26/09/24

Memory

① what is Memory?

Ans ⇒ In computing Memory refers to the hardware components used to store data temporarily or permanently.

⇒ There are two types of Memory.

① Primary Memory ② Secondary Memory

Primary Memory :-

Primary memory is also known as main memory or RAM (Random Access Memory) is a type of volatile computer memory that is used to temporarily store data & program code that the CPU (central Processing unit) actively uses during its operation. Primary memory plays critical role in the overall performance of a computer. Here are key characteristics & functions of primary memory.

① Volatile ⇒ Primary memory is usually volatile, meaning it loses its data when the power is turned off.

② Speed ⇒ It is much faster than Secondary memory allowing the CPU to quickly read & write data during program execution.

③ Direct Accessible ⇒ The CPU can directly access any location in primary memory. This is why it's called "Random Access Memory" data can be retrieved in a non-Sequential (random) manner.

(4) Cost :- It is more expensive per unit of storage compared to Secondary memory.

(5) Temporary Storage ⇒ It holds data & instruction that the CPU needs while performing tasks. This includes operating system files, application, programs & currently processed data.

(6) Limited Capacity ⇒ The capacity of primary memory is generally smaller compared to Secondary storage devices like hard drives or Solid State drives. It's designed to hold the data & code needed for immediate processing, not long term storage.

(7) Cache levels ⇒ Many modern computers have multiple levels of memory caches, including L_1, L_2 & L_3 caches, which are part of the CPU architecture & provide even faster access to frequently used data.

(8) Expansion & Upgrade ⇒ In many computers, primary memory can be expanded or upgrade by adding more RAM modules or replacing existing ones with higher capacity modules. This can improves the computer's performance especially when working with resources intensive tasks.

(9) Shared by OS and Application ⇒ Primary Memory is shared among the operating system and all running application. The operating system manage memory allocation to ensure that each application has access to the necessary resources without interfacing with other.

~~In Secondary~~

In Summary, primary memory, RAM is fast & volatile form of computer memory that stores data & program code for CPU to actively use during processing. It is a critical component for the overall performance of a computer System & its capacity & speed can influence how efficiently a computer runs various application & tasks.

RAM "Random Access Memory"

Types of RAMs

=> There are several types of RAM (Random access memory) used in computer & other electronic devices, each with its own characteristics and application. The main type of RAM include.

① DRAM (Dynamic RAM)

DRAM is the most common type of RAM used in computers. It store data in tiny capacitor within a integrated circuit. These capacitor must be refreshed periodically to maintain data that is why its called "Dynamic RAM".

(+) Characteristics :-

1. Lower than SRAM
2. Less expensive per Megabyte.
3. Require regular refreshing to maintain data.

(+) Application :-

Main System memory in desktop and laptop computers.

② SRAM (Static RAM) :-

SRAM is faster and more expensive than DRAM. It stores data using flip-flop circuits, which don't require constant refreshing to maintain data.

(#) Characteristics ⇒

1. Faster than DRAM.
2. More expensive per megabyte
3. Does not need refreshing.

(#) Functions :-

CPU cache memory, cache in memory controllers and certain high speed memory components.

③ SDRAM (Synchronous Dynamic RAM) :-

SDRAM is a type of DRAM that synchronizes its operations with the computer's clock speed. This synchronization allows for faster data transfer rates compared to asynchronous DRAM.

(#) characteristics :-

Faster than traditional DRAM.

(#) Application ⇒ Commonly used in modern computers and devices for system memory.

④ DDR SDRAM (Double data rate SDRAM) :-

DDR SDRAM is an evolution of SDRAM that can transfer data on both the rising and falling edges of the clock ~~speed~~ signal effectively doubling the data transfer rate compared to SDRAM.

(#) Application => Main System Memory in desktops, laptops & Servers.

(5) DDR2, DDR3, DDR4, DDR5 etc:-

These are subsequent generations of DDR SDRAM with each generations offering improved data transfer rates, lower power consumption and other performance enhancements.

(#) Characteristics:-

Each generation offers increased performance compared to, its predecessor and is backward compatible with older motherboard slots (e.g., DDR3 slots can accept DDR2 memory but not DDR4.

(#) Application:- DDR4 & DDR5 are the most common in modern System.

(6) LPDDR (Low Power DDR):-

A variation of DDR SDRAM designed to consume less power making it ideal for mobile devices.

(#) Characteristics:-

(1) Lower power usage compared to standard DDR.

=> Application:-

Main system memory in smartphones, tablets & other mobile devices

These are some of the most common types of RAM used in computing each tailored to different performance, power consumption and cost requirement. The choice of RAM types depends on the specific needs of the devices or system in which it is used.

Input & Output

① Explain I/O devices?

Ans » Input & output devices are the hardware components of computer system that enable communication between the computer and the external world, allowing users to interact with the computer and exchange data. Here are definition and example of Input & output devices.

Input Devices:

Input devices are the hardware components that allows users to input data commands or instructions into a computer or electronic devices. They convert physical actions or data from the external environment into digital information that the computer can process.

⇒ Characteristics of Input devices:-

- Function ⇒ They capture raw data or control signals and send them to the computer for processing.
- Types of data ⇒ The data can be various forms such as text, images, sound, movement or electrical signals.

Examples of Input Devices.

- Keyboards ⇒ Allow users to input text & commands through the use of keys.
- Mouse ⇒ Used for pointing, clicking & interacting with graphical user interfaces.
- Touchscreen ⇒ Allow users to input data by touching the screen directly, commonly found on smartphones & tablets.
- Scanners ⇒ Convert video documents, photos or images into digital formats.

- Webcam ⇒ Capture video or images, often used for video conferencing or live streaming.
- Microphone ⇒ Convert sound into digital audio data, enabling voice input or recording.
- Barcode Scanner ⇒ Reads barcodes for inventory and retail applications.
- Joystick / Gamepad ⇒ Used for gaming and control in certain applications.
- Digital Pen ⇒ Allows for precise drawing or handwriting input on touchscreens or graphics tablets.

(#) Output Devices.

(#) Definition :-

Output devices are the hardware components that display, present or provide the results of computer processing to the user or external systems they convert digital information from the computers into a form that humans or other devices can understand.

⇒ Characteristics of Output devices :-

- Functions ⇒ They receive process data from the computer and present it in a form the user can understand (visual, audio or physical).
- Types of Data :-

The data output can be in the form of text, images, audio or other media.

(#) Types of Output Devices :-

- **Monitor (Display) :-**
  Presents visual information including text, images & videos to the user.
- **Printer :-** Produces physical copies of documents images or graphics on paper or other media.
- **Speaker :-** Converts digital audio into sound waves for listening.
- **Headphones / Earphones :** Provide audio output for private listening.
- **Projector :** Displays computer content on a large screen or wall for presentations.
- **LED \ LCD Panels :-** Used in signs, billboards and display for advertising and information dissemination.
- **Plotter :-** Outputs high quality graphics or technical drawings with precisions.

Input and output devices are essential for human-computer interaction and data exchange, enabling users to communicate with computers and receive feedback. The choice of specific input and output devices depends on the intended use of the computer system of data or information to be processed or presented.