Chapter2: Basic Computer Architecture

Definition of Program:

Program is a set of sequenced instruction (Written in a language that can be understood by a computer) used to direct and control the operation of the computer to solve a problem, or to perform a particular task.

Definition of Data:

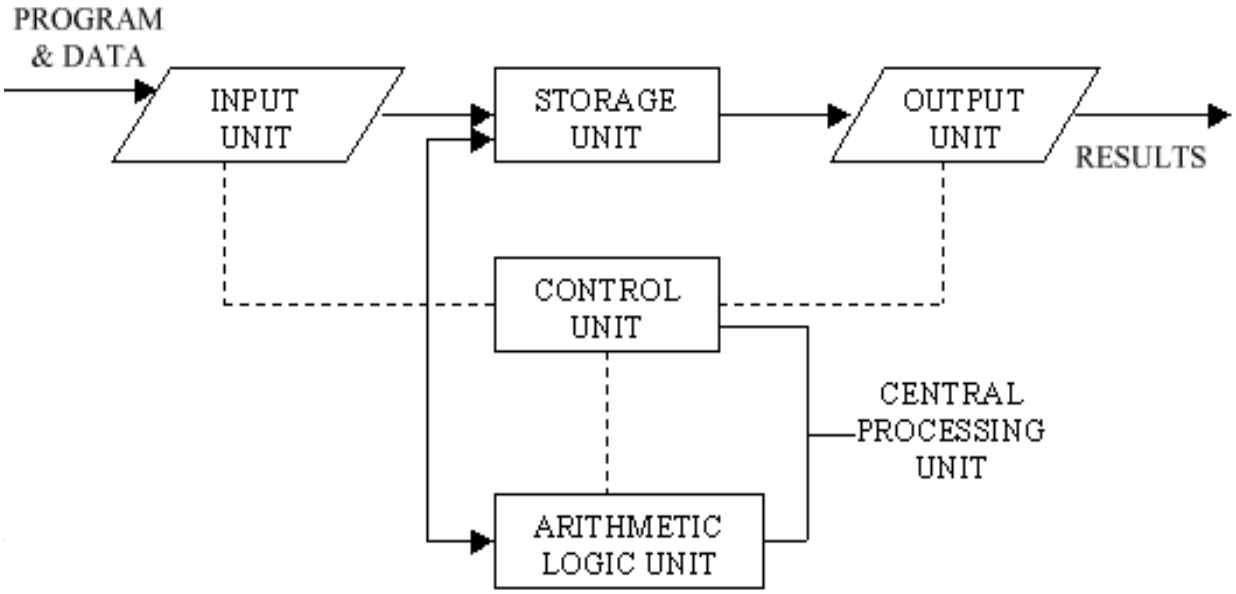
Data is a collection of facts in raw form, which become information after proper organization or processing.

Definition of Information:

Information is a processed data obtained as the output of data processing. It is used by people to enhance understanding and to achieve specific purposes.

Definition of Instruction:

Instruction is a command or order given to a computer. It normally consists of a code to indicate the operation to be performed, and address in memory where the operand would be found.



Central Processing Unit (CPU)

Functional units / organization/ structure of computer system

In order to carry out the operations mentioned in the previous section the computer allocates the task between its various functional units. The computer system is divided into three separate units/components/ devices for its operation.

1. Input Unit/Devices
2. Output Unit/Devices
3. Central Processing Unit
4. Memory Unit/Storage Devices

All these components are basically the integral parts of general- purpose computers. These may be the Desktop systems or Workstations.

1. Input Unit/Devices

The unit used for getting the data and instructions into the computer is known as an Input Unit /device.

Data and instruction enter a computer through an input unit (scanner, keyboard, mouse, etc...). In a form that depend upon the input devise used.
Ex: - Data can be entered using a keyboard in a manner similar to typing and this differs form the way in which data is entered through what scanner.

In short it accepts (or read) instruction and data form outside world. It converts this instruction and data in computer acceptable form. It supplies the convert at instruction and data to computer system for further processing.

- Basic Input Devices
  1. Keyboard
  2. Mouse
- Special Input Devices/ Other Pointing Devices
  1. Trackball
  2. Touch Screen
  3. Joystick
  4. Light Pen
  5. Digitizer
  6. Voice-input Devices
  7. Scanner

2. Output Unit/Devices

Output devices are hardware components, which are used to display or

print the processed information.

The output unit performs the reverse operation of an input unit. It supplies information obtained from data processing, to outside world. Hence, it links the computer with its external environment. As computer work with binary code result produced are also in binary form. There, before supplying the result to outside world, the system must convert them to human acceptable (readable) form. Output interface match the unique physical or electronically characteristic of output devices (ex:- printer, monitor, plotter, LCD, etc…).

1. Monitor
2. Printer
3. Computer Output Microfilm
4. Terminals

3. Central Processing Unit (CPU)

Control unit and the arithmetic logic unit of a computer system are a together non as the CPU.
The CPU is the brain of a computer system.
All major calculation and comparisons take place inside the CPU and the CPU is the responsible for activating and controlling the operation of other units of the computer system.

Its function is to fetch, examine and then execute the instructions stored in the main memory of a computer. In microcomputers, the CPU is built on a single chip or integrated Circuit (IC) and is called as a Microprocessor.
The ALU and the CU of a computer system are jointly known as the central processing unit. You may call CPU as the brain of any computer

system. It is just like brain that takes all major decisions, makes all sorts of calculations and directs different parts of the computer functions by activating and controlling the operations. The CPU consists of the following distinct parts:

Arithmetic Logic Unit
Control Unit
Registers
Buses
Clock

3.1 Arithmetic Logical Unit (ALU)

After you enter data through the input device it is stored in the primary storage unit. Arithmetic Logical Unit performs the actual processing of the data and instruction. The major operations performed by the ALU are addition, subtraction, multiplication, division, logic and comparison. Data is transferred to ALU from storage unit when required. After processing the output is returned back to storage unit for further processing or getting stored.

The arithmetic and logic unit of CPU is responsible for all arithmetic operations like addition, subtraction, multiplication and division as well as logical operations such as less than, equal to and greater than. Actually, all calculations and comparisons are performed in the arithmetic logic unit.

ALU of a computer system is a place, where the actual execution of instruction takes place, during processing operation.
It performs arithmetic, add, subtract, multiply & divide and also logical operation like greater then, less then and equal to data in store in

primary storage before processing, are transferred as and when needed to the ALU, where processing takes place.

Intermediate results generated in the ALU are temporarily transferred back to the primary storage, until needed later.

3.2 Control Unit (CU)

The next component of computer is the Control Unit, which acts like the supervisor seeing that things are done in proper fashion. The control unit determines the sequence in which computer programs and instructions are executed. Things like processing of programs stored in the main memory, interpretation of the instructions and issuing of signals for other units of the computer to execute them. It also acts as a switchboard operator when several users access the computer simultaneously. Thereby it coordinates the activities of computer's peripheral equipment as they perform the input and output. Therefore it is the manager of all operations mentioned in the previous section.

The control unit is responsible for controlling the transfer of data and instructions among other units of a Computer. It is considered as the "Central Nervous System" of computer, as it manages and coordinates all the units of the computer. It obtains the instructions from the memory, interprets them and directs the operation of the computer. It also performs the physical data transfer between memory and the peripheral device.

The function of a control unit is execute the instruction one , in the desired sequence.

It interprets each instruction & than prompts its execution by one of the units likes input, output, storage, ALU.

Ex: For example a comparison of two number [Logical operation] to be performed by the ALU may required lading the two numbers in to the main moray

Which is a function performed by the control unit.

It will than pass on the education of the computer function of the ALU.

3.3 Registers

Registers are small high-speed circuits (memory locations), which are used to store data, instructions and memory ad- dresses (memory location numbers), when ALU performs arithmetic and logical operations. Registers can store one word of data (1 word = 2 bytes & 1 byte = 8 bits. Depending on the processor's capability, the number and type of registers vary from one CPU to another. Registers can be divided into six categories viz. General Purpose Registers, Pointer Registers, Segment Registers, Index Registers, Flags Register and Instruc- tion Pointer Register, depending upon their functions.

3.4 Buses

Data is stored as a unit of eight bits (BIT stands for Binary Digit i.e. 0 or 1) in a register. Each bit is transferred from one register to another by means of a separate wire. This group of eight wires, which is used as a common way to transfer data between registers, is known as a bus. It is actually a connection between two components to transmit signal between them. Bus can be of three major types viz. Data Bus, Control Bus and Address Bus. The data bus is used to move data, address bus to move address or memory location and control bus to send control signals between various components of a computer.

3.5 Clock

Clock is another important component of CPU, which measures and allocates a fixed time slot for processing each and every micro-operation

(smallest functional operation). In simple terms, CPU is allocated one or more clock cycles to complete a micro-operation. CPU executes the instructions in synchronization with the clock pulse. The clock speed of CPU is measured in terms of Mega Hertz (MHz) or Millions of Cycles per second. The clock speed of CPU varies from one model to another in the range 4.77 MHz (in 8088 processor) to 266 MHz (in Pentium II). CPU speed is also specified in terms of Millions of instructions Per Second (MIPS) or Million of Floating Point Operations Per Second (MFLOPS).

Now these days we have clock speeds of CPU which in Gigahertz. E.g. we have Pentium IV having a clock speed of 3.04GHz, or AMD Athlon having speed of 2.7GHz.

Storage Unit:

Data and instruct ion entered in to a computer system through input unit's had to be store inside the computer before actually processing start.

Similarly result produced by a computer after processing have to be kept some were inside the computer system before being passed on to an output unit.

Moreover, a computer must also preserve intermediate result for on going process.

Storage unit of all computers is divided in to two types.

Primary Storage

Secondary Storage

Primary Storage:

Primary storage of computer also known a main memory which is used to store program instruction and data, inter mediate result of processing and recently produced results on which.

Computer is currently working.

As soon as computer system switches of or reset the information held in primary storage is erased (removed).

Normally, it has limited storage capacity and expensive.

Secondary Storage:-

Secondary storage of a computer, like auxiliary storage, is used to take care of limitations of primary storage.

Secondary storage holds the program instruction, data, and information of those jobs on which the computer system is not currently working but needs to hold them for processing later.

Magnetic disk is the most commonly used secondary storage medium.

It is not volatile in nature.

It is cheaper (low cost).

Secondary Storage	Primary Storage
Secondary Storage (also called auxiliary storage, permanent storage, or mass storage).	Primary Storage (also called main memory).
Nonvolatile Storage - Permanent storage of data, programs, instructions, and information for future use.	Volatile Storage - A temporary holding place for data and instructions.
Back-up - can be used to backing-up data.	Consists of one or more chips on the motherboard
The speed of the secondary memory is slower compared to primary memory.	The primary memory is much faster in speed than the secondary memory.
Secondary devices are: Floppy disk/Hard disk.	Primary devices are: RAM / ROM.

In secondary storage device the storage capacity is larger.	In primary storage device the storage capacity is limited.
Secondary memory is less expensive than primary memory.	Primary memory is more expensive than secondary memory.

Address:

Address is Identification, represented in the form of a name, label, or number, for designating a location in storage area.

8085MP uses following Address modes.

1. Direct Addressing
2. Register Addressing
3. Indirect Addressing
4. Immediate Addressing
5. Implicit Addressing

1. Direct Addressing:

Direct Addressing mode in this mode of addressing the address of operand is given in the instruction. Store the contain of accumulator in the memory location 6000H.

2. Register Addressing:

A high-speed circuit that holds the addresses of data to be processed or of the next instruction to be executed.

3. Indirect Addressing

An address mode that points to another pointer rather than the actual data. This mode is prohibited in RISC architecture.

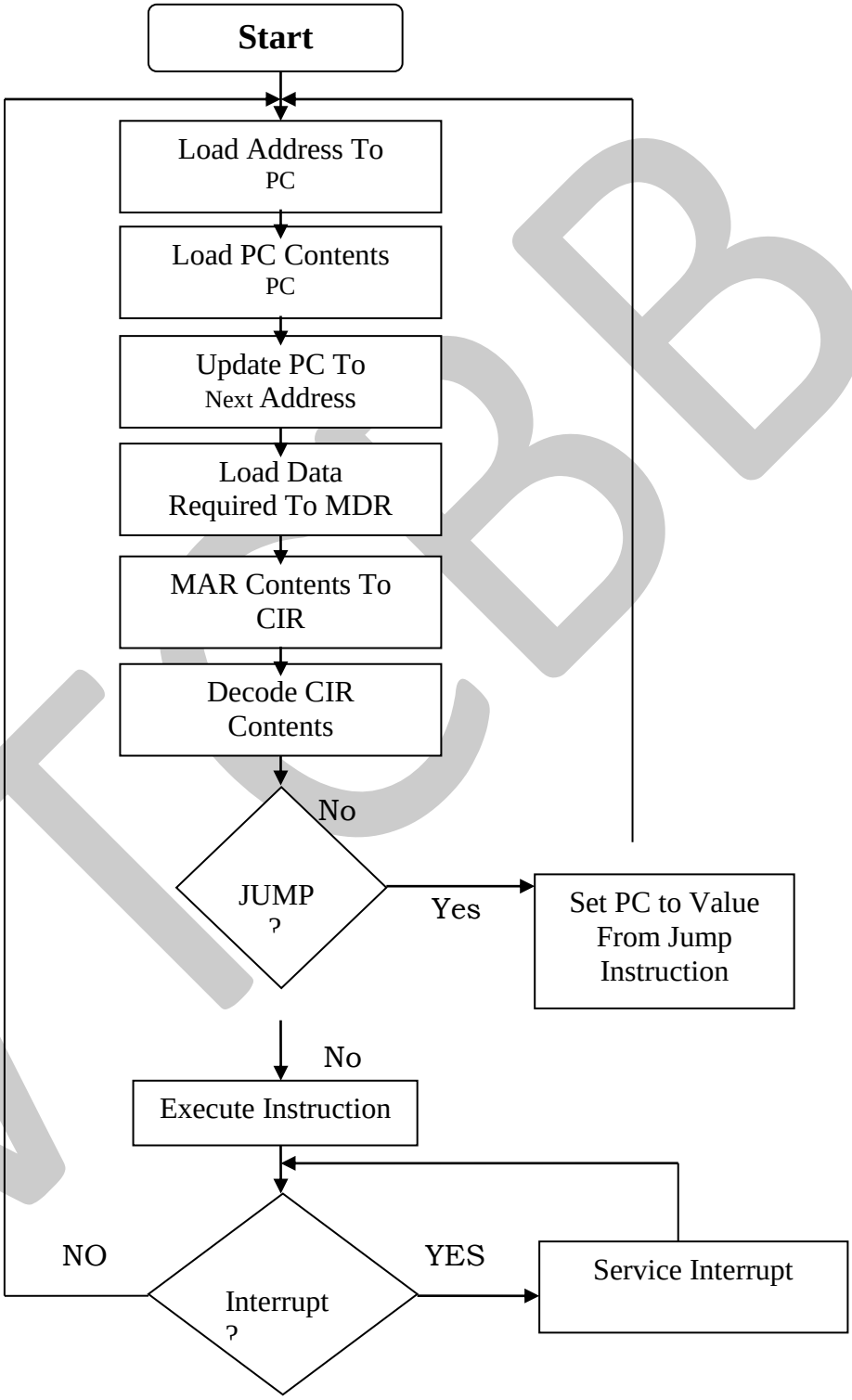
4. Immediate Addressing

In immediate addressing, the instruction itself contains the value to be used. This is like using a constant like 7 or 39 in an expression in a higher level language.

5. Implicit Addressing

An implicit address structure and technique are disclosed for rapidly accessing storage registers by eliminating the need for generating a separate address before referencing the register. A structure is provided for generating an address composed of parameters which are incorporated into the contents of the storage register. At the same time that the address generation occurs, the structure of the present invention provides an associative compare of the implicit registers, and if there is a match, the address generation step is terminated and the data is immediately available from the implicit register.

Phases of Machine Cycle



Instruction Cycle:

An **instruction cycle** (commonly called the **fetch-and-execute cycle**, **fetch-decode-execute cycle**, and **FDX**) is the basic operation of a computer. It is the process by which a computer retrieves a program instruction from its memory, and translates it into a machine code instruction that is then carried out in the central processing unit (CPU). This cycle is repeated continuously from boot up to when the computer is shut down.

Circuits used

The circuits used in the CPU during the cycle are:

- **Program Counter (PC)** - an incrementing counter that keeps track of the memory address of which instruction is to be executed next
- **Current Instruction Register (CIR)** - a temporary holding ground for the instruction that has just been fetched from memory
- **Control Unit (CU)** - decodes the program instruction in the CIR into machine code instructions, and sequences and executes them
- **Arithmetic logic unit (ALU)** - performs mathematical and logical operations.

Instruction cycle

Each computer's CPU can have different cycles based on different instruction sets, but will be similar to the following cycle:

1. Fetch the instruction

The CPU presents, on the address bus, the value stored in the Program Counter. This is the memory address of the next instruction that is to be executed. The CPU then fetches the instruction from main memory via the data bus, and it is then placed into the CIR. The Program Counter is incremented to contain the address the next instruction.

2. Execute the instruction

The CU passes the decoded information as a sequence of control signals to the relevant function units of the CPU to perform the actions required by the instruction such as reading values from registers, passing them to the ALU to perform mathematical or logic functions on them, and writing the result back to a register. If the ALU is involved, it sends a condition signal back to the CU.

3. Store results

The result generated by the operation is stored in the main memory, or sent to an output device. Based on the condition of any feedback from the ALU, Program Counter may be updated to a different address from which the next instruction will be fetched.

The cycle is then repeated

Fetch cycle

Steps 1 and 2 of the Instruction Cycle are called the Fetch Cycle. These steps are the same for each instruction. The fetch cycle processes the instruction from the instruction word which contains an opcode and an operand.

Execute cycle

Steps 3 and 4 of the Instruction Cycle are part of the Execute Cycle. These steps will change with each instruction.

The first step of the execute cycle is the Process-Memory. Data is transferred between the CPU and the I/O module. Next are the Data-Processing uses mathematical operations as well as logical operations in reference to data. Central alterations is the next step, is a sequence of

operations, for example a jump operation. The last step is a combined operation from all the other steps.

Initiating the cycle

The cycle is usually managed in modern computers by the Operating System (OS). However, since the OS usually resides on a disk, it cannot operate immediately on boot up before the OS is loaded. Therefore when a computer is initially booted, the cycle begins by searching for the code at a specific starting memory address, (0xffffff0 in the Read Only Memory (ROM) in the case of an Intel CPU) from where the Basic Input/output System (BIOS) is loaded. The BIOS then manages boot up, performing a number of functions such as making sure that all the different chips, hard drives, and the CPU function together as an entity. It also loads the OS which takes over the running of the instruction cycle.

The Fetch-Execute cycle in Transfer Notation

Expressed in register transfer notation
(Increment the PC for next cycle)

Definition of BUS:

Bus is the way carried out **data from one place to another place.**

OR

BUS is in the computer architecture, a bus is a subsystem that transfers data between computer components inside a computer or between computers.

The interaction between the CPU and memory takes place very frequently. To enable this interaction, some type of connectivity is needed between the two units of a computer system. This connectivity channel is known as bus. Physically, a bus is set of wires, which carries a group of

bits in parallel and has an associated control scheme. The bus width is defined as the number of parallel lines in the bus. Every computer has three types of buses for interconnecting the CPU and memory.

There are four types of Memory BUSES:

1. **Address Bus:**

Every location in the memory has a unique address. The address of a location does not change, but the data stored in it can change. In order to retrieve some data from memory, it is necessary to specify the address of the location where the data is stored. The address bus is used to carry the address of a memory location whenever data is to transferred to or from memory.

For example, a system with a 32-bit address bus can address 2^{32} (4,294,967,296) memory locations. If each memory address holds one byte, the addressable memory space is 4 GB.

A computer system normally has multiple I/O devices like disk, tape, network etc simultaneously connected to it. Each I/O devices has a unique identifier associated with it. The address

bus is used to carry the address bus is used to carry the address of the I/O device to be accessed by the CPU.

2. **Data Bus:**

The data bus is used to transfer data between the CPU and memory. The one that you hear most about is the data bus. The bus width of the data bus is important parameter that affects the overall speed of a computer system. This is because each wire of a bus can transfer one bit at a time. Hence an 8-bit bus cans move8 bits data time, a 16 bit bus can transfer two bytes, and 32 bit buses can transfer four bytes at a time. This is similar to a multi-lane highway. The wider the highway, the more traffic can flow simultaneously. Similar wider the bus enables

more bits of data to travel, simultaneously resulting in faster exchange of data.

Types of Data buses

The data bus is used to transfer data between the CPU and I/O devices

ISA bus

ISA stands for industry standard architecture. It is a 16-bit bus that can transmit data along either 8 or 16 data lines depending upon what kind of adapter card is used in the expansion slot.

MCA bus

MCA stands for micro channel architecture. It is 32-bit bus that transmits data along 32 data lines. Due to is wider bus width, it is significantly faster than the ISA bus. MCA expansion slots can not accept 8-bit or 16 bit adapter cards and required specifically designed 32-bit adapter cards.

EISA

EISA stands for extended industry standard architecture. Since the expansion slots into an ISA bus could not work with the MCA bus, the MCA bus had the problem of upward compact- ability. EISA bus was designed to solve this problem. Hence like MCA, EISA is also a 32-bit bus. However, unlike MCA, it was designed to accept and use the old ISA expansion slots. The EISA is faster than the ISA, but not as fast as the MCA – the price of its compatibility with the older 16-bit expansion slots.

3. **Control Bus :**

In addition to spending address and exchanging data with the memory, the CPU also needs to send control signals to the memory to specify whether the data is to be read from or written to the specified address location. The control bus carries such signals, which are in the form of READ/WRITE commands.

The control bus is used to carry commands such as Start, READ, WRITE, REWIND Tape, etc. from the CPU to I/O devices. It is also used to carry the status information of the I/ O devices to the CPU.
It defines how exactly these functional units of a Computer system and connected to each other.
Three commonly used interconnection architecture:
• Unibus
• Dual bus
• DMA

4. **Memory Address Bus:**

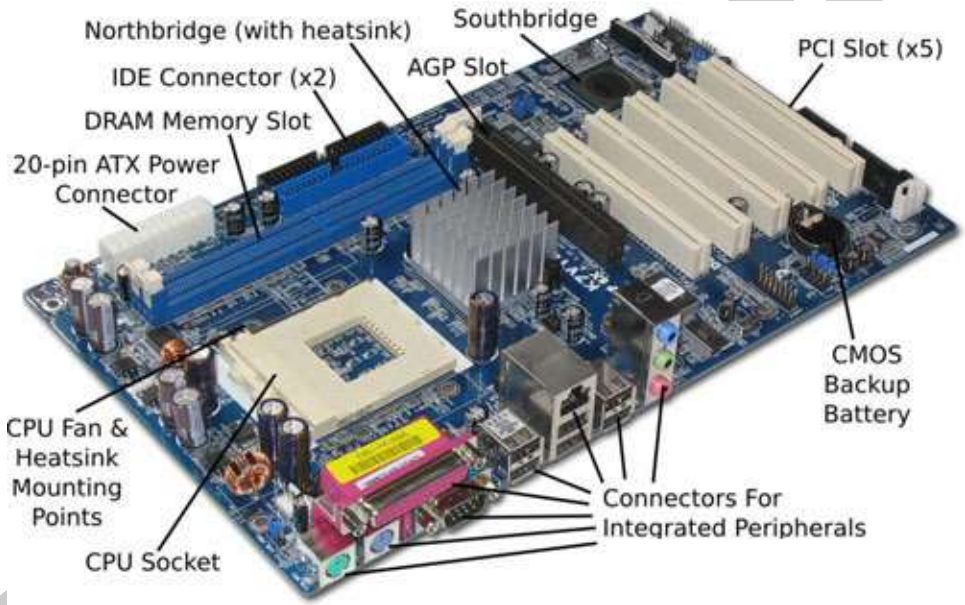
Memory Address Bus is with will equal the word lend of the bit memory. In order to get a word from memory it is necessary to specify it's address. The address is carried out by memory address bus whose width equal the no. of bits in the memory address register of the memory. If the computer has memory of 64 kilobyte. Then the address bus bits 16 bits wide.

I / O Buses

The flow of data between the CPU and memory, data also flows from between the CPU and I?O devices in a computer system. Hence just looked the buses between the CPU and memory every computer system also uses buses for intercom- netting the CPU with I/O devices.

Various Hardware Components

A PC has several chip RAM chips, ROM chips, Heater fun, processor, chip are the components of mother board.



Motherboard

RAM: RAM stands for Random Access memory the purpose of RAM is to hold programs and data while they are in use.

The CPU stores and retrievers each piece at data using a memory address. This is the number that indicates a location on the memory chips.

It is volatile in nature i.e. When the computer circuit board attached to the mother board. If you want to have more memory.

Random-access memory is a form of computer data storage. Today, it takes the form of integrated circuits that allow stored data to be accessed

in any order. The word *random* thus refers to the fact that any piece of data can be returned in a constant time, regardless of its physical location and whether or not it is related to the previous piece of data.

By contrast, storage devices such as magnetic discs and optical discs rely on the physical movement of the recording medium or a reading head. In these devices, the movement takes longer than data transfer, and the retrieval time varies based on the physical location of the next item.

The word RAM is often associated with volatile types of memory (such as DRAM memory modules), where the information is lost after the power is switched off. Many other types of memory are RAM, too, including most types of ROM and a type of flash memory called NOR-Flash.

Processor

A processor is the logic circuitry that responds to and processes the basic instructions that drives a computer. The term processor has generally replaced the term central processing unit (CPU). The processor in a personal computer or embedded in small devices is often called a microprocessor.

Co – Processor:

A coprocessor is a computer processor used to supplement the functions of the primary processor (the CPU). Operations performed by the coprocessor may be floating point arithmetic, graphics, signal processing, string processing, Savitsky-Golay derivation, or encryption.

RISC Processor:

→ RISC stands for Reduced Instruction set computer Architecture.

→ The acronym RISC for reduced instruction set computer, represents a CPU design strategy emphasizing the insight that simplified instructions

that "do less" may still provide for higher performance if this simplicity can be utilized to make instructions execute very quickly.

→ Many proposals for a "precise" definition have been attempted, and the term is being slowly replaced by the more descriptive load-store architecture.

→ Well known RISC families include Alpha, ARC, ARM, AVR, MIPS, PA-RISC, Power Architecture (including PowerPC), SuperH, and SPARC.

→ Being an old idea, some aspects attributed to the first RISC-labeled designs include the observations that the memory restricted compilers of the time were often unable to take advantage of features intended to facilitate coding, and that complex addressing inherently takes many cycles to perform.

→ It was argued that such functions would better be performed by sequences of simpler instructions, if this could yield implementations simple enough to cope with really high frequencies, and small enough to leave room for many registers, factoring out slow memory accesses.

→ Uniform, fixed lengths instructions with arithmetic have restricted to registers were chosen to ease instruction pipelining in these simple designs, with special load-store instructions accessing memory.

CISC Processor:

→ CISC stands for Complex Instruction Set Computing

→ This class of microprocessors has characteristics that fit most early microprocessor designs. As such their characteristics consisted of practical design choices for the time that they were invented.

→ For some applications, the rate at which data can be fetched from memory is a limiting factor to the performance of the application.

→ These types of applications are still well suited to the design guide lines of CISC processors.

→ Two common design choices that reduce High Memory Overhead are:

[1] Variable Length Instructions

[2] Extensive Instruction Set

Another common attribute to CISC processors is support for some programming sequences that:

- Hinder a processor's performance
- Occur rarely
- Could have been initially defined as producing unpredictable results

[1] Variable Length Instructions:

→ High Memory Overhead

The programmers who made the CISC processor were going for one goal; to conserve memory as best they could. Back when CISC processors were first made, memory was very expensive. This made them compact everything instruction to as small as they could get it so to save memory. Some common mechanisms, used by CISC processor designers, to reduce memory usage are:

→ Variable Length Instructions

Variable length instructions were used in CISC processors to limit the amount of memory each instruction took up. It also made it so that any instruction length would fit in one cycle so it wouldn't have to make two cycles to get one piece of data. Saving memory is not a bad idea, but one down side to this design guide line is it is difficult for the I-unit to perform out of order execution, which slows the computer down greatly. Another down side is it is very difficult to find the opcodes in the upcoming instructions.

→ Extensive Instructions Set

Frequently CISC supports SS (Storage to Storage) instructions. A SS instruction is the act of allowing data to be moved from one place in memory to another in one instruction. The good thing about SS instructions is CISC processors only have to use one instruction to perform what would take a RISC processor two instructions to do; one to

load the data from memory into a register and another to store it in memory again at the new destination

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Memory

Computer data storage, often called **storage or memory**, refers to computer components and recording media that retain digital data used for computing for some interval of time. **Computer data storage provides one of the core functions of the modern computer**, that of information retention. It is one of the fundamental components of all modern computers, and coupled with a **central processing unit (CPU, a processor), implements the basic computer model.**

In contemporary usage, memory usually refers to a form of **semiconductor** storage known as **random-access memory** (RAM). Sometimes other forms of fast but temporary storage. Similarly, storage today more commonly refers to mass storage — optical discs, forms of magnetic storage like hard disk drives, and other types slower than RAM, but of a more permanent nature.

Memory and storage were respectively called main memory and secondary storage (or auxiliary storage). Auxiliary storage (or auxiliary memory units) was also used to represent memory which was not directly accessible by the CPU (secondary or tertiary storage). The terms internal memory and external memory are also used.

Primary storage (or **main memory** or **internal memory**), often referred to simply as memory, is the only one directly accessible to the CPU. The CPU continuously reads instructions stored there and executes them as required. Any data actively operated on is also stored there in uniform manner.

Secondary storage (or external memory) differs from primary storage in that it is not directly accessible by the CPU. The computer usually uses its input/output channels to access secondary storage and

transfers the desired data using intermediate area in primary storage. Secondary storage does not lose the data when the device is powered down—it is non-volatile. Per unit, it is typically also two orders of magnitude less expensive than primary storage. Consequently, modern computer systems typically have two orders of magnitude more secondary storage than primary storage and data is kept for a longer time there.

In modern computers, hard disk drives are usually used as secondary storage. The time taken to access a given byte of information stored on a hard disk is typically a few thousandths of a second, or milliseconds. By contrast, the time taken to access a given byte of information stored in random access memory is measured in billionths of a second, or nanoseconds. This illustrates the very significant access-time difference which distinguishes solid-state memory from rotating magnetic storage devices: hard disks are typically about a million times slower than memory. Rotating optical storage devices, such as CD and DVD drives, have even longer access times. With disk drives, once the disk read/write head reaches the proper placement and the data of interest rotates under it, subsequent data on the track are very fast to access. As a result, in order to hide the initial seek time and rotational latency, data are transferred to and from disks in large contiguous blocks.

Port

Port is an interface on a computer to which you can connect a device. Personal computers have various types of ports.

OR

Port is on computer and telecommunication devices, a port (noun) is generally a specific place for being physically connected to some other device.

OR

Port are Used to connect external devices to the computer.

Typically, a personal computer is provided with one or more serial ports and usually one parallel port. The serial port supports sequential, one bit-at-a-time transmission to peripheral devices such as scanners and the parallel port supports multiple-bit-at-a-time transmission to devices such as printers.

Internally, there are several ports for connecting disk drives, display screens, and keyboards. Externally, personal computers have ports for connecting modems, printers, mice, and other peripheral devices.
Almost all personal computers come with a serial RS-232C port or RS-422 port for connecting a modem or mouse and a parallel port for connecting a printer. On PCs, the parallel port is a Centronics interface that uses a 25-pin connector. SCSI (Small Computer System Interface) ports support higher transmission speeds than do conventional ports and enable you to attach up to seven devices to the same port.

Different types of Port

USB
Fire wire
Ethernet port
Serial port
Parallel Port
PS/2 Connector
Video Graphics Array
VGA Connector
Digital Visual Interface

Serial Port	Parallel Port
1. Serial Port delivers one bit at	1. Parallel Port delivers multiple

a time.	bytes at once depending on the size
2. Serial Port is used modems, controller & other devices	2. Parallel Port is mostly use for printers.

BIOS: Basic Input Output System

- The BIOS is special software that interfaces the major hardware components of your computer with the os. It is usually stored on a Flash memory chip (known as flash BIOS) on motherboard, but sometimes placed in ROM (known as ROM BIOS).
- BIOS s/w has a number of different roles, but its most important role is to load os.
- When you turn on your computer & microprocessor tries to execute its first instruction, it has to get that instruction from somewhere. It cannot get it from os because os is located on hard disk, & microprocessor cannot get to it without some instructions that tell it how. BIOS provide those instructions.
- Some of the other common tasks that the BIOS performs include:
  1. A power-on self-test (POST) for all of the different hardware components in the system to make sure everything is working properly
  2. Activating other BIOS chips on different cards installed in computer. I.e. SCSI (Small Computer Sys Interface), graphics cards often have their own BIOS chips.
  3. Providing a set of low-level routines that os uses to interface to different hardware devices - It is these routines that give BIOS its name. They manage things like keyboard, screen & serial & parallel ports, especially when computer is booting.
  4. Managing a collection of settings for the hard disks, clock, etc.

- When you turn on computer, BIOS does several things. Below is its usual sequence:
  1. Check the CMOS Setup for custom settings
  2. Load the interrupt handlers and device drivers
  3. Initialize registers and power management
  4. Perform the power-on self-test (POST)
  5. Display system settings
  6. Determine which devices are bootable
  7. Initiate the bootstrap sequence

Flash memory is considered a **solid state** storage device. Solid state means that there are no moving parts -- everything is electronic instead of mechanical. Flash memory is a type of **EEPROM** chip. Flash memory is used for easy and fast information storage in such devices as digital cameras and home video game consoles.

Examples of Flash memory:

1. Your computer's BIOS chip
2. Compact Flash (most often found in digital cameras)
3. Smart Media (most often found in digital cameras)
4. Memory Stick (most often found in digital cameras)
5. PCMCIA Type I and Type II memory cards (used as solid-state disks in Laptops).

Memory cards for video game consoles

POST: Power On Self-Test

The Power on Self Test (POST) is the first set of instructions executed during the start-up of your computer.

- It is the first step of the more general process called initial program load (IPL), booting, or bootstrapping.

- You can recognize it during the RAM test, which is one of the system components that the POST checks, along with the other key components on the motherboard.
- The POST order of execution looks like the following:
  1. Information about the graphics adapter
  2. Information about the BIOS (name, version)
  3. Information about the RAM (counted)
- If the POST detects an error or errors in the system, it will write the error messages on the screen.
- However, if the monitor is not ready, or if there are video card errors, it provides an audible code.
- If a catastrophic fault has been detected in the POST that your computer does at start-up, the number of these audible beeps can be indicative of the type of failure. These beeps (or beep code) can be useful in troubleshooting problems prior to the initialization of your computer's video system. T
- His number of beeps is dependent on your computer's particular BIOS and is unfortunately not standardized across manufacturers. If you can match your beep code to your particular BIOS and version, you can accurately diagnose problems with your CPU, RAM, motherboard, video board, or drive controller.

Your system's beep codes should be in the written documentation for your motherboard, or obtainable from the manufacturer's web site.