

(1)



Unit 1

Microprocessor-Based Digital Systems

MICROPROCESSOR-BASED SYSTEMS

**Degree in Computer Science Engineering
Double Degree in Computer Engineering and Mathematics**

EPS - UAM

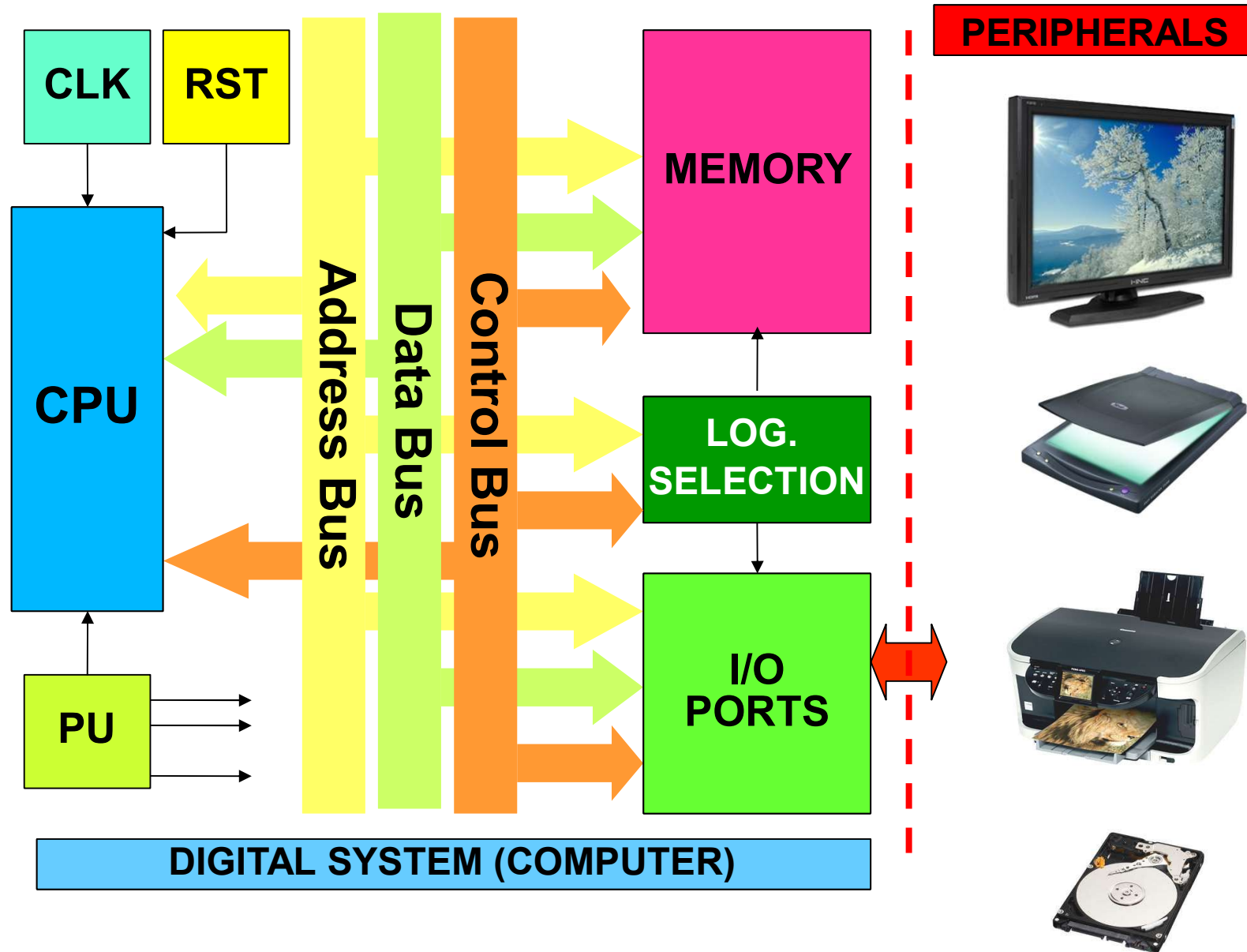
(1)

Index

1. Microprocessor-based digital systems.
 - 1.1. Basic architecture of a microprocessor-based digital system.
 - 1.2 Basic architecture of a microprocessor.
 - 1.3. Operation of a microprocessor-based system.

(1)

1.1 Basic architecture of a microprocessor-based digital system (I)

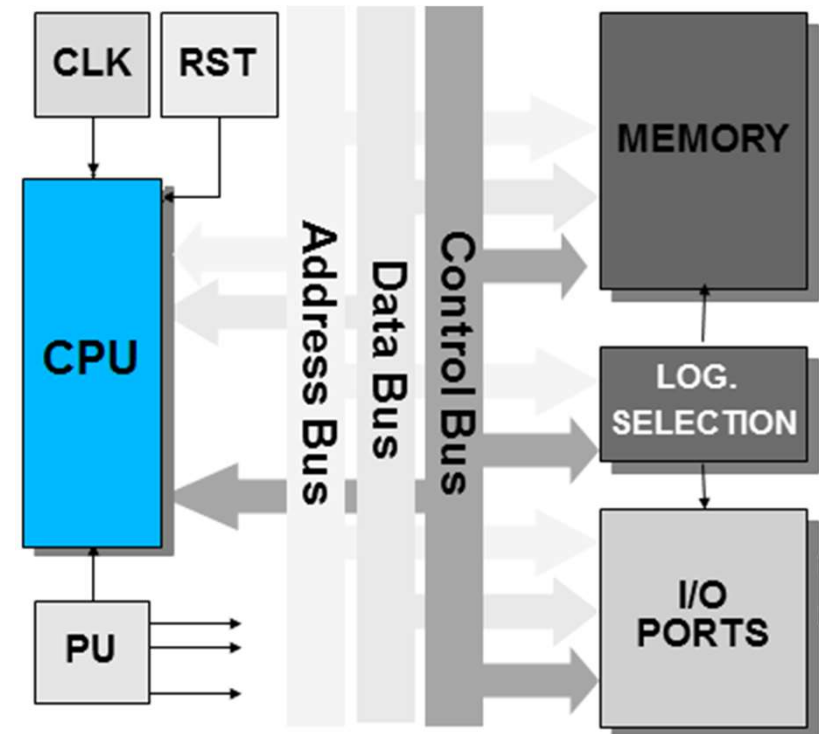


(1)

1.1 Basic architecture of a microprocessor-based digital system (II)

• CPU or MICROPROCESSOR

- Device that runs programs.
- It interacts with the remaining system devices (I/O ports and peripherals, memory) according to the program.

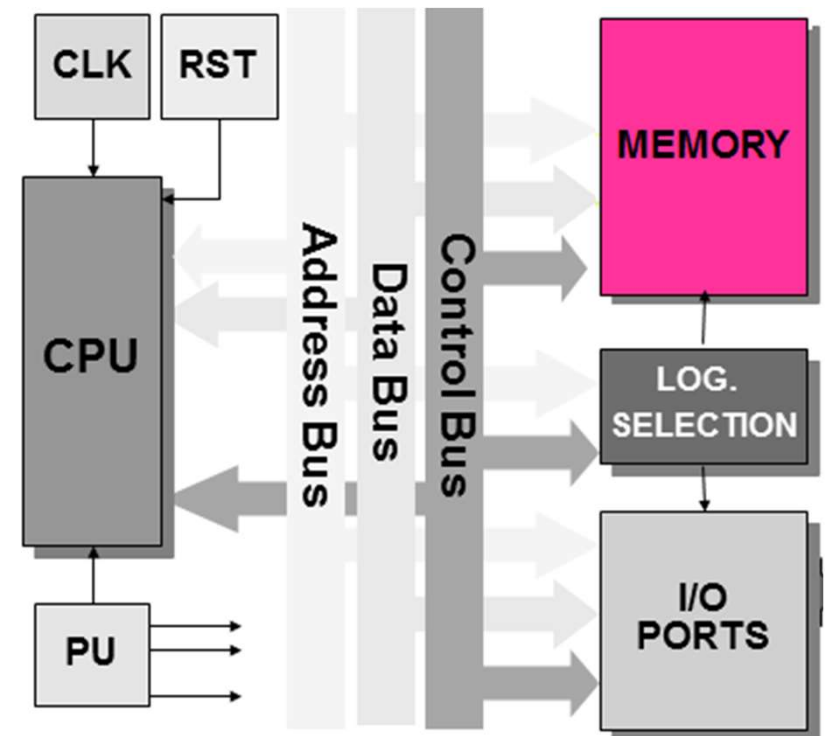


(1)

1.1 Basic architecture of a microprocessor-based digital system (III)

• MEMORY

- Device that stores the program's machine code instructions and their related data.
- Non-volatile memory (ROM) for the program.
- Volatile memory (RAM) for variables and stack.

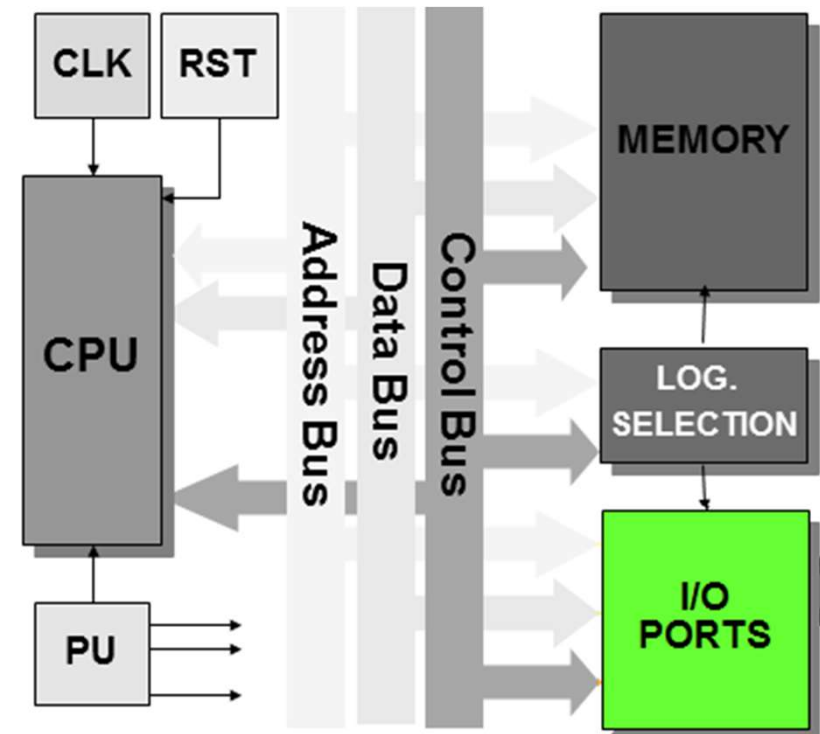


(1)

1.1 Basic architecture of a microprocessor-based digital system (IV)

I/O PORTS

- Varied set of devices that facilitate the connection of peripherals (keyboard, screen, printer, etc.) to the digital system.
- In some cases they are known as *controllers*.

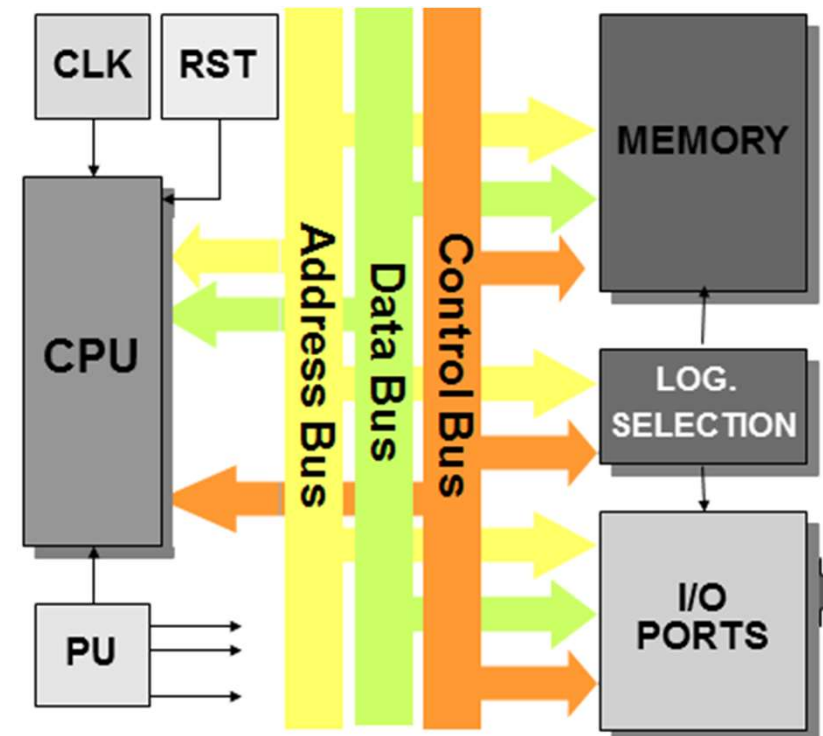


(1)

1.1 Basic architecture of a microprocessor-based digital system (V)

• SYSTEM BUSES

- Set of connections that carry the data between the CPU and the system devices (MEMORY and I/O PORTS).

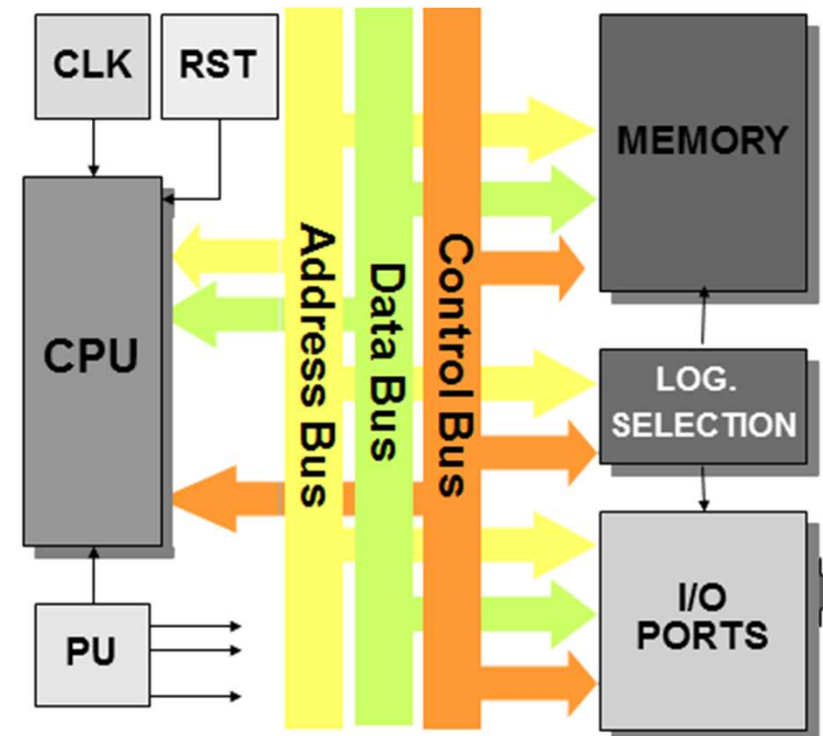


(1)

1.1 Basic architecture of a microprocessor-based digital system (VI)

• SYSTEM BUSES

- Using standard I/O bus adapters (ISA, EISA, PCI, PCIe), they allow direct connection of peripheral devices integrated in the motherboard (planar devices) or in expansion cards (GPUs, data acquisition cards, ...) plugged into standard slots on the motherboard.

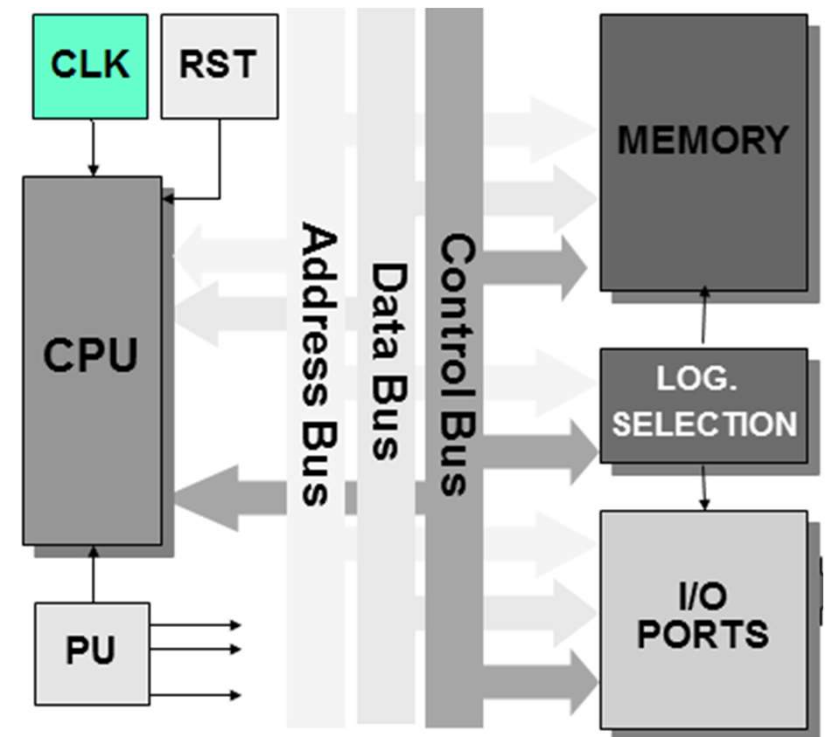


(1)

1.1 Basic architecture of a microprocessor-based digital system (VII)

- Secondary elements

- CLOCK (CLK):** Circuit that generates the clock signal necessary for the CPU (sequential circuit) and other devices (ports) that require temporization, synchronization, etc.

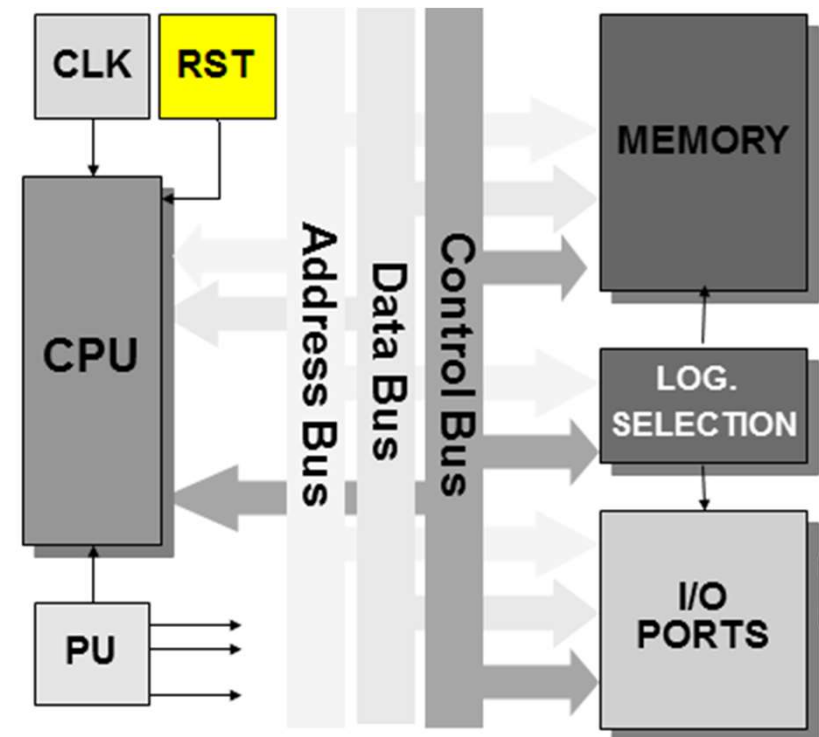


(1)

1.1 Basic architecture of a microprocessor-based digital system (VIII)

- Secondary elements

- RESET (RST):** Circuit that generates a pulse that the CPU and other devices interpret as a restart request.

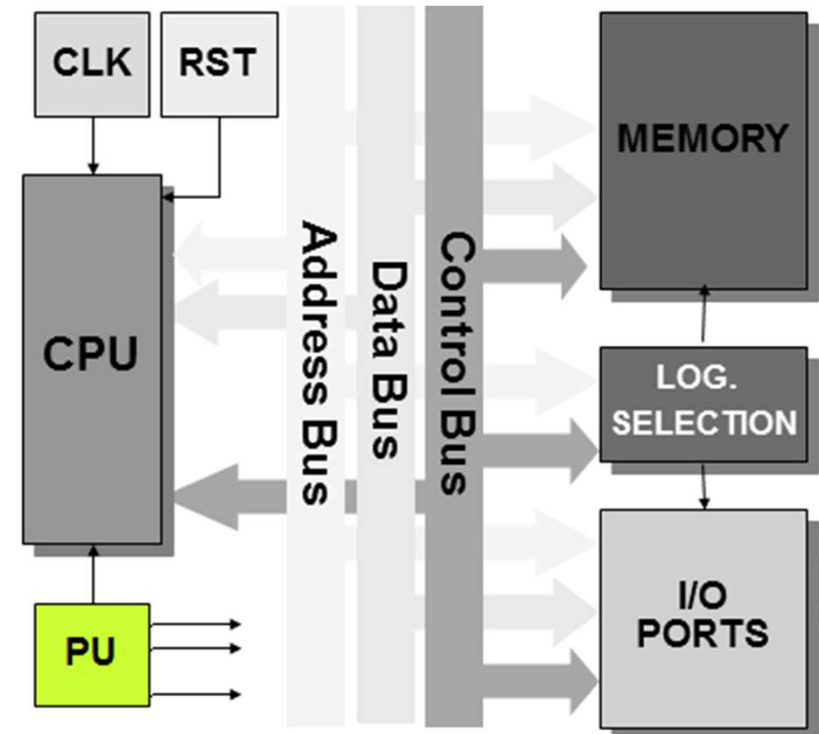


(1)

1.1 Basic architecture of a microprocessor-based digital system (IX)

- Secondary elements

- Power Unit (PU):** Circuit that generates the voltages necessary for feeding the electronic devices of the system.



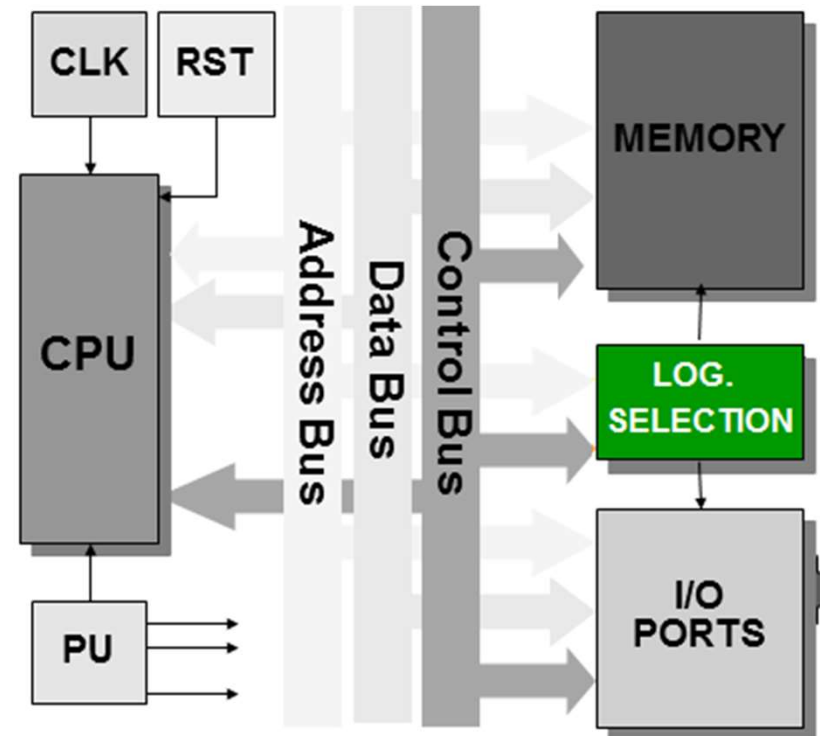
(1)

1.1 Basic architecture of a microprocessor-based digital system (X)

- Secondary elements

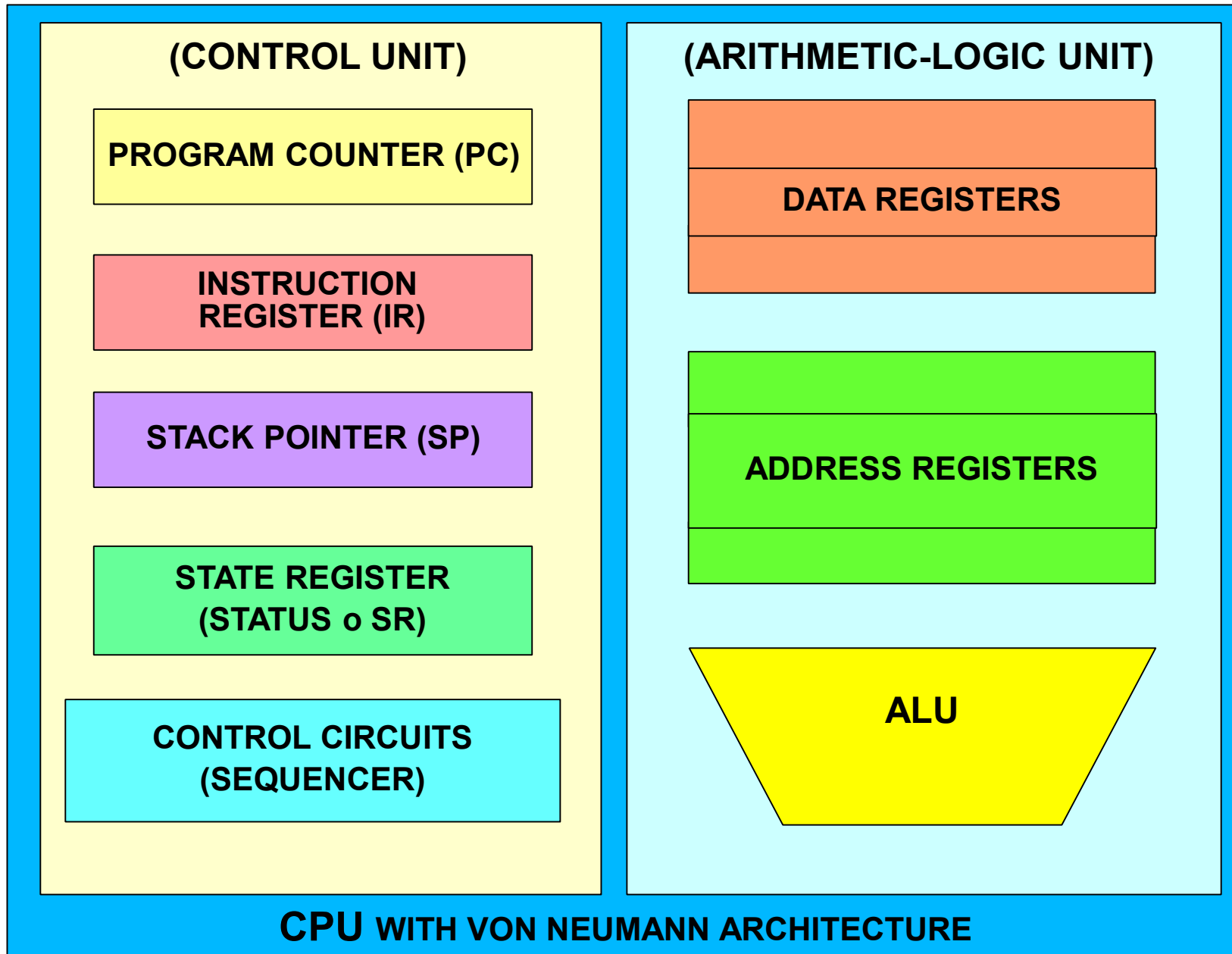
- SELECTION LOGIC:** Simple combinatorial circuit (gates, PLD, etc.) that activates/deactivates the system devices according to their addresses assigned in the memory map (*).

(*) In systems with I/O MAPPING to memory



(1)

1.2 Basic architecture of a microprocessor



(1)

1.3 Operation of a microprocessor-based system (I)

- Application program stored in memory (machine code)
 - The CPU sequentially reads (state machine) the program instructions and interprets them internally by translating them into micro-commands.
- According to the executed instructions, the CPU can:
 - Transfer data to/from the I/O ports or memory.
 - Execute control sequences internally.
 - Perform arithmetic and logic operations.
 - Manipulate some internal parameters through the system registers.

(1)

1.3 Operation of a microprocessor-based system (II)

USER PROGRAMS AND OTHER APPLICATIONS

LIBRARIES AND APPLICATION INTERFACES (APIs)

**OPERATING SYSTEM
(MONITOR, DOS, WINDOWS, LINUX)**

**LOW-LEVEL ROUTINES
(BIOS)**

HARDWARE