Computer Fundamental

UNIT : 01

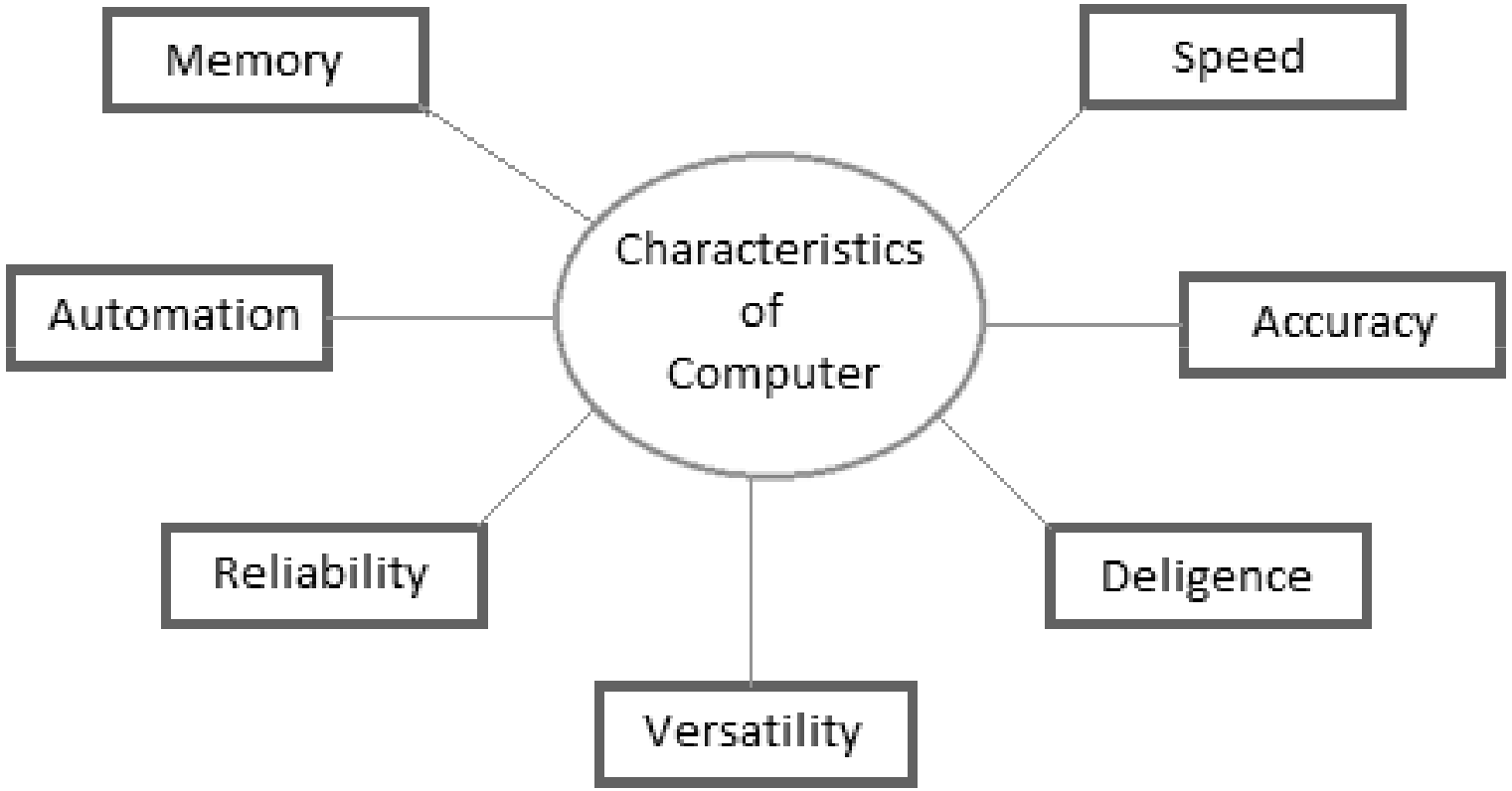
Introduction to computer

-By Hiral Pandya

What is computer :

- A computer is a machine that can be programmed to carry out sequences of arithmetic or logical operations automatically. Computers can perform generic sets of operations, known as programs.
- **Computer** is not an **acronym**, it is a word derived from a word "**COMPUTE**" which means to calculate.
- **Computer = Compute + ER**
  - **COMPUTE** : To Calculate
  - **ER** : Engineering

characteristics of computer :



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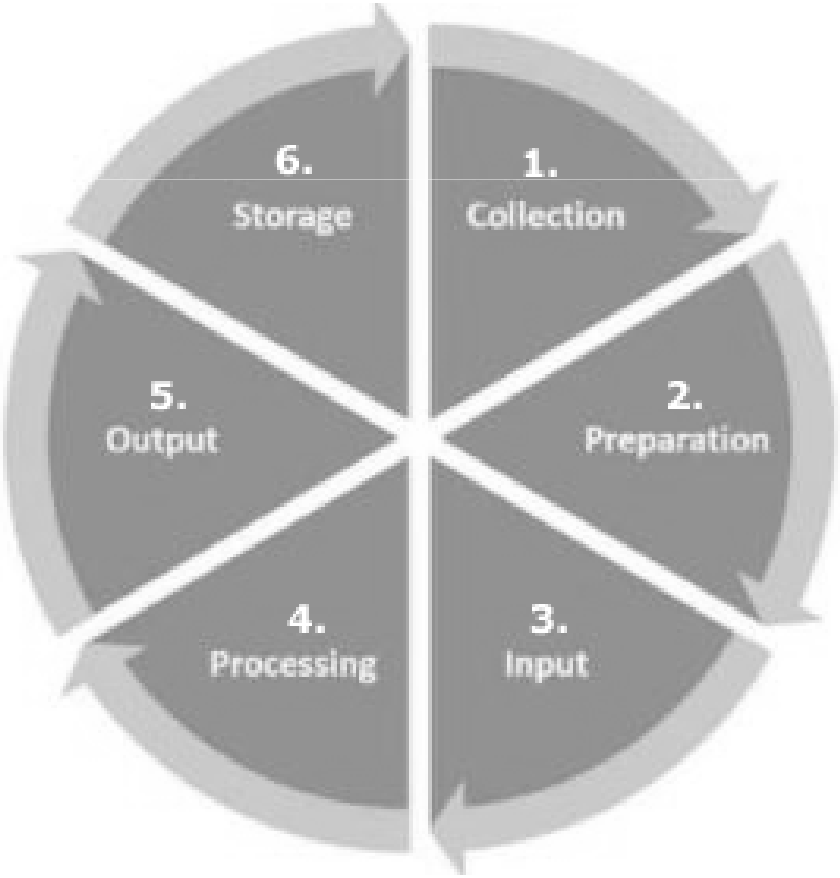
Data Processing Cycle :



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CLASSIFICATION OF COMPUTER BY DATA PROCESSED :

- Computers differ based on their data processing abilities. They are classified according to purpose, data handling and functionality.
- According to data handling, computers are Analog, Digital or Hybrid Computers.
- **Analog computers** work on the principle of measuring, in which the measurements obtained are translated into data.
- **Digital Computer** performs calculations and logical operations with quantities represented as digits, usually in the binary number system. Such computers process data into a digital value (in 0s and 1s).
- **Hybrid Computer (Analog + Digital) is** combination of computers those are capable of inputting and outputting in both digital and analog signals. A hybrid computer system setup offers a cost effective method of performing complex simulations.

classification of computer by processing Capabilities :

- **Micro Computer :**
- It is a complete computer on a small scale, designed for use by one person at a time. An antiquated term, a microcomputer is now primarily called a personal computer (PC), or a device based on a single-chip microprocessor.
- Common microcomputers include laptops and desktops. Beyond standard PCs, microcomputers also include some calculators, mobile phones, notebooks, workstations and embedded systems.

CLASSIFICATION OF COMPUTER BY PROCESSING CAPABILITIES :

- **Micro Computer :**

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CLASSIFICATION OF COMPUTER BY PROCESSING CAPABILITIES :

- **Mini Computer :**
- It is also known as **Mini**. It is a class of small computers that was introduced into the world in the mid-1960s. A minicomputer is a computer which has all the features of a large size computer, but its size is smaller than those.
- A minicomputer is also called as a mid-range computer. Minicomputers are mainly multi-users systems where more than one user can work simultaneously.
- Mini computer examples: IBM's AS/400e, Honeywell200, TI-990.

CLASSIFICATION OF COMPUTER BY PROCESSING CAPABILITIES :

- **Mini Computer :**

CLASSIFICATION OF COMPUTER BY PROCESSING CAPABILITIES :

- **Mainframe Computer :**
- A main frame is the largest, fastest and perhaps one of the most expensive computer systems of general use.
- Before MINIS and MICROS were developed, all data processing was done on mainframes.
- Thousand of such machines are still in business, universities, hospitals etc. These machines have a very high processing speed.
- The machines have a very large primary storage capability and have a very high processing speed.
- Their applications mainly include processing of huge amounts of different kinds of data in large private and public enterprises, Government agencies etc.

CLASSIFICATION OF COMPUTER BY PROCESSING CAPABILITIES :

- **Mainframe Computer :**

CLASSIFICATION OF COMPUTER BY PROCESSING CAPABILITIES :

- **Super Computer :**
- Supercomputers are the fastest ad the most powerful of all computer systems.
- They are typically 200 times faster mainly used for applications requiring enormous amounts of data to be processed weather forecasting, weapons research, breaking secret codes, designing air craft and so on.

CLASSIFICATION OF COMPUTER BY PROCESSING CAPABILITIES :

- **Super Computer :**

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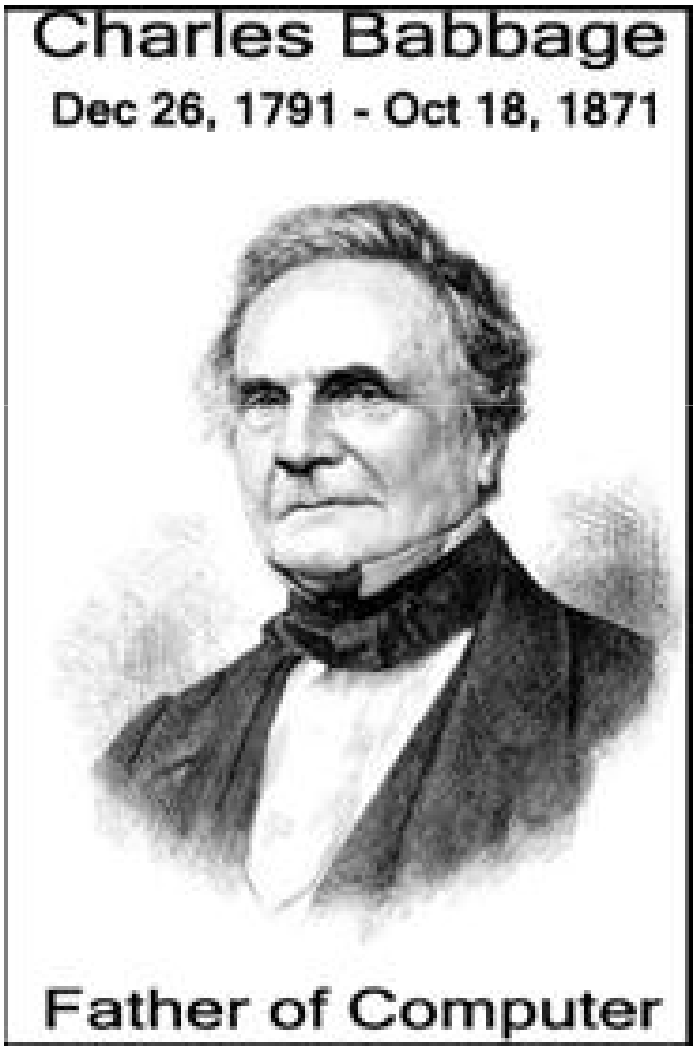
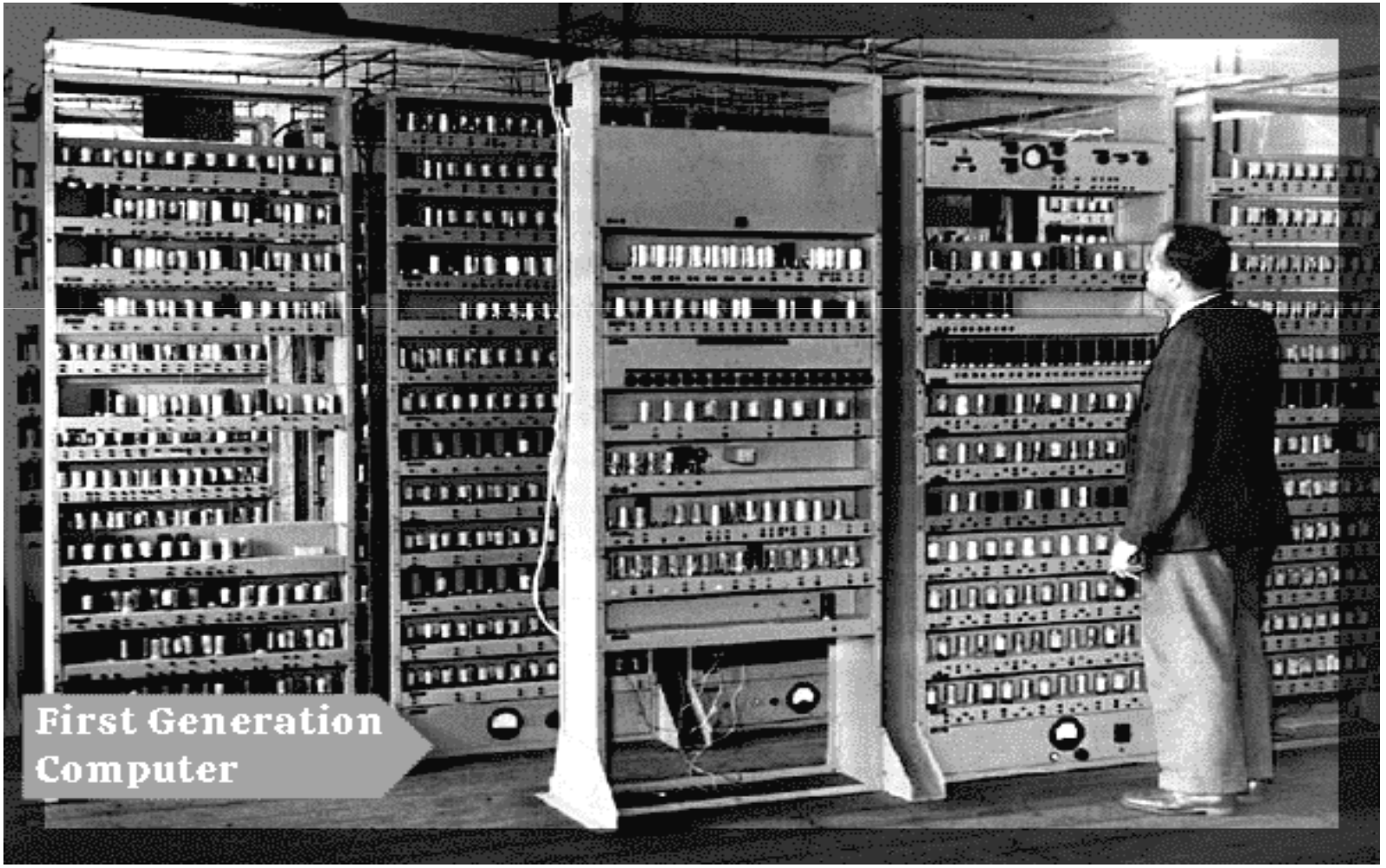
History and Generations of Computers :



- **Charles Babbage**, an English mechanical engineer and polymath, originated the concept of a programmable computer. Considered the "**father of the computer**", he conceptualized and invented the first mechanical computer in the early 19th century.

History and Generations of Computers : (*First Generation*)

- **FIRST GENERATION OF COMPUTERS(1946-1959):**



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History and Generations of Computers : (*First Generation*)

- **FIRST GENERATION OF COMPUTERS(1946-1959):**
- Developed in *late forties and early fifties* used ***VACCUM TUBES*** as the electronic devices for the hardware implementation of its building blocks.
- As a result, these computers were extremely large and had a poor reliability.
- These computers had limited internal storage capacity and were slow as compared to computers available today.
- They needed extensive air conditioning arrangements for its continuous operation due to the large amount of heat produced by tubes.
- Machines were mostly programmed in machine language i.e. instruction to the computer were in the form of 0s and 1s.

History and Generations of Computers : (*First Generation*)

- ***Some feature of first generation computers are :***
- Use Vacuum tubes for electronic circuits and memory delay lines for memory elements. Magnetic drum was used as the primary storage medium.
- Had limited storage capacity (1kb to 4kb).
- Programming was done in machine language.
- Cycle time was in milliseconds.
- Processing speed of typically 2000 instruction per second.
- 5 dollars per floating point operation cost.
- Main applications were in scientific calculations, records keeping and payroll processing.

History and Generations of Computers : (Second Generation)

- **SECOND GENERATION OF COMPUTERS(1959-1964):**

History and Generations of Computers : (*Second Generation*)

- **SECOND GENERATION OF COMPUTERS(1959-1964):**
- Invention of SEMICONDUCTOR TRANSISTOR by three physicists *Johan Bardeen, Walter Brattain and William Shockley* at *Bell Telephone Laboratories* in 1948 and the subsequent development of its manufacturing technology signaled the arrival of second generation of computers which is also earmarked by the development of *MAGNETIC CORE MEMORY*.
- The transistor replaced vacuum tubes of the first generation computers, while magnetic core memories replaced CRT and delay line memories as the internal storage medium.

History and Generations of Computers : (*Second Generation*)

- **SECOND GENERATION OF COMPUTERS(1959-1964):**
- Transistors were smaller, faster and more reliable. They could handle much larger powers without generating any heat. When second generation computers were begins developed, there was a software explosion.
- A number of HIGH LEVEL LANGUAGES were developed, there was a software explosion. A number of HIGH LEVEL LANGUAGES were developed, COBOL, ALGOL, FORTRAN were developed during second generation period only.

History and Generations of Computers : (*Second Generation*)

- **SOME FEATURE OF SECOND GENERATION COMPUTERS :**
- Semiconductor transistors were used for hardware implementation.
- Magnetic core memories were used for internal storage.
- High Level Programming languages were used.
- Faster Input-Output devices.
- Increased speed and reliability reduce size.
- Faster Input-output devices. Processing speed up to 3 million instructions per second.
- Cycle time in microseconds.

History and Generations of Computers : (*THIRD Generation*)

- **THIRD GENERATION OF COMPUTERS(1964-1972):**

History and Generations of Computers : (*Third Generation*)

- **THIRD GENERATION OF COMPUTERS(1964-1972):**
- The major technological developments responsible for emergence of third generation of computers were the *INTERGRATED CIRCUIT* and *SEMICONDUCTOR MEMORY ELEMENTS*. *Small Scale Integrated circuits (SSI) and Medium scale Integrated circuit (MSI)* replaced discreet transistors in the hardware implementation of the basic building blocks and semiconductor memory elements replaced the magnetic core memory elements as the emergence of MINICOMPUTER.
- These computers were much smaller and much more reliable than the second generation computers. They were less costly and used English like Languages.

History and Generations of Computers : (*THIRD Generation*)

- **SOME FEATURE OF THIRD GENERATION COMPUTERS :**
- Smaller size, greater reliability and better performance features.
- Integrated Circuit (ICs) used in place of discreet transistors for hardware implementation.
- Solid state memory used in place of magnetic core memory.
- Extensive use of HIGH PROGRAMMING LANGUAGES.
- Emergence of Minicomputer
- Cycle time reduced to nanoseconds. Processing speed typically 10 million instructions per second.

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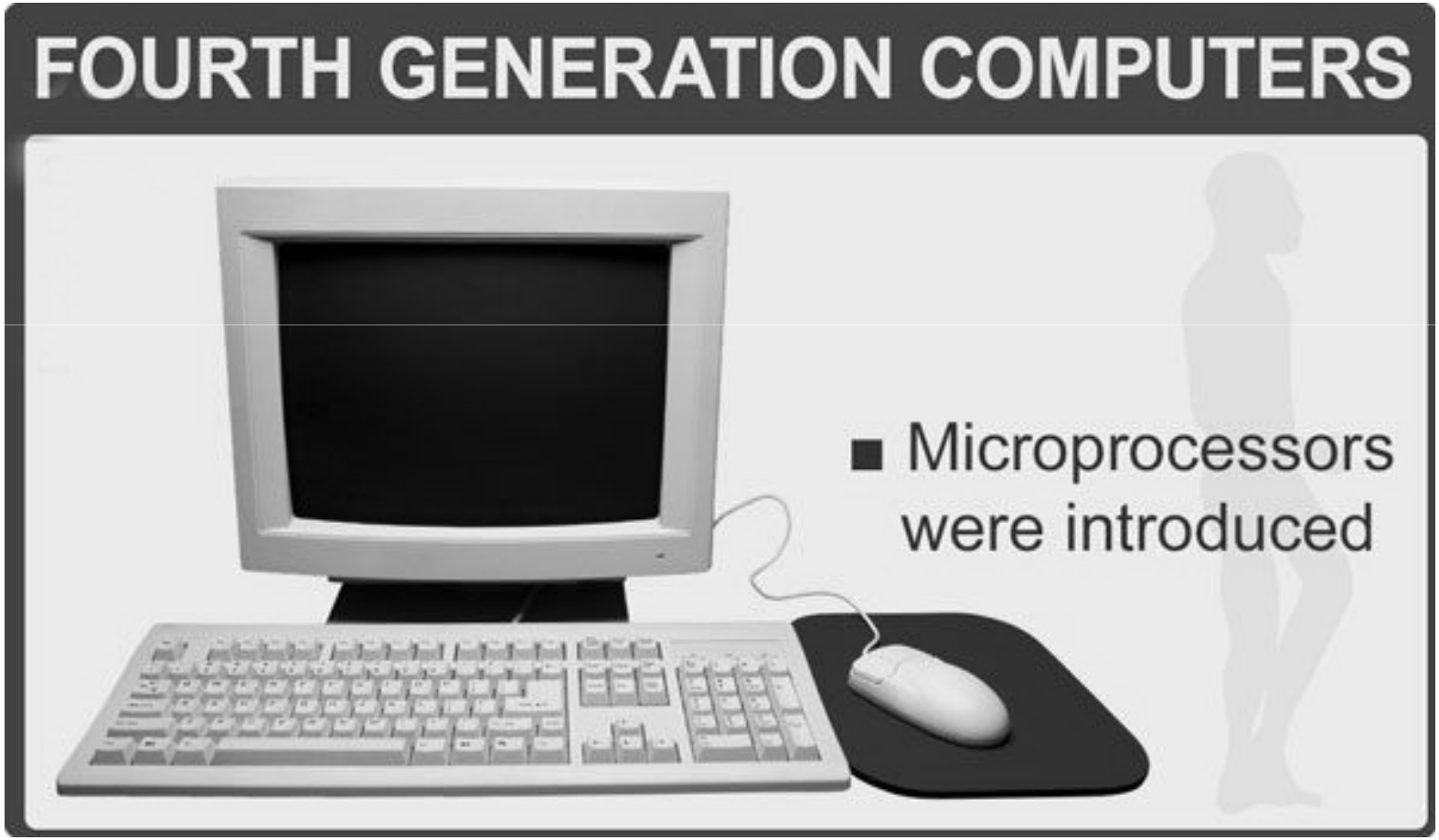
History and Generations of Computers : (*fourth Generation*)

- **Fourth Generation Computer (1972-2000):**



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History and Generations of Computers : (*fourth Generation*)

- **Fourth Generation Computer (1972-2000) :**
- *VLSI (Very large Scale of Integrated circuit)* and *VHIC (Very High Speed Integrated Circuit)* and Microprocessor were introduced during Forth Generation.
- Microcomputers use *RANDAM ACCESS MEMORY (RAM)* which allows data in a memory location to access without referring to the other memory locations. SUPER COMPUTERS started in early eighties during the fourth generation.
- Personal Computers is a type of microcomputer, seen all over belong to the fourth generation only.

History and Generations of Computers : (*fourth Generation*)

- **SOME FEATURE OF FOURTH GENERATION COMPUTERS :**
- These use SLI, VLSI and VHIC.
- These have increased strong capacity.
- These are more users' friendly.
- These have grater versatility of I/O devices.
- Processing speed touching 1 billion instructions per second.

History and Generations of Computers : (*fifth Generation*)

- **FIFTH GENERATION COMPUTER(Present & Beyond):**

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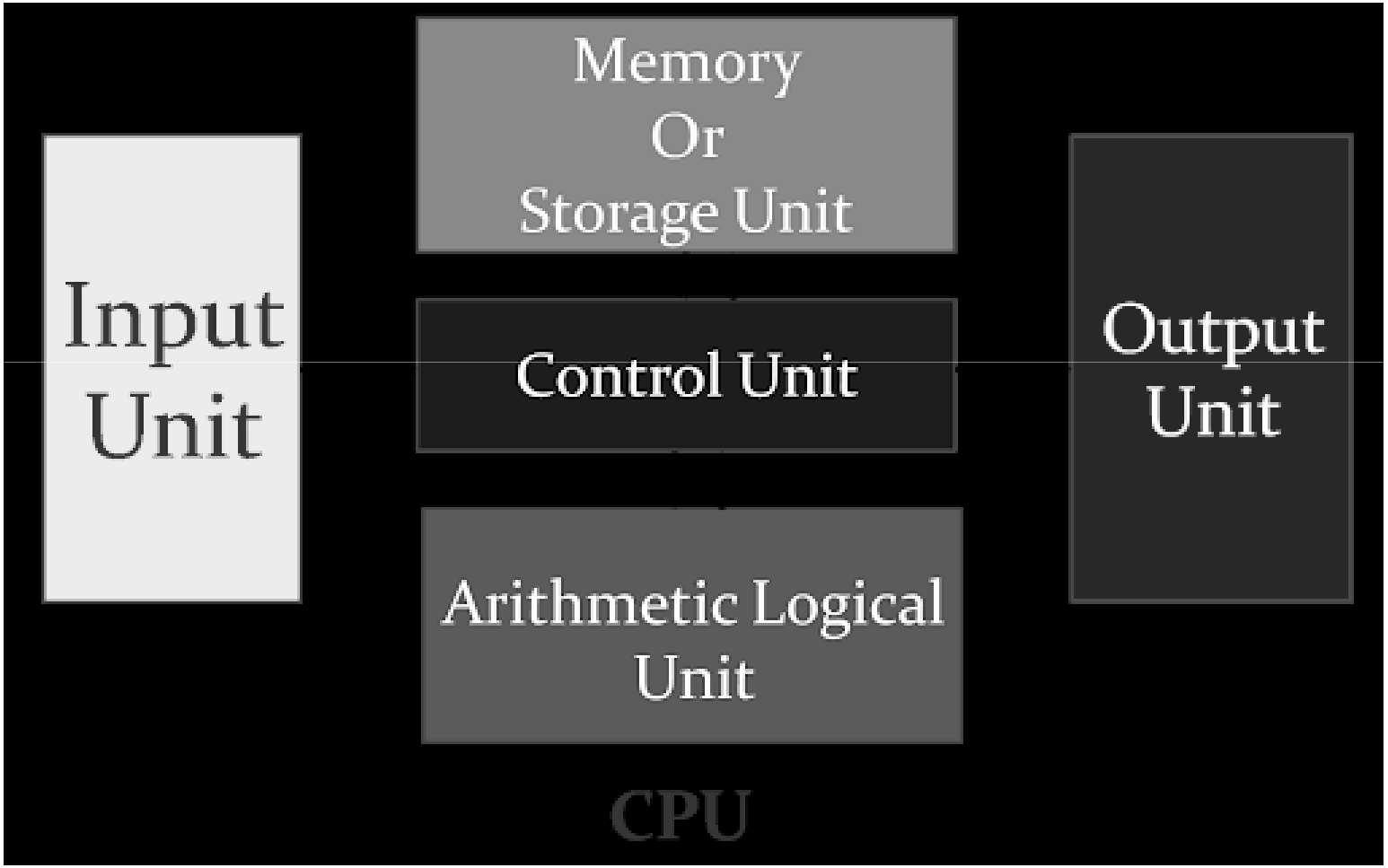
History and Generations of Computers : (*fifth Generation*)

- **FIFTH GENERATION COMPUTER(Present & Beyond) :**
- A new generation of computer called the FIFTH GENERATION has already been conveyed.
- In fact, the ***Institute of new generation Computer Technology (ICOT)*** in Japan has already announced the fifth generation computer systems project.
- We are heading towards an intelligent machine, that is, a machine that thinks.

Simple Model of Computer



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Simple Model of Computer

input devices

- ✓Keyboard
- ✓Mouse
- ✓Scanner
- ✓Joystick
- ✓Light Pen
- ✓Digitizer
- ✓Microphone
- ✓Magnetic Ink Character Recognition (MICR)
- ✓Optical Character Reader (OCR)
- ✓Digital Camera
- ✓Paddle
- ✓Steering Wheel
- ✓Gesture recognition devices
- ✓Light Gun
- ✓Touch Pad
- ✓Remote
- ✓Touch screen
- ✓VR (Virtual Reality)
- ✓Webcam
- ✓Biometric Devices

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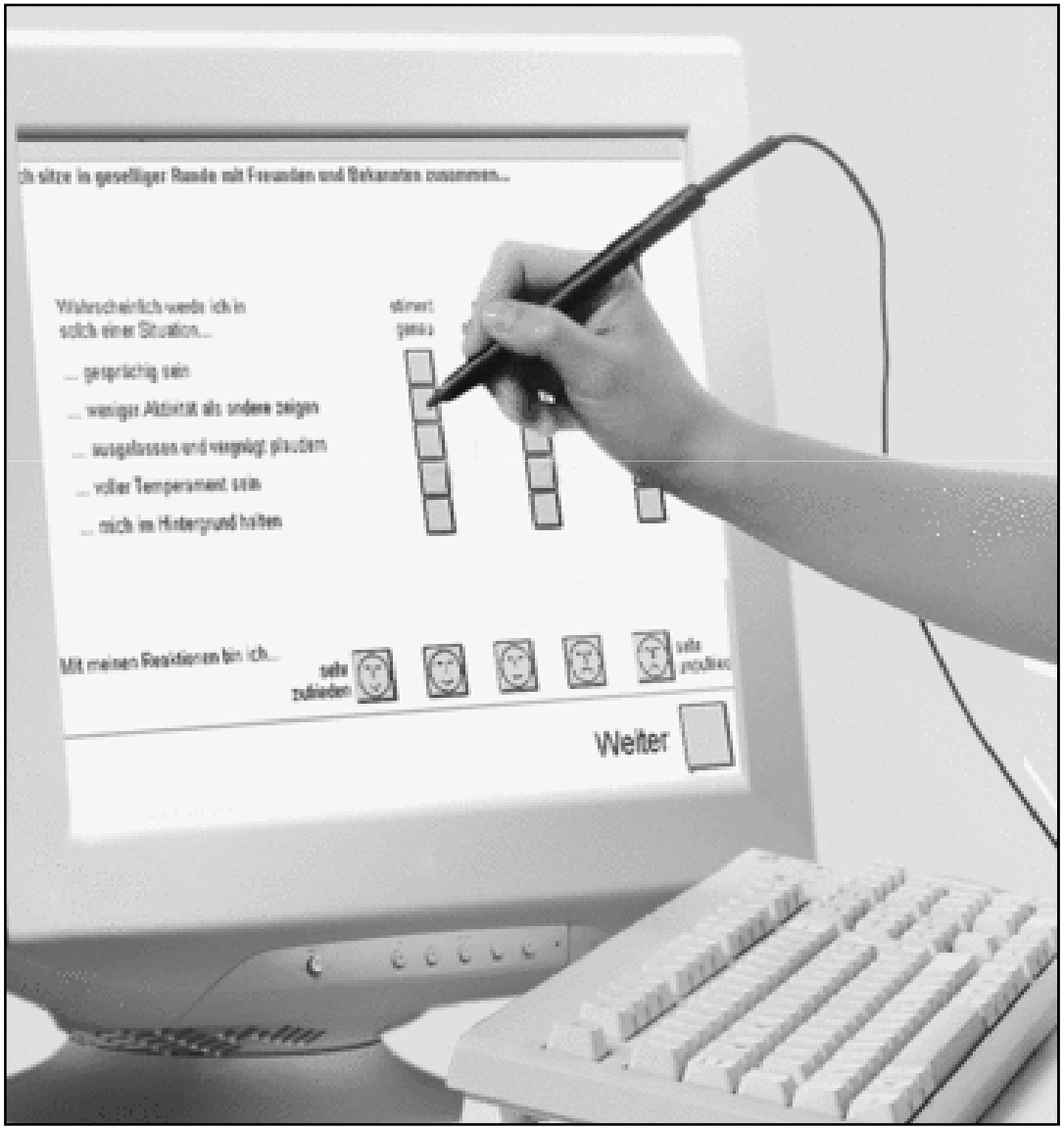
Simple Model of Computer

input devices : Light PEN



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Simple Model of Computer

input devices : Digitizer

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Simple Model of Computer

input devices : MICR

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Simple Model of Computer

input devices : Paddle

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Simple Model of Computer

input devices : Gesture recognition devices

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Simple Model of Computer

input devices : Light Gun

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Simple Model of Computer
input devices : VR (Virtual Reality)

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Simple Model of Computer

CPU

- **CPU (Central Processing Unit) :**
- The CPU is the central processing unit of the computer. A computer's CPU handles all instructions it receives from hardware and software running on the computer.
- The CPU is often referred to as the ***brain of the computer***. However, it is more appropriate to refer to software as the brain and the CPU as a very efficient calculator. A CPU is really good with numbers, but if it wasn't for the software it wouldn't know how to do anything else.

Simple Model of Computer
CPU

- **CPU (Central Processing Unit) :**
- In the past, computer processors used numbers to identify the processor and help identify faster processors. For example, the Intel 80486 (486) processor is faster than the 80386 (386) processor.
- After the introduction of the Intel Pentium processor (which would technically be the 80586), all computer processors started using names like Athlon, Duron, Pentium, and Celeron.
- Today, in addition to the different names of computer processors, there are different architectures (32-bit and 64-bit), speeds, and capabilities. Below is a list of the more common types of CPUs for home or business computers.

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Simple Model of Computer

arithmetic & logical unit

- Short for arithmetic logic unit, the ALU is a complex digital circuit with an AU (arithmetic unit) and a LU (logic unit). Multiple Arithmetic Logic Units are in a computer, including multiple ALU's in the CPU (central processing unit), GPU (graphics processing unit), and FPU (floating-point unit).
- The computer central processing unit ALU performs both bitwise and mathematical operations on binary numbers and is the last component to perform calculations in the processor.

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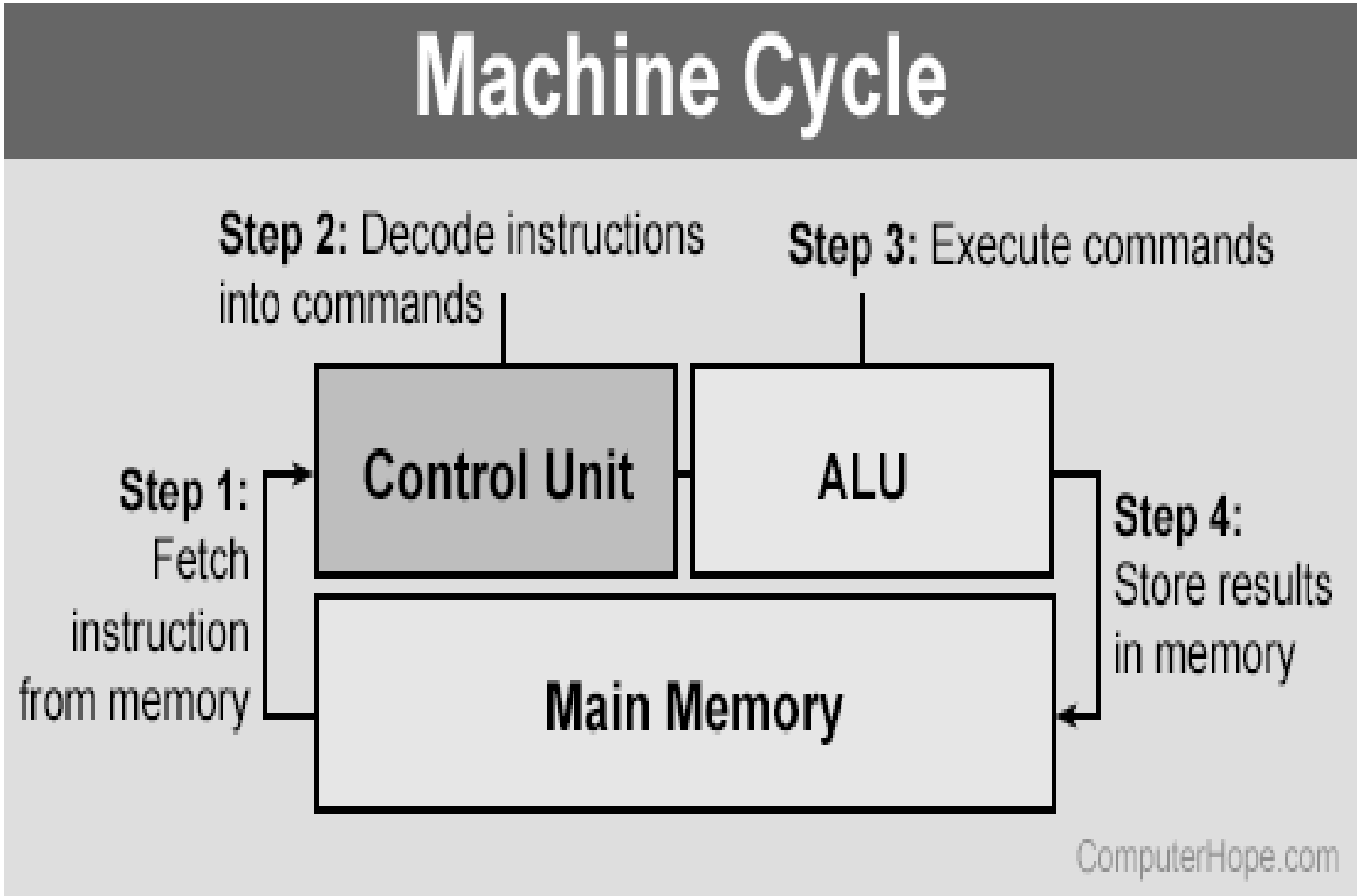
Simple Model of Computer

arithmetic & logical unit



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Simple Model of Computer

Control unit

- A control unit or CU is circuitry that directs operations within a computer's processor. It lets the computer's logic unit, memory, and both input and output devices know how to respond to instructions received from a program.
- Examples of devices that utilize control units include CPUs and GPUs.

Simple Model of Computer

Control unit

- A control unit works by receiving input information that it converts into control signals, which are then sent to the central processor.
- The computer's processor then tells the attached hardware what operations to carry out.
- The functions that a control unit performs are dependent on the type of CPU, due to the variance of architecture between different manufacturers.

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Simple Model of Computer

internal memory

- Internal memory, also called "*Main or Primary memory*" refers to memory that stores small amounts of data that can be accessed quickly while the computer is running.
- External memory, also called "*Secondary memory*" refers to a storage device that can retain or store data persistently. They could be embedded or removable storage devices. Examples include hard disk or solid state drives, USB flash drives, and compact discs.
- There are basically two kinds of internal memory: ***ROM and RAM***.

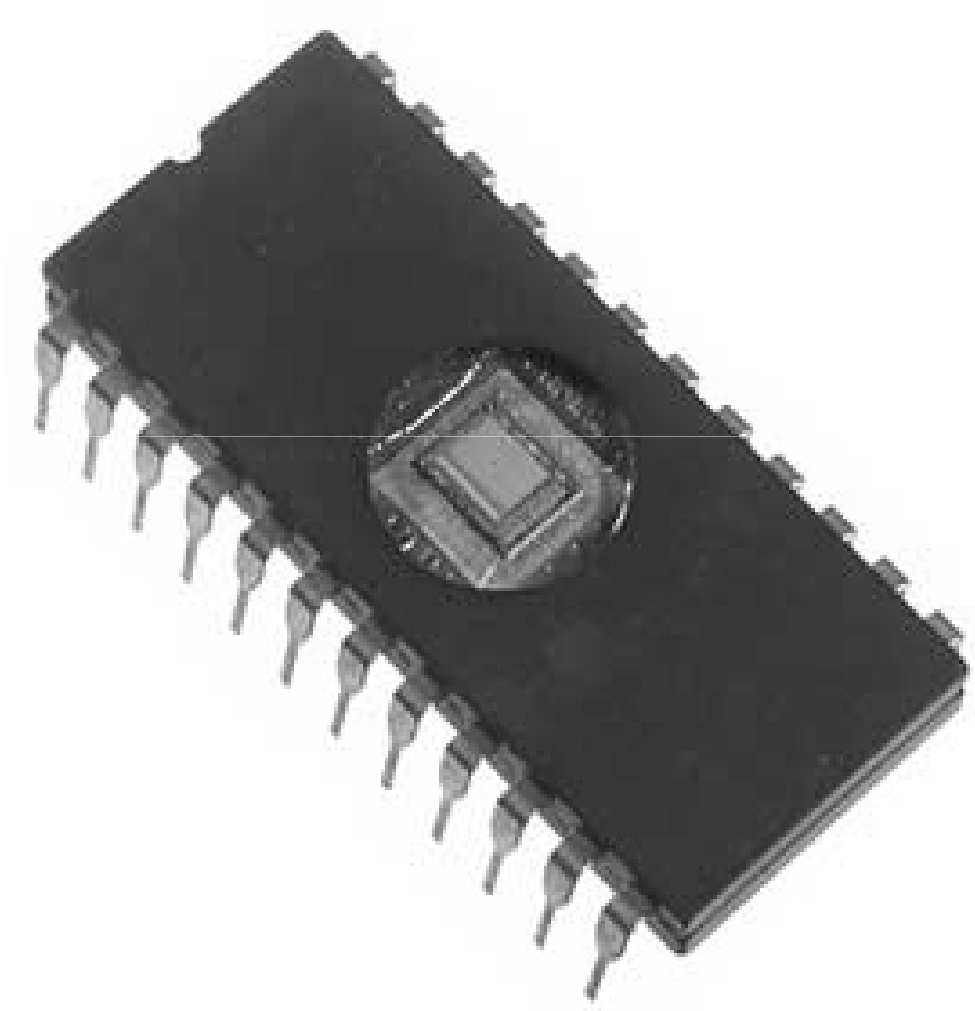
Simple Model of Computer

internal memory : ROM

- ROM stands for *Read Only Memory*.
- The memory from which we can only read but cannot write on it.
- This type of memory is non-volatile. The information is stored permanently in such memories during manufacture.
- A ROM stores such instructions that are required to start a computer.
- This operation is referred to as bootstrap.
- ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven

Simple Model of Computer

internal memory : ROM



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Simple Model of Computer

internal memory : RAM

- *RAM (Random Access Memory)* is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.
- Access time in RAM is independent of the address, that is, each storage location inside the memory is as easy to reach as other locations and takes the same amount of time. Data in the RAM can be accessed randomly but it is very expensive.
- RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. RAM is small, both in terms of its physical size and in the amount of data it can hold.

Simple Model of Computer

internal memory : RAM

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Simple Model of Computer

output device

- An output device is any device of computer hardware equipment which converts information into human readable form.
- It can be text, graphics, tactile, audio, and video.
- Some of the output devices are Visual Display Units (VDU)
- Examples : Monitor, Printer, Graphic Output Devices, Plotters, Speakers etc.

Simple Model of Computer

secondary storage devices

- A secondary storage device refers to any *non-volatile* storage device that is internal or external to the computer.
- It can be any storage device beyond the primary storage that enables permanent data storage.
- A secondary storage device is also known as an auxiliary storage device, backup storage device, tier 2 storage, or external storage.

Simple Model of Computer

secondary storage devices

- Hard Drive
- Solid-State Drive
- USB Drive
- SD Card
- CD
- DVD
- Floppy Disk
- Tape Drive

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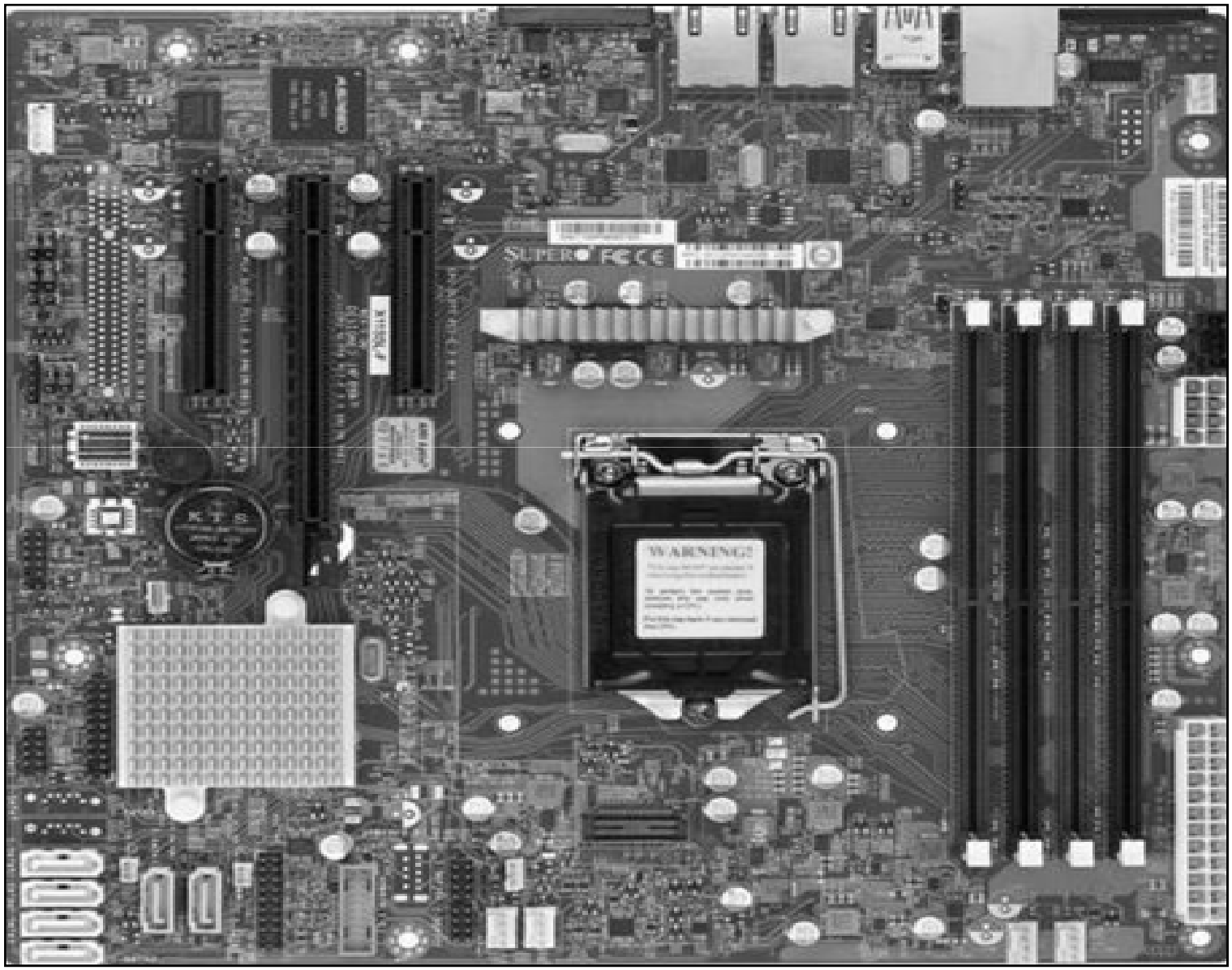
Introduction to mother board :

- A motherboard is the main **Printed Circuit Board (PCB)** found in computers and other expandable systems.
- It holds many of electronic components of the system, such as the Central Processing Unit (CPU) and memory, and provides connectors for other peripherals.
- A motherboard contains significant sub-systems such as the CPU.

mother board :



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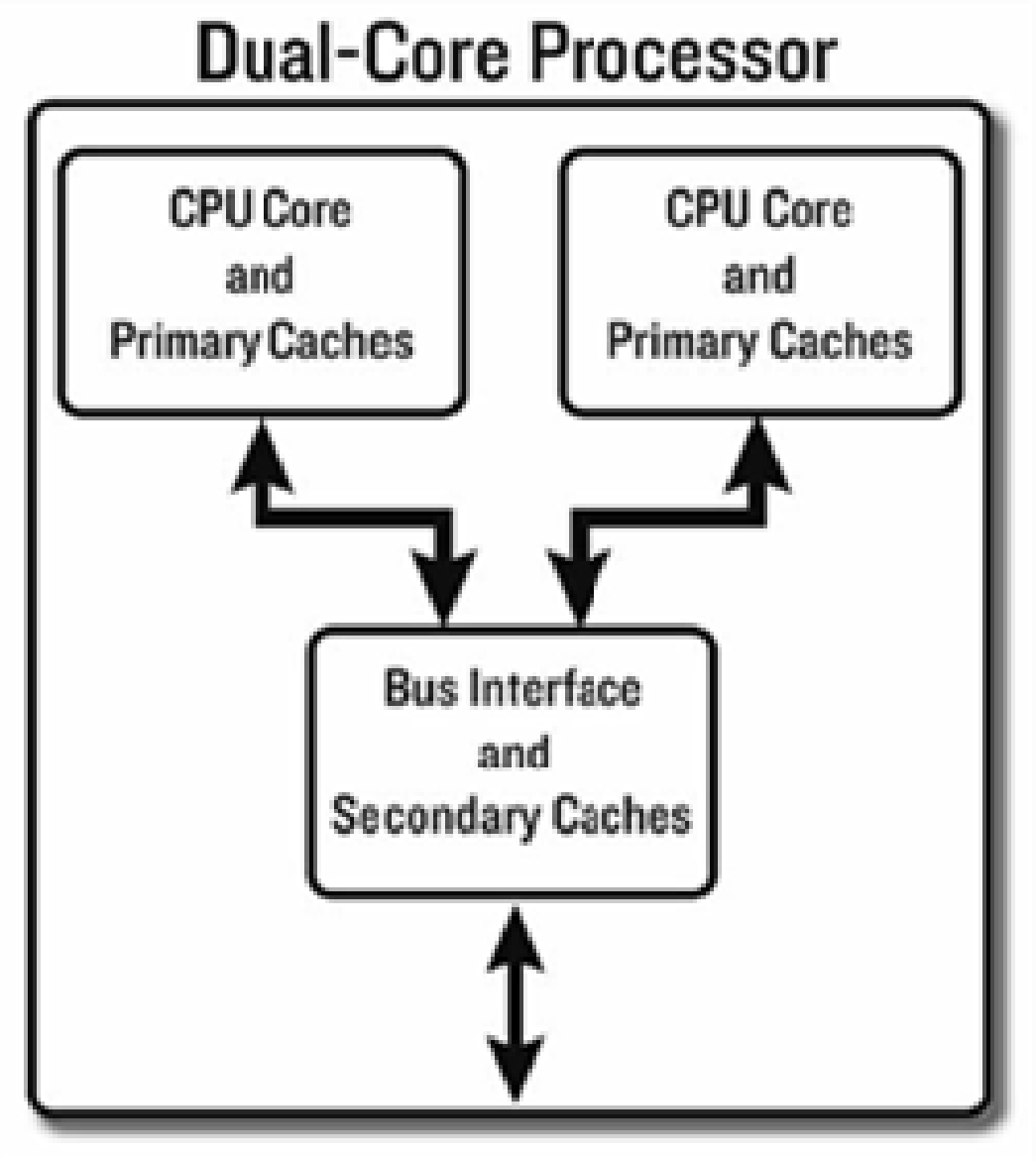
Types of processors :

- The processor is a chip or a logical circuit that responds and processes the basic instructions to drive a particular computer.
- The main functions of the processor are fetching, decoding, executing, and write back the operations of an instruction.
- The ALU (Arithmetic Logic Unit) and CU (Control Unit) are the two parts of the processors. The Arithmetic Logic Unit performs all mathematical operations such as additions, multiplications, subtractions, divisions, etc.
- The processor communicates with the other components also they are input/output devices and memory/storage devices.

Types of processors :

- Dual Core
- Core 2 Duo
- I2
- I3
- I4
- I5
- I7
- And So On...

Types of processors : (Dual Core)



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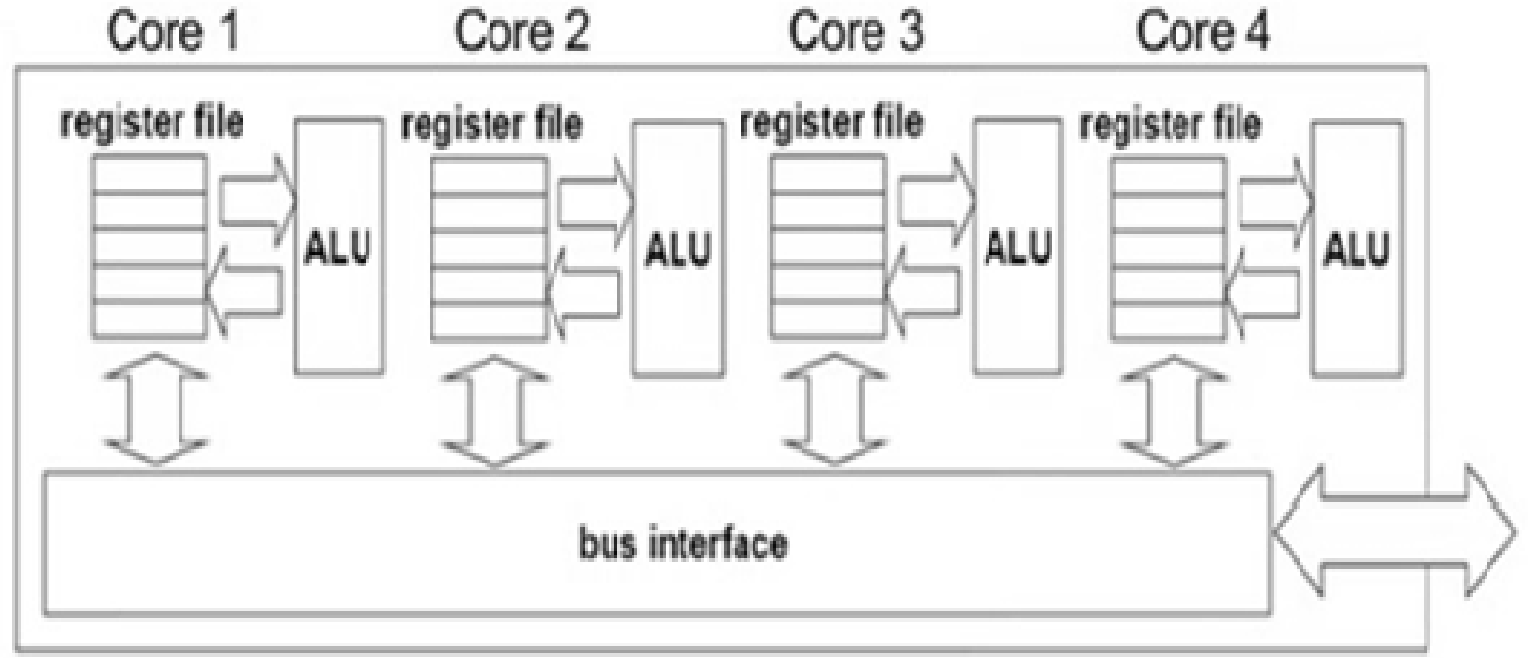
Types of processors : (Core 2 Duo)



Core 2 Duo Processor Architecture

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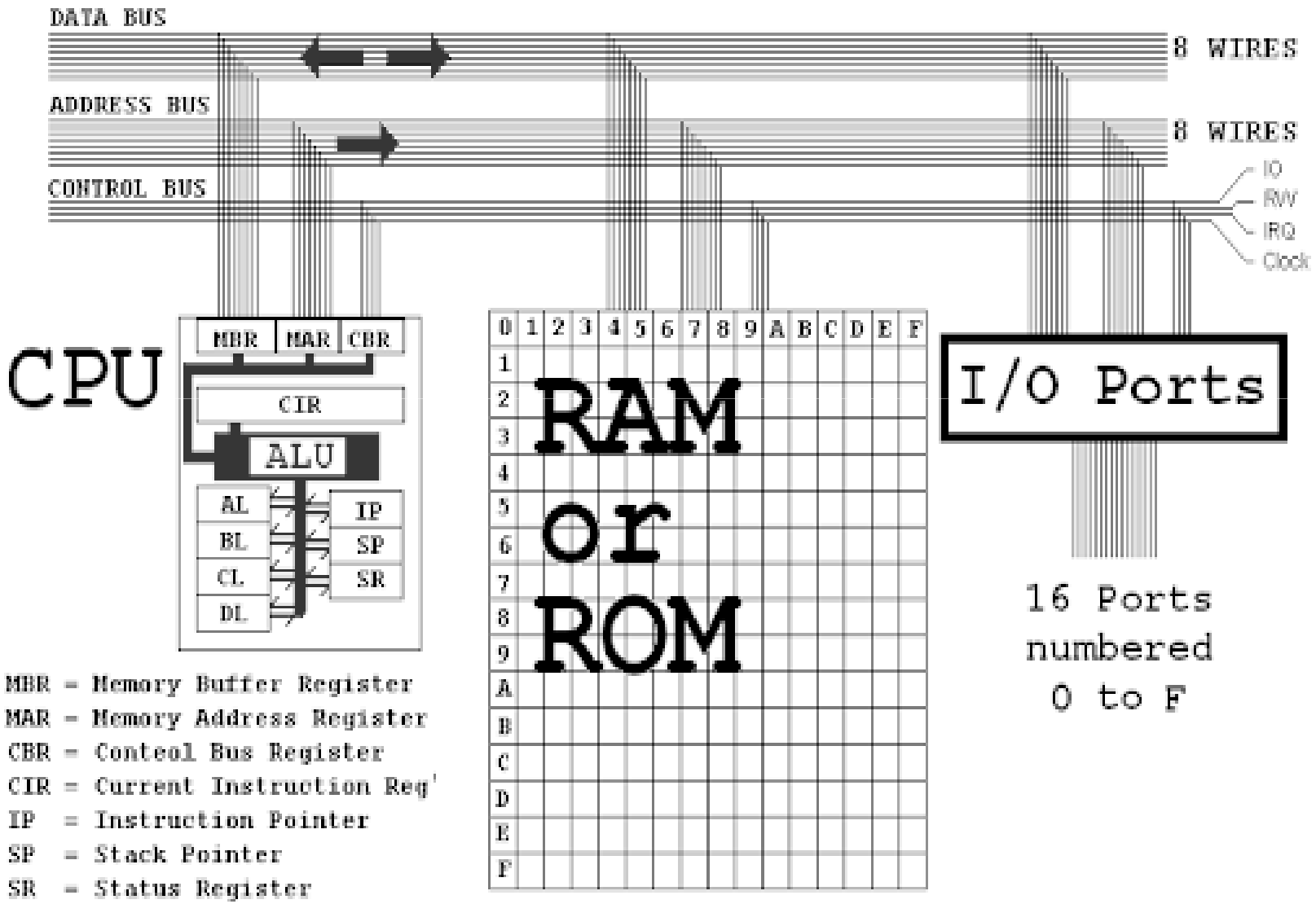
Types of processors : (I - series)



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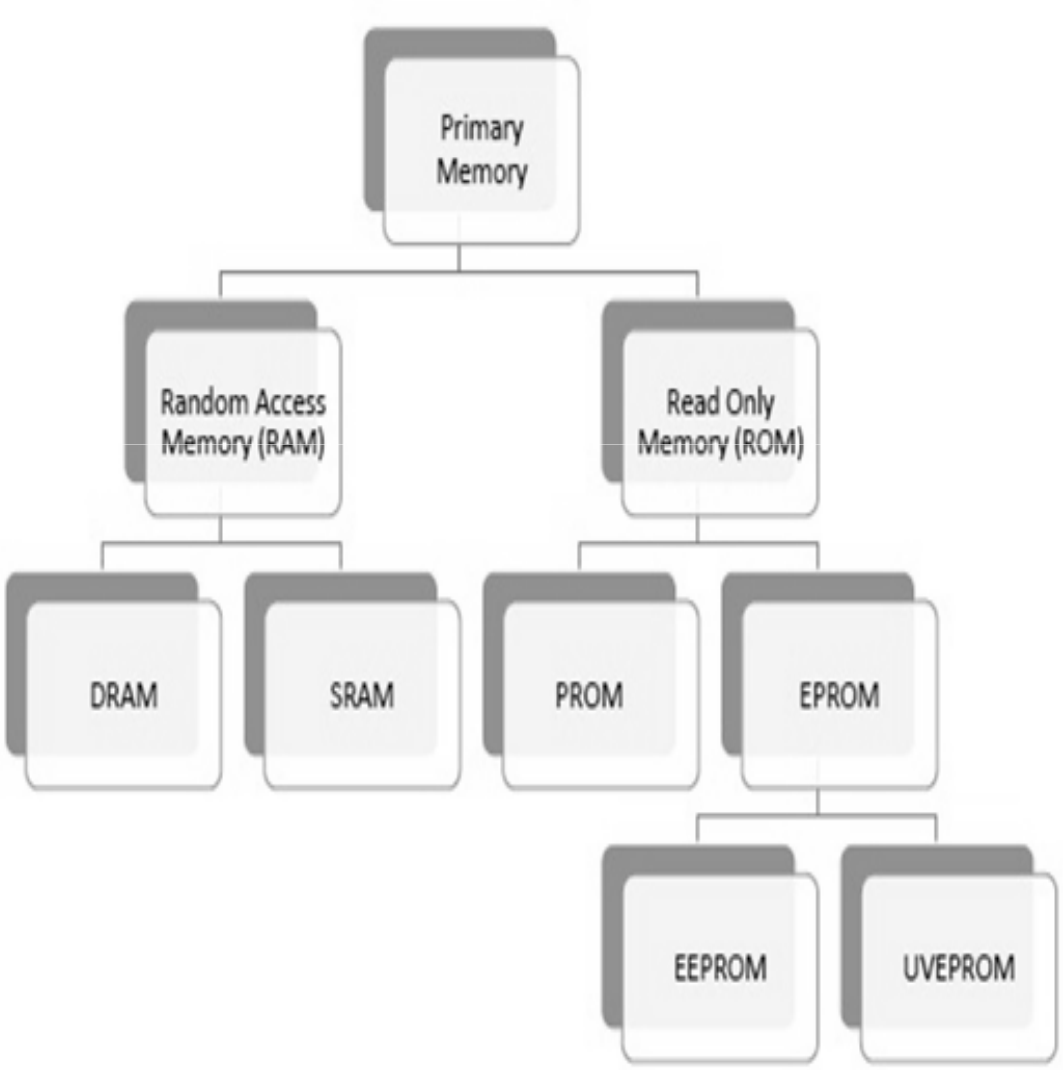
Memory Structure & Types of Memory :

- Computer memory is the storage space in computer where data is to be processed and instructions required for processing are stored.
- The memory is divided into large number of small parts called cells.
- Each location or cell has a unique address which varies from zero to memory size minus one.
- For example, if computer has 64k words, then this memory unit has (64 * 1024) = 65536 memory locations. The address of these locations varies from 0 to 65535.
- **Memory Is Primarily Of Three Types :**
  - Cache Memory
  - Primary Memory / Main Memory
  - Secondary Memory

Memory Structure & Types of Memory : (Cache Memory)

- Cache memory is a very high speed semiconductor memory which can speed up CPU. It acts as a buffer between the CPU and main memory. It is used to hold those parts of data and program which are most frequently used by CPU. The parts of data and programs are transferred from disk to cache memory by operating system, from where CPU can access them.
- **The advantages of cache memory are as follows:**
  - Cache memory is faster than main memory.
  - It consumes less access time as compared to main memory.
  - It stores the program that can be executed within a short period of time.
  - It stores data for temporary use.
- **The disadvantages of cache memory are as follows:**
  - Cache memory has limited capacity.
  - It is very expensive.

Memory Structure & Types of Memory : (Primary Memory)



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Memory Structure & Types of Memory : (Primary Memory - RAM)

- RAM stands for ***RANDOM ACCESS MEMORY***. The processor accesses all memory addresses directly, irrespective of word length, making storage and retrieval fast. RAM is the fastest memory available and hence most expensive. These two factors imply that RAM is available in very small quantities of up to 1GB. RAM is volatile but my be of any of these two types
- **DRAM (Dynamic RAM) :**
  - Each memory cell in a DRAM is made of one transistor and one capacitor, which store one bit of data. However, this cell starts losing its charge and hence data stored in less than thousandth of a second. So it needs to be refreshed thousand times a second, which takes up processor time. However, due to small size of each cell, one DRAM can have large number of cells. ***Primary memory of most of the personal computers is made of DRAM***.
- **SRAM (Static RAM) :**
  - Each cell in SRAM is made of a flip flop that stores one bit. It retains its bit till the power supply is on and doesn't need to be refreshed like DRAM. It also has shorter read-write cycles as compared to DRAM. ***SRAM is used in specialized applications.***

Memory Structure & Types of Memory : (Primary Memory - ROM)

- ROM stands for ***READ ONLY MEMORY***. As the name suggests, ***ROM can only be read by the processor***. New data cannot be written into ROM. Data to be stored into ROM is written during the manufacturing phase itself. They contain data that does not need to be altered, like booting sequence of a computer or algorithmic tables for mathematical applications. ROM is slower and hence cheaper than RAM. It retains its data even when power is switched off.
- **PROM (Programmable ROM) :**
  - PROM can be programmed using a special hardware device called PROM programmer or PROM burner.
- **EPROM (Erasable Programmable ROM) :**
  - EPROM can be erased and then programmed using special electrical signals or UV rays. EPROMs that can be erased using UV rays are called UVEPROM and those that can be erased using electrical signals are called EEPROM. However, handling electric signals is easier and safer than UV rays.

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Memory Structure & Types of Memory : (SECONDARY MEMORY)

- This type of memory is also known as external memory or non-volatile. It is slower than main memory. These are used for storing data/Information permanently. CPU directly does not access these memories instead they are accessed via input-output routines. Contents of secondary memories are first transferred to main memory, and then CPU can access it.
- For example :
  - Hard Disk,
  - CD-ROM,
  - DVD,
  - Pen Drive,
  - etc.

SLOTS :

- In computers, a slot / expansion slot , is an engineered technique for adding capability to a computer in the form of connection pinholes (*typically, in the range of 16 to 64 closely-spaced holes*) and a place to fit an expansion card containing the circuitry that provides some specialized capability, such as video acceleration, sound, or disk drive control.
- Almost all desktop computers come with a set of expansion slots. These help ensure that you'll be able to add new hardware capabilities in the future.

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SLOTS : ISA Slots

- ISA Stands for ***Industry Standard Architecture***, ISA was introduced by ***IBM*** and headed by ***Mark Dean***. ISA was originally an 8-bit computer bus that was later expanded to a 16-bit bus in 1984. When this bus was originally released, it was a proprietary bus, which allowed only IBM to create peripherals and the actual interface.
- However, in the early 1980s other manufacturers were creating the bus.
- In 1993, Intel and Microsoft introduced a PnP ISA bus that allowed the computer to automatically detect and setup computer ISA peripherals, such as a modem or sound card.

SLOTS : PCI Slots

- PCI Stands for ***Peripheral Component Interconnect.***
- A PCI slot is a built-in slot on a device that allows for the attachment of various hardware components such as network cards, modems, sound cards, disk controllers and other peripherals.
- These can come in the form of sound cards, RAID cards, SSDs, graphics cards, NIC cards, Co-processors, and several other functional computer parts. So it enables to expand the capabilities of the PC by adding what do not have in it. It falls under the expansion bus category also known as the ***I/O bus***.

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Sockets :

- A CPU socket uses a series of pins to connect a CPU’s processor to the PC’s motherboard. If a CPU is connected via a CPU socket, it is not soldered and can therefore be replaced.
- When buying a motherboard, finding the best motherboard isn't just about making sure it has the features you want. Step one is making sure the motherboard has the right CPU socket (and a supported chipset) for CPU model.
- Even if having the best CPU, it won't work with just any CPU socket.
- Intel has different socket types for its mainstream CPUs versus its high-end desktop (HEDT) ones, as does AMD.

CABLES :

- In the computer system, there are several different parts which are connected to the system.
- These parts can be directly plugged into the computer system computer motherboard, or there can be a requirement of some cable to connect computer parts to the system.
- These parts can be digital cameras, hard drives, mice or other devices.
- There are different types of cables, like HDMI cable, VGA cable, DVI cable, Ethernet cable, PS/2 cable, 3.5 mm audio cable, USB cable, and computer power cord cable.

CABLES : *USB CABLES*

- The USB ***(Universal Serial Bus)*** cable is a standard cable used to connect universal devices or personal computers.
- It is mainly used for short-distance digital communication. The digital data can be transferred using a USB cable.
- The USB cables can be used to connect two devices directly. The USB cable is connected to the USB port present in the computer system.
- The mouse and keyboard are also connected to a USB port as they have USB cables. As the device is connected through the USB cable, the unplugging of the USB cable when a device is running can cause damage to a device, so whenever there is a need of removing the USB cable, first it should be eject safely and then it should be removed from the system.

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CABLES : *parallel CABLE*

- A series of metal wires that enable multiple bits of data to be transferred simultaneously.
- Parallel cables have mostly given way to serial cables, ***where data is transferred one bit after another***.
- In computing, a parallel port was a type of interface found on computers (personal and otherwise) for connecting peripherals.
- The name refers to the way the data is sent; parallel ports send multiple bits of data at once (parallel communication), as opposed to serial communication, in which bits are sent one at a time.

CABLES : *SERIAL CABLE*

- A serial cable is a cable used to transfer information between two devices using a serial communication protocol.
- The form of connectors depends on the particular serial port used.
- Data communication between digital devices is often done through serial cables, which are used to transfer data between devices that use bit-by-bit or serial port communication techniques.
- Generally, serial cables are categorized according to their interfaces and standards.

POWER DEVICE : UPS

- An *Uninterruptible Power Supply (UPS)*, also known as a battery backup, provides backup power when regular power source fails or voltage drops/rise to an unacceptable level.
- A UPS allows for the safe, orderly shutdown of a computer and connected equipment.

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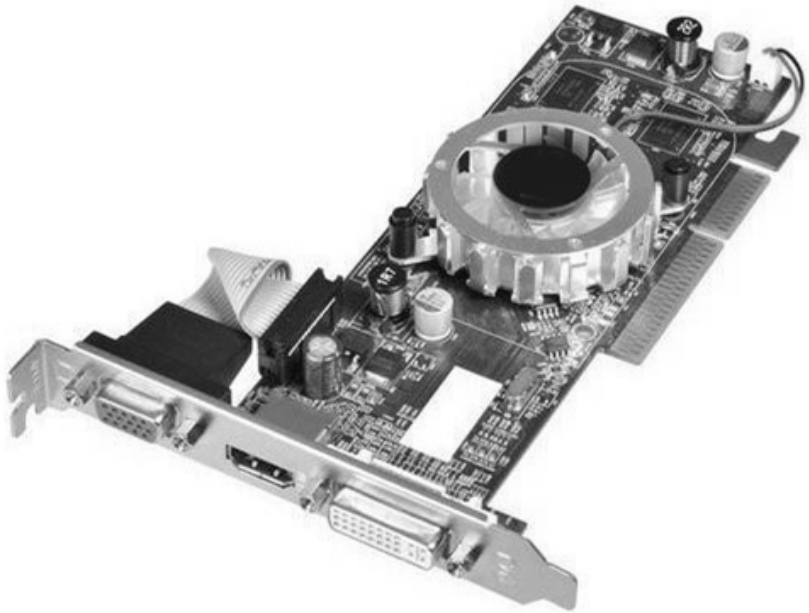
Graphic Card :

- A graphics card is an expansion card for PC that is responsible for rendering images to the display.
- High-end GPUs are used for gaming, ray tracing, graphics production, and even mining cryptography.



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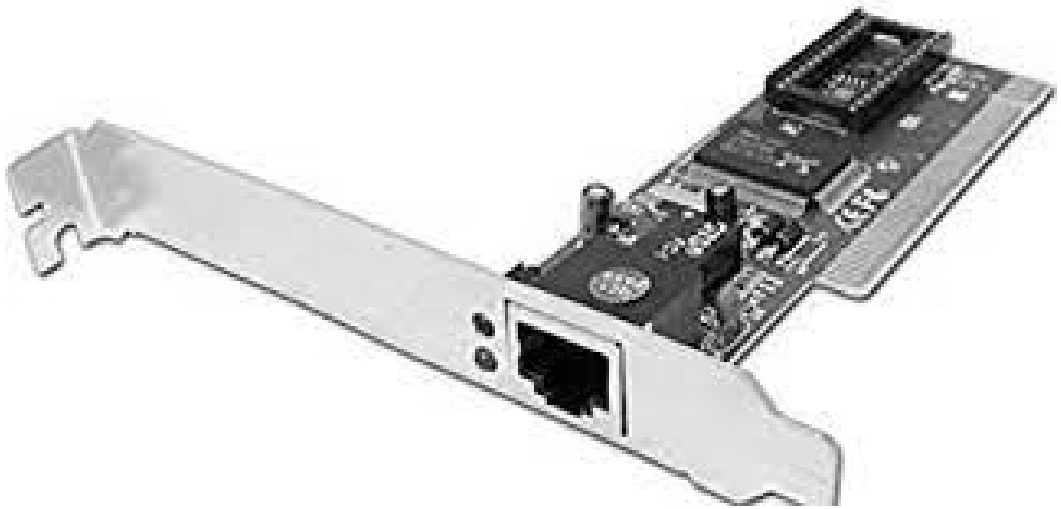
NETWORK Card :

- A Network Interface Card (also known as a NIC, network card, or network interface controller) is an electronic device that connects a computer to a computer network, usually a LAN.
- It is considered a piece of computer hardware.



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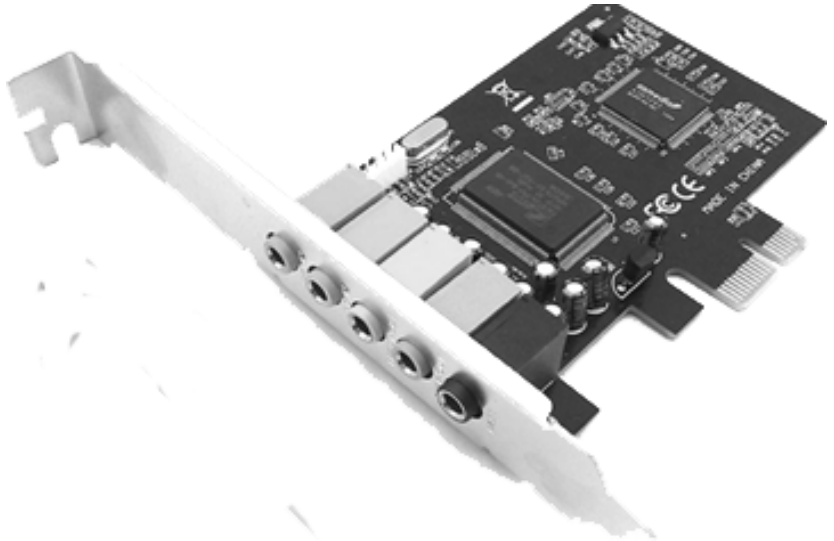
SOUND Card :

- A sound card (also known as an audio card) is an internal expansion card that provides input and output of audio signals to and from a computer under control of computer programs.
- The term sound card is also applied to external audio interfaces used for professional audio applications.



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Computer Fundamental

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