COMPUTER ARCHITECTURE EVOLUTION

COMPUTER ARCHITECTURE

- Computer architecture refers to those attributes of a system visible to a programmer or that have direct impact on the logical execution of a program.
- Computer architecture is the study of the structure, behavior and design of a computer system.

- It deals with high level design issues.
- It deals with the functional behavior of computer.
- It determine what computer does.

Examples of architectural attributes include:

- Instruction set.
- Number of bits used to represent various data types.
- I/O mechanism and techniques for addressing memory.

EVOLUTION

Mechanical era (1623-1945):

- The idea of using machines to solve mathematical problems can be traced back to 17th century where mathematician designed and implemented calculators that were capable of addition, subtraction, multiplication & division included Wilhelm Schickhard, Blaise Pascal, Gottfried Leibnitz.
- The first multi-purpose programmable computing device was Charles Babbage's difference and analytical engine.
- First commercial use of mechanical computers was in US census Bureau by Herman Hollerith.

Two major drawbacks of mechanical computers are :

- Speed of operation limited by the inertia of moving parts.
- unreliable and expensive.

Electronic era :

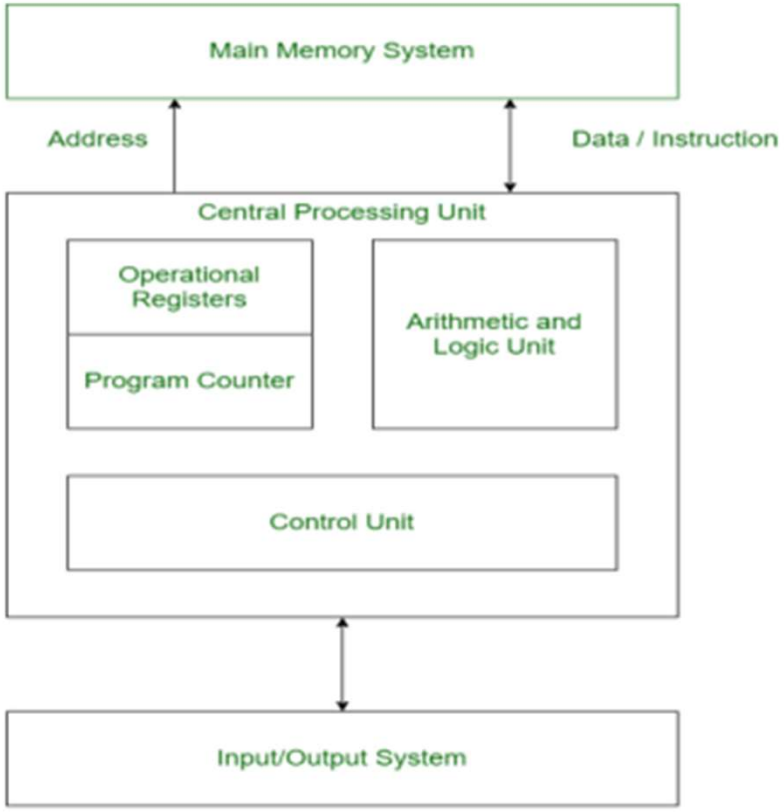
1. First Generation (1945-1956)

- Vacuum Tubes were used in these computers.
- These computers were large in size, consumed a lot of power, generated a lot of heat, and were unreliable.
- These computers were primarily used for scientific and military calculations.
- Examples of the first generation system include:

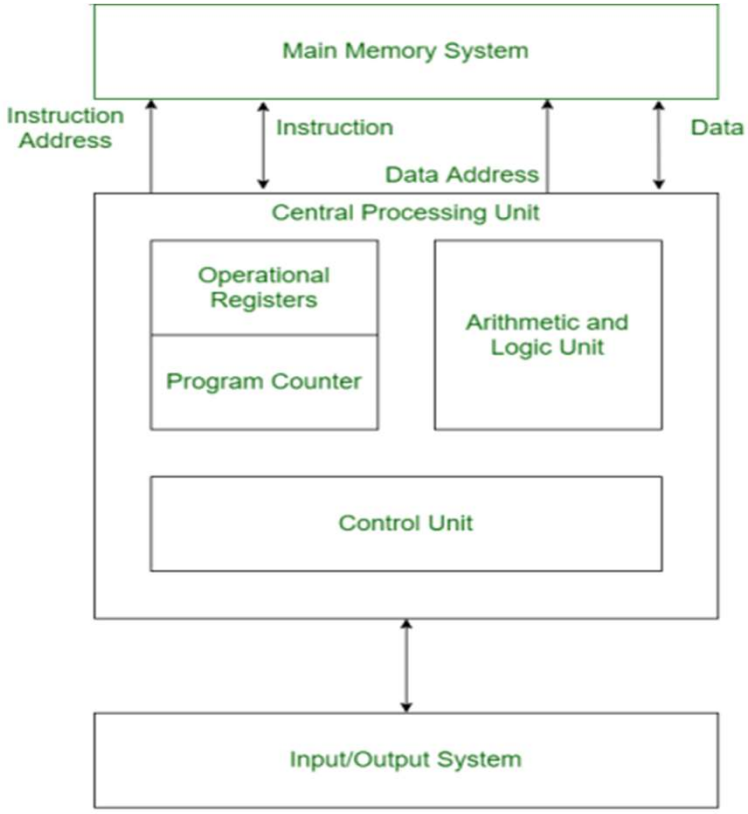
  a) The Harvard Architecture which employed a relay-based computer which stored instructions on a punched tape and the data in relay latches.

  b) The Von Neuman Architecture which use a single storage structure to hold programs and data.

  c) ENIVAC(Electronic Numerical Integrator and Calculator) was built initially to calculate the trajectories for ballistic shells during world warll periods.



Von Neumann Architecture



Harvard Architecture

2. Second generation (1956-1963)

- Transistors replaced vacuum tubes in these computers.
- These computers were smaller, faster, more reliable, and consumed less power.
- More complex arithmetic and logic unit, control units.
- These computers were used for business and scientific applications.
- Examples include IBM 1401 and IBM 1620.

3. Third generation (1964-1971)

- Integrated Circuits (ICs) replaced transistors in these computers.
- These computers were even smaller, faster, more reliable, and consumed even less power.
- These computers were used for business, scientific and engineering applications.

- Third generation computer through keyboards and monitors and interface with an operating system, which allowed the device to run many different applications at one time with central program that monitored the memory
- Examples include IBM System/360 and IBM System/3.

4. Fourth Generation (1971-present)

- Microprocessors replaced Integrated Circuits (Ics) in these computers.
- These computers were extremely small, fast, reliable, and consumed very little power.
- Used micro-processor, fourth generation of computers as thousands of integrated circuits were built on a single silicon chip.
- Intel 4004 chip developed in 1971 located all the components of the computer from CPU to memory to I/O controls on a single chip.
- Examples include IBM PC and 1984 apple macintosh.

5. Fifth Generation (Present)

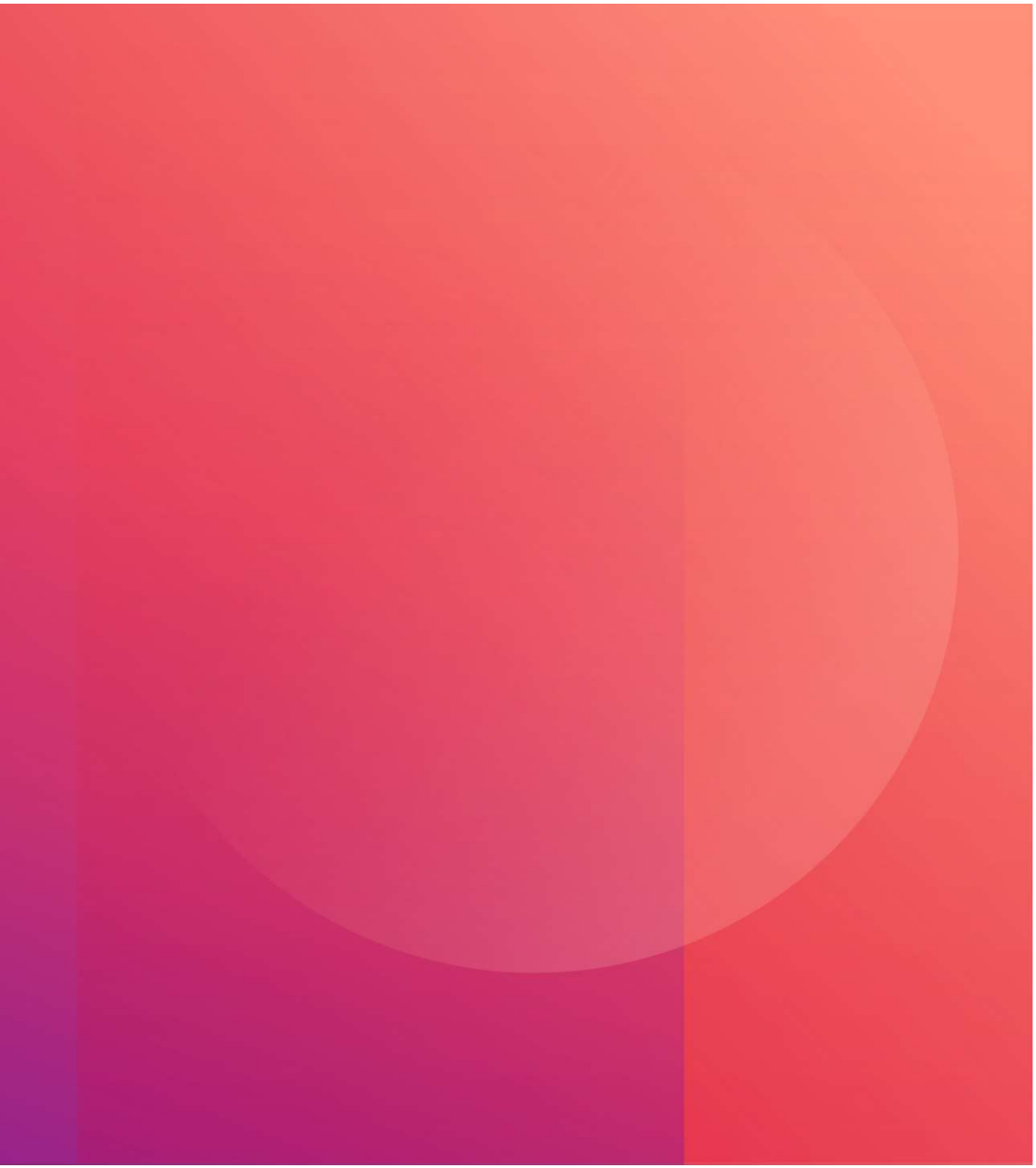
- Artificial Intelligence and parallel processing are the defining features of these computers.
- This generations have voice recognition, self-decision, nano technology, self-organization.
- These computers are expected to be even smaller, faster, more reliable, and consume even less power.
- These computers are used for advanced applications such as machine learning, computer vision, and data analysis.
- Examples include IBM Watson and Google DeepMind.

Advantages of computer architecture evolution :

- Increased processing power and speed, allowing for faster and more efficient computation.
- Increased storage capacity, allowing for larger and more complex data sets to be processed.
- Improved energy efficiency, leading to longer battery life and lower power consumption.
- Greater flexibility and adaptability, allowing for a wider range of applications and use cases.
- Improved reliability and durability, leading to fewer failures and longer lifetimes.

Disadvantages of computer architecture evolution :

- Increased complexity, making it more difficult for developers to create and optimize software.
- Higher cost, as newer and more advanced technologies tend to be more expensive.
- Increased vulnerability to security threats, as more complex systems are more difficult to secure.
- Obsolescence, as older systems may no longer be compatible with newer technologies and software.
- Limited scalability, making it harder to expand or upgrade existing systems as technology evolves.



THANK YOU