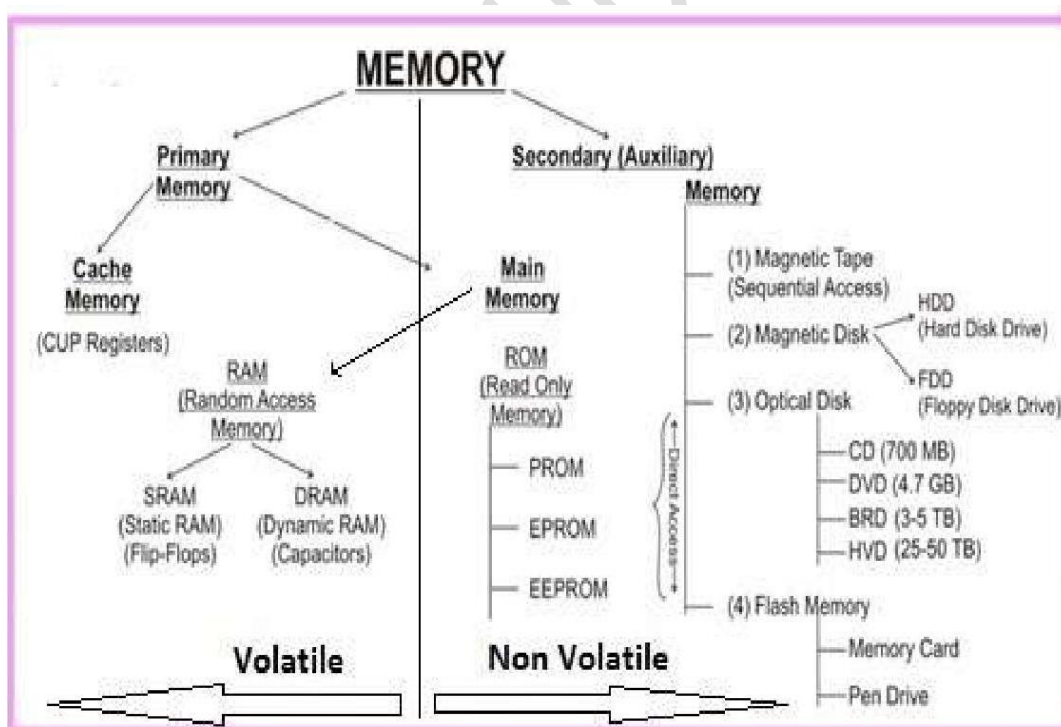# MEMORY
## BHARAT SCHOOL OF BANKING- VELLORE

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in computer where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address which varies from zero to memory size minus one. For example if computer has 64k words, then this memory unit has 64 * 1024=65536 memory locations. The address of these locations varies from 0 to 65535.



Memory is primarily of three types

- Cache Memory
- Primary Memory/Main Memory
- Secondary Memory

# Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up CPU. It acts as a buffer between the CPU and main memory. It is used to hold those parts of data and program which are most frequently used by CPU. The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.

## Advantages

The advantages of cache memory are as follows:

- Cache memory is faster than main memory.

- It consumes less access time as compared to main memory.

- It stores the program that can be executed within a short period of time.

- It stores data for temporary use.

## Disadvantages

The disadvantages of cache memory are as follows:

- Cache memory has limited capacity.
- It is very expensive.



# Primary Memory (Main Memory)

Primary memory holds only those data and instructions on which computer is currently working. It has limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed

reside in main memory. It is divided into two subcategories RAM and ROM.

## Characteristics of Main Memory

- These are semiconductor memories
- It is known as main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without primary memory.

# Secondary Memory

This type of memory is also known as external memory or non-volatile. It is slower than main memory. These are used for storing data/Information permanently. CPU directly does not access these memories instead they are accessed via input-output routines. Contents of secondary memories are first transferred to main memory, and then CPU can access it. For example : disk, CD-ROM, DVD etc.

## Characteristic of Secondary Memory

- These are magnetic and optical memories
- It is known as backup memory.
- It is non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without secondary memory.
- Slower than primary memories.

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**RAM:**

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

Access time in RAM is independent of the address that is, each storage location inside the memory is as easy to reach as other locations and takes the same amount of time. Data in the RAM can be accessed randomly but it is very expensive.

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 have to be refreshed on a regular basis.

Because of the extra space in the matrix, SRAM uses more chips than DRAM for the same amount

of storage space, thus making the manufacturing costs higher. So SRAM is used as cache memory and has very fast access.

## Characteristic of the Static RAM

- It has long life
- There is 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 because it is cheap and small. All DRAMs are made up of memory cells which are composed of one capacitor and one transistor.

## Characteristics of the Dynamic RAM

- It has short data lifetime

- Need to be refreshed continuously
- Slower as compared to SRAM
- Used as RAM
- Lesser in size
- Less expensive
- Less power consumption

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.
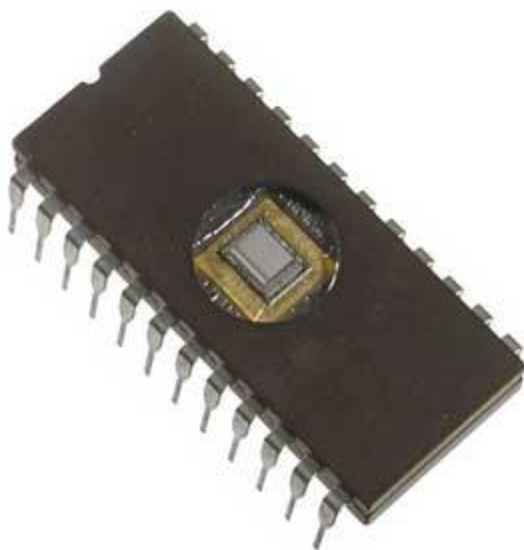


Following are the various types of ROM

# MROM (Masked ROM)

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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)

The 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 ten 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)

The 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 (milli second). 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 re-programming is flexible but slow.

# Advantages of ROM

The advantages of ROM are as follows:

- Non-volatile in nature
- These cannot be accidentally changed
- Cheaper than RAMs
- Easy to test
- More reliable than RAMs
- These are static and do not require refreshing
- Its contents are always known and can be verified

## Memory unit is:

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

| Sr.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 |

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| Sr.No. | Unit | Description |
|---|---|---|
| | | 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 and 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. |

# MEMORY
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| 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 |