Department of biology

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COMPUTER SCIENCE
1 stage

chapter_4

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THE VON NEUMANN ARCHITECTURE

The task of entering and altering programs for the ENIAC was extremely tedious. The programming process can be easy if the program could be represented in a form suitable for storing in memory alongside the data. Then, a computer could get its instructions by reading them from memory, and a program could be set or altered by setting the values of a portion of memory. This idea is known a the stored-program concept. The first publication of the idea

was in a 1945 proposal by von Neumann for a new computer, the EDVAC (Electronic Discrete Variable Computer)

In 1946, von Neumann and his colleagues began the design of a new stored-program computer, referred to as the IAS computer, at the Princeton Institute for Advanced Studies. The IAS computer, although not completed until 1952, is the prototype of all subsequent general-purpose computers.
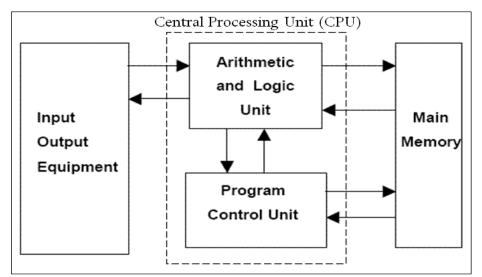

Figure : General structure of Von Neumann Architecture

It consists of

- ❖ A main memory, which stores both data and instruction
- ❖ An arithmetic and logic unit (ALU) capable of operating on binary data
- ❖ A control unit, which interprets the instructions in memory and causes them to be executed
- ❖ Input and output (I/O) equipment operated by the control unit

BUS STRUCTURES:

Bus structure and multiple bus structures are types of bus or computing. A bus is basically a subsystem which transfers data between the components of Computer components either within a computer or between two computers. It connects peripheral devices at the same time.

- A multiple Bus Structure has multiple inter connected service integration buses and for each bus the other buses are its foreign buses. A Single bus structure is very simple and consists of a single server.

- A bus cannot span multiple cells. And each cell can have more than one buses. - Published messages are printed on it. There is no messaging engine on Single bus structure

I) In single bus structure all units are connected in the same bus than connecting different buses as multiple bus structure.

II) Multiple bus structure's performance is better than single bus structure. Iii)single bus structure's cost is cheap than multiple bus structure.

Group of lines that serve as connecting path for several devices is called a bus (one bit per line).

Individual parts must communicate over a communication line or path for exchanging data, address and control information as shown in the

diagram below. Printer example – processor to printer. A common approach is to use the concept of buffer registers to hold the content during the transfer.
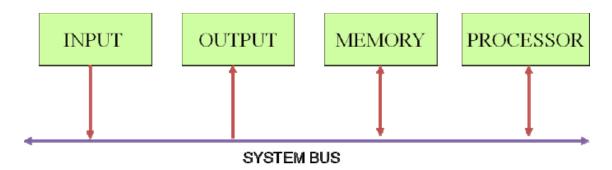

Figure 5: Single bus structure

Buffer registers hold the data during the data transfer temporarily. Ex: printing

Types of Buses:

1. Data Bus:

Data bus is the most common type of bus. It is used to transfer data between different components of computer. The number of lines in data bus affects the speed of data transfer between different components. The data bus consists of 8, 16, 32, or 64 lines. A 64-line data bus can transfer 64 bits of data at one time.

The data bus lines are bi-directional. It means that :

CPU can read data from memory using these lines CPU can write data to memory locations using these lines

2. Address Bus:

Many components are connected to one another through buses. Each component is assigned a unique ID. This ID is called the address of that component. It a component wants to communicate with another component, it uses address bus to specify the address of that component. The address bus is a unidirectional bus. It can carry information only in one direction. It carries address of memory location from microprocessor to the main memory.

3. Control Bus:

Control bus is used to transmit different commands or control signals from one component to another component. Suppose CPU wants to read data from main memory. It will use control is also used to transmit control signals like ASKS (Acknowledgement signals). A control signal contains the following:

1 Timing information: It specifies the time for which a device can use data and address bus.

2 Command Signal: It specifies the type of operation to be performed. Suppose that CPU gives a command to the main memory to write data. The memory sends acknowledgement signal to CPU after writing the data successfully. CPU receives the signal and then moves to perform some other action.

SOFTWARE

If a user wants to enter and run an application program, he/she needs a System Software. System Software is a collection of programs that are executed as needed to perform functions such as:

- Receiving and interpreting user commands

- Entering and editing application programs and storing then as files in secondary storage devices

- Running standard application programs such as word processors, spread sheets, games etc…

Operating system - is key system software component which helps the user to exploit the below underlying hardware with the programs.

Types of software

A layer structure showing where Operating System is located on generally used software systems on desktops

System software

System software helps run the computer hardware and computer system. It includes a combination of the following:

- device drivers
- operating systems
- servers
- utilities
- windowing systems
- compilers
- debuggers
- interpreters
- linkers

The purpose of systems software is to unburden the applications programmer from the often complex details of the particular computer being used, including such accessories as communications devices, printers, device readers, displays and keyboards, and also to partition the computer's resources such as memory and processor time in a safe and stable manner. Examples are- Windows XP, Linux and Mac.