

I.T Study Materials for Class 11

(NCERT Based Revision Notes)

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Memory Hierarchy in Computer Architecture

In the design of the computer system, **a processor**, as well as a large amount of memory devices, has been used. However, the main problem is, these parts are expensive. So the **memory organization** of the system can be done by memory hierarchy. It has several levels of memory with different performance rates. But all these can supply an exact purpose, such that the access time can be reduced. The memory hierarchy was developed depending upon the behavior of the program. This article discusses an overview of the memory hierarchy in computer architecture.

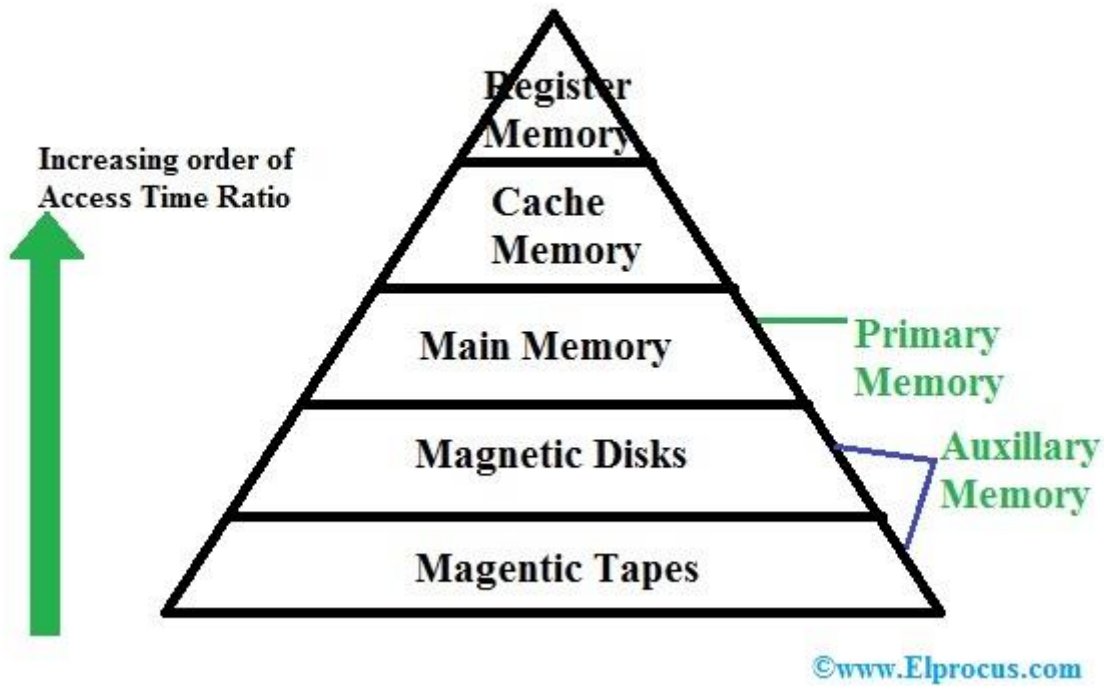
What is Memory Hierarchy?

The memory in a computer can be divided into five hierarchies based on the speed as well as use. The processor can move from one level to another based on its requirements. The five hierarchies in the memory are registers, cache, main memory, magnetic discs, and magnetic tapes. The first three hierarchies are volatile memories which mean when there is no power, and then automatically they lose their stored data. Whereas the last two hierarchies are not volatile which means they store the data permanently.

A memory element is the set of **storage devices** which stores the binary data in the type of bits. In general, **the storage of memory** can be classified into two categories such as volatile as well as non- volatile.

Memory Hierarchy in Computer Architecture

The **memory hierarchy design** in a computer system mainly includes different storage devices. Most of the computers were inbuilt with extra storage to run more powerfully beyond the main memory capacity. The following **memory hierarchy diagram** is a hierarchical pyramid for computer memory. The designing of the memory hierarchy is divided into two types such as primary (Internal) memory and secondary (External) memory.



Memory Hierarchy

Primary Memory

The primary memory is also known as internal memory, and this is accessible by the processor straightly. This memory includes main, cache, as well as CPU registers.

Secondary Memory

The secondary memory is also known as external memory, and this is accessible by the processor through an input/output module. This memory includes an optical disk, magnetic disk, and magnetic tape.

Characteristics of Memory Hierarchy

The memory hierarchy characteristics mainly include the following.

Performance

Previously, the designing of a computer system was done without memory hierarchy, and the speed gap among the main memory as well as the CPU registers enhances because of the huge disparity in access time, which will cause the lower performance of the system. So, the enhancement was mandatory. The enhancement of this was designed in the memory hierarchy model due to the system's performance increase.

Ability

The ability of the memory hierarchy is the total amount of data the memory can store. Because whenever we shift from top to bottom inside the memory hierarchy, then the capacity will increase.

Access Time

The access time in the memory hierarchy is the interval of the time among the data availability as well as request to read or write. Because whenever we shift from top to bottom inside the memory hierarchy, then the access time will increase

Cost per bit

When we shift from bottom to top inside the memory hierarchy, then the cost for each bit will increase which means an internal Memory is expensive compared with external memory.