Rai Technology University

ENGINEERING MINDS

Advanced Computer Architecture

Subject: ADVANCED COMPUTER ARCHITECTURE **Credits: 4**

SYLLABUS

Computer System

Generation of computers, Classification of computers, Organization, Structure and function, Von Neumann architecture. System bus, Bus Structure, Elements of Bus design (Type, Arbitration, Timing, Width, Data transfer Type), Interrupts, Instruction Cycle state Diagram with interrupts/Without interrupts, Characteristic of Internal memory (ROM, PROM, EPROM, Flash memory), Input / Output: (External / Peripheral Device, Function of I/O module, Programmer I/O, Interrupt Driver I/O DMA)

The Central Processing Unit

ALU, Binary Arithmetic, Floating point Arithmetic, Basic combinational and sequential Circuit Design, RTL representation,

Suggested Reading:

- John L. Hennessy and David A. Patterson. *Computer Architecture: A Quantitative Approach* (Third Edition ed.). Morgan Kaufmann Publishers.
- Laplante, Phillip A. (2001). *Dictionary of Computer Science, Engineering, and Technology*.

Lecture 1

INTRODUCTION TO COMPUTERS

Objectives of the lecture:

1. To understand the basics of the computer.

Hello! Students, In today's information age, computers are being used in every occupation. They are used by people of all age and profession, in their work as well as their leisure. This new social age have changed the basic concept of 'Computing'. Computing, in today's information age, is no more limited to computer programmers and computer engineers. Rather than knowing how to program a computer, most computer users simply need to understand how a computer functions so in this lecture I will be discussing with you about this versatile tool, why is it so powerful and useful, its history and you will also be briefed about the classification of computers its devices in my today's lecture.

What is A Computer?

A computer is an electronic machine that accepts information, stores it until the information is needed, processes the information according to the instructions provided by the user, and finally returns the results to the user. The computer can store and manipulate large quantities of data at very high speed, but a computer cannot think. A computer makes decisions based on simple comparisons such as one number being larger than another. Although the computer can help solve a tremendous variety of problems, it is simply a machine. It cannot solve problems on its own.

History of Computers

Since civilizations began, many of the advances made by science and technology have depended upon the ability to process large amounts of data and perform complex mathematical calculations. For thousands of years, mathematicians, scientists and businessmen have searched for computing machines that could perform calculations and analyze data quickly and efficiently. One such device was the abacus.

The abacus was an important counting machine in ancient Babylon, China, and throughout Europe where it was used until the late middle ages. It was followed by a series of improvements in mechanical counting machines that led up to the development of accurate mechanical adding machines in the 1930's. These machines used a complicated assortment of gears and levers to perform the calculations but they were far to slow to be of much use to scientists. Also, a machine capable of making simple decisions such as which number is larger was needed. **A machine capable of making decisions is called a computer.**

The first computer like machine was the **Mark I** developed by a team from IBM and Harvard University. It **used mechanical telephone relays** to store information and it processed data entered on punch cards. This machine was not a true computer since it could not make decisions.

In June 1943, work began on the world's first electronic computer. It was built at the University of Pennsylvania as a secret military project during World War II and was to be used to calculate the trajectory of artillery shells. It covered 1500 square feet and weighed 30 tons. The project was not completed until 1946 but the effort was not wasted. In one of its first demonstrations, the computer solved a problem in 20 seconds that took a team of mathematicians three days. This machine was a vast improvement over the mechanical calculating machines of the past because it used vacuum tubes instead of relay switches. It contained over 17,000 of these tubes, which were the same type tubes used in radios at that time.

The invention of the **transistor made smaller** and less expensive computers possible. Although computers shrank in size, they were still huge by today's standards. Another innovation to computers in the 60's was storing data on tape instead of punched cards. This gave computers the ability to store and retrieve data quickly and reliably.

Classification of Computers

- Mainframe Computers
- Minicomputers
- Microcomputers
- Supercomputers

Mainframe computers are very large, often filling an entire room. They can store enormous of information, can perform many tasks at the same time, can communicate with many users at the same time, and are very expensive. . The price of a mainframe computer frequently runs into the millions of dollars. Mainframe computers usually have many terminals connected to them. These terminals look like small computers but they are only devices used to send and receive information from the actual computer using wires. Terminals can be located in the same room with the mainframe computer, but they can also be in different rooms, buildings, or cities. Large businesses, government agencies, and universities usually use this type of computer.

Minicomputers : are much smaller than mainframe computers and they are also much less expensive. The cost of these computers can vary from a few thousand dollars to several hundred thousand dollars. They possess most of the features found on mainframe computers, but on a more limited scale. They can still have many terminals, but not as many as the mainframes. They can store a tremendous amount of information, but again usually not as much as the mainframe. Medium and small businesses typically use these computers.

Microcomputers : These computers are usually divided into desktop models and laptop models. They are terribly limited in what they can do when compared to the larger models discussed

above because they can only be used by one person at a time, they are much slower than the larger computers, and they cannot store nearly as much information, but they are excellent when used in small businesses, homes, and school classrooms. These computers are inexpensive and easy to use. They have become an indispensable part of modern life.

Computer Tasks

- Input
- Storage
- Processing
- Output

When a computer is asked to do a job, it handles the task in a very special way.

1. It accepts the information from the user. This is called input.
2. It stored the information until it is ready for use. The computer has memory chips, which are designed to hold information until it is needed.
3. It processes the information. The computer has an electronic brain called the Central Processing Unit, which is responsible for processing all data and instructions given to the computer.
4. It then returns the processed information to the user. This is called output.

Every computer has special parts to do each of the jobs listed above. Whether it is a multi-million dollar mainframe or a thousand dollar personal computer, it has the following four components, Input, Memory, Central Processing, and Output.

The central processing unit is made up of many components, but two of them are worth mentioning at this point. These are the arithmetic and logic unit and the control unit. The control unit controls the electronic flow of information around the computer. The arithmetic and logic unit, ALU, is responsible for mathematical calculations and logical comparisons.

Input Devices

- Keyboard
- Mouse
- Scanner
- Microphone
- CD-ROM
- Joystick

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