

**UCS1401**

**COMPUTER ORGANIZATION AND  
ARCHITECTURE**

# Objectivies

- What is CA?
- Why CA ?
- The Big Picture
- Performance

# Computer

**A *Computer* is a machine which solves problems for people written as programs.**

**It is a Electronic data processing machine which  
takes data as input  
processes it,  
performs necessary calculations ,  
stores the results  
and outputs the results as when required.**

# Program

***A Program*** is a sequence of statements/steps stating how to perform a task. For each step an arithmetic and logical operation is done. For each operation a different set of control signals is needed – i.e. an instruction.

***An instruction*** can be machine language instructions or assembly language instructions or even high level language instructions.

# Hardware

- A *hardware* is something that is tangible.
- For e.g. CPU, Memory, I/O devices, Bus etc.

# Software

- ***A software*** is a collection of programs.
- **S/W – system S/w & Appl s/w**
- **System s/w-**
  - Ser of pgm designed to control the operation and extend the capability of computer system
  - compilers, linkers, loaders, assemblers
- **Appl s/w –**
  - It is a set of pgm designed to solve a specific problem
  - Banking s/w, payroll s/w

# Firmware

- ***A firmware* is software embedded in hardware during manufacture.  
E.g. home appliances, etc**

# CO

- **It deals with how features are implemented.**
- **Hidden from Programmer**
- **Information flow between components**

**Example:**

- 1. Control signals**
  - 2. Memory technology**
  - 3. Interfaces**
- **It basically discuss how h/w components operates and how they are connected to form computer system.**



# Need for Computers

- Automatic
- Speed
- Accuracy
- Diligence
- Versatility

# What is “Computer Architecture”

Computer Architecture =

Instruction Set Architecture + Machine Organization

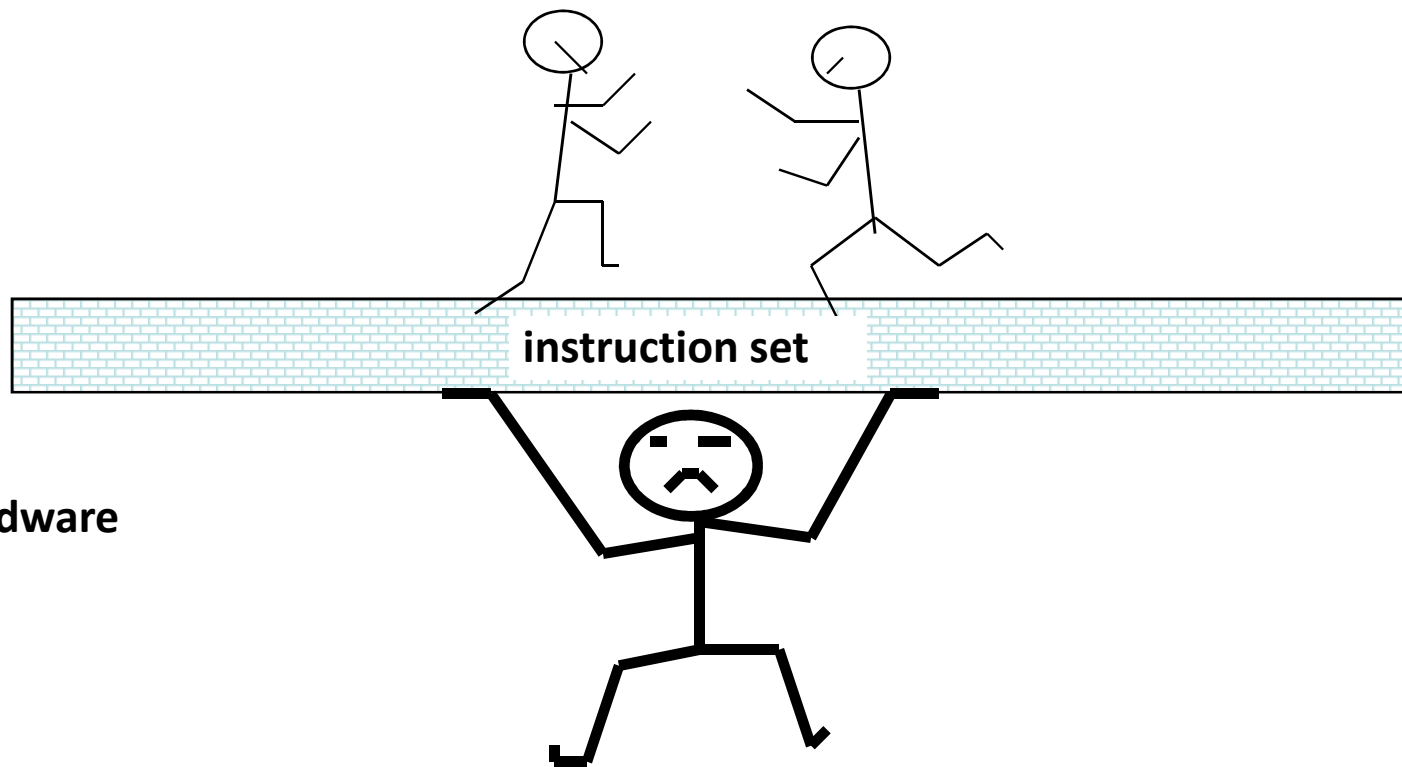
# What is Computer Architecture...

- is concerned with the structure and behavior of the computer as seen by the user/programmer. It includes attributes such as
  - Instruction Formats
  - Addressing Modes
  - Instruction Sets
  - I/O Mechanisms
  - The number of bits used
  - Techniques for Memory management

For example, It is an architectural design issue whether the computer will have multiply instruction

# The Instruction Set: a Critical Interface

software



hardware

# Instruction Set Architectures

- Digital Alpha (v1, v3) 1992-97
- HP PA-RISC (v1.1, v2.0) 1986-96
- Sun Sparc (v8, v9) 1987-95
- SGI MIPS (MIPS I, II, III, IV, V) 1986-96
- Intel(8086,80286,80386, 1978-200x  
80486,Pentium, MMX, Pentium pro, Itanium...)

# Organization

- Capabilities & Performance
  - Characteristics of Principal Functional Units
  - (e.g., Registers, ALU, Shifters, Logic Units, ...)

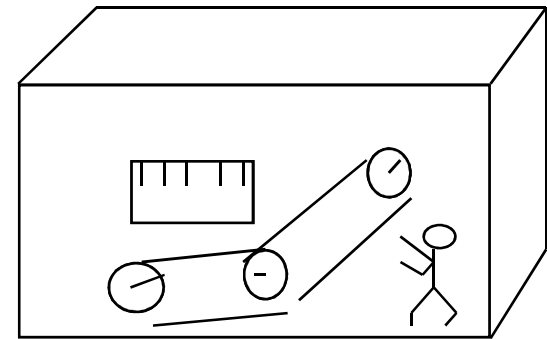
# Organization

*Logic Designer's View*

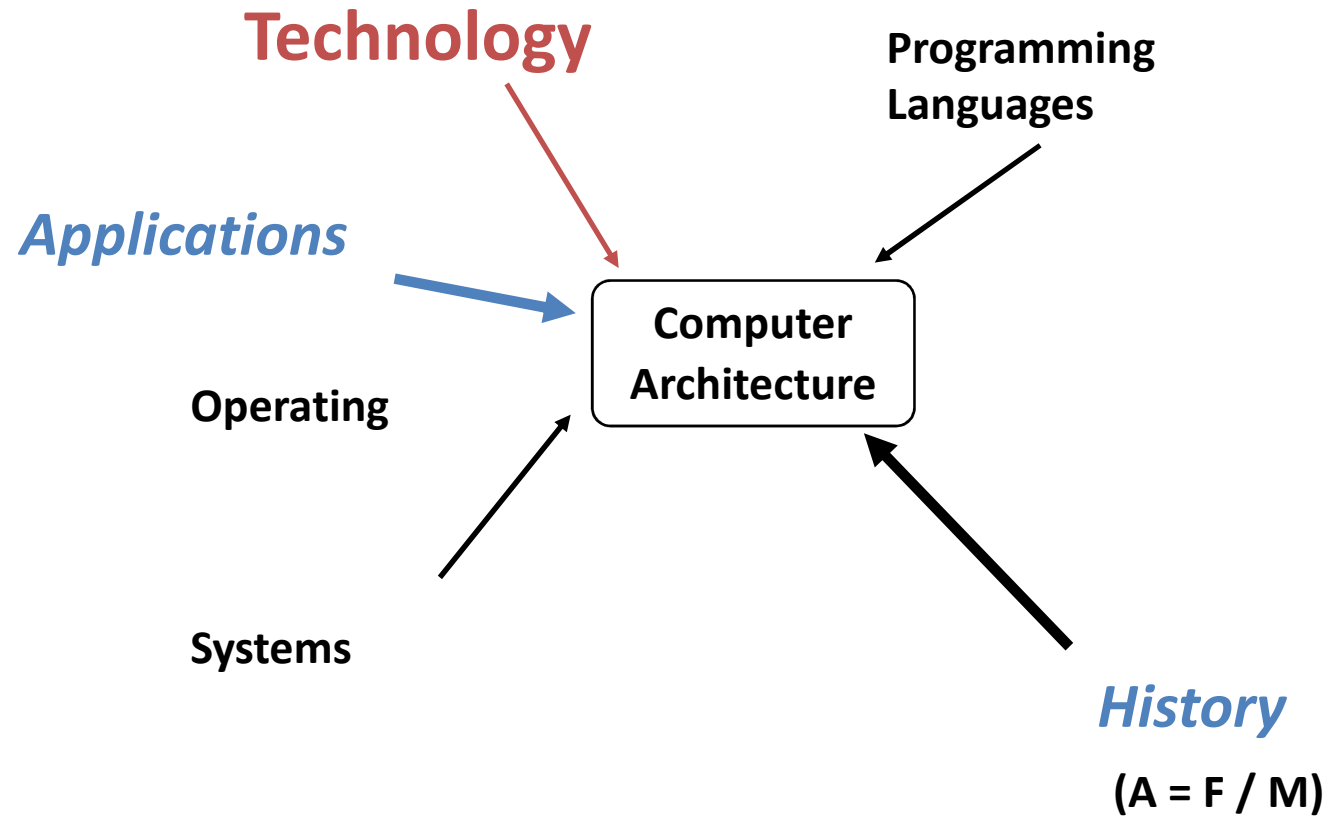
ISA Level

FUs & Interconnect

- Ways in which these components are interconnected
- Information flows between components
- Logic and means by which such information flow is controlled.
- Choreography of FUs to realize the ISA
- Register Transfer Level (RTL) Description



# Forces on Computer Architecture





# Why do Computer Architecture?

- It's exciting!
- It impacts every other aspect of electrical engineering and computer science

# What does a CA Course Contain ?

## **Computer Architecture and Engineering**



Instruction Set Design

Interfaces

Compiler/System View

-“Building Architect”

Computer Organization

Hardware Components

Logic Designer’s View

-“Construction Engineer”

# Generations of Computers

# First Generation (1945-54)

- Single CPU
- Accumulator based.
- Fixed point Execution
- All the operations.
- PC
- ALP and MLP
- Ex: ENIAC, Princeton IAS ,IBM 701

## II Generation(1955-64)

- Index Register
- Fixed point and Floating point.
- Multiplexed Memory
- Batch Processing
- Subroutine and Libraries.
- IOP
- RTL

## II Generation (Contd..)

- HLL such as FORTRAN, COBOL, ALGOL
- EX: IBM7090, UNIVAC LARC

# III Generation (1965-74)

- Pipelining
- Cache memory
- Virtual Memory
- Multiprogramming
- Time sharing
- Ex: IBM 360/370, CDC 6600/7600, TI ASC  
DE PDP8

## IV Generation (1975-90)

- Parallel Computers
- Shared Memory and Distributed Memory.
- Multiprocessing O.S (MACH)
- Ex:IBM3090,BBN TC 2000, VAX 9000

CRAY X-MP



# V-Generation

- MPP
- Scalable
- Latency Tolerant
- Terra flops
- Heterogeneous Processing.
- Ex: KABRU,FUJITSU,PARAGON