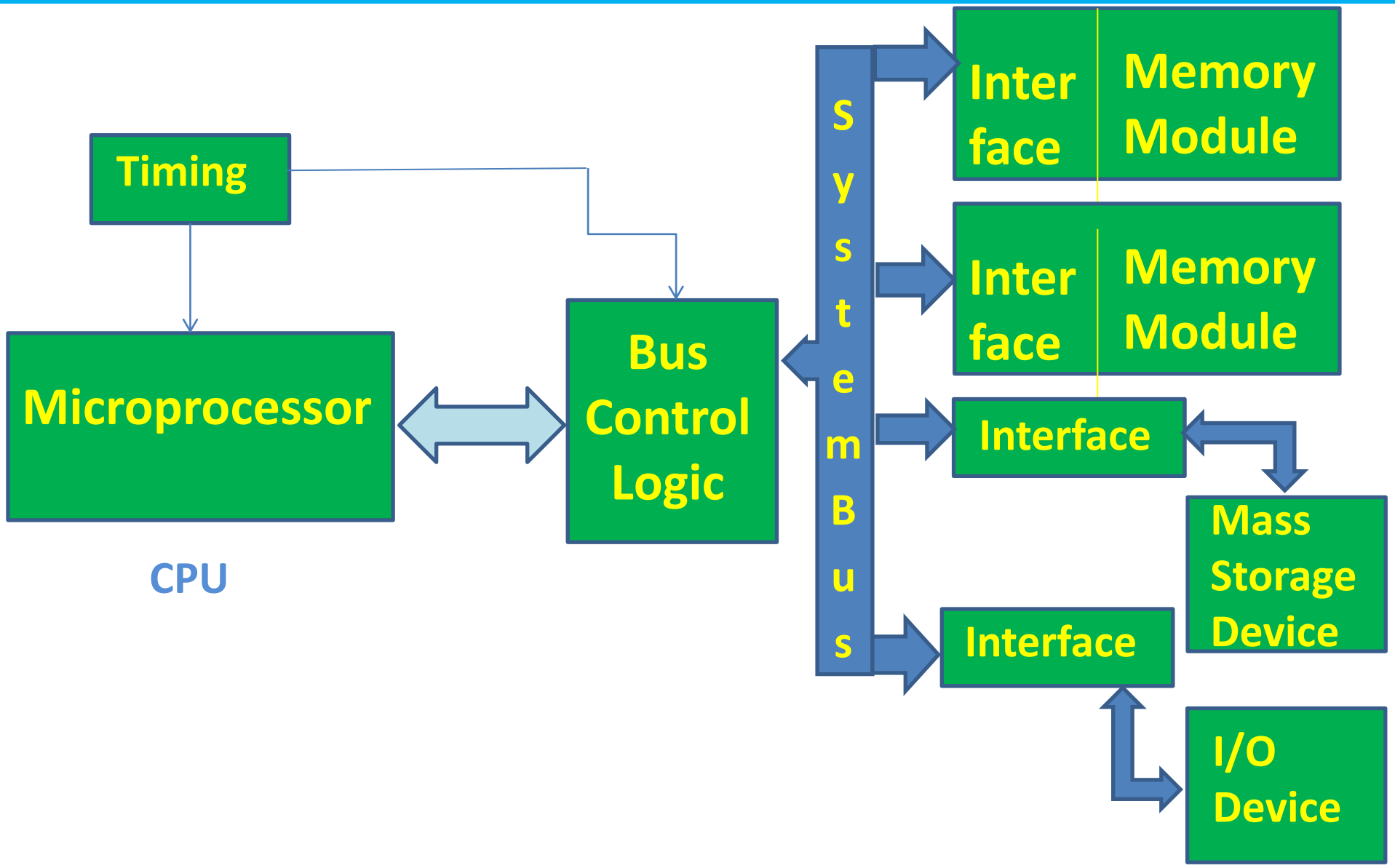
Microcomputer Structure & Operation

Sub: EE304- Microprocessors and Microcontrollers

Microcomputer Structure & Operation



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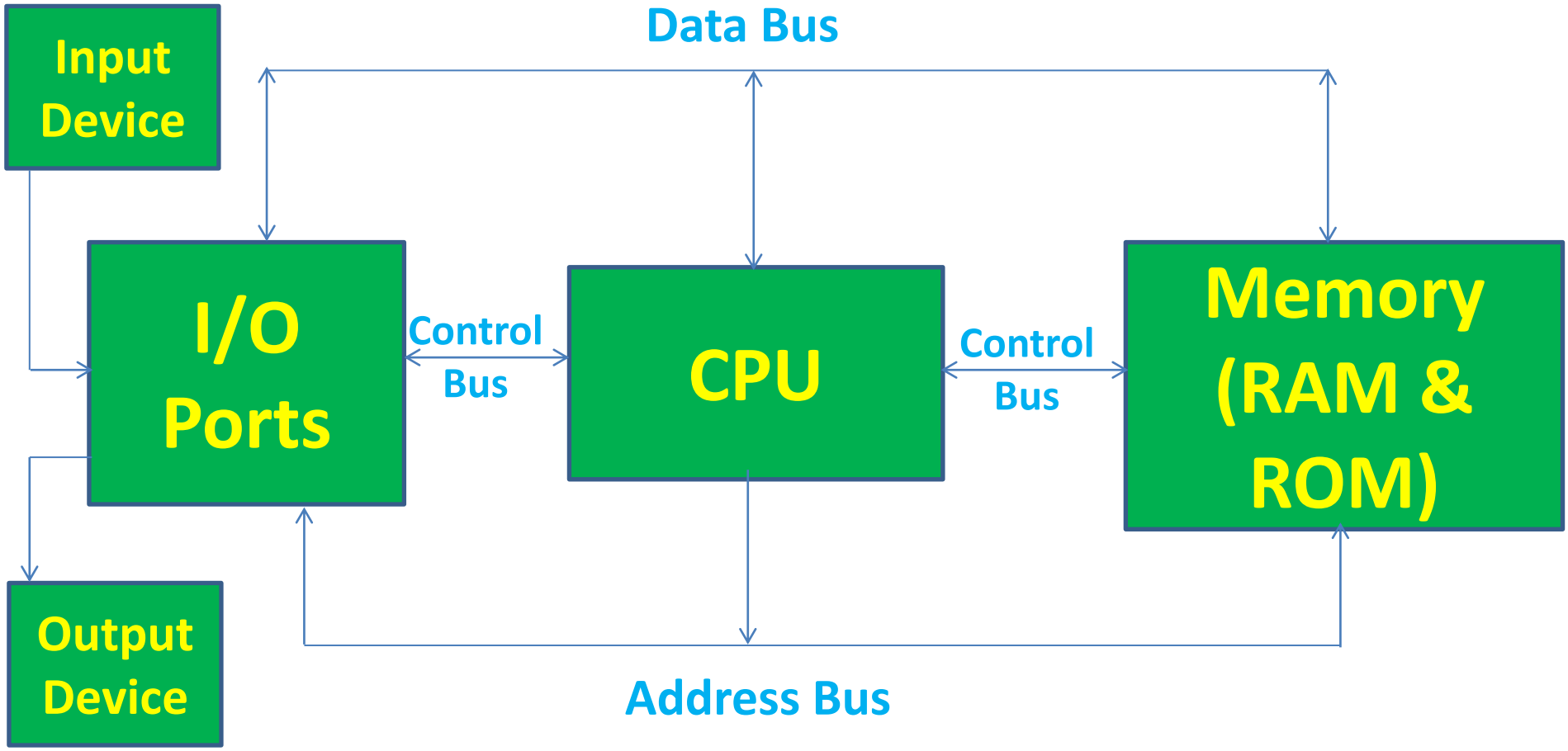
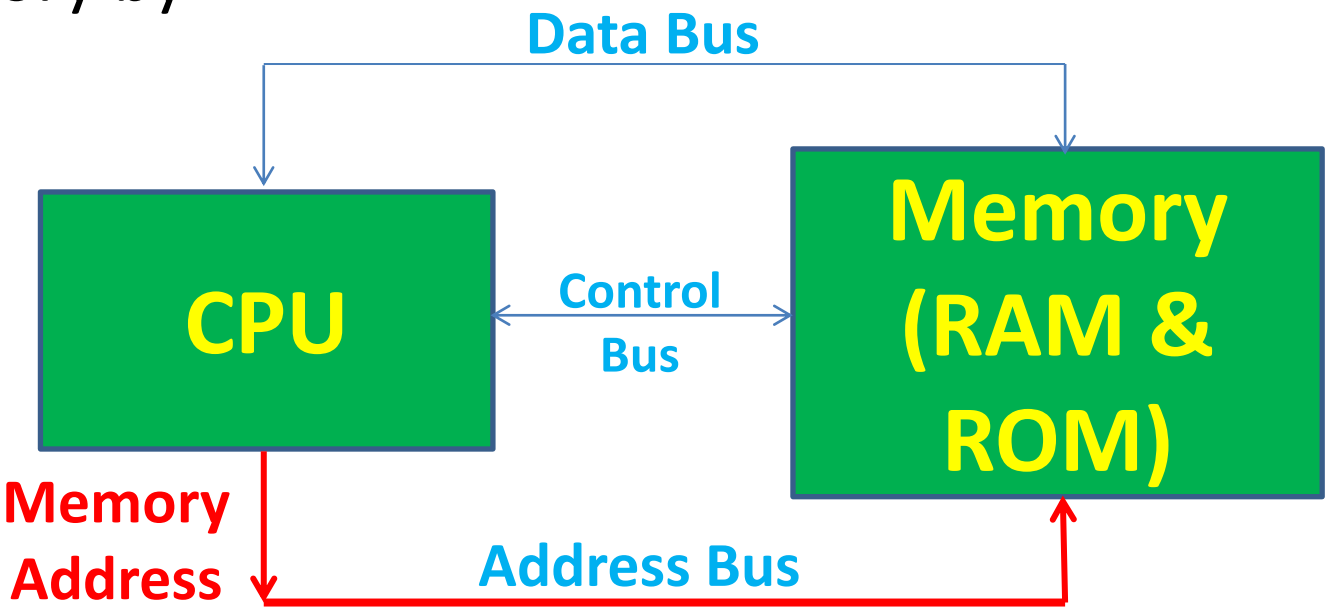


Microcomputer Structure & Operation

The Processor fetches each program instruction in sequence, decodes the instruction and executes it.

Simple Memory read operation

- Fetches instructions or reads data from memory by



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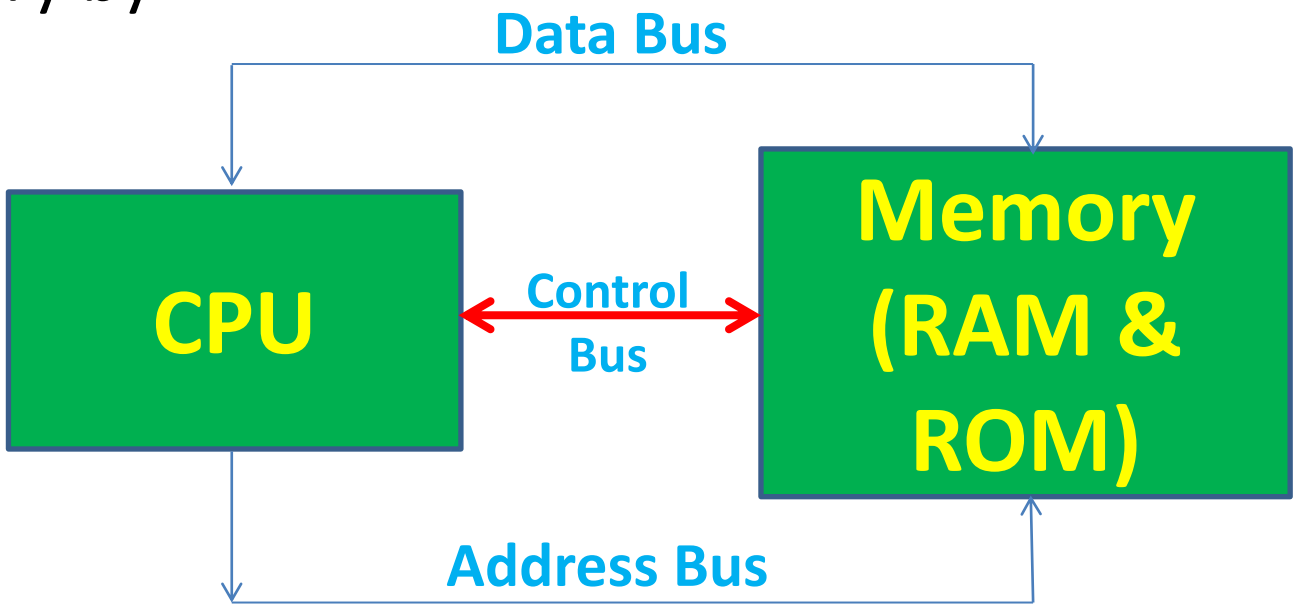

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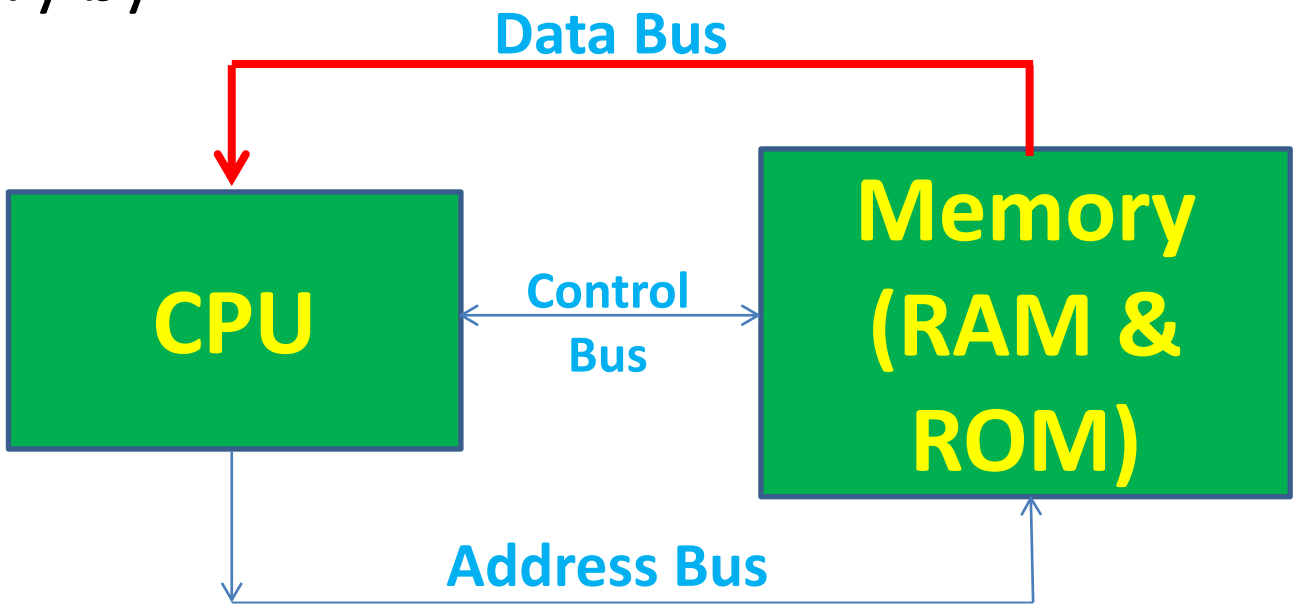

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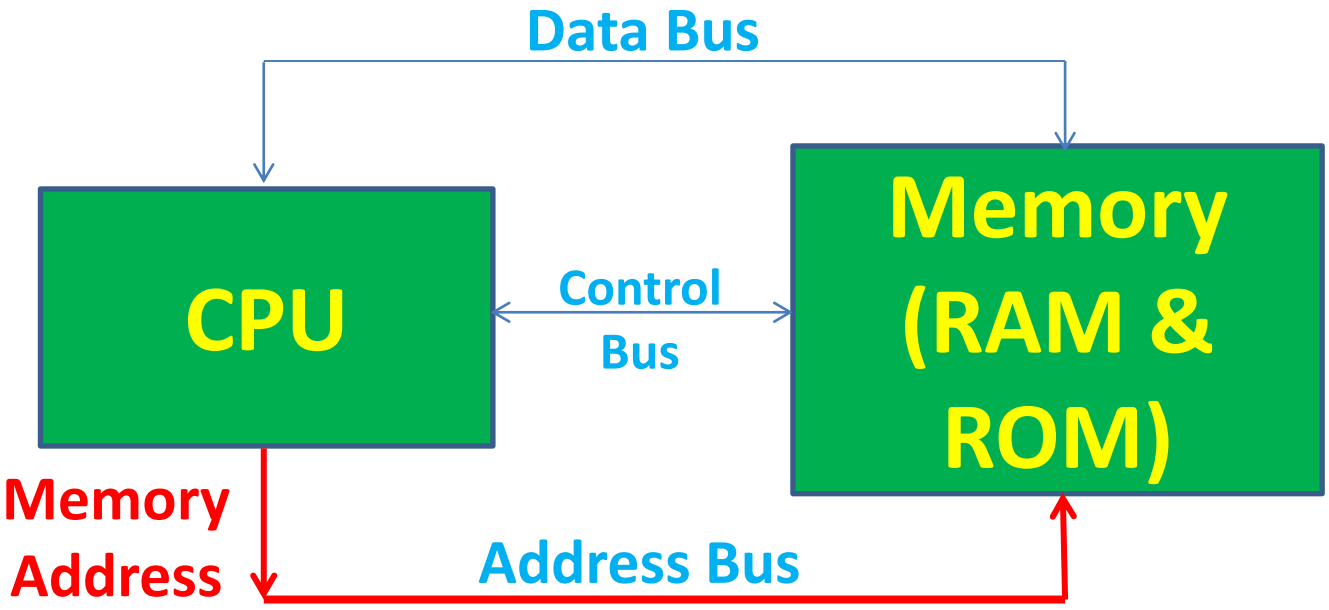

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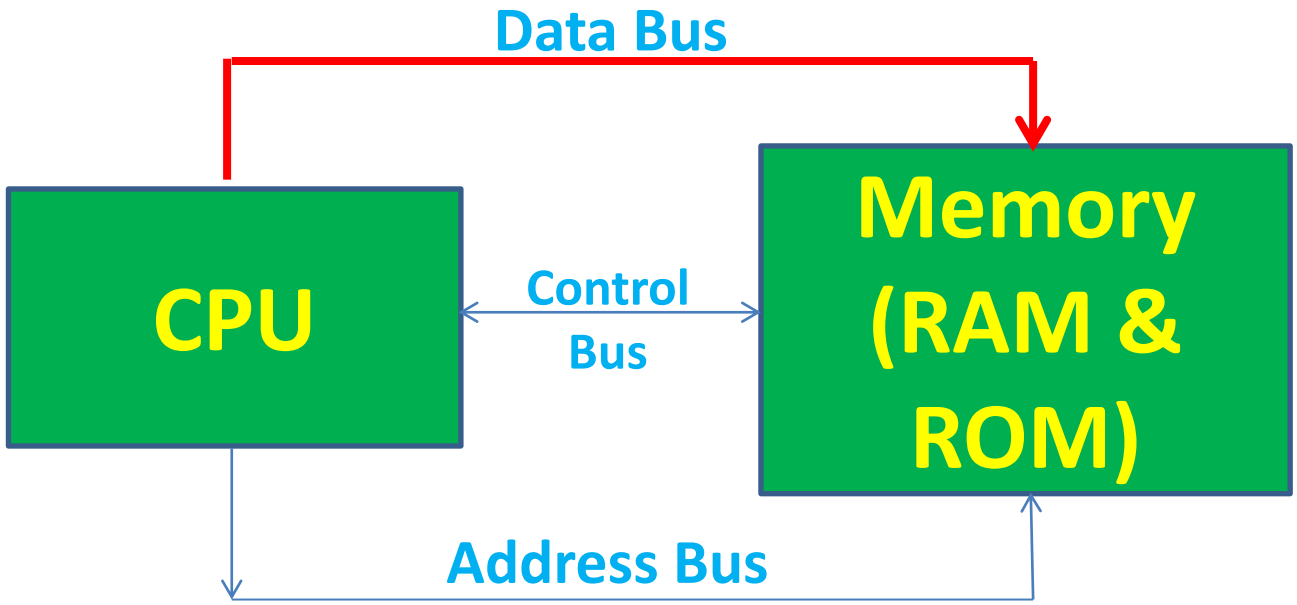

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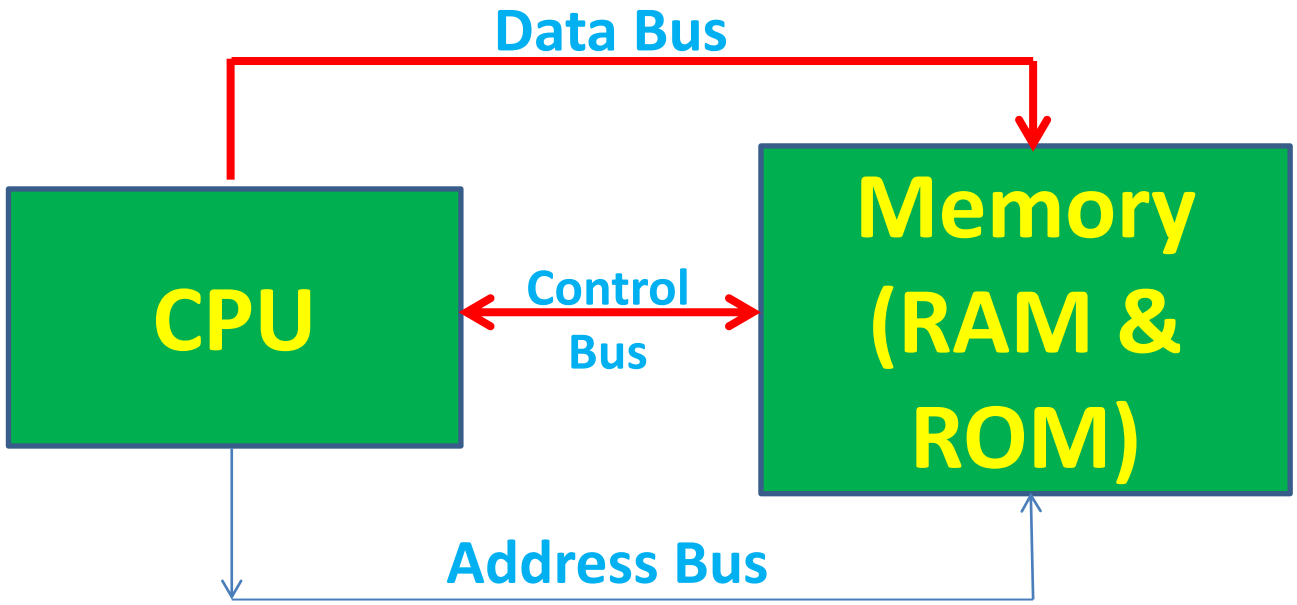

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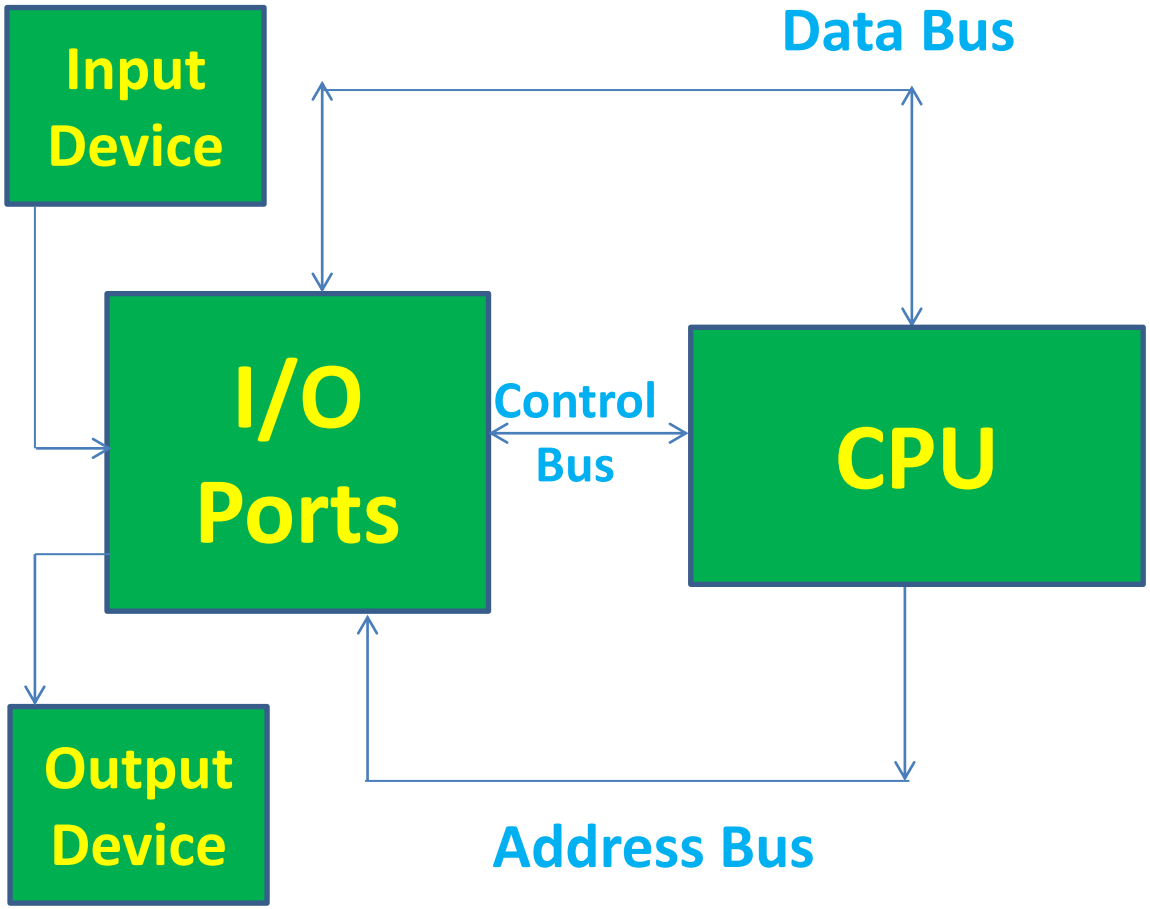
Simple I/O read operation



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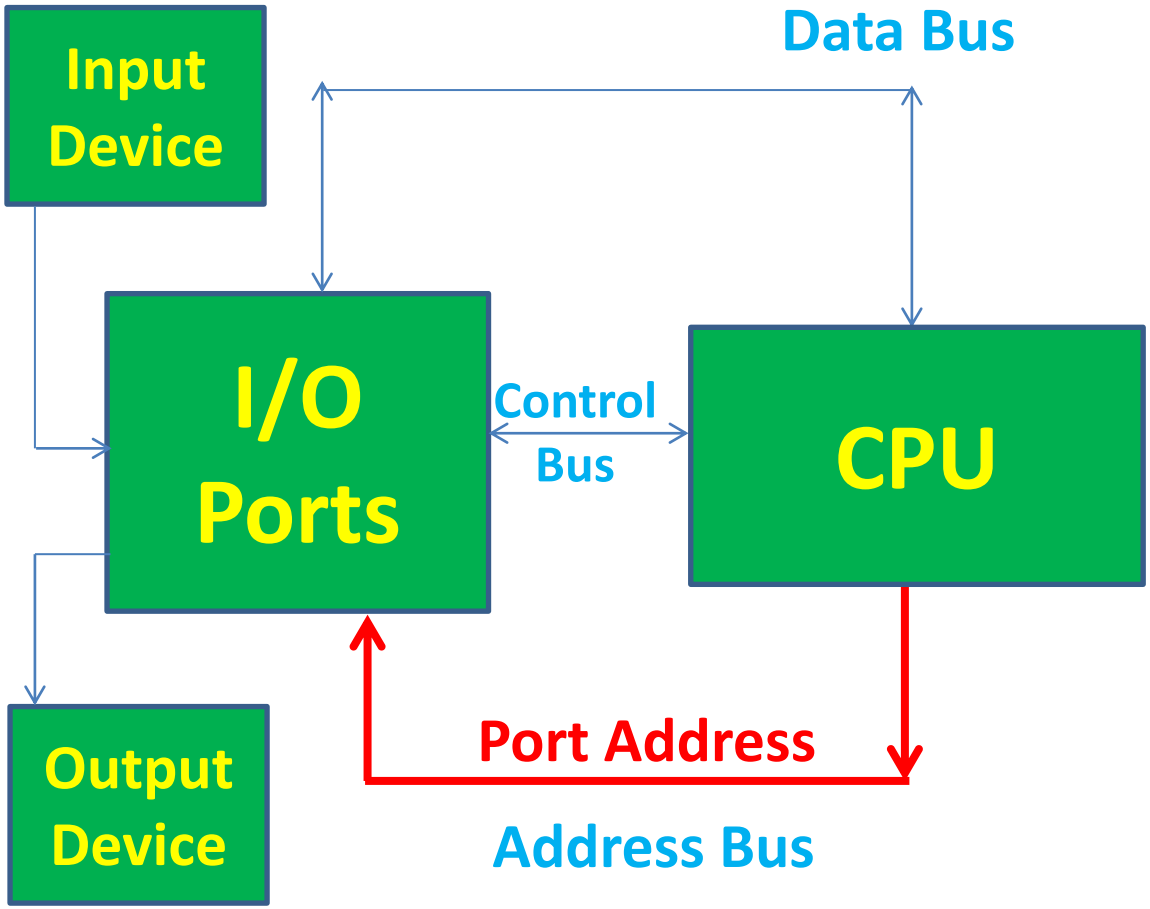

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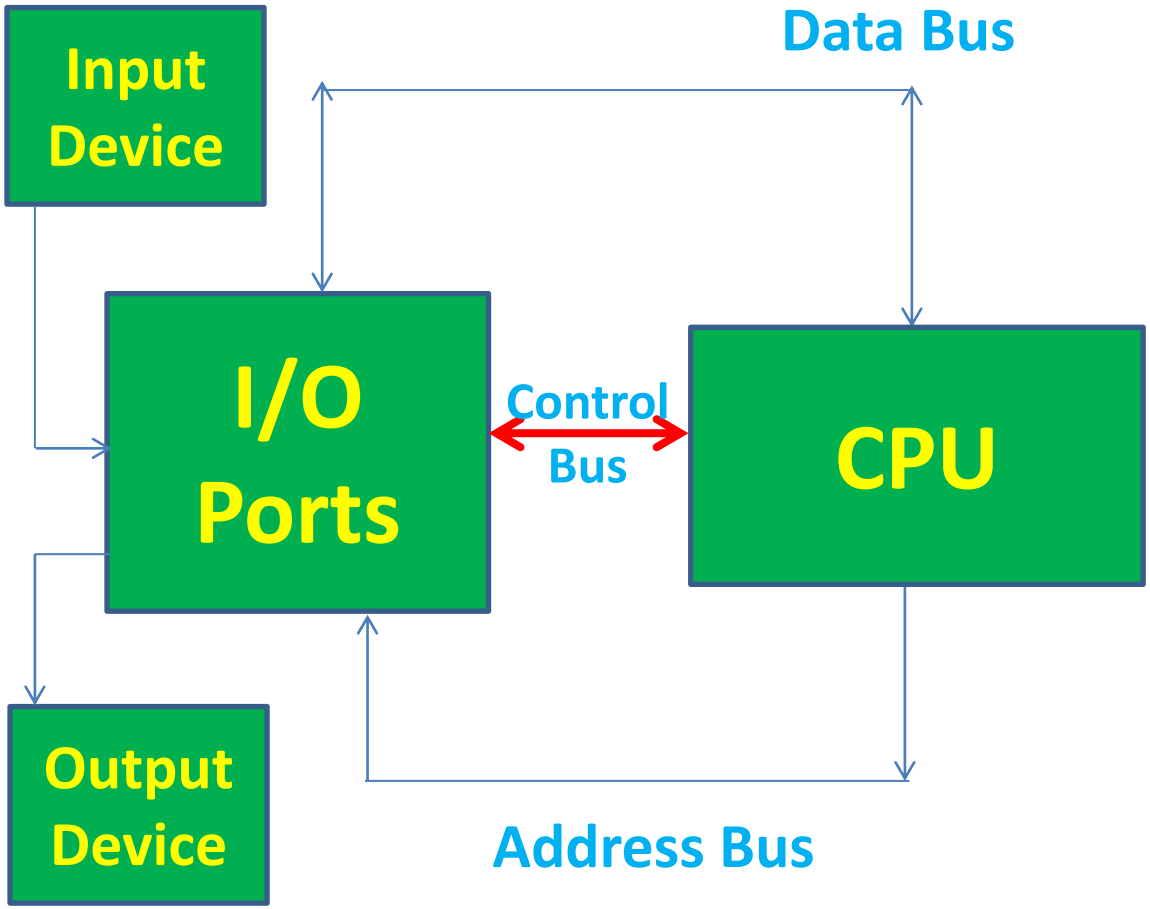

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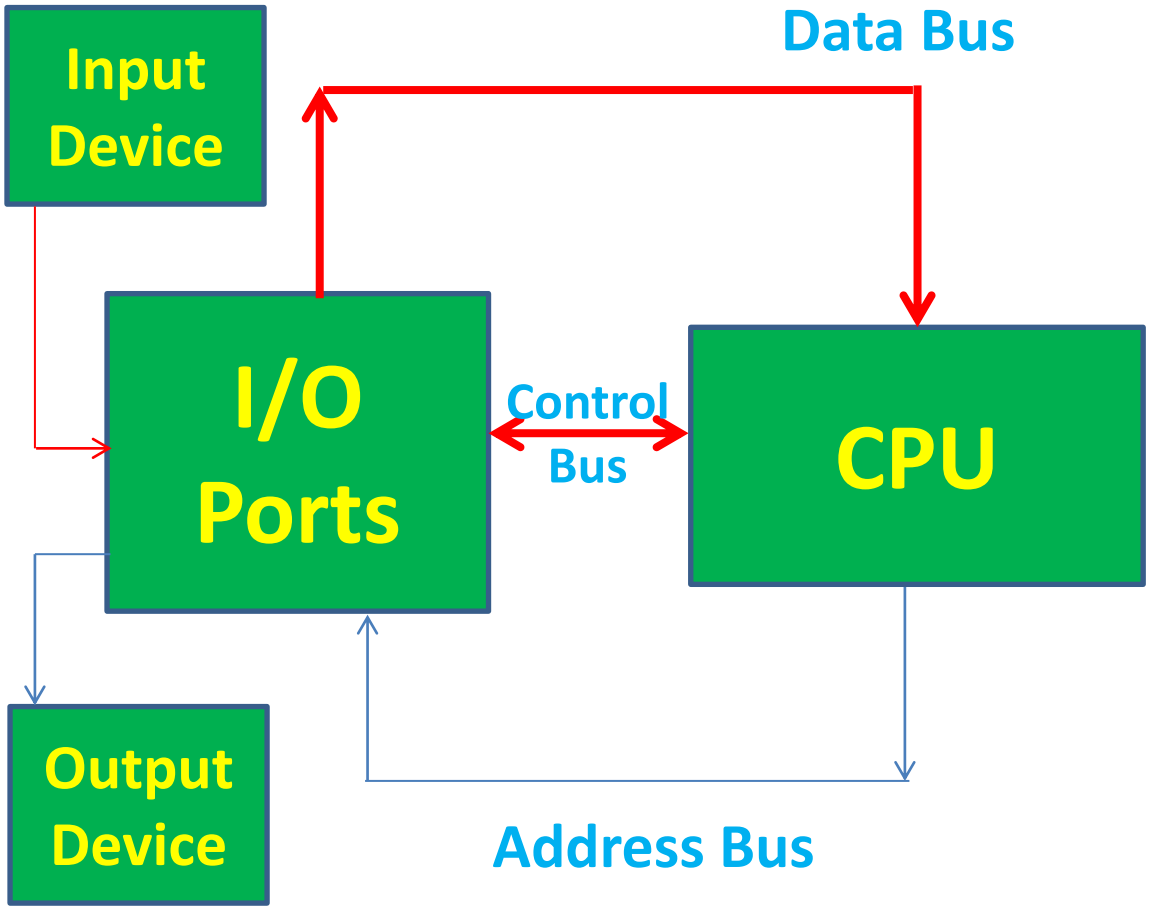


Microprocessor Evolution

- One way of categorizing microprocessors is by the number of bits work with it at a time.

(i.e. their Arithmetic and logical unit (ALU), its internal registers and most of instructions designed to work with)

Microprocessor Evolution

- First Commercially available Microprocessor was the **INTEL 4004** Produced in 1971
- Intel 8008 in 1972
- Intel 8080 in 1974 and referred to as second generation microprocessor
- Motorola MC 6800
- Apple II Microcomputer and Zilog Z80

Microprocessor Evolution

Then with taking care of architecture and features optimized for doing certain types of task, microprocessor evolved in three major directions

- General Purpose CPU
- Dedicated or Embedded Controllers
- Bit-Slice Processors

Internal Architecture of 8086 Microprocessor

EE304- Microprocessors and Microcontrollers

Architecture of 8086 Microprocessor

- It is a 16-bit Microprocessor
- It has 16-bit databus
  - It can read data from or write data to memory and ports either 16-bits or 8-bits at a time
- It has 20-bit Address bus
  - It can address 2^{20} memory locations i.e. 1MB
  - Each location is of Byte wide
  - 16-bit word will be stored in two consecutive memory locations
  - If the first byte of a word is at even address, 8086 can read the entire word in one operation and if odd, in two operations

Architecture of 8086 Microprocessor

- 8086 microprocessor contains 29000 transistors and fabricated using HMOS technology (n-mos and p-mos amalgumated)
- It is 40-pin IC
- It has 20-address pins, 16 of which used as data pins
  - AD_0-AD_{15}
  - A_{16}-A_{19}
- Multiplexing of addresses and data reduces the no. of pins needed, but slow down the transfer of data.
- Because of the timing on the bus, the transfer rate is not decreased as much.

Architecture of 8086 Microprocessor

- 16-control lines for providing Handshaking signals during bus transfers and for permitting at least some external control of the CPU.
- +5V supply voltage
- Clock frequency
  - 5MHz (8086)
  - 8 MHz (8086-version 2)
  - 10 MHz (8086-version 1)

Architecture of 8086 Microprocessor

Register organization of 8086 microprocessor

General Data Registers		
	15 8	7 0
AX	AH	AL
BX	BH	BL
CX	CH	CL
DX	DH	DL

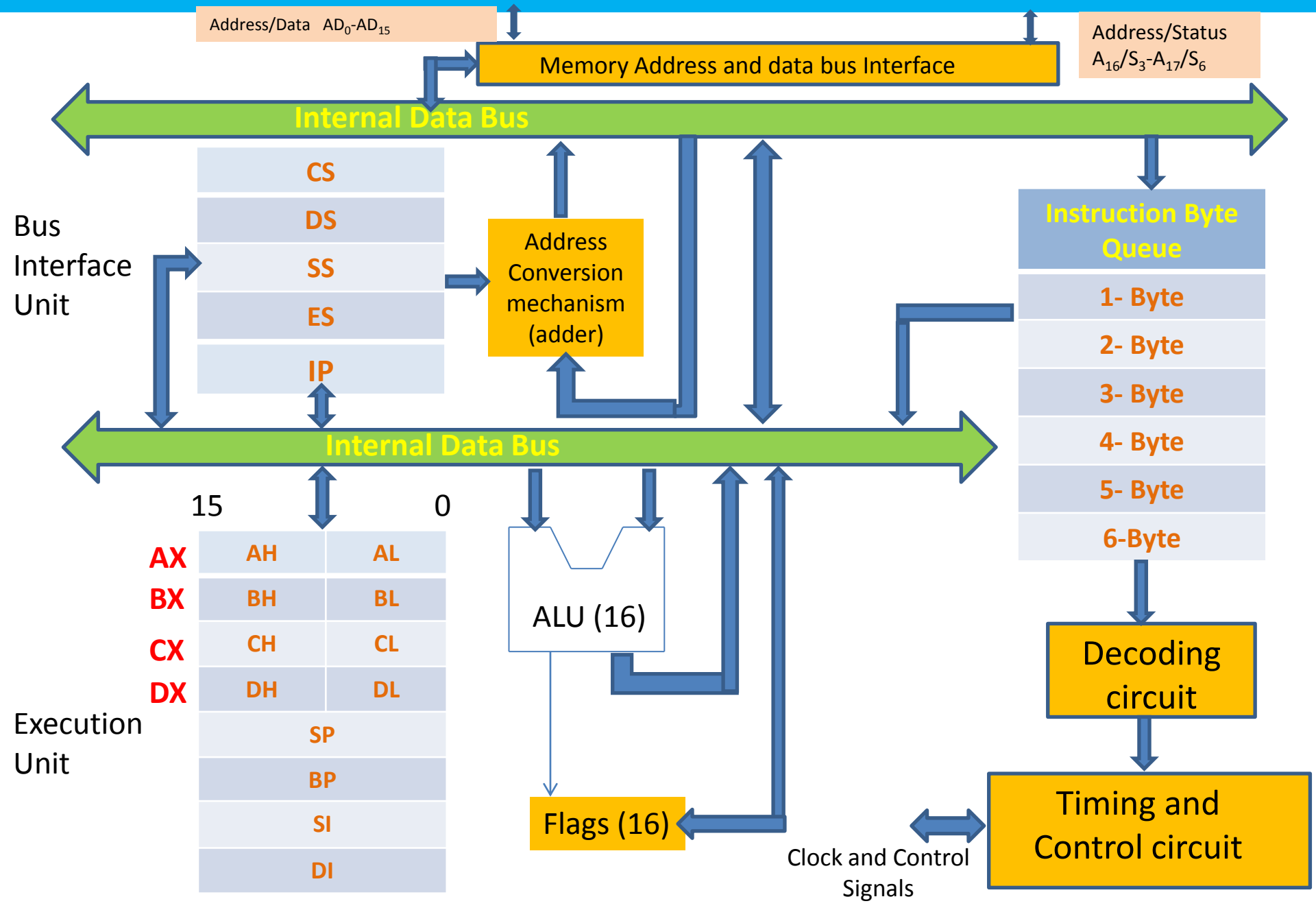
Segment Registers	
CS	Code Segment Register
DS	Data Segment Register
SS	Stack Segment Register
ES	Extra Segment Register

Pointer Registers	
IP	Instruction Pointer Register
BP	Base Pointer Register
SP	Stack Pointer Register

Index Registers	
SI	Source Index Register
DI	Destination Index Register

Flag Register	
6-Conditional Flags	3-Control Flags

Architecture of 8086 Microprocessor



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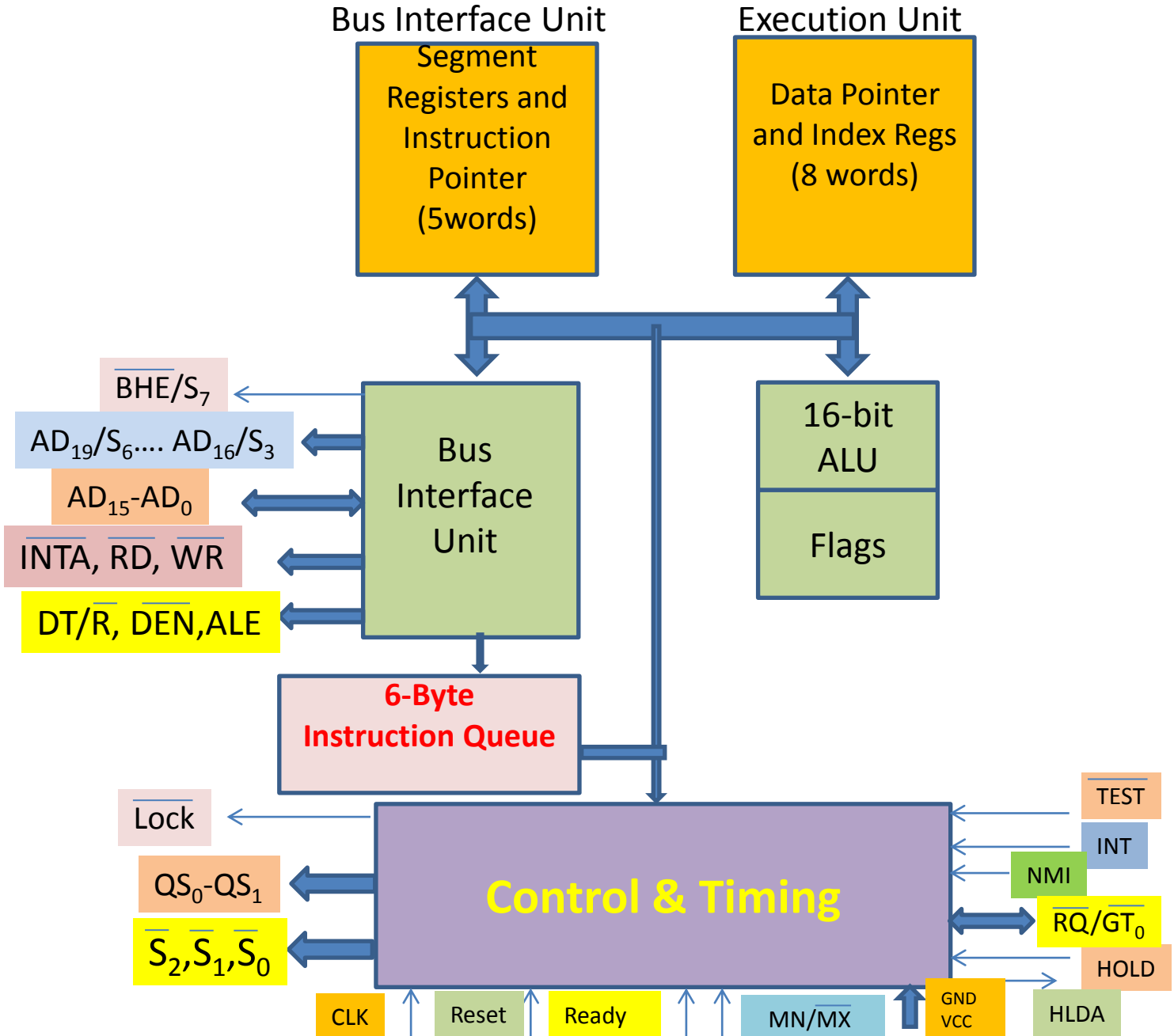

Architecture of 8086 Microprocessor

	15	0
AX	AH	AL
BX	BH	BL
CX	CH	CL
DX	DH	DL

Nibble	4-bit
Byte	8-bit
word	16-bit
Double Word	32-bit

AX		0001001000110100	
AH	AL	00010010	00110100
AX		1234H	
AH	AL	12H	34H

Architecture of 8086 Microprocessor3

Special functions of General Purpose Data Registers

AX Register

- It is used as 16-bit accumulator
- AL is used as 8-bit accumulator
- Default operand in MUL and DIV operation
- Source and Destination for data during I/O operations

Architecture of 8086 Microprocessor3

Special functions of General Purpose Data Registers

BX Register

- It can be used as a Memory Pointer to access data i.e. used as a base register in address calculation

- MOV AX,[BX]
- MOV AX, [BX][SI]