# Computers in Business: Concepts in Hardware and Software

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**NB:**

- Listen to what I say, What matters is not what is in the notes.
- Assignments are very essential
- TRY questions are optional, BUT very important.

# Hardware

**Assignment:**

1. History of Computers (1 page).

**Class Quiz:**

- Mention two components of the computer you think are very essential, and explain why.

What is a Computer?

- Electronic
- Mechanical
- Accepts user input(s)
- Performs computation on the input and produces output accordingly (Garbage in Garbage out).

What is a Computer System? Made up of

- Hardware
- Software and
- People (Users)

**TRY:** What are the various types of computers, and how do they differ from each other?

# System Components

**Processor:**

- Reads instructions from Memory and executes them.
- Always faster than Main Memory (RAM)

**Components of Processor:**

- Registers (Accumulators)
- Arithmetic and Logic Unit (ALU)
- Control Unit
- Input/Output Interfaces

Other concepts relating to Processor include:

- **Clock:** No. of PULSES per second that sets the tempo for the processor
- **Cache:** Small but fast memory close to the processor.
- **Bus:** Size determines the amount of data that can be transferred (16 bit,32 bit, 64 bit etc. )

- **Pipeline:** Multiple instructions are overlapped during execution.

**TRY:**

1. How do you pick a processor for your system? What factors will you consider?
2. What relationship exist between the speed of a processor and the performance of the computer?

**Main Memory:**

- Storage for Programs and data
- Bandwidth is proportional to system bus speed (size)
- Packaged in slots on the Motherboard

## Types of Memory:

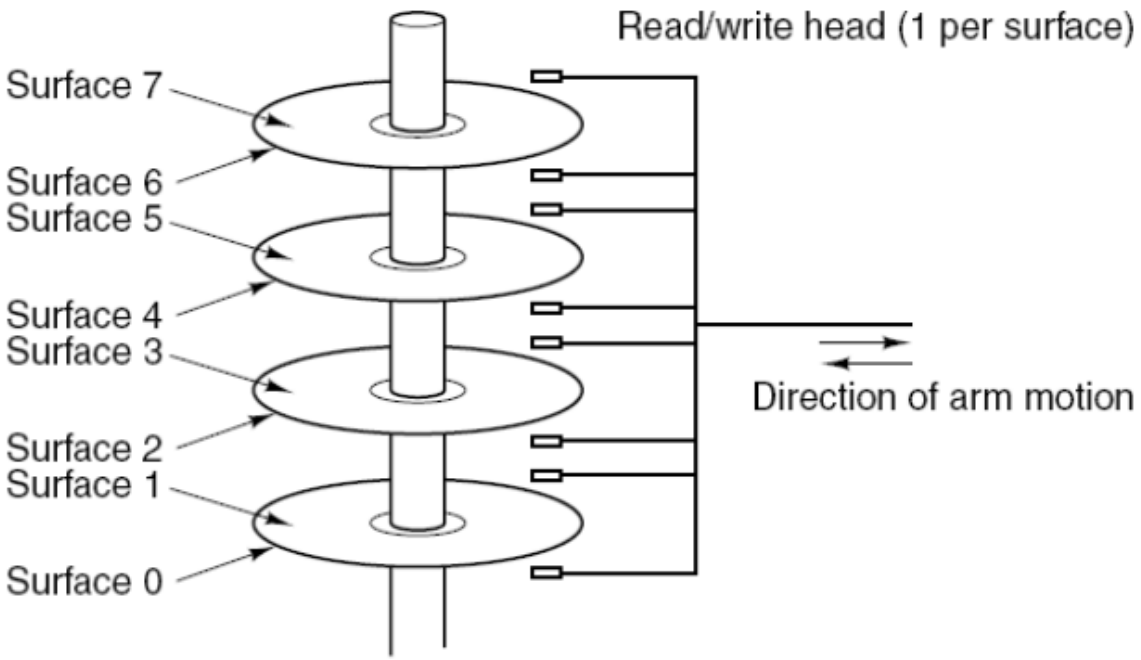
1. Dynamic RAM (DRAM): Made up of capacitors. Needs to be refreshed always.Has 1 Read Port and 1 Write Port (only 1 of them is operational at a time).
   - Extended DataOut DRAM (EDORAM): Enhanced for a pipeline processor access
   - Synchronous DRAM (SDRAM): Load/Store can only occur on positive clock edge
   - Double Data Rate SDRAM (DDR SDRAM):Allows activation of output operation during both rising and falling clock edges. Doubles the Speed of operation.
   - Rambus DRAM (RDRAM): Can support very high bus speeds.
2. Static RAM:
   - Made up of Flip-Flops.
   - Larger,faster with lower access time than DRAM.
   - Expensive.
   - Used as Cache memory
3. Video DRAM (VRAM): Has two ports, one for reading and

# Non-Volatile Memory

1. Mask Programmed ROM:
   - Hardcode memory content onto some logic cct. A mask is created to represent the binary content of the memory, then a photo-lithography process is used to etch the image to a logic cct.
2. Programmable ROM (PROM):
   - Allows the programming of a blank device with some image. Once the image is etched, changes are not possible.
3. Erasable Programmable ROM (EPROM):
   - Device is read only when in use as memory
   - Can be erased (eg. The first EPROM was erasable by exposure to ultraviolet light).
4. Electrically Erasable PROM (EEPROM):
   - Supports both total and selective erasure by electrical cct.
   - Has a number of times it is allowed to be erased. eg. Flash Memory.

5 Magnetic Disk:

- A collection of magnetic coated circular rotating platters
- To encode a single binary digit, the disk head is placed above the platter and used to magnetize a region on the platter surface.
- The magnetic field is aligned in different ways in order to encode 1 or 0.
- To read the info, the disk head is placed n the same position , the magnetic field on the platter induces current in the disk head to be relayed back as binary data.
- A disk is made up of
  - Platters which are made up of
  - Tracks which are made up of
  - Sectors containing the binary data
- Each platter has a dedicated disk head.


Read/write head (1 per surface)
Surface 7
Surface 6
Surface 5
Surface 4
Surface 3
Surface 2
Surface 1
Surface 0
Direction of arm motion

Access latency is determined by:

- Seek Time: How quickly the disk head can be moved to the right track.
- Rotational Latency: How quickly the right sector arrives under the disk head as the disk spins.

**TRY:** What are the performance parameters of a Hard Disk?

## OPTICAL DISCS:

- Info is encoded as binary digits by making indentations on the surface of the disc in the form of Pits and Lands.
- Info is read by positioning a laser head over the required region and firing it at the surface.
- The reflection from both pits and lands are phase shifted.
- This phase shifting id detected by a device which converts it to binary data.

Egs of Optical Discs include:

- Compact Disc (CD) Read Only Memory (ROM)
- Digital Versatile Disc (DVD) Read Only Memory (ROM)
- Compact Disc Read Write Memory (CDRW)

# Mother Board

- Holds all the major components of the computer.
  item Made up of a Chip Set called "Glue Logic", some code in ROM and Interconnections (Buses).

The Motherboard contains the following:

- Expansion slots: Holds cards such as Graphics card, Sound Card, ect.
- CPU: Inserted into a socket on the motherboard.
- Coprocessor: Special purpose microprocessor that takes some of the processor functions.
- Most coprocessors are maths processors, current CPUs have their coprocessors built in.
- Main Memory (RAM)
- Support cct of chipset for interrupts.
- BIOS: Basic Input Output System stored on the ROM and

**TRY:**

- What is Form Factor of a Motherboard and what are the different types?
- What are the upgradable parts on the Motherboard?

**BIOS:** For boot up.

- Check CMOS (Complementary Metal-Oxide Semiconductor) set up.
- POST (Power On Self Test).
- Initiate bootrap sequence.

**BIOS Configuration:**

- System Date/Time
- Boot Sequence
- Plug and Play Device settings
- Drive Configurations
- Security
- Power Management

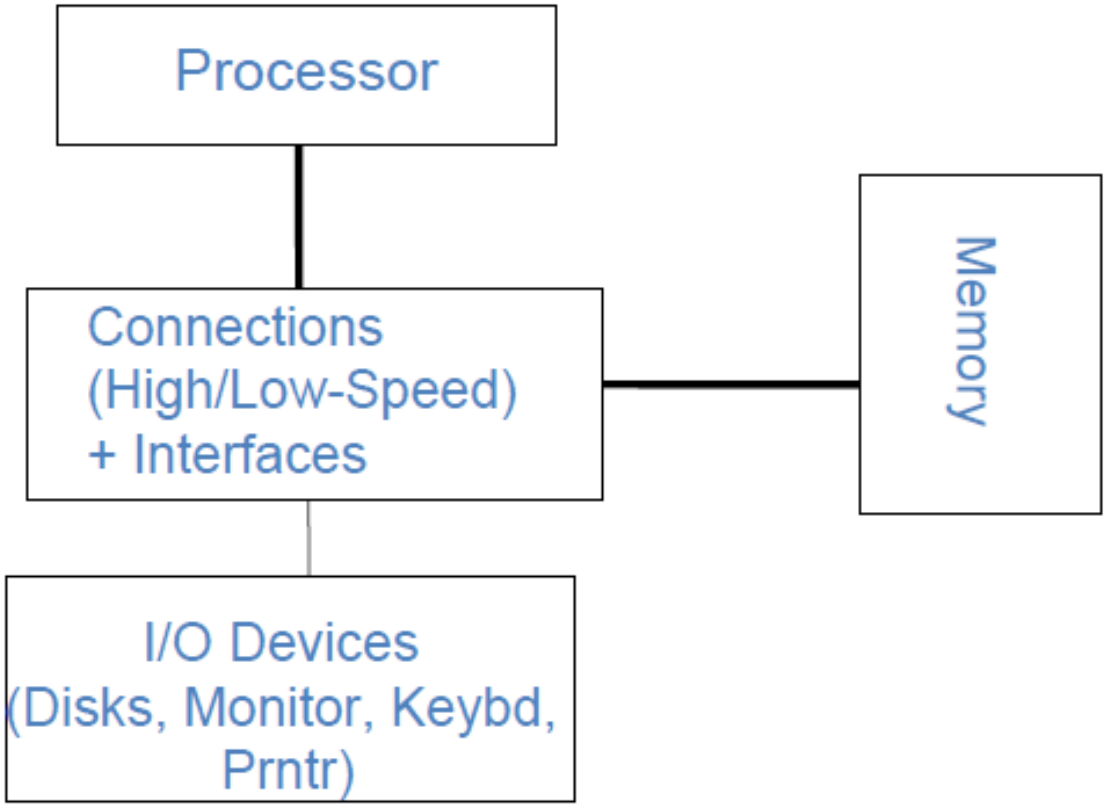
# Steps in the Boot process

1. Power on PC.
   - CPU resets itself.
   - CPU looks for ROM BIOS.
   - BIOS invokes POST to check the fitness of your computer.
2. POST goes to CMOS RAM to determine the kind of components in your PC. If a component is faulty, m/c will display error (and beep).
3. Else,
   - ROM BIOS look in Boot Sector of Hard disk to find the Boot Loader program for your OS.
   - It loads the file into Main Memory and let your OS take control.
   - Else, an error message is displayed.
4. The OS configures your system (Loads hardware drivers) to facilitate the use of peripheral devices.
5. Your PC is now ready.

# Components of a Computer

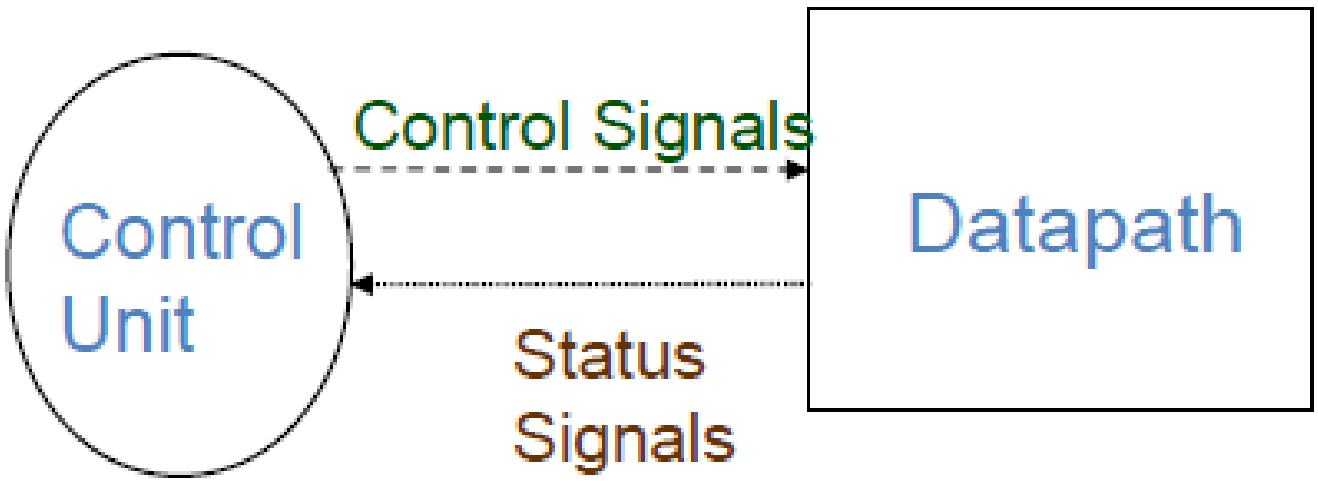
## Components of Computer

$$Computer = Processor + Memory + I/O + Interfaces$$



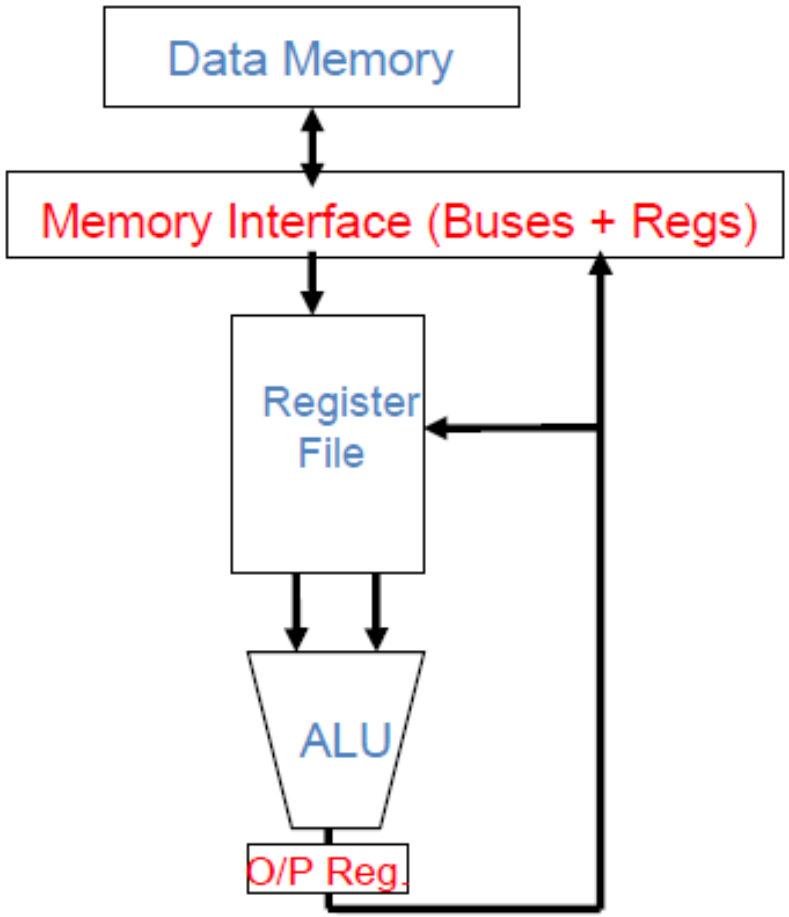
## Processor

*Processor* = *Datapath* + *Control*



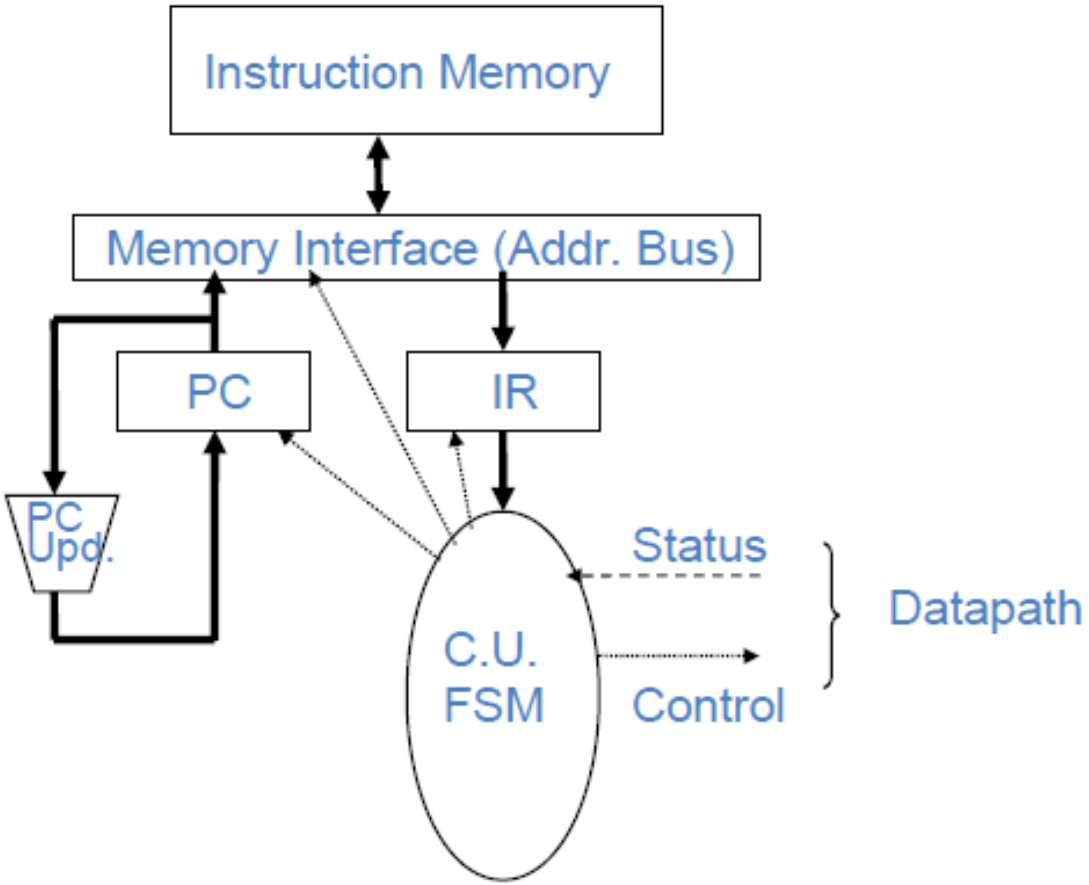
## Datapath

$$Datapath = DataMemory + RegisterFile + ALU$$



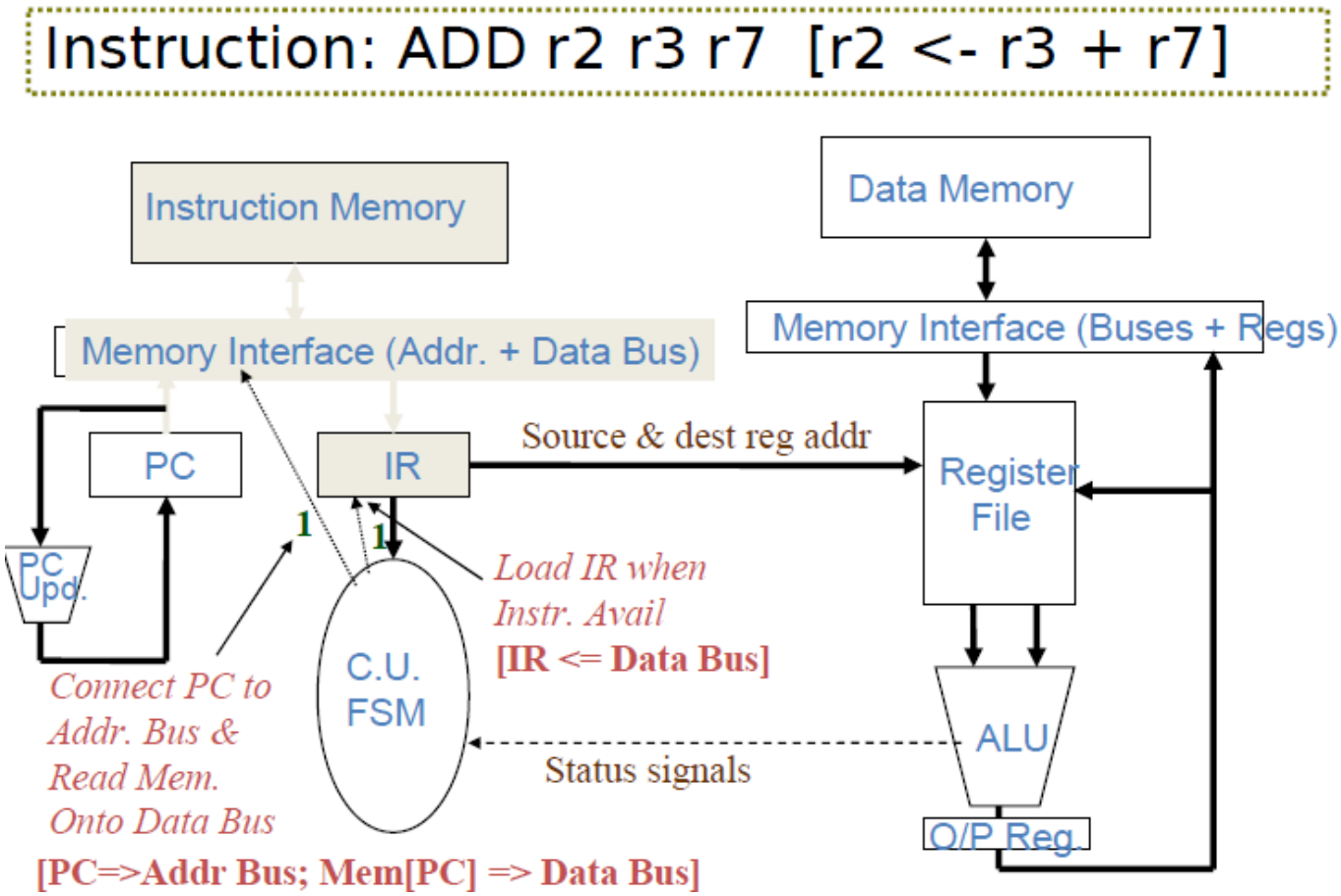
## Control

$$Control = Instr.Memory + PC + Instr.Register + ControlUnit$$



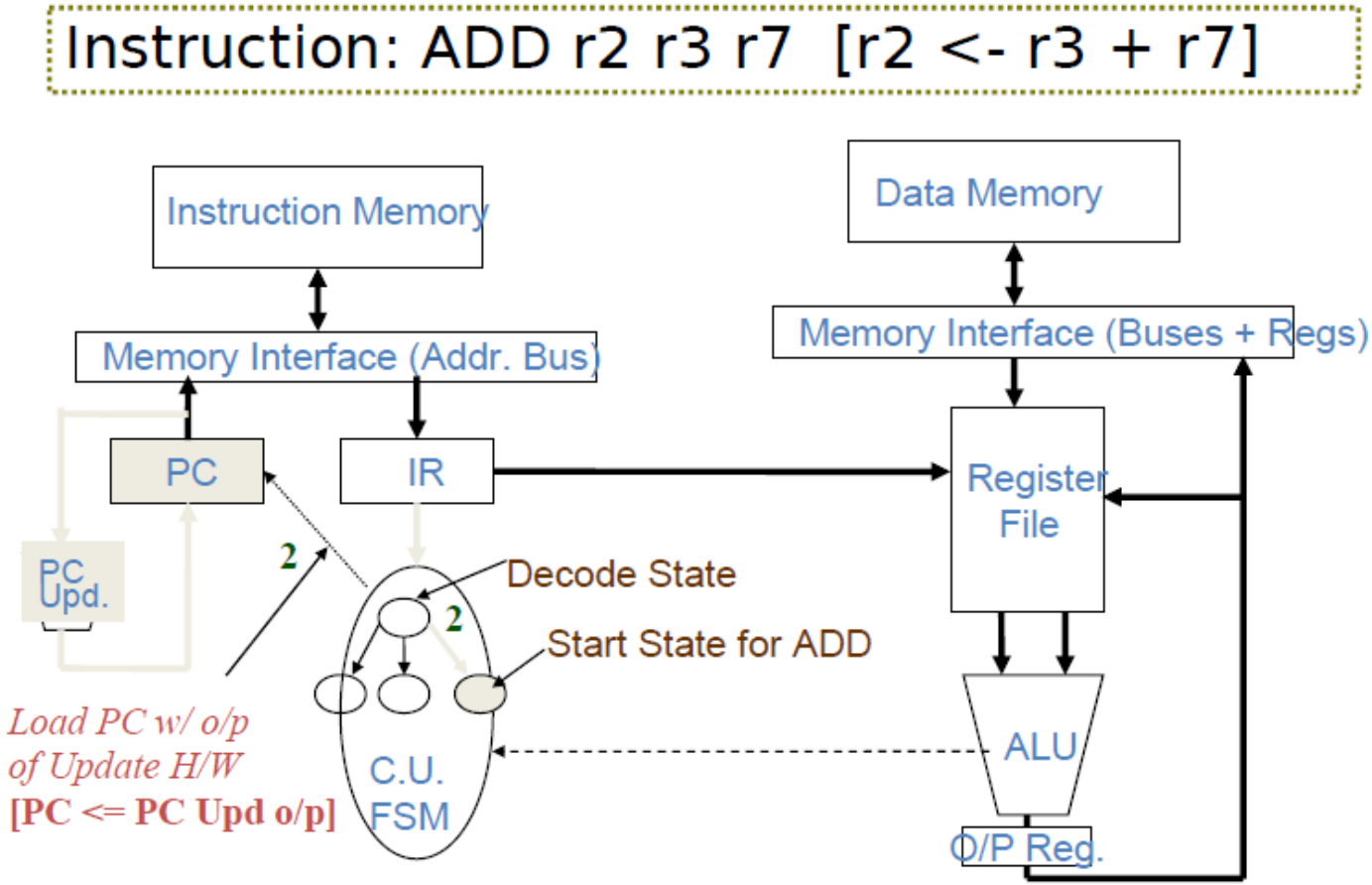
# Instruction Processing- 5 Cycles (MIPS)

## 1.Fetch:



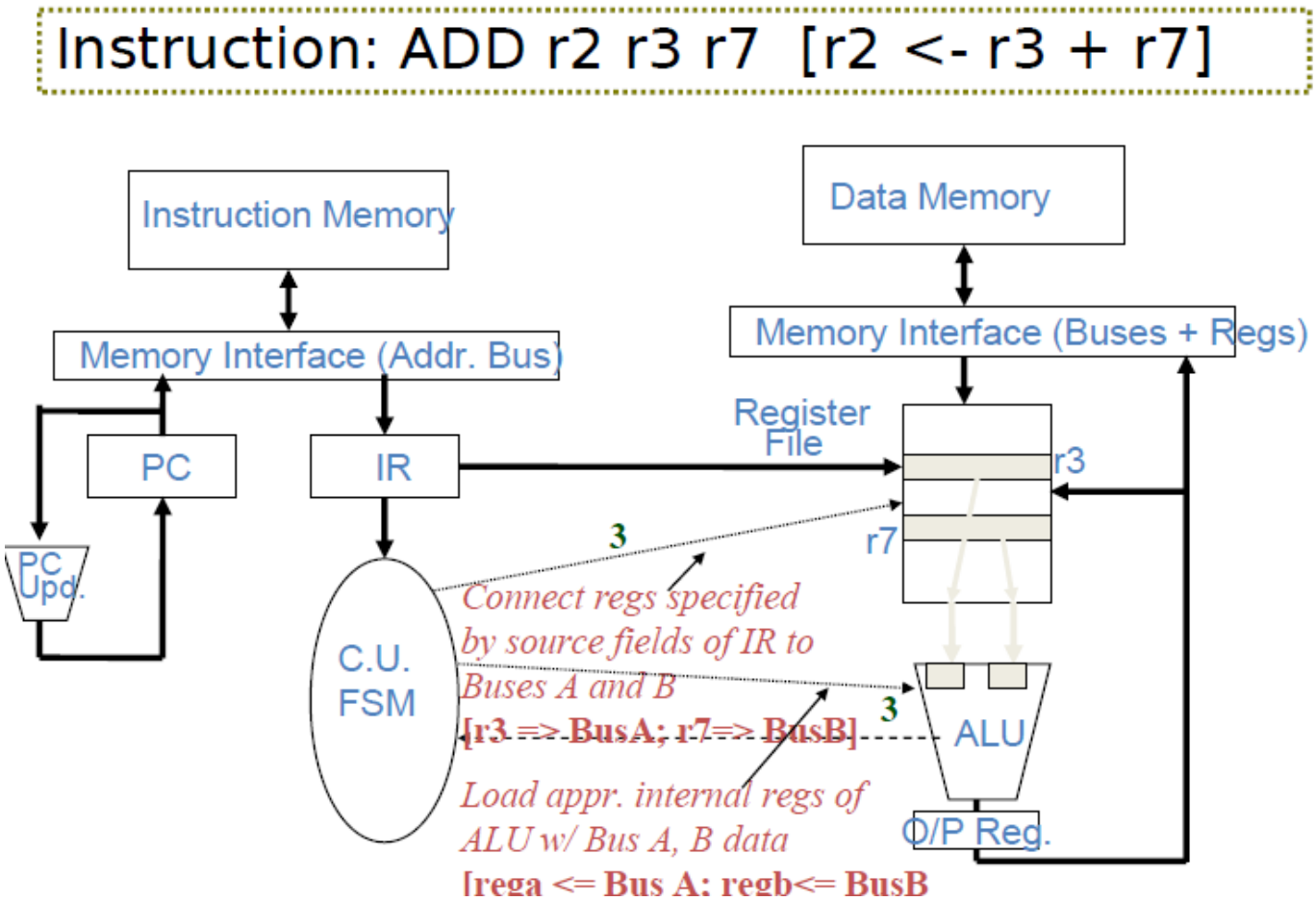
# Instruction Processing- 5 Cycles (MIPS)

## 2.Decode and Increment. PC:



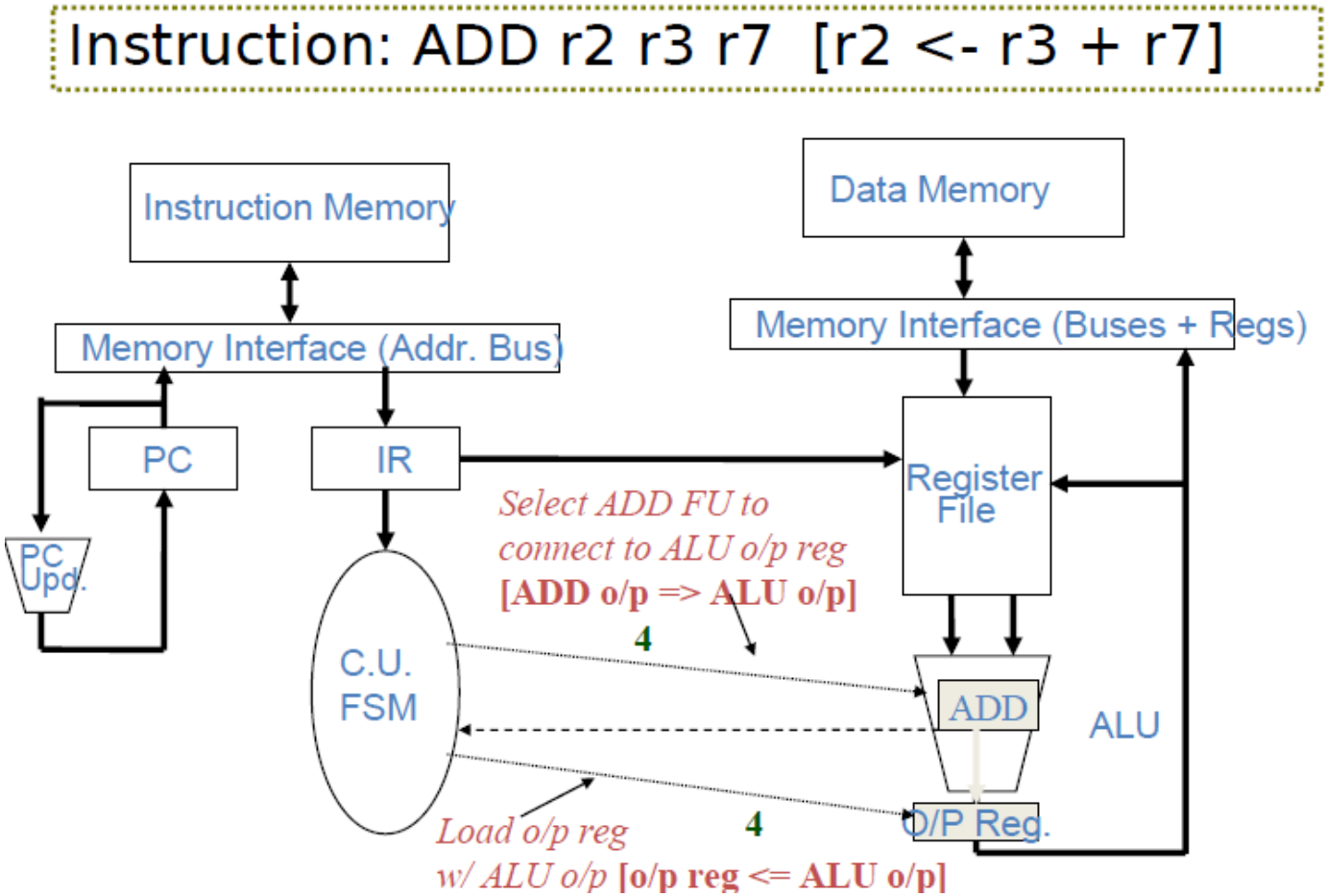
# Instruction Processing- 5 Cycles (MIPS)

## 3.Read Operands into RF:



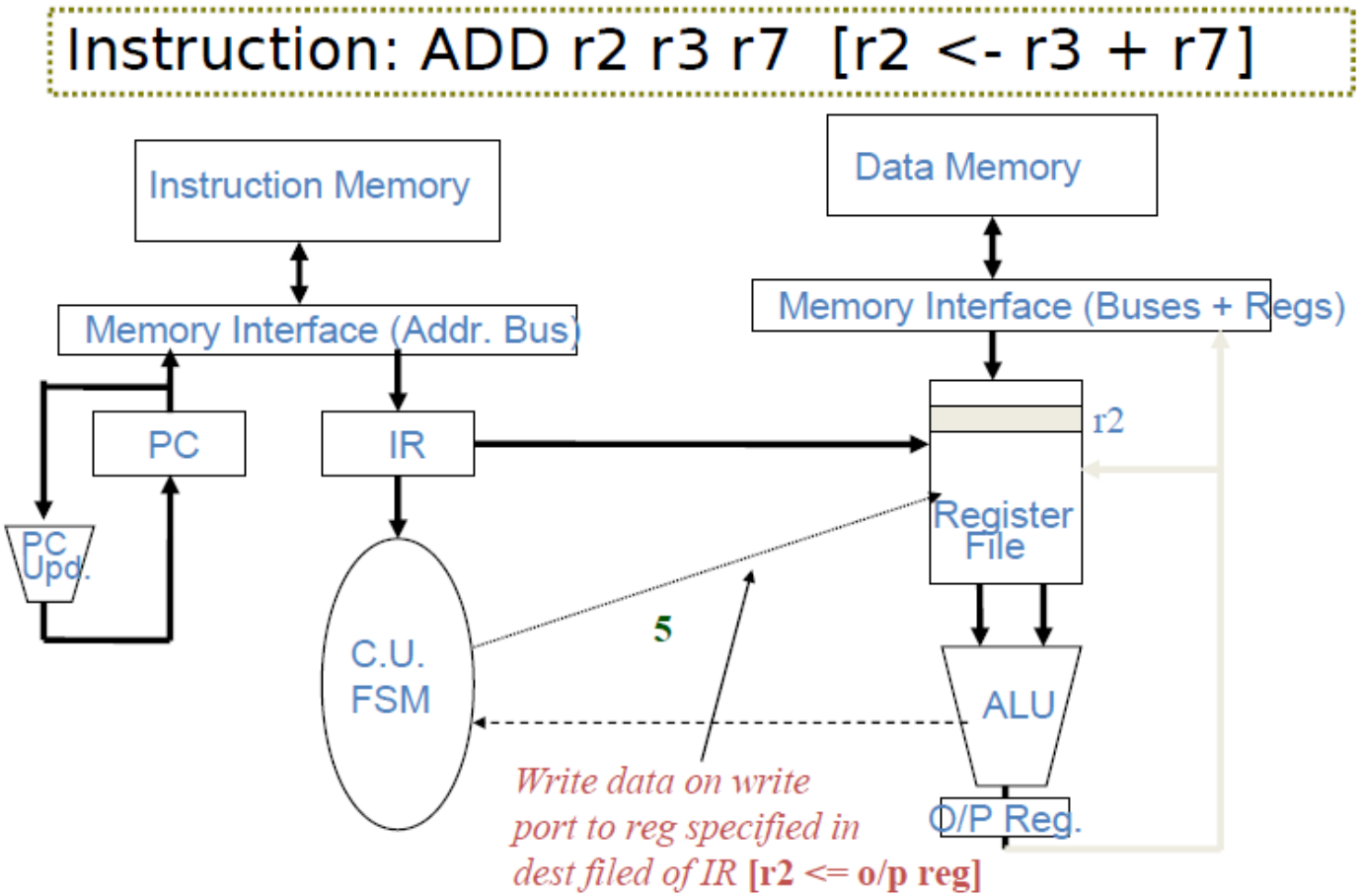
# Instruction Processing- 5 Cycles (MIPS)

## 4.Execute in ALU:

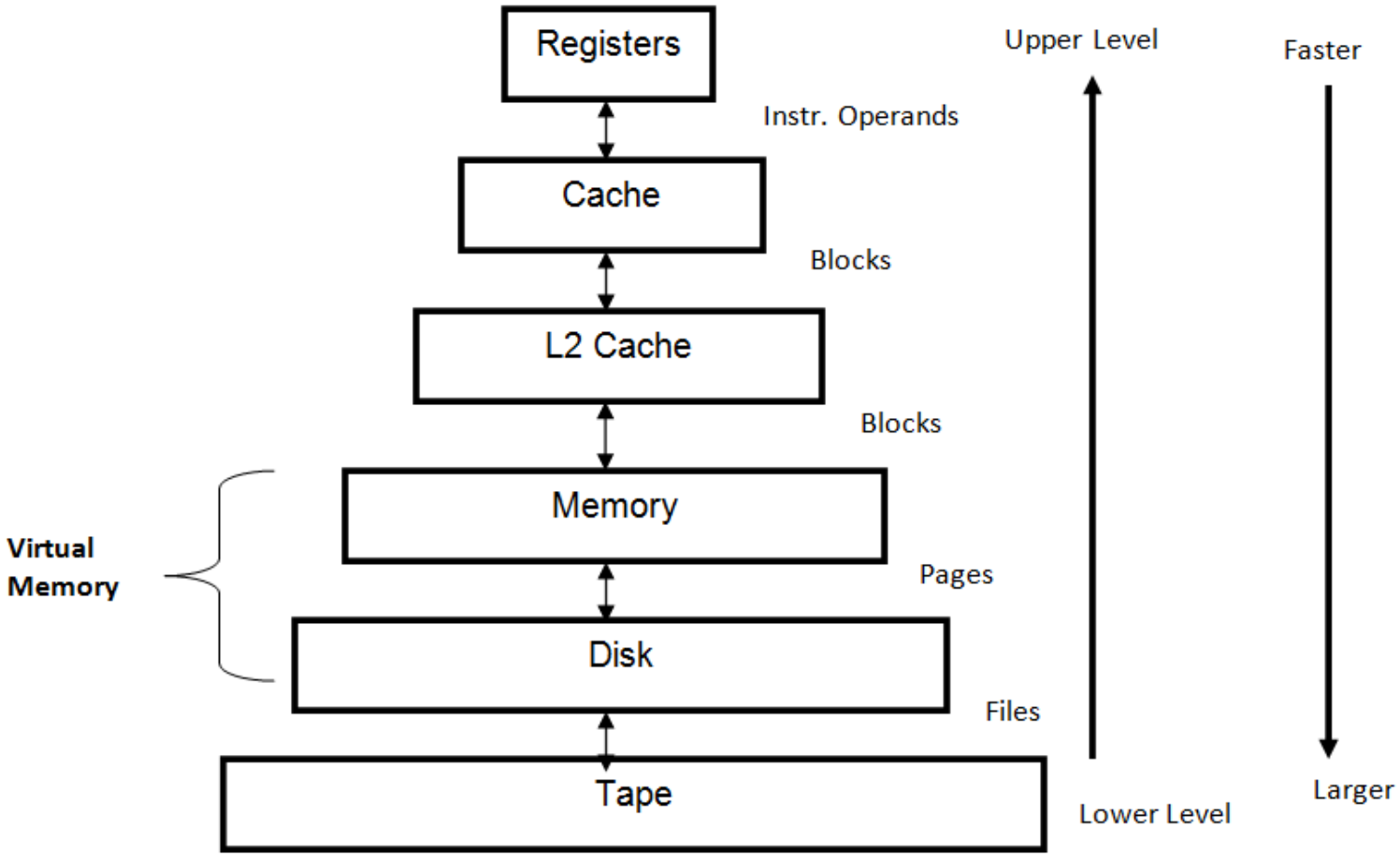


# Instruction Processing- 5 Cycles (MIPS)

## 5. Write Back:



# Memory Hierarchy



# TRY:

1. Where is the CPU located?
2. Compare the likely costs for the different memories.
3. Explain the concept of Virtual Memory?

# Operating System

An OS is a collection of system software that coordinates between the hardware, provides a platform for softwares to run on and provides the user with an interface for command inputs.eg. DOS, Linux, Unix, Windows, MAC, OS/2, Minix, and many more. The governmental systems like Postal system, Railway System are analogous to Operating Systems.

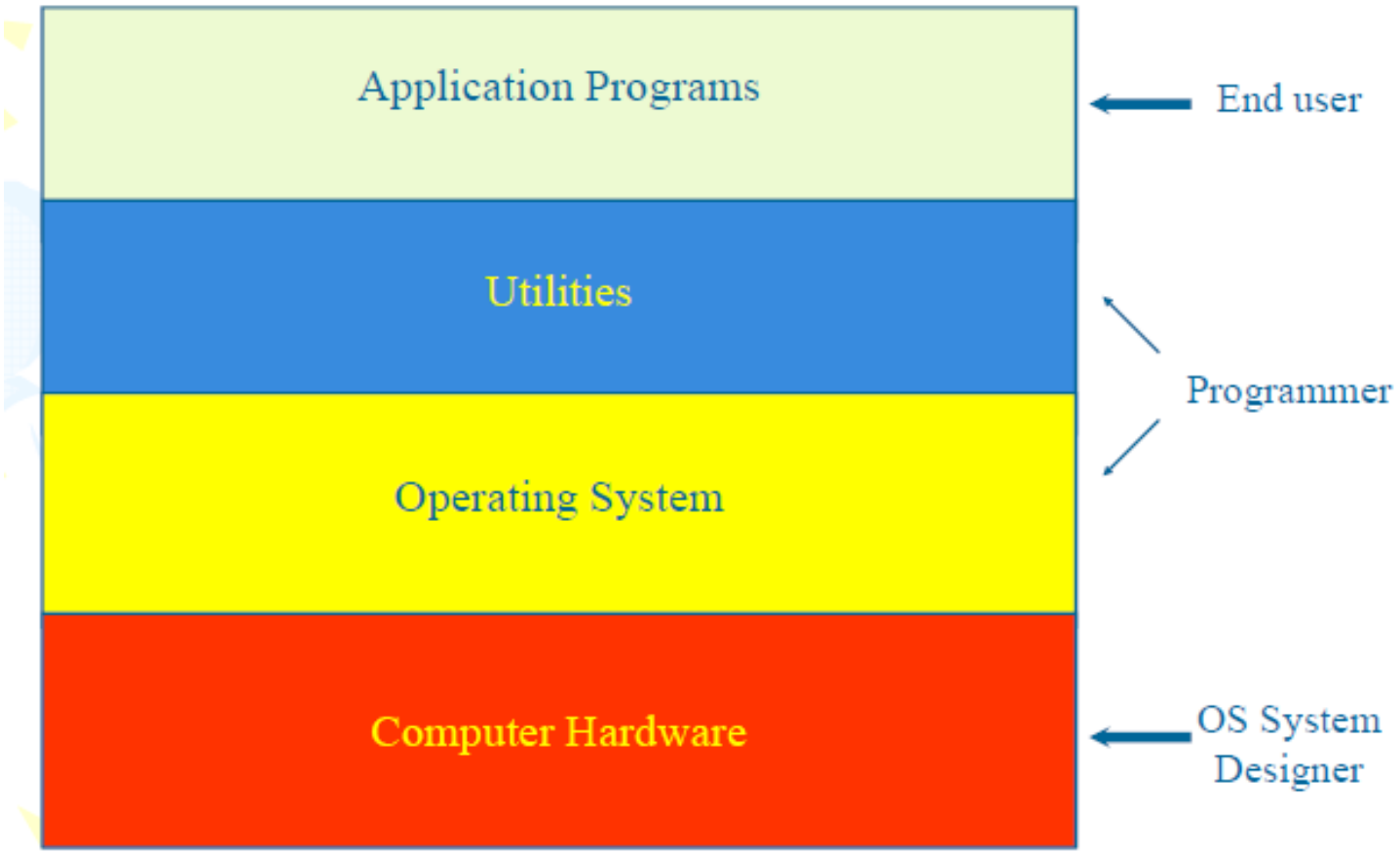
**Objectives of an OS:**

- Controls the execution of application programs.
- Convenience of Users.
- Manages the resources associated with a computer.
- Acts as an interface between applications and computer hardware.

# Basic Functions of an OS:

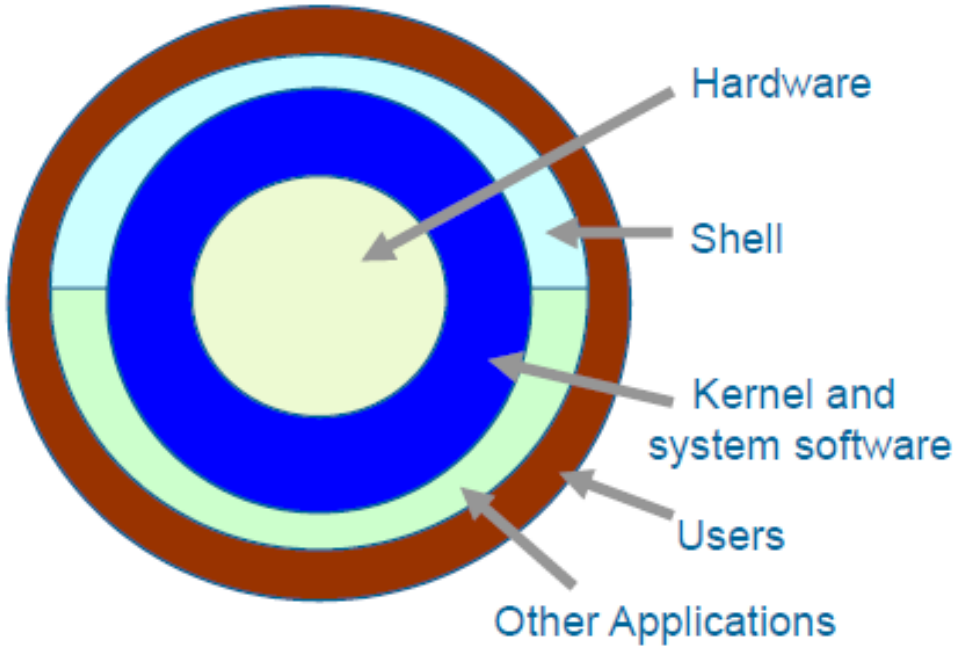
- Process Management  Managing the programs that are running.
- Memory Management  Managing and rationing the memory between processes and data.
- Storage Management  Managing the permanent Storage of data on disks or other media
- I/O Management  Managing the input and output
- Device / Resource Management  Managing devices and resources and allowing the users to share the resources
- Security and Protection Protecting the parts of the system against damage (eg. Firewall).
- Booting the System and getting it ready to work.
- Data communications  Providing interface to connect to other computers or allowing others to connect

# OS as an Interface



# Components of OS:

The architecture shown below is applicable for Unix and its family – Including Linux



1. User  The system representation of the human operator who requests for services.
2. Application Software  Special software to help the user do his task (E.g.. MS Word)
3. Shell  The program that interprets the commands or requests given by the user and gets the job done by the kernel.
4. Kernel  The core of the operating system. It uses the hardware to do the jobs required by the user or the system. It coordinates among the hardware and interfaces it with the above layers.
5. System Software  Software that can access the hardware directly and generally provides various system services. (E.g.. The kernel itself, device drivers etc.).
6. Hardware  The set of electronic devices that work together to ultimately do the job required by all the upper levels.