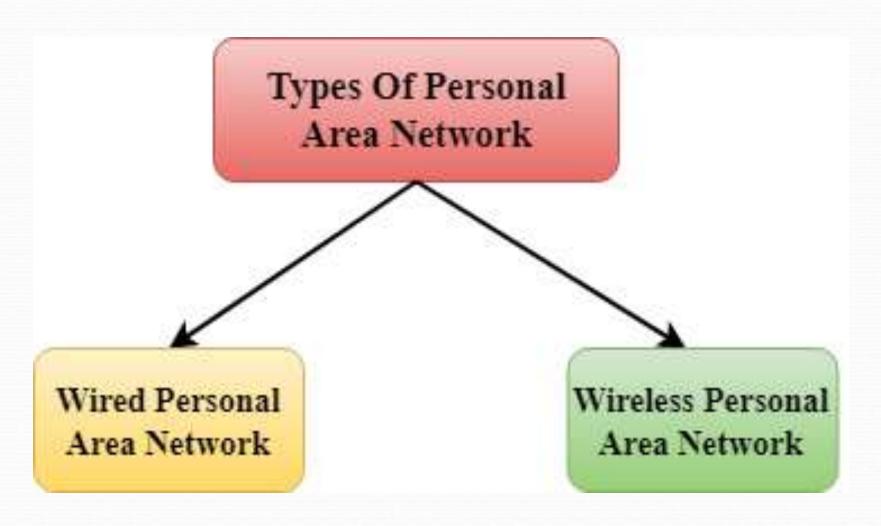


PAN(Personal Area Network)

- Personal Area Network is a network arranged within an individual person, typically within a range of 10 meters.
- Personal Area Network is used for connecting the computer devices of personal use is known as Personal Area Network.
- Thomas Zimmerman was the first research scientist to bring the idea of the Personal Area Network.
- Personal Area Network covers an area of 30 feet.
- Personal computer devices that are used to develop the personal area network are the laptop, mobile phones, media player and play stations.



- There are two types of Personal Area Network:
- Wired Personal Area Network
- Wireless Personal Area Network

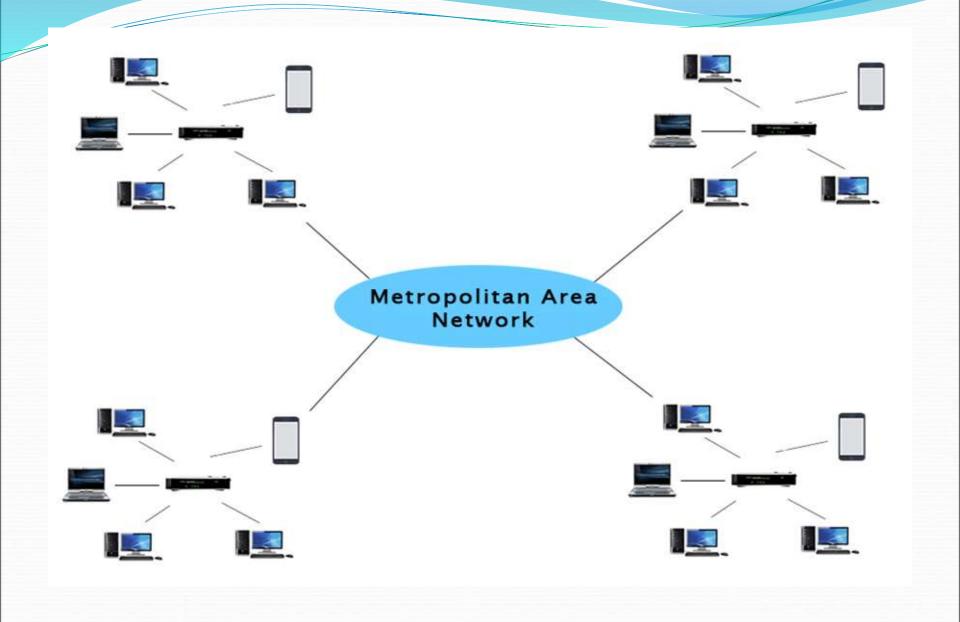


- Wireless Personal Area Network: Wireless Personal Area Network is developed by simply using wireless technologies such as WiFi, Bluetooth. It is a low range network.
- Wired Personal Area Network: Wired Personal Area Network is created by using the USB.
- Examples Of Personal Area Network:
- **Body Area Network:** Body Area Network is a network that moves with a person. **For example**, a mobile network moves with a person. Suppose a person establishes a network connection and then creates a connection with another device to share the information.

- **Offline Network:** An offline network can be created inside the home, so it is also known as a **home network**. A home network is designed to integrate the devices such as printers, computer, television but they are not connected to the internet.
- **Small Home Office:** It is used to connect a variety of devices to the internet and to a corporate network using a VPN

MAN(Metropolitan Area Network)

- A metropolitan area network is a network that covers a larger geographic area by interconnecting a different LAN to form a larger network.
- Government agencies use MAN to connect to the citizens and private industries.
- In MAN, various LANs are connected to each other through a telephone exchange line.
- The most widely used protocols in MAN are RS-232, Frame Relay, ATM, ISDN, OC-3, ADSL, etc.
- It has a higher range than Local Area Network(LAN).

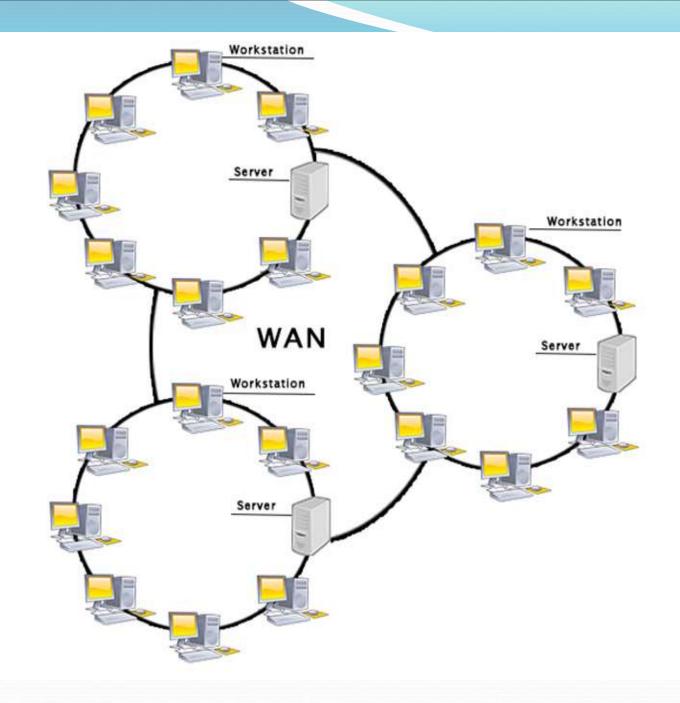


Uses Of Metropolitan Area Network

- MAN is used in communication between the banks in a city.
- It can be used in an Airline Reservation.
- It can be used in a college within a city.
- It can also be used for communication in the military.

WAN(Wide Area Network)

- A Wide Area Network is a network that extends over a large geographical area such as states or countries.
- A Wide Area Network is quite bigger network than the LAN.
- A Wide Area Network is not limited to a single location, but it spans over a large geographical area through a telephone line, fibre optic cable or satellite links.
- The internet is one of the biggest WAN in the world.
- A Wide Area Network is widely used in the field of Business, government, and education.



Examples Of Wide Area Network

- **Mobile Broadband:** A 4G network is widely used across a region or country.
- Last mile: A telecom company is used to provide the internet services to the customers in hundreds of cities by connecting their home with fiber.
- **Private network:** A bank provides a private network that connects the 44 offices. This network is made by using the telephone leased line provided by the telecom company.

Advantages Of Wide Area Network

- **Geographical area:** A Wide Area Network provides a large geographical area. Suppose if the branch of our office is in a different city then we can connect with them through WAN. The internet provides a leased line through which we can connect with another branch.
- **Centralized data:** In case of WAN network, data is centralized. Therefore, we do not need to buy the emails, files or back up servers.
- **Get updated files:** Software companies work on the live server. Therefore, the programmers get the updated files within seconds.

- **Exchange messages:** In a WAN network, messages are transmitted fast. The web application like Facebook, Whatsapp, Skype allows you to communicate with friends.
- **Sharing of software and resources:** In WAN network, we can share the software and other resources like a hard drive, RAM.
- **Global business:** We can do the business over the internet globally.
- **High bandwidth:** If we use the leased lines for our company then this gives the high bandwidth. The high bandwidth increases the data transfer rate which in turn increases the productivity of our company.

Disadvantages of Wide Area Network

- **Security issue:** A WAN network has more security issues as compared to LAN and MAN network as all the technologies are combined together that creates the security problem.
- Needs Firewall & antivirus software: The data is transferred on the internet which can be changed or hacked by the hackers, so the firewall needs to be used. Some people can inject the virus in our system so antivirus is needed to protect from such a virus.
- **High Setup cost:** An installation cost of the WAN network is high as it involves the purchasing of routers, switches.
- **Troubleshooting problems:** It covers a large area so fixing the problem is difficult.

Data communication,

Data can be any text, image, audio, video, and multimedia files. Communication is an act of sending or receiving data. Thus, data communication refers to the exchange of data between two or more networked or connected devices. These devices must be capable of sending and receiving data over a communication medium.

Topologies

- The way in which devices are interconnected to form a network is called network topology.
- Bus Topology:



- Data network with bus topology has a **linear transmission cable**, usually **coaxial**, to which many **network devices** and **workstations** are attached along the length. **Server** is at one end of the bus. When a workstation has to send data, it transmits **packets** with **destination address** in its header along the bus.
- The data travels in both the directions along the bus. When the destination terminal sees the data, it copies it to the local disk.

- Advantages of Bus Topology:
- Easy to install and maintain
- Can be extended easily
- Very reliable because of single transmission line
- Disadvantages of Bus Topology:
- Troubleshooting is difficult as there is no single point of control
- One faulty node can bring the whole network down
- Dumb terminals cannot be connected to the bus

Ring Topology



- In **ring topology** each terminal is connected to exactly **two nodes**, giving the network a circular shape. Data travels in only one pre-determined direction.
- When a terminal has to send data, it transmits it to the neighboring node which transmits it to the next one. Before further transmission data may be amplified. In this way, data traverses the network and reaches the destination node, which removes it from the network. If the data reaches the sender, it removes the data and resends it later.

- Advantages of Ring Topology:
- Small cable segments are needed to connect two nodes
- Ideal for optical fibres as data travels in only one direction
- Very high transmission speeds possible
- Disadvantages of Ring Topology:
- Failure of single node brings down the whole network
- Troubleshooting is difficult as many nodes may have to be inspected before faulty one is identified
- Difficult to remove one or more nodes while keeping the rest of the network intact

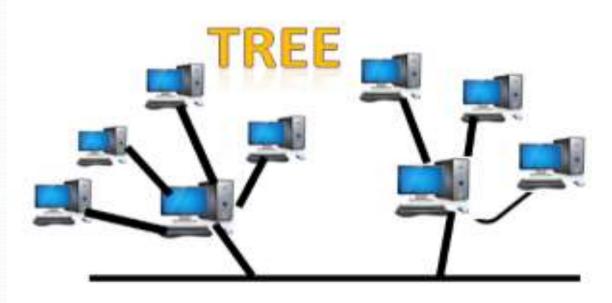
Star Topology



In star topology, server is connected to each node individually. Server is also called the central node. Any exchange of data between two nodes must take place through the server. It is the most popular topology for information and voice networks as central node can process data received from source node before sending it to the destination node.

- Advantages of Star Topology:
- Failure of one node does not affect the network
- Troubleshooting is easy as faulty node can be detected from central node immediately
- Simple access protocols required as one of the communicating nodes is always the central node
- Disadvantages of Star Topology:
- Long cables may be required to connect each node to the server
- Failure of central node brings down the whole network

Tree Topology



Tree topology has a group of star networks connected to a linear bus backbone cable. It incorporates features of both star and bus topologies. Tree topology is also called hierarchical topology.

- Advantages of Tree Topology:
- Existing network can be easily expanded
- Point-to-point wiring for individual segments means easier installation and maintenance
- Well suited for temporary networks
- Disadvantages of Tree Topology:
- Technical expertise required to configure and wire tree topology
- Failure of backbone cable brings down entire network
- Insecure network
- Maintenance difficult for large networks