

Memory Organization

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored.

Type of Memory:

- Primary Memory (Main Memory)
- Secondary Memory

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Primary memory:

- Primary memory holds only those data and instructions on which the computer is currently working.
- It has a 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 resides in the main memory.
- It is divided into two subcategories RAM and ROM.

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Characteristics of Main Memory

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

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Secondary Memory

- This type of memory is also known as external memory or non-volatile.
- It is slower than the 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.
- The contents of secondary memories are first transferred to the main memory, and then the CPU can access it. For example, disk, CD-ROM, DVD, etc.

Characteristics of Secondary Memory

- These are magnetic and optical memories.
- It is known as the backup memory.
- It is a 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 the secondary memory.
- Slower than primary memories.

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RAM (Random Access Memory)

- RAM is the internal memory of the CPU for storing data, program, and program result.
- It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.
- RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. RAM is small, both in terms of its physical size and in the amount of data it can hold.

ROM

- 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.

Advantages of ROM:

- The advantages of ROM are as follows –
- Non-volatile in nature
- Cannot be accidentally changed
- Cheaper than RAMs
- Easy to test
- More reliable than RAMs
- Static and do not require refreshing
- Contents are always known and can be verified

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Cache Memory:

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

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Advantages:

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 –

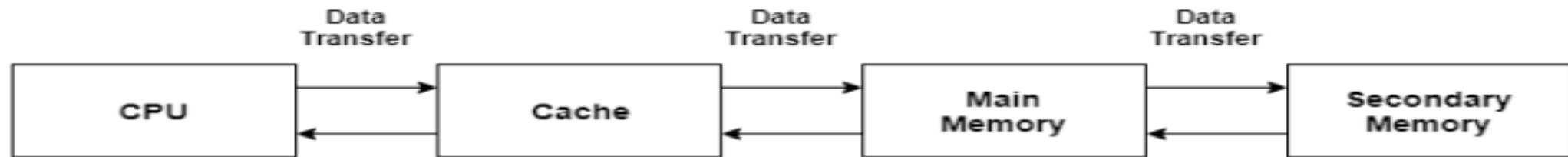
Cache memory has limited capacity.

It is very expensive.

Cache Management

Cache is a type of memory that is used to increase the speed of data access. Normally, the data required for any process resides in the main memory. However, it is transferred to the cache memory temporarily if it is used frequently enough.

A diagram to better understand the data transfer in cache management is as follows –



Virtual Memory:

Virtual Memory is a technique to increase the main memory capacity. It uses data swap technology and hard disk area is used as virtual memory.

Sr. No.	Key	Cache Memory	Virtual Memory
1	Objective	Cache memory increase CPU access speed.	Virtual memory increase main memory capacity.
2	Memory Unit	Cache memory is a memory unit and is very fast to access.	Virtual memory is a technique and involves hard disk and is slower to access.
3	Management	CPU and related hardware manages cache memory.	Operating System manages virtual memory.
4	Size	Cache memory is small in size.	Size of virtual memory is much larger than cache memory.
5	Operation	Cache memory keeps recently used data.	Virtual memory keeps the programs which are not getting accommodated in main memory.

School of Computing Science & Engineering

Course Code : BCAC2101

Course Name: Computer Architecture

Summary of lecture followed by Questions for practice – 1 Minutes



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