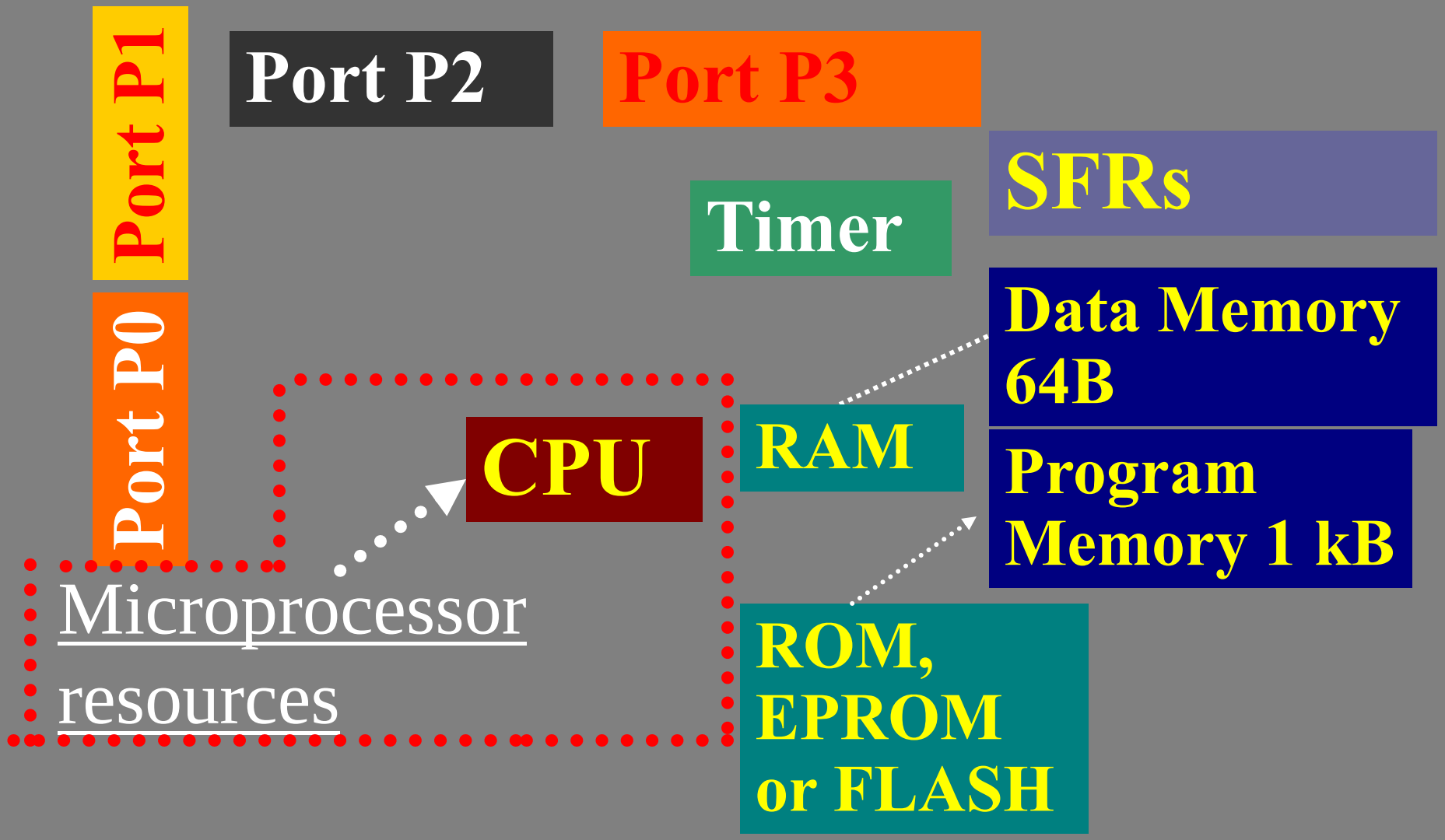
Chapter 2

Overview of Architecture and Microcontroller-Resources

Lesson 1

Additional resources to a microprocessor in Microcontroller Architecture

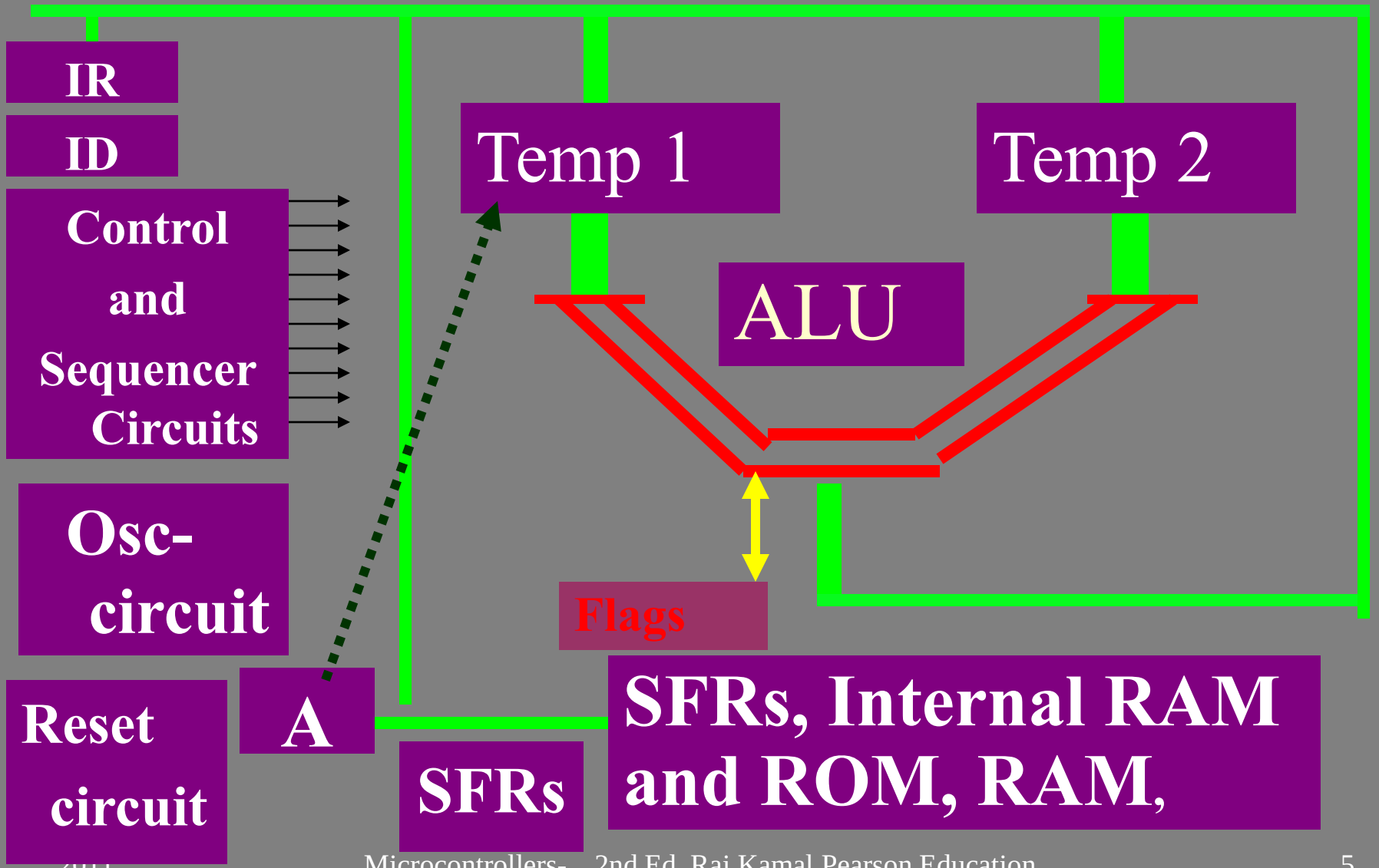


8048 MCU (CPU + Internal Resources)

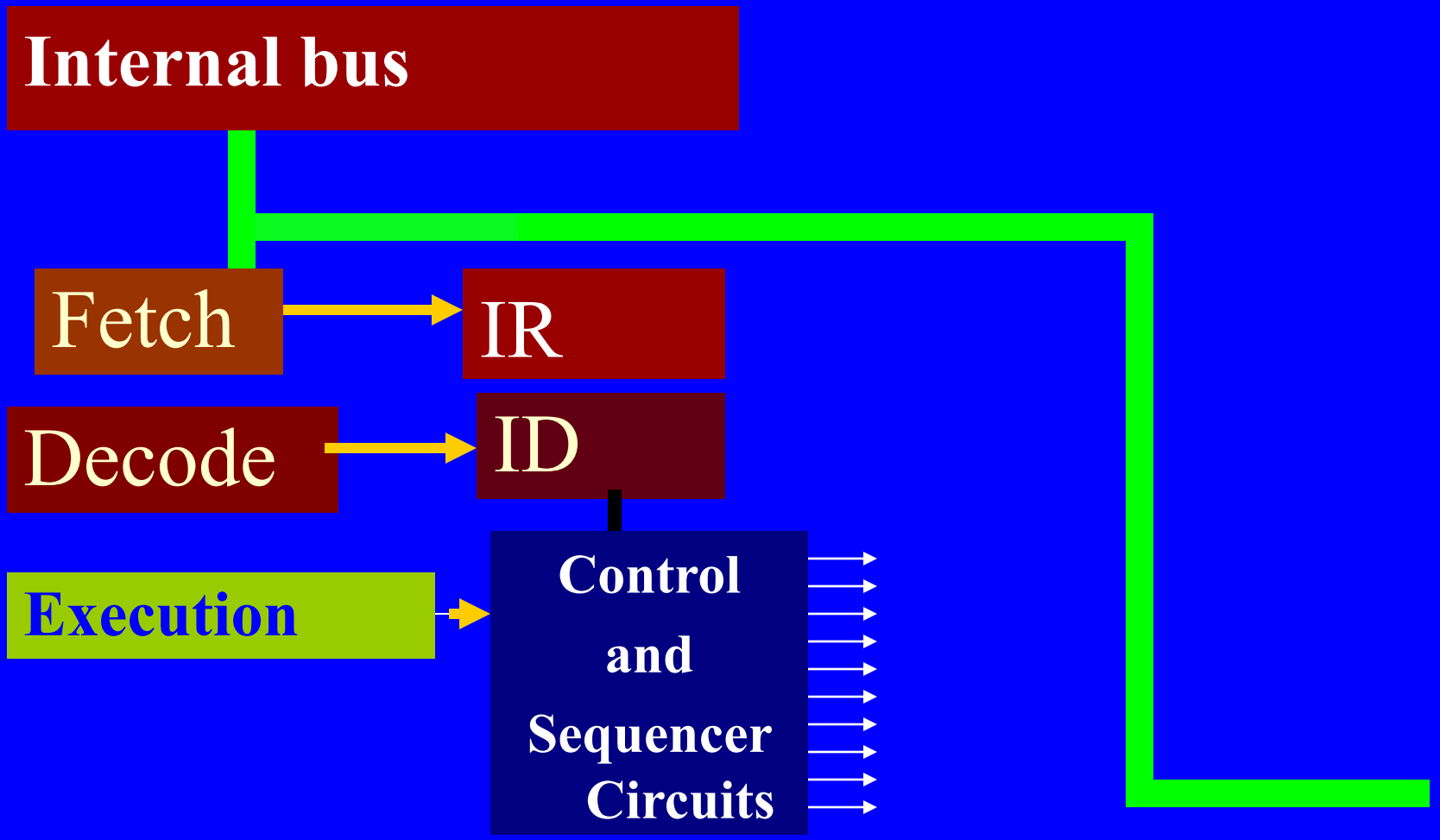
Pointer 16-bit Registers

- 16-bit Program Counter PC to point to program memory
- 16-bit Data Pointer DPTR points to external data memory.
- DPTR—two bytes DPH-DPL (two SFRs)

8048 Execution Unit



- Instructions have operands of **8 - bit** data type



Control memory
Micro codes based -Implementation

Buses and XTAL

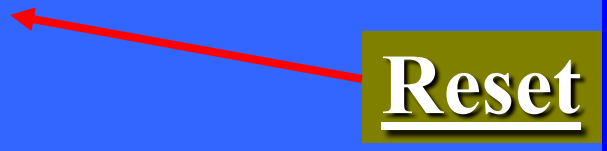
- 16-bit and 8-bit internal buses separate for program memory and data memory
- 16 bit address and 8 bits external data buses to program and data memory
- XTAL- Osc circuit

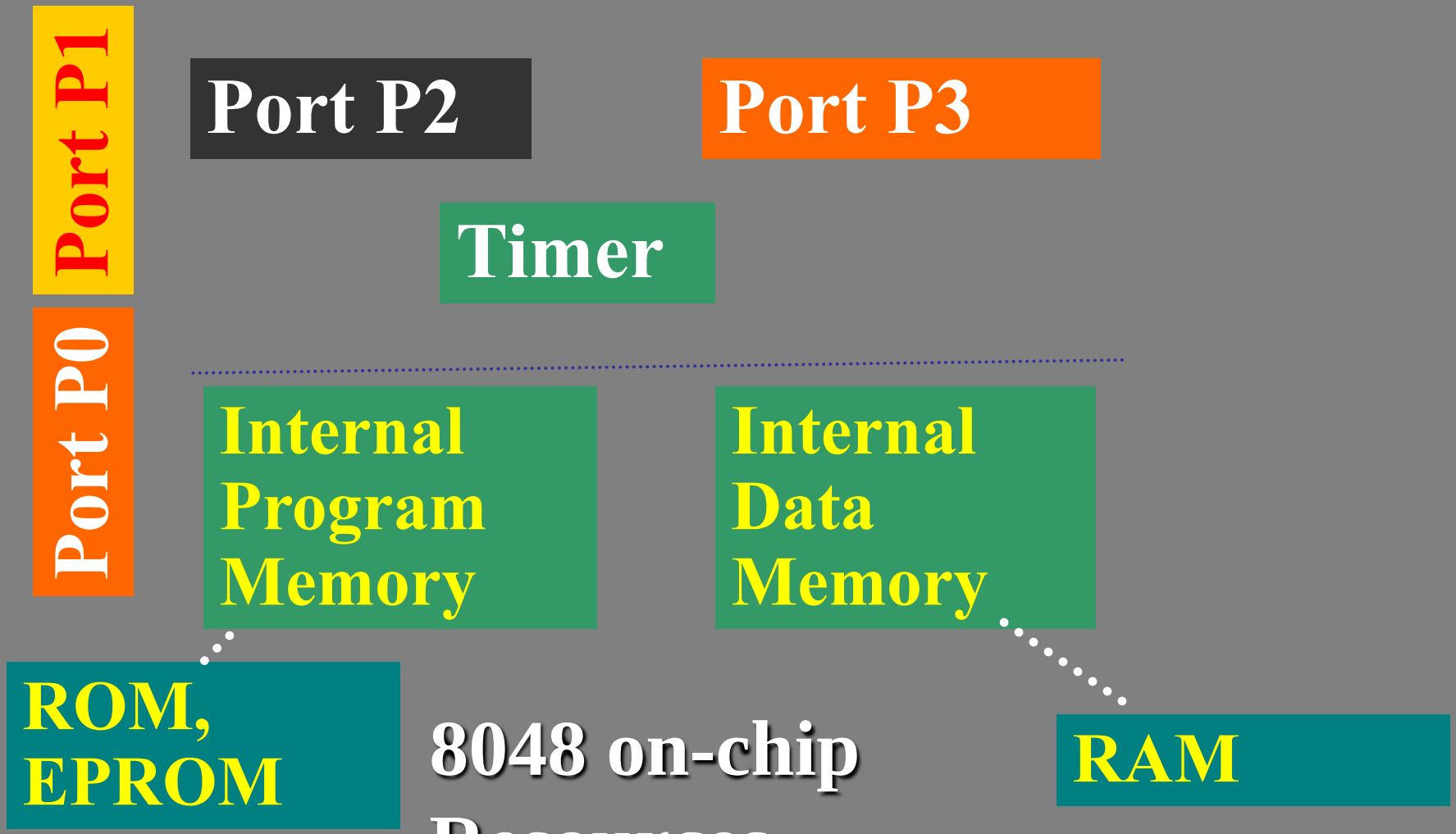
8051 Family Boolean Processing Unit

- An additional Boolean Processor for the operations on single bits
- Bit transfer, Bit XOR,OR, AND, Complement Operations

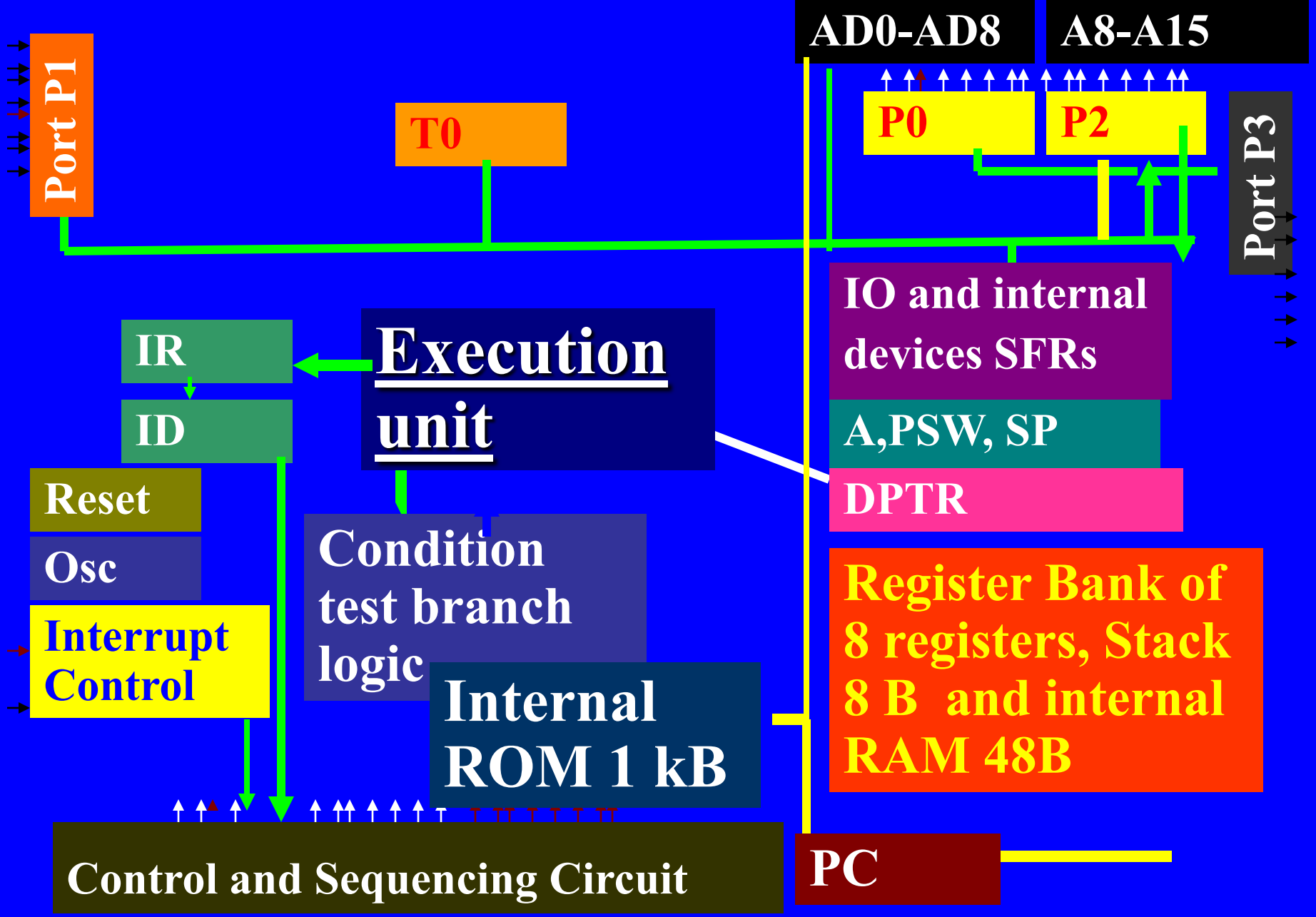
8048 Architecture view

- Harvard architecture bus
- Bus interface for 16-bit/8-bit address, data and instructions.
- 1 Interrupt requests $\overline{\text{INT}}$ at P3.2
- PC initialization 0000H

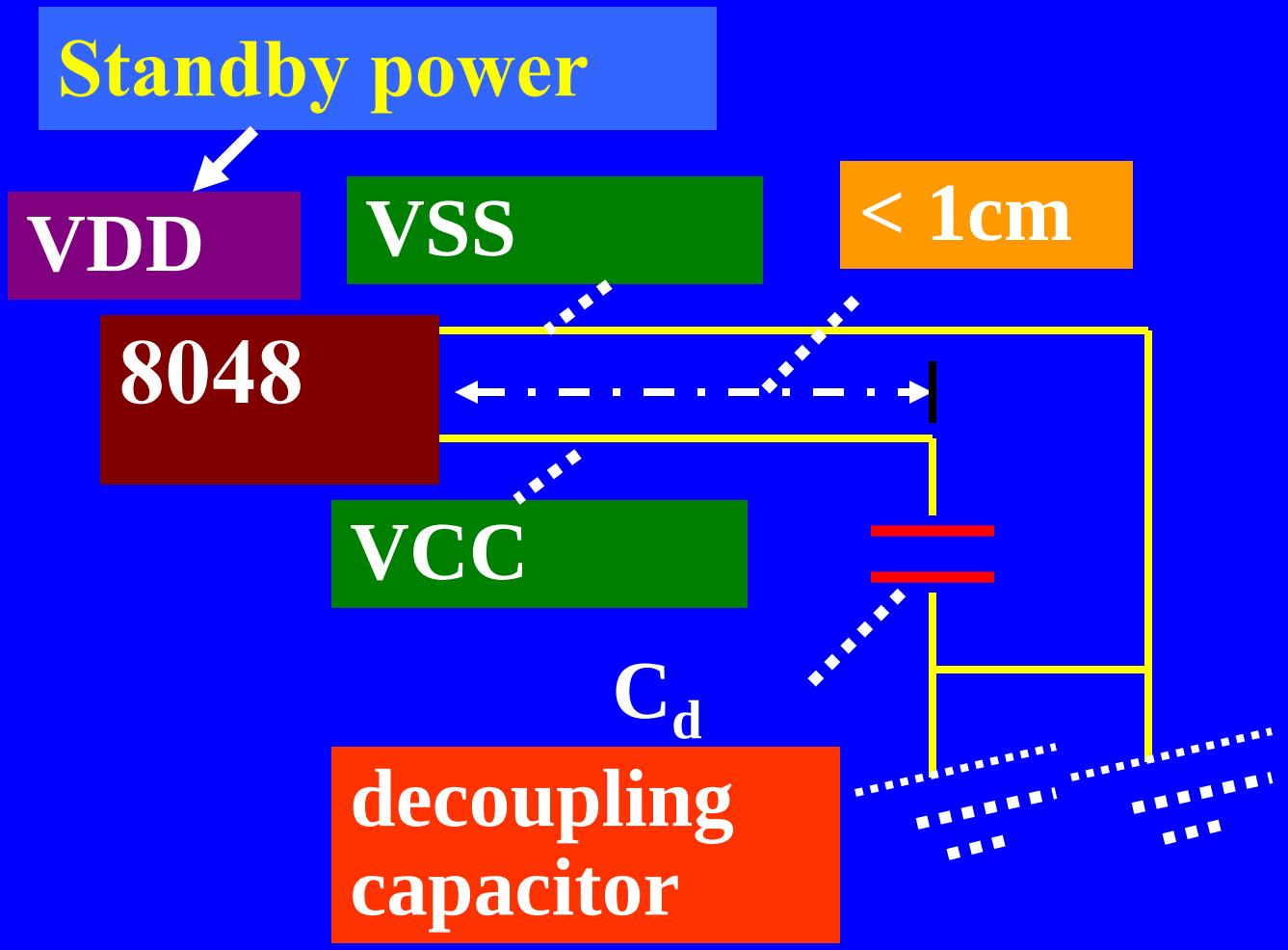


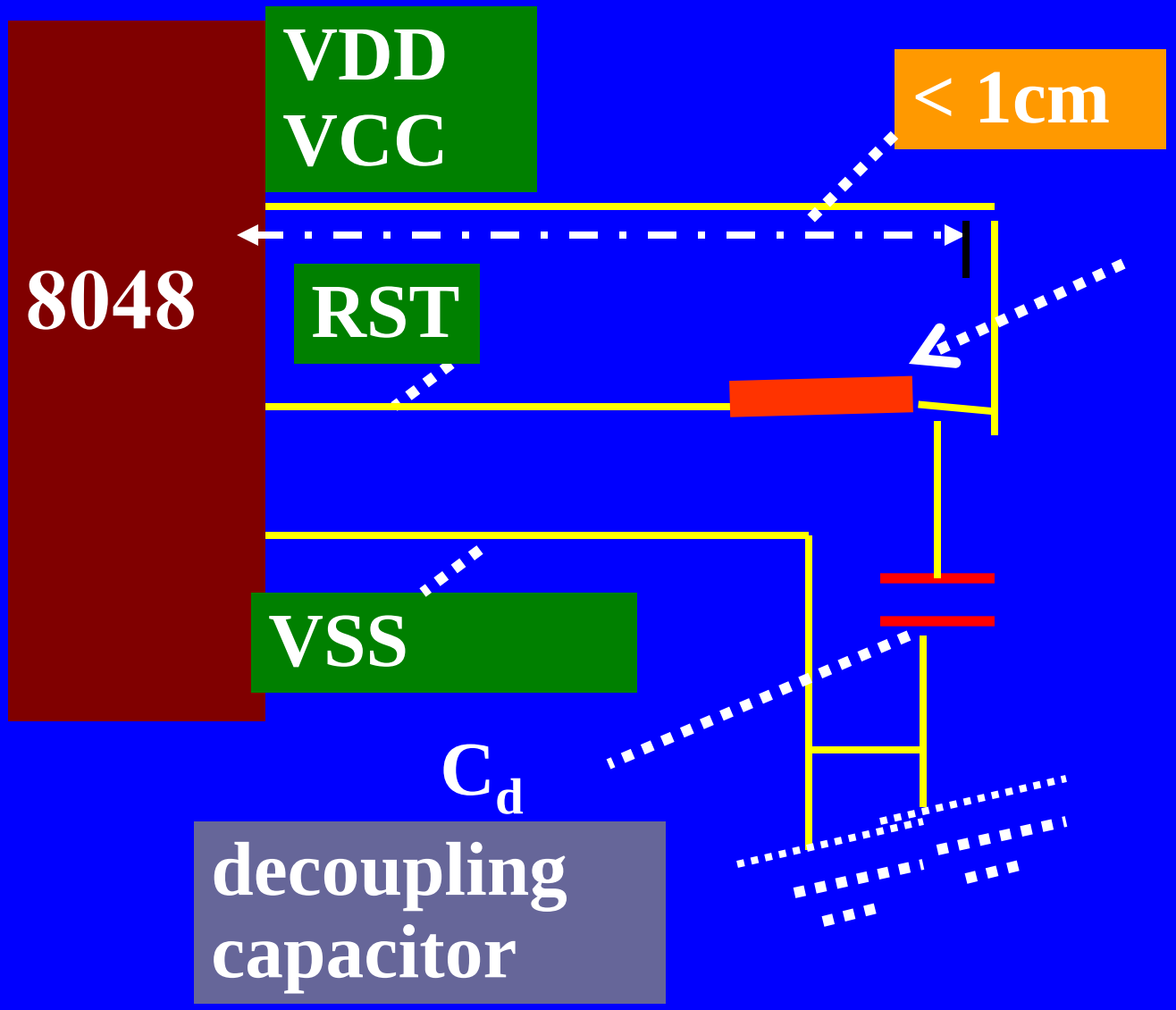


Microcontroller-resources


AD0-AD8
A8-A15
Port P1
T0
P0
P2
Port P3
IO and internal devices SFRs
IR
Execution unit
ID
A,PSW, SP
Reset
DPTR
Osc
Condition test branch logic
Register Bank of 8 registers, Stack 8 B and internal RAM 48B
Interrupt Control
Internal ROM 1 kB
Control and Sequencing Circuit
PC

Supply circuit

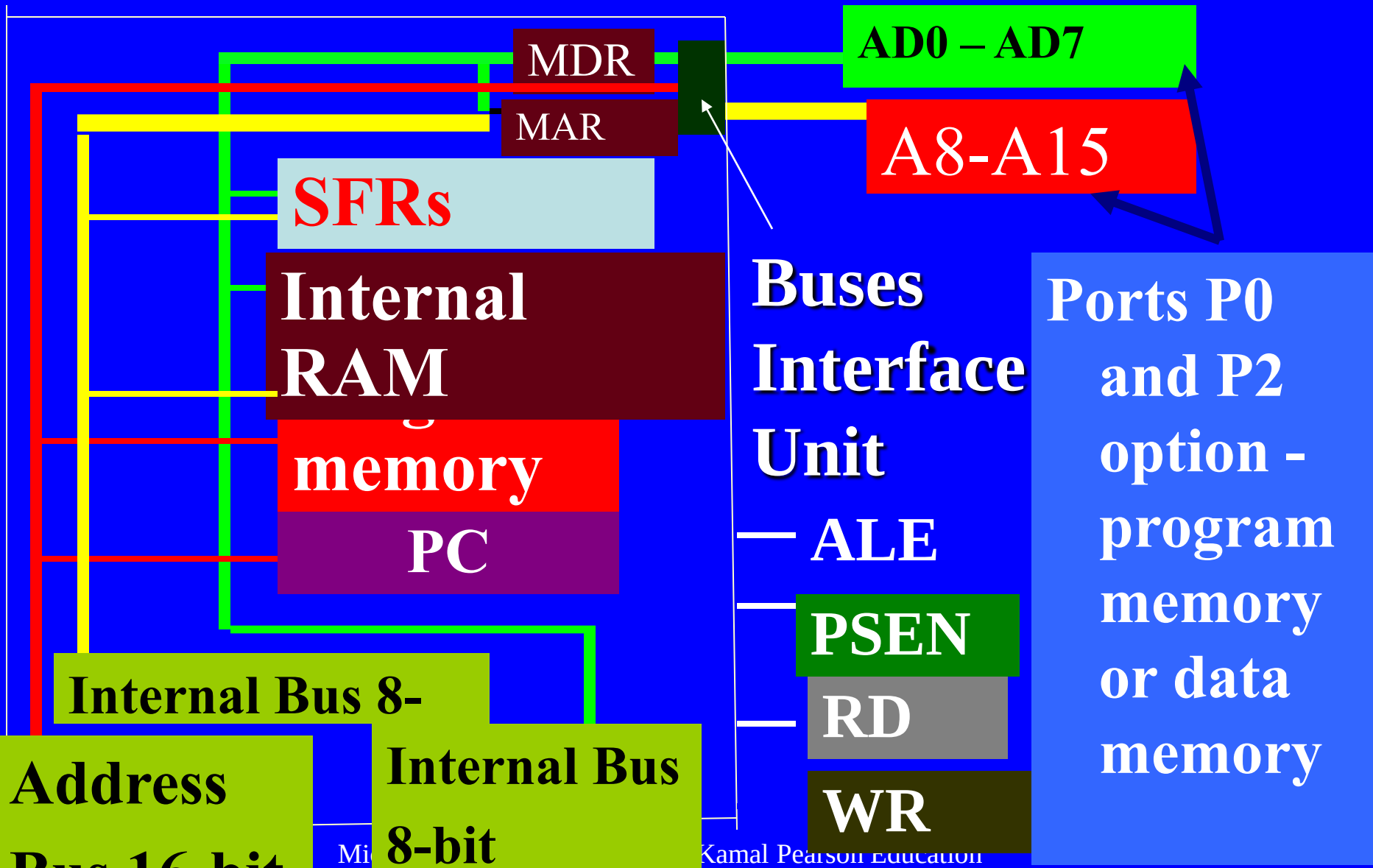




An IC for reset or a Push button for manual reset

Reset circuit

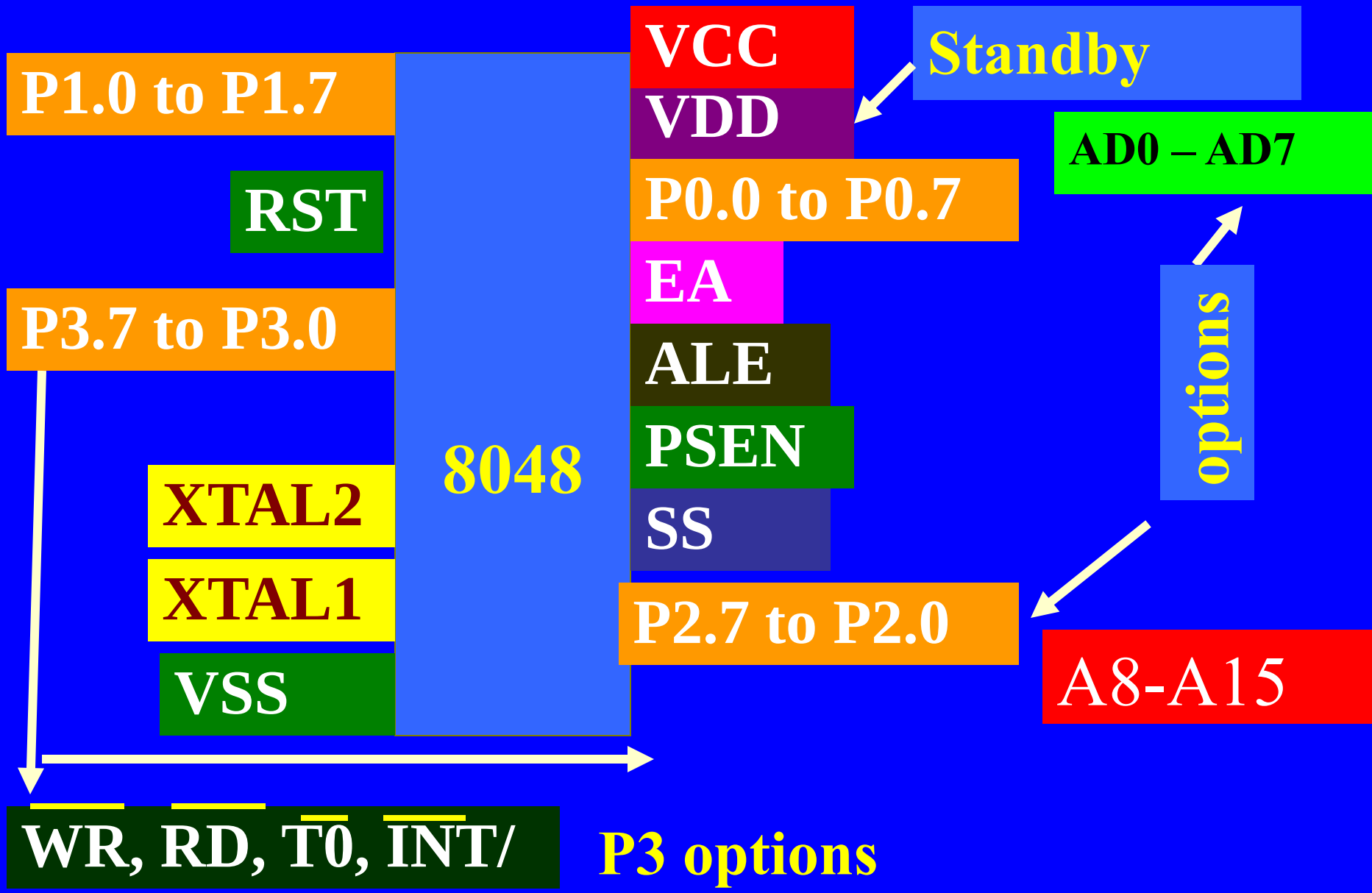
Internal and External Buses



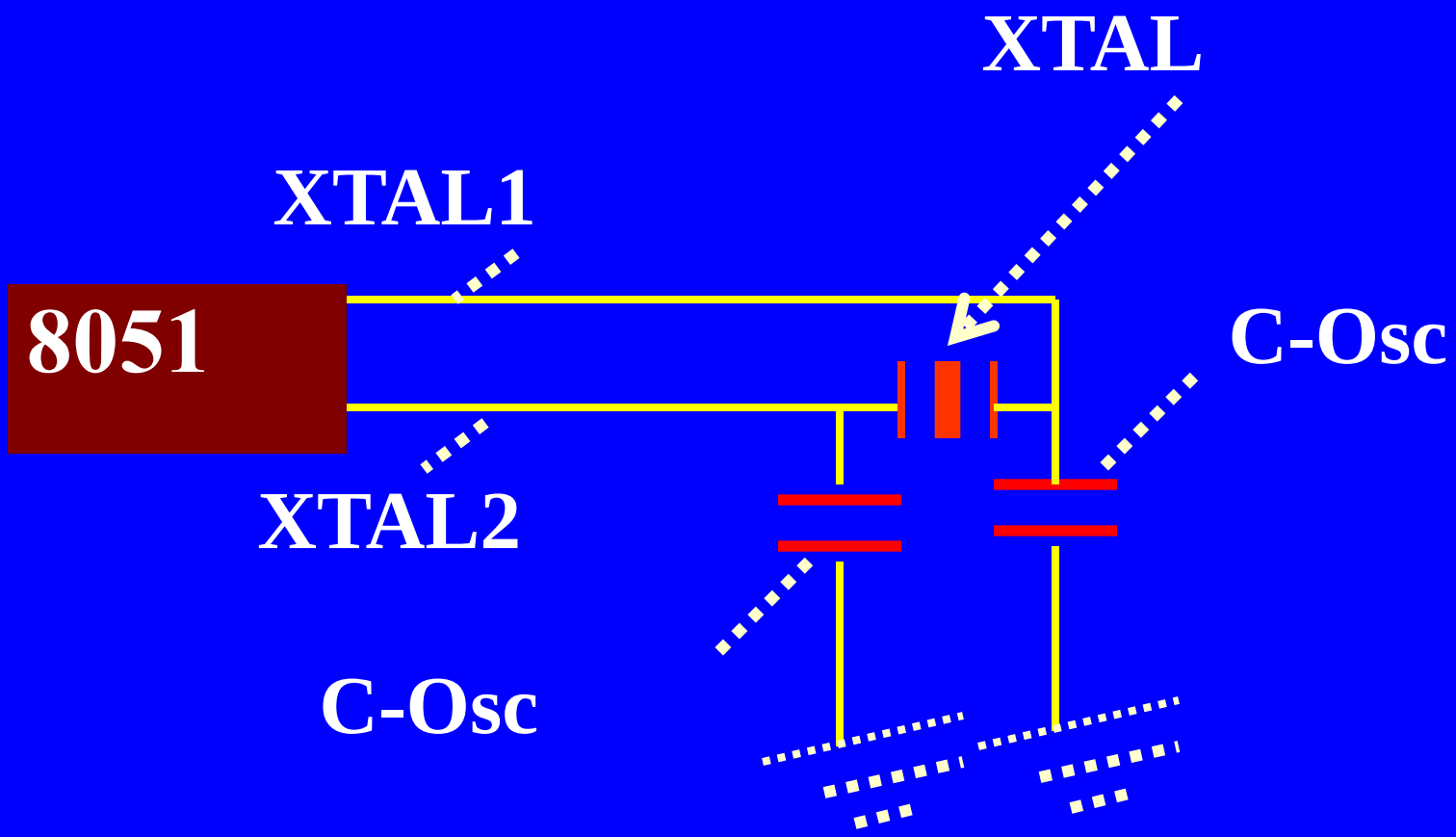
Internal Device

- Timers T0 - Event Counter

8048 Pins


P1.0 to P1.7
RST
P3.7 to P3.0
XTAL2
XTAL1
VSS
8048
VCC
VDD
P0.0 to P0.7
EA
ALE
PSEN
SS
P2.7 to P2.0
Standby
AD0 – AD7
options
A8-A15
WR, RD, T0, INT/
P3 options

Oscillator Circuit,



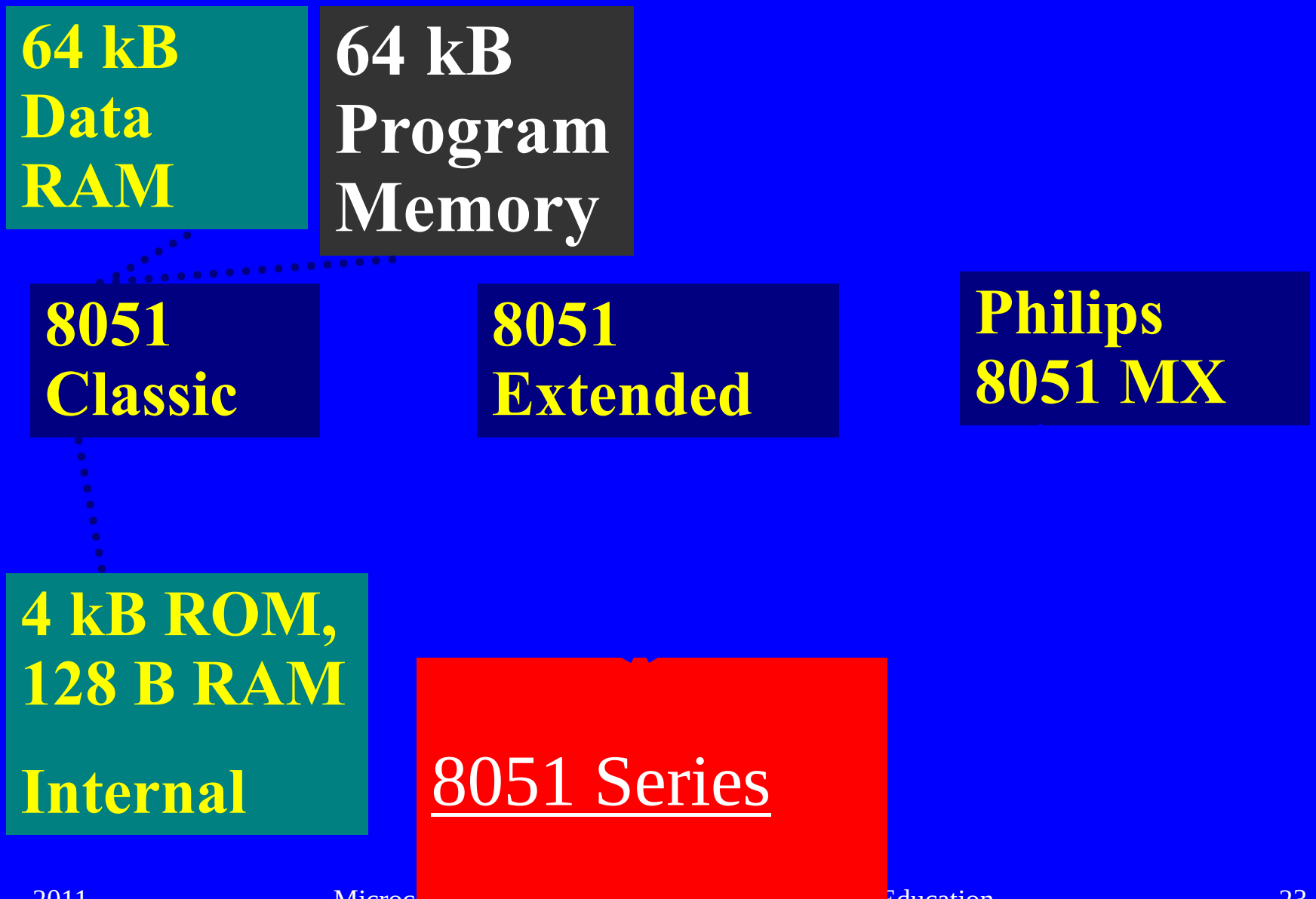
$\overline{EA}$, ALE, $\overline{PSEN}$, $\overline{SS}$

- **$\overline{SS}$ means single step mode**
- **$\overline{EA}$** is made 0 by user to enable use of external program memory space in place of the internal program memory space
- Control signal **ALE** = 1 to enable latching of address A0-A7 bits from AD0-AD7
- Control signal **$\overline{PSEN}$** = 0 to enable read of program memory bits from external program memory

Outline

- 8048 MCU Feature and Resources
- Execution Unit- ALU
- MCU Architecture overview
- **8051 Series Family Members**
- 68HC11 Series Family Members

8051 Series Family Members



8051 Series Family Members

4 kB ROM, 256 B RAM

Internal

8051 Classic

Extended 16 MB Data RAM

8051 Extended

Extended

16 MB Program Me

Philips 8051 MX

8051 Series

8051 Series Family Members

External/

Internal unified

8 MB ROM + 8MB Constants ROM

Unified 64 MB Program/Data Memory

8051 Classic

8051 Extended

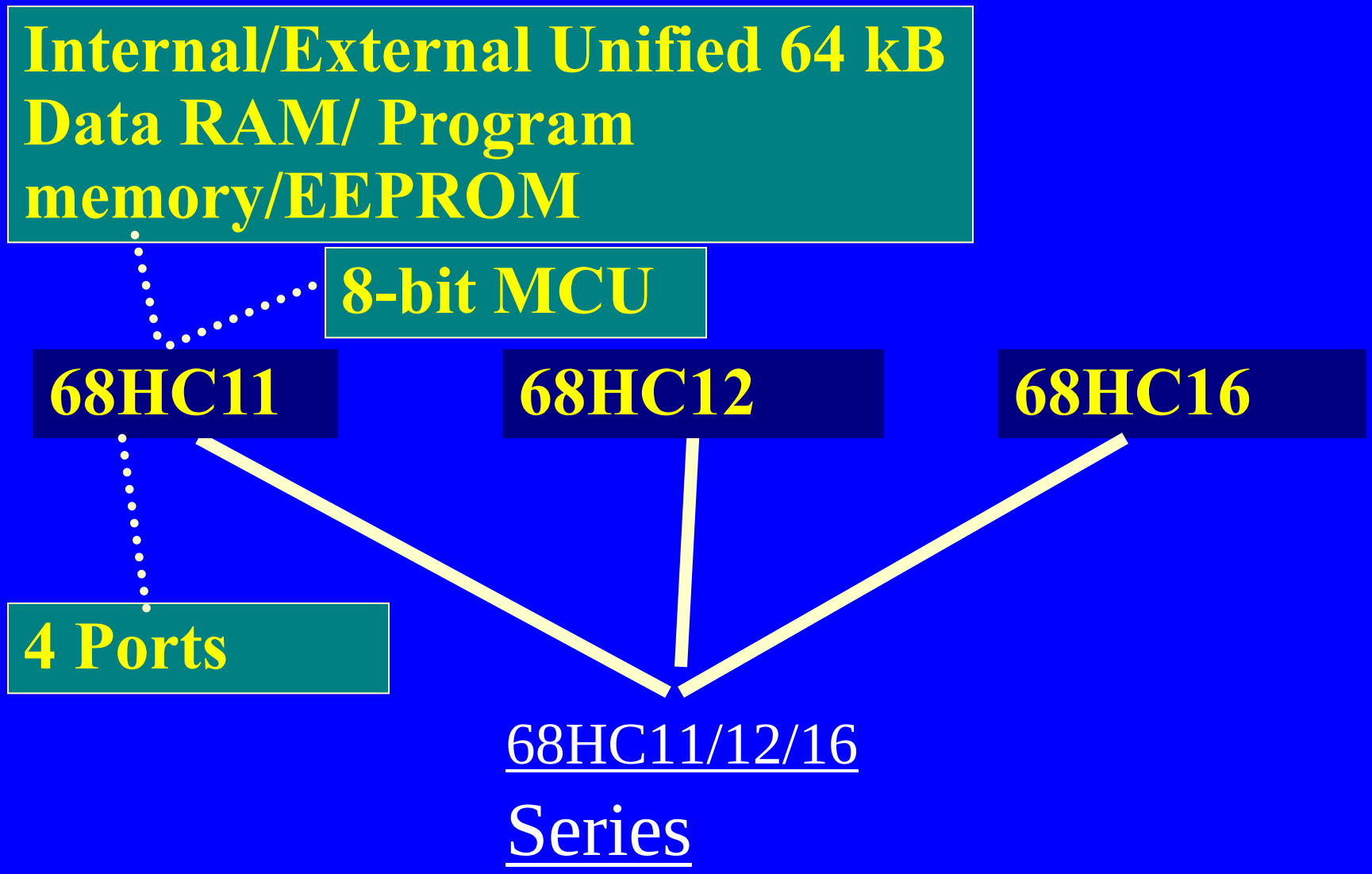
Philips 8051 MX

16-bit Stack Pointer,

768 B Internal RAM

8051 Series

68HC11/12/16 Series Family Members



68HC11/12/16 Series Family Members

Internal/External Unified 4 MB Data RAM/ Program memory/ EEPROM

8CH. Timers

16-bit PACNT

16-bit MCU

12 Ports

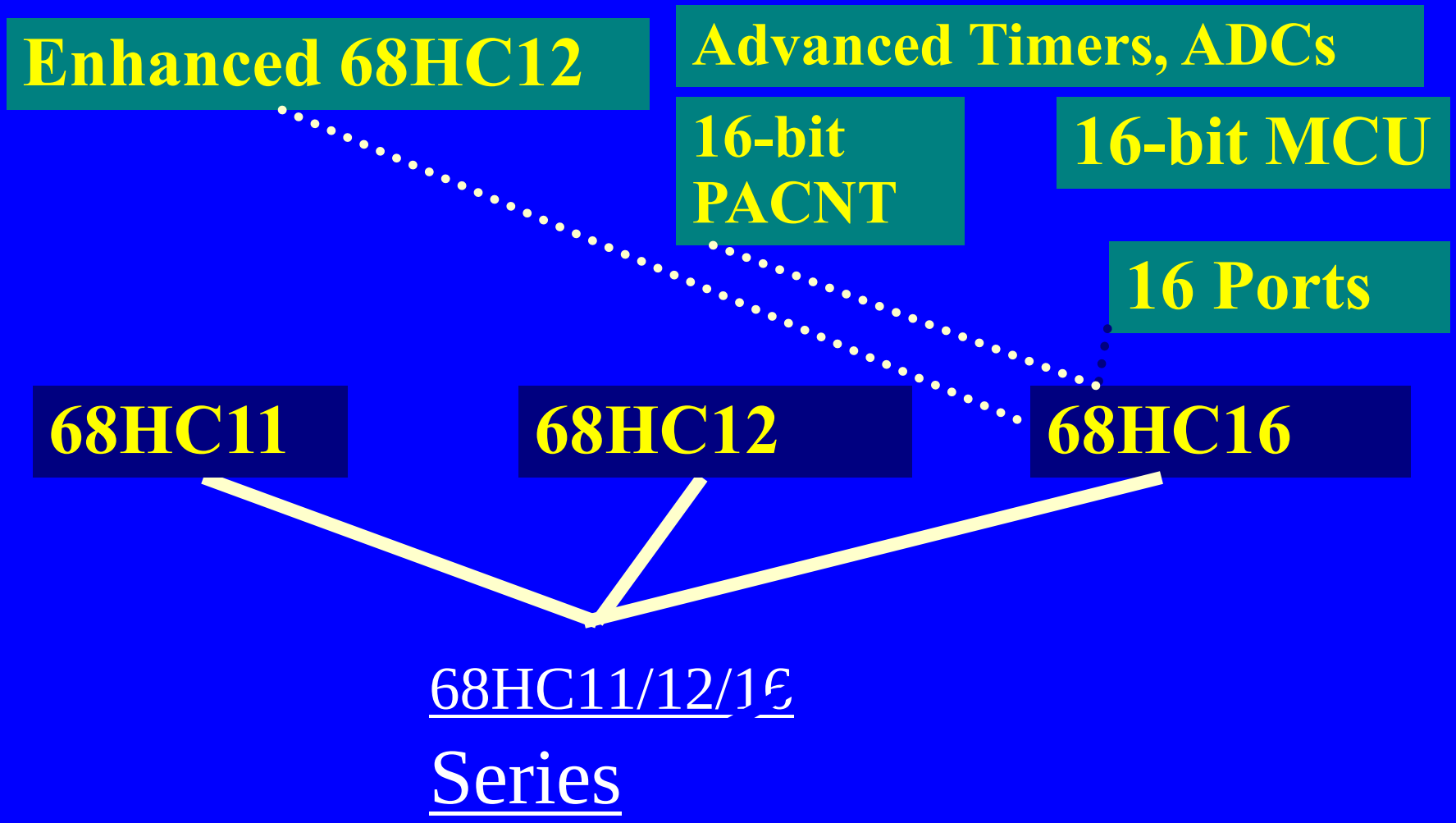
68HC11

68HC12

68HC16

68HC11/12/16 Series

68HC11/12/16 Series Family Members



Summary

We learnt

- Microcontrollers— A CPU with on-chip Ports, Memory, Special Function Registers, timers and other registers

We learnt

- 8048/51 family 8-bit processor, Harvard architecture
- 8051 has Boolean processing unit also
- 68HC11/12/16 Series, Princeton Architecture