MEMORY ORGANISATION

INTRODUCTION

Memory unit is an essential component in digital computers since it is needed for storing programs and data. Two or three levels of memory such as

- Main memory
- Secondary memory and
- Cache memory

are provided in a digital computer. The main memory is a fast memory.

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Main memory stores the programs along with data, which are to be executed. It also stores necessary programs of system software. The cache memory is placed in between the CPU and the main memory. Secondary memory is permanent storage used to store programs and data that are used infrequently.

MEMORY DEVICE CHARACTEISTICS

To identify the behavior of various memories certain characteristics are considered. These are as follows-

Memory types : On the basis of their location inside the computer, memory can be placed in four groups :
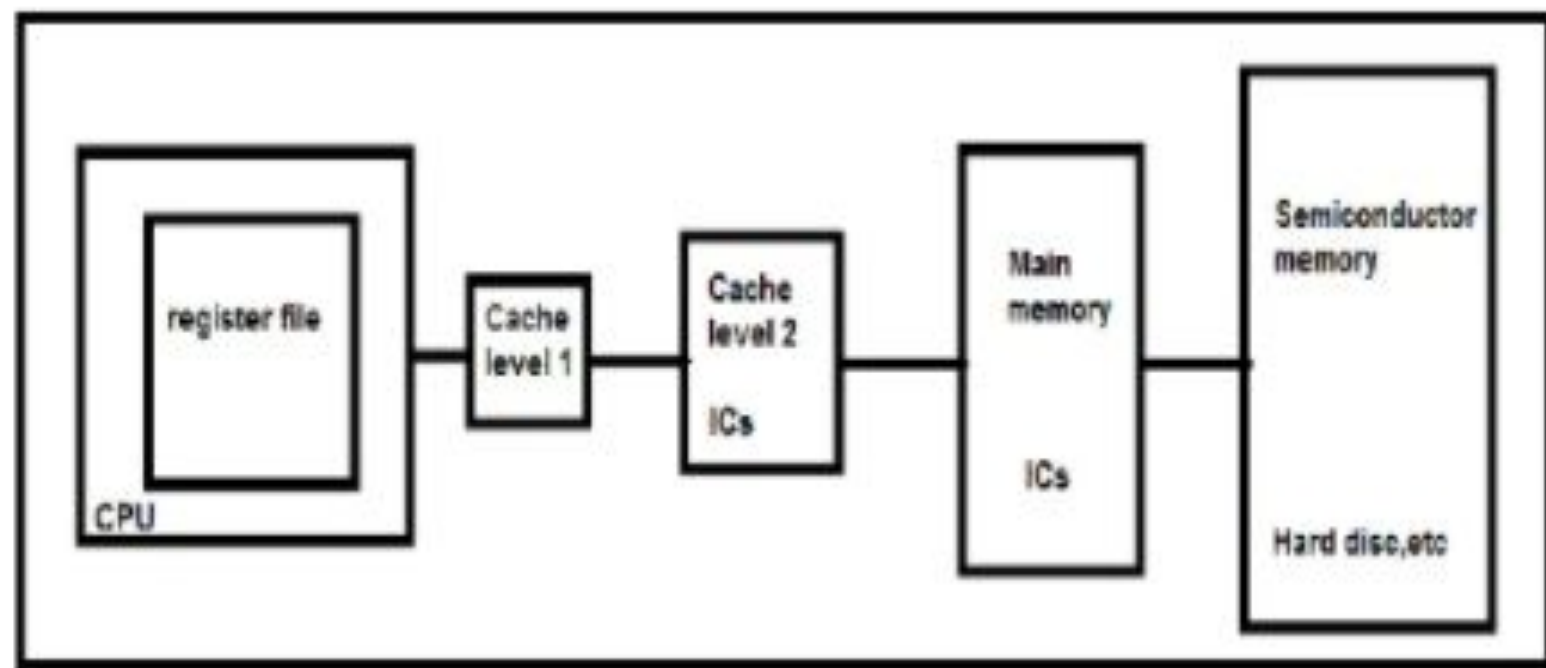
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- **CPU Registers**: these high speed registers in the CPU work as memory for temporary storage of instruction and data. The data can be read from or written into a register within a single clock cycle.

- **Main Memory or Primary Memory**: Main memory size is large and fast accessing external memory stores programs and data. This memory is slower compared to CPU registers because of main memory has large storage capacity is typically 1 and 2^{10} megabyte.

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- **Secondary Memory**: This memory has larger in capacity but slower than main memory. Secondary memory stores system programs, large data files and like the data are not continually required by the CPU. It also acts as an overflow memory when the capacity of the main memory is exceeded. Information in secondary storage is accessed indirectly via input output processor that transfer information between main and secondary memory.

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- **Cache Memory**: Most computers have another level of IC memory called cache memory. It is placed between CPU registers and main memory. A cache memory capacity is less than that of main memory but it is faster than that of main memory because some or all of it can reside on the same IC as the CPU. Cache memories are essential components of high performance computers.

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- **Location**: The memory which is inside the processor called the internal memory. The memory which is external to the processor is known as external memory.
- **Access Method**: Each memory is a collection of various memory location. Accessing the memory means finding and reaching desired location and than reading information from memory location. The information from locations can be accessed as follows:

1. Random access
2. Sequential access
3. Direct access.

- **Random Access**: It is the access mode where each memory location has a unique address. Using these unique addresses each memory location can be addressed independently in any order in equal amount of time. Generally, main memories are random access memories.

- **Sequential Access**: If storage locations can be accessed only in a certain predetermined sequence, the access method is known as serial or sequential access.

- **Direct Access**: In this access information is stored on tracks and each track has a separate read/write head. This features makes it a semi random mode which is generally used in magnetic disks.

- **Volatile Memories**: The memories that looses their contents when the power is turned off called volatile memories.

- **Non-volatile Memories**: The memories that do not loose their contents when the power is removed called Non-volatile memories.

MEMORY CLASSIFICATION

In general the memory is classified in two types based on their mode of access of a memory system.

1. Random access memory
2. Sequential access memory

▸ **Random Access Memory**: The world of data reading or writing from or to the memory requires same time. We can access the data randomly.

Example: hard disk.

▸ **Sequential Access Memory**: The information stored in some medium is not immediately accessible but is available as certain intervals of time. The access time is variable.

Example: magnetic tape.

TYPES OF RAM

- **<u>Static RAM</u>**: It consist of internal latches that store the binary information. The stored information remains valid as long as power is applied to the unit.

- **<u>Dynamic RAM</u>**: It stores the binary information in the form of electric charges on capacitors. The capacitors are provided inside the chip by MOS transistors. The stored charge on the capacitor tends to discharge with time and the capacitors must be periodically recharged by refreshing the dynamic memory.

ROM & THEIR TYPES

▸ **Read only memory**: It is non-volatile memory, which retains the data even when power is removed from this memory. Programs and data that can not be altered are stored in ROM. The required paths in a ROM may be programmed in four different ways:

1. **Mask Programming**: It is done by the company during the fabrication process of the unit. The procedure for fabricating a ROM requires that the customer fills out the truth table he wishes the ROM to satisfy.

2. **Programmable Read only memory(PROM):**

PROM contain all the fuses intact giving all 1's in the bits of the stored words. A blown fuse defines binary 0 state and an intact fuse give a binary 1 state. This allows the user to program the PROM by using a special instruments called PROM programmer.

3. **Erasable PROM(EPROM):** In a PROM once fixed

pattern is permanent and can not be altered. The EPROM can be restructured to the initial state even through it has been programmed previously. When EPROM is placed under a special ultra-violet light for a given period of time all the data are erased. After erase, the EPROM returns to it initial state and can be programmed to a new set of values.

4. Electrically Erasable PROM(EEPROM): It is

similar to EPROM except that the previously
programmed connections can be erased with an
electrical signal instead of ultra violet light. The
advantage is that device can be erased without
removing it from it's socket.