

# Chapter 8

## Memory Units

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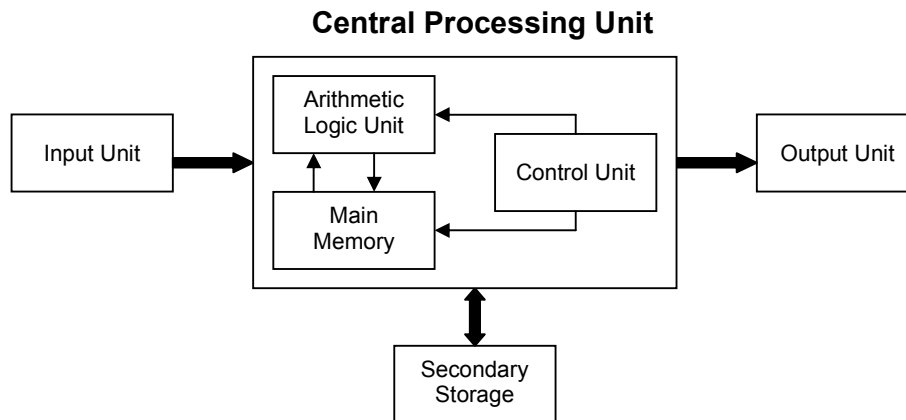
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### I. Introduction

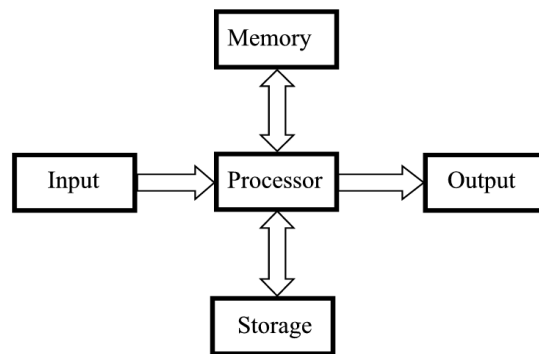
The computer system essentially comprises three important parts – input device, central processing unit (CPU) and the output device. The CPU itself is made of three components namely, the arithmetic logic unit (ALU), memory unit, and the control unit.

In addition to these, auxiliary storage/secondary storage devices are used to store data and instructions on a long-term basis.



**Figure 1 : Schematic Representation of a Computer**

The objective of this chapter is to introduce the concept of Memory units of the computer which are shown in the above figure as main memory and secondary memory. The Memory unit is linked with other parts of the computer specifically as shown in the figure2.



**Figure 2: Linking Memory with other units**

All storage devices are characterized with the following features:

- Speed
- Volatility
- Access method
- Portability
- Cost and capacity

### 1.1 Basic Units of Measurement

All information in the computer is handled using electrical components like the integrated circuits, semiconductors, all of which can recognize only two states – presence or absence of an electrical signal. Two symbols used to represent these two states are **0** and **1**, and are known as **BITS** (an abbreviation for **B**inary **D**igi**T**S). **0** represents the absence of a signal, **1** represents the presence of a signal. A **BIT** is, therefore, the smallest unit of data in a computer and can either store a **0** or **1**.

Since a single bit can store only one of the two values, there can possibly be only four unique combinations:

**00    01    10    11**

Bits are, therefore, combined together into larger units in order to hold greater range of values.

**BYTES** are typically a sequence of eight bits put together to create a single computer alphabetical or numerical character. More often referred to in larger multiples, bytes may appear as **Kilobytes** (1,024 bytes), **Megabytes** (1,048,576 bytes), **GigaBytes** (1,073,741,824), **TeraBytes** (approx. 1,099,511,000,000 bytes), or **PetaBytes** (approx. 1,125,899,900,000,000 bytes).

Bytes are used to quantify the amount of data digitally stored (on disks, tapes) or transmitted (over the internet), and are also used to measure the memory and document size.

## II. [RAM,ROM,PROM,EPRM](#)

The Term Computer Memory is defined as one or more sets of chips that store Data/program instructions, either temporarily or permanently. It is critical processing

component in any computer. The PCs use several different types. They are :

- Main Memory / Primary Memory units
  - Two most important are
    - RAM(Random Access Memory)
    - ROM(Read-only Memory)
  - They work in different ways and perform distinct functions
  - CPU Registers
  - Cache Memory
- Secondary Memory/Auxiliary Memory
  - Also termed as ‘auxiliary’ or ‘backup’ storage, it is typically used as a supplement to main storage. It is much cheaper than the main storage and stores large amount of data and instructions permanently. Hardware devices like magnetic tapes and disks fall under this category.

Computer’s memory can be classified into two types – RAM and ROM.

**RAM** or Random Access Memory is the central storage unit in a computer system. It is the place in a computer where the operating system, application programs and the data in current use are kept temporarily so that they can be accessed by the computer’s processor. The more RAM a computer has, the more data a computer can manipulate.

Random access memory, also called the Read/Write memory, is the temporary memory of a computer. It is said to be ‘volatile’ since its contents are accessible only as long as the computer is on. The contents of RAM are cleared once the computer is turned off.

**ROM** or Read Only Memory is a special type of memory which can only be read and contents of which are not lost even when the computer is switched off. It typically contains manufacturer’s instructions. Among other things, ROM also stores an initial program called the ‘bootstrap loader’ whose function is to start the computer software operating, once the power is turned on.

Read-only memories can be **manufacturer-programmed** or **user-programmed**. While manufacturer-programmed ROMs have data burnt into the circuitry, user-programmed ROMs can have the user load and then store read-only programs. PROM or Programmable ROM is the name given to such ROMs.

Information once stored on the ROM or PROM chip cannot be altered. However, another type of memory called EPROM (Erasable PROM) allows a user to erase the information stored on the chip and reprogram it with new information. EEPROM (Electrically EPROM) and UVEPROM (Ultra Violet EPROM) are two types of EPROM’s.

### Storage Vs. Memory

RAM is volatile memory having a limited storage capacity. Secondary/auxiliary storage is storage other than the RAM. These include devices that are peripheral and are connected and controlled by the computer to enable permanent storage of programs and data.

**Magnetic medium** was found to be fairly inexpensive and long lasting medium and, therefore, became the preferred choice for auxiliary storage. Floppy disks and hard disks fall under this category. The newer forms of storage devices are **optical storage**

**devices** like CDs, DVDs, Pen drive, Zip drive etc.

### **To Summaries:**

The memory is specifically meaning the RAM. This keeps the information for a shorter period of time (usually volatile), is faster and more expensive.

By Storage we mean the Hard disk. Here the information is retained longer (non-volatile), It's Slower and Cheaper

### **III. Auxiliary Storage Devices-Magnetic Tape, Floppy Disk, Hard Disk.**

The Magnetic Storage Exploits duality of magnetism and electricity. It converts electrical signals into magnetic charges, captures magnetic charge on a storage medium and then later regenerates electrical current from stored magnetic charge. Polarity of magnetic charge represents bit values zero and one.

#### **Magnetic Disk**

The Magnetic Disk is Flat, circular platter with metallic coating that is rotated beneath read/write heads. It is a Random access device; read/write head can be moved to any location on the platter.

#### **Floppy Disk**

These are small removable disks that are plastic coated with magnetic recording material. Floppy disks are typically 3.5" in size (diameter) and can hold 1.44 MB of data. This portable storage device is a rewritable media and can be reused a number of times.

Floppy disks are commonly used to move files between different computers. The main disadvantage of floppy disks is that they can be damaged easily and, therefore, are not very reliable. The following figure shows an example of the floppy disk. Figure 3 shows a picture of the floppy disk:



**Figure 3: Floppy Disk**

#### **HARD DISK**

Another form of auxiliary storage is a hard disk. A hard disk consists of one or more rigid metal plates coated with a metal oxide material that allows data to be magnetically recorded on the surface of the platters. The hard disk platters spin at

a high rate of speed, typically 5400 to 7200 revolutions per minute (RPM). Storage capacities of hard disks for personal computers range from 10 GB to 120 GB (one billion bytes are called a gigabyte).



Figure 4: Hard Disk

#### IV. Optical Disks: CD-R Drive, CD-RW disks, DVD, Blue ray Discs

Optical Mass Storage Devices Store bit values as variations in light reflection. They have higher area density & longer data life than magnetic storage. They are also Standardized and relatively inexpensive. Their Uses: read-only storage with low performance requirements, applications with high capacity requirements & where portability in a standardized format is needed.

##### Example of the Optical Drives

- CD's (Compact Disk)

##### Their storage:

~ 700 MB storage

##### Their Types:

- CD-ROM (read only)
- CD-R: (record) to a CD
- CD-RW: can write and erase CD to reuse it (re-writable)
- DVD(Digital Video Disk)

##### CD:

Compact Disk (CD) is portable disk having data storage capacity between 650-700 MB. It can hold large amount of information such as music, full-motion videos, and text etc. It contains digital information that can be read, but cannot be rewritten. Separate drives exist for reading and writing CDs.

Since it is a very reliable storage media, it is very often used as a medium for distributing large amount of information to large number of users. In fact today most of the software is distributed through CDs.

##### DVD

Digital Versatile Disk (DVD) is similar to a CD but has larger storage capacity and enormous clarity. Depending upon the disk type it can store several Gigabytes of data (as opposed to around 650MB of a CD). DVDs are primarily used to store music or

movies and can be played back on your television or the computer too. They are not rewritable media. Its also termed DVD (Digital Video Disk)

#### DVD-ROM

- Over 4 GB storage (varies with format)
- DVD- ROM (read only)
- Many recordable formats (e.g., DVD-R, DVD-RW; ..)
- Are more highly compact than a CD.
- Special laser is needed to read them

#### Blu-ray Technology

The name is derived from the blue-violet laser used to read and write data. It was developed by the Blu-ray Disc Association with more than 180 members. Some companies with the technology are Dell, Sony, LG.The Data capacity is very large because Blu-ray uses a blue laser(405 nanometers) instead of a red laser(650 nanometers) this allows the data tracks on the disc to be very compact. This allows for more than twice as small pits as on a DVD. Because of the greatly compact data Blu-ray can hold almost 5 times more data than a single layer DVD. Close to 25 GB!.Just like a DVD Blu-ray can also be recorded in Dual-Layer format. This allows the disk to hold up to 50 GB!!

The Variations in the formats are as follows:

- BD-ROM (read-only) - for pre-recorded content
- BD-R (recordable) - for PC data storage
- BD-RW (rewritable) - for PC data storage
- BD-RE (rewritable) - for HDTV recording

#### Summary:

The chapter has introduced the concept of memory units and its categories as the main and the second memory and their characteristic features. It discusses the features of RAM, ROM, PROM, and EPROM. Auxiliary Storage Devices like -Magnetic Tape, Hard Disk, Floppy Disk are also discussed .The chapter concludes with an introduction to the Optical Disks such as CD-R Drive,CD-RW disks,DVD,Blue ray Discs