LOVELY PROFESSIONAL UNIVERSITY

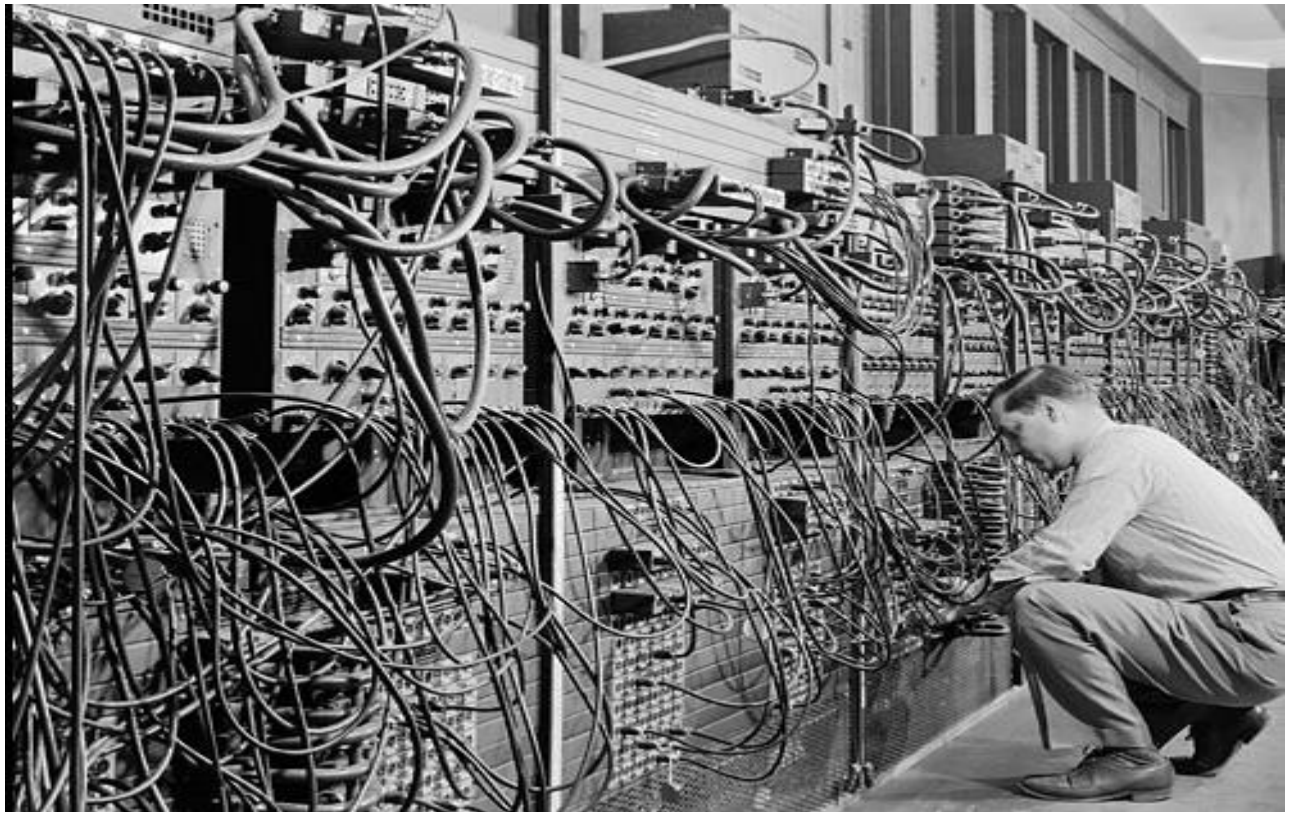
CSE211

Computer Organization and Design

Lecture : 3 Tutorial: 1 Practical: 0

Historical Perspective

❖**First generation Computers (1941-1956):**



Characteristics

- Vacuum Tubes
- Magnetic Drums
- Slow Operating Systems
- Production of the heat
- Machine language was used for programming
- First generation computers were unreliable
- They were difficult to program and use

***Von Neumann Computers**

❖Second Generation Computers (1956-1963):

Characteristics

- Use of transistors
- Reliable in comparison to first generation computers
- Smaller size as compared to first generation computers
- Generated less heat as compared to first generation computers
- Consumed less electricity as compared to first generation computers
- Faster than first generation computers
- Still very costly
- AC required
- Supported machine and assembly languages

❖Third Generation Computers (1964-1971)

Characteristics

- IC used
- More reliable
- Smaller size
- Generated less heat
- Consumed lesser electricity
- Supported high-level language

❖Fourth Generation (1971-2010)

Characteristics

- VLSI technology used
- Very cheap
- Portable and reliable
- Use of PCs
- Very small size

2010- : Fifth Generation – Artificial Intelligence

- Computer devices with artificial intelligence are still in development, but some of these technologies are beginning to emerge and be used such as voice recognition.
- AI is a reality made possible by using parallel processing and superconductors. Leaning to the future, computers will be radically transformed again by quantum computation, molecular and nano technology.
- The essence of fifth generation will be using these technologies to ultimately create machines which can process and respond to natural language, and have capability to learn and organise themselves.

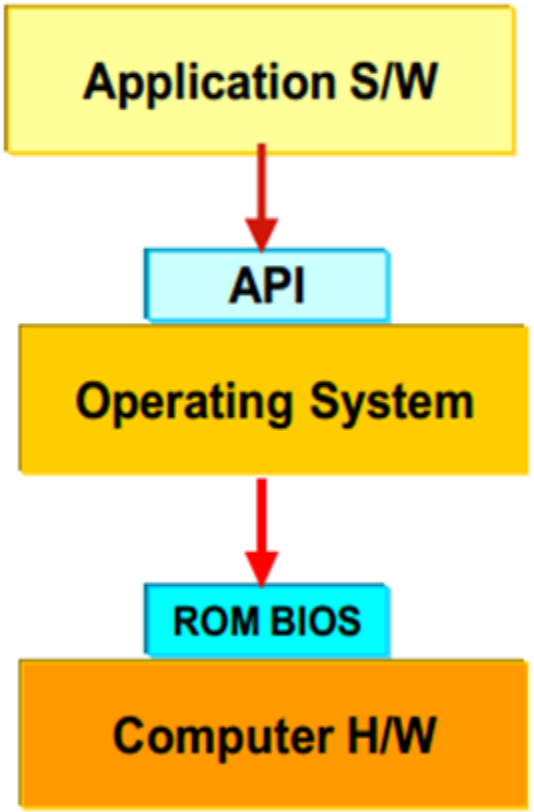
Unit 1 : Basics of Digital Electronics

- Introduction
- Logic Gates
- Flip Flops
- Decoder
- Encoder
- Multiplexers
- Demultiplexer
- Binary Counters
- Combinational Circuits
- Sequential Circuits

1-1 Digital Computers

- Digital – A limited number of discrete value
- Bit – A Binary Digit
- Program – A Sequence of instructions

- Computer = H/W + S/W
- Program(S/W)
  - A sequence of instruction
  - S/W = Program + Data
    - The data that are manipulated by the program constitute the data base
  - Application S/W
    - DB, word processor, Spread Sheet
  - System S/W
    - OS, Firmware, Compiler, Device Driver



1-1 Digital Computers

- Computer Hardware
  - CPU
  - Memory
    - Program Memory(ROM)
    - Data Memory(RAM)
  - I/O Device
    - Interface
    - Input Device: Keyboard, Mouse, Scanner
    - Output Device: Printer, Plotter, Display
    - Storage Device(I/O): FDD, HDD, MOD

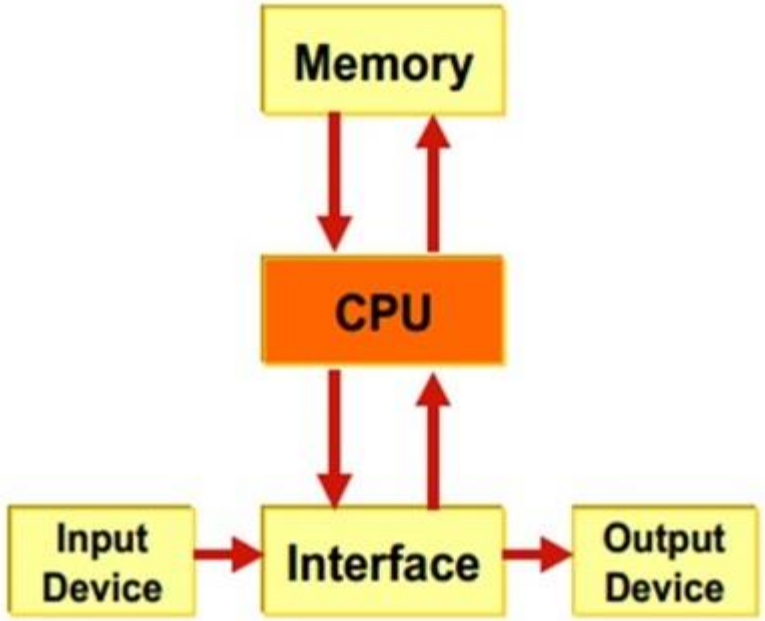


Figure ***Block Diagram of a digital Computer***

1-1 Digital Computers

- 3 different point of view(Computer Hardware)
  - Computer Organization
    - H/W components operation/connection
  - Computer Design
    - H/W Design/Implementation
  - Computer Architecture
    - Structure and behavior of the computer as seen by the user
    - Information format, Instruction set, memory addressing, CPU, I/O, Memory
- ISA(Instruction Set Architecture)
  - the attributes of a system as seen by the programmer, i.e., the conceptual structure and functional behavior, as distinct from the organization of the data flows and controls, the logic design, and the physical implementation.

    - Amdahl, Blaaw, and Brooks(1964)

Instruction Set Architecture

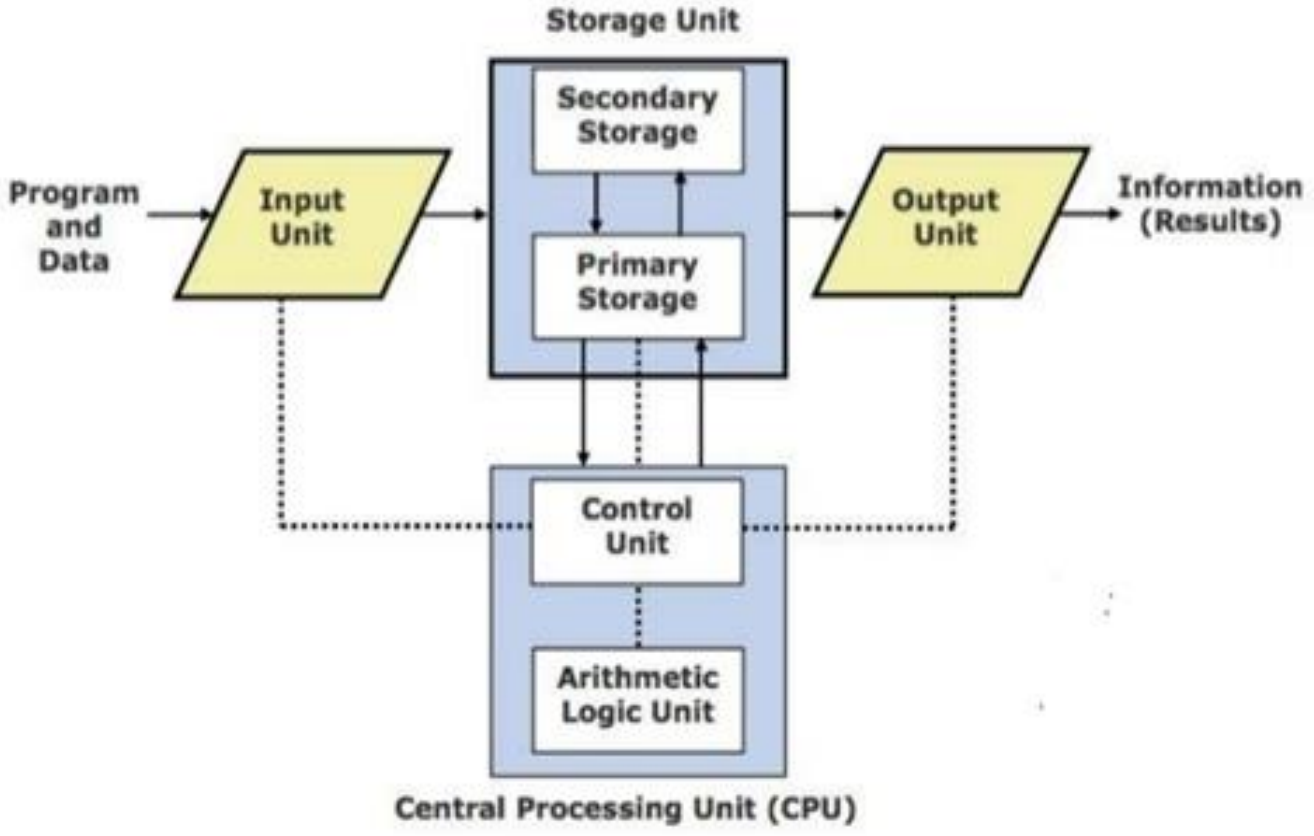
- the **instruction set architecture refers to what the programmer** sees as the machine's instruction set. The instruction set is the boundary between the hardware and the software, and most of the decisions concerning the instruction set affect the hardware, and the converse is also true, many hardware decisions may beneficially/adversely affect the instruction set.

Computer organization is concerned with the way the hardware components operate and the way they are connected together to form the computer system. The various components are assumed to be in place and the task is to investigate the organizational structure to verify that the computer parts operate as intended.

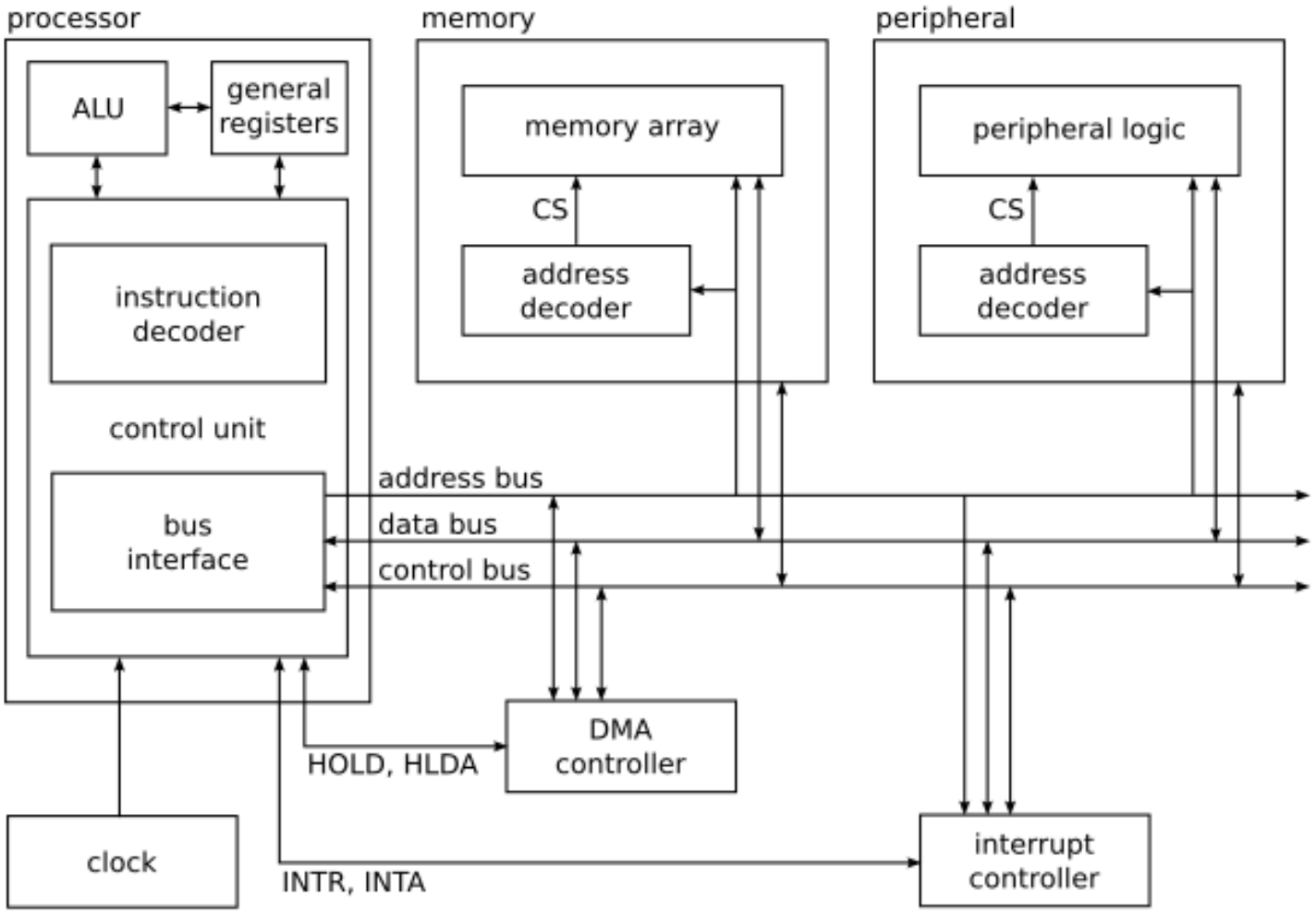
Computer design is concerned with the hardware design of the computer. Once the computer specifications are formulated, it is the task of the designer to develop hardware for the system. Computer design is concerned with the determination of what hardware should be used and how the parts should be connected. This aspect of computer hardware is sometimes referred to as *computer implementation*.

Computer architecture is concerned with the structure and behavior of the computer as seen by the user. It includes the information formats, the instruction set, and techniques for addressing memory. The architectural design of a computer system is concerned with the specifications of the various functional modules, such as processors and memories, and structuring them together into a computer system.

Computer Organization



Computer Architecture



Structure & Function

- Structure is the way in which components relate to each other
- Function is the operation of individual components as part of the structure

Types of computer

- **Mainframes: large computers that can support many users** while delivering great computing power. It is mainly in mainframes where most of the innovations (both in architecture and in organization) have been made. These are **known for their large size, amount of storage, processing power and higher reliability level**.
- **Minicomputers: have adopted many of the mainframe** techniques, yet being designed to sell for less, satisfying the computing needs for smaller groups of users. It is the minicomputer group that improved at the fastest pace (since 1965 when DEC introduced the first minicomputer, PDP-8), mainly due to the evolution of integrated circuits technology (the first IC appeared in 1958). It has **limited functionality and slower processors,** often dedicated to a single application. These are mid-sized computers. It can support 4 to about 200 users simultaneously. The use of these computers have merged with servers.

- **Supercomputers: designed for scientific applications, they are** the most expensive computers (over one million dollars), processing is usually done in batch mode, for reasons of performance.
- **Microcomputers: have appeared in the microprocessor era** (the first microprocessor, Intel 4004, was introduced in 1971). The term *micro refers only to physical dimensions, not to* computing performance. A typical microcomputer (either a PC or a workstation) nicely fits on a desk. Microcomputers are a direct product of technological advances: faster CPUs, semiconductor memories, etc. Over the time many of the concepts previously used in mainframes and minicomputers have become common place in microcomputers.

Microprocessors

The microprocessor is nothing but the CPU and it is an essential component of the computer. It is a **silicon chip that comprises millions of transistors and other electronic components that process millions of instructions per second**. A Microprocessor is a versatile chip, that is combined with memory and special-purpose chips and **pre-programmed by a software**. It accepts digital data as i/p and processes it according to the instructions stored in the memory. The microprocessor has many functions like functions of data storage, interact with various other devices and other time-related functions. But, the main function is to send and receive the data to make the function of the computer well. This article discusses the types and evolution of microprocessors.