Computer Memories

Definition

Memory: is any physical device capable to store information temporarily or permanently.

There are many types of computer memories:

1- **Random Access Memory (RAM):** is a type of data storage located on the motherboard. It is a volatile memory which mean that all information stored in lost when the computer is turned off.

* Volatile memory is temporary memory.

* RAM speed measured by Megahertz (MHz), like CPU speed.

What does RAM Speed determine in the system?

RAM Speed determines how much data transferred at a time in the system. Faster the RAM, faster processing speed.

RAM chips are available in two forms:

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

What is SRAM?

Consist of circuits capable of retaining the stored information as long as the power is applied. That means this type of memory requires constant power. SRAM memories used to build Cache Memory.

What is DRAM?

DRAM stores the binary information in the form of electric charges applied to capacitors. The stored information on the capacitors tends to lose over a period of time and thus the capacitors must be periodically recharged to retain their usage. DRAM requires refresh time. The main memory is generally made up of DRAM chips.

SRAM	DRAM
SRAM has a lower access time, so it faster than DRAM.	DRAM has a higher access time, so it is slower than SRAM.
SRAM is costlier than DRAM.	DRAM costs less than SRAM.
SRAM requires a constant power supply, which means this type of memory consumes more power.	DRAM offers reduced power consumption.
Due to complex internal circuitry, less storage is available compared to the same physical size of a DRAM memory chip.	Due to the small internal circuitry in the one-bit memory cell of DRAM, a large storage capacity is available.
SRAM does not require refresh time.	DRAM requires periodic refresh time.

2- **Read Only Memory (ROM):** is another type of data storage contains the programming that allows the computer to be "booted up". The contents of ROM can be read only not written on and could not be changed. ROM is non-volatile storage. The information on it maintained even if the computer is turned off.


Different between RAM and ROM

RAM	ROM
Used in the normal operations of a computer	Used primarily in the startup process of a computer
Volatile memory	Non-volatile memory
Its contents are lost when the device powered off.	Its contents retained even when the device is powered off.
Can be written on	Could not be written on
Is faster than ROM	Is slower than RAM

3- Cashe Memory

A small-sized type of volatile computer memory that provides high-speed data access to a processor and stores applications, data and programs that used frequently. It is the fastest memory in a computer, and typically integrated on the Motherboard and directly embedded to the processor.
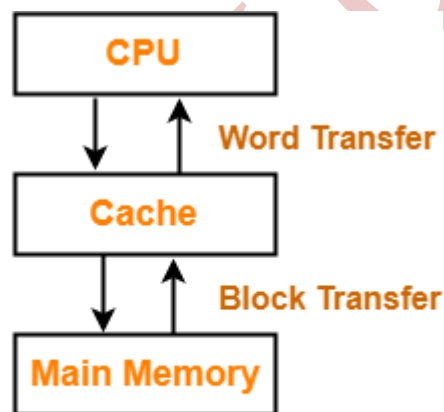
Cache and Main Memory

Types of cache memory

It is categorized as "levels" that describe its closeness and accessibility to the microprocessor.

There are three general cache levels:

1- **Level 1 (L1 cache)** , or primary cache, is fast but small, and usually embedded in the processor chip as CPU cache.

2- **Level 2 (L2 cache)**, or secondary cache, is often more wide than L1 embedded on the CPU, or it can be on a separate chip have a high-speed alternative system bus connecting the cache and CPU.

3- **Level 3 (L3 cache)** is specialized memory developed to improve the performance of L1 and L2. L1 or L2 can be significantly faster than L3, though L3 is usually double the speed of DRAM.

Memory capacity measurement

If the memory has enough space, the computer will be fast.

Each **0** or **1** is called a binary digit **(bit)**. A group of eight bits called a **byte**.

Bit	0 , 1
Byte	8 Bit
Kilobyte	2^{10} byte = 1024 byte
Megabyte	2^{20} byte = 1024 Kilobyte
Gigabyte	2^{30} byte = 1024 Megabyte
Terabyte	2^{40} byte = 1024 Gigabyte