IT Fundamentals for Cyber Security

Chapter 02: Fundamentals of Computer Systems

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2. Fundamentals of Computer Systems

Understanding Computer Hardware Components

Computer hardware includes the physical parts of a computer, such as a case, central processing unit (CPU), random access memory (RAM), monitor, and mouse which processes the input according to the set of instructions provided to it by the user and gives the desired output.

The computer has mainly has two major components:

1. Hardware
2. Software

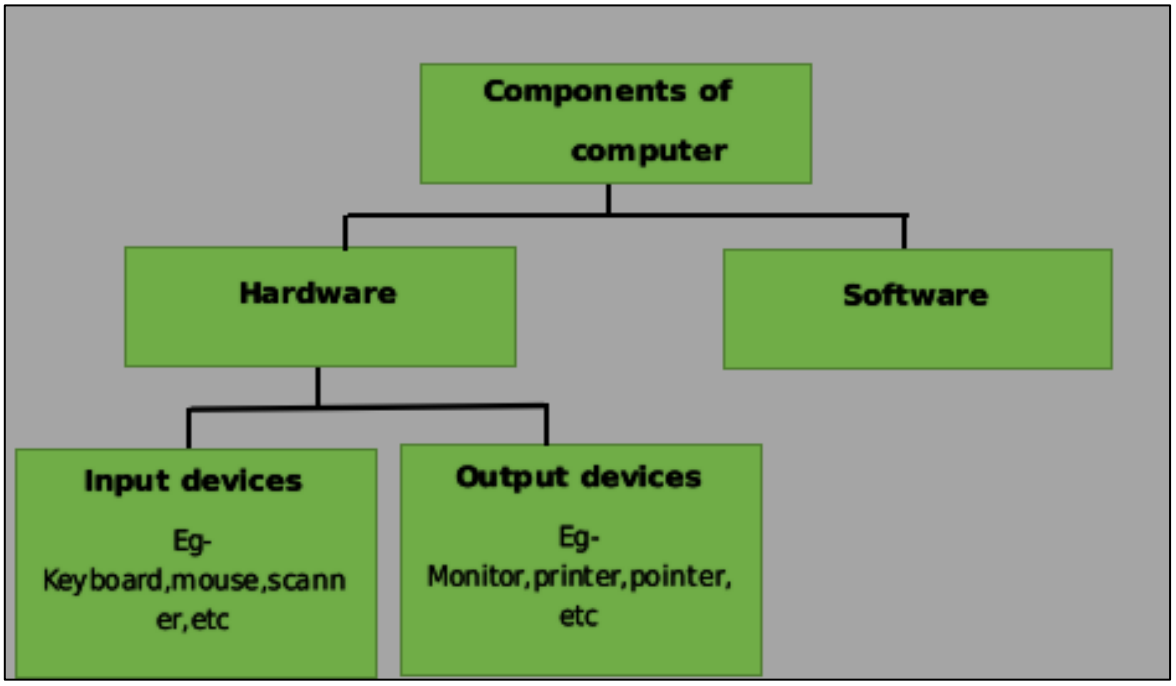

Figure 1. Components of Computers

2.1. Introduction to Computer systems

A computer system is a basic, full-featured hardware and software configuration with all the components needed to perform computing operations. It enables humans to input, process, and output data effectively and systematically. A computer system comprises several connected, integrated devices collaborating to carry out one or more tasks. It often consists of software and hardware elements, including operating systems, programs, and drivers, as well as memory, input/output devices, storage devices, and a central processing unit (CPU).

2.1.1. History of Computer Systems

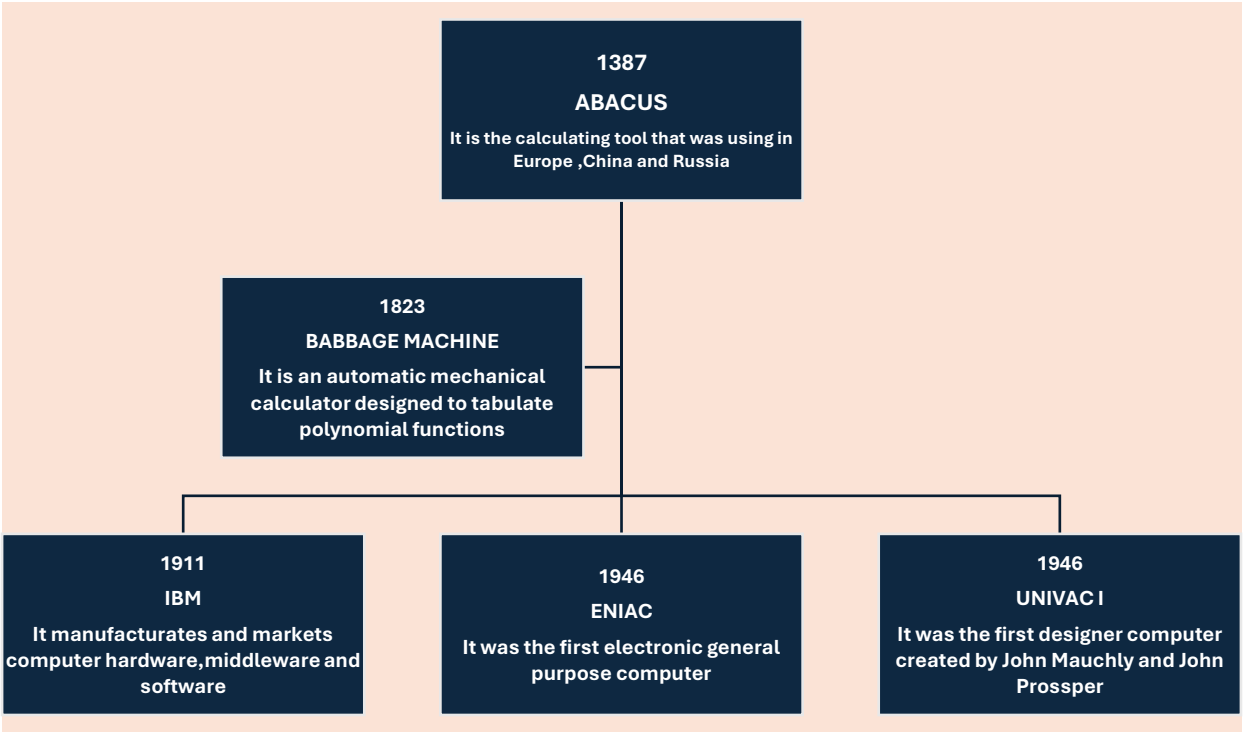

Figure 2. History of Computers

1. **Abacus.** Abacus was probably the earliest of counting devices. It consists of rectangular wooden frame with two compartments and beads sliding along the steel wires for counting. Multiplication and divisions are done using repeated additions and subtractions. Even today in which cross strings are fixed. Beads are inserted on to the strings. There are a number of rows of beads.
2. **Napier's logs and bones.** John Napier, a Scottish mathematician invented logarithm. The use of logarithms enabled him to transform multiplications and division problems of addition and subtractions. In the beginning he called logarithms as artificial numbers. But later he named them logarithms. Napier also invented a computing device consisting of sticks with numbers carved on them. These sticks are called bones as they were made of bones. These bones helped a lot in multiplication involving large numbers.
3. **Slide rule.** As the name indicates, the slide rule has one scale sliding within the other. Suppose you want to add two numbers 3 and 5, set 3 on the fixed scale and slide the moving scale. So that its "0' coincides with"5" of sliding scale. This is the sum of 3 and 5. The process of reading could be quick if you are trained in the use of slide rule.
4. **Calculating machines and Pascal's calculator.** A French mathematician, Blaise Pascal invented a machine based on gear wheels. Blaise Pascal wanted to make his job easier by inventing a calculator. You might be familiar with gear wheels in use in your bicycle which meshes with a driving chain. He used similar gear wheels with ten teeth for each digit position. He fixed them together so that one wheel drives the other. When the wheel corresponding to units position rotated by ten teeth, it drove the wheel corresponding to the next higher position by one tooth. Thus one could make calculations. Pascal provided

dials, which indicated numbers stored on each wheel. He also used suitable "dialling system" to operate the gear wheels. Other people also made a number of such calculators. Computer scientists honoured Pascal by naming a programming language Pascal after him.

5. **Babbage difference and analytical engines.** Babbage, a British National and the son of a wealthy banker wanted to correct the errors in the logarithm tables being used during his time. In 1822, he made a machine which calculated the successive difference of expressions (X2 + ax + b is an example of an expression) and prepared table which helped him in his calculations. He wanted to make an accurate calculating machine called "Babbage's Analytical Engine". The analytical Engine was supposed to be very accurate. So it needed lot of parts made with precision. Babbage could not make such parts. He conceived that his machine would use input devices, would have a processing part called "mill" where you can perform calculations, would also incorporate It consists of rectangular frame in which cross strings are fixed. Beads are inserted on to the strings. There are a number of rows of beads. Since he was about 100 years ahead in his ideas, he could not get parts needed for his machine. This is because there were no tools to make such precision parts. He did lot of work related to making precision parts and spend all the grants (and lot of his money too) but failed in his attempt to make a machine.
6. **Herman Hollerith's Machine.** Dr. Herman Hollerith Produced cards out of special paper pulp designed punching machines to punch holes in the card to count census figures and invented sorting machines to read such punched card and collect data. He could complete the job within three years, achieving a speedup of about three times.
7. **ABC Computer.** In 1937, Dr. John Atanstoff with the help of his assistant Berry designed the Atanstoff Berry Computer (ABC). The machine laid the foundation for the development of electronic digital computer.
8. **ENIAC- Electronic Numerical Integrator and Calculator.** In 1947 john Mauchly and Eckart completed the first large scale Electronic Digital Computer, ENIAC. In this computer, each time a program was changed, the wiring had to be completely rearranged. It weighed 30 tons, contained 18,000 vacuum tubes and occupied a space of 30 50 feet.
9. **EDSAC-Electronic Delay Storage Automatic Calculator.** Maurice V. Wilkes of Cambridge University completed EDSAC in 1949. EDSAC was the first computer to operate on the stored program concept.
10. **UNIVAC-I – Universal Automatic Computers.** In 1947, after ENIAC became operational Mauchly and Eckart formed their own Company-The Eckart-Mauchly Computer Corporation". Immediately after this they started the design of UNIVAC-I. This was purchased by US bureau of Census. UNIVAC was the first computer dedicated to business applications.

2.1.2. Components & Types of Computer Systems

COMPONENTS OF COMPUTER SYSTEM

1. **Computer hardware –** are physical parts/ intangible parts of a computer. eg Input devices, output devices, central processing unit and storage devices
2. **Computer software –** also known as programs or applications. They are classified into two classes namely - system software and application software
3. **Liveware –** is the computer user also known as orgware or the human ware. The user commands the computer system to execute on instructions.

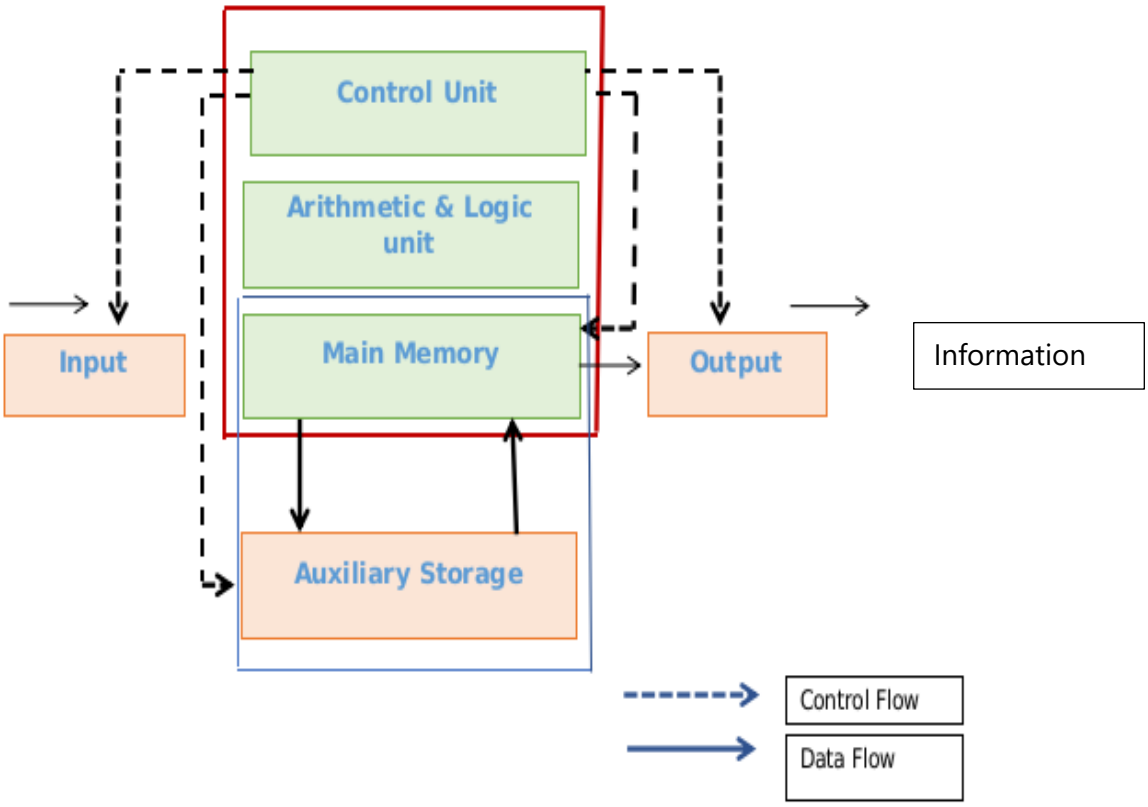

Figure 3. Block Diagram of Computer

A computer can process data, pictures, sound and graphics. They can solve highly complicated problems quickly and accurately.

A. Input Unit:

Computers need to receive data and instruction in order to solve any problem. Therefore we need to input the data and instructions into the computers. The input unit consists of one or more input devices. Keyboard 8 is the one of the most commonly used input device. Other commonly used input devices are the mouse, floppy disk drive, magnetic tape, etc. All the input devices perform the following functions.

- Accept the data and instructions from the outside world.

- Convert it to a form that the computer can understand.

➢ Supply the converted data to the computer system for further processing.

B. Storage Unit:

The storage unit of the computer holds data and instructions that are entered through the input unit, before they are processed. It preserves the intermediate and final results before these are sent to the output devices. It also saves the data for the later use. The various storage devices of a computer system are divided into two categories.

1. **Primary Storage:** Stores and provides data very fast. This memory is generally used to hold the program being currently executed in the computer, the data being received from the input unit, the intermediate and final results of the program. The primary memory is temporary in nature. The data is lost, when the computer is switched off. In order to store the data permanently, the data has to be transferred to the secondary memory. Very small portion of primary storage memory is permanent is nature eg. ROM which holds the data permanent even if power off. The cost of the primary storage is more or compared to the secondary storage. Therefore most computers have limited primary storage capacity.

2. Secondary Storage: Secondary storage is used like an archive. It stores several programs, documents, databases etc. The programs that you run on the computer are first transferred to the primary memory before it is actually run. Whenever the results are saved, again they get stored in the secondary memory. The secondary memory is slower and cheaper than the primary memory. Some of the commonly used secondary memory devices are Hard disk, CD, etc.

C. Output Unit:

The output unit of a computer provides the information and results of a computation to outside world. Printers, Visual Display Unit (VDU) are the commonly used output devices. Other commonly used output devices are floppy disk drive, hard disk drive, and magnetic tape drive.

D. Arithmetic Logical Unit:

All calculations are performed in the Arithmetic Logic Unit (ALU) of the computer. It also does comparison and takes decision. The ALU can perform basic operations such as addition, subtraction, multiplication, division, etc. and does logic operations via, >, <, =, 'etc. Whenever calculations are required, the control unit transfers the data from storage unit to ALU once the computations are done, the results are transferred to the storage unit by the control unit and then it is send to the output unit for displaying results.

E. Control Unit:

It controls all other units in the computer. The control unit instructs the input unit, where to store the data after receiving it from the user. It controls the flow of data and instructions from the storage unit to ALU. It also controls the flow of results from the ALU to the storage unit. The control unit is generally referred as the central nervous system of the computer that control and synchronizes its working.

F. Central Processing Unit:

The control unit and ALU of the computer are together known as the Central Processing Unit (CPU). The CPU is like brain performs the following functions:

- It performs all calculations.
- It takes all decisions.
- It controls all units of the computer.

A PC may have CPU-IC such as Intel 8088, 80286, 80386, 80486, Celeron, Pentium, Pentium Pro, Pentium II, Pentium III, Pentium IV, Dual Core, and AMD etc.

Types of Computers

A. PC/desktop computers

Advantages

- Spare parts and connections tend to be standardized, which usually results in low costs.
- Desktops tend to have a better specification for a given price (often due to size and construction constrains in laptops)
- The large casing allows good dissipation of any heat build-up.

Disadvantages

- Desktops are not particularly portable since they are made up of separate components.
- All the components need to be hooked up by wiring, which can be quite complex and clutters up the desk space.
- Because they are not particularly portable, it is necessary to copy files, etc. When you want to do some work elsewhere

B. Laptop computers

Laptop (or notebook) refers to a type of computer where the monitor, keyboard, pointing device and processor are all together in one single unit
The key features are:

- low weight (to aid portability)
- low power consumption (and also long battery life)
- a processer that does not generate too much heat (cooling is very important).

Advantages

- They are very portable, since the monitor, pointing device, keyboard, processor and backing store units are all together in one single box.
- There are no trailing wires
- They can take full advantage of WIFI
- Since they are portable, they can link into any multimedia system

Disadvantages

Since they are portable, they are easy to steal!

- They have been limited battery life so the user may need to carry a heavy adaptor
- The keyboards and pointing devices can sometimes be awkward to use
- Heat dissipation is more difficult due to the structure of the laptop computers

C. Netbooks

Disadvantages

- Netbooks don't have optical drives
- The keyboards are only about 80 per cent the size of laptop keyboards
- They lack some of the features found in larger machines, principally due to the size constraints and to the fact that they are cheaper to purchase

D. Personal digital assistants

Advantages

- They can be used anywhere because of their size
- They are very lightweight and are more portable than laptop computers

Disadvantages

- It is difficult to enter text quickly.
- They have very limited capabilities due to the software and the operating system used

E. Mainframe computers

- The main features of main frame computers are as follows
- They can have several CPUs
- They have very fast processor speeds
- They can support multiple operating systems
- They have huge amounts of storage capacity
- They have huge internal memories
- They often operate using time sharing or batch processing

Advantages

- They can be used to do large jobs
- The very powerful facilities afforded
- They are capable of very large number crunching

Disadvantages

- Mainframe computers need to be permanently housed in a large room, so cannot be moved around
- They are very expensive to operate and maintain

2.1.3. Security, Future Trends and Challenges in Computer Systems

Security

Ensuring the confidentiality, integrity and availability of data in Computer System as we discussed in earlier chapter is crucial to safeguarding against cyber threats and attacks.

Future Trends in Computer Systems

1) Generative AI

Generative artificial intelligence (AI) is a type of artificial intelligence that can create new content, such as articles, images, and videos. Anyone who has used ChatGPT or Microsoft Copilot has toyed with generative AI. These AI models can summarize and classify information or answer questions because they have been trained to recognize patterns in data

2) Quantum Computing

Quantum computing operates on subatomic particles rather than a stream of binary impulses, and its bits, called qubits, can exist in more than one state simultaneously. It is much more powerful, but far less well-developed, than traditional computing. Should quantum computing become widely accessible, it would challenge current communication and cryptography practices.

3) Artificial Intelligence and Machine Learning

AIML stands for Artificial Intelligence Modelling Language. AIML is an XML based markup language meant to create artificial intelligent applications. AIML makes it possible to create human interfaces while keeping the implementation simple to program, easy to understand and highly maintainable.

4) IoT and Smart Devices

The internet of things, or IoT, is a network of interrelated devices that connect and exchange data with other IoT devices and the cloud. IoT devices are typically embedded with technology such as sensors and software and can include mechanical and digital machines and consumer objects.

IoT ecosystem consists of web-enabled smart devices that use embedded systems -- such as processors, sensors and communication hardware -- to collect, send and act on data they acquire from their environments.

5) Cloud Computing

Cloud computing is defined as the use of hosted services, such as data storage, servers, databases, networking, and software over the internet. Since cloud computing began, the world has witnessed an explosion of cloud-based applications and services in IT, which continue to expand. Almost every application we use resides on the cloud, helping us save storage space, expenses, and time. This article discusses the types of cloud computing and 10 trends to watch out for.

Challenges in Computer Systems

- Scalability and Performance
- Compatibility and Interoperability

- Failure to make organizational culture change to align with computer-based knowledge management systems.
- No support, commitment and accountability.
- The knowledge gap between the subject and knowledge management designers.
- Fast-changing nature of the technology.
- Shortage of skilled human resources.
- Failure to convert tacit and explicit information into systematic knowledge.
- The failure to comprehend the technologies complexity.

2.2. Overview of Operating System (O.S) and Software Application

2.2.1. Operating System & Software

An operating system is act as an intermediary between the computer and computer hardware. The purpose of an operating system is to provide an environment in which a user can execute programs in a convenient and efficient manner.
An operating system is software that manages the computer hardware. The hardware must provide appropriate mechanisms to ensure the correct operation of the computer system and to prevent user programs from interfering with the proper operation of the system.

Definition:

- An Operating system is a program that controls the execution of application programs and acts as an interface between the user of a computer and the computer hardware.
- A more common definition is that the operating system is the one program running at all times on the computer (usually called the kernel), with all else being applications programs.
- An Operating system is concerned with the allocation of resources and services, such as memory, processors, devices and information. The Operating System correspondingly includes programs to manage these resources, such as a traffic controller, a scheduler, memory management module, I/O programs, and a file system.

Features:

- An operating system is a program that acts as an interface between the software and the computer hardware.
- It is an integrated set of specialized programs that are used to manage overall resources and operations of the computer.
- It is specialized software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.

History of Operating System:

Operating systems have been evolving through the years.
Following table shows the history of OS.

Table 1. Historz od OS

Generation	Year	Electronic Devices used	Types of OS and Devices
First	1945-55	Vacuum tubes	Plug boards
Second	1955-65	Transistors	Batch Systems
Third	1965-80	Integrated Circuit (IC)	Multiprogramming
Fourth	Since 1980	Large Scale Integration	PC

Architecture

We can draw a generic architecture diagram of an Operating System which is as follows:

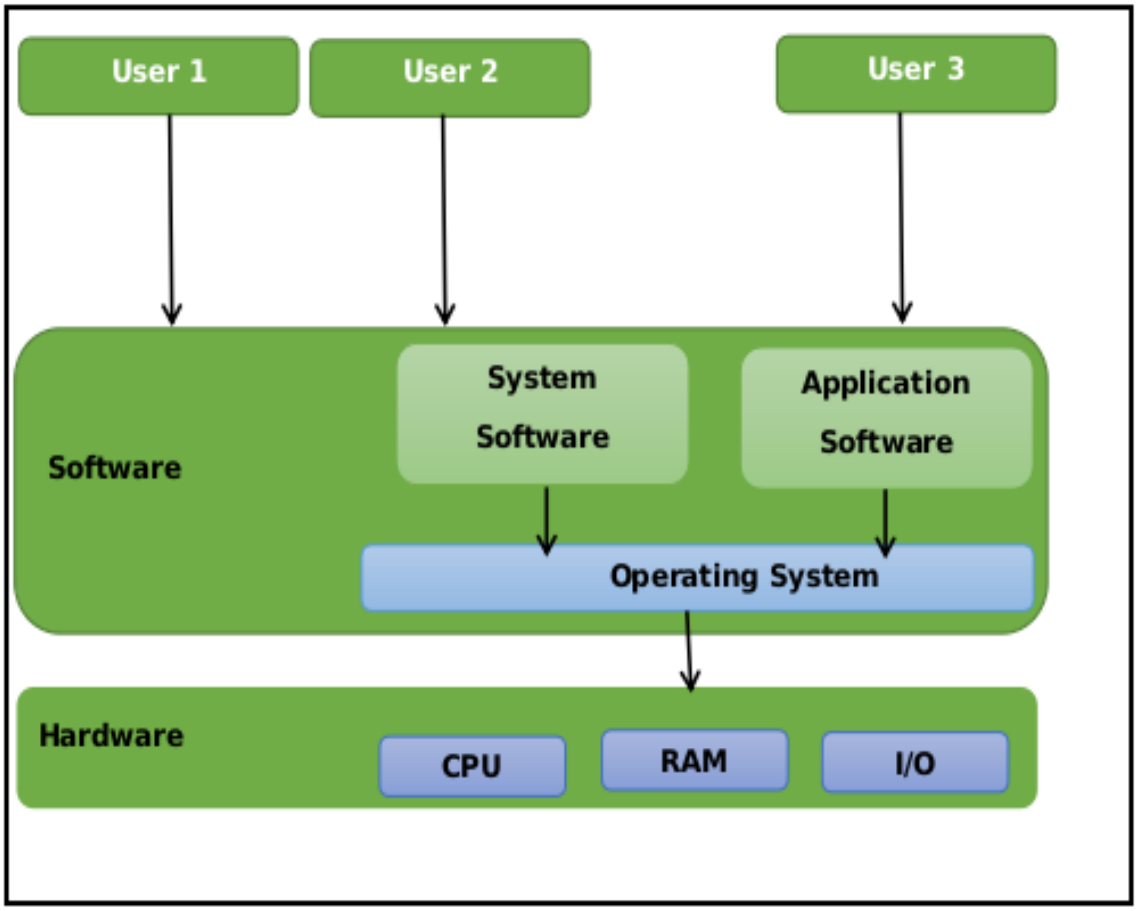

Figure 4. Generic Architecture Diagram of Operating System

Following are some of important functions of an operating System.

1. Memory Management
2. Processor Management
3. Device Management
4. File Management

Memory Management

Memory management refers to management of Primary Memory or Main Memory. Main memory is a large array of words or bytes where each word or byte has its own address.
Main memory provides a fast storage that can be accessed directly by the CPU. For a program to be executed, it must in the main memory. An Operating System does the following activities for memory management −

- Keeps tracks of primary memory, i.e., what part of it are in use by whom, what part are not in use.
- In multiprogramming, the OS decides which process will get memory when and how much.
- Allocates the memory when a process requests it to do so.
- De-allocates the memory when a process no longer needs it or has been terminated.

Processor Management

In multiprogramming environment, the OS decides which process gets the processor when and for how much time. This function is called process scheduling. An Operating System does the following activities for processor management

- Keeps tracks of processor and status of process. The program responsible for this task is known as traffic controller.
- Allocates the processor (CPU) to a process.
- De-allocates processor when a process is no longer required.

Device Management

An Operating System manages device communication via their respective drivers. It does the following activities for device management

- Keeps track of all devices. Program responsible for this task is known as the I/O controller.
- Decides which process gets the device when and for how much time.
- Allocates the device in the efficient way.
- De-allocates devices.

File Management

A file system is normally organized into directories for easy navigation and usage. These directories may contain files and other directions.
An Operating System does the following activities for file management

- Keeps track of information, location, uses, status etc. The collective facilities are often known as file system.
- Decides who gets the resources.
- Allocates the resources.
- De-allocates the resources.

Software applications:

Software Application is one of the type of software which runs or executes as per user request. High level languages such as java, c, c++ etc are used to develop the application software. Application software is a specific purpose software which is intended to perform some task

grouped together. Without an operating system application software can not be installed. It's examples are Photoshop, VLC media player, Mozilla Firefox, Opera, Google chrome etc.

Types of Software Application

Below are some types of Application Software.

1. **Freeware:** This application software is offered for free, as the name implies. Among the freeware programs are Adobe Reader, Yahoo Messenger, LibreOffice, and others.
2. **Open source:** These programs' source code is accessible to everyone, allowing for modifications and the addition of new features. Examples of open source software include the GIMP and the Apache web server.
3. **Shareware:** This software has a trial period during which it is free to download; after that, a fee is required to continue using it. Among the shareware applications are Winzip, Adobe Acrobat, Skype, and others.
4. **Custom software:** Software specifically created for a person or organization is known as custom software. Among the custom software solutions are e-commerce and fintech solutions.
5. **Packaged software:** Software that is packaged is software that consists of several related apps. The best illustration for this is Microsoft Office. Word, Excel, PowerPoint, Outlook, and other programs are included.

2.2.2. Data Storage and Memory

Basically, we want the programs and data to reside in main memory permanently.

This arrangement is usually not possible for the following two reasons:

1. Main memory is usually too small to store all needed programs and data permanently
2. Main memory is a volatile storage device that loses its contents when power is turned off or otherwise lost.

There are two types of storage devices:

1. **Volatile Storage Device –** It loses its contents when the power of the device is removed.
2. **Non-Volatile Storage device –** It does not loses its contents when the power is removed. It holds all the data when the power is removed.

Secondary Storage is used as an extension of main memory. Secondary storage devices can hold the data permanently.

Storage devices consists of Registers , Cache , Main-Memory , Electronic-Disk , Magnetic-Disk , Optical-Disk, Magnetic-Tapes.

Each storage system provides the basic system of storing a datum and of holding the datum until it is retrieved at a later time.

All the storage devices differ in speed, cost, size and volatility. The most common Secondary-storage device is a Magnetic-disk, which provides storage for both programs and data.

In this fig Hierarchy of storage is shown

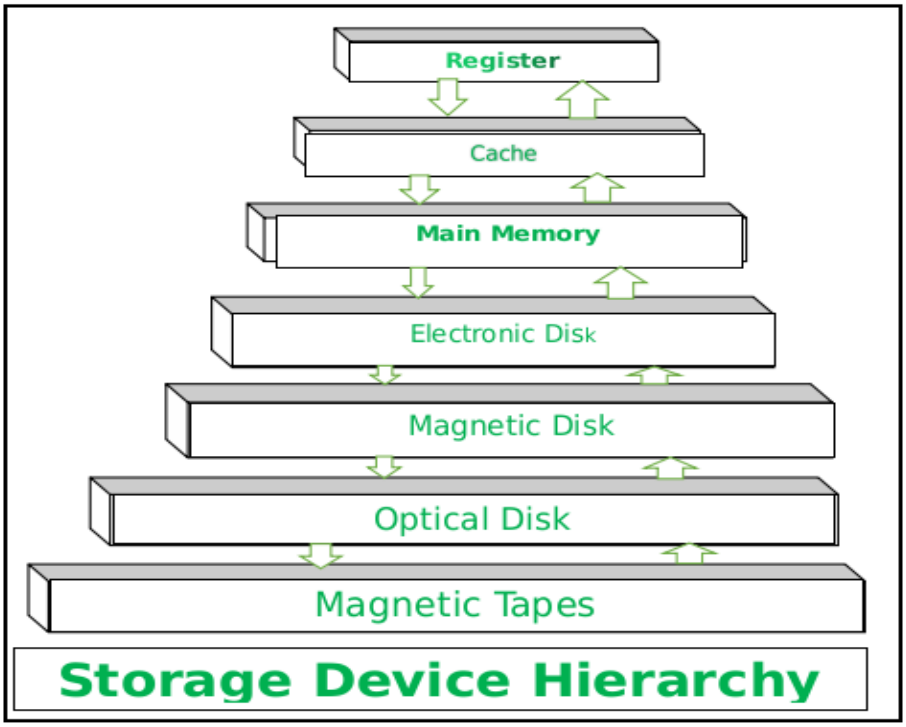

Figure 5. Storage Device Hierarchy

- In this hierarchy all the storage devices are arranged according to speed and cost. The higher levels are expensive, but they are fast. As we move down the hierarchy, the cost per bit generally decreases, where as the access time generally increases.
- The storage systems above the Electronic disk are Volatile, where as those below are Non-Volatile.
- An Electronic disk can be either designed to be either Volatile or Non-Volatile. During normal operation, the electronic disk stores data in a large DRAM array, which is Volatile. But many electronic disk devices contain a hidden magnetic hard disk and a battery for backup power. If external power is interrupted, the electronic disk controller copies the data from RAM to the magnetic disk. When external power is restored, the controller copies the data back into the RAM.
- The design of a complete memory system must balance all the factors. It must use only as much expensive memory as necessary while providing as much inexpensive, Non-Volatile memory as possible. Caches can be installed to improve performance where a large access-time or transfer-rate disparity exists between two components.

2.3. Introduction to Computer Networks and Protocols

2.3.1. Computer Networking Fundamentals

What is a Computer Network?

- "A Computer Network is defined as a set of two or more computers that are linked together either via wired cables or wireless networks i.e., WiFi with the purpose of communicating, exchanging, sharing or distributing data, files and resources."

- On internet you'll be able to do chatting and exchange of information with many services offered by it. As internet is collection of computers where several computers grouped together share their data, the results of such sharing will led to spread of virus on host computer, that the user download any infectious attachment send by someone.
- Network is usually the connection between the Sender and also the Receiver

The figure shows two people sitting in a network.

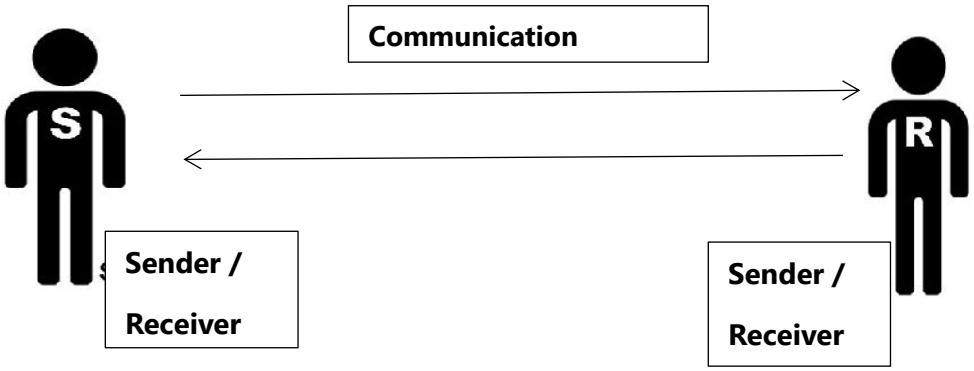

Figure 6. Networks

The general network comprises of:

- Sender
- Communication Channel Medium
- Receiver

A computer network is an interconnection of two or more computer systems located at the same or different places. It is a network that can connect two computers as shown in fig 1.4.

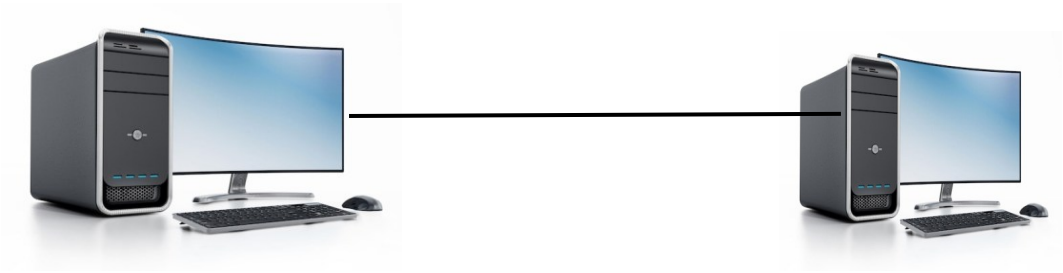

Figure 7. Computer in Network

A computer network is a collection of two or more connected computers. When these computers are joined in a network, people can share files and also share the peripheral devices such as modems, printers, tape backup drives, or CDROM drives as shown in figure.

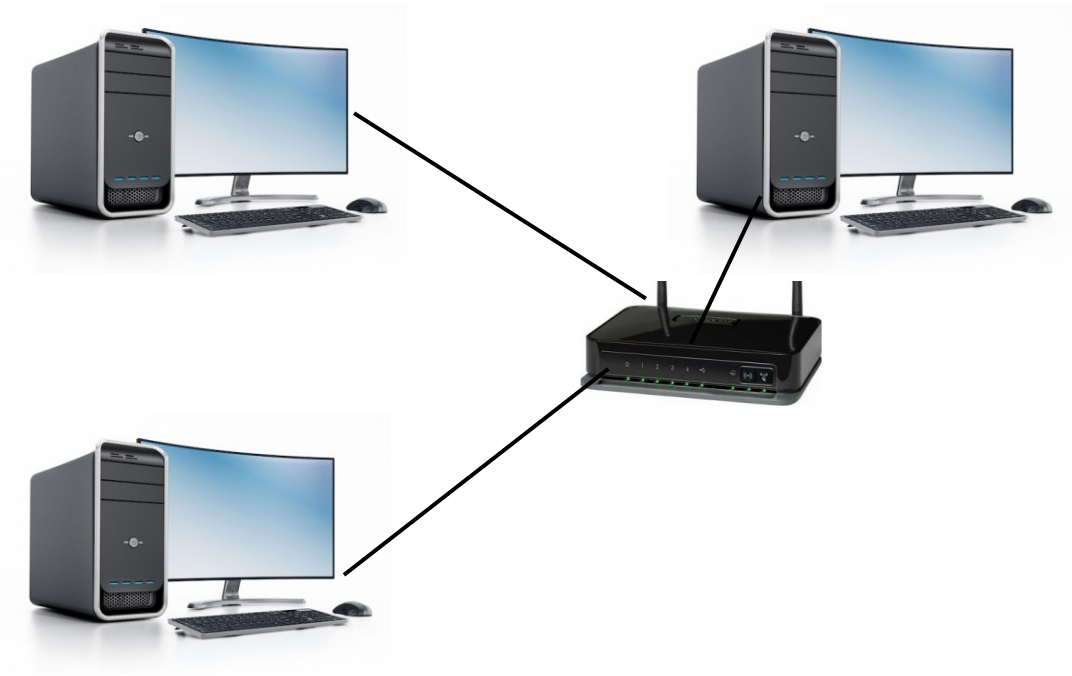

Figure 8. Network of Computers

Computer network consist of:

- Two or more computers Server or Client workstation. ▪
- Networking Interface Card's (NIC) ▪
- A connection medium i.e. wires or wireless. ▪
- Network Operating system software, such as Microsoft Windows NT or 2000, Novell NetWare, UNIX and Linux.

2.3.2. Network Types

Below are the most common computer network types that are frequently used these days:

- LAN [Local Area Network}
- WLAN [Wireless local area network]
- CAN [Campus Area Network]
- MAN [Metropolitan Area Network]
- PAN [Personal Area Network]
- SAN [Storage Area Network]
- VPN [Virtual Private Network]
- WAN [Wide Area Network]

1. LAN

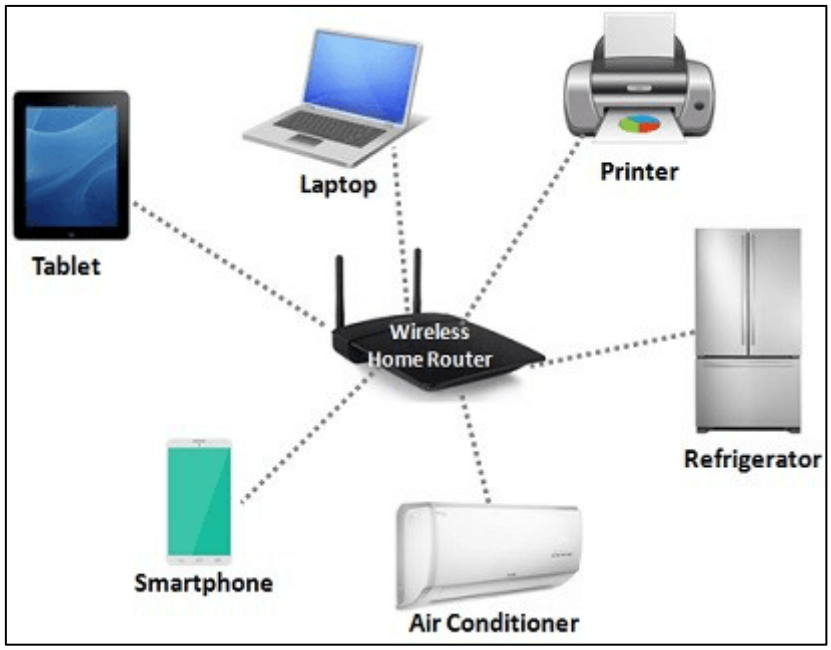

Figure 9. Local Area Network

LAN or Local Area Network is a group of devices connecting the computers and other devices such as switches, servers, printers, etc., over a short distance such as office, home. The commonly used LAN is Ethernet LAN. This network is used as it allows the user to transfer or share data, files, and resources.

2. WLAN

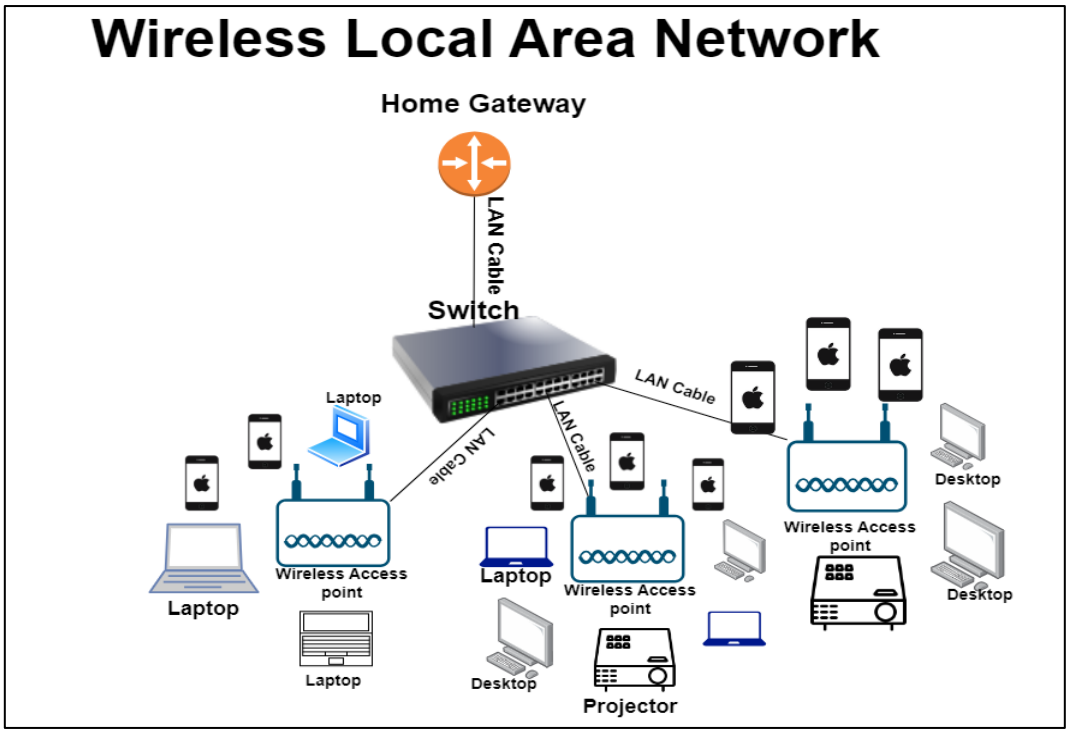

Figure 10. Wireless local area network

WLAN or Wireless local area network is similar to LAN with the difference that it uses wireless communication between devices instead of wired connections. WLAN typically involves a Wi-Fi router or wireless access point for devices, unlike smartphones, laptops, desktops, etc.

3. **CAN**

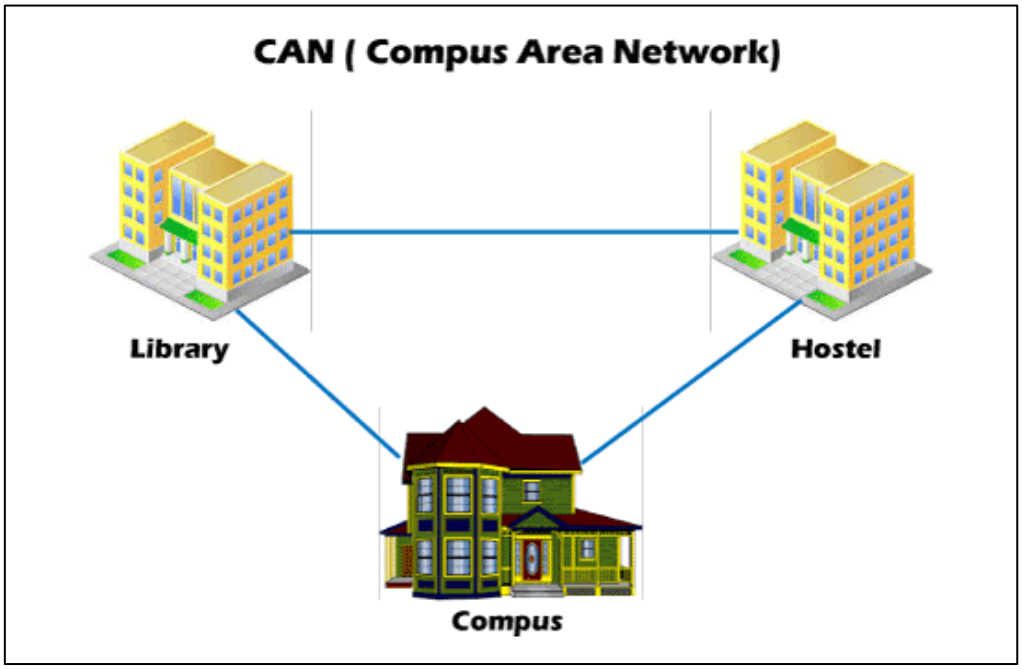

Figure 11. Campus Area Network

4. MAN

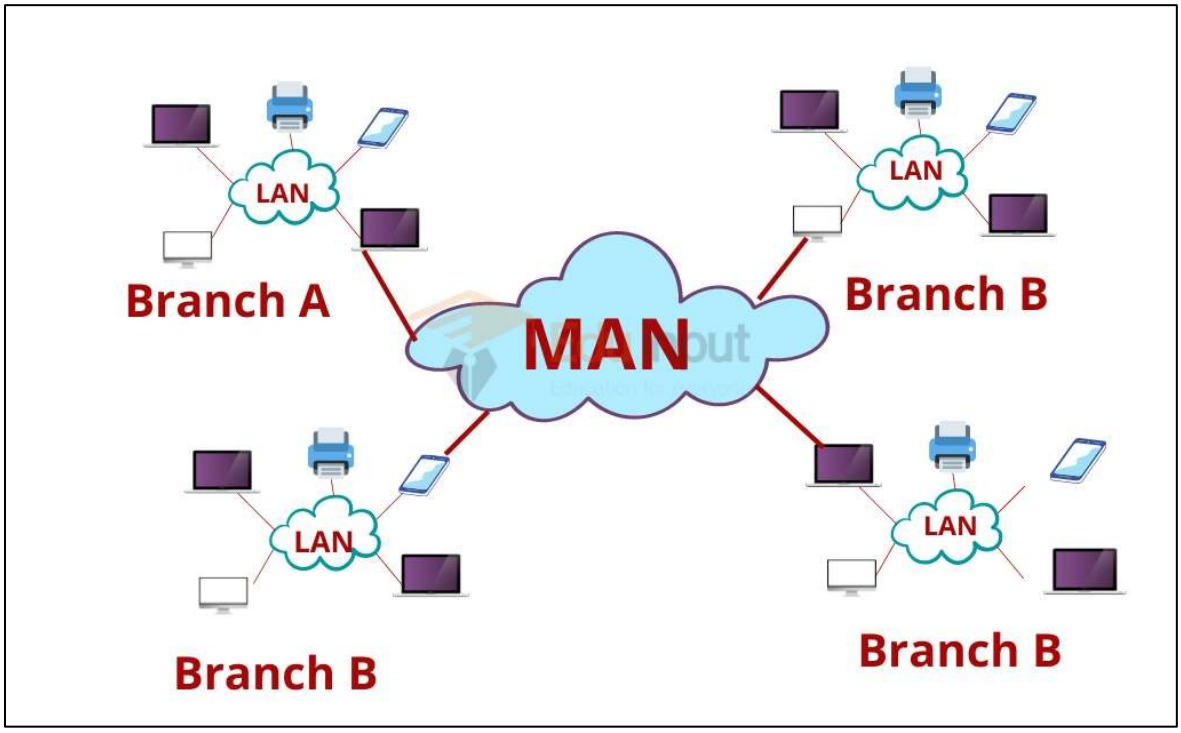

Figure 12. Metropolitan Area Network

MAN or Metropolitan Area Network is typically a more extensive network when compared to LANs but is smaller than WANs. This network ranges between several buildings in the same

city. Man networks are connected via fiber optic cable (usually high-speed connection). Cities and government bodies usually manage MANs.

5. PAN

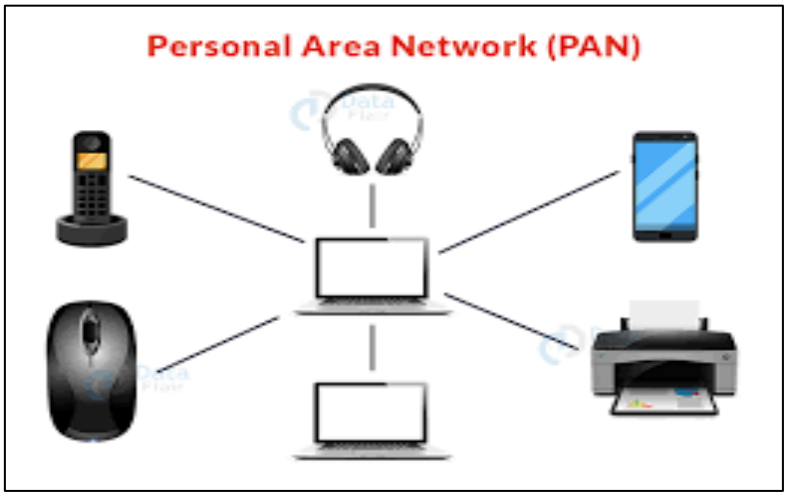

Figure 13. Personal Area Network

PAN or Personal Area Network is a type of network used personally and usually serves one person. This network usually connects devices unlike your smartphones, laptop, or desktop to sync content and share small files, unlike songs, photos, videos, calendars, etc. These devices connect via wireless networks such as Wi-Fi, Bluetooth, Infrared, etc

6. SAN

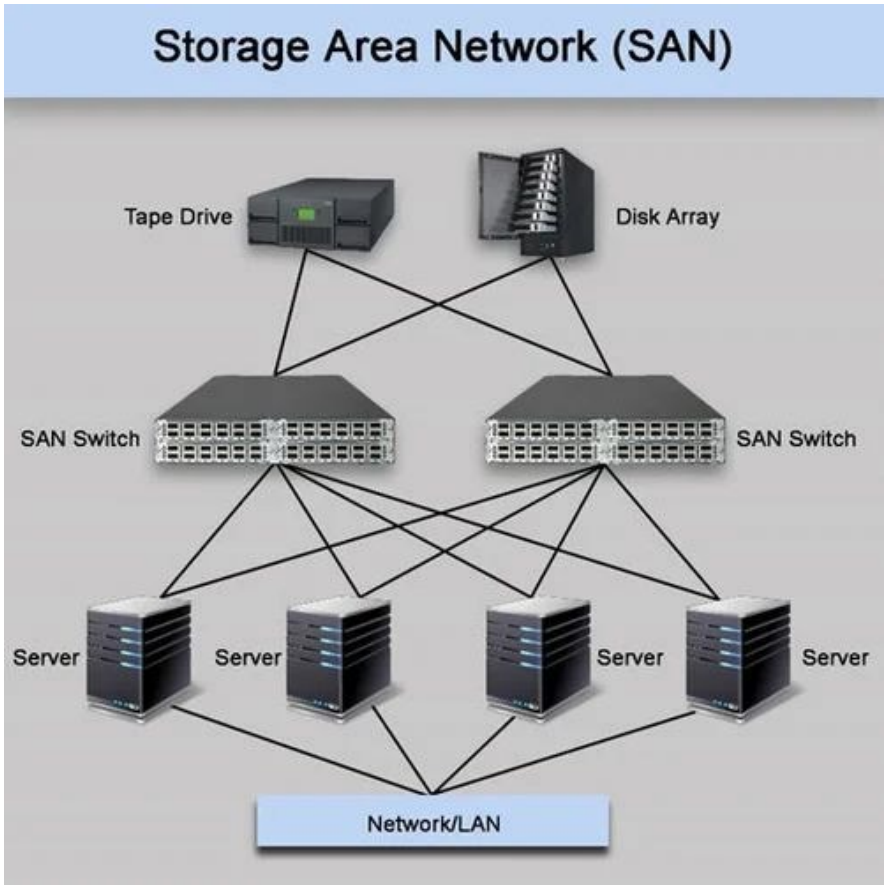

Figure 14. Storage Area Network

SAN or Storage Area Network is a specialized high-speed network that stores and provides access to block-level storage. It is a dedicated shared network that is used for cloud data storage that appears and works like a storage drive.

SAN consists of various switches, servers, and disks array. One of the advantages of SAN is that it is fault-tolerant, which means if any switch or server goes down, the data can still be accessed.

7. VPN

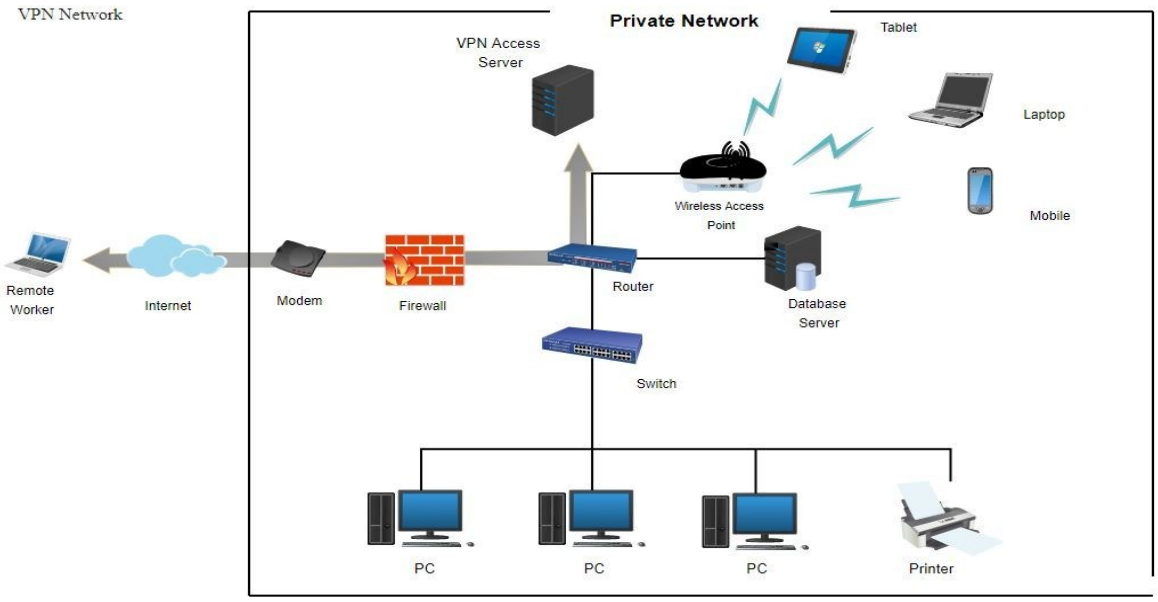

Figure 15. Virtual Private Network

VPN or Virtual Private Network is a secure tool that encrypts point-to-point Internet connection and hides the user's IP address and virtual location. It determines an encrypted network to boost user's online privacy so as their identity and data are inaccessible to hackers.

8. WAN

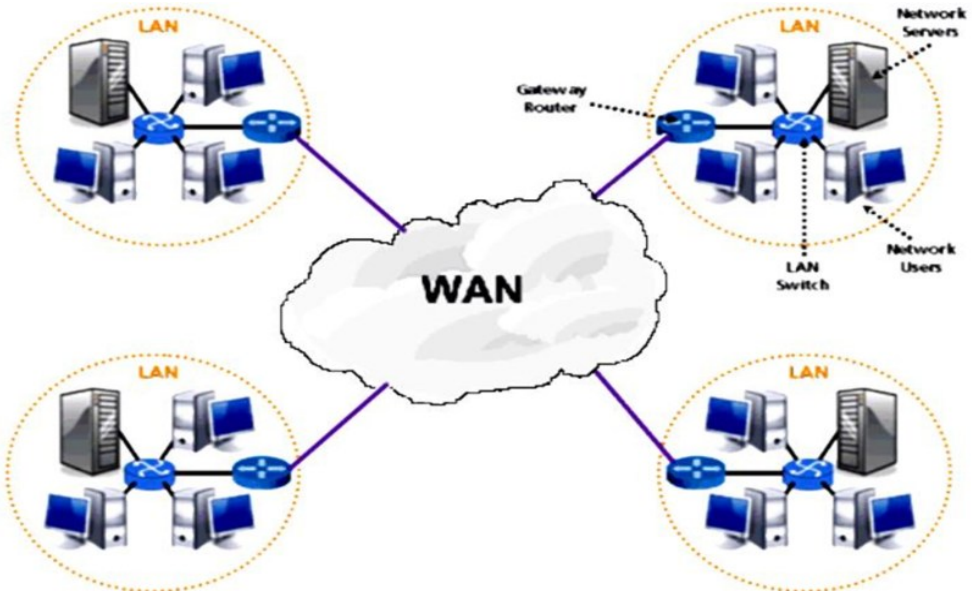

Figure 16. Wide Area Network

WAN or Wide Area Network is the most significant network type connecting computers over a wide geographical area, such as a country, continent. WAN includes several LANs, MANs, and CANs. An example of WAN is the Internet, which connects billions of computers globally.

2.3.3. Network Protocols

Communication protocols are really important for the functioning of a network. They are so crucial that it is not possible to have computer networks without them. These protocols formally set out the rules and formats through which data is transferred. These protocols handle syntax, semantics, error detection, synchronization, and authentication. Below mentioned are some network communication protocol:

1. Hypertext Transfer Protocol (HTTP)

It is a layer 7 protocol that is designed for transferring a hypertext between two or more systems. HTTP works on a client-server model, most of the data sharing over the web is done through using HTTP.

2. Transmission Control Protocol (TCP)

TCP layouts a reliable stream delivery by using sequenced acknowledgment. It is a connection-oriented protocol i.e., it establishes a connection between applications before sending any data. It is used for communicating over a network. It has many applications such as emails, FTP, streaming media, etc.

3. User Datagram Protocol (UDP)

It is a connectionless protocol that lay-out a basic but unreliable message service. It adds no flow control, reliability, or error-recovery functions. UPD is functional in cases where reliability is not required. It is used when we want faster transmission, for multicasting and broadcasting connections, etc.

4. Border Gateway Protocol (BGP)

BGP is a routing protocol that controls how packets pass through the router in an independent system one or more networks run by a single organization and connect to different networks. It connects the endpoints of a LAN with other LANs and it also connects endpoints in different LANs to one another.

5. Address Resolution Protocol (ARP)

ARP is a protocol that helps in mapping logical addresses to the physical addresses acknowledged in a local network. For mapping and maintaining a correlation between these logical and physical addresses a table known as ARP cache is used.

6. Internet Protocol (IP)

It is a protocol through which data is sent from one host to another over the internet. It is used for addressing and routing data packets so that they can reach their destination.

7. Dynamic Host Configuration Protocol (DHCP)

it's a protocol for network management and it's used for the method of automating the process of configuring devices on IP networks. A DHCP server automatically assigns an IP address and various other configurational changes to devices on a network so they can communicate with

other IP networks. it also allows devices to use various services such as NTP, DNS, or any other protocol based on TCP or UDP.

2.3.4. Network Security

These protocols secure the data in passage over a network. These protocols also determine how the network secures data from any unauthorized attempts to extract or review data. These protocols make sure that no unauthorized devices, users, or services can access the network data. Primarily, these protocols depend on encryption to secure data.

1. Secure Socket Layer (SSL)

It is a network security protocol mainly used for protecting sensitive data and securing internet connections. SSL allows both server-to-server and client-to-server communication. All the data transferred through SSL is encrypted thus stopping any unauthorized person from accessing it.

2. Hypertext Transfer Protocol (HTTPS)

It is the secured version of HTTP. this protocol ensures secure communication between two computers where one sends the request through the browser and the other fetches the data from the web server.

3. Transport Layer Security (TLS)

It is a security protocol designed for data security and privacy over the internet, its functionality is encryption, checking the integrity of data i.e., whether it has been tampered with or not, and authentication. It is generally used for encrypted communication between servers and web apps, like a web browser loading a website, it can also be used for encryption of messages, emails, and VoIP.

Reference Books:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.
3. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
4. Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC PressT&FGroup

Reference Links:

1. https://www.researchgate.net/publication/258339295_FUNDAMENTALS_OF_COMPUTER_STUDIES
2. https://www.researchgate.net/publication/358784151_Fundamentals_of_computer_systems

Question Answers

Q.No. 01 **Marks**

Question: What are the main components of a computer system? **05**

Answer: 1. Motherboard. ...

2. Central Processing Unit (CPU) ...

3. Graphical Processing Unit (GPU) ...

4. Random Access Memory (RAM) ...

5. Storage device.

Q. No.02 **05**

Question: Elaborate the challenges in computer systems.

Answer: Challenges in computer system:-

- Scalability and Performance
- Compatibility and Interoperability
- Failure to make organizational culture change to align with computer-based knowledge
- management systems.
- No support, commitment and accountability.
- The knowledge gap between the subject and knowledge management designers.

Q. No. 03 **05**

Question: Describe various types of computers.

Answer: Types of computers is given below:

- PC/desktop computers
- Laptop computers
- Netbooks
- Personal digital assistants
- Mainframe computers

Q. No. 04 **05**

Question: Define Operating System and discuss the features of operating system.

Answer: Definition:- An Operating system is a program that controls the execution of application programs and acts as an interface between the user of a computer and the computer hardware.

Features of Operating System:-

1. An operating system is a program that acts as an interface between the software and the computer hardware.

2. It is an integrated set of specialized programs that are used to manage overall resources and operations of the computer.

3. It is specialized software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.

Q. No. 05 **05**

Question: Explain the functions of the operating system.

Answer: Following are some of the important functions of an operating System.

1. Memory Management

Memory management refers to management of Primary Memory or Main Memory. Main memory is a large array of words or bytes where each word or byte has its own address.

2. Processor Management

In a multiprogramming environment, the OS decides which process gets the processor when and for how much time. This function is called process scheduling.

3. Device Management

An Operating System manages device communication via their respective drivers.

4. File Management

A file system is normally organized into directories for easy navigation and usage.

Q. No. 06 **05**

Question: Restate Software Application with the help of various types of software application.

Answer: Software Application is one of the types of software which runs or executes as per user request.Application software is a specific purpose software which is intended to perform some task grouped together. Without an operating system application software can not be installed. Its examples are Photoshop, VLC media player, Mozilla Firefox, Opera.

Types of Software Application:-

1. Freeware
2. Open Source
3. Shareware
4. Custom Software
5. Package Software

Q. No. 07 **05**

Question: What is a Computer Network?

Answer: A Computer Network is defined as a set of two or more computers that are linked together?either via wired cables or wireless networks i.e., WiFi with the purpose of communicating, exchanging, sharing or distributing data, files and resources.

On the internet you'll be able to chat and exchange information with many services offered by it. As

internet is collection of computers where several computers grouped together share their data, the results of such sharing will led to spread of virus on host computer, that the user download any infectious attachment send by someone.

Q. No. 08 **05**

Question: List the various types of network.

Answer: Types of Network:-

- LAN [Local Area Network}
- WLAN [Wireless local area network]
- CAN [Campus Area Network]
- MAN [Metropolitan Area Network]
- PAN [Personal Area Network]
- SAN [Storage Area Network]
- VPN [Virtual Private Network]
- WAN [Wide Area Network]

Q. No. 09 **05**

Question: Discuss the network protocol with the help of different types.

Answer:

1 Hypertext Transfer Protocol(HTTP)

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Q. No. 10

Question: Explain the network security.

Answer: These protocols secure the data in passage over a network. These protocols also determine how the network secures data from any unauthorized attempts to extract or review data. These protocols make sure that no unauthorized devices, users, or services can access the network data. Primarily, these protocols depend on encryption to secure data.

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