Microcontrollers

Part two of Review

Microprocessor

Intel: 8086, 80286, 80386, 80486, and Pentium

Motorola: 68000, 68010, 68020, 68030, 68040

Microprocessor

On the chip

No RAM; No ROM; No I/O ports;

Intel: 8086, 80286, 80386, 80486, and Pentium

Motorola: 68000, 68010, 68020, 68030, 68040

Microcontrollers

Microchip, Motorola, Zilog, Atmel, Dallas Semiconductor:

- Based on 8051
- Family members of 8051: 8052 and 8031

Texas Instruments: based on 8751

Renesas: M34501 *Motorola:* 68HC16Z3

Sharp: LH79520

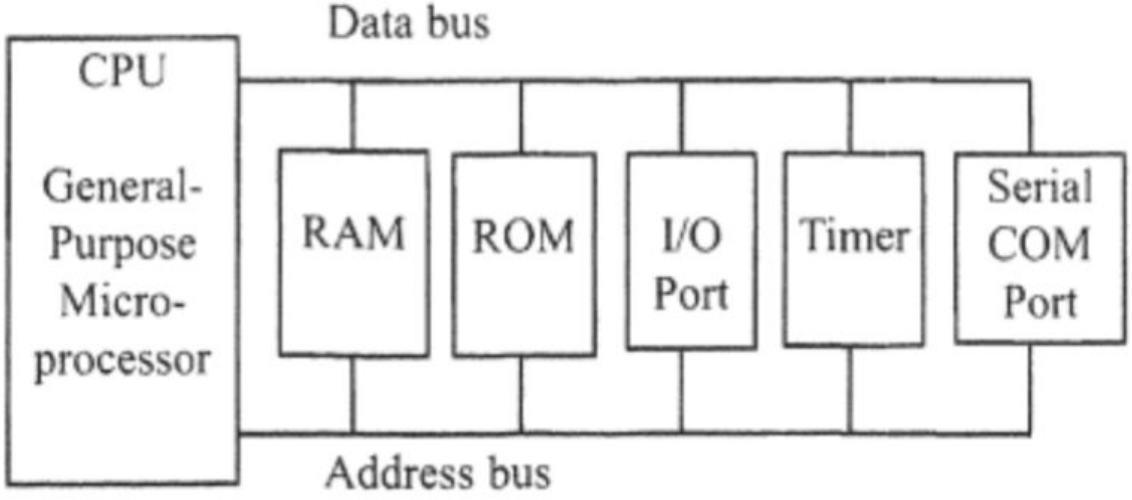
Microcontroller

CPU

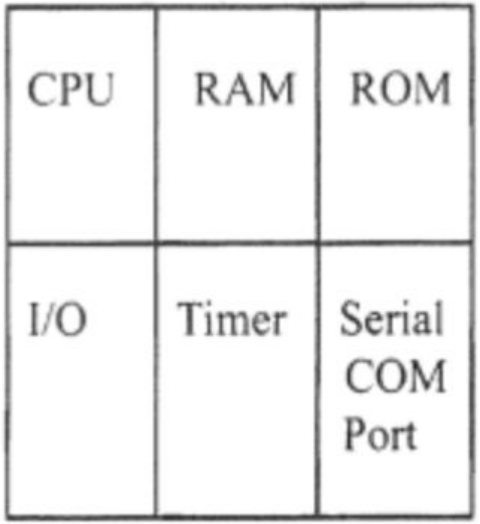
+ RAM + ROM

+ I/O ports + Timers + ...

On the Chip



(a) General-Purpose Microprocessor System



(b) Microcontroller

μCs vs μPs (other diffs)

smaller

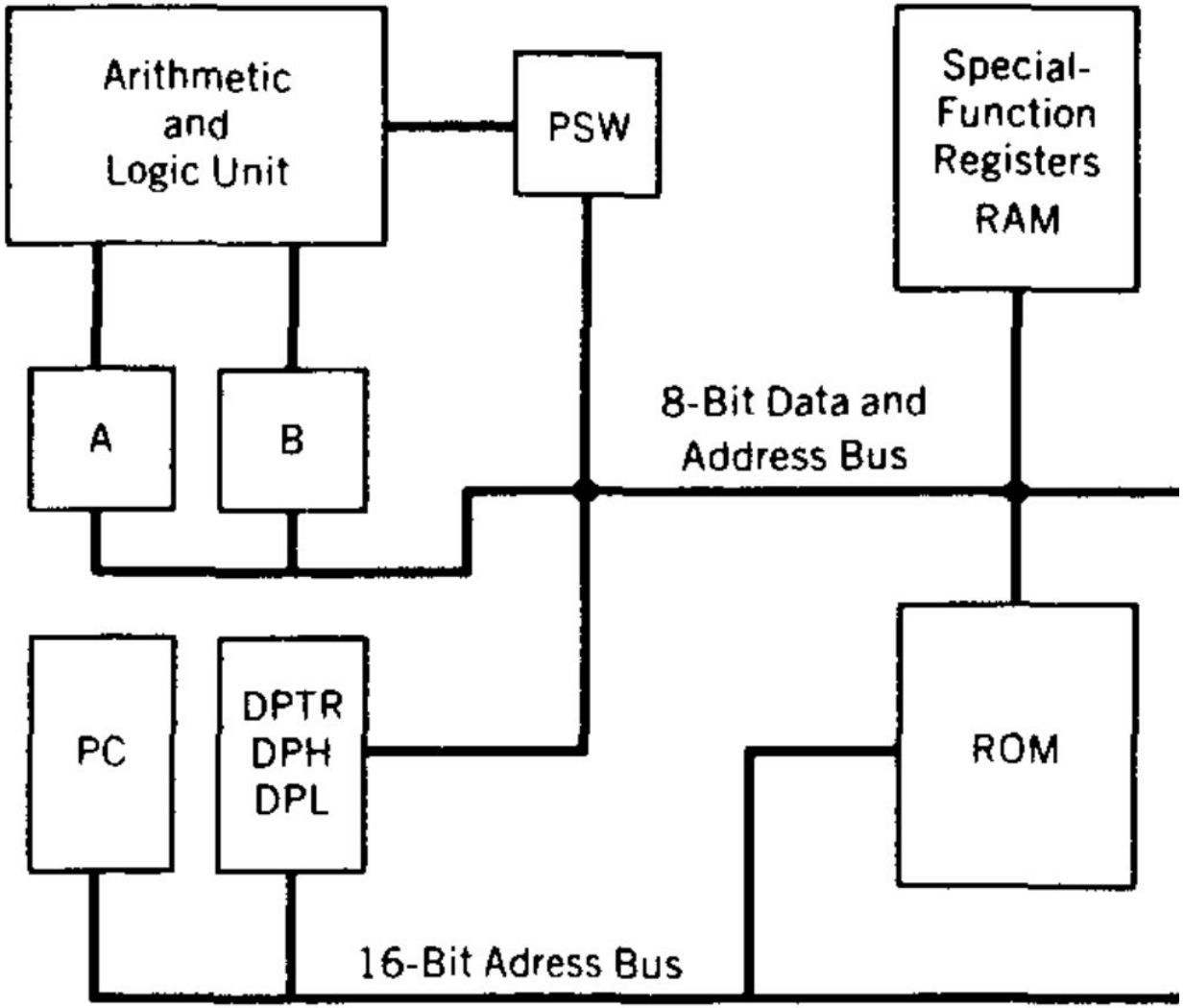
cost and space are critical

computing power needs are less

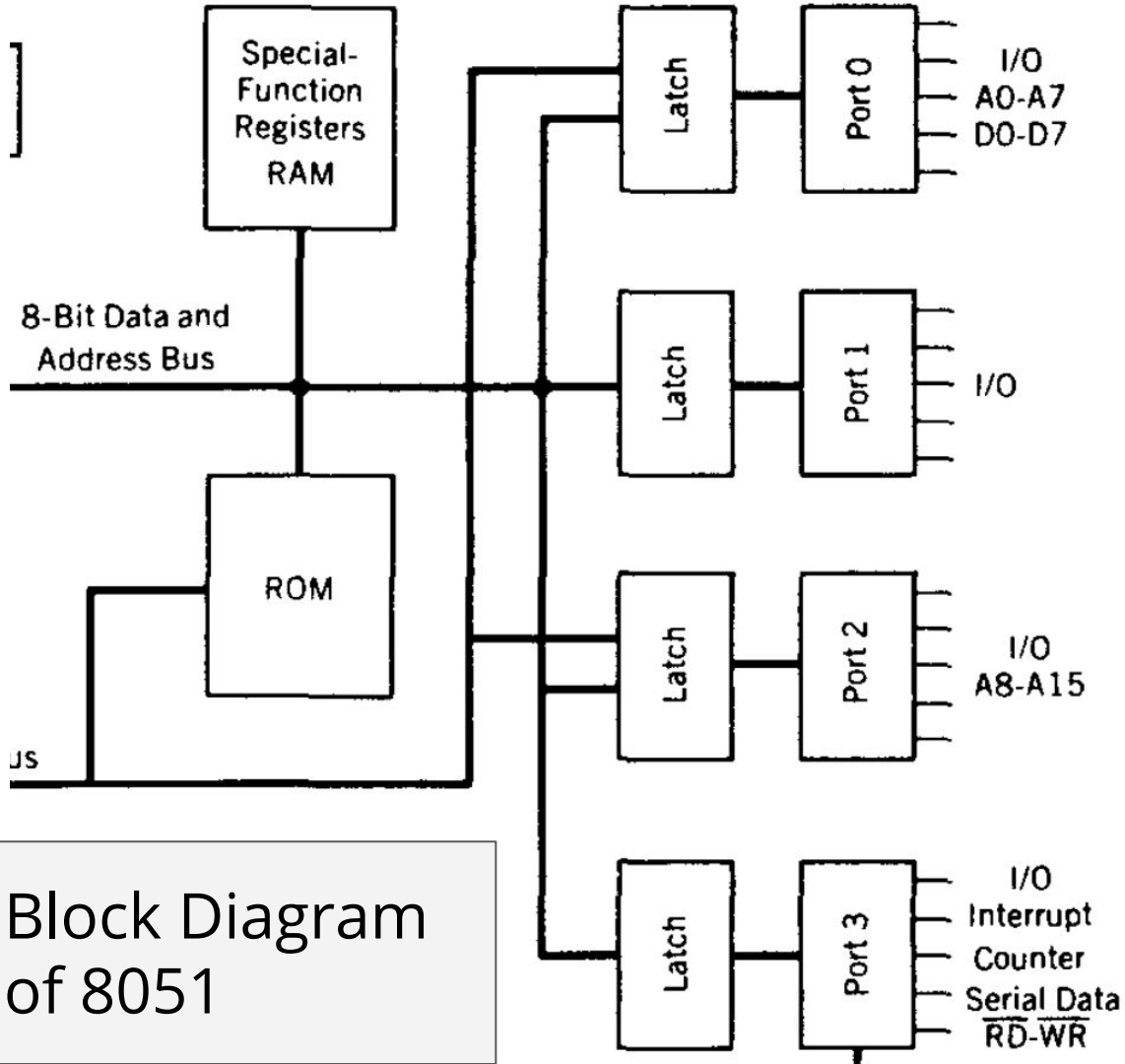
power and price per unit

8051 Microcontroller

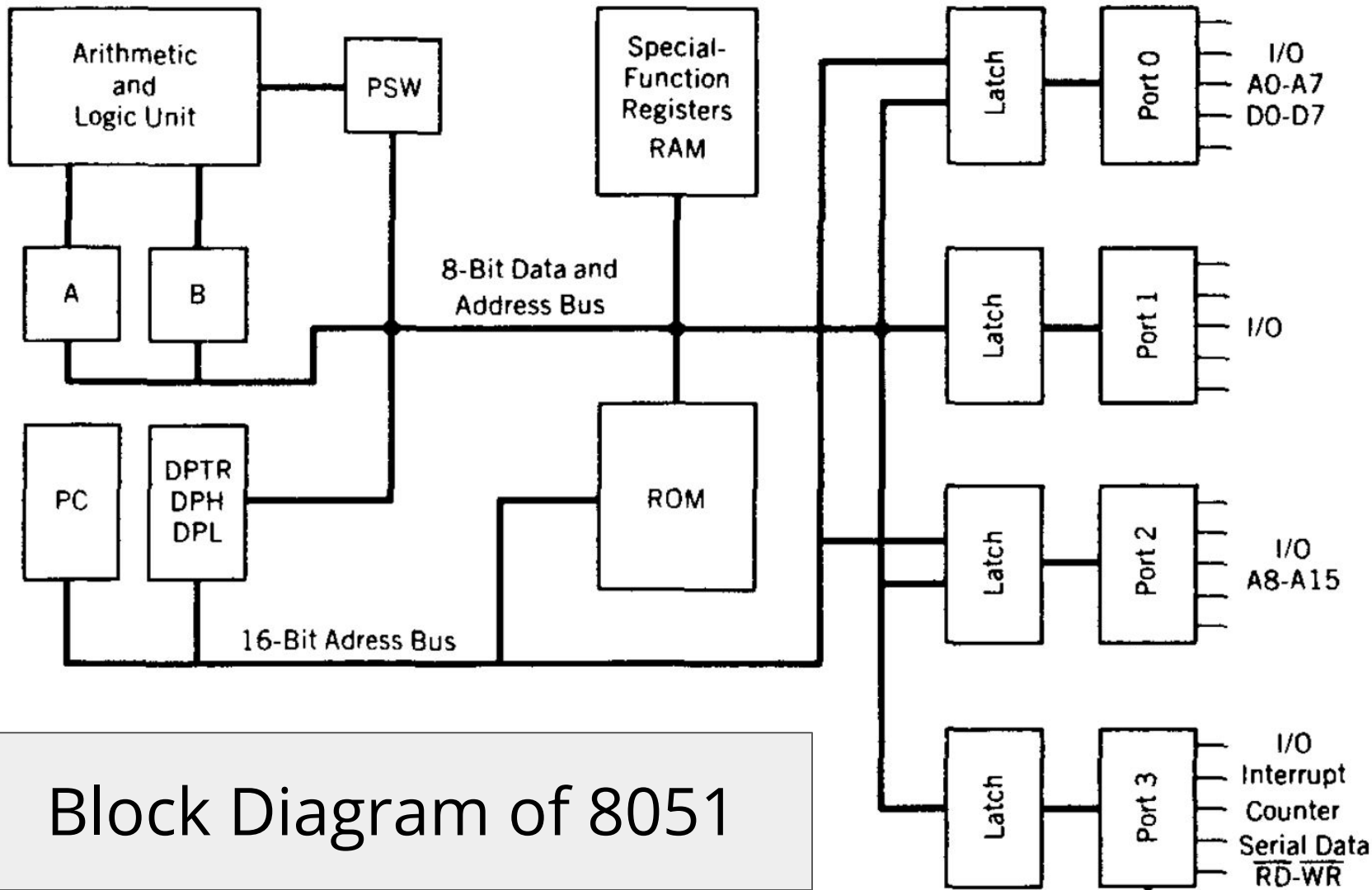
Internal Architecture



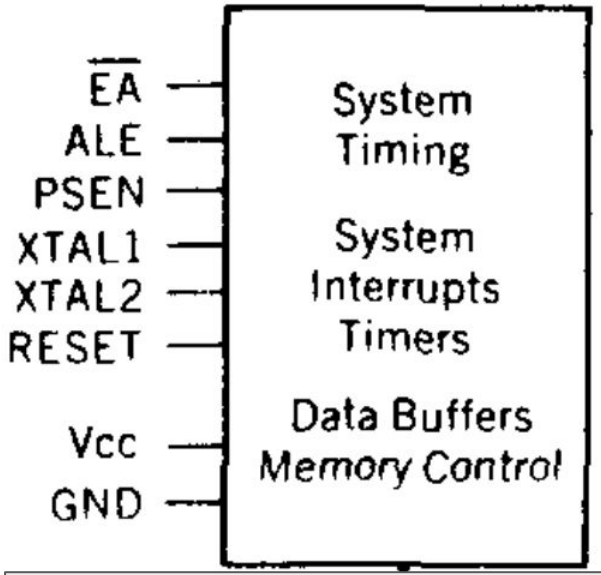
Block Diagram of 8051



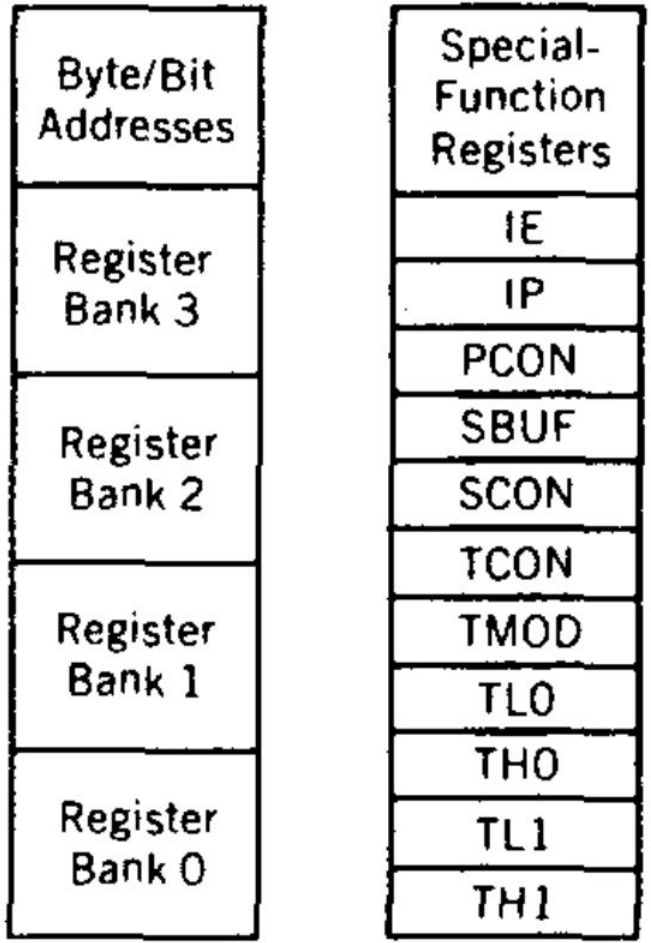
Block Diagram of 8051



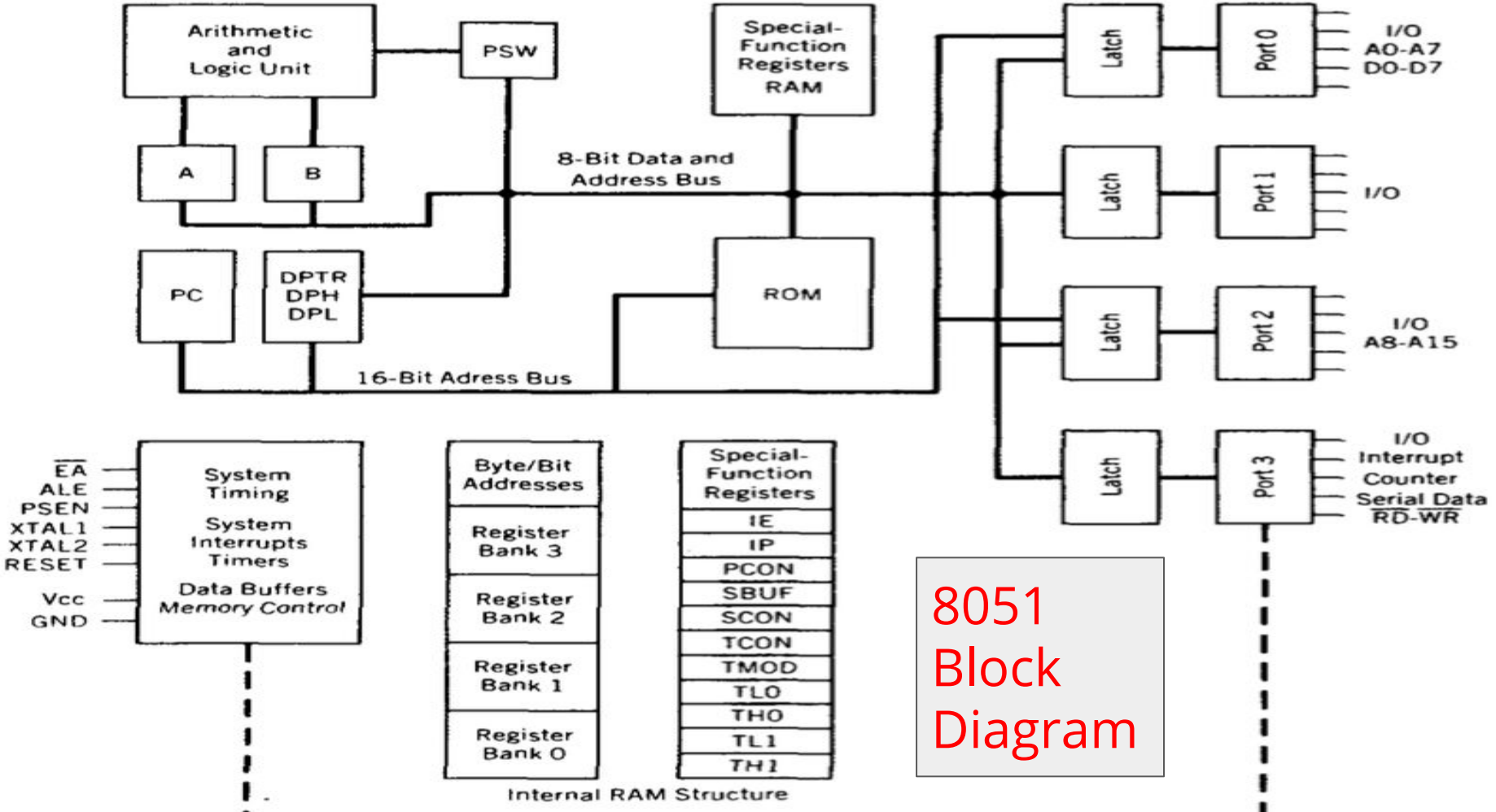
Block Diagram of 8051



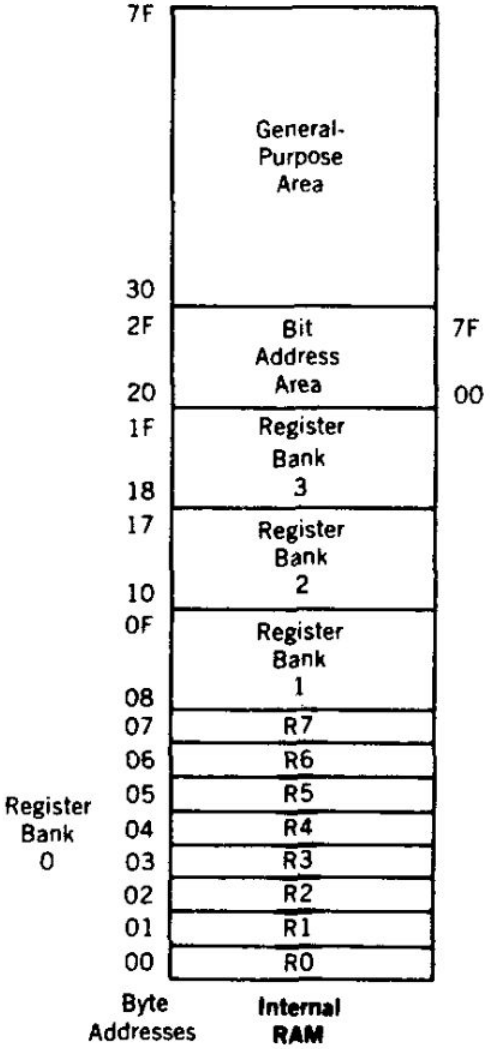
Block Diagram of 8051



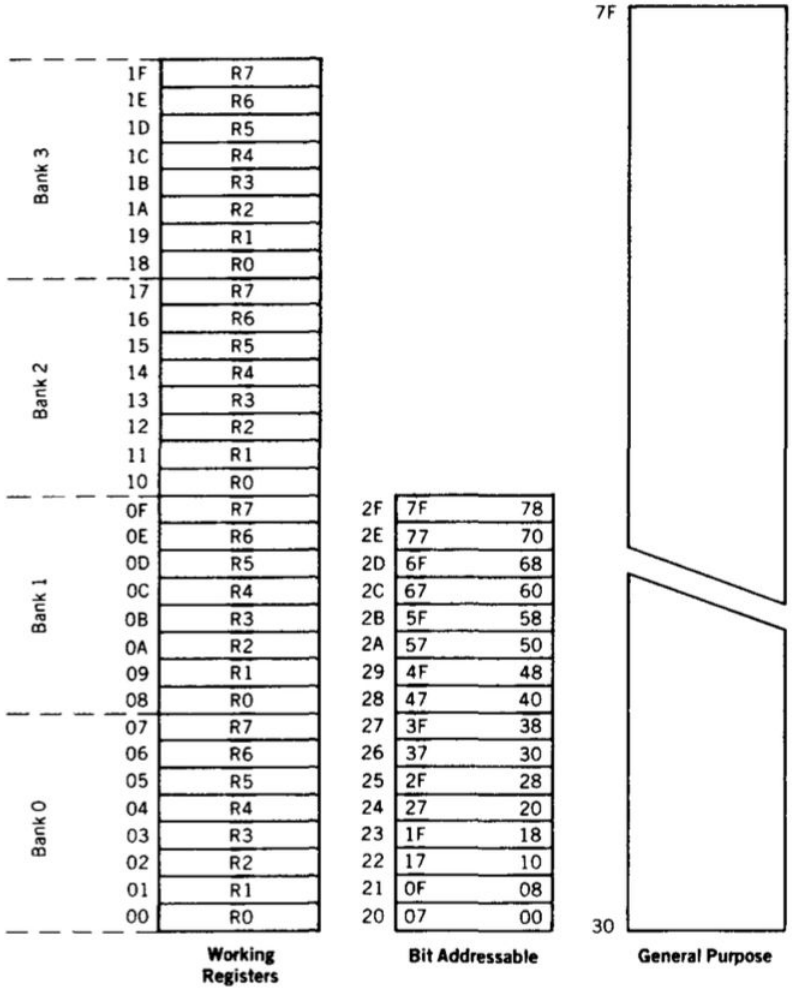
Internal RAM Structure


Arithmetic and Logic Unit
PSW
A
B
PC
DPTR DPH DPL
8-Bit Data and Address Bus
16-Bit Adress Bus
Special-Function Registers RAM
ROM
Latch
Port 0
I/O A0-A7 D0-D7
Latch
Port 1
I/O
Latch
Port 2
I/O A8-A15
Latch
Port 3
I/O Interrupt Counter Serial Data RD-WR
EA
ALE
PSEN
XTAL1
XTAL2
RESET
Vcc
GND
System Timing
System Interrupts Timers
Data Buffers Memory Control
Byte/Bit Addresses
Register Bank 3
Register Bank 2
Register Bank 1
Register Bank 0
Special-Function Registers
IE
IP
PCON
SBUF
SCON
TCON
TMOD
TL0
TH0
TL1
TH1
Internal RAM Structure
8051 Block Diagram

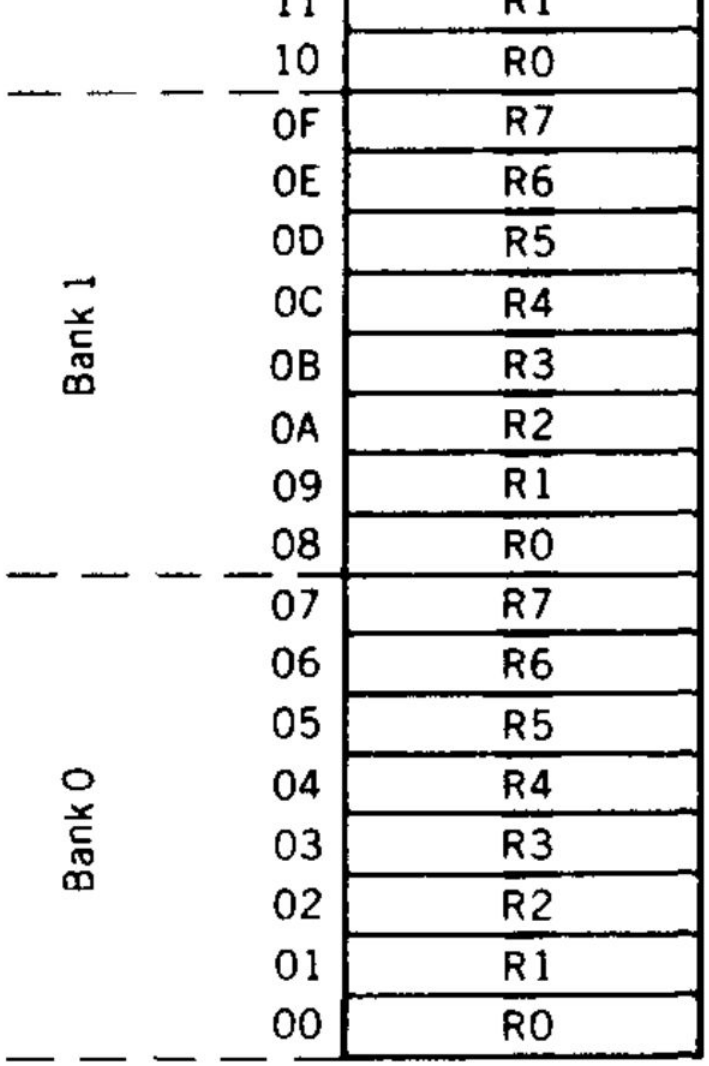
Internal RAM



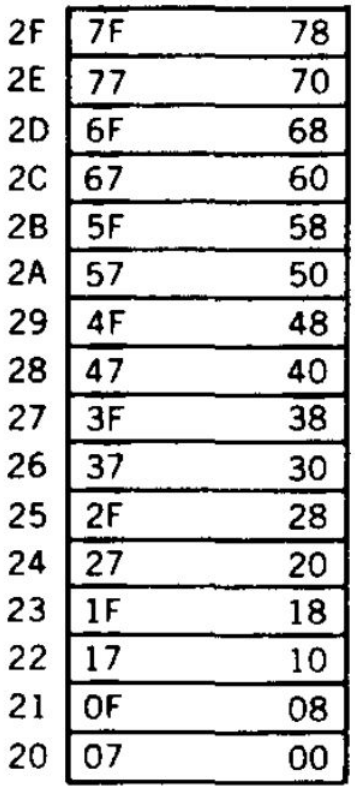
Internal RAM Organization



Internal RAM Organization - Register Banks

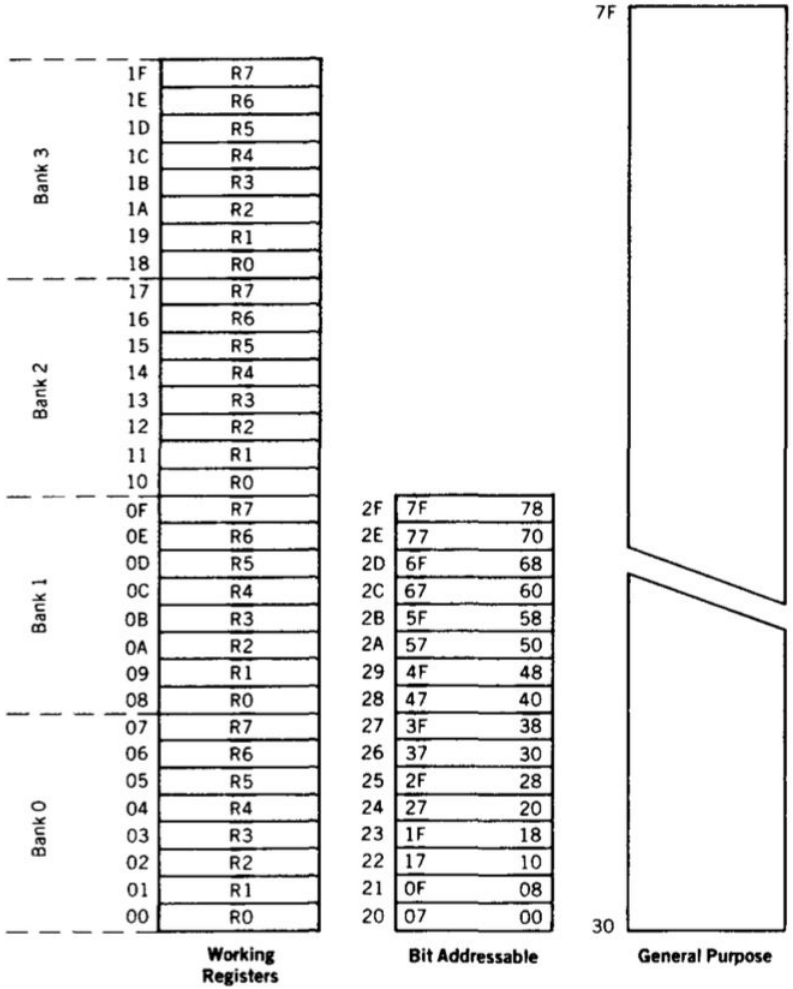


Internal RAM Organization - Bit/Byte Addressable Area



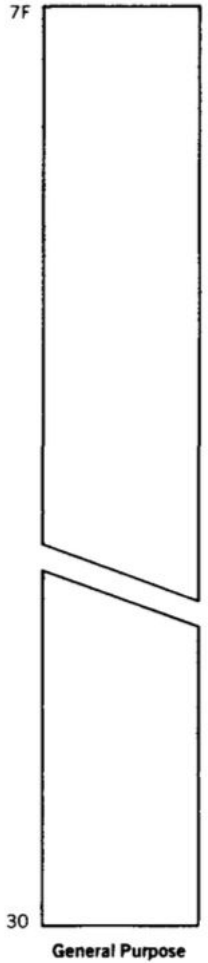
2F	7F	78
2E	77	70
2D	6F	68
2C	67	60
2B	5F	58
2A	57	50
29	4F	48
28	47	40
27	3F	38
26	37	30
25	2F	28
24	27	20
23	1F	18
22	17	10
21	0F	08
20	07	00

Internal RAM Organization



Internal RAM Organization

- General Purpose



Internal ROM

Data/Program Architecture

- 8051 is Harvard architecture
    - Program and data memory are different
    - 8051 uses the **same address** for code and data
        - Internal circuitry access the correct memory based on the nature of operation