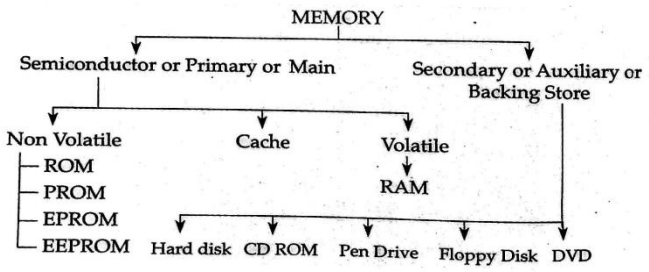
Memory – Study Material

Computer memory refers to the devices that are used to store data or programs on a temporary or permanent basis for use in a computer. Any data or instruction entered into the memory of a computer is considered as storage. It is one of the fundamental components of all modem computers coupled with a central processing unit. For central processing unit to process the input data, there must be a place for storing the data and instruction. This is provided in the Memory unit.

Data representation

The memory unit of the CPU consists of a large number of cells called location. Each location is identified with a unique label called an address, which is used to store data or instruction. The CPU keeps track of all data and program instructions through the use of memory address. Computers represent information in binary code, written as sequences of Os and 1s. 1 represents an on state and '0' represents an off state in a circuit. To store data in location is called 'Write' and fetch the data in location is called 'Read'. Each location can contain fixed number of bits called word length. Word length can be 8, 16, 32 or 64 bits. Bit is smallest unit of binary digit. A word is an arrangement of binary digits. A byte is the unit of memory which is a group of 8 bits in EBCDIC (Extended Binary Coded Decimal Interchange Code) and 7 bits in ASCII (American Standard Code for Information Interchange).

Types of Memory



Memory usually refers to a form of semi conductor storage known as Random-Access Memory (RAM) and sometimes other forms of fast but temporary storage. It is a place in the computer system where data and programs are temporarily stored in internal storage areas in the computer The term memory identifies data storage that comes in the form of chips

Similarly, storage today more commonly refers to mass storage such as optical discs, forms of magnetic storage such as hard disk drives, and other types slower than RAM, but of a more permanent nature. The primary device that a computer uses to store information is hard drive. Memory and storage were respectively called main memory and secondary storage. The terms internal memory and external memory are also used. Storage and memory differ with respect to price reliability and speed.

Primary or Main Memory or Semi conductor Memory or Internal Memory

Computer memory usually refers to the semi conductor technology that is used to store information in electronic devices. Current primary computer memory makes use of IC consisting of silicon-based transistors.

There are two main types of memory

Volatile and Non-volatile. Volatile memory is computer memory that requires power to maintain the stored information, unlike Non-volatile memory which does not require a maintained power supply.

Volatile Memory

RAM (Random Access Memory): It is a volatile memory. It is the most common type of memory used in computer. It works with the CPU to hold instructions and data in order to be processed. It is the first place where data and instructions are placed after being input, and processed information is placed in it to be returned to an output device. But it can hold data only temporarily because it requires a continuous flow of electrical current. If current is interrupted,

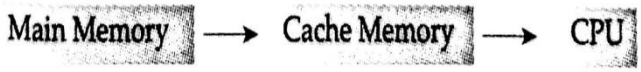
data is lost. It allows data to be read and written randomly not in sequence, so read and write of data is bit quickly. RAM is available in 64 MB, 128 MB, 256MB, 512MB and 1GB capacity.

There are two types of RAM: Dynamic RAM and Static RAM.

(a) Dynamic RAM: It requires constant refreshing of its contents. It loses its content in a very short period even though computer is working. It is cheapen than static RAM (SRAM).

(b) Static RAM: It does not require refreshing. It retains its content till computer is working. It is fasten than dynamic RAM (DRAM).

Cache Memory: Cache is a faster, costlier and a temporary storage area where frequently accessed data can be stored. Once the data is stored in the cache, it can be used in the future by accessing the cached copy rather than recomputing the original data. The CPU and hard drive frequently use a cache. When the processor needs to read from or write to a location in main memory, it first checks whether a copy of that data is in the cache. If so, the processor immediately reads from or writes to the cache, which is much faster than reading from or writing to main memory.



Non Volatile Memory

ROM (Read Only Memory): It is a non volatile memory. Data and instructions stored in it which can be read, only modified or destroyed. It is commonly used for storing program instructions that are not required to change. It is an internal storage area in the computer. It is a silicon chip on motherboard on which instructions are burned at the time of manufacture. When switched on, the computer instruction stored there is automatically initiated and after switching off instructions do not get lost. These permanent instruction stored in ROM are called BIOS (Basic Input Output System). On computer the BIOS contains all the instruction required to

control the keyboard, display screen, disk drives, serial communication and number of miscellaneous functions. The BIOS is copied from ROM to RAM each time the computer is booted. This is known as shadowing.

PROM (Programmable Read Only Memory): It is a non volatile memory. In PROM instructions can bum once, then it is unalterable. After that it behaves like ROM.

EPROM (Erasable Programmable Read Only Memory): It is a non volatile (memory) similar to PROM, but the burning process is reversible by exposure to ultraviolet light. It can be erased by exposure to strong ultraviolet light, then rewritten. It is also called ultraviolet EPROM.

EEPROM (Electrically Erasable)

Programmable Read Only Memory): It is a non volatile similar to EPROM, but the burning process is reversible by exposure to electric pulses. It can be electrically erased, then rewritten electrically. So that they need not be removed from the computer.

Secondary or Auxiliary Memory

The main memory is volatile and limited in capacity so there is a need to store data in a more permanent and cheaper form. Such kind of storage is known as secondary memory. It is also known as auxiliary or backing store memory. Secondary storage does not loose data when the device is powered off. It is non-volatile. Data that is not currently required by the CPU is kept in backing store and copied into main storage when needed. The operating system retrives data from secondary storage in same block size called pages. The most common storage media used as backing store is magnetic tape and magnetic disk. It differs from primary storage because it is not directly accessible by the CPU.

1. **Hard Disk:** A hard disk is a magnetic disk which stores and provides relatively quick access to large amounts of data. It provides higher capacity and greater reliability than

other types of disk drives. A hard disk is really a set of several stacked platters. Each of these looks like an old song record.

2. **Floppy Disk:** It is a soft removable magnetic disc that holds information. The disk is enclosed in an envelope to protect it from dust and scratches. Data is retrieved or recorded on the surface of the disk through a slot on the envelope. On most disk drives, the read / write head is in physical contact with the disk surface. After reading and writing the head lifts away to reduce any harm to disk. It is slower to access than hard disks and has less storage capacity, but it is much less expensive. And most important, they are portable and most popular form of backing store. It is an external memory.
3. **Magnetic Tape:** This is the most successful backup storage media. Storage of data in magnetic tape is similar to the cassette tape that we use for the storage and recording of music. It is made of mylar or polyester. It is generally 2400 to 3600 feet long and half an inch wide. The amount of data that can be stored on magnetic tape is enormous in comparison to punched cards and paper tapes. It can be re-used for storing the data by writing modifying and erasing the old data. Magnetic tape drive is needed for reading and writing data in magnetic tape. All magnetic tape drives have two tape reels. The one reel containing the tape to be read and write is called file reel and the other is called take up reel.
4. **CD-ROM (Compact Disc Read Only Memory):** CD-ROM is also called optical disk capable of storing large amounts, of data up to 1GB, although the most common size is 650MB. Data is recorded permanently on the surface of the optical disk through the use of laser. The laser bums the hole on the surface of the disk at the time of manufacture and the content recorded cannot be changed or erased by users. A laser beam of low intensify is used to read the data- recorded on the disk. To access the data from the CD, CD-Drive and to write the data on the CD, CD-Writer is needed. It is also called WORM (Write Once Read Many) disk because data can be read many times from CD but any modification is not possible. Erasable optical disks are also available. CD-ROM are

particularly well-suited to information that requires large storage capacity. This includes large software applications that support color, graphics, sound, and video.

5. **CD-R/W (Compact Disc Read / Write):** CD- R/W is also an optical disk. Data is recorded on the surface of the optical disk through the use of laser but it can be erased. To access the data from the CD, CD-R/W drive is needed.
6. **DVD:** DVD stands for Digital Versatile Disk or Digital Video disk. It's working technique is like a CD-ROM. It is single or double sided and each side can store one or two layers of data. It stores minimum 4.37 GB data or full movie of very good quality DVD-Video, including several audio tracks in formats like stereo, Dolby Digital and also advanced menu systems, subtitles and still pictures . It can be played by DVD Players and most computer DVD-ROM. Double sided and double layered DVD can store 17 GB audio and video.
7. **Pen Drive:** It looks like small key ring. Most pen drives use a standard USB (Universal Serial Bus) connection allowing plugging into a port on a personal computer. USB pen drive emulates a small disk drive and allows data to be transferred easily from one device to another. The way it works is very simple. It also works very fast. It consists of flash memory data storage device integrated with a USB interface. It is typically removable and rewritable. Since it is a relatively new device, storage capacities can range from 64 MB to 256 GB. It is also called Flash drive. It is an example of EEPROM memory. The common use of USB pen drive is to transport personal data or store personal files such as documents, pictures and video. One can also store medical alert information for emergency use or as preparation against disaster.
8. **Flash Memory:** It is sometimes called flash RAM. It is a non volatile computer storage that can be electrically erased and reprogrammed. It is used in cellular phone, digital camera and digital set top box etc.