Week 7: Computer Memory

- Memory
- Memory Units
- Types Of Memory
  - ROM, RAM, Cache Memory, Registers
- Types Of RAM
  - Static RAM, Dynamic RAM
- Types Of ROM
  - PROM, EPROM, EEPROM

Computer Memory

Memory

The Term Computer Memory is defined as one or more sets of chips that storeData/program instructions, either temporarily or permanently. It is critical processingcomponent in any computer. The PCs use several different types. They are:

1. Main Memory / Primary Memory units
2. Secondary Memory/Auxiliary Memory

1. **Main Memory / Primary Memory units:**also called ***internal*** memory. Following are the types of primary memory used with modern day PCs.
    i. ROM(Read-only Memory)
    ii. RAM(Random Access Memory)
    iii. CPU Registers
    iv. Cache Memory
2. **Secondary Memory/Auxiliary Memory:**Also termed as 'auxiliary' or 'backup' storage, it is typically used as asupplement to main storage. It is much cheaper than the main storage andstores large amount of data and instructions permanently. Hardware deviceslike magnetic tapes and disks fall under this category.

Memory Unit

Memory unit is the amount of data that can be stored in the storage unit.In memory units, the storage capacity is expressed in terms of Bytes.

Following are the basic main memory units:

1. Bit (Binary Digit): binary digit is the logical 0 (zero) and 1 (one). It represents a passive or an active state of a component in an electric circuit.
2. Nibble: a group of 4 bits is called nibble.
3. Byte: a group of 8 bits is called byte. A byte is the smallest unit whichcan represent a data item or a character.
4. Word: a group of fixed number of bitsprocessed as a unit.Word varies from computer to computer.The length of a computer word is called word-size or word length. It may be as small as 8 bits or may be as long as 96bits.

Following are the higher memory units (storage units):

Unit	Abbreviation	Description	
Kilobyte	**KB**	1 KB = 1024 Bytes	2^{10}
Megabyte	**MB**	1 MB = 1024 KB	2^{20}
Gigabyte	**GB**	1 GB = 1024 MB	2^{30}
Terabyte	**TB**	1 TB = 1024 GB	2^{40}
Petabyte	**PB**	1 PB = 1024 TB	2^{50}
Exabyte	**EB**	1 EB = 1024 PB	2^{60}
Zettabyte	**ZB**	1 ZB = 1024 EB	2^{70}

Yottabyte	**YB**	1 YB = 1024 ZB	2^{80}
Brontobyte		1Brontobyte = 1024 YB	2^{90}
Geopbyte		1 Geopbyte = 1024 brontobyte	

Types of Memory

Here the memory refers to the primary / internal / main memory. The two most important types of main memories are:

1. ROM stands for **R**ead – **O**nly **M**emory
2. RAM stands for **R**andom **A**ccess **M**emory

Other memories used in computer are:

3. Cache Memory
4. Registers

Read – Only Memory (ROM)

ROM or Read Only Memory is a special type of memory which can only be read.The contents of ROM are not lost even when the computer is switched off. It typicallycontains manufacturer's instructions. Among other things, ROM also stores an initialprogram called the 'bootstrap loader' whose function is to start the computer softwareoperating, once the power is turned on.

Random Access Memory (RAM)

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

Random access memory, also called the ***Read/Write memory***. Because the data stored in this memory can read, changed, or erased completely. RAM is also known as***temporary memory*** or ***volatile memory*** since its contents are accessible onlyas long as the computer is switched on. The contents of RAM are cleared once the computer isturned off.

Cache Memory

Cache memory is a very high speed memory used to increase the processing speed of CPU. It makes the data and programs available to the CPU that is frequently required. It is a memory between the main memory and the CPU. It is also known as ***high speed buffer***.

Registers

Registers are the memory cells inside a CPU, used to store data and instructions at the time of processing. The number of and types of registers varies among computers.

Some important registers are Accumulator register, Memory Address register (MAR), Memory Buffer register (MBR), Program Counter register (PC), Instruction register (IR), and Input / Output (I/O) register.

Types of ROM

Read-only memories can be manufacturer-programmed or user-programmed. Following are the types of ROMs, which can be programmed according to the user's specifications.

i. Programmable Read Only Memory (PROM)
ii. Erasable Programmable Read Only Memory (EPROM)
iii. Electrically Erasable Programmable Read Only Memory (EPROM)

Programmable Read Only Memory (PROM)

PROM allows a chip to be programmed once, after that it cannot be altered further. The data is recorded on them with special programming device. PROMs are normally programmed by the manufacturers or developers who records dedicated programs such as graphics, games, etc.

Erasable Programmable Read Only Memory (EPROM)

An EPROM has the features of PROM. But the contents of EPROM can be erased using ultraviolet light. To erase the contents, the chip is removed from the circuit and exposed to ultraviolet light. Once the contents are removed, the chip can be reprogrammed for further use.

Electrically Erasable Programmable Read Only Memory (EEPROM)

The EEPROM chips can be erased and reprogrammed electrically. So, there is no need to physically remove the chips from its circuit (as with the case with EPROM). EEPROMs are costly than other ROM chips.

Types of RAM

The two widely usedtypes of modern RAM are

i. Static RAM (SRAM)
ii. Dynamic RAM (DRAM)

Static RAM (SRAM)

SRAM (static RAM) is random access memory (RAM) that retains data bits in its memory as long as power is being supplied. SRAM does not have to be periodically refreshed. It exhibits "data remanence". It is still *volatile* in the conventional sense that data is eventually lost when the computer is switched off. SRAM is faster and more expensive than DRAM.SRAM is used for a computer's cache memory and as part of the random access memory digital-to-analog converter on a video card.

SRAM is more expensive and less dense than DRAM and is therefore not used for high-capacity, low-cost applications such as the main memory in personal computers.

Dynamic RAM (DRAM)

DRAM is a common type of random access memory (RAM) used in personal computers (PCs), workstations and servers.DRAM stores each bit of data or program code in a storage cell consisting of a capacitor and a transistor. DRAM storage cell is dynamic in that it needs to be refreshed or given a new electric charge every few milliseconds to compensate for charge leaks from the capacitor.

DRAM is a successor to SRAM.The main advantages of DRAM are its simple design, speed and low cost in comparison to alternative types of memory. The main disadvantages of DRAM are volatility and high power consumption relative to other options.

Flash Memory

Flash memory is electronic non-volatile computer storage medium. It can be electrically erased and reprogrammed. They are developed from EEPROM. The two main types of flash memory are

i. NAND type flash memory
ii. NOR type flash memory

NAND Flash Memory

The NAND type is primarily used in main memory, memory cards, USB Flash Drives, solid-state drives etc. these devices are used for general storage and transfer of data.

NOR Flash Memory

The NOR type allows true random access. It is used as a replacement for the older EPROM. It also used as alternative to certain kind of ROM applications. Some example applications are PCs, PDAs, digital audio players, digital cameras, mobile phones, synthesizers, video games, scientific instrumentation, industrial robotics, medical electronics etc.

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