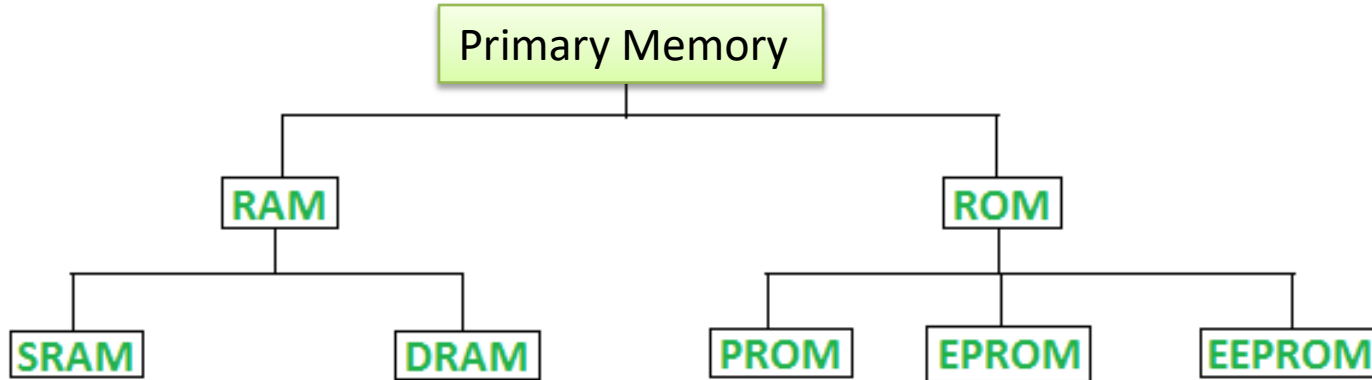


Primary Memory/Main Memory

- Primary memory is the main memory of computer. It is a chip mounted on the motherboard of computer.
- Primary memory is categorized into two main types-
 - **Random Access Memory (RAM)**, and
 - **Read Only Memory (ROM)**

Primary Memory/Main Memory



Classification of computer memory

Random Access Memory

- RAM is used to **store data and instructions during the operation of computer.**
 - The data and instructions that need to be operated upon by CPU are **first brought to RAM from the secondary storage devices like the hard disk.**
 - CPU interacts with RAM to get the data and instructions for processing.

Random Access Memory

- RAM loses information when the computer is powered off. It is a **volatile memory**.
- When the power is turned on, again, all files that are required by the CPU are loaded from the hard disk to RAM.
- Since RAM is a volatile memory, **any information that needs to be saved for a longer duration of time must not be stored in RAM.**

Random Access Memory

- RAM provides **random access** to the stored bytes, words, or larger data units. This means that it requires **same amount of time to access information from RAM, irrespective of where it is located** in it.
- RAM can be read from and written to with the **same speed**.
- The size of RAM is limited due to its high cost. The size of RAM is measured in MB or GB.
- RAM is a microchip **implemented using semiconductors**.

Random Access Memory

- There are **two categories of RAM**, depending on the technology used to construct a RAM—
 - (1) **Dynamic RAM (DRAM)**, and
 - (2) **Static RAM (SRAM)**.

DRAM

- DRAM is the most common type of memory chip. DRAM is mostly used as main memory since it is small and cheap.
 - It uses **transistors and capacitors**. The transistors are arranged in a matrix of rows and columns. The capacitor holds the bit of information 0 and 1. The transistor and capacitor are paired to make a memory cell.
 - DRAM **must be refreshed continually to store information**.
 - DRAM gets its name from the refresh operation that it requires to store the information; otherwise it will lose what it is holding. The refresh operation occurs automatically thousands of times per second. **DRAM is slow because the refreshing takes time**.
 - **Access speed of DRAM ranges from 50 to 150 ns.**

SRAM

- SRAM uses multiple **transistors** (four to six), for each memory cell. It does **not have a capacitor in each cell**.
- A SRAM memory cell has more parts so it takes more space on a chip than DRAM cell.
- It does **not need constant refreshing** and therefore is **faster than DRAM**.
- SRAM is **more expensive than DRAM**, and it takes up more space.
- It stores information as long as it is supplied with power.
- SRAM are easier to use and very fast. **The access speed of SRAM ranges from 2– 10 nanosecond.**

RAM

- Memory chips are generally available as part of a card called a memory module. There are generally **two types of RAM** modules—**Single Inline Memory Module (SIMM)** and **Dual Inline Memory Module (DIMM)**.
- SIMM modules have memory chip on **one side of the PCB**. SIMM modules can store 8 bits to 32 bits of data simultaneously.
- DIMM modules have memory chips **on both sides of the PCB**. DIMM format are 64-bit memories.
- Smaller modules known as **Small Outline DIMM (SO DIMM)** are designed for portable computers. SO DIMM modules have 32-bit memory.

Read Only Memory (ROM)

- ROM is a **non-volatile primary memory**. It does **not lose its content when the power is switched off**.
- ROM, as the name implies, has **only read capability and no write capability**. After the information is stored in ROM, it is permanent.
- ROM comes **programmed by the manufacturer**. It stores standard processing programs that permanently reside in the computer. **ROM stores the data needed for the start up of the computer**. The instructions that are required for initializing the devices attached to a computer are stored in ROM.

Read Only Memory (ROM)

- The **ROM memory chip stores the Basic Input Output System (BIOS)**.
- BIOS provides the processor with the information **required to boot the system**.
- It provides the system with the settings and resources that are available on the system.
- BIOS is a **permanent part of the computer**. It does not load from disk but instead is stored in a ROM memory chip.

Read Only Memory (ROM)

- When the computer is turned on, the BIOS does the following things:
 - **Power On Self Test (POST)** is a program that runs automatically when the system is booted. BIOS performs the power-on self-test. It checks that **the major hardware components are working properly.**
 - **BIOS setup program**, which is a built-in utility in BIOS, lets the user set the many functions that control how the computer works. BIOS **displays the system settings and finds the bootable devices.** It loads the interrupt handlers and device drivers. It also initializes the registers.
 - **Bootstrap Loader** is a program whose purpose is to start the computer software for operation when the power is turned on. **It loads the operating system into RAM and launches it.** It generally seeks the operating system on the hard disk. The bootstrap loader resides in the ROM. The BIOS initiates the bootstrap sequence.

Types of ROM

- All the different kinds of ROM retain their content when the power is turned off.
- **PROM (Programmable ROM)** can be programmed with a special tool, but after it has been programmed the contents cannot be changed.
- **EPROM (Erasable Programmable ROM)** can be programmed in a similar way as PROM, but it can be erased by exposing it to ultra violet light and re-programmed. EPROM chips have to be removed from the computer for re-writing.
- **EEPROM (Electrically Erasable Programmable ROM)** memories can be erased by electric charge and re-programmed. EEPROM chips do not have to be removed from the computer for re-writing.