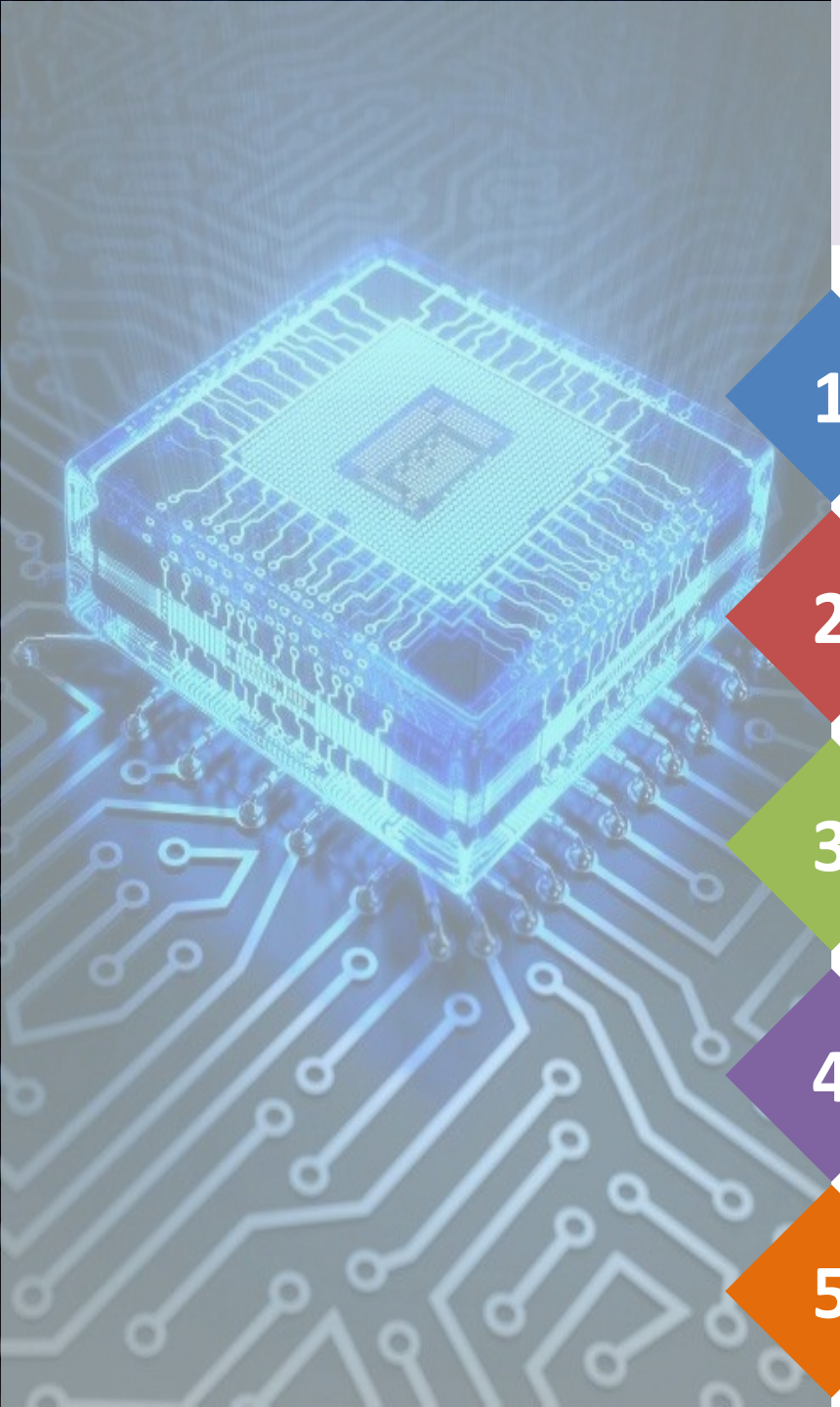
Computer Architecture and IOT

Chapter1

Computer Architecture

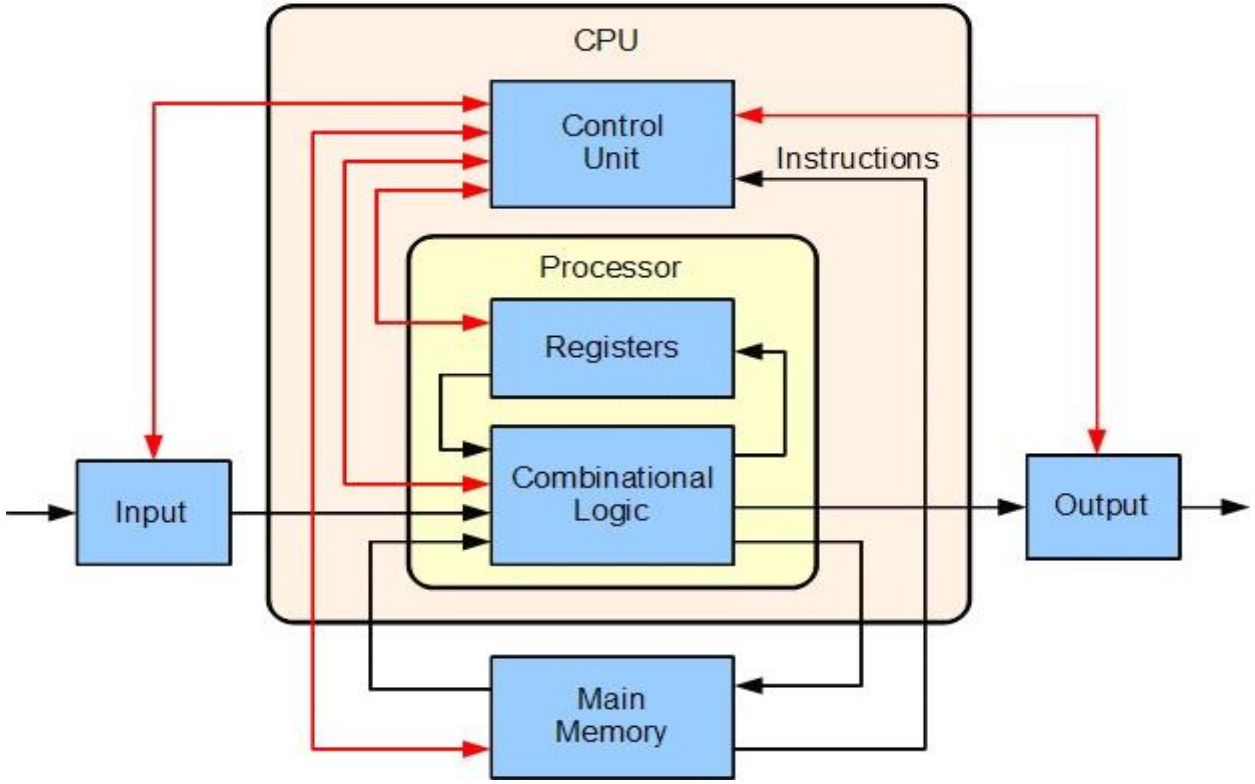


You will Learn

1. Introduction to Computer Architecture
2. Introduction to Microprocessor
3. How to use microprocessor
4. Development of Microprocessor
5. CISC VS RISC

Introduction to Computer Architecture

- computer architecture is a set of rules and methods that describe the functionality, organization, and implementation of computer systems.

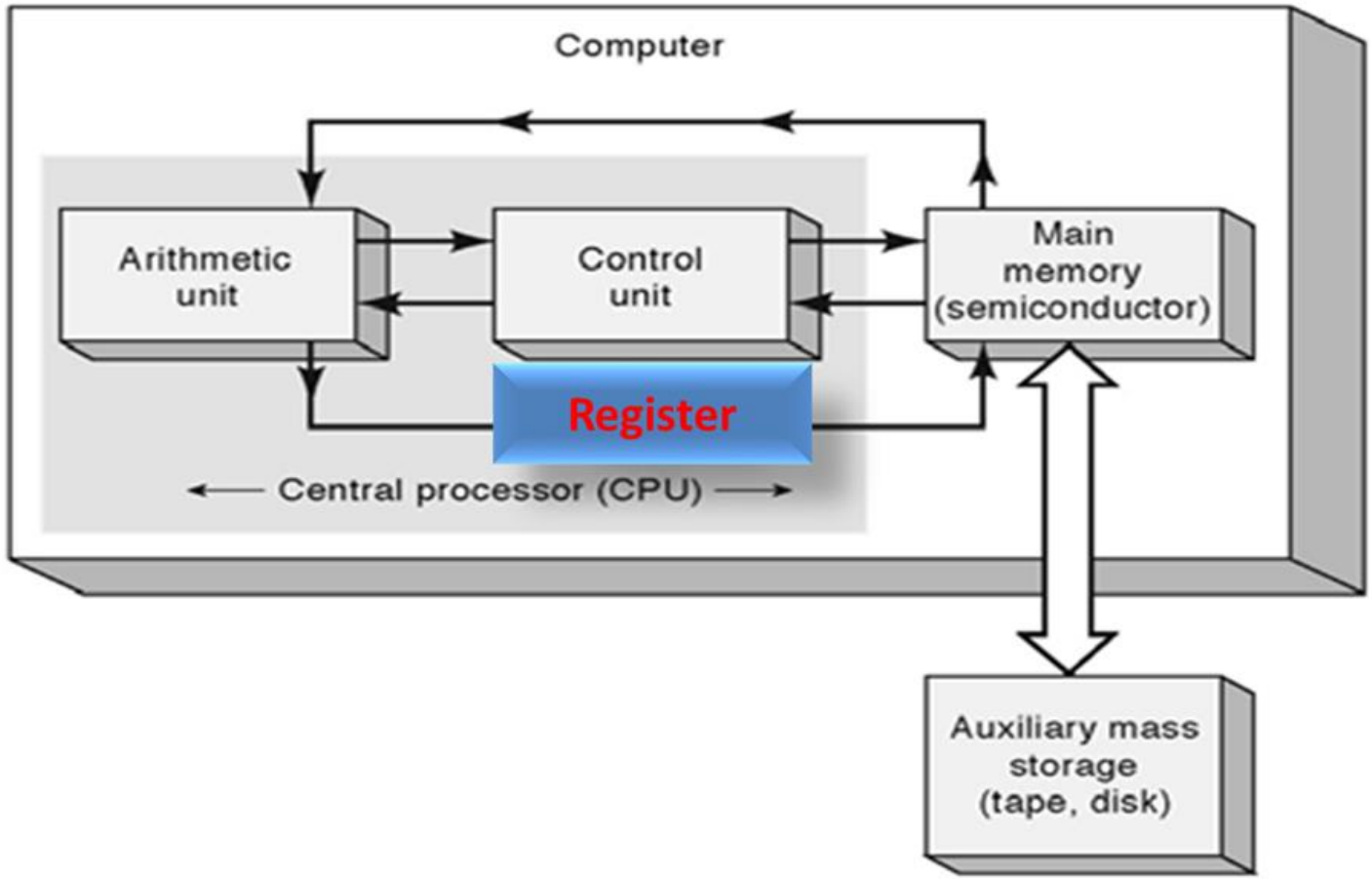


Introduction to Microprocessor

Microprocessor = Micro + Processor

- Micro is the smallest in size of devices that can not see by eye.
- Processor is Computer brain . It tells your computer what to do and when to do it. it decides which tasks are more important and prioritizes them to your computers needs.

Introduction to Microprocessor



Introduction to Microprocessor

Control Unit (CU)

coordinates sequence of execution Instructions .

Arithmetic Logic Unit (ALU)

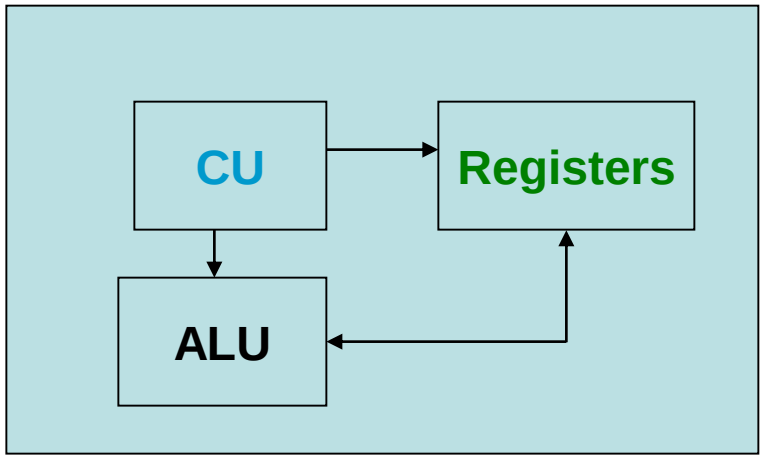
performs arithmetic , Logic and bitwise processing .

Register

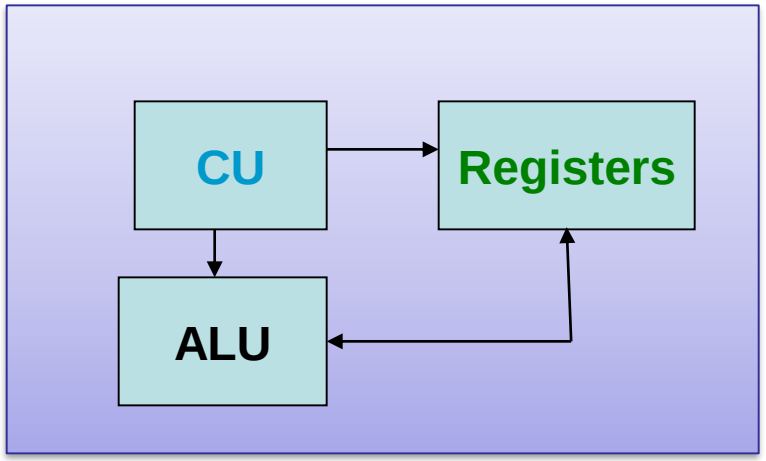
high-speed storage locations inside the CPU .

Introduction to Microprocessor

CPU:1942-1957(Vacuum tube)

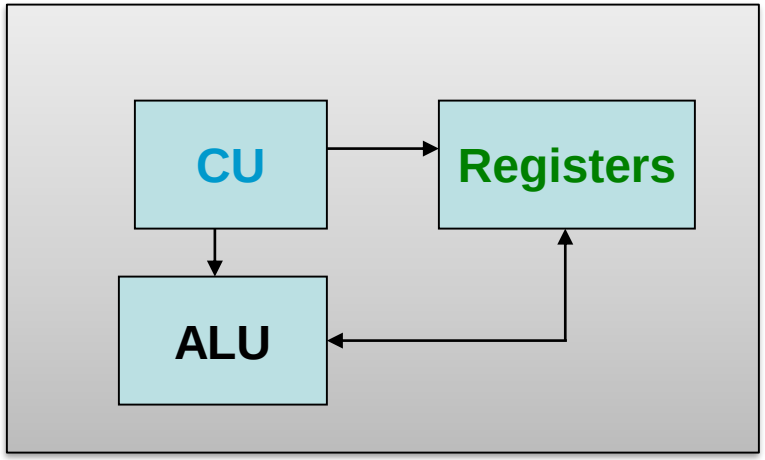


CPU:1957-1964(Transistor)

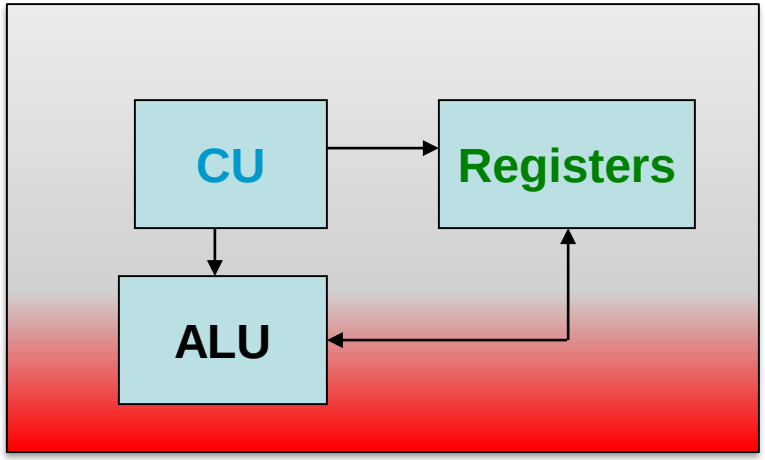


Introduction to Microprocessor

CPU:1964-1971(IC:SSI, MSI)



CPU:1971-Present (IC:LSI, VLSI,SVLF)



CPU (Vacuum tube)

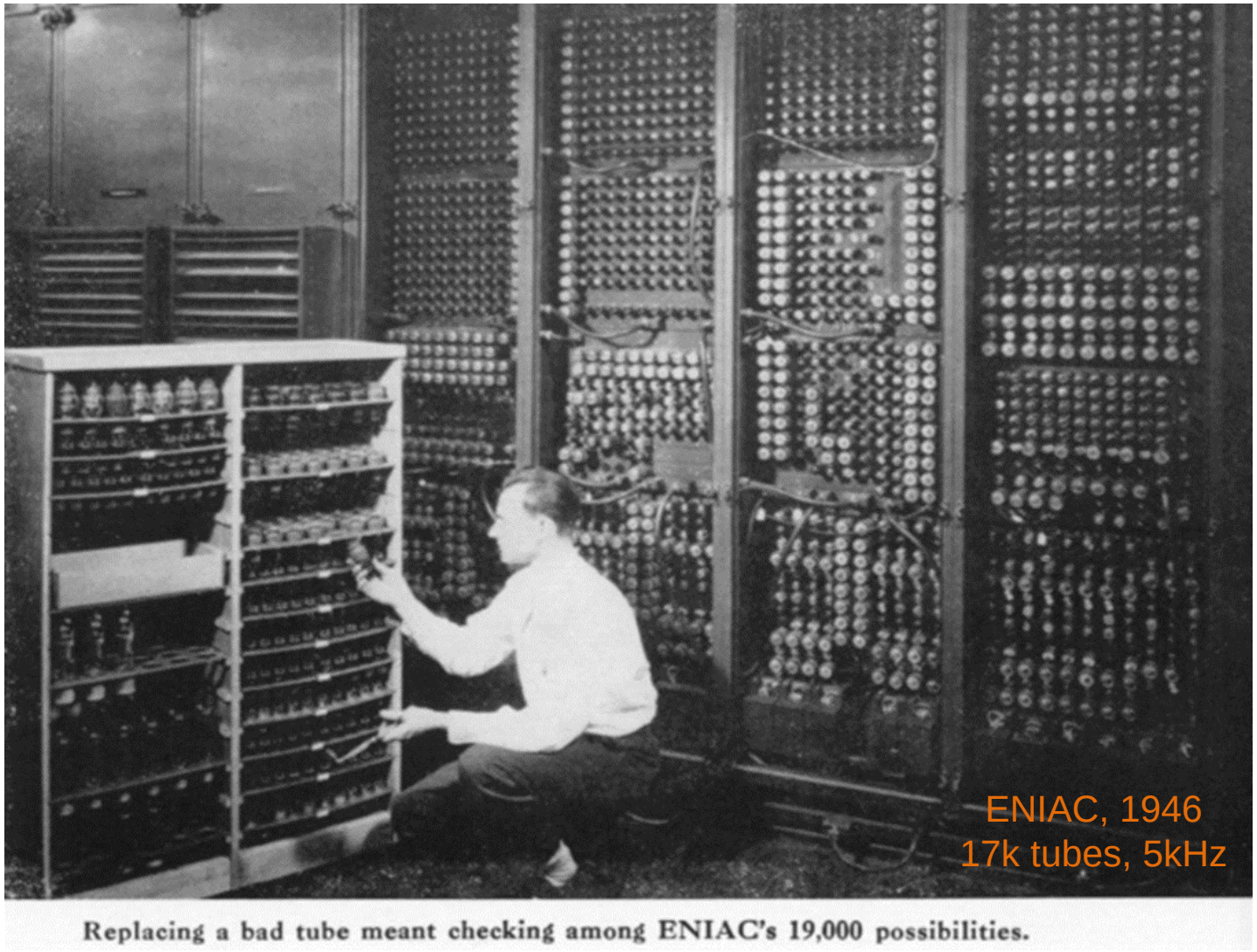
CPU:1942-1957(Vacuum tube)

- Vacuum tube is used to calculate (CPU) and to store data (RAM)
- Vacuum tube use binary number 0 and 1
- Data or Instruction are store in 0 and 1

Ex: A => 0100 0001 = 41H

All Circuit has been created by Vacuum tube

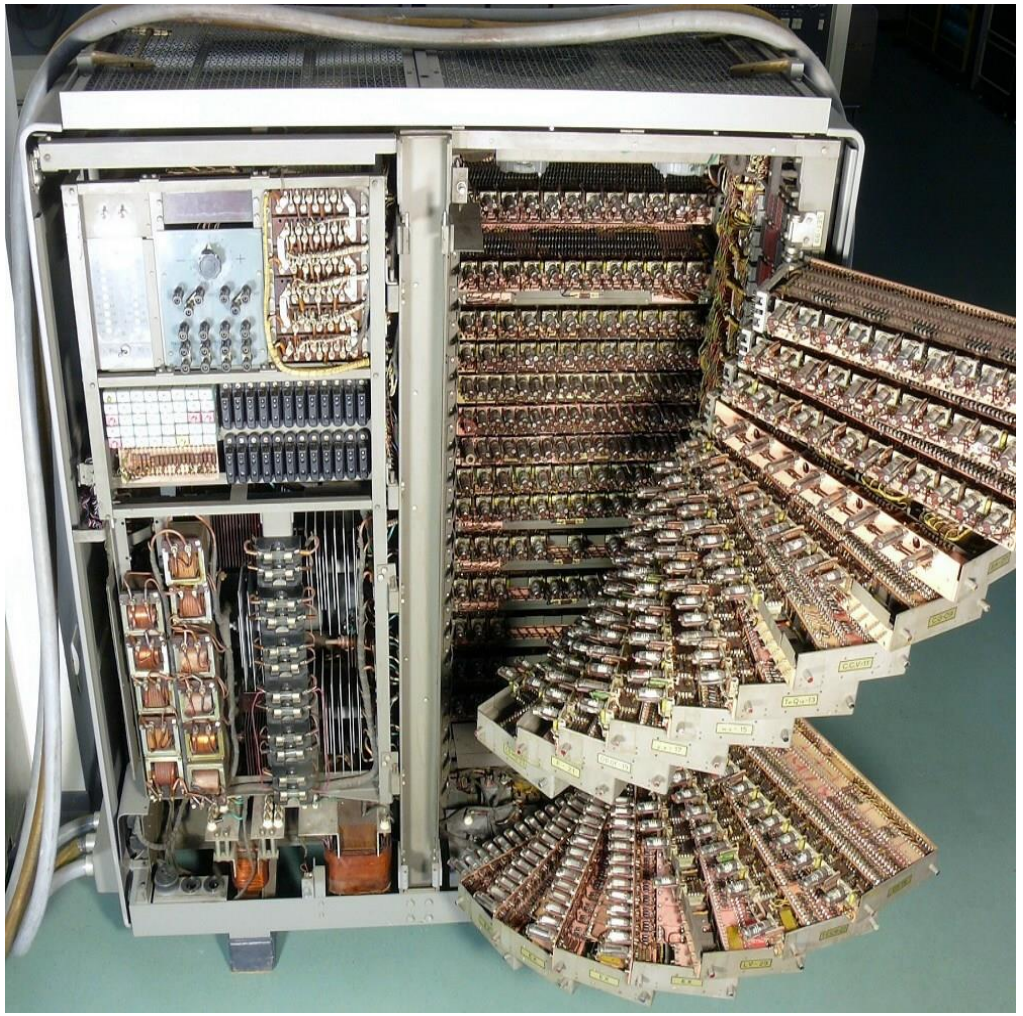
CPU (Vacuum tube)



ENIAC, 1946
17k tubes, 5kHz

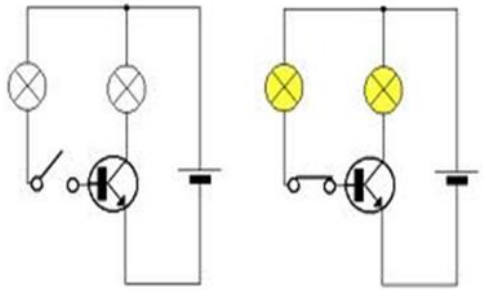
Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.

CPU (Vacuum tube)



CPU (Transistor)

CPU:1957-1964(Transistor)

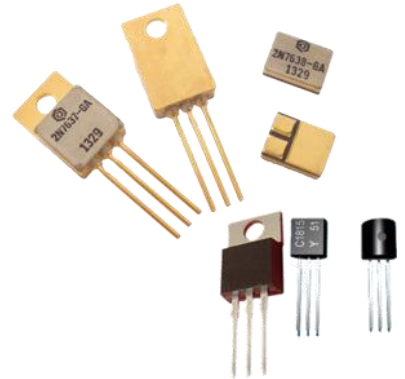


Transistor is used instead of Vacuum Tube

The equivalent of an on/off switch inside a microchip.

When this switch is “ON” it represents is 1.

When is “OFF” it represents is 0.

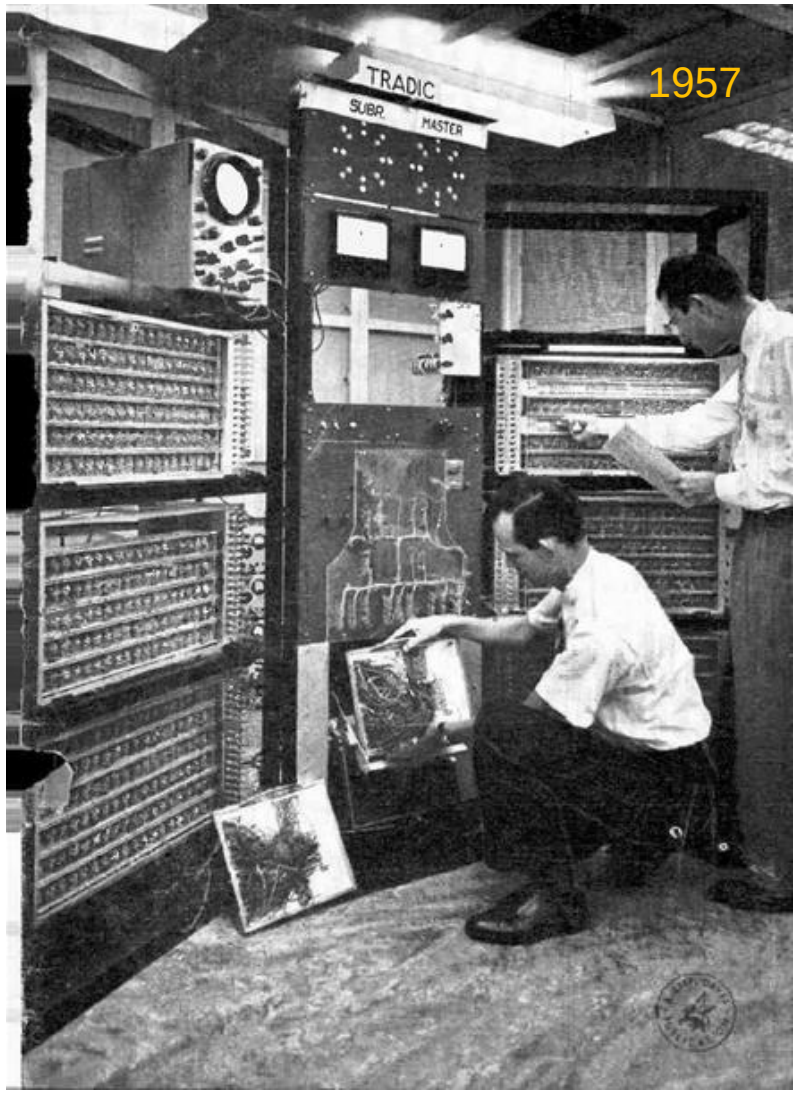


These 1’s and 0’s made up the computer data and instruction .

EX : A = 41H = 0100 0001

MOV AL , 12H = B012H=10110000 00010010

CPU (Transistor)



CPU (Integrated Circuit)

- 1964 – 1971 Computer using IC
- Integrated Circuit is used instead of Transistor
- Several Types of Circuit

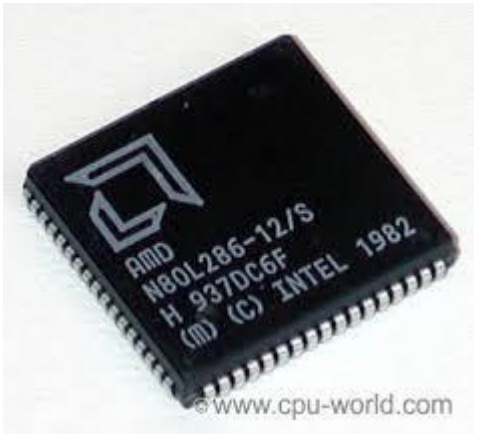
SSI (Small Scale Integration)	1-100
MSI (Medium Scale Integration)	100-3000
LSI (Large Scale Integration)	3000-100000
VLSI (Very Large Scale Integration)	1000000 and up

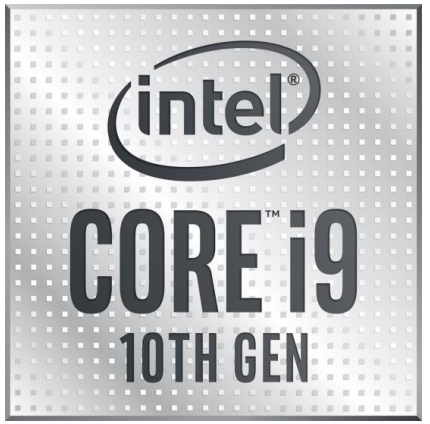
CPU (Integrated Circuit)

Firstly SSI or MSI builds CU, ALU, Register circuit in separated chips

CPU (Integrated Circuit)

Secondly LSI or VLSI builds CU, ALU and Register circuits integrated in single chip, is called CPU.





How to use Microprocessor

- The microprocessor, also known as the Central Processing Unit (CPU), is the brain of all computers and many electronic devices.
- Multiple microprocessors, working together, are the "hearts" of datacenters, super-computers, communications products, and other digital devices.

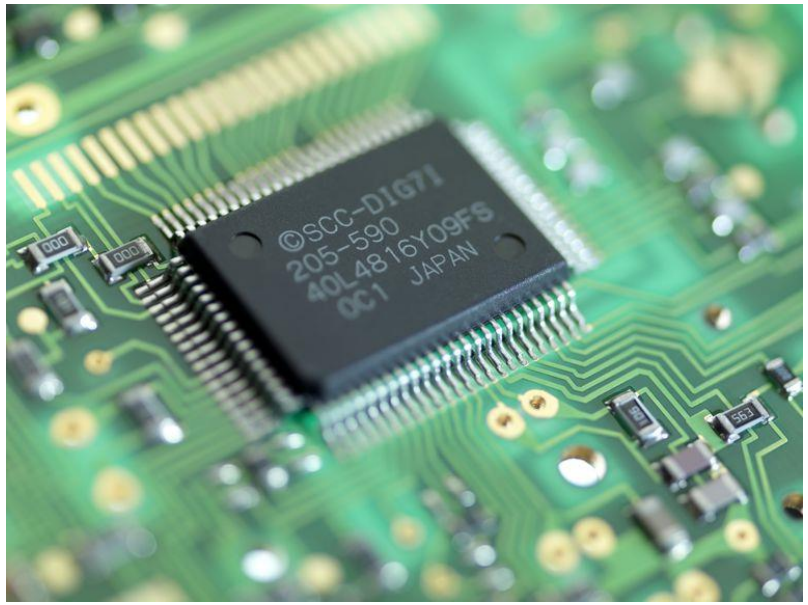
How to use Microprocessor

- Reads and Executes Program Instruction
- Performs calculate arithmetic and logic
- Responsible for storing and retrieving data on disk or other storage .
- Handles moving data from one part of a computer to another .

How to use Microprocessor

- What is a bus?

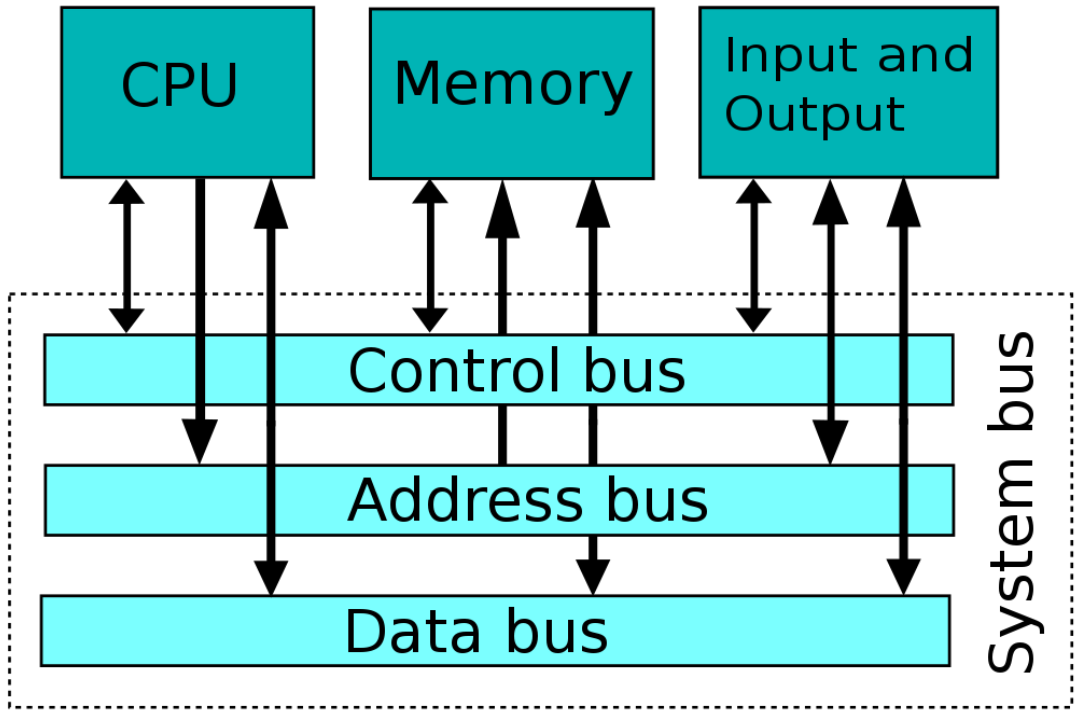
A bus is a communication system that transfers data between components inside a computer, or between computers.



How to use Microprocessor

- What is system bus?

A system bus is a single computer bus that connects the major components of a computer system, combining the functions of a data bus to carry information, an address bus to determine where it should be sent, and a control bus to determine its operation.



How to use Microprocessor

- Data Bus is a bus which connect the main memory to the memory controller in computer system.
- Address Bus is a bus that used to specify a physical memory. When a processor need to read or write to a memory location, it specifies that memory location on the address bus.

How to use Microprocessor

- Control Bus is a part of system bus, used by CPU for communicating with other devices within the computer. When address carries the information about the devices with which the CPU is communicating and the data bus carries the actual data being process, the control bus carries the commands from the CPU and return status signals from the devices.

How to use Microprocessor

- What is expansion bus?

An expansion bus is a bus that allows for computer expansion with the use of an expansion board, a printed circuit board inserted into an expansion slot on the motherboard or backplane that provides additional features to a computer system.

An expansion bus provides an input/output pathway for transferring information between internal hardware, such as RAM or the CPU, and expansion devices such as a graphics card or sound card.

Development of Microprocessor

- 4004 Microprocessor

IDB	: 4 bits
EDB	: 8 bits
AB	: 9 bits
PM	: 512 bytes
Transistor	: 2300
MH_z	: 0.1- 0.5
Computer	:Altair 8800
Year	:1971

Development of Microprocessor

- 8008 Microprocessor

IDB : 8 bits

EDB :8 bits

AB : 14 bits

PM : K bytes

Transistor : 3000

MH_z : 0.5- 0.8

Year :1972

Development of Microprocessor

- 8080 Microprocessor

IDB : 8 bits

EDB :8 bits

AB : 16 bits

PM : 64 Kbytes

Transistor : 4500

MH_z : 2- 3

Year :1974

Development of Microprocessor

- 8085 Microprocessor

IDB : 8 bits

EDB :8 bits

AB : 16 bits

PM : 64 Kbytes

Transistor : 6500

MH_z : 3- 8

Year :1976

Development of Microprocessor

- 8086 Microprocessor

IDB : 16 bits

EDB :16 bits

AB : 20 bits

PM : 1 MB

Transistor : 29 000

MH_z : 8-16

Year :1978

Development of Microprocessor

- 8088 Microprocessor

IDB : 16 bits

EDB :8 bits

AB : 20 bits

PM : 1 Mbytes

Transistor : 29 000

MH_z : 5- 8

Year :1979

Development of Microprocessor

- 80286 Microprocessor

IDB : 16 bits

EDB :16 bits

AB : 24 bits

PM : 16 Mbytes

Transistor : 130 000

MH_z : 6-16

Year :1982

Development of Microprocessor

- 80386 Microprocessor

IDB : 32 bits

EDB :32 bits

AB : 32 bits

PM : 4 gbytes

Transistor : 275 000

MH_z : 16-33

Year :1985

Development of Microprocessor

- 80486 Microprocessor

IDB : 32 bits

EDB :32 bits

AB : 32 bits

PM : 4 Gbytes

Transistor : 1.2 million

MH_z : 25- 60

Year :1989

Development of Microprocessor

- 80586 Microprocessor

IDB : 32bits

EDB : 32bits

AB : 32bits

PM : 4Gbytes

Transistor : 3.1 million

MH_z :60 - 133

Year :1993

Development of Microprocessor

- Pentium Pro Microprocessor

IDB : 32 bits

EDB :64 bits

AB : 36 bits

PM : 64 G bytes

Transistor : 5.5 million

MH_z : 133- 233

Year : 1995

Development of Microprocessor

- Pentium II Microprocessor

IDB : 32 bits

EDB :64 bits

AB : 36 bits

PM : 64 G bytes

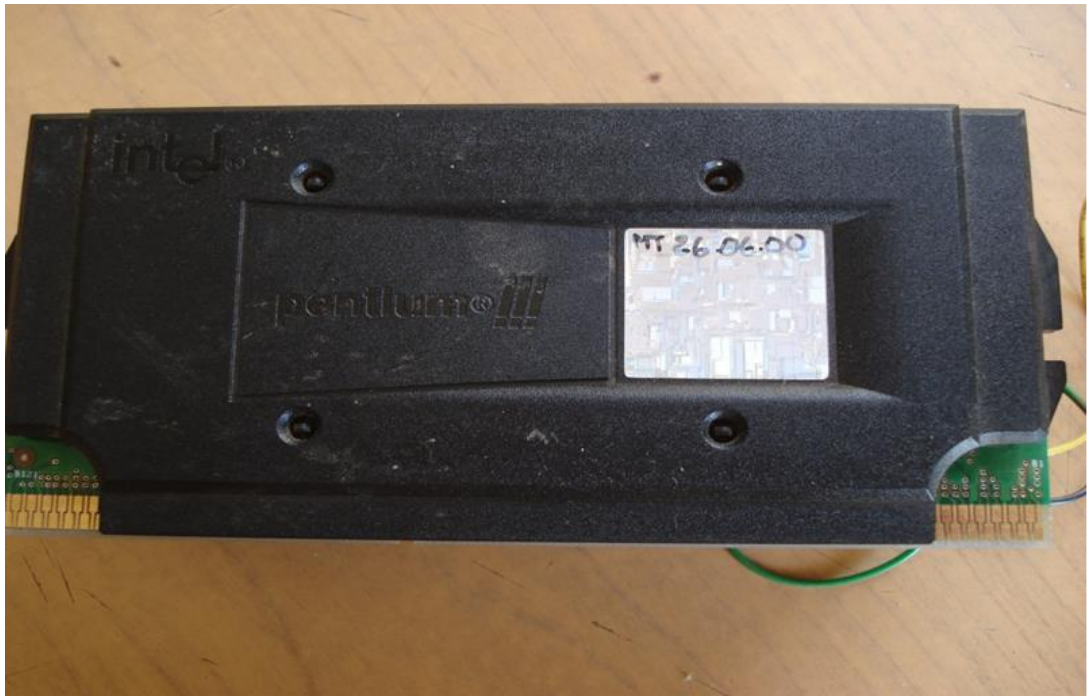
Transistor : 7.5 Million

MH_z : 233- 450

Year :1997

Development of Microprocessor

- Pentium III Microprocessor



IDB : 32 bits

EDB :64 bits

AB : 36 bits

PM : 64 G bytes

Transistor : 9.5-28 millio

MH_z : 400- 1000

Year :1999

Development of Microprocessor

- Pentium IV Microprocessor

IDB : 32 bits

EDB :64 bits

AB : 36bits

PM : 64 Gbytes

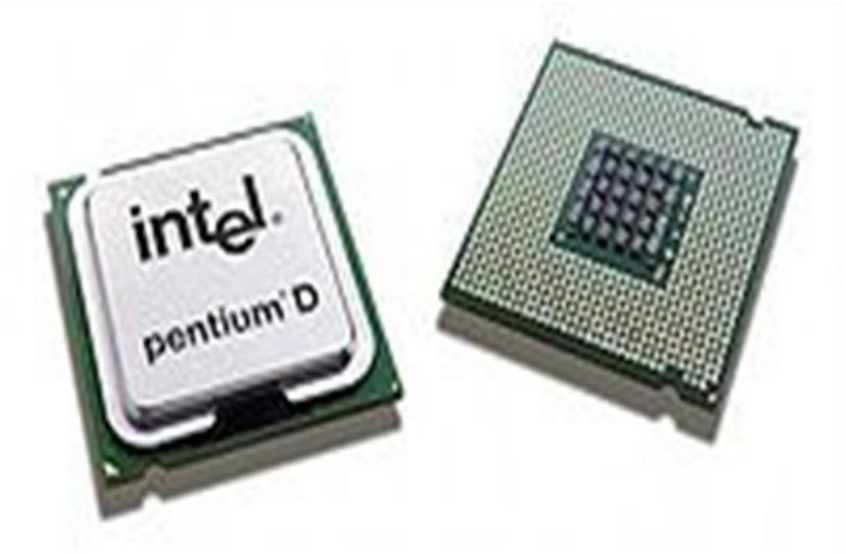
Transistor : 42 million

GH_z : .1- 1.5

Year :2000

Development of Microprocessor

- Pentium D Microprocessor



IDB : 64 bits

EDB :64 bits

AB : 36 bits

PM : 64 Gbytes

Transistor : 169 million

GH_z : .2.8- 3.6

Year :2004

Development of Microprocessor

- Core Microprocessor

IDB : 64 bits

EDB :64 bits

AB : 36 bits

PM : 64 Gbytes

Transistor : 376 million

GH_z : .2.8- 3.6

Year :2006

Development of Microprocessor

- Core I3 Microprocessor

64 Kb L1 cache

512 Kb L2 cache

4 MB L3 cache

Introduced January, 2010

Variants

530 – 2.93 GHz Hyper-Threading

540 – 3.06 GHz Hyper-Threading

550 – 3.2 GHz Hyper-Threading

560 – 3.33 GHz Hyper-Threading

Development of Microprocessor

- Core I5 / Core I7 / Core I9 Microprocessor

CISC vs RISC

Complex Instruction Set Computer (CISC)	Reduced Instruction Set Computer (RISC)
The original microprocessor ISA	Redesigned ISA that emerged in the early 1980s
Instructions can take several clock cycles	Single-cycle instructions
Hardware-centric design -the ISA does as much as possible using hardware circuitry	Software-centric design -High-level compilers take on most of the burden of coding many software steps from the programmer
More efficient use of RAM than instructions	Heavy use of RAM (can cause bottlenecks if RAM is limited)
Complex and variable length instructions	Simple, standardized instructions
May support microcode (micro-programming where instructions are treated like small programs)	Only one layer of instructions
Large number of instructions	Small number of fixed-length instructions
Compound addressing modes	Limited addressing modes