

IT WORKSHOP I



Computer Components

22-Nov-22



PC Components

- A computer system is a collection of electronic and mechanical devices operating as a unit.
- These devices can be sorted according to the role they play in the computer system.
- The main computer device categories are:
 - System unit
 - Peripherals

System unit

- The system unit is the main container for system devices.
- It protects the delicate electronic and mechanical devices from damage.
- Typical system unit devices include:
 - Motherboard
 - CPU (Processor)
 - Memory
 - Disk drives
 - Expansion cards - sound card, graphics card, network card etc.
 - Ports - USB etc.
 - Power supply



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System unit



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Peripherals

- Peripherals are devices that connect to the system unit using cables or wireless technologies.
- Typical peripherals include:
 - Monitor
 - Keyboard
 - Mouse
 - Speakers
 - Printer
 - Plotter
 - Scanner



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System Unit Devices

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The Motherboard

- Often called the **mainboard or system board**, it is the main circuit board for the computer system.
- Every device in the computer system will either be **part of the motherboard or connected to it**.



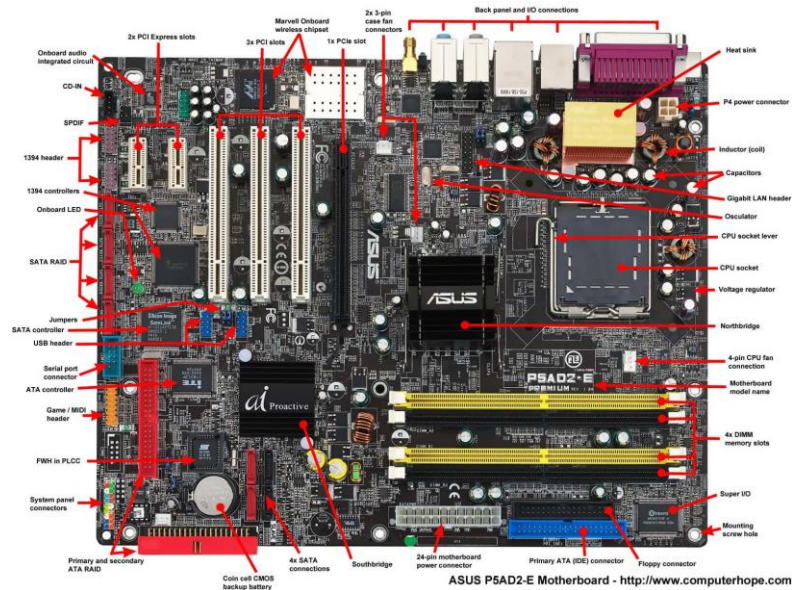
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Motherboard Main parts

- | | |
|---------------------------------|-------------------------------------|
| ■ Processor socket | ■ PCI-Express (graphics card) |
| ■ Memory sockets | ■ Audio ports (speakers) |
| ■ Power connector | ■ USB ports |
| ■ Primary IDE (HDD) | ■ Network port |
| ■ Secondary IDE (DVD) | ■ Video port (monitor) |
| ■ CMOS battery | ■ Parallel port (printers, Scanner) |
| ■ SATA connectors (HDD) | ■ Serial port (external modem) |
| ■ BIOS chip | ■ PS2 ports (keyboard, mouse) |
| ■ PCI sockets (Modem, N/w card) | |

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Motherboard Main parts



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The Processor (CPU)

- A processor is an integrated circuit (IC) supplied on a single silicon chip.
- All of the components and pathways necessary for the movement of data around the processor are etched on this single chip.



AMD Processor

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The Processor (CPU)

- The processor's function is to **control the activities** of the computer system.
- A computer program is made up of instructions and when the program is run, **the processor is responsible for executing these instructions** in an orderly fashion.
- The type of instructions the processor can execute includes:
 - **Arithmetic instructions** - It carries out all the addition, subtraction, multiplication and division requested by computer programs.
 - **Logical instructions** - It can make decisions by comparing data and acting in a particular way depending on the result.
 - **Move operations** - It can move data from place to place within the computer system. This could be from memory to the processor for addition or from memory to a printer or disk drive etc.

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The Processor (CPU)

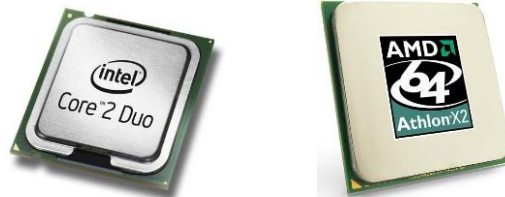
- The speed of a processor is measured in **megahertz (MHz) or Gigahertz (GHz)**.
- This is the speed of the **system clock (clock speed)** within the processor and it controls how fast instructions can be executed:
 - 1 MHz - One million clock ticks every second
 - 1 GHz - One billion clock ticks every second
- This means that if **one instruction was executed every clock tick**, a 3GHz processor could execute three billion instructions every second.
- The two main computer processor manufacturers are **Intel and Advanced Micro Devices (AMD)**. These two companies produce almost all of the processors used in desktop and notebook computers.

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The Processor (CPU)

In Computers

- Intel - Intel makes the Pentium and Centrino ranges of processors.
- AMD - AMD makes the Athlon and Turion ranges of processors.

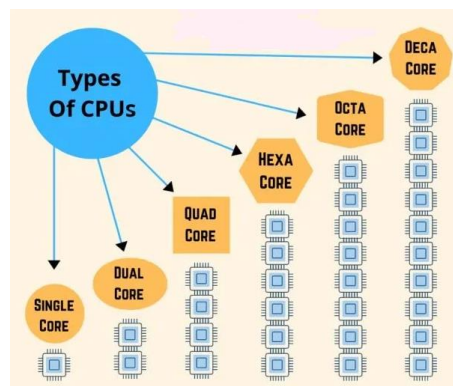


Latest technology - multi-core processors
(dual, quad, hexa, octa core processors)

Qualcomm (SnapDragon), MediaTek, Samsung (Exynos), and Apple Bionic are in mobile devices. 13

The Processor Speed

- **Processor cores and clock speeds** determine the speed



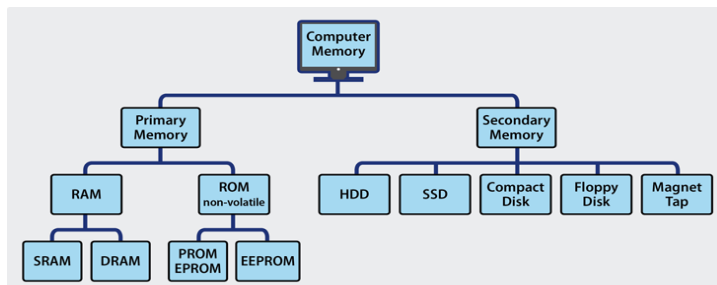
The Processor (CPU)

CPU (Processor)	No. of Cores	Launched	Name	Speed and Cache Level
Single Core CPU	1	Intel released their first Single-core processor in the Year 1971 .	Intel 4004	740 KHz and 640 bytes of RAM.
Dual Core CPU	2	Intel released their first Dual-core processor in the Year 2005 .	Pentium D	2.80 GHz and 2 MB of Cache.
Quad Core CPU	4	AMD released their first Quad-core processor in the Year 2009 .	Athlon II X4	3 GHz and 2 MB of Cache.
Hexa Core CPU	6	Intel released their first Hexa-core processor in the Year 2010 .	Intel core i7-980X	3.60 GHz and 12 MB of Cache.
Octa Core CPU	8	Intel released their first Octa-core processor in the Year 2014 .	Intel Core i7-5960X	3.50 GHz and 20 MB of Cache.
Deca Core CPU	10	Intel released their first Deca-core processor in the Year 2017 .	Xeon Silver 4114T	3 GHz and 13.75 MB of Cache.

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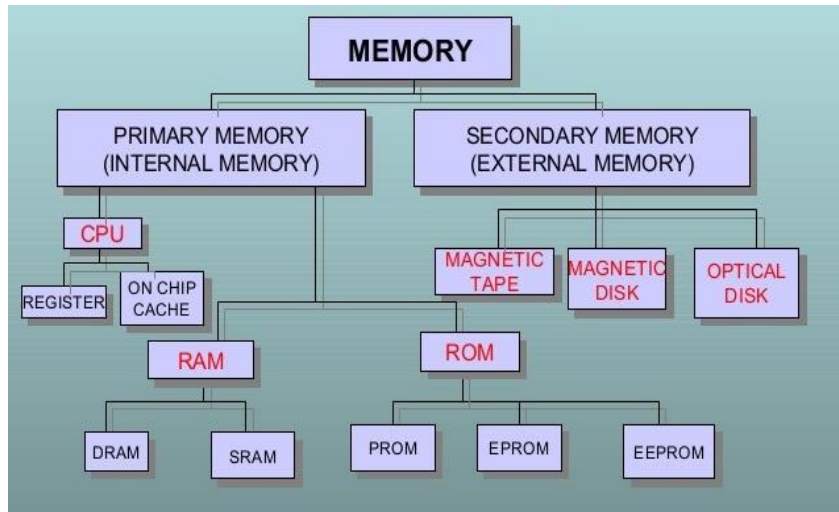
Memory

- Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored.
- It is used to store data and instructions.
- Memory is primarily of three types,
 - Primary Memory/Main Memory
 - Secondary Memory



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Computer Memory Hierarchy



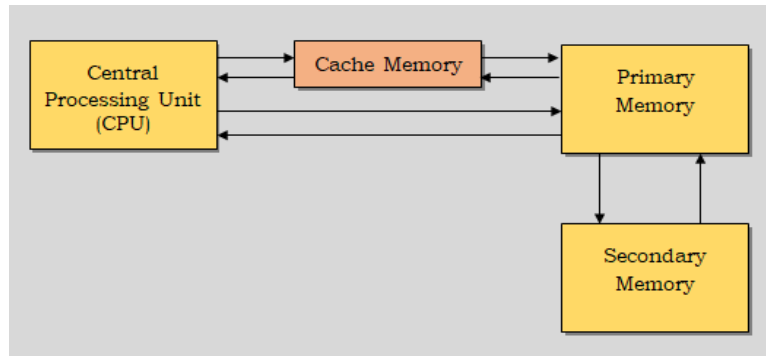
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Primary Memory

- Primary memory is computer memory that is **accessed directly by the CPU**.
- The primary memory of a computer can be categorized into three major types.
 - **Main memory** that holds instructions and data of the current program,
 - **Cache memory** that enhances the performance of CPU by holding a copy of instructions / data stored in the main memory to save unwanted retrieval,
 - **Register memory** that holds information required by arithmetic and logical unit of CPU to execute the instructions.

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Primary Memory



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Main Memory

- The size of Main memory is the largest when compared to Cache Memory and Register memory but the **cost is the lowest among them**.
- Main memory can be divided into two main types viz.,
 - Random Access Memory (RAM)
 - Read-only memory (ROM)

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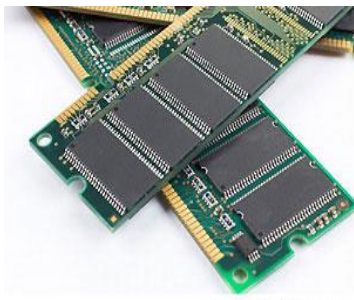
RAM

- Stands for **Random Access Memory**
- Known as **primary storage**, it is the **main working memory** of the computer system.
- RAM is the internal memory of the CPU for **storing data, program, and program result**.
- **Data and programs currently in use** are held in RAM.
- It is called random access because data can be accessed in any order.
- RAM is volatile which means that when the computer is turned off, the contents of RAM are lost.
 - autosave feature????
- RAM is made in the **form of integrated circuits (IC's)**.

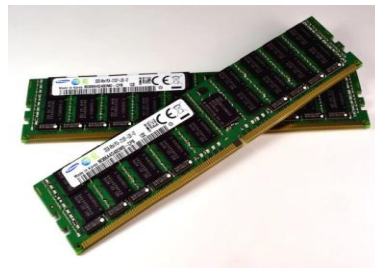
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RAM

- RAM is of two types,
 - Static RAM (SRAM) - a form of **flip-flop - bits**
 - Dynamic RAM (DRAM) - made of **transistors and capacitors**



SRAM



DRAM

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RAM Types

SRAM

- Less memory cells per unit area
- Less Access time
- Uses Flipflops
- Refreshing Circuitry is not required
- Costly
- Used for cache memory

DRAM

- More memory cells per unit area
- More Access time
- Uses Capacitors
- Refreshing Circuitry is required
- Less Costly
- Used for main memory

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RAM Types

- Therefore static RAM is used to create the CPU's speed-sensitive cache, while dynamic RAM forms the larger system RAM space.
- The most common RAM technology is dynamic random access memory (DRAM).
- DRAM is available in modules,
 - DIMM's (dual inline memory module) for desktop computers and
 - SODIMM's (small outline dual inline memory module) for notebook computers.
- DIMM's and SODIMM's are sold in modules with capacities of 1GB, 2GB even 16GB.
- The current technology is called DDR (Double Data RAM) and there are three types DDR1, DDR2, DDR3 and (4 & 5).

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RAM Types



DIMM



SODIMM

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ROM

- ROM stands for **Read Only Memory**
- a ROM is programmed (i.e. has data written to it) during the **manufacturing process**
- we can only read but cannot write on it.
- ROM is a type of **non-volatile memory**
 - the data stored in ROM persists in the memory even when it receives no power
- A ROM stores such instructions that are required **to start a computer**.
 - This operation is referred to as **bootstrap**.
 - The ROM usually contains "**bootstrap code**" which is the basic set of instructions a computer needs to carry out at the power-on.
- ROM chips are not only used in the computer but also in other electronic items like **washing machine and microwave oven**.

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Types of ROM

- **PROM** - stands for Programmable Read-Only Memory, a PROM is manufactured in an empty state and then programmed later using a PROM programmer or burner.
- **EPROM** - stands for Erasable Programmable Read-Only Memory
 - data stored in an EPROM can be erased and the EPROM reprogrammed.
 - Erasing an EPROM involves removing it from the computer and exposing it to ultraviolet light before re-burning it.
- **EEPROM** - stands for Electrically Erasable Programmable Read-Only Memory
 - can be erased and written to by the computer system it is installed in.
 - the write process is slow, so it is normally only done to update program code such as firmware or BIOS code on an occasional basis

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Cache memory

- Frequently addressed Instructions and data are stored in an exclusive faster memory in CPU to avoid waste effort and time to bring it from slow main memory.
- its size is in the range of 2KB to 64KB.
- The size of this memory is much lower than the main memory and cost is higher than the main memory

256 KB to 8 MB

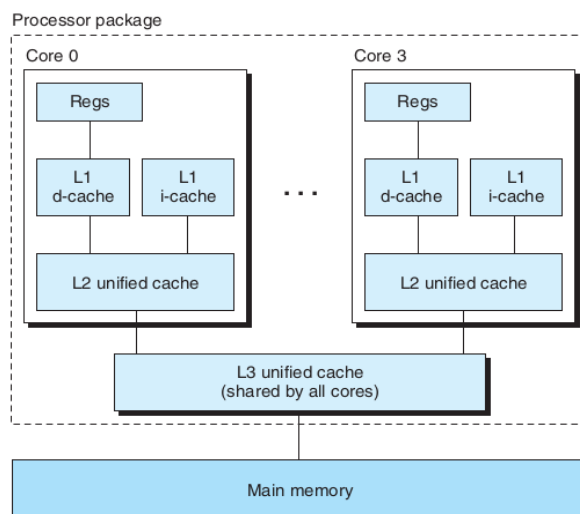
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Cache memory Types

- **Level 1 (L1) cache** - the first level of cache memory.
 - In this type of cache memory, a small amount of memory is present inside the CPU itself.
 - If a CPU has four cores (quad core CPU), then each core will have its own level 1 cache and the size will be 2KB to 64KB.
- **Level 2 (L2) cache** - This level cache may be inside the CPU or outside the CPU.
 - All the cores of a CPU can have their own separate level 2 cache, or they can share one L2 cache among themselves.
 - The memory size is in the range of 256 KB to the 512 KB (1MB).
- **Level 3 (L3) cache**
 - is not present in all the processors
 - used to enhance the performance of Level 1 and Level 2 cache.
 - memory size ranges from 1 MB to 8 MB (64MB).

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Cache memory Types



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Cache memory Types

L1	L2	L3
A cache memory that is directly built into the processor and is used to store the CPU's recently accessed information	A cache memory that is located outside and separated from the CPU chip core, although it is found on the same CPU chip package	A cache memory that is used by the CPU and is usually built onto the motherboard within the CPU module itself
Smallest cache	Larger than L1 but smaller than L3 cache	Largest cache
Called level 1 or primary or internal cache	Called level 2, secondary or external cache	Called level 3 or external cache
Fastest cache	Slower than L1 but faster than L3	Slowest cache
Each core in the CPU has their own L1 cache memory	Each code in the CPU has their own L2 cache memory	All cores in the CPU share the same L3 cache memory

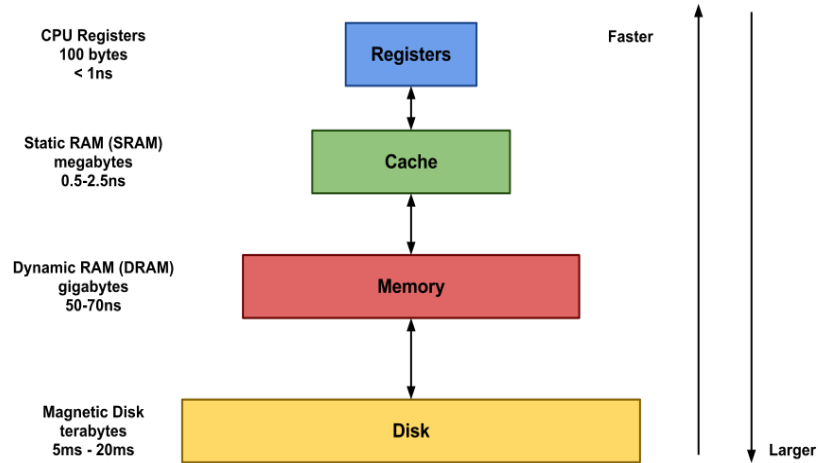
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Register Memory

- Registers as part of CPU, are used to hold the memory addresses of the data, next instruction, and intermediate results during the program execution.
- It also acts as transit storage between the main memory and the Processor.
- It is the costliest of all the memory and size-wise it is the smallest.

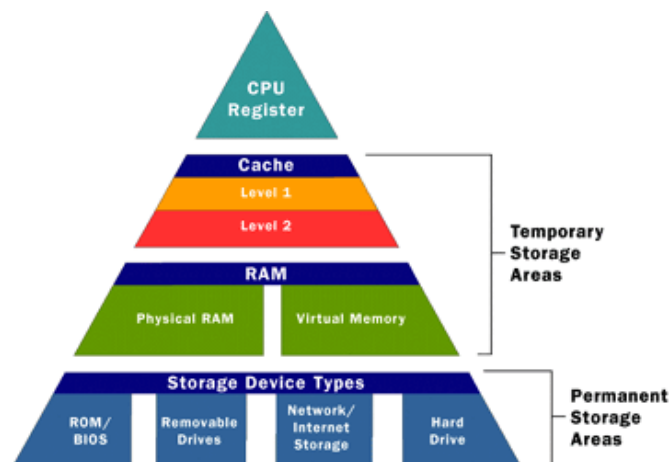
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Computer Memory



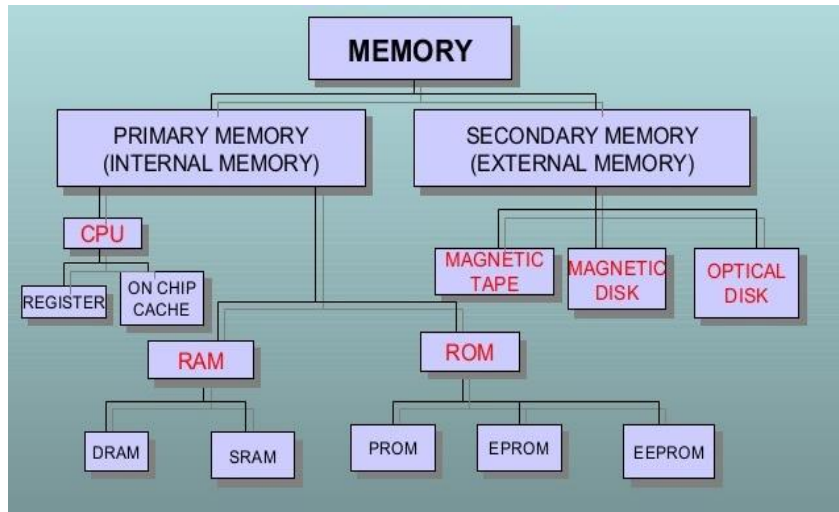
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Computer Memory



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Computer Memory Hierarchy



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Memory is not disk storage

- Although both the hard drive and RAM are memory, it's more appropriate to refer to **RAM** as "**memory**" or "primary memory" and a **hard drive** as "**storage**" or "secondary storage."

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Secondary Memory/Storage

- If we need to **store large amount of data** or programs permanently, we need **a cheaper and permanent memory**.
- It is **non-volatile**, so permanently stores the data even when the computer is turned off or until this data is overwritten or deleted.
- The CPU **can't directly access** the secondary memory.
 - First, the secondary memory data is transferred to primary memory then the CPU can access it.
- Secondary memory refers to storage devices, such as **hard drives and solid state drives**.
 - It may also refer to removable storage media, such as USB flash drives, CDs, and DVDs.

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Secondary Memory/Storage

- Secondary memory may also refer to as *auxiliary storage*, *secondary storage*, *auxiliary memory*, *external storage* or *external memory*.
- These are some characteristics of secondary memory,
 - It is non-volatile, i.e. it retains data when power is switched off
 - It is large capacities to the tune of terabytes
 - It is cheaper as compared to primary memory

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Hard Disk

- Hard disks are flat, **circular plates made of aluminum or glass and coated with a magnetic material.**
- Hard disks for personal computers can store up to several gigabytes (billions of bytes) of information.
- Data are stored on their surfaces in concentric tracks.
- Find the Terms?
 - Sector
 - Track
 - Cylinder
 - Head



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Solid-state Drive

- SSD (Solid State Drive) is also a non-volatile storage medium that is used to hold and access data.
- Unlike a hard drive, it does not have moving components, so it offers many advantages over HDD, such as
 - faster access time,
 - noiseless operation,
 - less power consumption, and more.



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Pen drive

- The USB flash drive, thumb drive, or a jump drive is also known.
- It connects via a USB port to a computer.
- The pen drive has no moving parts; it includes a built-in circuit memory chip to store data.
- The chip is housed within an **aluminum or plastic housing**.
- The storage capacity of the pen drive is usually 2 Gigabytes to 128 GB.
- It is also a **play and plug device** because there are no further drives, hardware, or software needed for use.



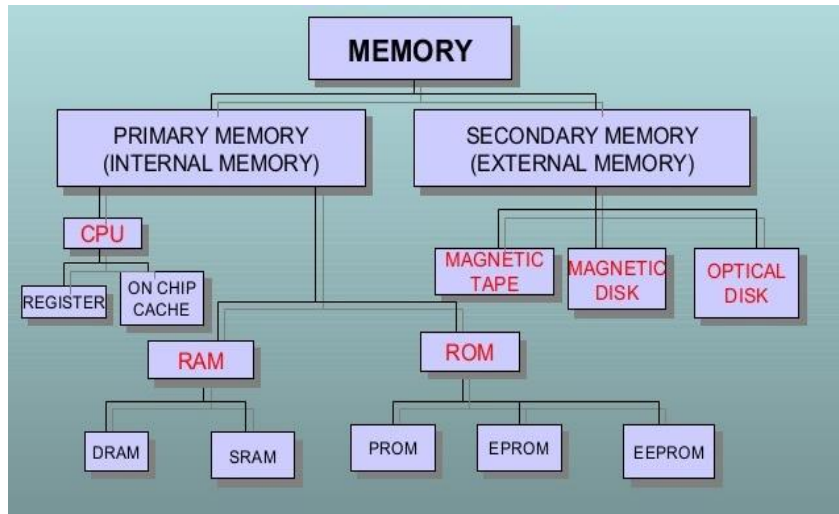
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Self -Explore

- SD Card
- Compact Disk (CD)
- Digital Versatile Disc or Digital Video Disc (DVD)

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Computer Memory Hierarchy



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End

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