Advance Microprocessor and Microcontroller

EI 603

By
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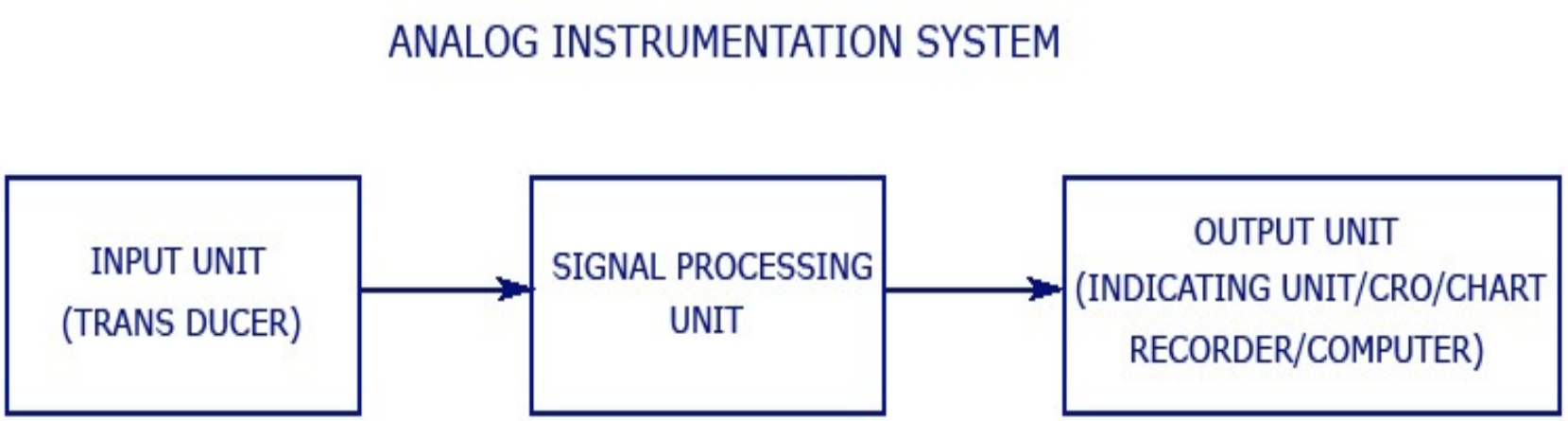
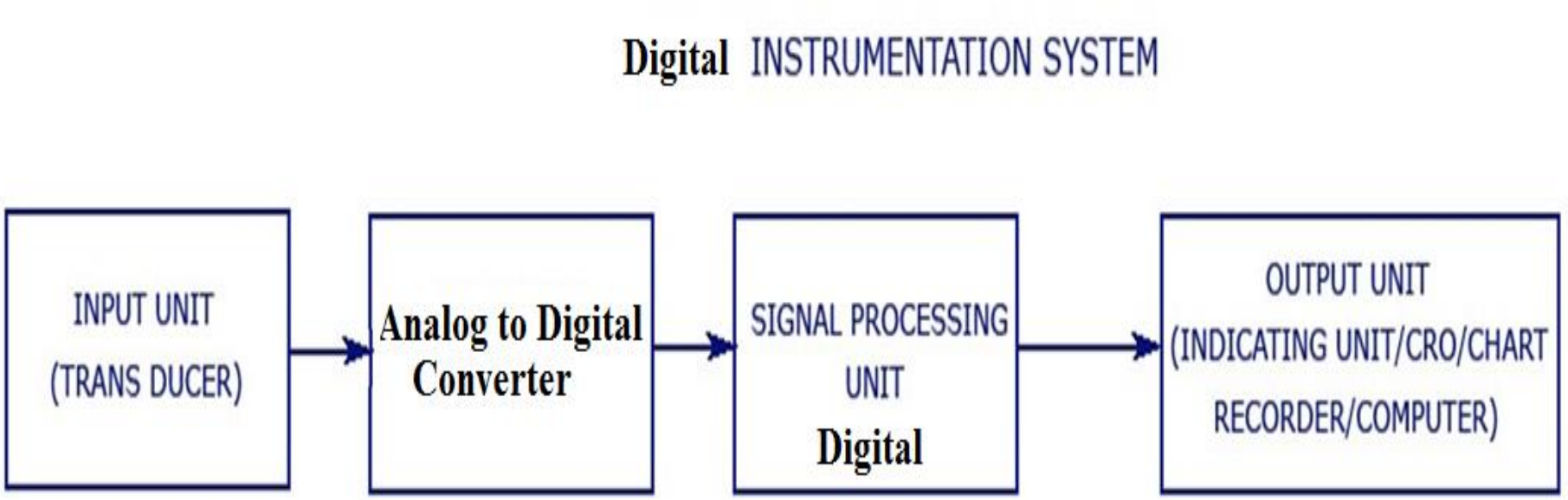
Introduction

* Content
  * General block diagram of Instrumentation system
  * General block diagram of microprocessor based system
  * General definition
  * History of microprocessor

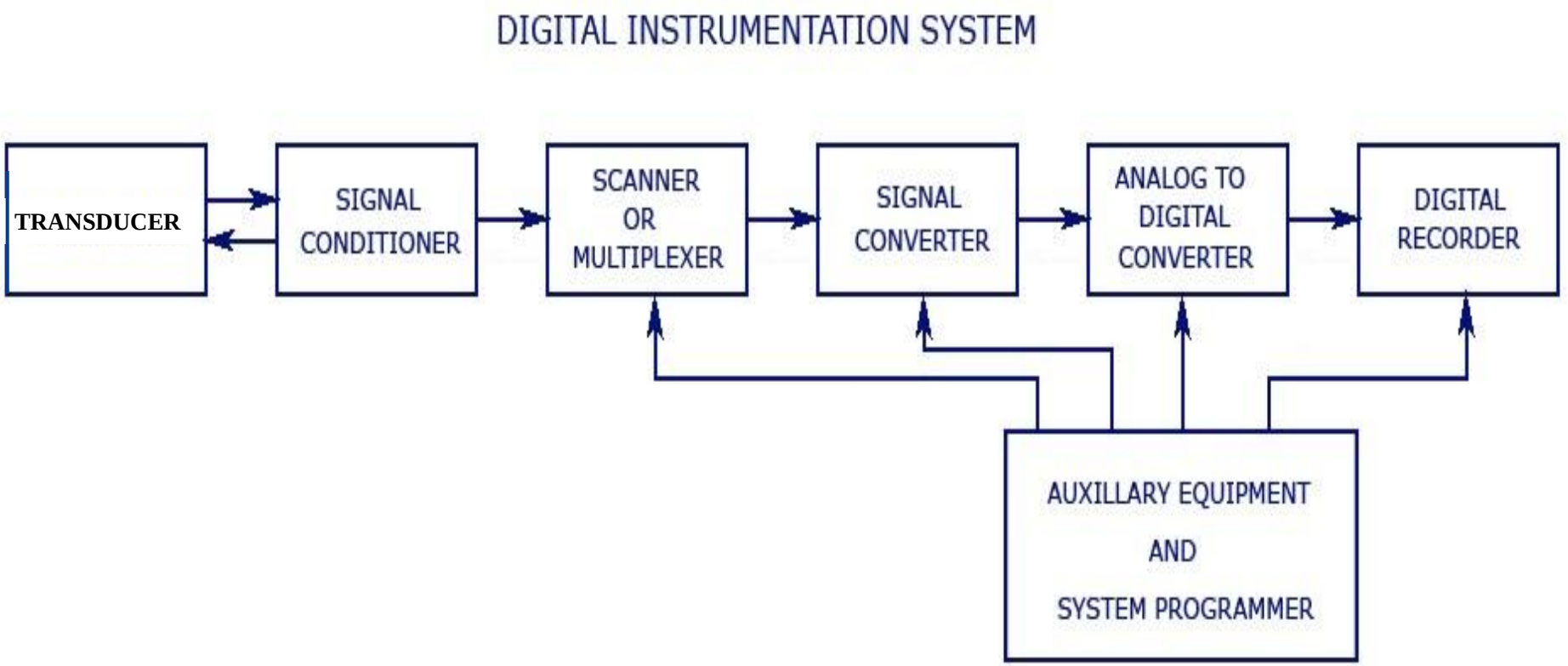
General Block Diagram of Instrumentation System



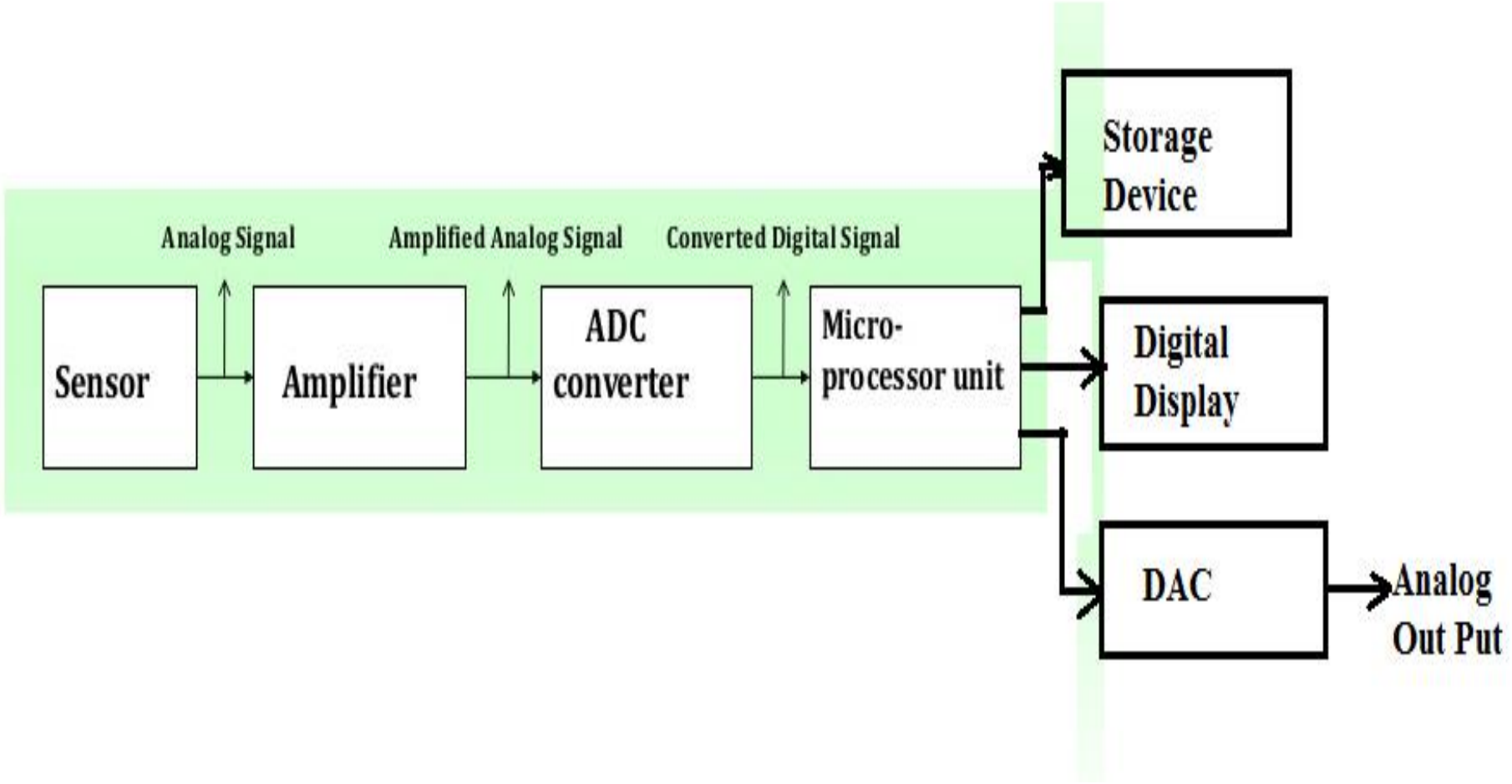
General Block Diagram of Instrumentation System



General Block Diagram of Instrumentation System

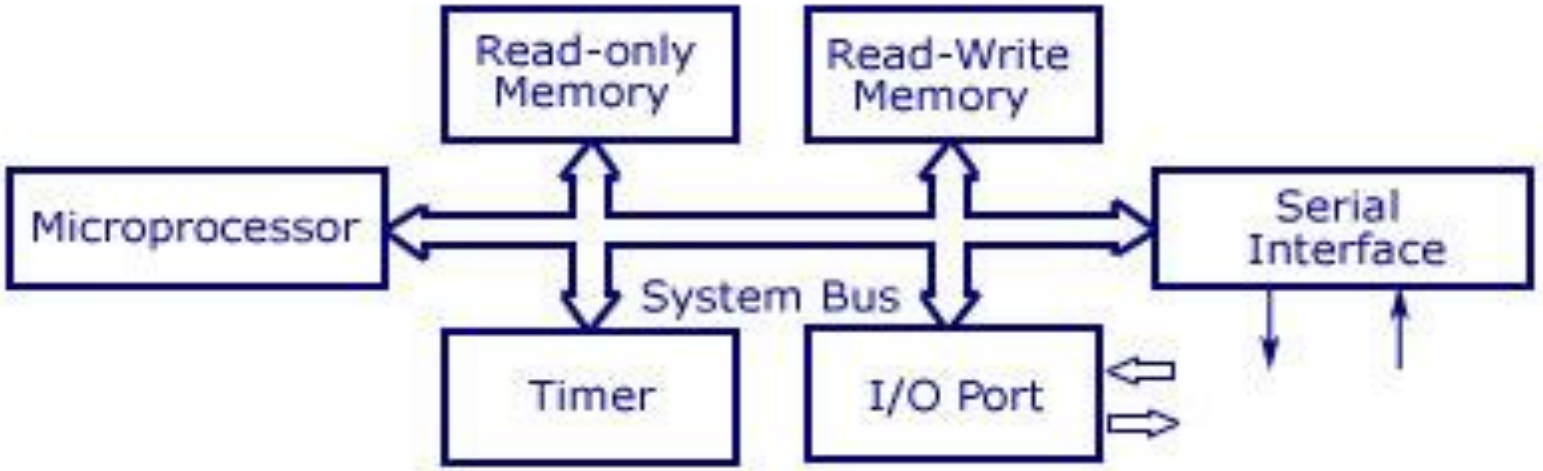


Microprocessor Based Systems

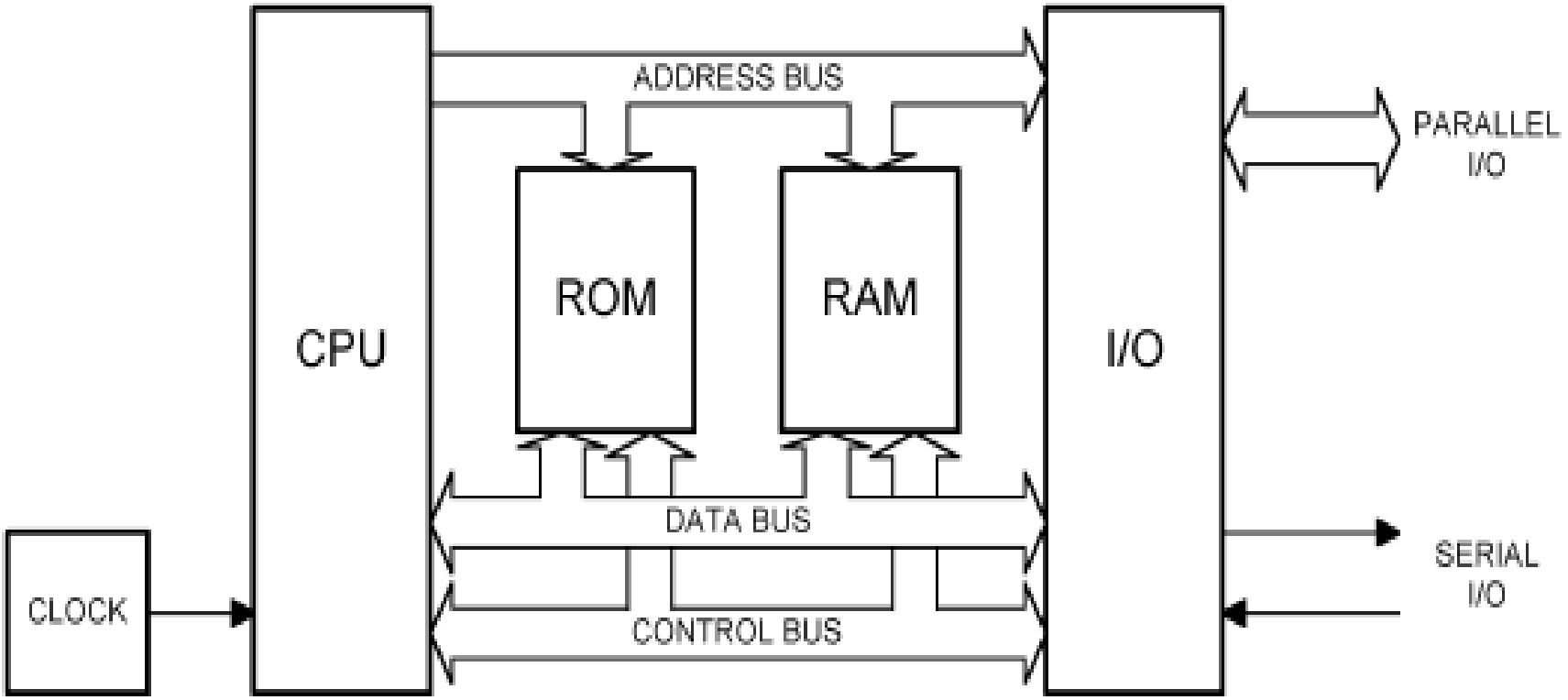


Microprocessor Based Systems

Schematic Arrangement of a Microprocessor Based System



Microprocessor Based Systems



General Definitions

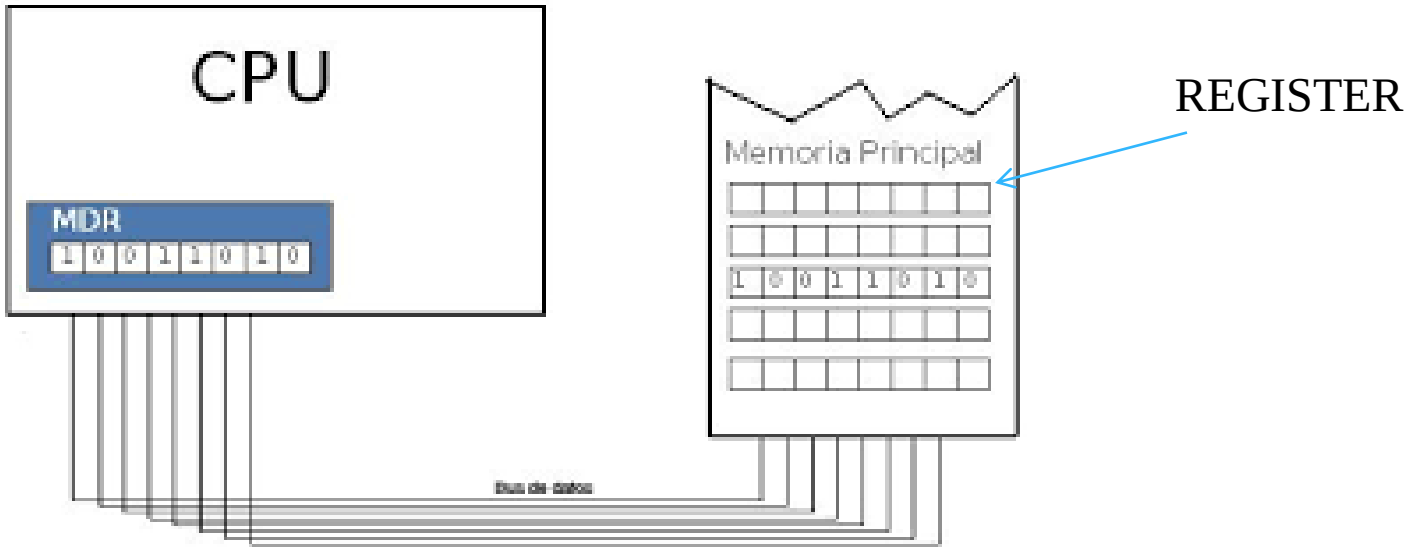
Bit size

The bit size of a microprocessor refers to the number of bits that can be processed simultaneously by the basic arithmetic circuits.(also called world length of processor)

General Definitions

Memory Word

* The number of bits that can be stored in a register or memory elements is called memory word.



General Definitions

Bus

* A bus is group of wires/lines that carry similar information.

General Definitions

Firmware

* Software written for a microprocessor application without provision for changes is called firmware. These are stored in ROM of computer.

General Definitions

High level language

* A computer programming language in which programs are written without knowledge of the processor in which program will be executed.

  E.g. FORTRAN, PASCAL, JAVA, etc.

General Definitions

Assembly language:

* A programing language written using mnemonics or the instruction set of a particular microprocessor is called assembly language.
  * E.g. MOV A,B
    * ADD B

General Definitions

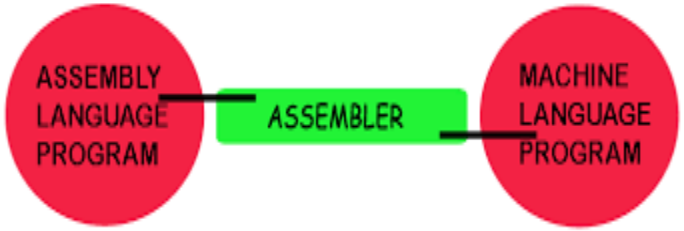
Machine language

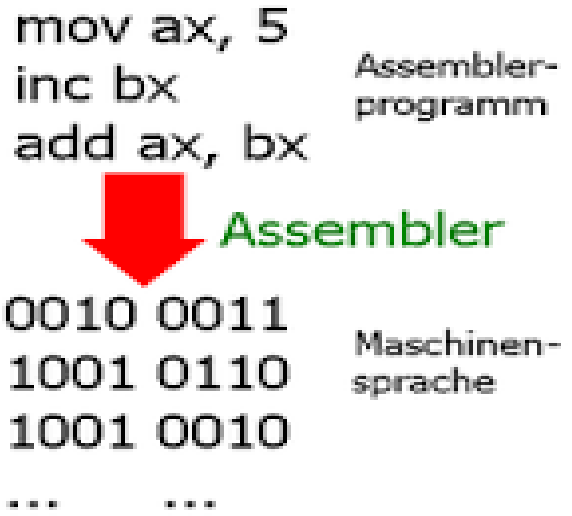
* Machine language refers to binary code programs that are specific to the processor and can be directly executed by the processor.

General Definitions

Assembler

* A computer application (software) program that converts the assembly language program into machine language.

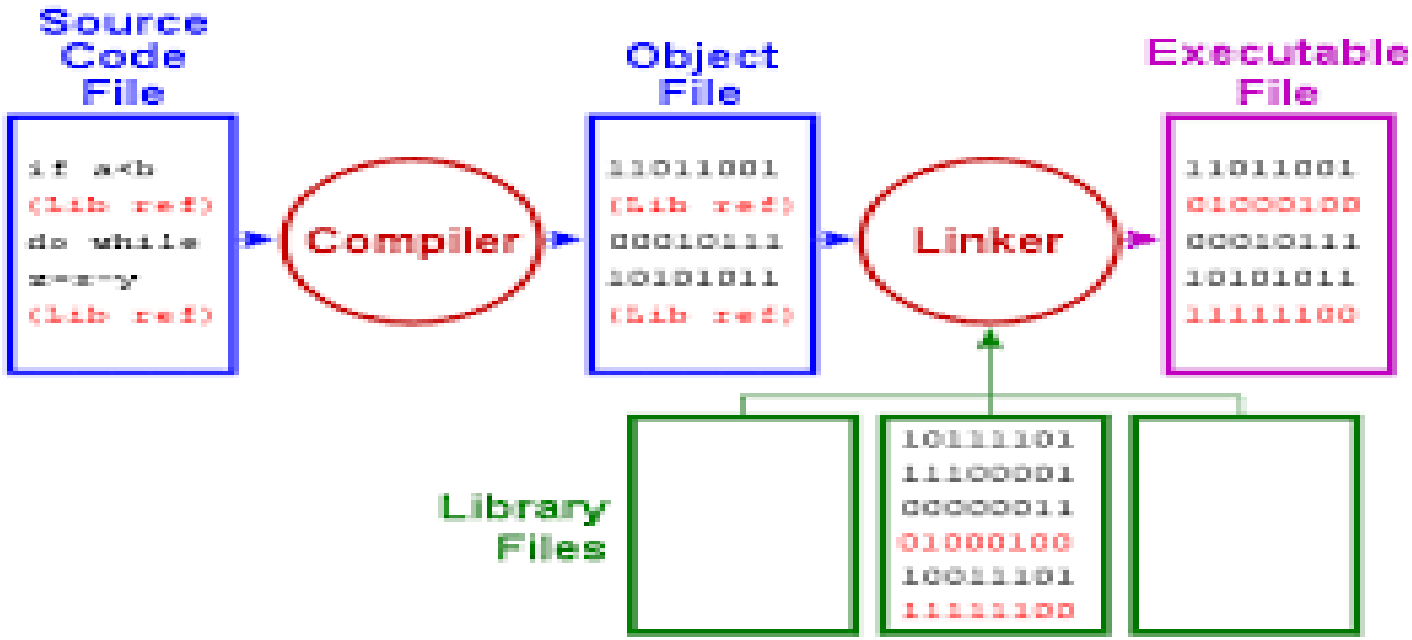




General Definitions

Compiler

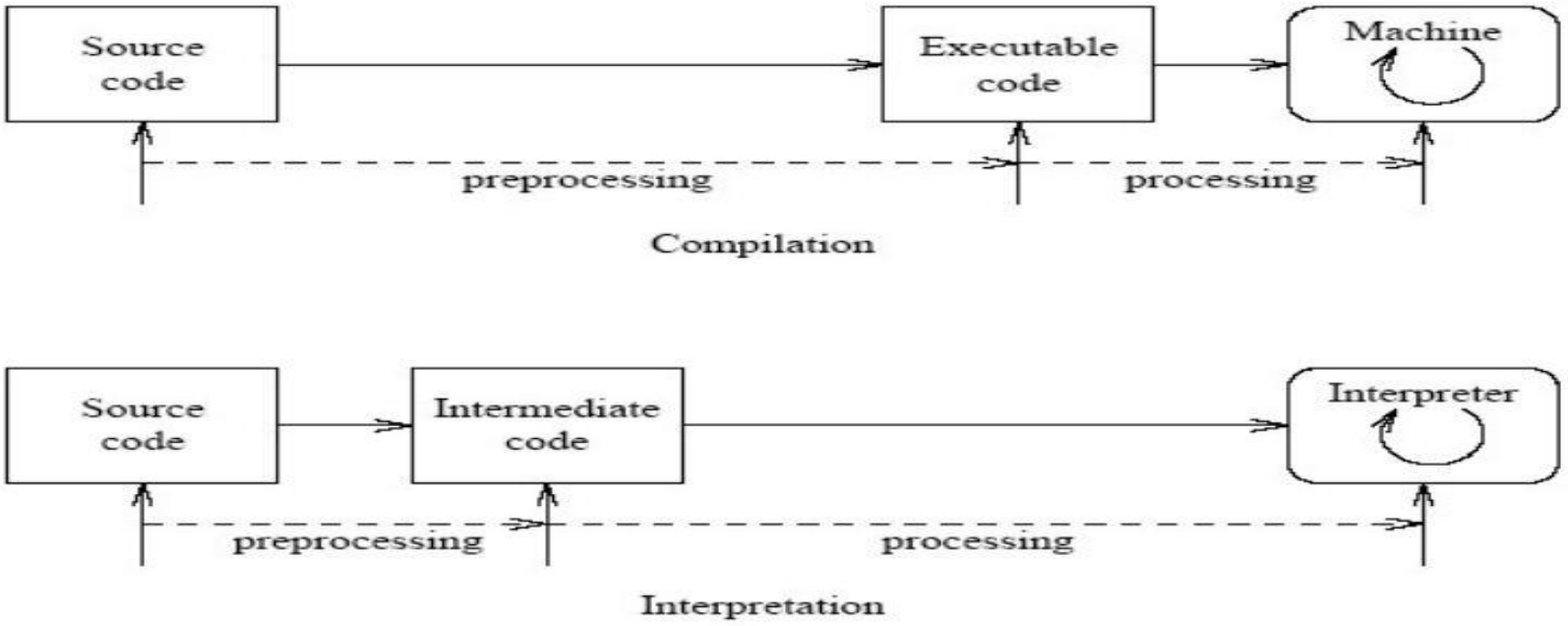
* A compiler program that converts the high-level language program into machine-level language program.



General Definitions

Interpreter

* A computer program that reads the high-level or assembly-level program one line at a time and converts into machine-level program.



Difference between compiler and interpreter

Sr No	Compiler	Interpreter
1	Compiler Takes **Entire** program as input	Interpreter Takes **Single** instruction as input .
2	Intermediate Object Code is **Generated**	**No** Intermediate Object Code is **Generated**
3	Conditional Control Statements are Executes **faster**	Conditional Control Statements are Executes **slower**
4	**Memory Requirement** : **More** (Since Object Code is Generated)	**Memory Requirement** is **Less**
5	Program need not be **compiled** every time	Every time higher level program is converted into lower level program
6	**Errors** are displayed after **entire program** is checked	**Errors** are displayed for **every instruction** interpreted (if any)
7	**Example** : C Compiler	**Example** : BASIC

General Definitions

Algorithm

* A sequence of operation that defines how to solve a problem using a computer or microprocessor.

General Definitions

BIOS

* Basic Input/Output System is a set of programs that handles the input and output functions and interacts with the hardware directly. A new hardware installed must be provided with the corresponding BIOS routine.

General Definitions

* **MIPS**
* Million instructions per second is a measure of the speed at which the instructions are executed in a processor.

General Definitions

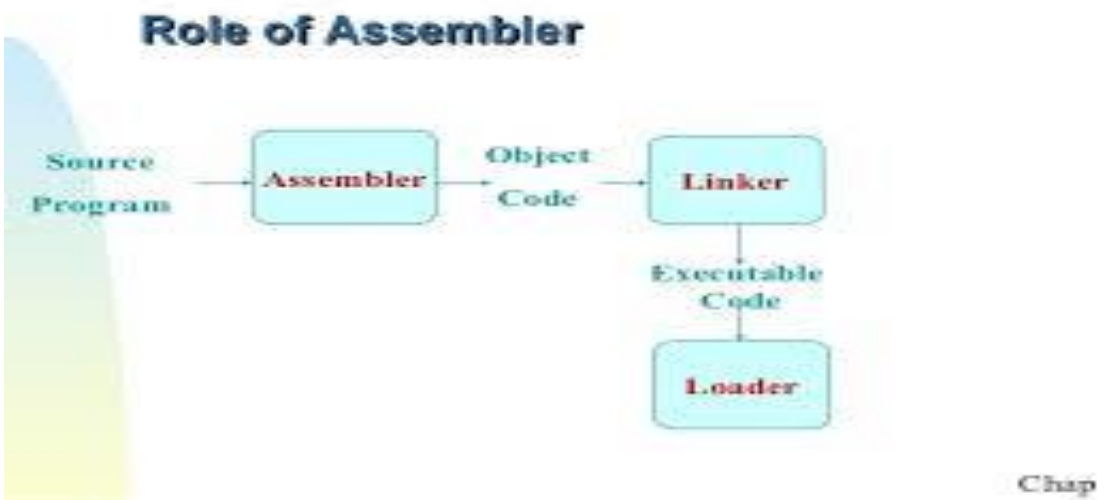
Operating System

* The program that controls the entire computer and its resources and enables users to access the computer and its resources is called operating system.

General Definitions

Loader

* The loader (or linker) is a program that takes the object file generated by the assembler and generates a file in binary code called com file or exe file.



General Definitions

Debugger

* The debugger is a program that allows the user to test and debug the object file. The user can employ this program to perform the following functions:
  * Make change in the object code.
  * Examine and modify the content of memory.
  * Set break points, execute a segment of the program and
  * Display register content after the execution.

General Definitions

Cross Assembler

* A cross-assembler is a program that can be used to translate 8085 mnemonics by a computer that has a microprocessor other than 8085.

General Definitions

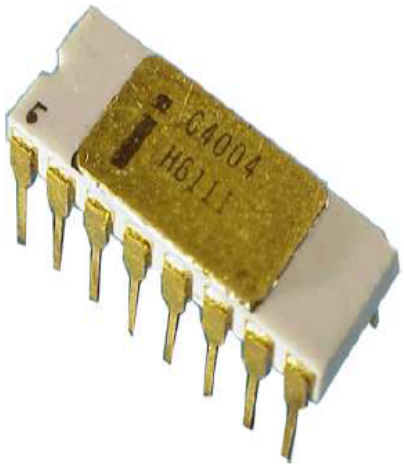
Microprocessor:

* Integrated circuit that contains the entire central processing unit of a computer on a single chip.
* Microprocessor is a device that integrates the functions of the CPU in a computer onto the IC or semiconductor chip.
* Microprocessor is a clock driven semiconductor device consisting of electronic logic circuits manufactured by using either LSI or VLSI technology.

Evaluation of Microprocessor

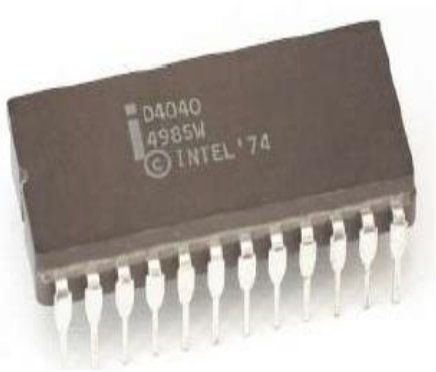
4-BIT MICROPROCESSORS

INTEL 4004



- Introduced in 1971.
- It was the first microprocessor by Intel.
- It was a 4-bit µP.
- Its clock speed was 740KHz.
- It had 2,300 transistors.
- It could execute around 60,000 instructions per second.

INTEL 4040

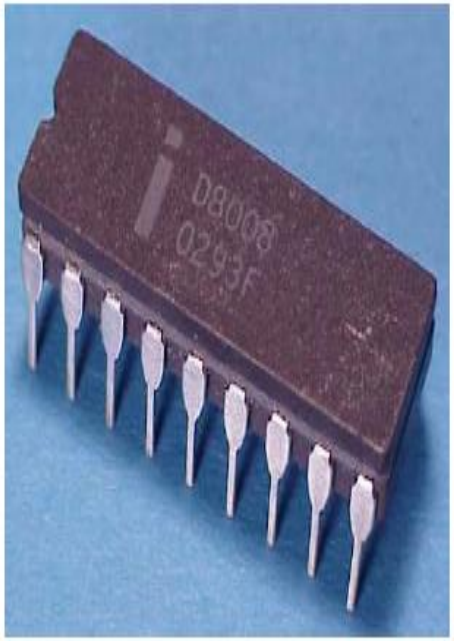


- Introduced in 1974.
- It was also 4-bit µP.

Evaluation of Microprocessor

8-BIT MICROPROCESSORS

INTEL 8008



- Introduced in 1972.
- It was first 8-bit µP.
- Its clock speed was 500 KHz.
- Could execute 50,000 instructions per second.

INTEL 8080

- Introduced in 1974.
- It was also 8-bit µP.
- Its clock speed was 2 MHz.
- It had 6,000 transistors.
- Was 10 times faster than 8008.
- Could execute 5,00,000 instructions per second.

Evaluation of Microprocessor

8-BIT MICROPROCESSORS

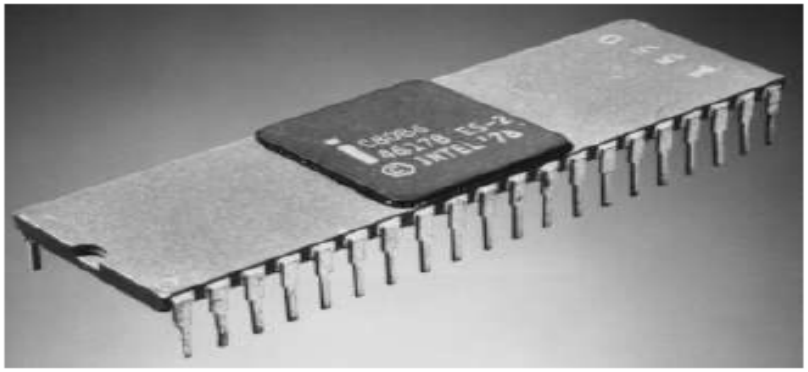
INTEL 8085

- Introduced in 1976.
- It was also 8-bit µP.
- Its clock speed was 3 MHz.
- Its data bus is 8-bit and address bus is 16-bit.
- It had 6,500 transistors.
- Could execute 7,69,230 instructions per second.
- It could access 64 KB of memory.
- It had 246 instructions.
- Over 100 million copies were sold.

Evaluation of Microprocessor

16-BIT MICROPROCESSORS

INTEL 8086

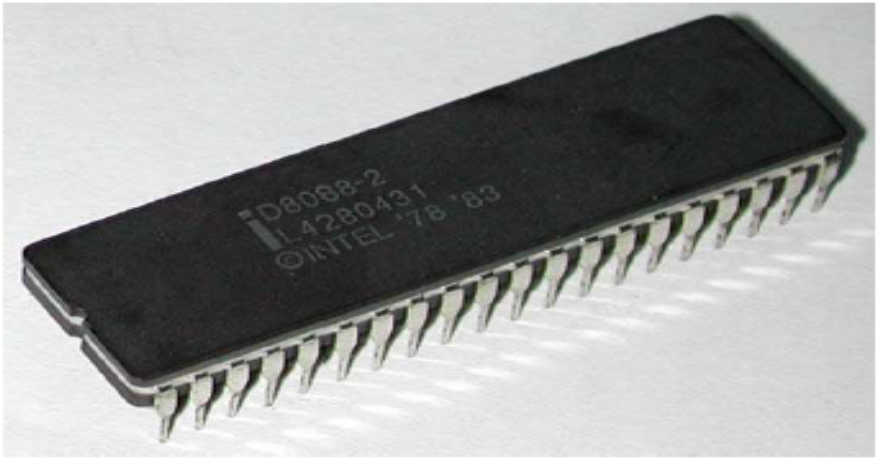


- Introduced in 1978.
- It was first 16-bit µP.
- Its clock speed is 4.77 MHz, 8 MHz and 10 MHz, depending on the version.
- Its data bus is 16-bit and address bus is 20-bit.
- It had 29,000 transistors.
- Could execute 2.5 million instructions per second.
- It could access 1 MB of memory.
- It had 22,000 instructions.
- It had ***Multiply*** and ***Divide*** instructions.

Evaluation of Microprocessor

16-BIT MICROPROCESSORS

INTEL 8088



- Introduced in 1979.
- It was also 16-bit µP.
- It was created as a cheaper version of Intel's 8086.
- It was a 16-bit processor with an 8-bit external bus.
- Could execute 2.5 million instructions per second.
- This chip became the most popular in the computer industry when IBM used it for its first PC.

Evaluation of Microprocessor

16-BIT MICROPROCESSORS

INTEL 80186 & 80188

- Introduced in 1982.
- They were 16-bit µPs.
- Clock speed was 6 MHz.
- 80188 was a cheaper version of 80186 with an 8-bit external data bus.
- They had additional components like:
  - Interrupt Controller
  - Clock Generator
  - Local Bus Controller
  - Counters

INTEL 80286

- Introduced in 1982.
- It was 16-bit µP.
- Its clock speed was 8 MHz.
- Its data bus is 16-bit and address bus is 24-bit.
- It could address 16 MB of memory.
- It had 1,34,000 transistors.
- It could execute 4 million instructions per second.

Evaluation of Microprocessor

32-BIT MICROPROCESSORS

INTEL 80386

- Introduced in 1986.
- It was first 32-bit µP.
- Its data bus is 32-bit and address bus is 32-bit.
- It could address 4 GB of memory.
- It had 2,75,000 transistors.
- Its clock speed varied from 16 MHz to 33 MHz depending upon the various versions.
- Different versions:
  - 80386 DX
  - 80386 SX
  - 80386 SL
- Intel 80386 became the best selling microprocessor in history.

INTEL 80486

- Introduced in 1989.
- It was also 32-bit µP.
- It had 1.2 million transistors.
- Its clock speed varied from 16 MHz to 100 MHz depending upon the various versions.
- It had five different versions:
  - 80486 DX
  - 80486 SX
  - 80486 DX2
  - 80486 SL
  - 80486 DX4
- 8 KB of cache memory was introduced.

Evaluation of Microprocessor

32-BIT MICROPROCESSORS

INTEL PENTIUM

- Introduced in 1993.
- It was also 32-bit µP.
- It was originally named 80586.
- Its clock speed was 66 MHz.
- Its data bus is 32-bit and address bus is 32-bit.
- It could address 4 GB of memory.
- Could execute 110 million instructions per second.
- Cache memory:
  - 8 KB for instructions.
  - 8 KB for data.

INTEL PENTIUM PRO

- Introduced in 1995.
- It was also 32-bit µP.
- It had L2 cache of 256 KB.
- It had 21 million transistors.
- It was primarily used in server systems.
- Cache memory:
  - 8 KB for instructions.
  - 8 KB for data.
- It had L2 cache of 256 KB.

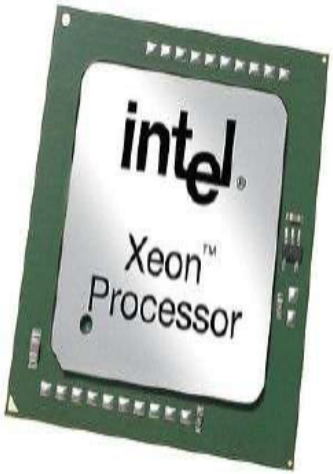
Evaluation of Microprocessor

32-BIT MICROPROCESSORS

INTEL PENTIUM II

- Introduced in 1997.
- It was also 32-bit µP.
- Its clock speed was 233 MHz to 500 MHz.
- Could execute 333 million instructions per second.
- MMX technology was supported.
- L2 cache & processor were on one circuit.

INTEL PENTIUM II XEON



- Introduced in 1998.
- It was also 32-bit µP.
- It was designed for servers.
- Its clock speed was 400 MHz to 450 MHz.
- L1 cache of 32 KB & L2 cache of 512 KB, 1MB or 2 MB.
- It could work with 4 Xeons in same system.

Evaluation of Microprocessor

32-BIT MICROPROCESSORS

INTEL PENTIUM III

- Introduced in 1999.
- It was also 32-bit µP.
- Its clock speed varied from 500 MHz to 1.4 GHz.
- It had 9.5 million transistors.

INTEL PENTIUM IV

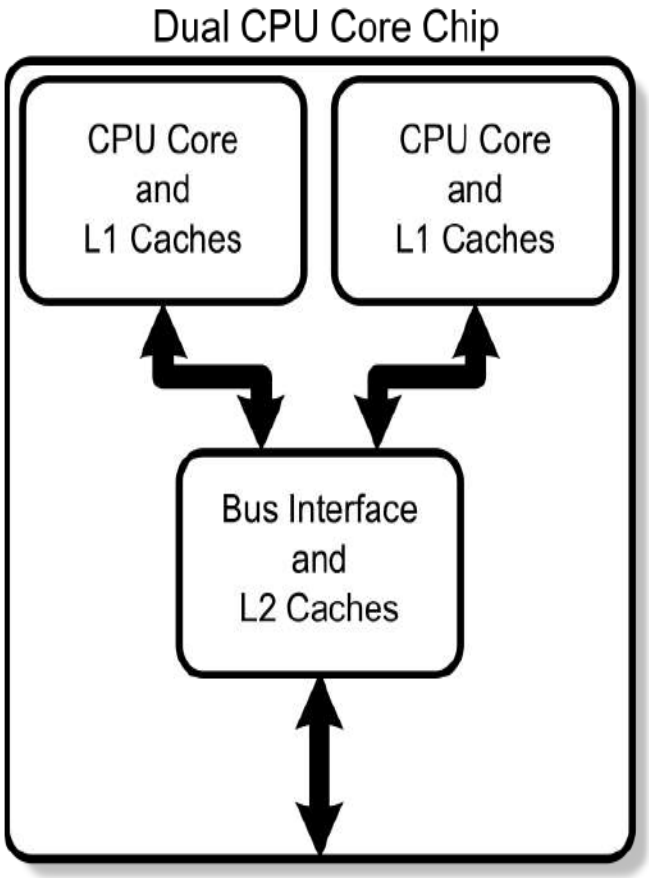
- Introduced in 2000.
- It was also 32-bit µP.
- Its clock speed was from 1.3 GHz to 3.8 GHz.
- L1 cache was of 32 KB & L2 cache of 256 KB.
- It had 42 million transistors.
- All internal connections were made from aluminium to copper.

Evaluation of Microprocessor

32-BIT MICROPROCESSORS

INTEL DUAL CORE

- Introduced in 2006.
- It is 32-bit or 64-bit µP.
- It has two cores.
- Both the cores have there own internal bus and L1 cache, but share the external bus and L2 cache (*Next Slide*).
- It supported SMT technology.
- SMT: Simultaneously Multi-Threading
- E.g.: Adobe Photoshop supported SMT.



Evaluation of Microprocessor

64-bit Microprocessors

Intel Core 2

- Introduced in 2006.
- It is a 64-bit µP.
- Its clock speed is from 1.2 GHz to 3 GHz.
- It has 291 million transistors.
- It has 64 KB of L1 cache per core and 4 MB of L2 cache.
- It is launched in three different versions:
  - Intel Core 2 Duo
  - Intel Core 2 Quad
  - Intel Core 2 Extreme

Intel Core i7

- Introduced in 2008.
- It is a 64-bit µP.
- It has 4 physical cores.
- Its clock speed is from 2.66 GHz to 3.33 GHz.
- It has 781 million transistors.
- It has 64 KB of L1 cache per core, 256 KB of L2 cache and 8 MB of L3 cache.

Evaluation of Microprocessor

64-bit Microprocessors

Intel Core i5

- Introduced in 2009.
- It is a 64-bit µP.
- It has 4 physical cores.
- Its clock speed is from 2.40 GHz to 3.60 GHz.
- It has 781 million transistors.
- It has 64 KB of L1 cache per core, 256 KB of L2 cache and 8 MB of L3 cache.

Intel Core i3

- Introduced in 2010.
- It is a 64-bit µP.
- It has 2 physical cores.
- Its clock speed is from 2.93 GHz to 3.33 GHz.
- It has 781 million transistors.
- It has 64 KB of L1 cache per core, 512 KB of L2 cache and 4 MB of L3 cache.

Evolution of Intel Microprocessors

4-bit	8-bit	16-bit	32-bit	64-bit
4004	8008	8086	80386	Dual Core
4040	8080	8088	80486	Core 2
	8085	80186	Pentium/80586	Core i7
		80188	PII	Core i5
		80286	PIII	Core i3
			PIV	
			Dual Core	

Thank you