INVENTYOURSHIT.COM

Computer Basics for Noobs

By ARCH1T3CT

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The Author

HELLO THERE! I'M ARCH1TECT.

HACKER, ARTIST AND PHILOSPHER

Welcome to my world of hacking and nuisance. I am a skilled hacker, certified in **OSCP**, **CySA+**, and **Security+**, with a passion for securing digital environments and solving complex cybersecurity challenges. With a knack for problem-solving and a deep understanding of network security, I have dedicated my career to staying one step ahead of cyber threats.

In addition to my hacking expertise, I am also the proud founder of **InventYourShit**, a cybersecurity edtech startup aimed at educating and empowering the next generation of cyberjunkies. Through this platform, I hope to share my knowledge and experience with aspiring cybersecurity professionals, helping them build the skills needed to protect against evolving threats in the digital landscape.

My dedication to the cybersecurity field has not gone unnoticed, as I have been recognized as one of the top 5000 hackers globally on TryHackMe, showcasing my ability to navigate and exploit secure systems with precision and expertise.

Join me on this thrilling journey as we delve into the world of hacking, Red-Teaming, and cybersecurity. Together, we can uncover the secrets of digital offense and build a safer, more secure online world.

Stay curious, stay informed, and always be ready to invent your shit.

Why are the fundamentals important?

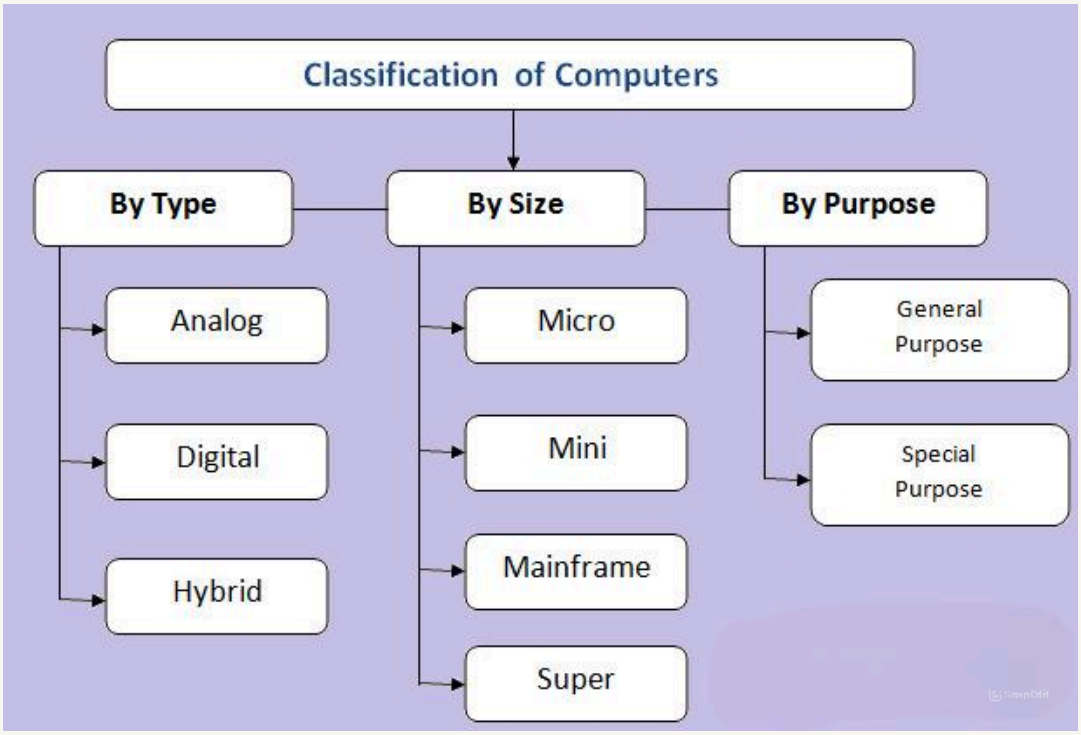
Computer fundamentals are crucial for students to understand as they form the basis of all technological systems and processes. A solid understanding of computer fundamentals allows students to navigate the digital world effectively, from using software programs for academic and professional tasks to troubleshooting common issues that may arise. Knowledge of computer fundamentals can also open up a wide range of career opportunities in technology-driven fields, as employers increasingly seek candidates with strong technical skills. Additionally, understanding computer fundamentals can enhance students' problem-solving abilities and critical thinking skills, as they learn to analyze and interpret data, create algorithms, and develop solutions to complex problems. In today's technology-driven society, computer fundamentals are essential for students to excel in both their academic and professional pursuits.

To embark any journey in the technical field. Once must understand the bare-bones of the system there are operating on. If talking about multi specialization field like cybersecurity. This makes even more important as we cannot penetrate into a system, which we does not understand fully. On that note, let’s set our ship to sail on the learning oath, starting our with the basics.

An expert in anything was once a beginner !!!

Classification of Computers

A computer can be classified based on its size, capacity, and purpose. The following diagram illustrates different types of computers as per their size, capacity, and purpose.



COMPUTER'S CLASSIFICATION BASED ON SIZE

As per the size, a computer can be broadly classified as follows −

- Micro Computer
- Mini Computer
- Mainframe Computer
- Super Computer

MICRO COMPUTER

Microcomputers, also known as personal computers (PCs), are a type of computer designed for individual use. They are distinguished by their compact dimensions, small size, processing power, compatibility, internet connectivity, portability, low price, and versatility. In the 1970s and 1980s, microcomputers gained popularity and became more popular in the modern computing era.

- **Size** – Microcomputers are small in size. These are portable.
- **Example** – Some of the popular microcomputers are laptops and desktops, standard PCs, mobile phones, and notebooks.
- **Why microcomputer ?** - Microcomputers have become an important part of modern life. They have had a big impact on society, companies, education, and related areas.
- **Uses of Microcomputers** – Microcomputers are most widely used in education and learning, entertainment and media, innovation and creativity, research and science, healthcare and medicine, home automation, remote work, and e-commerce and online shopping.

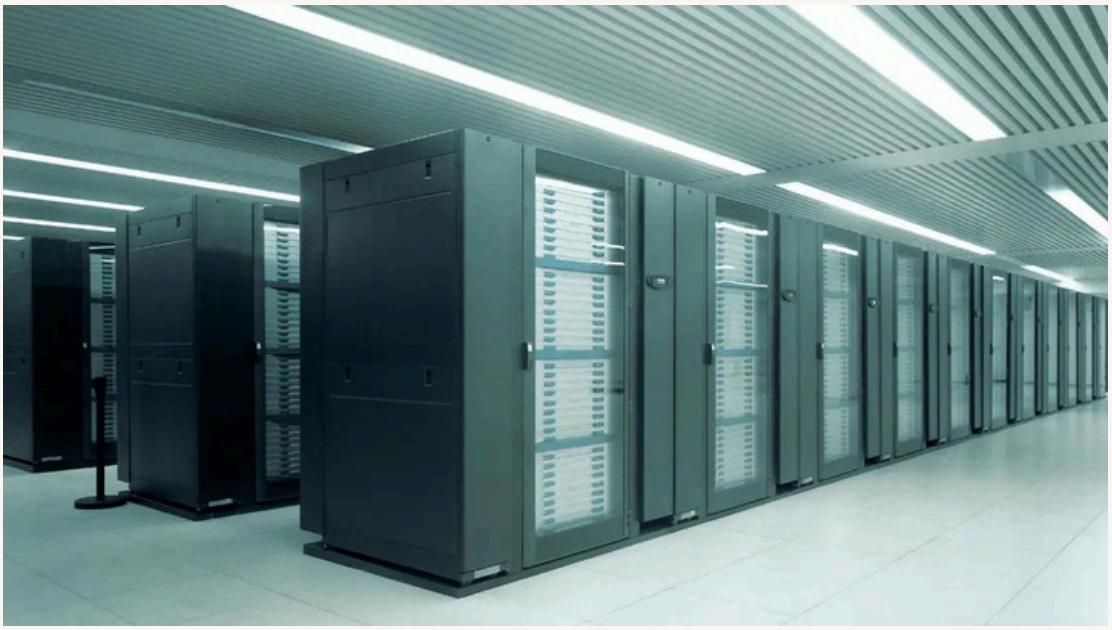
MINICOMPUTER

A minicomputer is a type of computer that is smaller in size than large computers. It possesses all the capabilities of a large computer. Hence, it is a midsize multi-processing system capable of supporting up to 250 users simultaneously.

- **Size** – Its size falls between mainframes and microcomputers. It is larger than mainframe computers and smaller than microcomputers.
- **Example** – Some of the popular minicomputers are the PDP-11, IBM's AS/400e, Honeywell 200, and TI-990.
- **Why a Mini Computer?** - Mini computers are also known as mini PCs or small-form-factor (SFF) computers. These have impressive computing capabilities, high performance, connectivity options, portability, and versatility features.
- **Uses of Minicomputers –** Minicomputers are most widely used in scientific computations, engineering, business transaction processing, file handling, and database management.

MAINFRAME COMPUTER

The mainframe is very large and is an expensive computer capable of supporting hundreds or even thousands of users simultaneously. The mainframe executes many programmes concurrently and supports simultaneous execution of programmes.



- **Size** – Mainframe computers can vary in size; their size generally depends on their specifications and the specific model being considered.

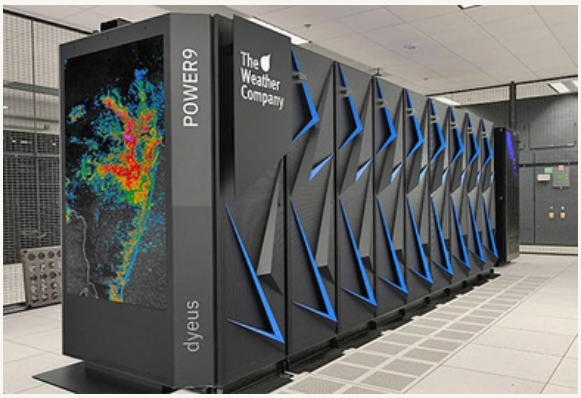
- **Example** – Some of the popular mainframe computers are IBM zSeries mainframes (BM z14 and IBM z15), Unisys ClearPath, Fujitsu GS21 Series, and Hitachi VOS3.

- **Why a mainframe computer?** - The processing capacity of mainframes is frequently measured in MIPS (million instructions per second) or other units. This enables them to process a large volume of transactions and perform extensive data processing.

- **Uses of the Mainframe** – Mainframe computers are most widely used in finance, government, healthcare, and more.

SUPERCOMPUTER

A supercomputer is a special type of computer that is more powerful and capable of high-performance computing. It is specifically designed to compute complex and intensive tasks that regular computers cannot do efficiently.



- **Size** - Supercomputers can vary in size, from small clusters of computers to massive installations. A supercomputer may contain 10, 100, 1000, or more computers that all work together.

- **Example** - Some of the popular supercomputers are Fugaku, Google Sycamore, Baidu's quantum supercomputer, and Sierra.

- **Why Supercomputer?**

    - A supercomputer's processing speed is exceptional and can perform billions of calculations per second. Multiple processors work in parallel mode to execute tasks, which makes processing powerful.
    - Supercomputers are specially built using specialised hardware like GPUs (Graphics Processing Units) or TPUs (Tensor Processing Units), which are used in graphics rendering or machine learning tasks.
    - Supercomputers represent the pinnacle of computing power, and these are very expensive and are employed for specialised applications.

- **Uses of the Supercomputer** - Supercomputers are most widely used in scientific research, data analysis, weather forecasting, scientific simulations, graphics, fluid dynamic calculations, nuclear energy research, electronic design, and the analysis of geological data.

COMPUTER'S CLASSIFICATION BASED ON CAPACITY

As per the capacity, a computer can be broadly classified as follows –

- Analog Computer
- Digital computer
- Hybrid computer

ANALOG COMPUTER

A computer that uses physical means like mechanical or hydraulic components to do the computation rather than electronic circuits is called an analogue computer. These computers work with continuous data and can manage physical quantities efficiently. They are particularly good at solving differential equations and simulating dynamic systems.

In lieu of numbers, an analogue computer performs arithmetic operations based on measurable quantities, such as mechanical movement or the rotation of gears. In analogue computers, data is processed as continuous signals for its operation, whereas in digital computers, data is transmitted as discrete signals (or discontinuous signals).

DIGITAL COMPUTER

A digital computer is a type of computer that represents and processes data using discrete, distinct values.

In digital computers, data is processed using binary numbers 0 and 1. These computers are designed to perform arithmetic calculations and complex data processing and manipulation. The main components of a digital computer are input, processing, and output.

HYBRID COMPUTER

A hybrid computer is a type of computer system that integrates the features and capabilities of both analogue and digital computers. This integration allows the hybrid computer to perform various tasks efficiently by leveraging the strengths of both digital and analogue technologies.

The main components of a hybrid computer are the analogue and digital components –

- **Analog Component** – Analogue components in a hybrid computer can process real-world data like voltage, current, temperature, pressure, etc. using analogue circuits and components.

- **Digital Component** – Digital computers work with discrete data and are based on binary numbers (0s and 1s). Digital components in a hybrid computer provide the computational power to perform complex calculations and control the overall operation of the system.

COMPUTER'S CLASSIFICATION BASED ON PURPOSE

As per the capacity, a computer can be broadly classified as follows –

- Special Purpose
- General Purpose

SPECIAL PURPOSE COMPUTER

A computer that is designed and optimised for a specific task or set of tasks is called a special purpose computer (SPC). SPCs are designed to excel at a single or limited set of functions, frequently with a high degree of efficiency, speed, and accuracy.

Some of the following popular SPCs are:

- **Embedded Systems** – These systems are integrated with devices to control specific functions. For example, a car's engine control unit and microwave ovens
- **Digital Signal Processors** – These are commonly used in applications like audio processing, image compression, and telecommunications.
- **Automated Teller Machines** – ATMs are special-purpose computers designed specifically for banking transactions and interactions with customers.
- **Medical Equipment** – Machines like MRI and CT scanners are specialized computers used for capturing and processing medical images.
- **Spacecraft Computers** – Computers used in spacecraft have to operate in extreme conditions and are optimised for the demands of space missions.

GENERAL PURPOSE COMPUTER

A computer that is designed to perform a wide range of tasks and functions is called A General Purpose Computer (GPC). A GPC is versatile and can be used for various purposes by running different software and applications.

Some of the following popular GPCs are as –

- **Turing Completeness** – A GPC can simulate any algorithm or computation that can be explored algorithmically.
- **Programmability** – GPCs can run different applications.
- **General-Purpose Operating System** – GPCs like Windows, macOS, or Linux that provide an interactive user interface and manage hardware resources, enabling the execution of various application programmes.
- **Input and Output Capabilities** – GPCs have input and output devices (keyboard, mouse, monitor, etc.) that permit users to interact with the system and receive feedback.

History & Evolution

The history of computers is a fascinating journey that spans centuries of innovation and technological advancement. Below mentioned table summarizes the historical development of a computer –

Time	Devices invented	Description
3000 BCE	Abacus	This is the earliest computing device. This was used to do basic arithmetic calculations. In this computer, beads were moved along rods to represent numbers.
17th century	Mechanical Calculators (Pascaline and Stepped Reckoner)	Mechanical methods were introduced to perform arithmetic calculations. Mechanical calculators are devices that perform mathematical calculations using mechanical mechanisms rather than electronic components. These calculators were widely used before the advent of electronic calculators and computers. The popular devices of this century were Pascaline and Stepped Reckoner.
18th century	Mechanical computer (Step Reckoner, Turk's Head, Difference Engine, Analytical Engine).	Mechanical devices and ideas that were important precursors to the development of computers and automation were introduced. It uses mechanical components, such as gears, levers, and switches, to perform calculations and process information. The popular mechanical devices developed during 18th century were Step Reckoner, Turk's Head, Difference Engine, Analytical Engine.

19th century	Electromechanical Computers Devices like the Z3, Mark I ENIAC (1945) Stored-Program Computers (1940s-1950s) Transistors and Integrated Circuits (1950s-1960s) Minicomputers (1960s-1970s) Microprocessors and Personal Computers (1970s-1980s) Graphical User Interfaces (1980s-1990s) Internet and World Wide Web (1990s)	Computers developed during 19th century were crucial in shaping the concepts and ideas that eventually led to the creation of the computers we use today. Most of the devices were based on the combination of mechanical and electrical switches to perform computation. The 19th century was the time where invention of computing devices was more and more. The size of computer was reduced and the devices with large storage and high computations were introduced. Interconnectivity with multiple devices and data sharing, remote accessing were recorded as the features of the computers which makes it popular in the world and make the computer as most demandable computing device in the world.
20th century	Laptops, Smartphones, and Tablets (2000s-Present) Cloud Computing and AI(Most demandable in cutting edge technology)	20th century is the time where computer technology is the next level. Portable and light weighted high computing devices are introduced and in trend. Cloud Computing technology makes the internet as a more useful platform to keep the data centralise in terms of accessing and its computation on server.

System Characteristics

The characteristics of the computer system are as follows –

- **Speed** – A computer can process millions (1,000,000) of instructions per second. The time taken by computers for their operations is microseconds and nanoseconds. Hence, a computer works with high speed during the execution of Mathematical & logical computations.

- **Accuracy** – Computers perform calculations with 100% accuracy. Errors may occur due to data inconsistency or inaccuracy. High accuracy indicates that a computer is performing its tasks correctly and producing reliable results. 100% accuracy depends on algorithm, data quality, hardware connectivity, and inherent uncertainties in the tasks being performed.

- **Diligence** – A computer can perform millions of tasks or calculations with the same consistency and accuracy. It doesn't feel any fatigue or lack of concentration. Hence, it can perform repetitive task without getting tired.

- **Versatility** – Versatility refers to the capability of a computer to perform different kinds of works with same accuracy and efficiency. Hence, a versatile computer can be used for different purposes. A versatile computer can support Software Compatibility, Operating System Support, Programming and Development, Multi-Tasking, Internet Connectivity, Media Handling, Hardware Compatibility, Customization, and can manage different types of applications and workloads.

- **Reliability** – A computer is reliable as it gives consistent result for similar set of data i.e., if we give same set of input any number of times, we will get the same result. Reliability is important to ensure safety, data integrity, and continuous operation. Reliability of a computer can be measured using Mean Time between Failures (MTBF), Mean Time to Failure (MTTF), Mean Time to Repair (MTTR), Availability (proportion of time a system is operational and accessible), and Failure Rate, Fault Tolerance(continuity of functioning even in the presence of hardware or software faults).

- **Automation** – Computer performs all the tasks automatically i.e. it performs tasks without manual intervention. The main aim of automation is to improve efficiency, accuracy, and consistency in different processes by reducing manual intervention in the system. Automation can lead to increased productivity, reduced errors, and cost savings.

- **Storage and Retrieval** – Memory is a storage device which stores data. The beauty of a computer is to execute the data in primary memory (RAM) whenever required. At the other side, data can permanently store to the secondary memory (Hard Disk) to the long time and a user can access it whenever they required; it does not delete the data until a user delete it.

- **Data Management and data analytics** – In digital world, data can be in various forms, such as text, numbers, images, audio, and video. A computer may process and manipulate this data efficiently and provides insightful results from text, numbers, images, audio, and video data. The analytical results are used in decision making and useful to frame the strategies for the organisations.

- **Connectivity** – The connectivity of computers enables data communication, resource sharing, and remote access to information and services.

- **Multitasking** – Modern computer systems support multitasking, which means parallel execution of tasks. During multitasking process, processor rapidly switches between tasks, and giving the illusion of simultaneous execution. Multicore processors enable simultaneous execution of multiple tasks.

- **Security and Privacy** – Modern computers are kept the data security, privacy of data to protect against unauthorized access, data breaches, and cyberattacks. For example -Biometric authentication, encryption, and secure boot protect the computer and user data.

- **Graphics Processing Unit (GPU)** – GPUs manages graphical tasks like gaming, multimedia, and computational related things like AI and machine learning.

Generations of Computers

The development of computers has gone through different generations, each generation marked by significant advancements in terms of technology and architecture. These generations are classified as follows:

- First generation
- Second generation
- Third generation
- Fourth generation
- Fifth generation

FIRST GENERATION

- The timeline for the first generation computers was 1940 to 1956.
- The first generation computers were developed using vacuum tube or thermionic valve machine.
- Punched cards and paper tape were used as input/output.
- Magnetic drums and magnetic tapes were used as a memory device to save the data.
- These computers were consuming lot of electricity because of vacuum tubes and other electronic devices and generate lot of heat.
- These were bigger in size and more expensive.
- These computers were worked on binary-coded concept (i.e., language of 0-1).
- Examples - ENIAC, EDVAC, etc.

SECOND GENERATION

- The timeline for the second generation computers was 1956 to 1963.
- Transistors were used to develop.
- In comparison to the first generation, second generation computers were small in size.
- Punched cards and magnetic tape were used for input /output.
- Electricity consumption was low and produces less heat.
- Magnetic core memory was used.
- Fast computing and were used in business, scientific research, and government applications.
- Examples – UNIVAC, IBM 1401, IBM 7090.

THIRD GENERATION

- The timeline for the third generation computers was 1963 to 1971.
- Integrated Circuit (IC) was used to develop.
- In comparison to the second generation, third generation computers were small in size.
- Magnetic tape, keyboard, monitor, printer devices were used as input and output.
- Computation power was higher as compare to second generation computers.
- The third generation computer consumed less power and also generated less heat.

- The maintenance cost of the computers in the third generation was also low as these were consuming less power and generated less heat.
- These were most widely used in commercial purposes.
- Examples – UNIVAC, IBM 360, IBM 370.

FOURTH GENERATION

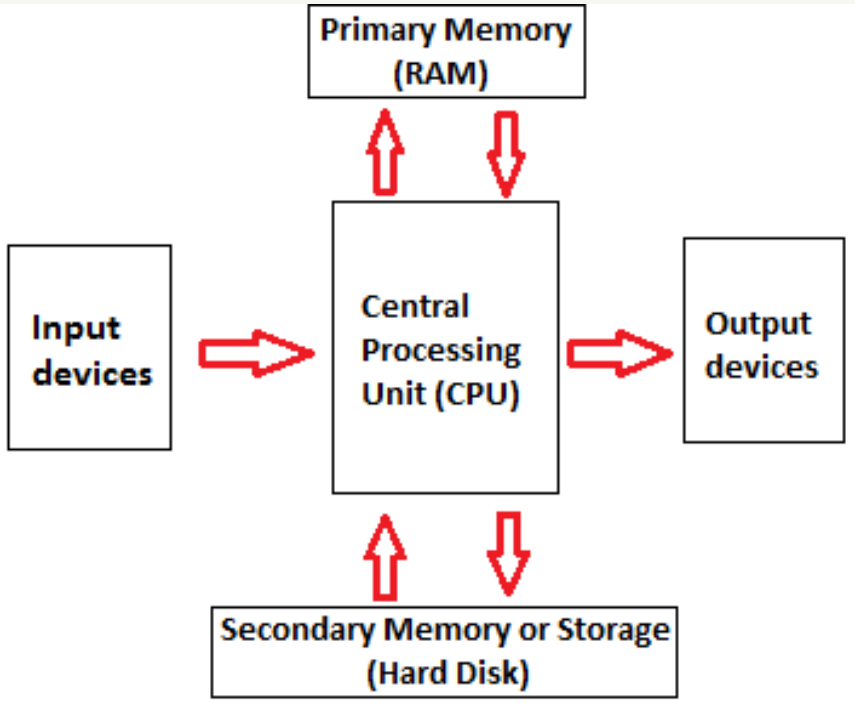
- The timeline for the fourth generation computers was 1972 to 2010.
- Microprocessor technology was used to develop.
- These were surprising in terms of size and computing power.
- Portable computers.
- Very less power consuming and affordable.
- Semiconductor memory such as RAM, ROM were used which makes computation faster.
- Keyboard, pointing devices, optical scanning, monitor, printer devices were used for input and output.
- It became available for the common people as well.
- Examples – IBM PC, STAR 1000, Apple.

FIFTH GENERATION

- The timeline for the fifth generation computers is form 2010 to till date.
- These computers are based on artificial intelligence, Ultra Large-Scale Integration (ULSI), Quantum computation, Nanotechnology, Parallel processing technology.
- Very fast and multiple tasks could be performed simultaneously.
- These are smaller in size as compare to fourth generation computers.
- Consumes very low power.
- Keyboard, monitor, mouse, touchscreen, scanner, printer are used as an input output devices.
- Examples – Laptops, tablets, smartphones are most popular examples of fifth generation computers.

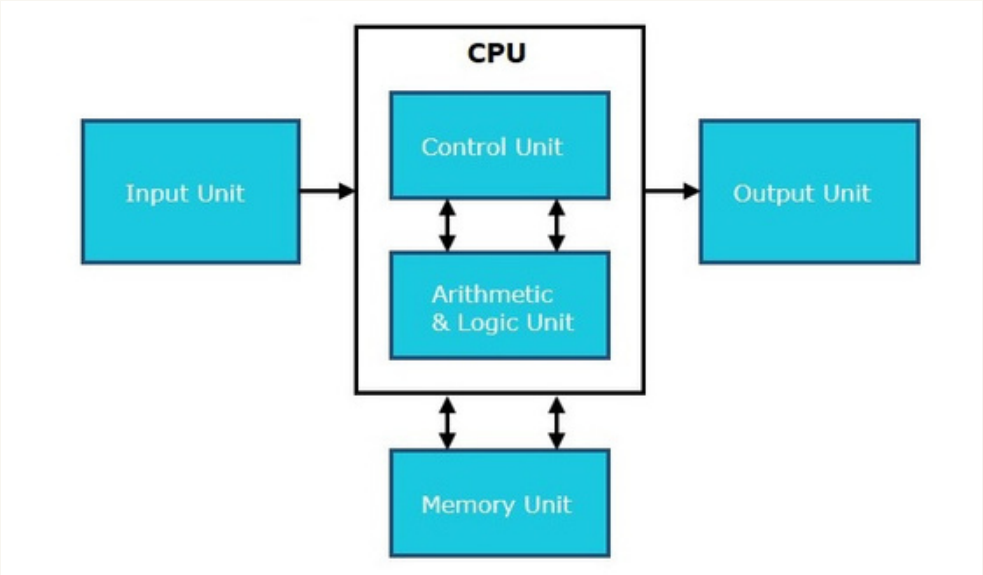
Components of Computer

Computer systems consist of three components: Central Processing Unit, Input devices and Output devices. Input devices provide data to the processor (processing unit), which processes it and generates useful information that's displayed to the user through output devices. Output devices are used to show the processed data to the user on computer screen or in print form. Below figure depicts the major components of computer systems –



CENTRAL PROCESSING UNIT

The Central Processing Unit (CPU) is also known as "the brain of computer". It controls operation of all components of a computer.



A CPU itself has three components which are as follows –

- Control Unit (CU)
- ALU (Arithmetic Logic Unit)
- Memory or Storage Unit

CONTROL UNIT

As its name implies, a control unit acts as the "brain" of the CPU. It executes instructions and manages the flow of data inside the CPU to perform the tasks specified by a computer program. It plays a pivotal role in the fetch-decode-execute cycle, which is a fundamental process by which a CPU runs program instructions.

FUNCTIONS OF CONTROL UNIT

- **Instruction Fetch** – To run and execute a program; a CU fetches instructions from RAM (Random Access Memory).

- **Instruction Decoding** – It decodes the fetched instructions to determine the operation to be performed.

- **Instruction Execution** – A CU executes the instructions by sending control signals to the appropriate functional units within the CPU, such as the ALU for arithmetic and logical operations.

- **Control Flow Management** – The Control Unit is responsible for overseeing the control flow of the programme. It accomplishes this by updating the programme counter, which enables the CPU to go to the subsequent instruction in the sequence based on conditional statements or jumps.

- **Exception Handling** – The system effectively manages exceptions and interruptions, including hardware failures, system calls, and external events, by appropriately diverting the control flow of the central processing unit (CPU) to the planned procedure for managing such exceptions.

- **Pipeline Control (in pipelined CPUs)** – The modern CPU's are available with pipeline designs; a CU controls the steps of the pipeline and makes sure that instructions are processed quickly and safely.

- **Synchronization** – In the context of multi-core processors, a CU plays a crucial role in facilitating the coordination of instruction execution across several cores, hence guaranteeing the appropriate synchronisation and maintenance of data consistency.

ARITHMETIC LOGIC UNIT (ALU)

The Arithmetic Logic Unit (ALU) is a component that has been extensively optimised and engineered to do multiple tasks concurrently. It is commonly built to execute operations speedily. It works in conjunction with other CPU components, such as registers, memory, and control units, to execute complex instructions.

FUNCTIONS OF AN ALU

- **Arithmetic Operations** – The ALU can perform basic arithmetic operations such as addition, subtraction, multiplication, and division.

- **Logic Operations** – The ALU can also perform logical operations like AND, OR, NOT, XOR, and bit-shifting operations.

- **Comparison** – The ALU can compare two binary values and determine whether they are equal, greater than, or less than each other. This function is most widely used in programming and sorting algorithms.

MEMORY UNIT

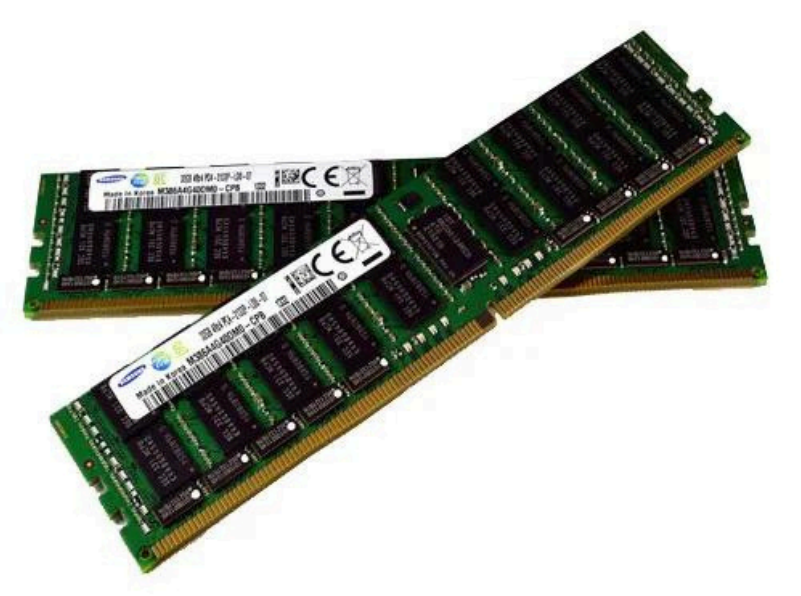
A memory or storage unit is a hardware component which is used to store the data and instructions and retrieve it whenever is required. Majorly computer memory has categorised as temporary (RAM) and permanent memory (secondary memory). RAM is used for short-term, fast data access and essential for active program execution. On the other hand, storage or secondary memory provides permanent data storage. Hence, memory and storage units both are critical components of a computer system.

RANDOM ACCESS MEMORY

RAM (Random Access Memory) is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

RAM (Random Access Memory) is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. Hence, a backup Uninterruptible Power System (UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold.



RAM is of two types –

- Static RAM (SRAM)
- Dynamic RAM (DRAM)

STATIC RAM (SRAM)

The word static indicates that the memory retains its contents as long as power is being supplied. However, data is lost when the power gets down due to volatile nature. SRAM chips use a matrix of 6-transistors and no capacitors. Transistors do not require power to prevent leakage, so SRAM need not be refreshed on a regular basis.

There is extra space in the matrix, hence SRAM uses more chips than DRAM for the same amount of storage space, making the manufacturing costs higher. SRAM is thus used as cache memory and has very fast access.

CHARACTERISTIC OF STATIC RAM

- Long life
- No need to refresh
- Faster
- Used as cache memory
- Large size
- Expensive
- High power consumption

DYNAMIC RAM (DRAM)

DRAM, unlike SRAM, must be continually refreshed in order to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory as it is cheap and small. All DRAMs are made up of memory cells, which are composed of one capacitor and one transistor.

CHARACTERISTICS OF DYNAMIC RAM

- Short data lifetime
- Needs to be refreshed continuously
- Slower as compared to SRAM
- Used as RAM
- Smaller in size
- Less expensive
- Less power consumption

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FUNCTIONS OF RAM

- The contents inside the RAM are erased when computer's power get off or restarted.
- RAM is actively used for program or instructions execution.
- Once we start the computer; systems necessary files, programs and the operating system files are loaded into the RAM for smoothly running of computer.
- The more RAM a computer has, the better it can handle multitasking and the faster it can run applications since data can be accessed more quickly.

READ ONLY MEMORY (ROM)

ROM stands for Read Only Memory. The memory from which we can only read but cannot write on it. This type of memory is non-volatile. The information is stored permanently in such memories during manufacture. A ROM stores such instructions that are required to start a computer. This operation is referred to as bootstrap. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.

Let us now discuss the various types of ROMs and their characteristics.

MROM (MASKED ROM)

The very first ROMs were hard-wired devices that contained a pre-programmed set of data or instructions. These kind of ROMs are known as masked ROMs, which are inexpensive.

PROM (PROGRAMMABLE READ ONLY MEMORY)

PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program. Inside the PROM chip, there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.

EPROM (ERASABLE AND PROGRAMMABLE READ ONLY MEMORY)

EPROM can be erased by exposing it to ultra-violet light for a duration of up to 40 minutes. Usually, an EPROM eraser achieves this function. During programming, an electrical charge is trapped in an insulated gate region. The charge is retained for more than 10 years because the charge has no leakage path. For erasing this charge, ultra-violet light is passed through a quartz crystal window (lid). This exposure to ultra-violet light dissipates the charge. During normal use, the quartz lid is sealed with a sticker.

EEPROM (ELECTRICALLY ERASABLE AND PROGRAMMABLE READ ONLY MEMORY)

EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (millisecond). In EEPROM, any location can be selectively erased and programmed. EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of reprogramming is flexible but slow.

ADVANTAGES OF ROM

The advantages of ROM are as follows –

- Non-volatile in nature
- Cannot be accidentally changed
- Cheaper than RAMs
- Easy to test
- More reliable than RAMs
- Static and do not require refreshing
- Contents are always known and can be verified

STORAGE (HARD DRIVES, SSDS, FLASH DRIVES, ETC.)

- Storage devices are used to store the data permanently, even when the computer is powered off.

- They are non-volatile in nature; the data remains intact even when the power is get off or system restarts.

- The most popular and commonly used storage devices are Hard Disk (HDs), Solid-State Drives (SSDs), USB flash drives, and optical disks (e.g., DVDs), pen drives.

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- The data storage capacity varies of these devices are in gigabytes (GB) to terabytes (TB) and more, depending on the type and size of the storage device.

MEMORY UNITS

Memory unit is the amount of data that can be stored in the storage unit. This storage capacity is expressed in terms of Bytes.

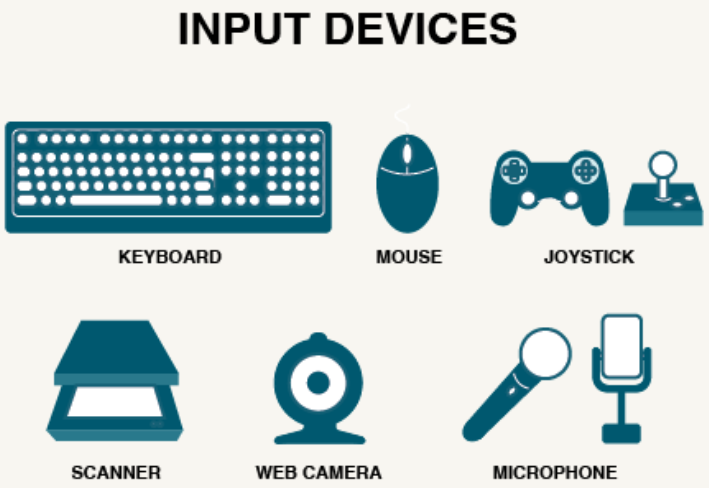
The following table explains the main memory storage units −

S.No	Unit & Description
1	**Bit (Binary Digit)** - A binary digit is logical 0 and 1 representing a passive or an active state of a component in an electric circuit.
2	**Nibble** - A group of 4 bits is called nibble.
3	**Byte** - A group of 8 bits is called byte. A byte is the smallest unit, which can represent a data item or a character.
4	**Word** - A computer word, like a byte, is a group of fixed number of bits processed as a unit, which varies from computer to computer but is fixed for each computer.The length of a computer word is called word-size or word length. It may be as small as 8 bits or may be as long as 96 bits. A computer stores the information in the form of computer words.

The following table lists some higher storage units −

S.No	Unit & Description
1	**Kilobyte (KB)** 1 KB = 1024 Bytes
2	**Megabyte (MB)** 1 MB = 1024 KB
3	**GigaByte (GB)** 1 GB = 1024 MB
4	**TeraByte (TB)** 1 TB = 1024 GB
5	**PetaByte (PB)** 1 PB = 1024 TB

INPUT DEVICES



The devices which are used to give input to the computer system is known as input devices.

- **Keyboard** - Keyboard is a most common and very popular input device which helps to input data to the computer. The layout of the keyboard is like a traditional typewriter, although there are some additional keys provided for performing additional functions.

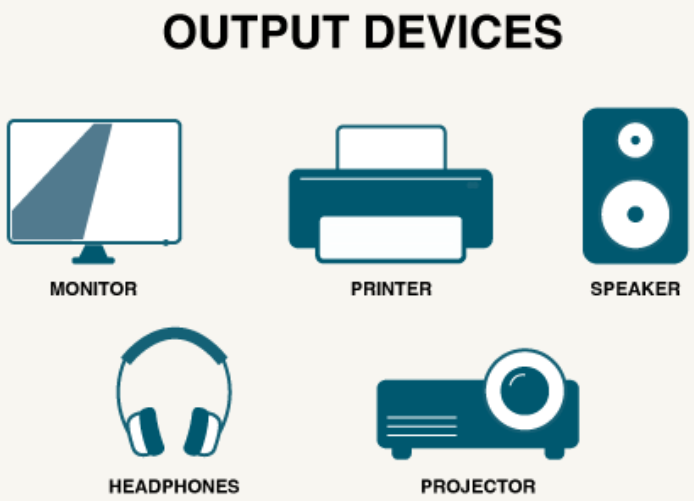
- **Mouse** - Mouse is a most popular input device. It is also known as a pointing device. It is a very famous cursor-control device having a small palm size box with a round ball at its base, which senses the movement of the mouse and sends corresponding signals to the CPU when the mouse buttons are pressed. Generally, it has two buttons called the left and the right button and a wheel is present between the buttons. A mouse can be used to control the position of the cursor on the screen, but it cannot be used to enter text into the computer.

- **Joystick** - Joystick is also a pointing device, which is used to move the cursor position on a monitor screen. It is a stick having a spherical ball at its both lower and upper ends. The lower spherical ball moves in a socket. The joystick can be moved in all four directions.

- **Microphone** - Microphone is an input device to input sound that is then stored in a digital form.The microphone is used for various applications such as adding sound to a multimedia presentation or for mixing music.

- **Scanner** - Scanner is an input device, which works more like a photocopy machine. It is used when some information is available on paper and it is to be transferred to the hard disk of the computer for further manipulation. Scanner captures images from the source which are then converted into a digital form that can be stored on the disk. These images can be edited before they are printed.

OUTPUT DEVICES



The devices which are used to give output from the computer system is known as output devices.

- **Monitors** - Monitors, commonly called as Visual Display Unit (VDU), are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels. There are two types of monitors - CRT (Cathode Ray Tube) and Flat Panel Displays.
    - **Cathode-Ray Tube (CRT) Monitor** - The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter 'e' in the word help.
    - **Flat-Panel Display Monitor** - The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, and graphics display.
- **Printers** - Printer is an output device, which is used to print information on paper. There are two types of printers – Impact Printers and Non-Impact Printers.
    - **Impact Printers** - Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper.
    - **Non-impact Printers** - Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time, thus they are also called as Page Printers.

Memory in Detail

WHAT IS COMPUTER MEMORY?

A physical device that stores data or information temporarily or permanently in it is called memory. It's a device where data is stored and processed. In common, a computer has primary and secondary memories. Auxiliary (secondary) memory stores data and programs for long-term storage or until the time a user wants to keep them in memory, while main memory stores instructions and data during programme execution; hence, any programme or file that is currently running or executing on a computer is stored in primary memory.

MEMORY CLASSIFICATION

Computer memory comes in various types and serves different purposes –

- **Primary Memory (RAM - Random Access Memory) –** Volatile memory loses its contents when the machine is turned off. RAM stores the data that is actively being used. During the booting process of a system, the operating system actively uses RAM and applications that are necessary to execute a file or a program. It speeds up CPU processing by providing fast data and instruction access.

- **Secondary Memory (Storage) –** Secondary Memory is also known as permanent memory or non-volatile memory of a computer. Secondary memory retains data when the machine shuts down. Files, programmes, and the OS are stored there permanently. HDDs, SSDs, USB flash drives, and optical discs are non-volatile memory devices.

- **Cache Memory –** Memory that is smaller and faster than RAM is called cache memory. It is placed closer to the CPU than the RAM.

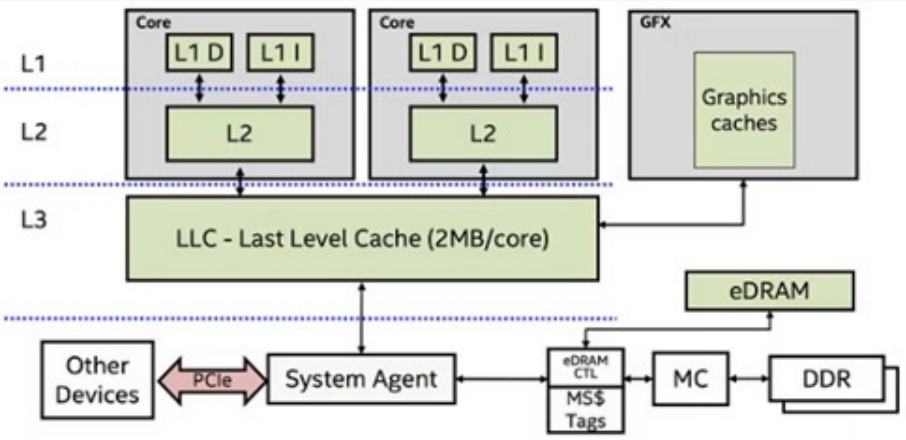
It saves data and instructions that are used a lot so that processing goes faster.

Different types of cache memory, like L1, L2, and L3 cache, have different speeds and amounts of space.

The Levels of Cache Memory: L1, L2, and L3.

CPU Cache memory is divided into three "levels": L1, L2, and L3. The memory hierarchy is again according to the speed and, thus, the cache size.

L1 CACHE



Level 1 cache is a computer's fastest memory. The CPU's most frequently accessed data resides in the L1 cache. CPU determines L1 cache size. Some high-end consumer CPUs, such as the Intel i9-9980XE, have a 1MB L1 cache, but they are expensive and rare. Server chipsets like Intel's Xeon have 1-2MB L1 memory cache. Before buying, examine the CPU specs to ascertain the L1 cache size. There is no "standard" amount.

The L1 cache normally has two sections: the instruction cache, which stores CPU operation information, and the data cache, which stores operation data.

L2 CACHE

Level 2 cache is larger but slower than L1. Modern L2 memory caches are gigabytes, not kilobytes. AMD's top-rated Ryzen 5 5600X has 384KB L1 and 3MB L2 caches and 32MB L3 cache. The L2 cache size depends on the CPU but is usually 256KB to 32MB. Nowadays, most CPUs have more than 256KB L2 cache, which is small. Some of the most powerful current CPUs have L2 memory caches exceeding 8MB. In terms of speed, the L2 cache is slower than the L1 cache but still faster than the system RAM. L2 caches are 25 times faster than RAM, while L1 caches are 100 times faster.

L1 CACHE

Level 3 cache. The L3 memory cache was originally on the motherboard. This was long ago when most CPUs were single-core. The L3 cache on top-end consumer CPUs can reach 32MB, while AMD's groundbreaking Ryzen 7 5800X3D CPUs have 96MB. CPU L3 caches in some servers can reach 128MB.

The largest and slowest cache memory unit is L3. Modern CPUs have an on-chip L3 cache. The chip's L1 and L2 caches serve each core, while the L3 cache is more like a memory pool for the whole chip. The following images illustrate the CPU memory cache levels for a 2012 Intel Core i5-3570K CPU and a 2020 AMD Ryzen 5800X CPU. The second image's bottom right corner contains CPU cache data.

Note how both CPUs have a split L1 cache and larger L2 and L3 caches. On the AMD Ryzen 5800X, the L3 cache is over five times greater than the Intel i5-3570K.

HOW CACHE MEMORY WORKS:

- **Hierarchy** – Computers normally have L1, L2, and L3 caches are the several layers of cache memory. The L1 cache is the smallest and fastest cache, located closest to the CPU; L2 and L3 caches are larger and slower.

- **Cache Organization** – Each block or line of cache memory contains a small bit of data copied from the main memory. The CPU accesses cache memory in fixed-size blocks, not bytes.

- **Cache Coherency** – Cache coherency ensures cached data matches the main memory data. Cache coherence techniques update other cores' caches when one core writes to a memory location in a multi-core processor.

- **Cache Replacement Policies** – A cache replacement policy decides which block to evict when the cache is full and a new block is needed. LRU, FIFO, and Random Replacement are common policies.

- **Cache Access** – The CPU checks the cache before reading or writing data. When data is cached, the CPU can quickly retrieve it. If data is not in the cache (cache miss), the CPU must fetch it from the main memory, which may delay it.

- **Cache Hierarchy** – Modern processors contain L1, L2, and L3 caches that grow in capacity and latency farther from the CPU cores. Parallel access is achieved by splitting the L1 cache into instruction and data caches.

- **Cache Management** – Optimization of cache utilization maximizes hit rates and minimizes miss penalties. Prefetching, where the processor predicts memory accesses and loads data into the cache, improves cache performance.Cache memory buffers frequently access data between the CPU and main memory to speed up processing and increase system performance. Modern computer systems require effective management and structure for optimal performance.

REGISTER MEMORY

Register memory, which is also called processor registers or "registers," is the smallest and fastest type of computer memory that is directly integrated into the CPU. Registers are small, fast storage units inside the CPU that are used to quickly store data that is being processed or instructions that are being run.

Registers serve several important functions in a computer system.

- **Instruction Execution** – Registers hold the instructions that the CPU is currently running. This includes the operation code (opcode) and associated operands with it.

- **Data Storage** – Registers store CPU-processed data. This can provide memory addresses, intermediate values during arithmetic or logical operations, and other data needed by the instructions being executed.

- **Addressing** – Memory addresses are used to store or retrieve data from memory locations in RAM or other parts of the computer's memory hierarchy.

TYPES OF REGISTERS

- **Program Counter (PC)** – Stores the memory address of the next instruction to be fetched and executed.

- **Instruction Register (IR)** – Holds the current instruction being executed by the CPU.

- **Memory Address Register (MAR)** – Stores the memory address of data being read from or written to memory.

- **Memory Data Register (MDR)** – Contains the actual data being read from or written to memory.

- **General-Purpose Registers (GPRs)** – Used for general data storage and manipulation during program execution.

VIDEO RANDOM-ACCESS MEMORY (VRAM)

Video Random-Access Memory (VRAM) is a type of memory that is intended to work with video cards and graphics processing units (GPUs). It's a special place in memory where graphics data like images, frame buffers, and other graphics-related data can be stored. There are two types of VRAM - **GDDR (Graphics Double Data Rate) VRAM** and **HBM (High Bandwidth Memory)**.

VRAM is designed to handle the fast, parallel processing demands of rendering graphics and images on computer displays. It enables GPUs to quickly access large amounts of graphic data, which lets them render complex scenes, textures, and animations.

HOW DOES VRAM WORK?

- **High Bandwidth** – VRAM typically offers high-speed data transfer rates, enabling fast access to graphical data by the GPU.

- **Parallel Access** – VRAM is designed to support parallel access, allowing multiple rendering tasks to access different portions of the memory simultaneously.

- **Specialized Architecture** – VRAM often has a specialized architecture optimized for graphics processing tasks, including features such as multi-port access and wide memory buses.

- **Dedicated Graphics Memory** – Unlike system RAM, which is shared among various system components, VRAM is dedicated solely to graphics processing, ensuring that the GPU has sufficient memory bandwidth and capacity for rendering graphics-intensive applications.

DATA STORAGE & MEMORY

Data storage and memory are both important parts of computers, but they do different things when it comes to storing and retrieving information. Computer memory stores data and instructions for the CPU to process tasks. Memory is vital for computer efficiency and comes in many forms.

Data Storage – The permanent, long-term storing of digital information is referred to as data storage. Data is stored on different physical and virtual storage systems and media. There are several types of data storage –

PRIMARY STORAGE (MAIN MEMORY OR RAM)

Computers keep active data in primary storage. Data is lost when the machine is turned off since it is volatile memory.

Data and programmes in use are stored quickly and temporarily. RAM is volatile, losing data when the computer is turned off. A computer with greater RAM can multitask and run apps smoothly.

SECONDARY STORAGE (NON-VOLATILE STORAGE)

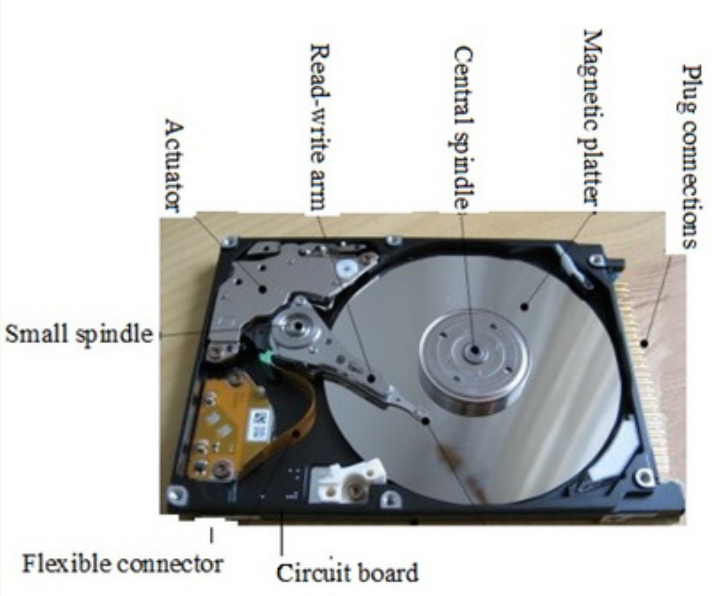
Secondary storage holds long-term data. It stores data even when the machine is off, unlike primary storage. HDDs, SSDs, CDs, DVDs, and USB drives are examples.

HARD DISK DRIVES (HDD)

The hard disc drive is a main hardware in a computer that stores data. Most files, including the operating system and programme titles, are kept on the hard disc drive.

A hard drive has few fundamental elements. One or more shiny silver platters store magnetically stored information, an arm mechanism moves a tiny magnet called a read-write head over the platters to record or store information, and an electronic circuit controls everything and connects the hard drive to your computer.

COMPONENTS OF HDD



- **Actuator** – The actuator arm is a mechanical element responsible for providing support to the read/write heads. The mechanism facilitates the movement of the read/write heads to the intended track on the platter for the purpose of data reading or writing. Contemporary hard disc drives (HDDs) employ voice coil actuators to achieve precise positioning.

- **Read-write Heads** – Every platter is equipped with a corresponding read/write head that hovers slightly above its surface. These components are tasked with the responsibility of retrieving data from and storing data onto the platters. The actuator arm is utilised to swiftly traverse the surface of the platter, facilitating access to various sections of the disc.

- **Central Spindle** – Platters rotate at a consistent pace with the spindle. Most HDDs spin at 5,400 or 7,200 RPM, while some high-performance devices spin at 10,000 or 15,000 RPM.

- **Magnetic Platter** – it stores information in binary form. The flat, round discs inside an HDD are called platters. Most of the time, these plates are made of aluminium or glass and have a magnetic coating. Magnetic patterns keep the information on the platters.

- **Power Connectors** – It links hard drive to circuit board in personal computer. A power connector is needed to power internal HDDs from the computer's power source. Modern discs use SATA power connectors.

- **Read-Write Head** – is a tiny magnet on the end of the read-write arm.

- **Circuit Board** – The controller board, also called a "Printed Circuit Board" (PCB), is the HDD's brain. It holds the drive's software, which controls how data is accessed and fixes errors. The drive is also connected to the computer's interface (such as SATA or IDE) by the driver board.

- **Data Connector** – The computer's power supply device powers internal HDDs through a power connector. SATA power connectors are common for newer drives.

- **Small Spindle** – This allows read-write arm to swing across platter.

Platters are the most critical hard drive elements. Their name implies that they are hard discs made of glass, ceramic, or aluminium coated with a thin metal coating that may be magnetised or demagnetized. Although compact hard drives have one platter, each side is magnetically coated. Larger drives feature platters stacked on a spindle with a tiny gap. The read-write heads can reach any region of the platters, which rotate at up to 10,000 rpm.

A five-platter hard drive would need ten read-write heads because each platter contains two, one for the top and one for the bottom. An electrically operated arm moves the read-write heads from the drive centre to the edge and back.

HOW HARD DRIVES WORK ?

The working of an HDD depends on its components which are described above. The main elements; a spinning platter and an actuator arm which are as:

- **Magnetic Platters** – Platters refer to circular plates. The number of platters in a hard drive is directly proportional to its storage capacity, as each platter can accommodate a specific quantity of information. Consequently, a hard drive with greater storage capacity would include a larger number of platters compared to one with lesser storage capacity. The process of storing and retrieving information from the platters involves the utilisation of concentric circles known as tracks, which are further divided into sectors.

- **Arm** – The arm refers to the component protruding above the platters. The arms equipped with read and write heads that are utilised for the purpose of reading and storing magnetic data onto the platters. Each platter will possess an own arm that is utilised for the purpose of reading and writing data from and onto it.The motor is employed to rotate the discs at speeds ranging from 4,500 to 15,000 revolutions per minute (RPM). A higher rotational speed of a drive corresponds to improved performance outcomes. When a computer requires data retrieval from the hard drive, the motor initiates the rotation of the platters, while the arm repositions itself to the designated location above the platter where the data is stored. The magnetic heads located on the arm are responsible for detecting the magnetic bits present on the platters. These heads then convert the detected bits into the corresponding data, which can be utilised by the computer. In contrast, during the process of data transmission to the drive, the magnetic heads will emit magnetic pulses towards the platters, so altering the magnetic characteristics of the platter surface and subsequently storing the information.

HDDs are cheaper and have a higher capacity than SSDs, but they are slower and less durable. The use case and cost-performance-storage capacity balance determine whether to utilise HDDs or SSDs. Computers and electronics store and retrieve data on HDDs. Based on their speed and dependability, Solid State Drives (SSDs) have become popular after decades of use.

SOLID STATE DRIVES (SSD)

A Solid State Drive (SSD) is a data storage device commonly employed in computers and various electronic gadgets. In contrast to conventional Hard Disc Drives (HDDs), which employ rotating discs for data retrieval and storage, Solid State Drives (SSDs) utilise NAND-based flash memory technology. Solid-state drives (SSDs) have experienced a surge in popularity owing to their different advantages which encompass enhanced speed, reduced energy usage, and heightened resilience.

Solid-state drives (SSDs) are capable of permanently storing data within an integrated circuit, commonly utilising flash memory technology. The utilisation of flash memory within a SSD facilitates the electrical and noiseless processes of data writing, transferring, and erasing. Unlike mechanical hard-disk drives (HDDs), SSDs do not have any moving components. Solid-state drives offer great performance and low noise levels due to their lack of moving components. However, it is important to note that SSDs are generally more expensive than HDD.

In the past, SSDs possessed a more restricted storage capacity in comparison to conventional hard disc drives. However, presently, both SSDs and HDDs are available in a wide range of sizes to cater to diverse storage requirements. SSDs are frequently employed in premium computing systems or as supplementary storage components within personal computers intended for consumer use.

HOW AN SSD WORKS

- **NAND Flash Memory** – The primary component of an SSD is NAND flash memory. This is a type of non-volatile storage that retains data even when the power is turned off. NAND flash memory is made up of memory cells organized into pages and blocks.

- **Cells and Bits** – Each memory cell in NAND flash can store multiple bits of data, typically one, two, or three bits per cell. The more bits a cell can store, the more cost-effective the SSD is, but it can also affect performance and longevity.

- **Pages and Blocks** – Data is written and read from NAND flash memory in fixed-size pages, which are grouped into larger blocks. When data is written to an SSD, it is first programmed into an empty page. To update or delete data, SSDs use a process called wear-leveling, which ensures that data is evenly distributed across the NAND cells to prevent excessive wear on any one cell.

- **Controller** – The SSD controller is a critical component that manages the reading and writing of data to and from the NAND flash memory. It handles tasks such as error correction, wear leveling, and garbage collection to optimize performance and longevity.

- **TRIM** – The TRIM command is an important feature of SSDs. It allows the operating system to inform the SSD which data blocks are no longer in use, allowing the SSD to perform efficient garbage collection and wear leveling, which helps maintain performance over time.

- **Wear Leveling** – NAND flash memory cells have a limited number of write-erase cycles before they degrade. Wear leveling ensures that data is written evenly across the memory cells, extending the lifespan of the SSD.

- **Read and Write Operations** – SSDs can read data very quickly since there are no moving parts involved. Write operations, however, can be more complex because data must be written to empty pages and previously used pages must be erased before they can be rewritten. This process is managed by the SSD controller to optimize speed and minimize write amplification.

SSDs work by storing data in NAND flash memory cells, using a controller to manage read and write operations, and implementing various techniques like wear leveling and garbage collection to ensure longevity and maintain performance. Their speed, reliability, and efficiency have made them a preferred choice for storage in modern computers and electronic devices.

TERTIARY STORAGE

Tertiary storage medium is used for long-term backups and archiving. It's slower and less used than main and secondary storage but offers high-capacity storage for long-term data. Magnetic tape, optical discs, USB Pen Drives, Memory cards and specialised hard drives are tertiary storage media.

CLOUD STORAGE

Cloud storage is a method of storing data on remote servers that are administered and operated by a service provider that is not directly involved with the user. Typically, the retrieval and administration of this data occur via internet connectivity, as opposed to being stored on local storage devices such as hard drives or on-site servers. Cloud storage services have numerous benefits, such as scalability, accessibility, cost-effectiveness, and data redundancy.

When choosing a cloud storage provider, organizations and individuals should consider factors such as their specific storage needs, budget, security requirements, and the provider's reliability and reputation. Different cloud storage services may offer various features and pricing structures, so it's important to select one that aligns with your unique requirements.

Hardware & Software

HARDWARE

Hardware represents the physical and tangible components of a computer, i.e. the components that can be seen and touched.

Examples of Hardware are the following –

- **Input devices** – keyboard, mouse, etc.
- **Output devices** – printer, monitor, etc.
- **Secondary storage devices** – Hard disk, CD, DVD, etc.
- **Internal components** – CPU, motherboard, RAM, etc.

SOFTWARE

Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.

There are two types of software –

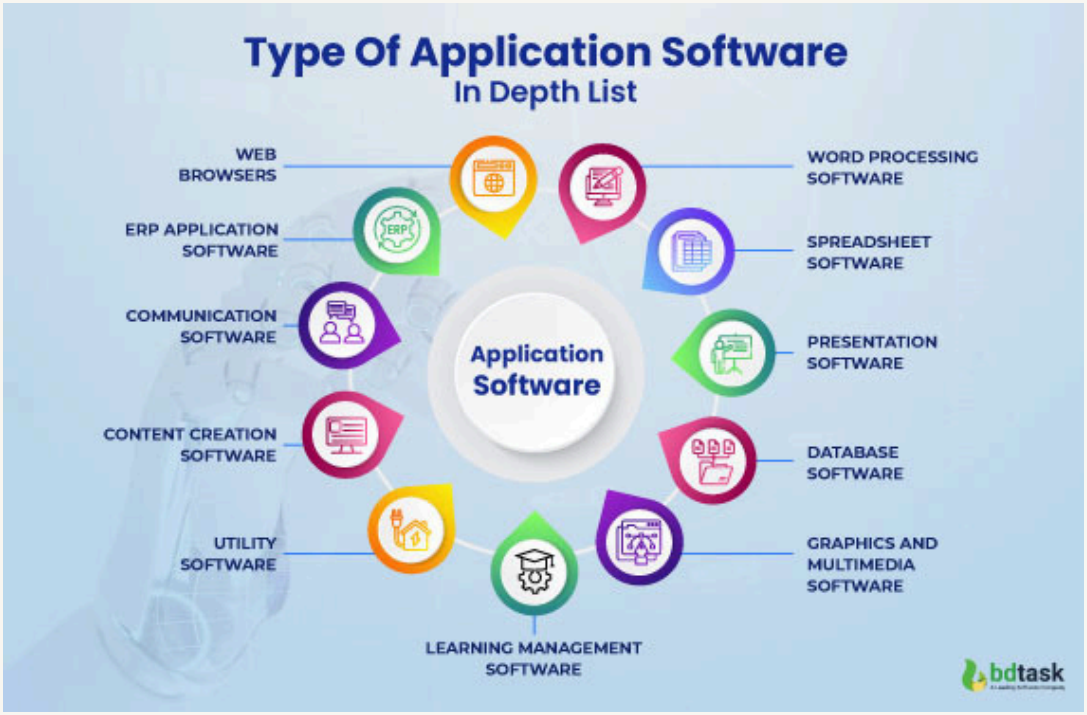
- **System Software**
- **Application Software**

SYSTEM SOFTWARE

The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software is generally prepared by the computer manufacturers.

These software products comprise of programs written in low-level languages, which interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users.
Some examples of system software are Operating System, Compilers, Interpreter, Assemblers, etc.

APPLICATION SOFTWARE



Application software products are designed to satisfy a particular need of a particular environment. All software applications prepared in the computer lab can come under the category of Application software.

Application software may consist of a single program, such as Microsoft's notepad for writing and editing a simple text. It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as a spreadsheet package.

Examples of Application software are the following –

- Payroll Software
- Student Record Software
- Inventory Management Software
- Income Tax Software
- Railways Reservation Software
- Microsoft Office Suite Software
- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint

MOTHERBOARD

The motherboard serves as a single platform to connect all of the parts of a computer together. It connects the CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via cables. It can be considered as the backbone of a computer.

The motherboard is mounted inside the case and is securely attached via small screws through pre-drilled holes. Motherboard contains ports to connect all of the internal components. It provides a single socket for CPU, whereas for memory, normally one or more slots are available. Motherboards provide ports to attach the floppy drive, hard drive, and optical drives via ribbon cables. Motherboard carries fans and a special port designed for power supply.There is a peripheral card slot in front of the motherboard using which video cards, sound cards, and other expansion cards can be connected to the motherboard.

RELATIONSHIP BETWEEN HARDWARE AND SOFTWARE

- Hardware and software are mutually dependent on each other. Both of them must work together to make a computer produce a useful output.
- Software cannot be utilized without supporting hardware.
- Hardware without a set of programs to operate upon cannot be utilized and is useless.
- To get a particular job done on the computer, relevant software should be loaded into the hardware.
- Hardware is a one-time expense.
- Software development is very expensive and is a continuing expense.
- Different software applications can be loaded on a hardware to run different jobs.
- A software acts as an interface between the user and the hardware.
- If the hardware is the 'heart' of a computer system, then the software is its 'soul'. Both are complementary to each other.

Internet and Intranet

INTERNET

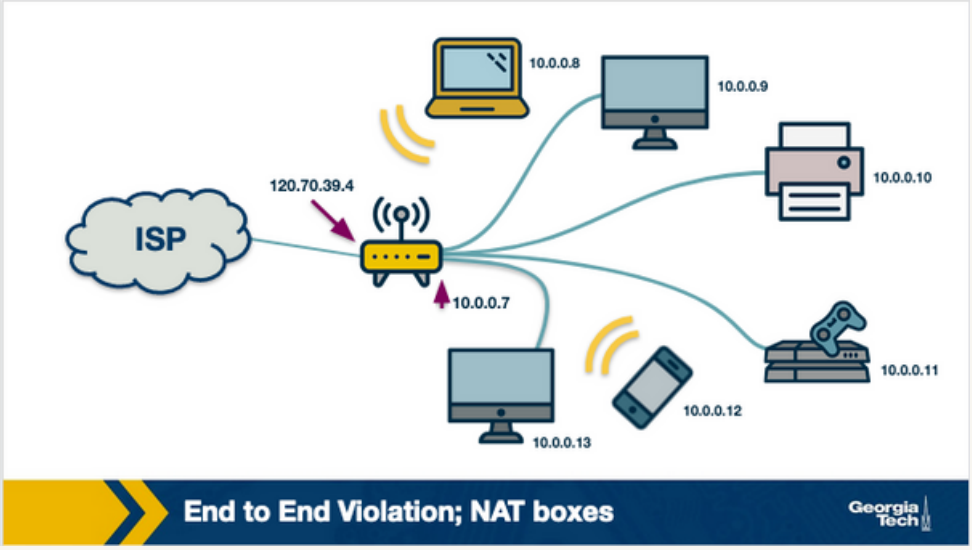
It is a worldwide/global system of interconnected computer networks. It uses the standard Internet Protocol (TCP/IP). Every computer in Internet is identified by a unique IP address. IP Address is a unique set of numbers (such as 110.22.33.114) which identifies a computer's location.

A special computer DNS (Domain Name Server) is used to provide a name to the IP Address so that the user can locate a computer by a name. For example, a DNS server will resolve a name https://www.inventyourshit.com to a particular IP address to uniquely identify the computer on which this website is hosted.

The main goal of the Internet is to make it easier for people to share information. This can be done with a lot of different tools on the Internet. You can use email, list servers, newsgroups, telnet, gopher, FTP, and the World Wide Web, among other tools.

The data or information is transmitted over the computer network using a transmission medium; it can be a wired or wireless medium. In wired data transmission, the data is transmitted using some set of cables like coaxial cable, twisted-pair cable, and fiber optic cable while in wireless communication data transmission; data is transmitted via cellular networks, Wi-Fi, and satellite communication.

ARCHITECTURE OF THE INTERNET



The internet's architecture allows devices worldwide to communicate and exchange data.

Layers and components make up this intricate structure.

A simplified view of Internet architecture is as –

- **End Devices** – End devices include PCs, cellphones, tablets, servers, IoT devices, etc. at the network edge. These devices produce and use data.

- **Network Infrastructure** – Routers, switches, cables, fibre-optic lines, satellites, and wireless access points are all part of the network. Data travels between end devices via network infrastructure.

- **Protocols** – Protocols regulate network data and how it is received. The modern Internet is based on the Internet Protocol Suite (TCP/IP), which includes –

    - **Internet Protocol (IP)** – This protocol is responsible for addressing and routing packets of data so they can travel across the network.

    - **Transmission Control Protocol (TCP)** – TCP establishes connections, acknowledges data, and retransmits missing packets to make sure that data packets are transferred securely and in sequence.

    - **User Datagram Protocol (UDP)** – UDP, unlike TCP, is a connectionless protocol that does not ensure reliable delivery. It is frequently employed in real-time applications where a tiny delay is preferable to data loss.

- **Internet Service Providers (ISPs)** – ISPs are firms that provide internet connection to customers, companies, and other organisations. They maintain the physical infrastructure and connections that allow people to access the internet.

WHY IS THE INTERNET CALLED A NETWORK?

The term "internet" means "interconnected network." A network is a set of interconnected computer networks that utilise standardised protocols to communicate. The following points demonstrate why the Internet is referred to as a network –

- **Interconnectedness –** The internet is made up of many networks. Small local area networks (LANs) in homes and businesses to worldwide networks controlled by ISPs, corporations, and governments are examples of these networks. These networks are linked by routers, switches, and other networking devices.

- **Communication Infrastructure** – The basic objective of a network is to make it easier for devices to communicate with one another and share information.

These devices can include laptops, servers, cellphones, Internet of Things devices etc.

- **Hierarchical Structure** – Many networks, including the Internet, are hierarchical. At the lowest level, devices are connected locally. The global internet is formed by connecting small networks to larger networks in a hierarchical framework.Hierarchical organisation streamlines data routing and management.

- **Distributed Control** – Distributed control models are used on networks like the Internet. Instead, ISPs, network managers, and users share control. This distributed control keeps the internet stable, resilient, and secure.

HOW DOES THE INTERNET WORK?

The Internet is operational because it is comprised of a sophisticated network of interconnected networks that enable devices to communicate with one another on a global scale. Two main concepts are fundamental to the way the Internet functions – packets and protocols.

- **Packets** - When data is transmitted over the Internet, it is first divided into smaller packets, which are then converted into bits. Different networking equipment, such as routers and switches, route packets to their intended destinations; when the packets arrive at their destination, the receiving device reassembles them in the proper order before using or displaying the data.Packet switching is the transfer of small pieces of data across networks. Packets of data allow faster, more efficient data transfer. User-sent files are often sent in smaller data packets over networks. A 3MB file will be broken into packets with packet headers that specify the origin IP address, destination IP address, number of packets, and sequence number.

- **Protocols** - The Internet is based on a collection of standardised communication protocols known as the Internet Protocol Suite, or TCP/IP (Transmission Control Protocol/Internet Protocol). This protocol stack ensures that data packets are consistently and efficiently sent over the network. In addition to the basic protocol, there are some other protocols for routing, testing, and encryption.

- **Routers** - A router is a device that sends data packets across different computer networks based on the destination of the packets. Routers are like traffic cops of the Internet; they make sure that data goes to the right networks.

- **Switches** - Switches link networked devices. Packet switching routes packets to the right devices.These devices send outgoing packets to them, which they route.

- **DNS** - Web servers are specialised computers that are equipped with a high level of processing power. They are responsible for storing and delivering content (webpages, photos, and videos) to users. In addition, servers are responsible for responding to DNS inquiries and carrying out a variety of other essential activities to ensure that the Internet remains operational. The vast majority of servers are stored in massive data centres, which can be found in many parts of the world.

HISTORY OF INTERNET

- **Early Concepts (1960s) –**
    - A decentralised network of computers was first envisioned in the early 1960s by scholars like J.C.R. Licklider and Leonard Kleinrock.
    - The Advanced Research Projects Agency Network (ARPANET), which was supported by the United States Department of Defence, became the first operational packet-switched network in 1969.
- **Development of Protocols (1970s) –**
    - The 1970s saw important networking protocol advancements. Vinton Cerf and Robert Kahn created TCP/IP to standardise network data transport.
    - Ray Tomlinson's design of the first email client and SMTP protocols enhanced network communication capabilities.

- **Expansion and Commercialization (1980s) –**
    - The 1980s saw the expansion of the internet.
    - In 1986, the National Science Foundation Network (NSFNET) was founded to connect educational and scientific institutions and organisations located all over the United States.
    - In 1989, Tim Berners-Lee introduced the World Wide Web (WWW), a system of hyperlinked documents accessible online, revolutionising the internet.
- **Growth (1990s) –**
    - The 1990s saw the internet commercialise and grow rapidly, driven by commercial ISPs and graphical browsers.
    - The introduction of web browsers like Mosaic, Netscape Navigator, and Internet Explorer increased internet accessibility for the public.
    - E-commerce, online banking, and social networking sites emerged, transforming the Internet for business and social interaction

.

- **Mobile Internet and Social Media (2000s - 2010s) –**
    - Smartphones and wireless networks led to an increase in mobile internet access in the 2000s and 2010s.
    - Facebook, Twitter, and YouTube became popular online platforms, enabling global communication and content sharing.
- **Internet of Things (IoT) and Future Trends (2010s - present) –**
    - The Internet of things (IoT) connects everyday objects and devices to the Internet, allowing new applications and services.
    - Emerging technologies like AI, blockchain, and 5G networks are driving internet innovation and transformation.

INTRANET

Intranet is the system in which multiple PCs are connected to each other. PCs in intranet are not available to the world outside the intranet. Usually each organization has its own Intranet network and members/employees of that organization can access the computers in their intranet.

Each computer in Intranet is also identified by an IP Address which is unique among the computers in that Intranet.

It serves as an extension of an organization's intranet. Extranets are safe computer networks for organisations or businesses to share business data and processes internally and with partners outside the company. They use internet-based apps and technology to do it and provide secure access to specific resources and information to authorized users outside of the organization, such as clients, partners, suppliers, or customers. An extranet is a safe and cooperative way for an organisation to connect its network to people outside the organisation.

HOW EXTRANET WORKS?

An extranet works as a secure extension of an organization's internal network; it provides controlled access to external users such as clients, partners, suppliers, or other stakeholders.

Here's a breakdown of how an extranet typically functions -

- **Authentication and Access Control** – External users access the extranet using usernames, passwords, or two-factor authentication. Access controls restrict users to information and features related to their role or relationship with the company. This is usually done through user roles, permissions, and access.

- **Secure Communication** – Internal and external users can securely communicate and collaborate on the extranet. Messaging, chat, forums, and email integration are some common examples of this. Communication channels are encrypted to prevent eavesdropping.

- **Document Management and File Sharing** – Users can upload, share, and collaborate on documents and files within the extranet environment. Document management features typically include version control, file organization, access permissions, and audit trails to track changes and maintain data integrity.

- **Project Management** – Project management technologies on extranets help internal and external teams collaborate. Users can assign duties, set deadlines, measure progress, and share project documents and information.

- **Data Sharing and Exchange** – Users can securely share sensitive files and information with others. Integration with cloud storage services may enable cross-platform data interchange and collaboration.

- **Collaboration and Workflow Automation** – Extranets consolidate information, tools, and resources, simplifying collaboration and workflows. Alerts, reminders, and task automation help users stay organized and productive.

- **Reporting and Analytics** – Reports and statistics reveal extranet usage, collaboration, and project performance. To increase efficiency and effectiveness, organizations can track KPIs, spot trends, and make data-driven choices.

- **Security and Compliance** – To keep sensitive information safe and in line with regulations, stringent security measures are put in place, including firewalls, encryption, and access controls. Extranets may adhere to industry standards and best practices for data security and privacy, such as GDPR, HIPAA, or ISO certifications.

SIMILARITIES BETWEEN INTERNET AND INTRANET

- Intranet uses the internet protocols such as TCP/IP and FTP.
- Intranet sites are accessible via the web browser in a similar way as websites in the internet. However, only members of Intranet network can access intranet hosted sites.
- In Intranet, own instant messengers can be used as similar to yahoo messenger/gtalk over the internet.

DIFFERENCES BETWEEN INTERNET AND INTRANET

- Internet is general to PCs all over the world whereas Intranet is specific to few PCs.
- Internet provides a wider and better access to websites to a large population, whereas Intranet is restricted.
- Internet is not as safe as Intranet. Intranet can be safely privatized as per the need.

WEBSITES

A website is a collection of web pages and related content identified by a domain name and hosted on at least one web server. Websites can serve different functions, including information, entertainment, communication, e-commerce, and many more. They are often created with web technologies such as HTML, CSS, and JavaScript, and may include multimedia components like videos, images, and interactive features. Websites can range from simple one-pagers to large web apps with several pages and dynamic content.

COMPONENTS OF A WEBSITE

The components of a website can vary depending on its purpose, complexity, and design.

Some common components of a website are as follows –

TYPES OF WEBSITE

Websites are typically classified into two categories based on their content and functionality: static websites and dynamic websites.

STATIC WEBSITES

Static websites consist of set content that is the same for every visitor. The content is coded directly into HTML files and doesn't change unless manually updated by the website owner.

- **Basic Static Website** – It consists of simple web pages with static content and no interaction. These are commonly used for small enterprises, personal portfolios, and informational websites.

- **Brochure Websites** – Like static webpages but designed to resemble digital brochures or flyers. They provide corporate, product, and service information.

- **Portfolio Websites** – Introduce the work, projects, or accomplishments of a company or an individual (for example, an artist or a photographer), and highlight their achievements as well.

DYNAMIC WEBSITES

Dynamic websites are websites that dynamically generate content based on the activities of users, the data inputs they provide, or other circumstances. Content can be pulled from databases, files, or other sources and assembled in real time.

- **Content Management Systems (CMS)** – These websites provide users with a user-friendly interface that facilitates the management and updating of content. It includes WordPress, Joomla, and Drupal.

- **E-commerce Websites** – Enables online purchasing and selling of goods and services. They often include dynamic product lists, shopping carts, and secure payment processing. Examples include Amazon, eBay, and Shopify.

- **Social Networking Websites** – Encourage user-to-user social interactions, such as content sharing, friend links, and group or community. Examples include Facebook, Twitter, and LinkedIn.

- **Blogs** – Websites where articles, updates, or commentary on specific topics are consistently published by individuals or organisations. They often include features such as commenting, categorization, and RSS feeds. Medium, Blogger, and WordPress are some of the key examples.

- **Forums and Discussion Boards** – Enable users with the ability to submit messages, ask questions, and participate in discussions on different topics. Reddit, Quora, and Stack Overflow are a few examples of such websites.

- **Web Applications** – Interactive functionality and user-specific experiences should be provided. Some examples are online banking, booking systems, and productivity applications. Examples of such applications include Gmail, Trello, and Google Docs.

These categories are not mutually exclusive, and many websites incorporate elements of both static and dynamic content to meet their specific requirements. Additionally, advances in web technologies have blurred the lines between static and dynamic websites, with modern static site generators allowing for more dynamic features while retaining the simplicity of static sites.

DIFFERENCE BETWEEN A WEBPAGE AND A WEBSITE

Webpage	Website
A webpage is a single document	A website is a collection of related web pages
It is written using HTML, CSS, and JavaScript	All the web pages of a website are written using HTML, CSS, and JavaScript
Web pages are accessible via a web browser	A Website is accessible via a web browser
It represents a single page of content	It represents multiple webpages of content
It may include text, images, videos, links, forms, and other multimedia elements.	A website also includes text, images, videos, links, forms, and other multimedia elements.
Webpages are the building blocks of a website	It encompasses a broader scope than a single webpage
Webpages are typically interconnected through hyperlinks.	Websites often include multiple webpages, along with other components such as a homepage, navigation menus, headers, footers

To summarise, a webpage is a single document that is shown in a web browser. On the other hand, a website is comprised of several interconnected web pages and sites that form a coherent online presence for a particular entity, organization, or purpose.

Number System

When we type some letters or words, the computer translates them in numbers as computers can understand only numbers. A computer can understand the positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.

The value of each digit in a number can be determined using -

- The digit
- The position of the digit in the number
- The base of the number system (where the base is defined as the total number of digits available in the number system)

DECIMAL NUMBER SYSTEM

The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands, and so on.

Each position represents a specific power of the base (10). For example, the decimal number 1234 consists of the digit 4 in the units position, 3 in the tens position, 2 in the hundreds position, and 1 in the thousands position. Its value can be written as

(1 x 1000)+ (2 x 100)+ (3 x 10)+ (4 x l)
(1 x 103)+ (2 x 102)+ (3 x 101)+ (4 x l00)
1000 + 200 + 30 + 4
1234

As a computer programmer or an IT professional, you should understand the following number systems which are frequently used in computers.

S.No	Number System and Description
1	**Binary Number System** Base 2. Digits used : 0, 1
2	**Octal Number System** Base 8. Digits used : 0 to 7
3	**Hexa Decimal Number System** Base 16. Digits used: 0 to 9, Letters used : A- F

BINARY NUMBER SYSTEM

Characteristics of the binary number system are as follows –

- Uses two digits, 0 and 1
- Also called as base 2 number system
- Each position in a binary number represents a 0 power of the base (2). Example 20
- Last position in a binary number represents a x power of the base (2). Example 2x where x represents the last position - 1.

Example
Binary Number: 10101

Calculating Decimal Equivalent –

Step	Binary Number	Decimal Number
Step 1	10101	((1 x 24) + (0 x 23) + (1 x 22) + (0 x 21) + (1 x 20))
Step 2	10101	(16 + 0 + 4 + 0 + 1)
Step 3	10101	21

OCTAL NUMBER SYSTEM

Characteristics of the binary number system are as follows –

- Uses two digits, 0 and 1
- Also called as base 2 number system
- Each position in a binary number represents a 0 power of the base (2). Example 20
- Last position in a binary number represents a x power of the base (2). Example 2x where x represents the last position - 1.

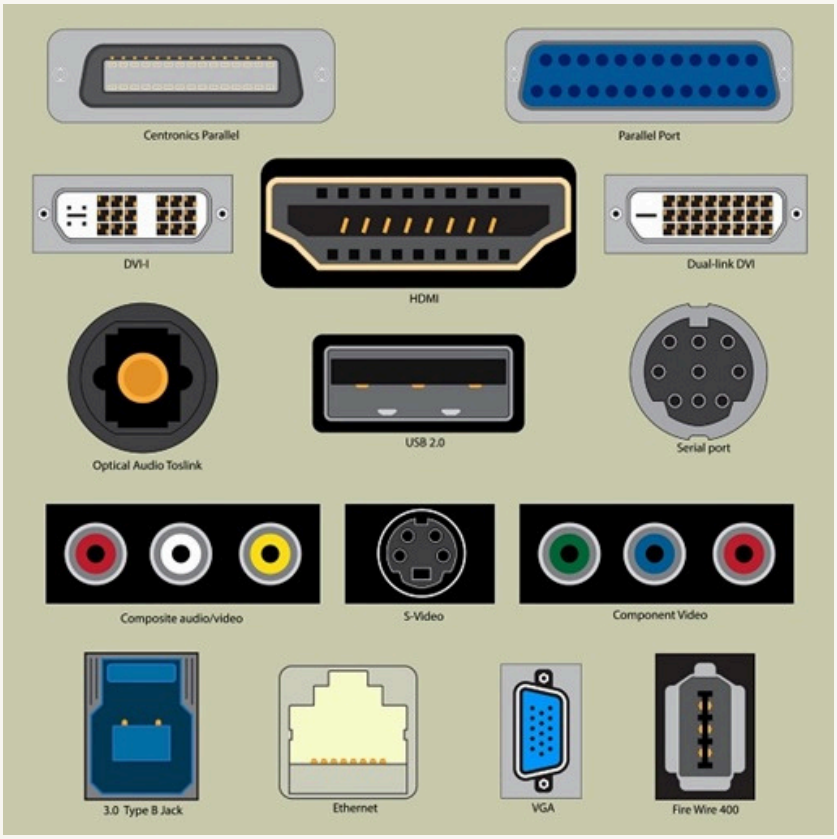
Computer Ports

WHAT ARE COMPUTER PORTS?

The computer ports are physical docking points of a computer that facilitate users to connect required external devices to the computer or computer network. A connection point that acts as an interface between the computer and external devices like a mouse, printer, modem, etc. is called a port. Ports are of two types –

- **Internal port** – It connects the motherboard to internal devices like hard disk drives, CD drives, internal modems, etc.
- **External port** – It connects the motherboard to external devices like modem, mouse, printer, flash drives, etc.

The below image gives an idea about what ports are look like –



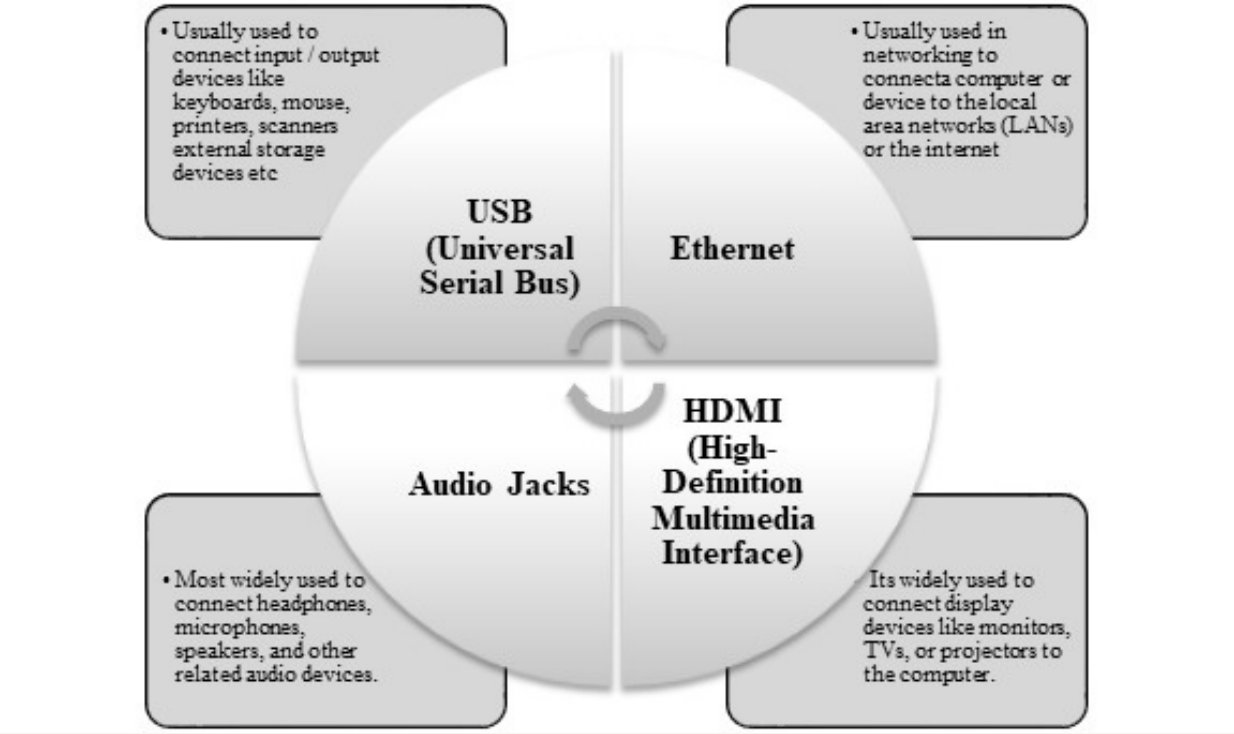
Expansion of a computer network or interconnection between multiple peripheral devices was possible through computer ports where network connections start and end. Generally, Ports are computer hardware which are software-based means they are operated by a software program like an operating system.

Generally, ports are docking points through which information flows from a program to the computer or over the Internet.

WORKING PRINCIPLES OF COMPUTER PORTS

Computer ports are tangible or virtual connectors on a computer or device that provide connectivity to external devices, peripherals, or networks. They enable the exchange of information between the computer and external devices.

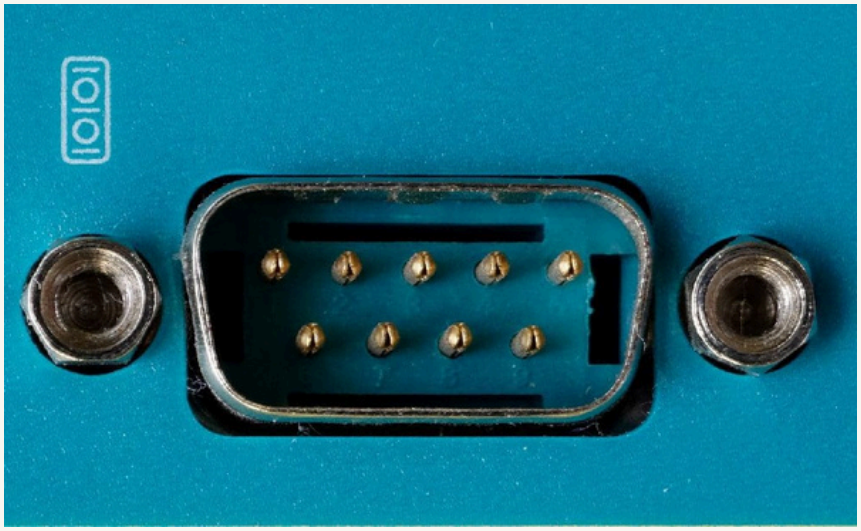
The functions or working principles of some common computer ports are as follows –



CHARACTERISTICS OF PORTS

- External devices are connected to a computer using cables and ports.
- Ports are slots on the motherboard into which a cable of the external device is plugged in.
- Examples of external devices attached via ports are the mouse, keyboard, monitor, microphone, speakers, etc.

SERIAL PORT

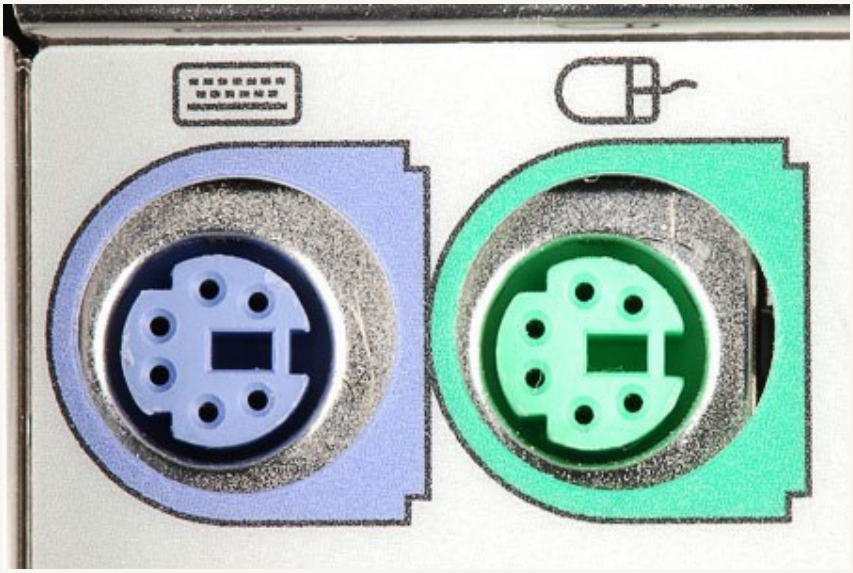


- Used for external modems and older computer mice.
- Two versions: 9-pin, 25 pin model.
- Data travels at 115 kilobits per second.

PARALLEL PORTS

- Used for scanners and printers.
- Also called a printer port.
- 25 pin model.
- IEEE 1284-compliant Centronics port.

PS/2 PORT



- Used for old computer keyboard and mouse/
- Also called the mouse port.
- Most of the old computers provide two PS/2 ports, each for the mouse and keyboard.
- IEEE 1284-compliant Centronics port.

UNIVERSAL SERIAL BUS (OR USB) PORT

- It can connect all kinds of external USB devices such as external hard disks, printers, scanners, mice, keyboards, etc.
- It was introduced in 1997.
- Most of the computers provide two USB ports as a minimum.
- Data travels at 12 megabits per second.
- USB-compliant devices can get power from a USB port.

VGA (VIDEO GRAPHICS ARRAY) PORT

- Connects monitor to a computer's video card.
- It has 15 holes.
- Similar to the serial port connector. However, the serial port connector has pins, VGA port has holes.

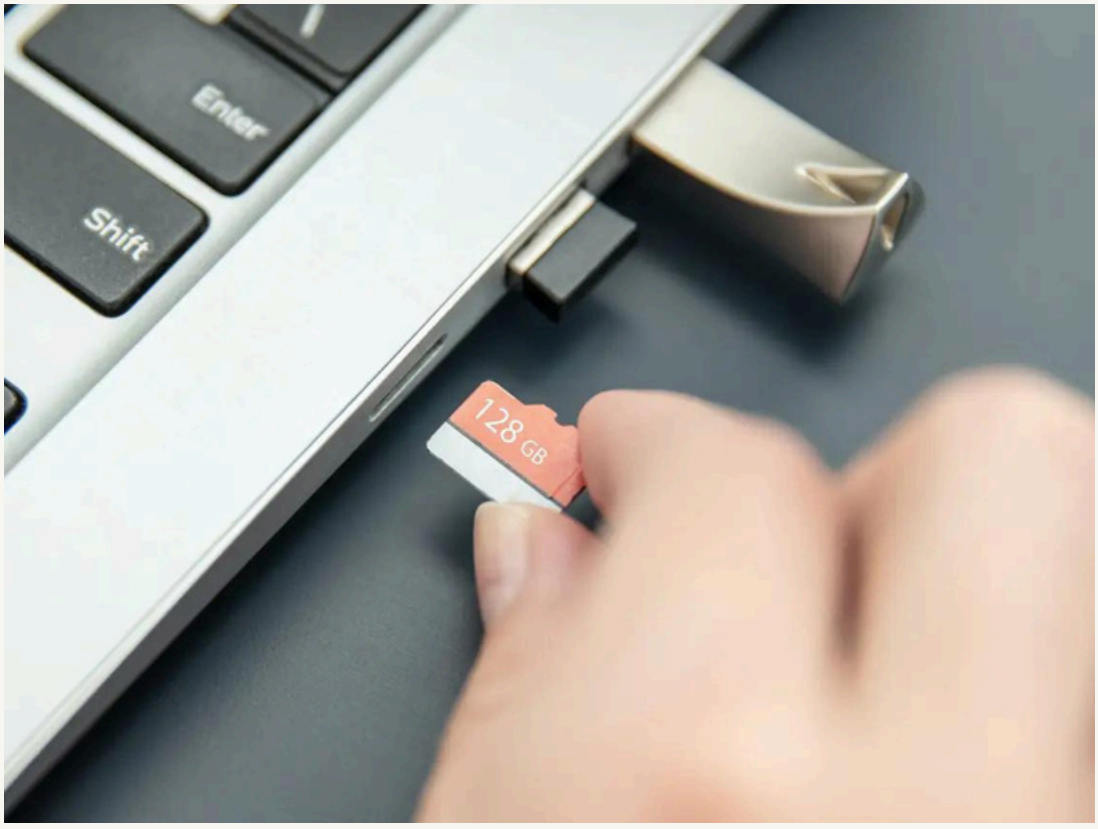
POWER CONNECTOR

- Three-pronged plug.
- Connects to the computer's power cable that plugs into a power bar or wall socket.

ETHERNET PORT

- Connects to a network and high-speed Internet.
- Connects the network cable to a computer.
- This port resides on an Ethernet Card.
- Data travels at 10 megabits to 1000 megabits per second depending upon the network bandwidth.

SD CARD SLOT



SD card slots are frequent functionality ports generally seen on desktop computers and laptops.

These slots enable users to insert SD memory cards, which are typically utilized in digital cameras and other portable devices.

Data & Information

WHAT IS DATA?

Data is a raw material; it's a collection of facts and figures. Data does not have a significant meaning because of its raw nature. Data may include text, figures, facts, images, numbers, graphs, and symbols and it can be generated from different sources like sensors, surveys, transactions, social media etc.

G15, KPL, and Gud are some examples of data. Data needs to be processed to convert into a useful manner which is known as information. For example – Gud is data; after text processing, it converts into Good which is information.

- Raw material
- Unstructured information
- It has no context
- Processed Data
- Structured information
- It has context

A proper analysis of data plays an important role in fields like research, science, business, healthcare, agriculture, and technology, driving decision-making and innovation.

CHARACTERISTICS OF DATA

Type of Data	Characteristics
Quantitative Data	• It's in numerical nature. • It can be measured and quantified like height, weight, temperature, etc. • This type of data can be analysed using statistical methods.
Qualitative / Descriptive Data	• It is descriptive. • It can be explored using colours, textures, opinions or any other related feature. • It's often subjective which requires interpretation. • It can be categorical or ordinal.
Structured Data	• It is organized in a predefined structure and usually includes a tabular form like databases, or spreadsheets. • Easy to search • It can be analysed using standard tools like SQL. • Allows performing queries to insert, delete and update.
Unstructured Data	• It lacks a predefined structure. • It does not have a pre-defined structure. • It may include text documents, social media posts, images, videos, etc. • It is difficult to analyse using traditional methods. • It processes using advanced techniques like natural language processing (NLP), machine learning, etc.
Big Data	• Data are bigger. • It is complex and processes using traditional data processing applications. • It has five V's to identify i.e. volume, velocity, variety, veracity, and value.

Metadata	• It gives information on data about data. • It includes data dictionaries, file descriptions, tags, etc. • It gives a direction to understand, manage, and improve data search ability and usability.
Streaming Data	• It is continuously generated and transmitted in a real-time environment like sensor data, social media updates, financial market data, etc. • It requires real-time data processing. • It often uses applications like IoT, real-time analytics, etc.

WHAT IS INFORMATION?

Information is processed data. It is always useful and used in decision-making. A person who has a lot of information about a particular thing is always considered a knowledgeable person. Hence, a good information base always makes a good knowledge base and a good knowledge base helps to make healthy or fruitful decisions.

CHARACTERISTICS OF INFORMATION

- It is effective and complete to make decisions.
- True information is broad in scope.
- Information relates to the current situation and has an acceptable level of integrity.
- Information is always compatible with response time.
- Information is concise and does not contain delicacy.

- Information is precise and accurate.
- Information is always relevant.
- Information can be verifiable.
- Information contains facts; that can be shared for making fruitful decisions.
- Information is organised and stored for future reference.

DIFFERENCES BETWEEN DATA VS INFORMATION

S.No	Data	Information
1	Data is a raw material	It's processed data
2	It is meaningless	It is meaningful
3	Is not use in decision-making	Uses in decision-making
4	Data does not rely on information	The information relies on data
5	Data is a collection of facts	Information kept facts in context
6	Data is unorganized	Information is organized
7	Data is represented in the form of graphs, numbers, figures, or statistics	Information is presented in the form of words, language, thoughts, and ideas.
8	Data does not have context	Information has context
9	It can be considered as a single unit that is unprocessed	It is a product and a collection of data
10	It is measured in bytes and bits.	It is measured using meaningful units like concerning quantity and time

Networking

COMPUTER NETWORKING

A computer network is a system in which multiple computers are connected to each other to share information and resources.

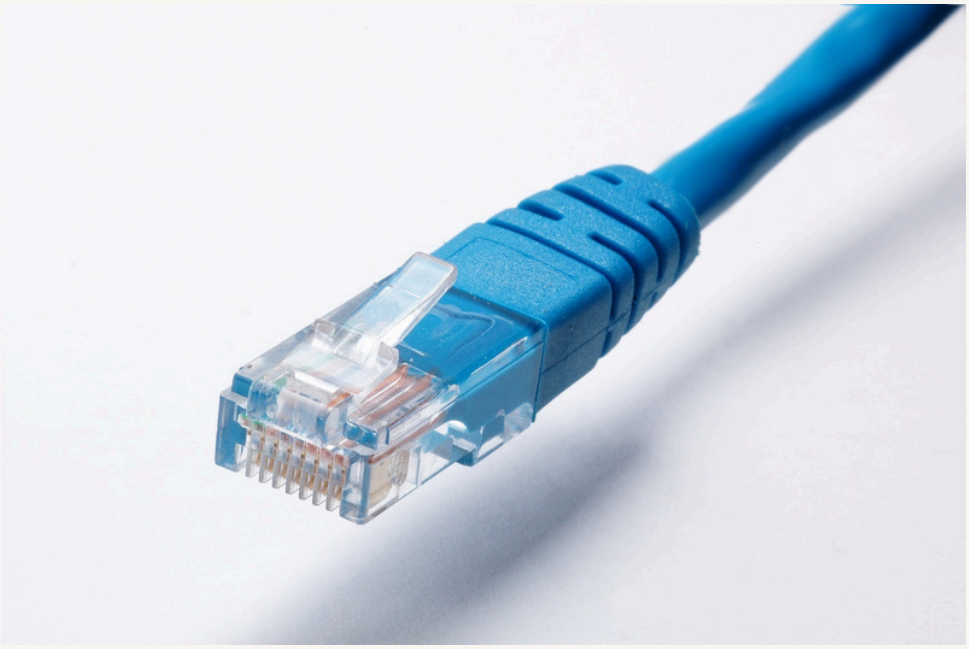
CHARACTERISTICS OF A COMPUTER NETWORK

- Share resources from one computer to another.
- Create files and store them in one computer, access those files from the other computer(s) connected over the network.
- Connect a printer, scanner, or a fax machine to one computer within the network and let other computers of the network use the machines available over the network.

HARDWARE REQUIRED

- Network Cables
- Distributors
- Routers
- Internal Network Cards
- External Network Cards

NETWORK CABLES



Network cables are used to connect computers. The most commonly used cable is Category 5 cable RJ-45.

DISTRIBUTORS

A computer can be connected to another one via a serial port but if we need to connect many computers to produce a network, this serial connection will not work.

The solution is to use a central body to which other computers, printers, scanners, etc. can be connected and then this body will manage or distribute network traffic.

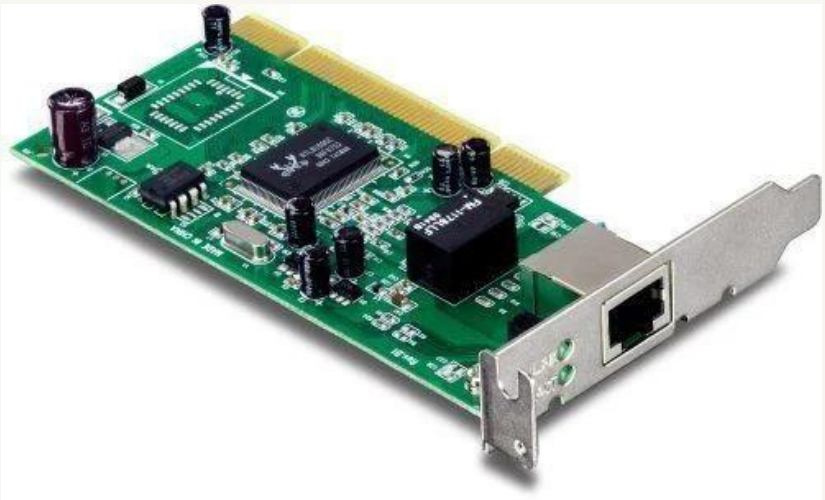
ROUTER

A router is a type of device which acts as the central point among computers and other devices that are a part of the network. It is equipped with holes called ports. Computers and other devices are connected to a router using network cables. Now-a-days router comes in wireless modes using which computers can be connected without any physical cable.

NETWORK CARD

Network card is a necessary component of a computer without which a computer cannot be connected over a network. It is also known as the network adapter or Network Interface Card (NIC). Most branded computers have network card pre-installed. Network cards are of two types: Internal and External Network Cards.

INTERNAL NETWORK CARDS



Motherboard has a slot for internal network card where it is to be inserted. Internal network cards are of two types in which the first type uses Peripheral Component Interconnect (PCI) connection, while the second type uses Industry Standard Architecture (ISA). Network cables are required to provide network access.

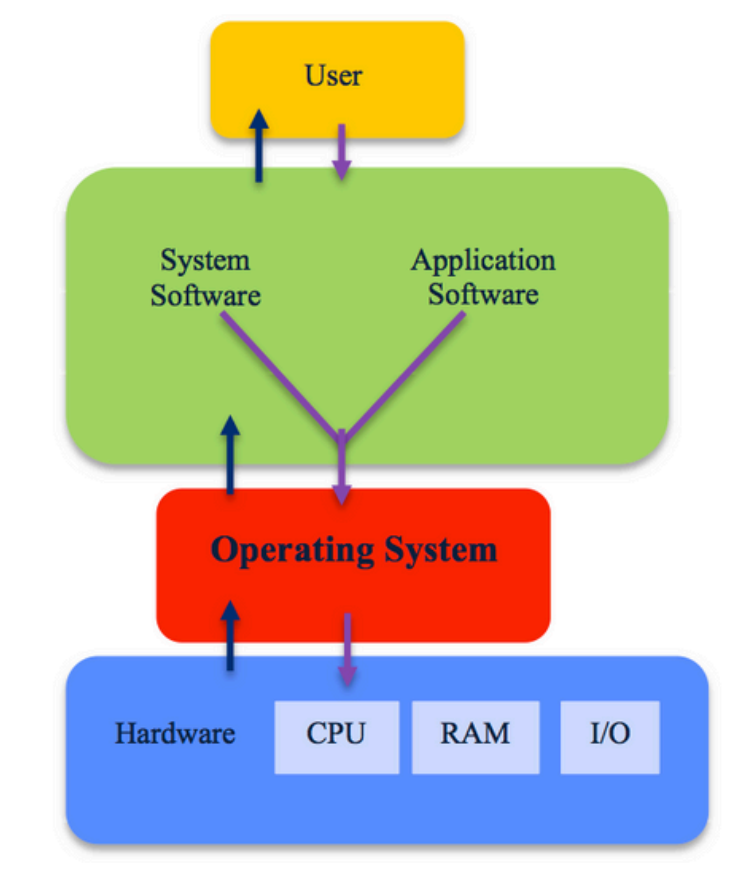
EXTERNAL NETWORK CARDS

External network cards are of two types: Wireless and USB based. Wireless network card needs to be inserted into the motherboard, however no network cable is required to connect to the network.

UNIVERSAL SERIAL BUS (USB)

USB card is easy to use and connects via USB port. Computers automatically detect USB card and can install the drivers required to support the USB network card automatically.

Operating System



The Operating System is a program with the following 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 used to manage overall resources and operations of the computer.
- It is a specialized software that controls and monitors the execution of all other programs that reside in the computer, including application programs and other system software.

OBJECTIVES OF OPERATING SYSTEM

- To make the computer system convenient to use in an efficient manner.
- To hide the details of the hardware resources from the users.
- To provide users a convenient interface to use the computer system.
- To act as an intermediary between the hardware and its users, making it easier for the users to access and use other resources.
- To manage the resources of a computer system.
- To keep track of who is using which resource, granting resource requests, and mediating conflicting requests from different programs and users.
- To provide efficient and fair sharing of resources among users and programs.

CHARACTERISTICS OF OPERATING SYSTEM

- **Memory Management** – Keeps track of the primary memory, i.e. what part of it is in use by whom, what part is not in use, etc. and allocates the memory when a process or program requests it.
- **Processor Management** – Allocates the processor (CPU) to a process and deallocates the processor when it is no longer required.
- **Device Management** – Keeps track of all the devices. This is also called I/O controller that decides which process gets the device, when, and for how much time.
- **File Management** – Allocates and de-allocates the resources and decides who gets the resources.

- **Security** – Prevents unauthorized access to programs and data by means of passwords and other similar techniques.

- **Job Accounting** – Keeps track of time and resources used by various jobs and/or users.

- **Control Over System Performance** – Records delays between the request for a service and from the system.

- **Interaction with the Operators** – Interaction may take place via the console of the computer in the form of instructions. The Operating System acknowledges the same, does the corresponding action, and informs the operation by a display screen.

- **Error-detecting Aids** – Production of dumps, traces, error messages, and other debugging and error-detecting methods.

- **Coordination Between Other Software and Users** – Coordination and assignment of compilers, interpreters, assemblers, and other software to the various users of the computer systems.

Build your own Computer

CHOOSING THE COMPONENTS

There are 7 parts that you will need while making your own PC. These include -

- **Graphics card, or GPU:** Arguably the most important component in a gaming rig, the GPU (graphics processing unit) renders images from your PC and puts them on your monitor. More powerful GPUs facilitate better in-game graphics and settings.

- **Motherboard:** The motherboard is where all the hardware in your computer lives. The most important thing about a motherboard is its compatibility with the parts you choose, but motherboards can also have integrated graphics cards, Wi-Fi systems and more.

- **Memory, or RAM:** RAM (random access memory) determines how much data your computer can process at any given moment. To oversimplify things considerably, RAM is where your computer stores information it needs to access right away. The more RAM you have, the more efficiently your computer can process lots of information — helpful for productivity; essential for games.

- **Storage, or SSD/HDD:** PC storage essentially comes in two flavors: Solid state drives (SSDs) and hard disk drives (HDDs). Either way, it's where your files live when they're not in use. Bigger drives mean more storage space, which means more room for files, games, media and so forth.

- **Power supply:** Possibly the least interesting and most vital piece of the PC puzzle, the power supply is exactly what it sounds like: It gets electricity from an outlet to individual systems in your computer. Picking the right one can be tricky, but once you do, you'll probably never need to think about it again.

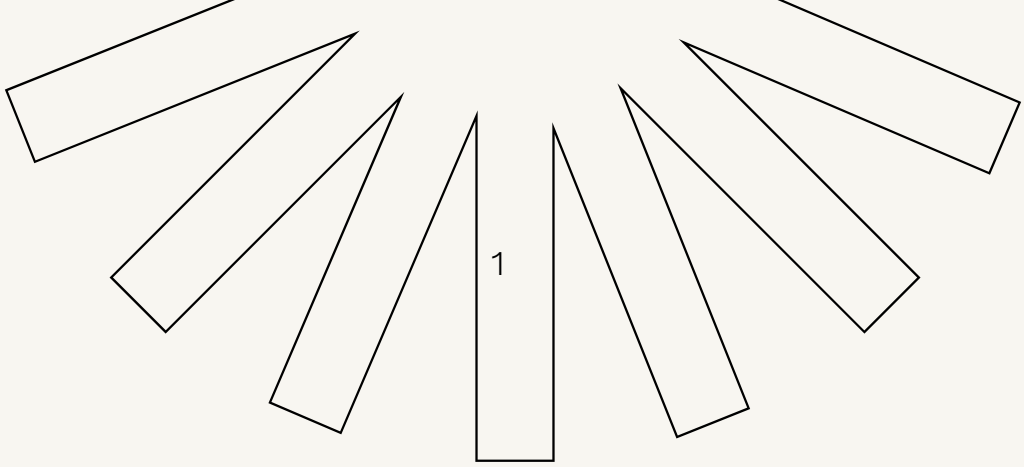
- **Case:** Your computer case is, for the most part, an aesthetic choice, although some models include fans for additional cooling. While it's possible to do an "open-air" build, a case is probably a better choice for keeping dust out and components sheltered.

Anything else, such as additional cooling systems or secondary hard drives, are nice to have, but not strictly necessary. These are the parts you need to go from a pile of hardware to a functioning PC.

HOW TO SHOP FOR THE COMPONENTS AND ASSEMBLE THEM?

While we have to select the above required parts to build a PC. Shopping for the rights parts is totally based on our budget and requirement. The below is the list of some buying and assembling guides that can help you with this.

- **Gaming Pc Build RTX 4070Ti With intel i7-13700K 2024**
- **The NO NONSENSE Gaming PC Build 2024! 😲 RX 7900 XTX, Ryzen 7950X**
- **🛑 How to Build a PC 🛑 Step By Step Ryzen & Intel 🛑 How To Build a Gaming PC**



Thank You !!!

Thank you for taking the time to read this book on computer fundamentals. We hope that it has provided you with valuable insights and knowledge about the foundational principles of computing.

We would like to express our gratitude to all the experts and researchers whose work has informed this book, as well as to the publishers and editors who have helped bring this project to fruition.

A special thank you to our readers for their interest in understanding the inner workings of computers and for their dedication to learning and improving their skills in this field.
We hope that this book has been a useful resource for you and that it has inspired you to delve deeper into the world of computer science. Thank you for your support and enthusiasm.

Sincerely, Arch1t3ct

LEARN MORE