Microprocessor architecture and registers

UCS1502
MICROPROCESSORS AND INTERFACING

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AP/CSE

Learning Objective

- To understand the Architecture of 8086 microprocessor
- To understand the purpose of registers

Overview

- Block Diagram of 8086
- Different categories of registers
- Purpose of each register

Block Diagram of 8086

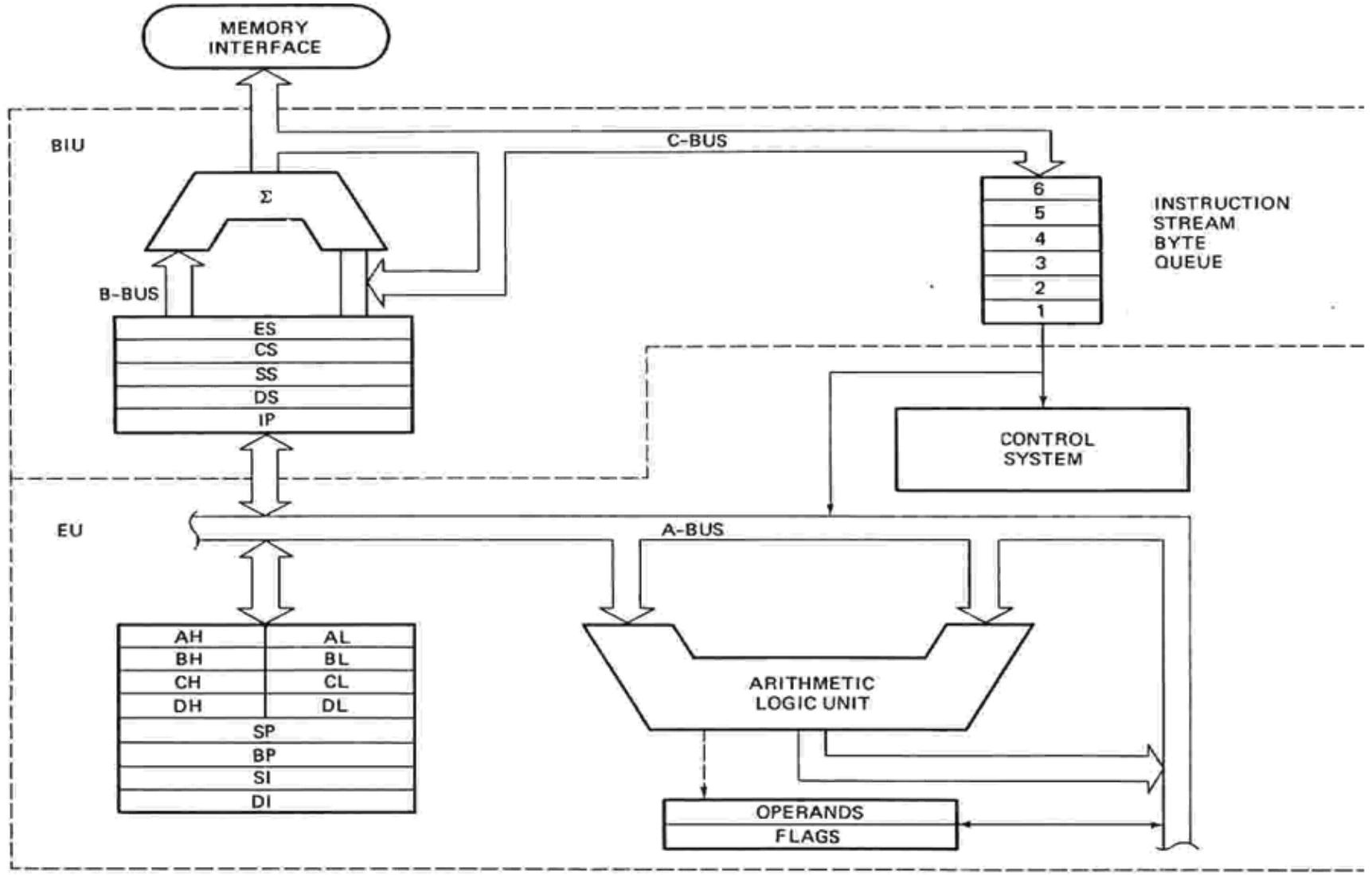
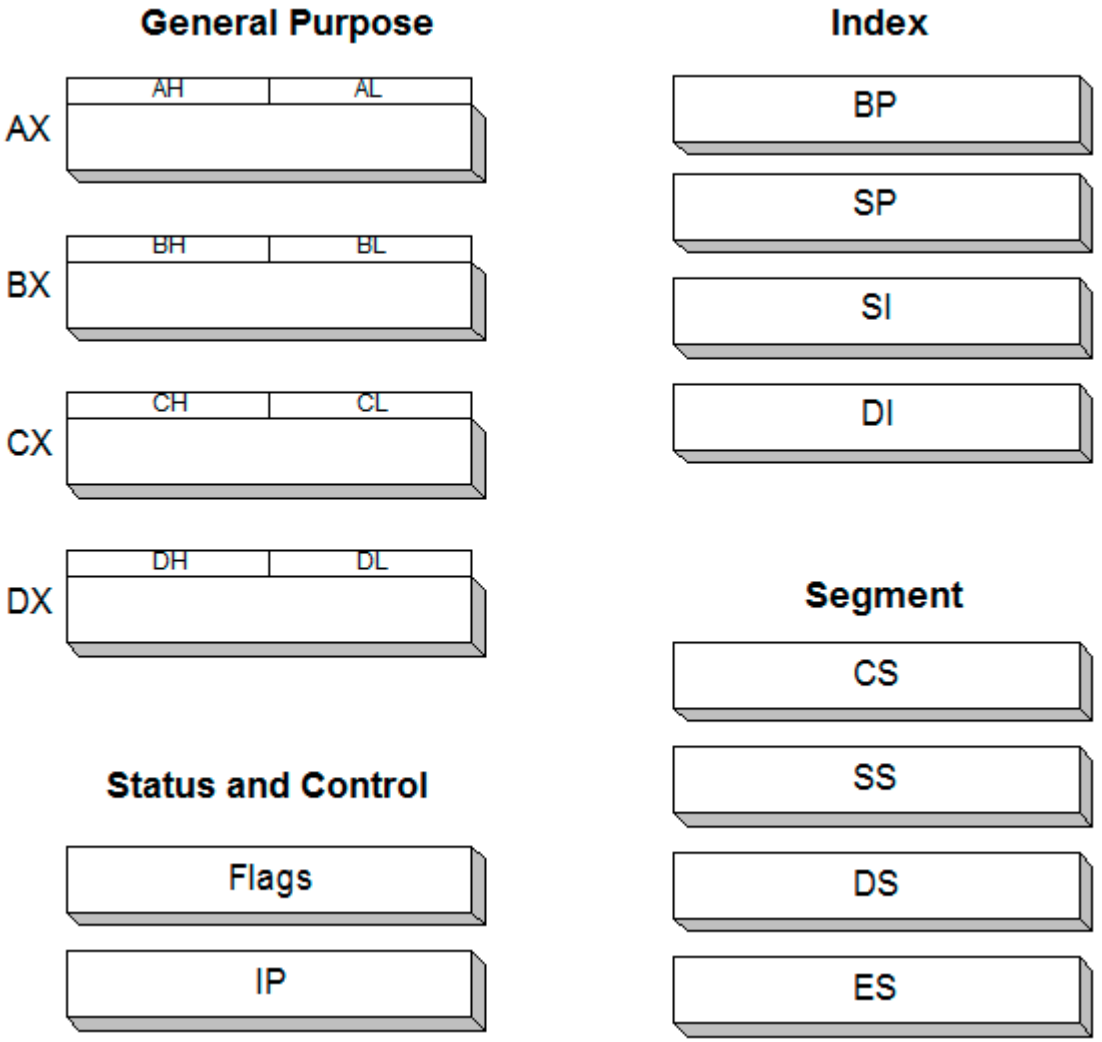


FIGURE 2-7 8086 internal block diagram. (*Intel Corp.*)

8086 Registers



General purpose registers

- AX
  - Accumulator Register
  - Preferred register to use in arithmetic, logic and data transfer instructions because it generates the shortest Machine Language Code
  - Must be used in multiplication and division operations
  - Must be used in I/O operations
- BX
  - Base Register
  - Serves as an address register

General purpose registers

- CX
  - Count register
  - Used as a loop counter
  - Used in shift and rotate operations
- DX
  - Data register
  - Used in multiplication and division
  - Also used in I/O operations

Pointer and Index Registers

- All 16 bits wide, L/H bytes are not accessible
- used as memory pointers
- Example: MOV AH, [SI]
  - Move the byte stored in memory location whose address is contained in register SI to register AH
- IP is not under direct control of the programmer

Pointer and Index Registers

- Contain the offset addresses of memory locations
- Can be used in arithmetic and other operations
- SP: Stack pointer
  - Used with SS to access the stack segment
- BP: Base Pointer
  - Primarily used to access data on the stack
  - Can be used to access data in other segments

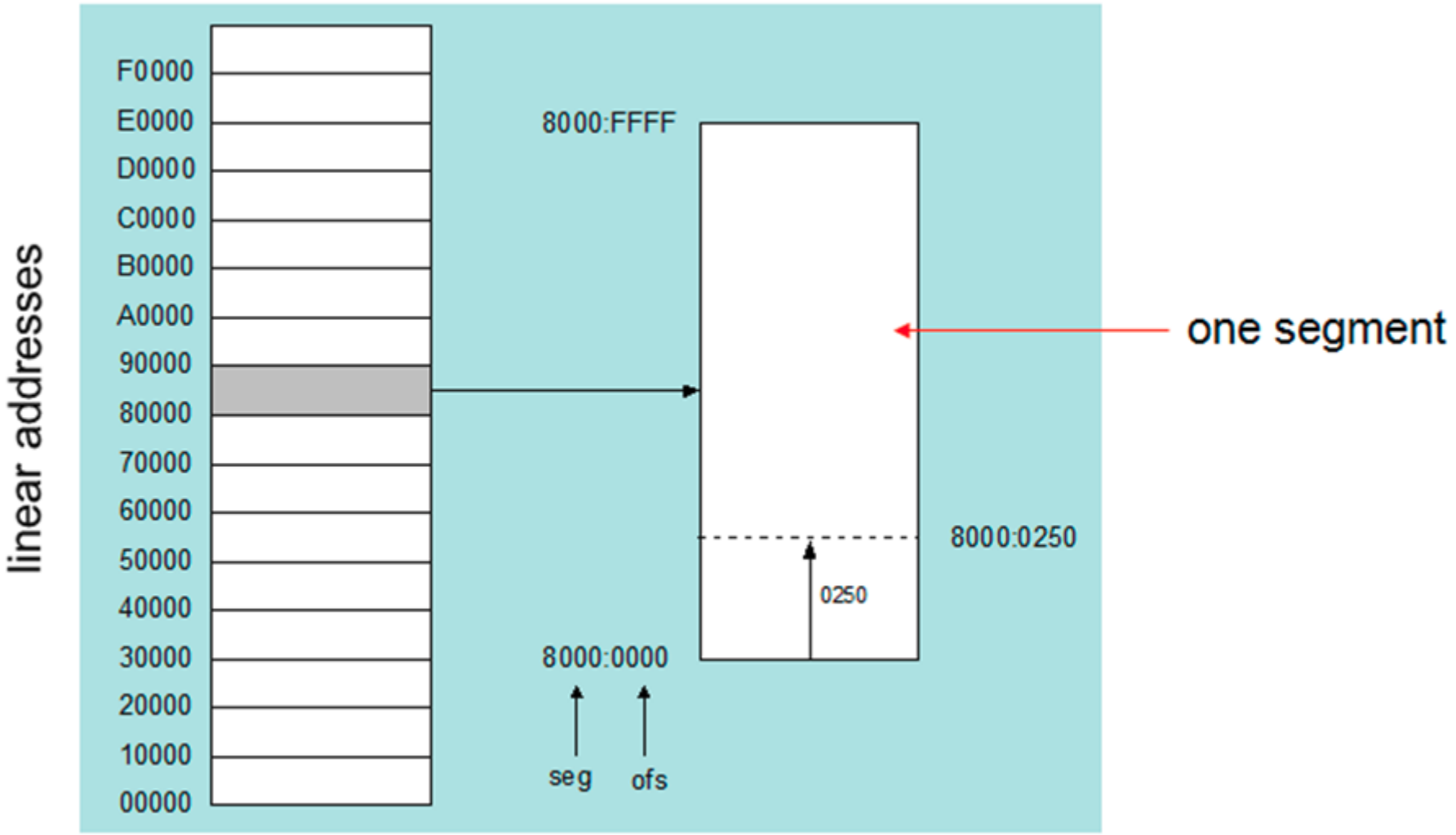
Pointer and Index Registers

- SI: Source Index register
  - Required for some string operations
  - When string operations are performed, the SI register points to memory locations in the data segment which is addressed by the DS register.
  - SI is associated with the DS in string operations.
- DI: Destination Index register
  - Required for some string operations
  - When string operations are performed, the DI register points to memory locations in the data segment which is addressed by the ES register.
  - DI is associated with the ES in string operations.
- The SI and the DI registers may be used to access data stored in arrays

Segment Register

- CS, DS, SS and ES
- Stores the memory addresses of instructions and data
- Memory Organization
  - Each byte in memory has a 20 bit address starting with 0 to 2^{20}-1 or 1 MB of addressable memory
  - Addresses are expressed as 5 hex digits from 00000 - FFFFF
  - Problem: But 20 bit addresses are TOO BIG to fit in 16 bit registers!
  - Solution: Memory Segment
    - Block of 64K (65,536) consecutive memory bytes
    - A segment number is a 16 bit number
    - Segment numbers range from 0000 to FFFF
    - Within a segment, a particular memory location is specified with an offset
    - An offset also ranges from 0000 to FFFF

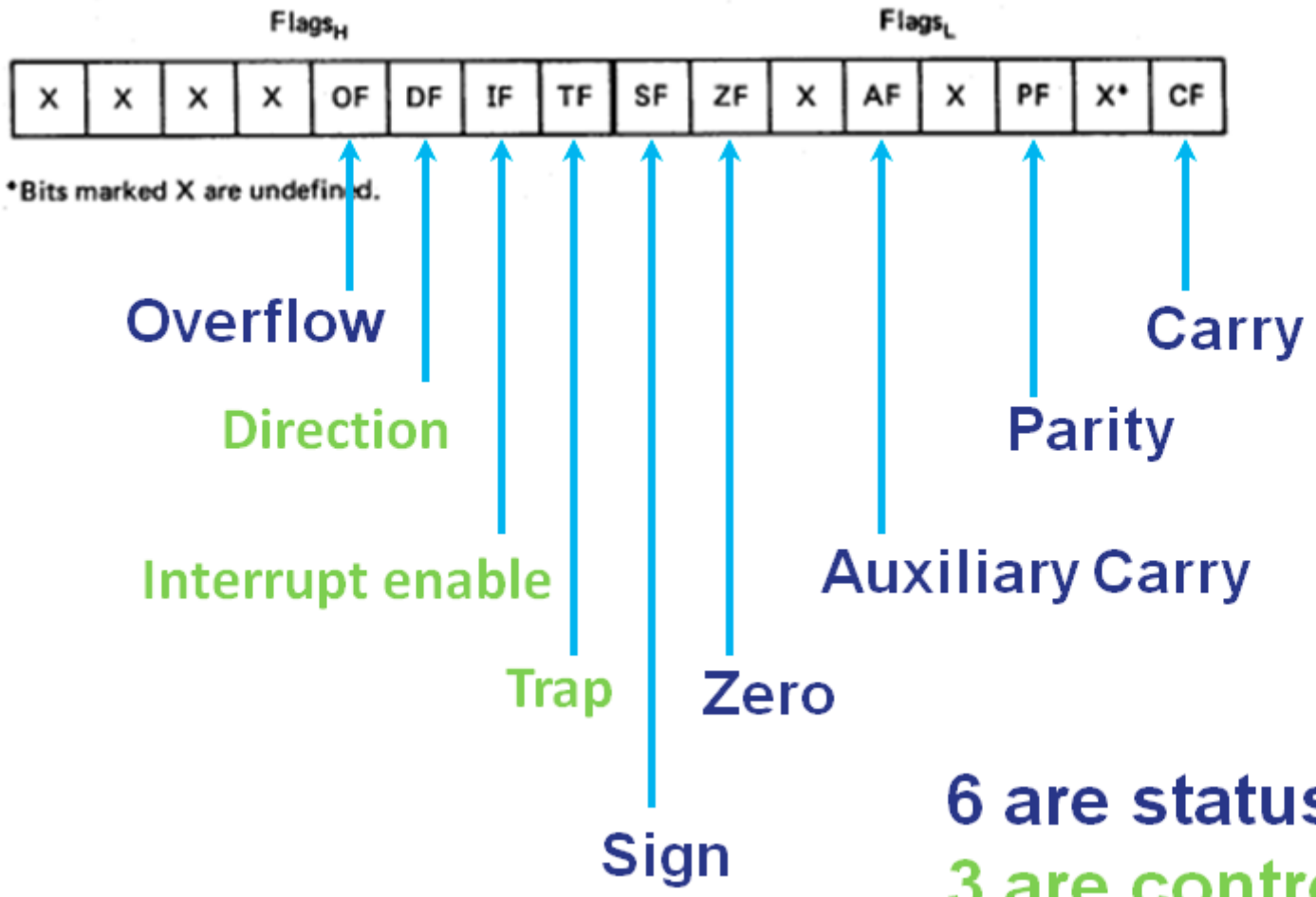
Memory Organisation



Computing Physical Address

SEGMENT	SEGMENT REGISTER	OFFSET REGISTER
Code Segment	CSR	**Instruction Pointer (IP)**
Data Segment	DSR	**Source Index (SI)**
Extra Segment	ESR	**Destination Index (DI)**
Stack Segment	SSR	**Stack Pointer (SP) / Base Pointer (BP)**

Flag register



Check your understanding

- What is the difference SI and SP?
- Why do we need segment registers?

Summary

- Architecture of 8086
- Registers and its purpose

Reference

- Doughlas V Hall, “Microprocessors and Interfacing, Programming and Hardware”, TMH, 2012.

Thank you