Computer System

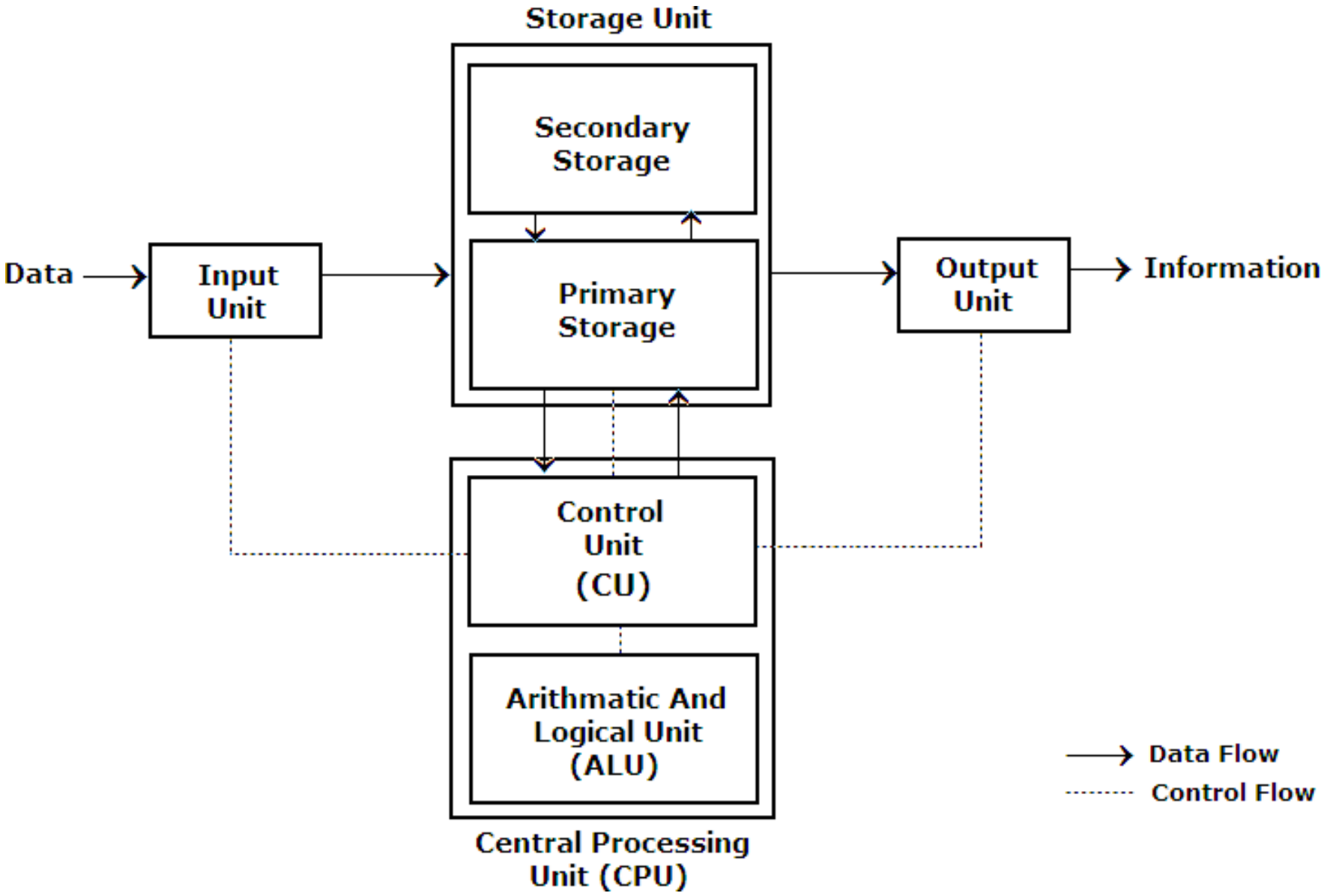
Computer System

- A computer system is a set of integrated devices that inputting , processing and outputting the storing data and information is known as computer system.

- A computer is a programmable machine designed to perform arithmetic and logical operations automatically and sequentially on the input given by the user and gives the desired output after processing. Computer components are divided into two major categories namely hardware and software.

- Hardware is the machine itself and its connected devices such as monitor, keyboard, mouse etc.
- Software are the set of programs that make use of hardware for performing various functions.

Block diagram of computer



Components of a Computer System

- Computer hardware provides the physical mechanisms to process, store, and input /output data. Includes CPU, memory, I/O devices

- Software provides instructions to tell the hardware what tasks to perform. It includes system (eg Windows (Operating System)) and application (eg Excel) software

Data in the computer may be representing numbers, characters, graphics etc but is always kept in a form that the hardware and software can manipulate.

INPUT UNIT

- Computer receives data and instructions through the Input Unit.
- The input unit consists of one or more input devices.
- Input devices include:
  - Keyboard
  - Mouse
  - Joystick
  - Scanner

FUNCTIONS OF INPUT UNIT

- Accept the data and instructions from the outside world.
- Convert it to a form that the computer can understand.
- Supply the converted data to the computer system for further processing.

OUTPUT UNIT

- Computer provides information and results of computation to the outside world through the Output Unit.
- The output unit consists of one or more output devices.
- Output devices include:
  - Monitor
  - Printer

FUNCTIONS OF OUTPUT UNIT

- Accept the results produced by the computer. (These are in a coded form.)
- Convert it to a form that the outside world can understand. (OR, Converts it into human readable form.)
- Supply the converted results to the outside world.

CENTRAL PROCESSING UNIT

CPU

- It is the **brain of the computer**.
- The ALU and the Control Unit (CU) of a computer system are jointly known as the central processing unit.
- CPU performs actual **processing** of data, according to instructions from programs.

3 MAIN PARTS OF CPU

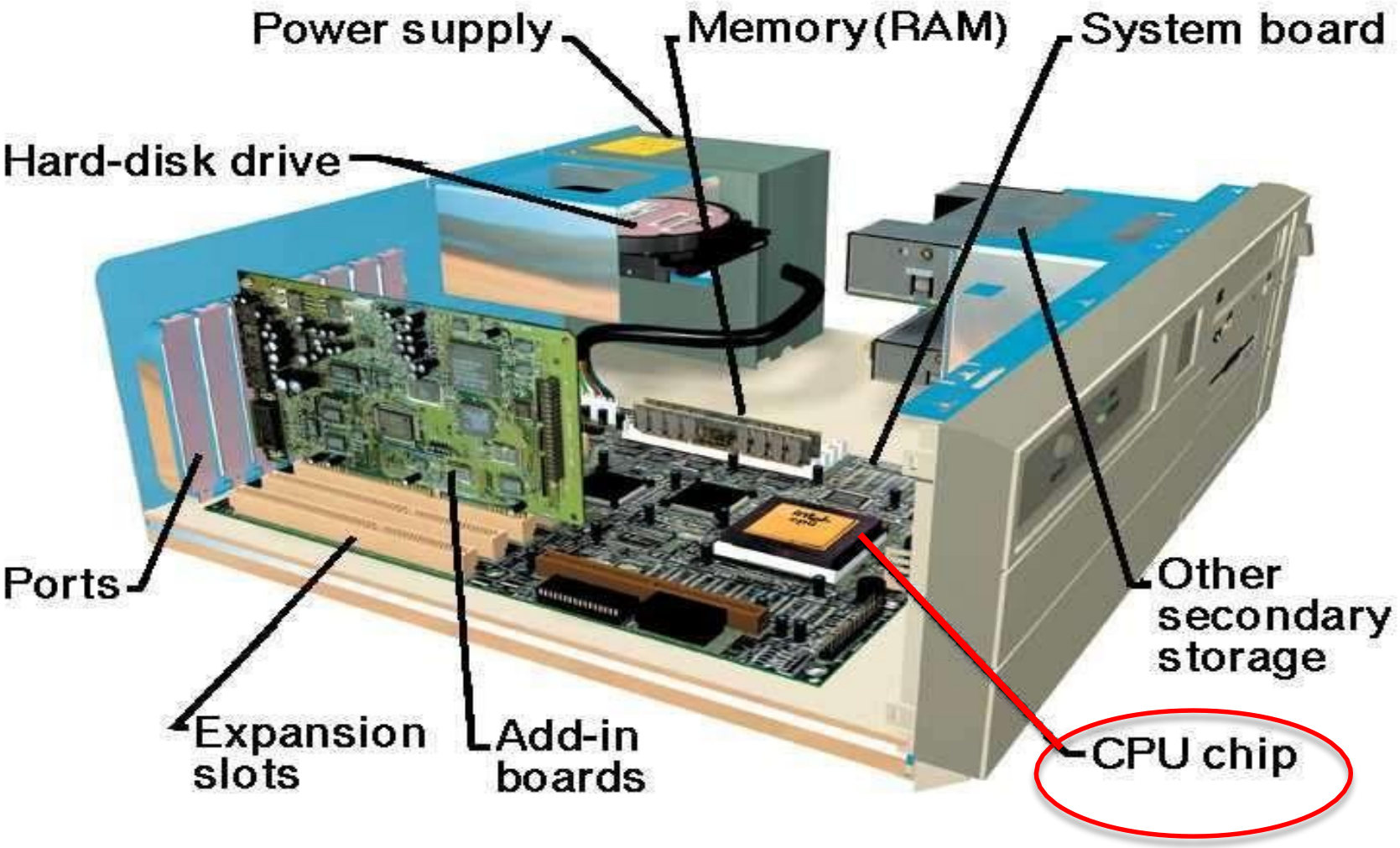
- CONTROL UNIT (CU)
- ARITHMETIC LOGIC UNIT (ALU)
- REGISTERS

FUNCTIONS OF CPU

- It performs all calculations.
- It takes all decisions.
- It controls all units of the computer.



The inside of a system unit



CONTROL UNIT

- It controls all other units in the computer.
- It is the **central nervous system** of the computer that controls and synchronizes its working.

FUNCTIONS OF CONTROL UNIT

- controls data movement and execution of instructions**(when to receive , where to store and when to display)**
- It instructs the input unit, where to store the data after receiving it from the user and
- It controls the flow of data and instructions from the storage unit to ALU.
- It also controls the flow of results from the ALU to the storage unit.
- The control unit determines the sequence in which computer programs and instructions are executed.
- The control unit is also capable of shutting down the computer when the power supply detects abnormal conditions.

1. It sends the input from the input device to the primary memory.
2. Then , raw data is send to the ALU for processing.
3. It interprets the instruction in the program.
4. It then sends back the processed data from the ALU to the memory.
5. Finally, it sends to the meaningful information from the primary memory to the output unit.
6. The control unit repeats a set of four basic operations: Fetching, Decoding, Executing and Storing.

ARITHMETIC LOGIC UNIT

- All **calculations** are performed in the Arithmetic Logic Unit (ALU) of the computer.
- Whenever calculations are required, the control unit transfers the data from memory to ALU. Once the computations are done, the results are transferred to the memory by the control unit and then it is send to the output unit for displaying results.

FUNCTIONS OF ALU

- It performs all arithmetic operations (addition, subtraction, multiplication, and division).
- It performs all logic operations (Logic operations test various conditions encountered during processing and allow for different actions to be taken based on the results.)
- It does comparison and takes decision.

REGISTERS

- Registers are small high speed storage areas.
- They hold various type of data, instruction, Address and the immediate result of the calculations when AlU performs arithmetic and logical operation
- To execute an instruction the control unit of the CPU retrieves it from main memory and place it into a register
- Type:

1. Program counter
2. Instruction Register
3. Memory data register
4. memory address Register
5. memory buffer register
6. Accumulator

Program Counter(PC)

- To keep the track of the next instruction to be executed.

Instruction Register(IR)

- To hold instruction to be decoded by the control unit

Memory Address Register(MAR)

- To hold the address of the next location in the memory to be accessed

Memory Buffer Register(MBR)

- For storing data received from or sent to the CPU.

Memory Data Register(MDR)

- For storing operands and data

Accumulator(ACC)

- For storing the results produced by arithmetic and logic units.

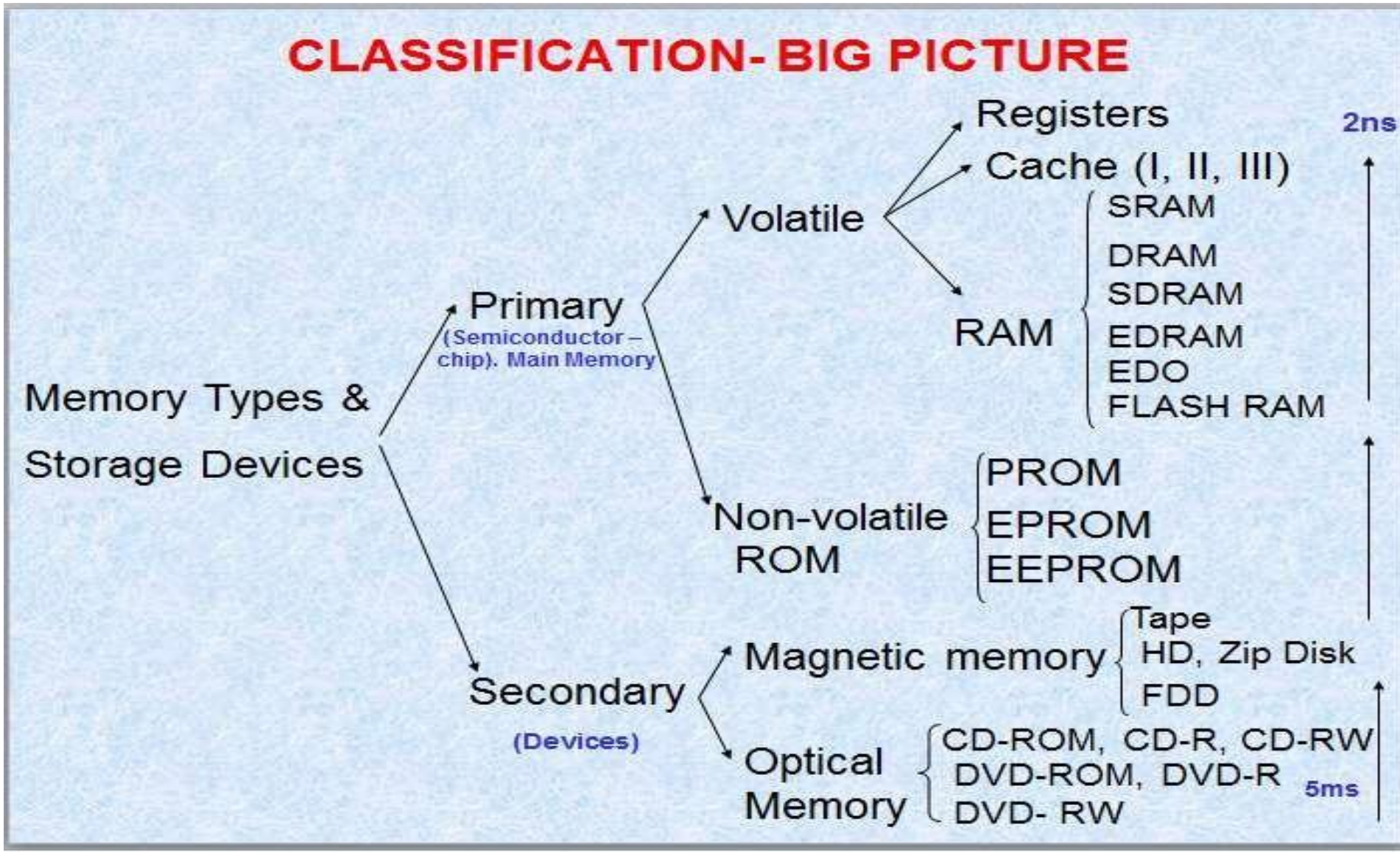
STORAGE UNIT/ MEMORY

- The storage unit of the computer holds data and instructions(either temporarily or permanently) that are entered through the input unit, before they are processed.

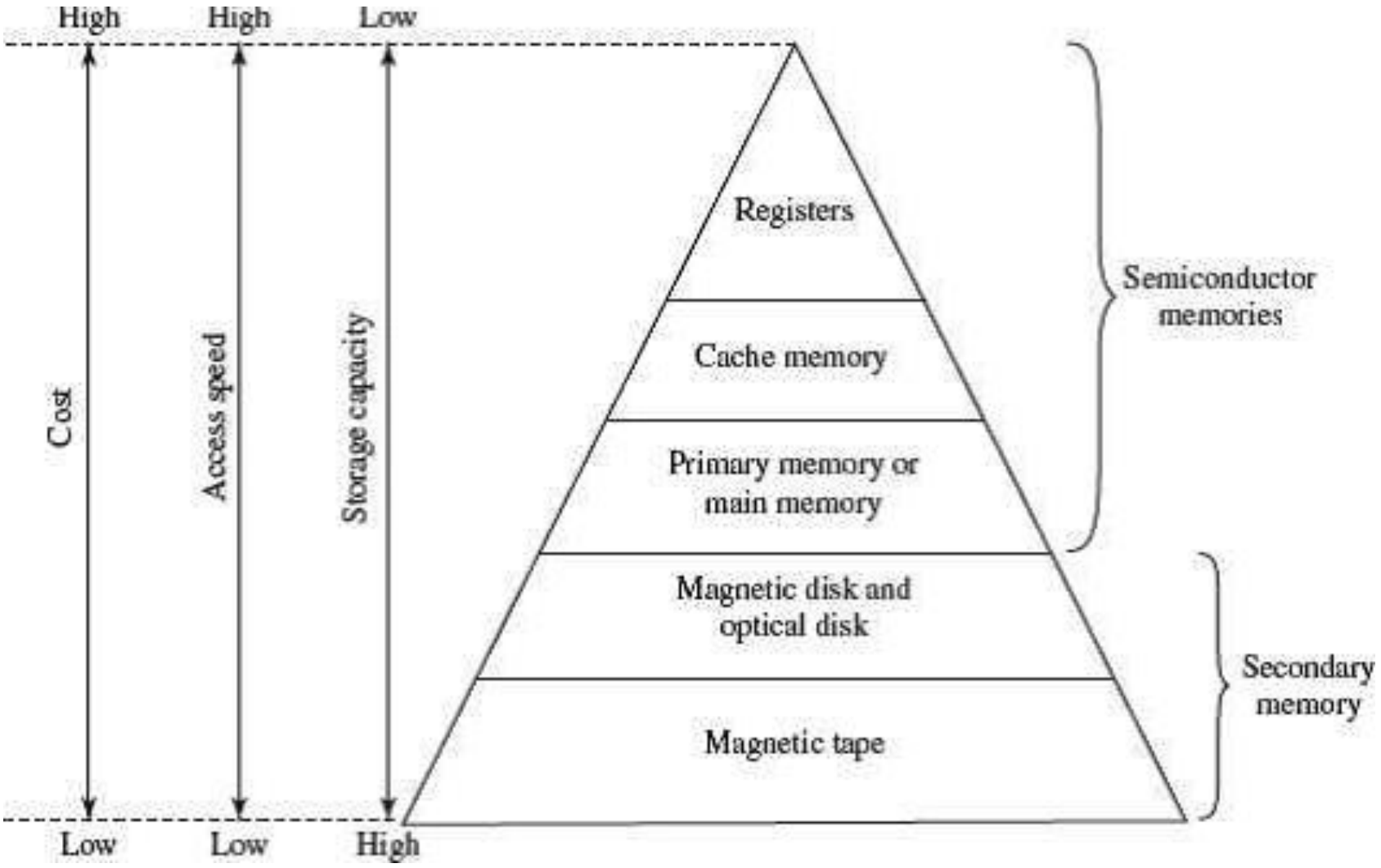
FUNCTIONS OF STORAGE UNIT

- It received the data and instructions required for processing from the input unit.
- It stores the intermediate results.
- It stores the final results before these results are released to the output unit.
- It saves data for later use.

Type of Memory



Hierarchy of Memory



Storage devices are divided into two categories:

- **Primary memory**

1. Primary memory stores data and programs while the program is being executed.
2. Primary memory is also known as main memory
3. Primary memory devices are volatile i.e its content is totally removed when power is switch off.
4. RAM, ROM, cache

- **Secondary memory**

1. The secondary memory stores data and programs for long periods of time. It provides large, non-volatile and cheap storage for programs and data
2. Magnetic tape, magnetic disk ,Hard disk, floppy disk,

Difference between primary and Secondary Memory

ON the Basis of	Primary Memory	Secondary Memory
Nature	Volatile	Non-volatile
Storage capacity	Small	Large
memory	Semiconductor	Magnetic and optical memory
speed	Fast	Slow
cost	High cost	Low cost
Memory Hierarchy	Higher position	Lower position
example	RAM, ROM Cache	Magnetic tape, magnetic disk ,Hard disk, floppy disk

Primary Memory



Cache Memory

- Cache memory is similar to RAM, except that it is extremely fast compared to normal memory and it is used in different way.
- Cache memory is a small memory that resides between CPU and RAM whose access time is closer to the processing speed of the CPU.
- When program is running and the CPU needs to read data and program instruction from RAM, the CPU check first to see whether the data is in cache memory. If the data is not there the CPU read the data from RAM into its register , but it also loads a copy of data into cache memory.
- The next time the CPU needs that same data , it finds it in the cache memory and saved the time needed to load the data from RAM.

- The successful retrieval of requested data from the cache is known as cache hit.
- Failure to find the requested data in the cache is known as cache miss.
- Type of cache memory:

Primary cache (level 1/ internal cache)

- It is located inside the CPU.
- It is smaller and fastest

Secondary cache (level 2/ external cache)

- It is located outside the CPU; normally positioned on the motherboard of a computer.
- It is larger but slower than primary cache

Random Access Memory (RAM)

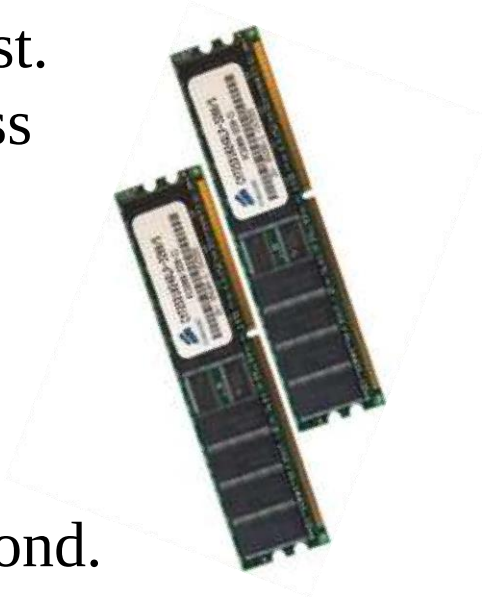


- A primary or main memory, which is also a ***Temporary memory.***
- It installed in the form of chips on motherboard and link to directly processor.
- It loses its data once the power is removed, so it is a ***volatile*** memory
- The computing system that it is used in usually stores data at various locations to retrieve it latter from these locations.
- There are ***two*** types of RAM
  - *Dynamic Random Access Memory (D-RAM)*
    - ***SIPP (Single inline Pin Package)***
    - ***SIMM (Single Inline Memory Module)***
    - ***DIMM (Dual Inline Memory Module)***
  - *Static Random Access Memory (S-RAM)*



Random Access Memory(RAM)

- **Dynamic Random Access Memory (D-RAM)**
  - Most popular RAM and mostly use.
  - Value must be refreshed many time in a second.
  - Main purpose is to decrease the processing cost.
  - Slower, Cheaper, easily available & require less power.



- **Static Random Access Memory (S-RAM)**
  - Not popular but faster than D-RAM.
  - Not need to refresh hundreds of times in a second.
  - Main purpose is to decrease the processing time.
  - Much more expensive, and require more space and power.

Read Only Memory (ROM)

- It also called BIOS (basic input/output of System)
- ROM is used for storing programs that are ***PERMENTLY.***
- When power is removed from a ROM chip, the information is not lost, so it is a nonvolatile type of memory
- User can not change the information, just read. So, it is called ***Read only Memory.***
- *There are **three** types of ROM:*
  - ***Programmable Read only Memory (P-ROM)***
  - ***Erasable Programmable Read only Memory (EP-ROM)***
  - ***Electrically Erasable Programmable Read only Memory (EEP-ROM)***

Types of ROM

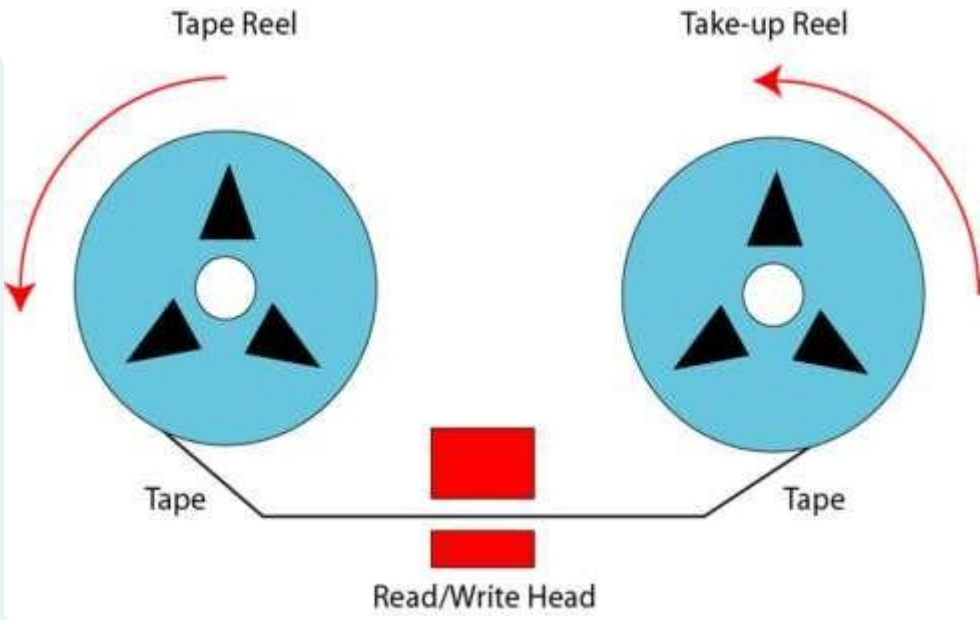
- **PROM – programmable ROM:**
  - *Provide facility to change the content of ROM once.*
  - *When something written and saved on PROM, it become ROM.*
- **EPROM – erasable ROM:**
  - *Content can be written, save and change two times.*
- **EEPROM – Electrically Erasable PROM:**
  - *Content can be written, save and change many times as programmer wish for that.*

Secondary Memory

Magnetic Storage Media:

Magnetic Tape Storage

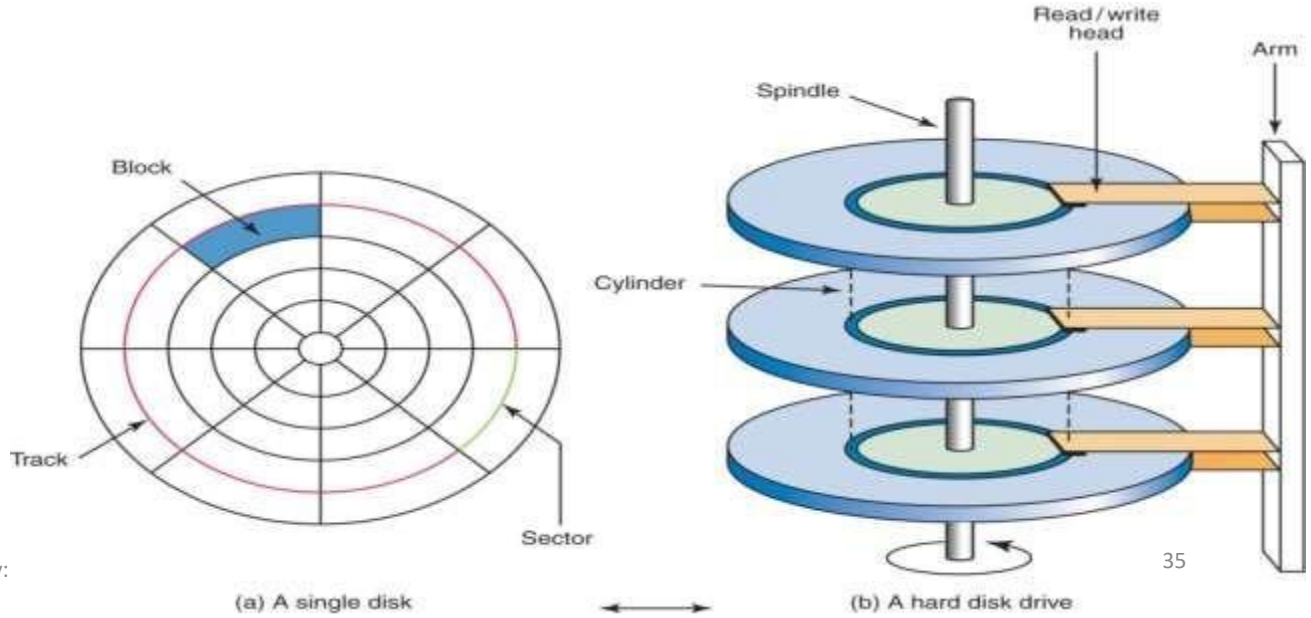
- *Its look like the music cassettes with magnetic coating.*
- *Provides sequential access*
- *Information stored in sequence*
- *It contain track, on which*
- *data is stored.*
- *not provide easy access to desired data.*



Secondary Memory

Magnetic Disk Storage:

- Most popular medium of direct-access secondary storage.
- Data read, write and change many time faster then magnetic disk.
- Magnetic Disk is a thin, circular metal plate, coated both sides with magnetic material.



Secondary Memory

- Types of Magnetic Disk Storage:
  - ***Hard Disk***
    - Long-term, nonvolatile storage
    - Large, inexpensive, slow level in the storage hierarch y
    - A magnetic disk consist of a collection of platters
    - Use thicker, metallic platters for storage
    - Faster than a floppy diskette
  - ***Floppy Disk***
    - Also known as Diskettes or floppies.
    - Introduced by IBM in 1972.
    - It is use to transfer small amount of data.
    - Floppy disk are lesser than the hard disk, because it consist on one platter.





Traditional Floppy Disk

Secondary Memory

Optical Storage Media:

- **CD-ROM (Compact Disk-read only memory):**
  - New storage media as compare to floppy disks.
  - It can written once, and read many time.
  - Optional Laser Disk Technology is used to read and write.
- **Rewriteable Optical Disk:**
  - Magnetic and optical technologies are used together in this.
  - It can read and write so many time.
  - Its size is 5.25 inch and store up to 1GB of data.
- **DVD-ROM Disk (Digital Versatile Disk ROM):**
  - It increase the storage capacity of data.
  - It can store 2GB of data.
  - It uses short waves length of LASER to read & Write data.

Summary

- Component of Computer
- Input/ Output Unit
- Central Processing Unit (CPU)
- Control unit and its function
- ALU and its function
- Storage System (Primary storage and Secondary Storage)
- Difference between primary memory and secondary memory
- Register and Its Type
- Cache Memory and its type