

**Computer Architecture:** Attributes of a system visible to the programmer. Have a direct impact on the logical execution of a program.

**Computer Organization:** The operational units and their interconnections that realize the architectural specifications.

- IBM System/370 architecture

**Structure:** The way in which components relate to each other.

**Function:** The operation of individual components as part of the structure.

There are four basic functions that a computer can perform:

1. Data processing
2. Data storing
3. Data movement
4. Control

There are four main structural components of the computer:

1. CPU
2. Main Memory
3. I/O
4. System Interconnection

**CPU:** Control Unit, ALU, Registers, CPU Interconnection

Multicore Computer Structure:

1. CPU
2. Core
3. Processor

**Cache Memory:**

- Multiple layers of memory between the processor and main memory (L1, L2, L3).
- Smaller and faster than main memory.
- Used to speed up memory access.

## History of Computers:

### 1. First Generation: Vacuum Tubes

1.1. Vacuum tubes were used for digital logic elements and memory.

1.2. IAS computer.

### 2. Second Generation: Transistors

2.1. IBM 7094 (chipper, smaller, etc.)

2.2. The use of high-level programming languages.

2.3. More complex arithmetic and logic units and control units.

### 3. Integrated Circuits

3.1. Discrete component.

3.2. IBM System/360 and the DEC PDP-8.

## Microprocessors:

Intel 4004, Intel 8008, Intel 8080, Intel 8086 and so on...

Intel x86 (CISC) vs ARM (RISC)

## Embedded Systems:

- ✓ The use of electronics and software within a product.
- ✓ Today many devices that use electric power have an embedded computing system.

## The Internet of Things (IoT):

- ✓ Refers to the expanding interconnection of smart devices.
- ✓ Is primarily driven by deeply embedded devices.
- ✓ Information technology (IT), Operational technology (OT), Personal technology, Sensor/actuator technology.

### ➤ Application processors vs Dedicated processor

- ❖ Cloud Computing
- ❖ Cloud Networking
- ❖ Cloud Storage

### History Of Computer:

1. **ENIAC:** Electronic Numerical Integrator and Computer
2. **EDVAC:** Electronic Discrete Variable Computer
3. **IAS computer:** Institute for Advanced Studies
4. **UNIVAC I:** Universal Automatic Computer
5. **UNIVAC II**
6. **IBM** (punched-card)
7. **Second Generation** (Transistors)
8. **Third Generation** (Integrated Circuits)
9. **Microprocessors**
10. **Multi-core systems**
11. **x86 Architecture**

### **Amdahl's Law:**

Deals with the potential speedup of a program using multiple processors compared to a single processor. Illustrates the problems facing industry in the development of multi-core machines.

### **Computer Components:**

#### Based on three key concepts:

- Data and instructions are stored in a single read-write memory.
- The contents of this memory are addressable by location, without regard to the type of data contained there.
- Execution occurs in a sequential fashion (unless explicitly modified) from one instruction to the next.

**Basic Instruction Cycle:** Fetch – Decode – Execute

### Interconnections:

- ❖ **Bus Interconnection** -> Data bus, address bus, control bus
- ❖ **Point-to-Point Interconnect**
- ❖ **Quick Path Interconnect (QPI)**
- ❖ **Peripheral Component Interconnect (PCI)**

**Characteristics of Memory Systems:**

- Location
- Capacity
- Unit of transfer

**Method of Accessing Units of Data:**

- Sequential
- Direct
- Random
- Associative

**Mapping Functions:**

- Direct Mapping
- Associative Mapping
- Set Associative Mapping