**Notes: Part 2**
**Class XI Computer Science**

## Von Neumann Concept / Architecture

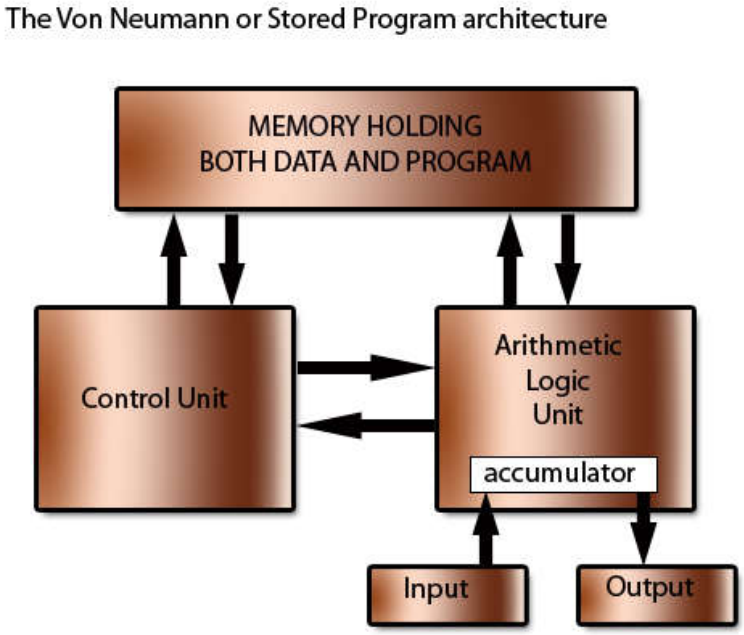
- **Stored Program Concept, Von Neumann Concept / Architecture**

  Computers that store both instructions and data on the same memory are said to be based on the **Von Neumann architecture.** Modern desktop computers are still based on the same stored program concept.

Stored-program concept, Storage of instructions in computer memory to enable it to perform a variety of tasks in sequence or intermittently. The idea was introduced in the late 1940s by John von Neumann, who proposed that a program be electronically stored in binary-number format in a memory device so that instructions could be modified by the computer as determined by intermediate computational results.

**Stored program concept**. Other engineers, notably John W. Mauchly and J. Presper Eckert, contributed to this idea, which enabled digital computers to become much more flexible and powerful. Nevertheless, engineers in England built the first stored-program computer, the Manchester Mark I, shortly before the Americans built EDVAC, both operational in 1949.

## :Features of a Von Neumann architecture



The illustration above shows the essential features of the Von Neumann or stored-program architecture.

**Memory**
The computer will have memory that can hold both data and also the program processing that data. In modern computers this memory is RAM.

**Control Unit**
The control unit will manage the process of moving data and program into and out of memory and also deal with carrying out (executing) program instructions - one at a time. This includes the idea of a 'register' to hold intermediate values. In the illustration above, the 'accumulator' is one such register.

The 'one-at-a-time' phrase means that the von neumann architecture is a **sequential processing machine**.

**Input - Output**
This architecture allows for the idea that a person needs to interact with the machine. Whatever values that are passed to and forth are stored once again in some internal registers.

**Arithmetic Logic Unit**
This part of the architecture is solely involved with carrying out calculations upon the data. All the usual Add, Multiply, Divide and Subtract calculations will be available but also data comparisons such as 'Greater Than', 'Less Than', 'Equal To' will be available.

**Bus**
Notice the arrows between components? This implies that information should flow between various parts of the computer. In a modern computer built to the Von Neumann architecture, information passes back and forth along a 'bus'. There are buses to identify locations in memory - an 'address bus'

And there are buses to allow the flow of data and program instructions - a 'data bus'.

## Conclusion

The Von Neumann architecture has been incredibly successful, with most modern computers following the idea. You will find the CPU chip of a personal computer holding a control unit and the arithmetic logic unit (along with some local memory) and the main memory is in the form of RAM sticks located on the motherboard.

# Computer Hardware Generations

### First Generation of Computers (1942-1955)

The beginning of commercial computer age is from **UNIVAC (Universal Automatic Computer)**. It was developed by two scientists **Mauchly** and **Echert** at the Census Department of United States in 1947. ***The first generation computers were used during***

***1942-1955***. They were based on vacuum tubes. Examples of first generation computers are **ENIVAC** and **UNIVAC-1**.

Advantages

- Vacuum tubes were the only electronic component available during those days.
- Vacuum tube technology made possible to make electronic digital computers.
- These computers could calculate data in millisecond.

Disadvantages

- The computers were very large in size.
- They consumed a large amount of energy.
- They heated very soon due to thousands of vacuum tubes.
- They were not very reliable.
- Air conditioning was required.
- Constant maintenance was required.
- Non-portable.
- Costly commercial production.
- Limited commercial use.
- Very slow speed.
- Limited programming capabilities.
- Used machine language only.
- Used magnetic drums which provide very less data storage.
- Used punch cards for input.
- Not versatile and very faulty.

Second Generation Computers (1955-1964)

The **second generation computers** used transistors. The scientists at Bell laboratories developed transistor in 1947. These scientists include John Barden, William Brattain and William Shockley. The size of the computers was decreased by replacing vacuum tubes with transistors. The examples of second generation computers are **IBM 7094 series**, **IBM 1400 series** and **CDC 164** etc.

Advantages

- Smaller in size as compared to the first generation computers.
- The 2nd generation Computers were more reliable
- Used less energy and were not heated.

- Wider commercial use
- Better portability as compared to the first generation computers.
- Better speed and could calculate data in microseconds
- Used faster peripherals like tape drives, magnetic disks, printer etc.
- Used Assembly language instead of Machine language.
- Accuracy improved.

Disadvantages

- Cooling system was required
- Constant maintenance was required
- Commercial production was difficult
- Only used for specific purposes
- Costly and not versatile
- Puch cards were used for input.

Third Generation Computers (1964-1975)

The **Third generation computers** used the integrated circuits (IC). Jack Kilby developed theconcept of integrated circuit in 1958. It was an important invention in the computer field. The first IC was invented and used in 1961. The size of an IC is about ¼ square inch. A single IC chip may contain thousands of transistors. The computer became smaller in size, faster, more reliable and less expensive. The examples of third generation computers are **IBM 370**, **IBM System/360**,**UNIVAC 1108** and **UNIVAC AC 9000** etc.

Advantages

- Smaller in size as compared to previous generations.
- More reliable.
- Used less energy
- Produced less heat as compared to the previous two generations of computers.
- Better speed and could calculate data in nanoseconds.
- Used fan for heat discharge to prevent damage.
- Maintenance cost was low because hardware failure is reare.
- Totally general purpose
- Could be used for high-level languages.
- Good storage
- Versatile to an extent
- Less expensive

- Better accuracy
- Commercial production increased.
- Used mouse and keyboard for input.

Disadvantages

- Air conditioning was required.
- Highly sophisticated technology required for the manufacturing of IC chips.

Fourth Generation Computers (1975-Present)

The fourth generation computers started with the invention of Microprocessor. The Microprocessor contains thousands of ICs. **Ted Hoff** produced the first microprocessor in 1971 for **Intel.** It was known as Intel 4004. The technology of integrated circuits improved rapidly. The LSI (Large Scale Integration) circuit and VLSI (Very Large Scale Integration) circuit was designed. It greatly reduced the size of computer. The size of modern Microprocessors is usually one square inch. It can contain millions of electronic circuits. The examples of fourth generation computers are **Apple Macintosh & IBM PC.**

**Advantages**

- More powerful and reliable than previous generations.
- Small in size
- Fast processing power with less power consumption
- Fan for heat discharging and thus to keep cold.
- No air conditioning required.
- Totally general purpose
- Commercial production
- Less need of repair.
- Cheapest among all generations
- All types of High level languages can be used in this type of computers

**Disadvantages**

- The latest technology is required for manufacturing of Microprocessors.

**Fifth Generation Computers (Present & Beyond)**

Scientists are working hard on the **5th generation computers** with quite a few breakthroughs. It is based on the technique of **Artificial Intelligence (AI).** Computers can understand spoken words & imitate human reasoning. Can respond to its surroundings using different types of sensors. Scientists are constantly working to increase the processing power of computers. They are trying to create a computer with real IQ with the

help of advanced programming and technologies. **IBM Watson** computers one example that outsmarts Harvard University students**.** The advancement in modern technologies will revolutionize the computer in future.