Intro to COA (16/01/24) Lecture-1

13 January 2024 18:10

Course Syllabus

Unit 1 Organization of Computer Systems: CPU, Memory and I/O organization, Instruction encoding and addressing modes. Von-Neumann versus Harvard Architecture, RISC and CISC architectures. Flynn Classification, Stack machines, subroutine calls, allocation and evaluation of data in stack machines. SIMD, SPMD and MIMD

Unit 2 CPU Organization: Addressing techniques, Instruction formats, Instruction set design, Instruction types: example for zero address, one address, two address and three address machines, Stack, accumulator and general purpose register organization.

Unit 3 Register Transfer Language: arithmetic, logic and shift micro operations and their hardware implementations as a simple ALU. Control Unit, Hardwired and Micro programmed control unit design.

Unit 4 Memory Organization: device characteristics, RAM organization, 1D and 2D organization, Virtual memory - Paging and Segmentation, High speed memories, Associative and Cache memory. Input-Output Design: IO interface, Bus structure, Modes of data transfer, Interrupts, Input Output Processor, Serial Communication Pipelining: Pipeline structure, Pipeline types - Instruction and Arithmetic pipelines. Interleaved memory organization, instruction prefetch, data buffers, pipeline performance measures.

Unit 5 Array processors: Routing mechanisms, Static v/s dynamic network. Multiprocessor systems, data flow concepts. Parallel processing languages.

Introduction:

1. Why are computers important?

2. How does a computer work? Why is it important to understand how a computer actually works?

--> What does brakes, accelerator and clutch do?
--> Working-
When the brake pedal is pressed, hydraulic fluid is transmitted through brake lines to either brake callipers (in disc brakes) or brake shoes (in drum brakes). The pressure applied causes friction material to make contact with the brake rotor or drum, creating resistance and slowing down the vehicle.

--> How to copy/cut a file and paste it in another folder?
--> Working-

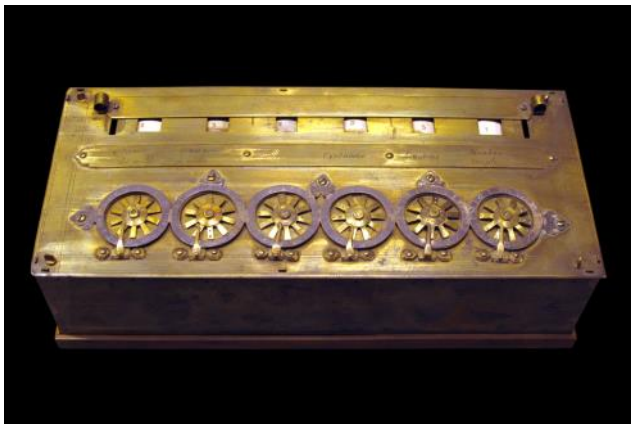
3. Two terms:

Computer Organization and Computer Architecture

Computer Organization	Computer Architecture
• the operational units and their interconnections that realize the architectural specifications. • Civil Engineer --> building construction (cement, bricks, iron rods, and building materials)	• those attributes of a system visible to a programmer or, those attributes that have a direct impact on the logical execution of a program. • Architect--> planning building (layout, floor planning)

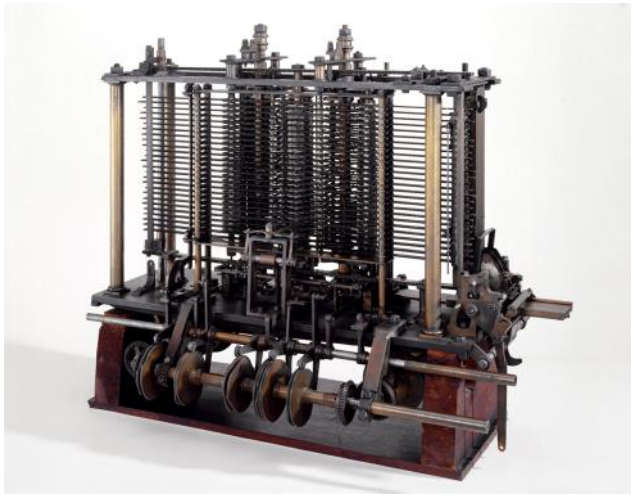
- **Evolution of Computers:**

--> PASCALINE (1642)



Mechanical calculator invented by B. Pascal
Add and subtract two numbers only.

--> Babbage Engine (1820s)



First automatic computing engine designed by Charles Babbage
Designed but couldn't build it. Completely built in 2002.
8000 parts, 5 tons, 11 feet.

--> **ENIAC (Electrical Numerical Integrator and Calculator) (1945)**

At University of Pennsylvania
18000 vacuum tubes , 30 tons, 30 x 50 feet.

Vacuum Tubes controls electric current between electrodes in an evacuated container in a tube.

--> Harvard Mark 1 (1944)

University of Harvard with IBM

Mechanical Relays, electric signals.
35 tons, 500 miles of wiring

--> IBM System/360

announced by IBM on April 7, 1964, and delivered between 1965 and 1978.

Advanced architectural concepts, appeared in microprocessors several decades later that we use today.

--> Intel Core i3, i5, i7

Table 1.2 Computer Generations

Generation	Approximate Dates	Technology	Typical Speed (operations per second)
1	1946–1957	Vacuum tube	40,000
2	1957–1964	Transistor	200,000
3	1965–1971	Small- and medium-scale integration	1,000,000
4	1972–1977	Large scale integration	10,000,000
5	1978–1991	Very large scale integration	100,000,000
6	1991–	Ultra large scale integration	>1,000,000,000

Moore's Law:

Observation by Intel co-founder Gordon Moore in 1965 which states that:

"The number of transistors per square inch on integrated circuits has doubled every year (has changed to 18 months now) since their invention and will continue into the future."

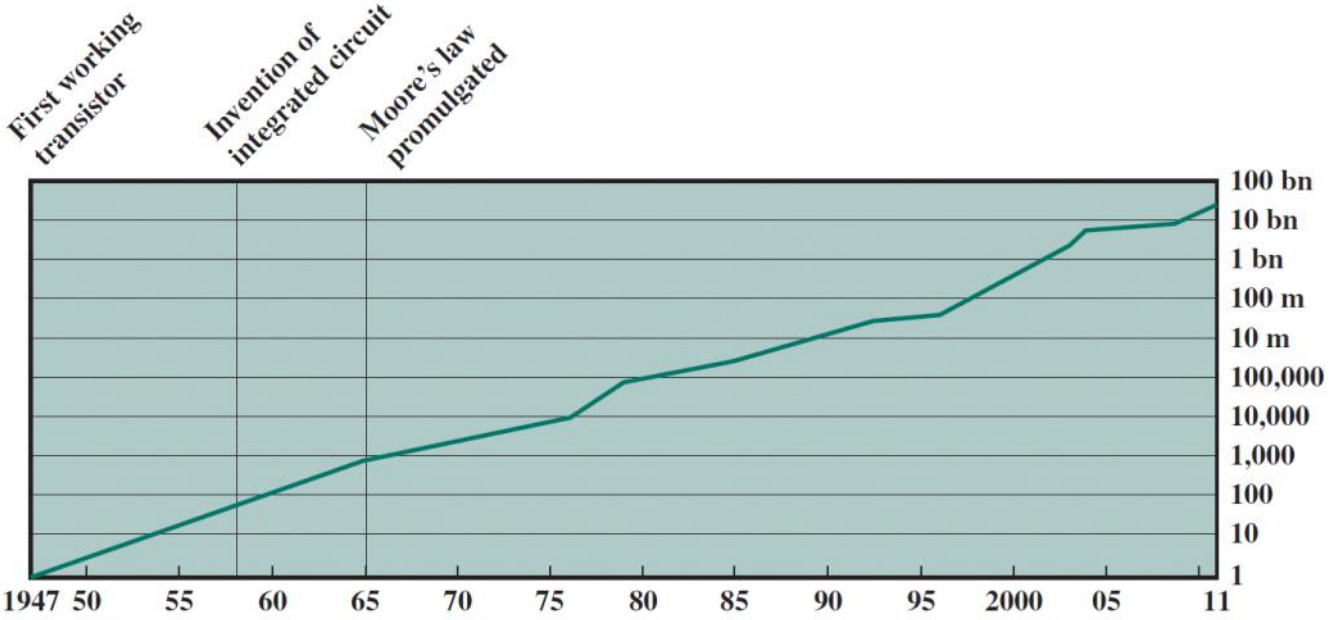


Figure 1.12 Growth in Transistor Count on Integrated Circuits