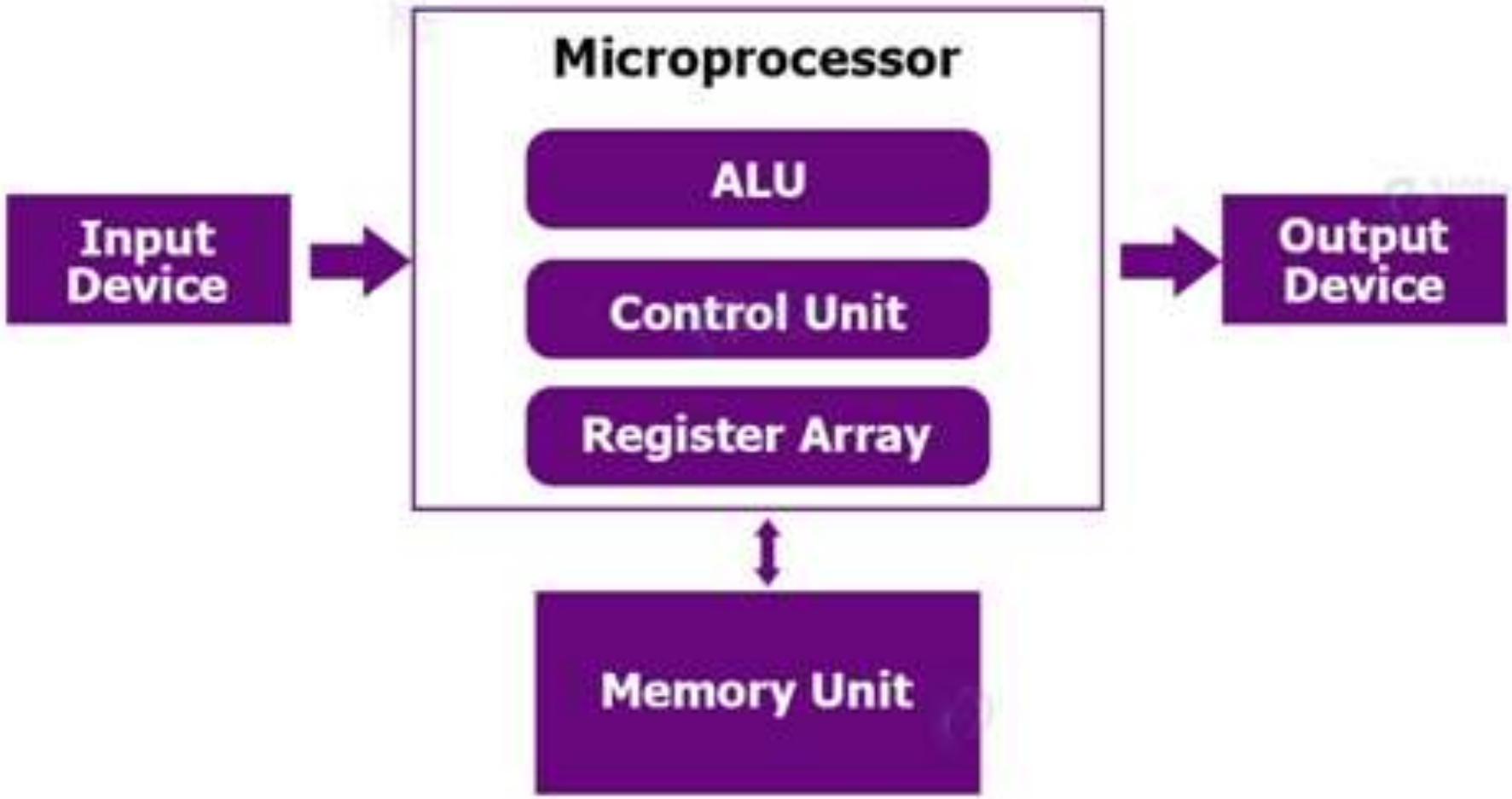
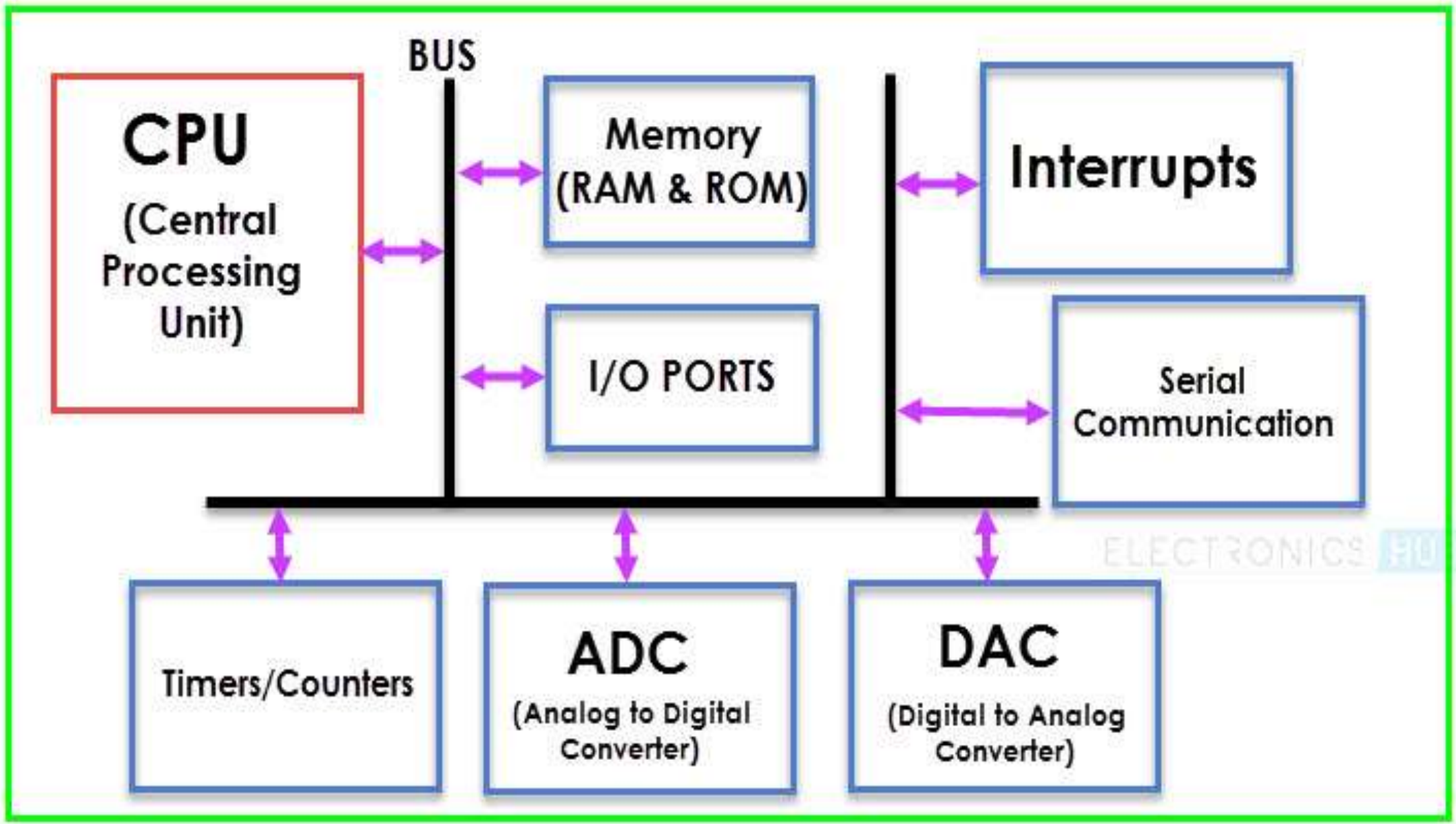
Block Diagram of Microprocessor

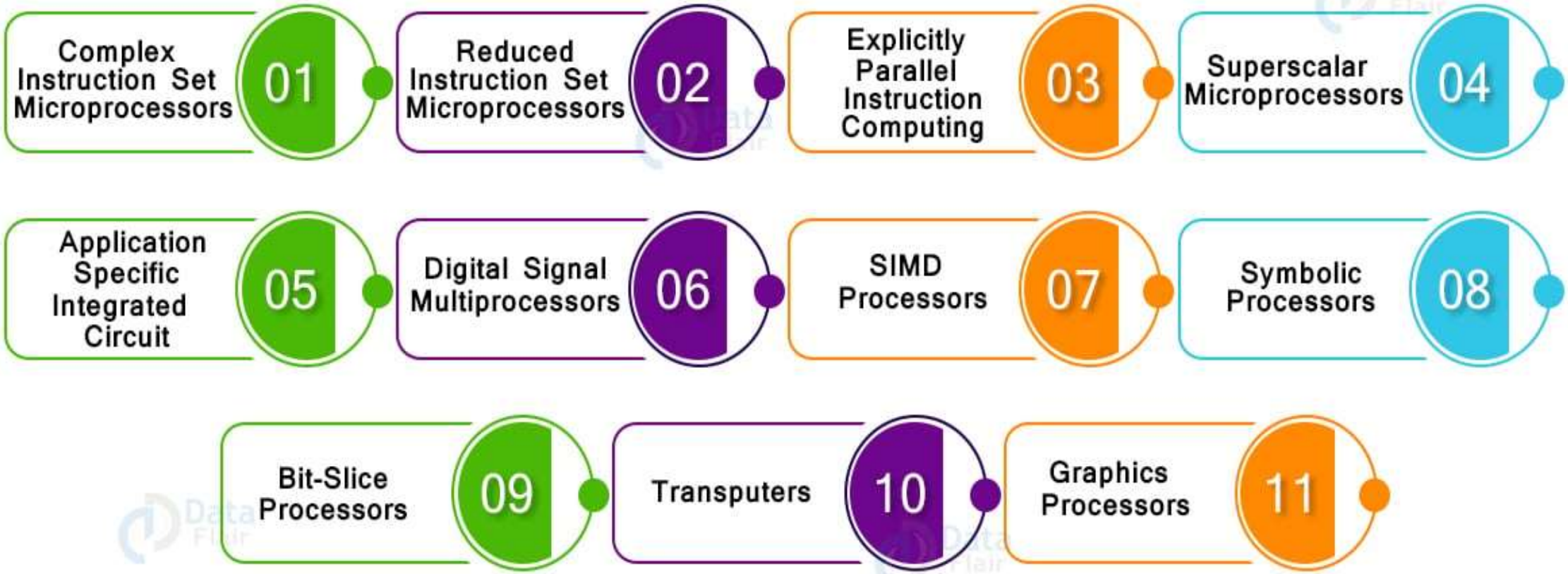



BUS
CPU
(Central Processing Unit)
Memory (RAM & ROM)
I/O PORTS
Interrupts
Serial Communication
Timers/Counters
ADC
(Analog to Digital Converter)
DAC
(Digital to Analog Converter)

- **Basic Microprocessor Terms**
  - **Instructions Per Cycle**
  - **Instruction Set**
  - **Bus**
  - **Word Length**
  - **Clock Speed / Clock Rate**
  - **Bandwidth**
  - **Data Types**
  - **SIMD**
  - **PGA** – Pin Grid Array
  - **FPU** – Floating Point Unit
  - **ALU** – Arithmetic and Logic Unit
  - **MMX** – MultiMedia eXtensions
- **MMU**

Features of Microprocessor

Types of Microprocessor



Microprocessor	Year	Word Length	Memory	Pins	Clock
4004	1971	4-bit	1 KB	16	750kHz
8085	1976	8-bit	64 KB	40	3-6 MHz
8086	1978	16-bit	1MB	40	5-8 MHz
80286	1982	16-bit	16MB real 4 GB virtual	68	6-12.5 MHz
80386	1985	32-bit	4GB real 64TB virtual	132 14X14 PGA	20-33 MHz
80486	1989	32-bit	4GB real 64TB virtual	168 17X17 PGA	25-100 MHz
Pentium	1993	32-bit	4GB real 32-bit address 64-bit data bus	237 PGA	60-200

Microprocessor	Microcontroller
Center of a computer system.	Center of embedded system.
Memory and I/O components are external to it.	Memory and I/O components are internal to it.
Large Circuit	Smaller Circuit
Not compatible with compact systems	Compatible with compact systems.
Higher cost	Lower Cost
High Power Consumption	Low Power Consumption
Mostly don’t have power features	Mostly have power features.
Mainly present in personal computers.	Mainly present in washing machines, music players, and embedded systems.
Less number of registers.	More number of registers.
Follows Von Neumann model	Follows Harvard architecture
Made on a silicon-based integrated chip.	Byproduct microprocessors and

Advantages of Microprocessors

- High-speed processing
- Brings intelligence to the system.
- Is flexible in nature.
- Has a compact size
- Is easy to maintain.

Disadvantages of Microprocessors

- Leads to overheating due to continuous use.
- The data size decides the performance.
- Larger than microcontrollers
- Doesn’t support floating-point operations.

Microcontroller in Computer

- A chip that controls electronic devices is a microcontroller. It is present in a single integrated circuit for embedded applications. It has a memory, processor, and I/O devices for functioning.
- History of Microcontrollers
  - Intel 8048 was one of the first to use it in 1975.
  - EEPROM came out in 1993 boosting the use of microcontrollers.
  - Atmel used flash memory in its microcontroller in the same year.

Features of Microcontrollers

- Processor reset.
- Program and Variable Memory .
- The central processor is device clocking.
- Follows instruction cycle timers.
-

Types of Microcontroller in Computer

- 8-bit Microcontroller
- 16-bit Microcontroller
- 32-bit Microcontroller
- Embedded Microcontroller

- **Applications of Microcontroller**
  - Mobile phones
  - Automobiles
  - CD/DVD players
  - Washing machines
  - Cameras
  - Security alarms
  - Keyboard controllers
  - Microwave oven
  - Watches
  - Mp3 players

Microprocessor	Microcontroller
Center of a computer system.	Center of embedded system.
Memory and I/O components are external to it.	Memory and I/O components are internal to it.
Large Circuit	Smaller Circuit
Not compatible with compact systems	Compatible with compact systems.
Higher cost	Lower Cost
High Power Consumption	Low Power Consumption
Mostly don’t have power features	Mostly have power features.
Mainly present in personal computers.	Mainly present in washing machines, music players, and embedded systems.
Less number of registers.	More number of registers.
Follows Von Neumann model	Follows Harvard architecture
Made on a silicon-based integrated chip.	Byproduct microprocessors and peripherals.
RAM, ROM, and other peripherals are absent.	RAM, ROM, and other peripherals are present.
Has an external bus to interface with devices.	Uses an internal controlling bus for communication.
Has a high speed.	Speed depends on the architecture.
Ideal for general purpose to handle more data	Ideal for the specific applications

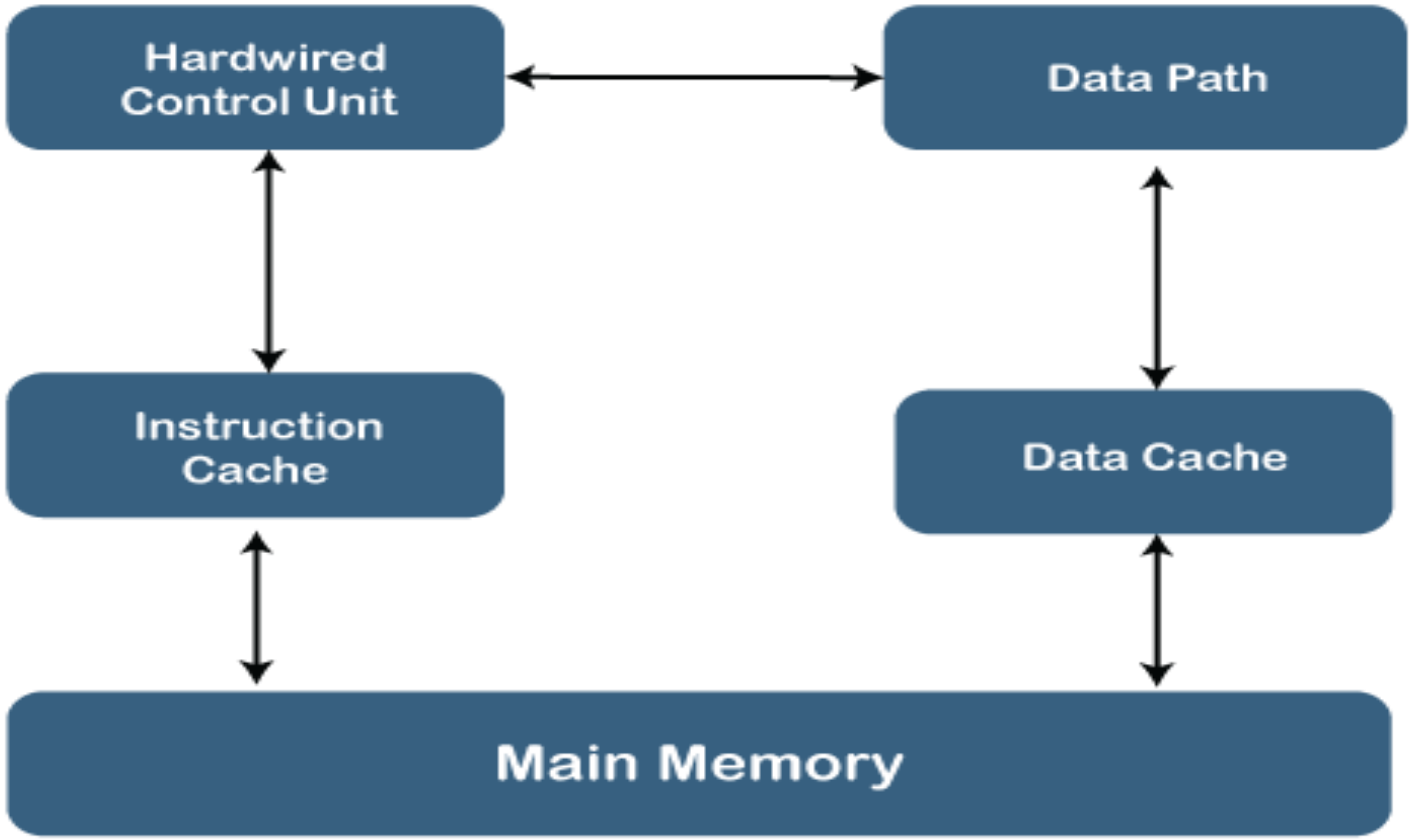
• Advantages of RISC Processor

1. The RISC processor's performance is better due to the simple and limited number of the instruction set.
2. It requires several transistors that make it cheaper to design.
3. RISC allows the instruction to use free space on a microprocessor because of its simplicity.
4. RISC processor is simpler than a CISC processor because of its simple and quick design, and it can complete its work in one clock cycle.

• Disadvantages of RISC Processor

1. The RISC processor's performance may vary according to the code executed because subsequent instructions may depend on the previous instruction for their execution in a cycle.
2. Programmers and compilers often use complex instructions.
3. RISC processors require very fast memory to save various instructions that require a large collection of cache memory to respond to the instruction in a short time.

RISC Architecture



RISC Architecture

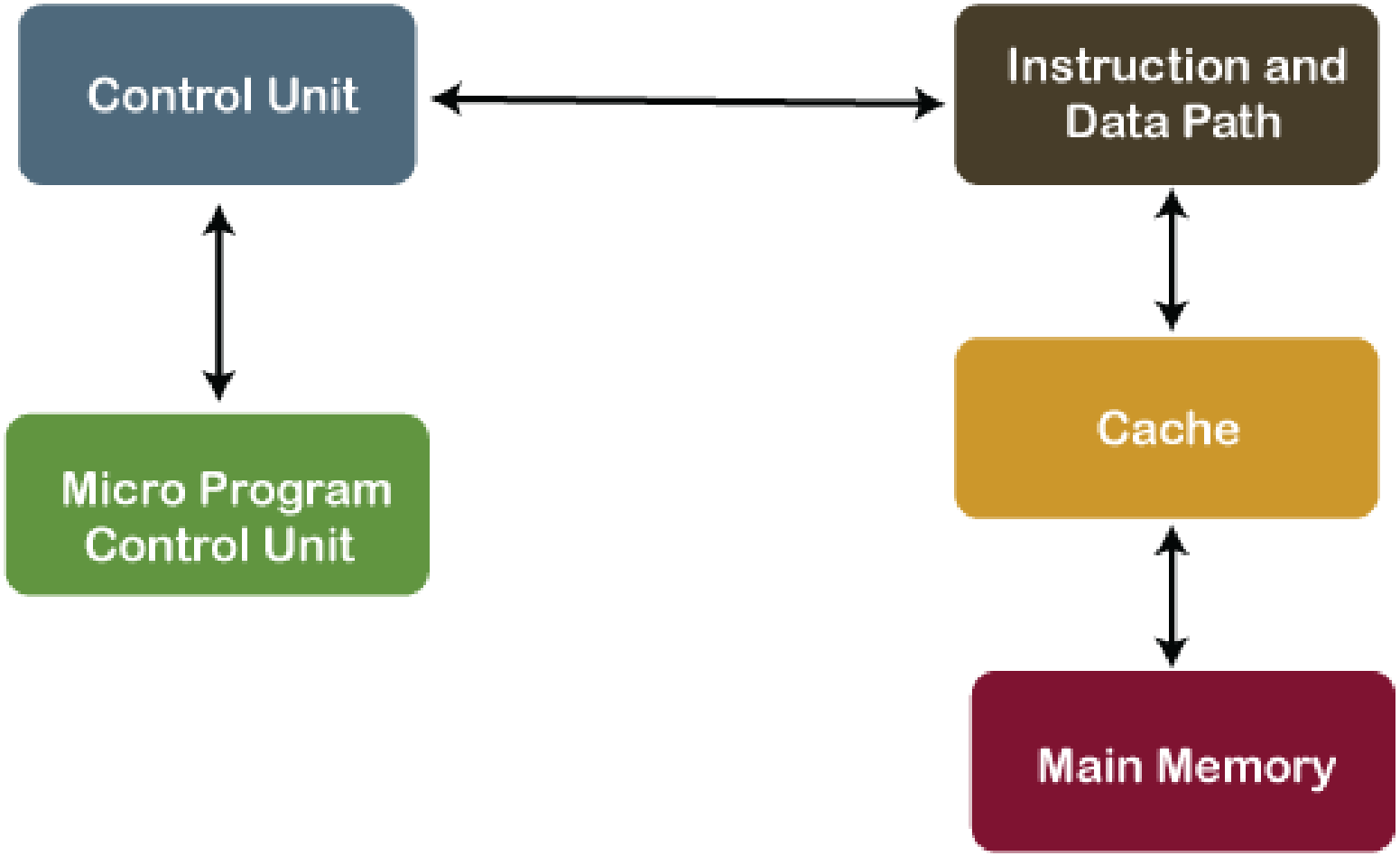
Features of RISC Processor

1. **Pipelining technique:** The pipelining technique is used in the RISC processors to execute multiple parts or stages of instructions to perform more efficiently.
2. **A large number of registers:** RISC processors are optimized with multiple registers that can be used to store instruction and quickly respond to the computer and minimize interaction with computer memory.
3. **It supports a simple addressing mode and fixed length of instruction for executing the pipeline.**
4. **It uses LOAD and STORE instruction to access the memory location.**
5. **Simple and limited instruction reduces the execution time of a process in a RISC**.

CISC Processor

1. The length of the code is shorts, so it requires very little RAM.
2. CISC or complex instructions may take longer than a single clock cycle to execute the code.
3. Less instruction is needed to write an application.
4. It provides easier programming in assembly language.
5. Support for complex data structure and easy compilation of high-level languages.
6. It is composed of fewer registers and more addressing nodes, typically 5 to 20.
7. Instructions can be larger than a single word.
8. It emphasizes the building of instruction on hardware because it is faster to create than the software.

CISC Processors Architecture



CISC Architecture

Advantages of CISC Processors

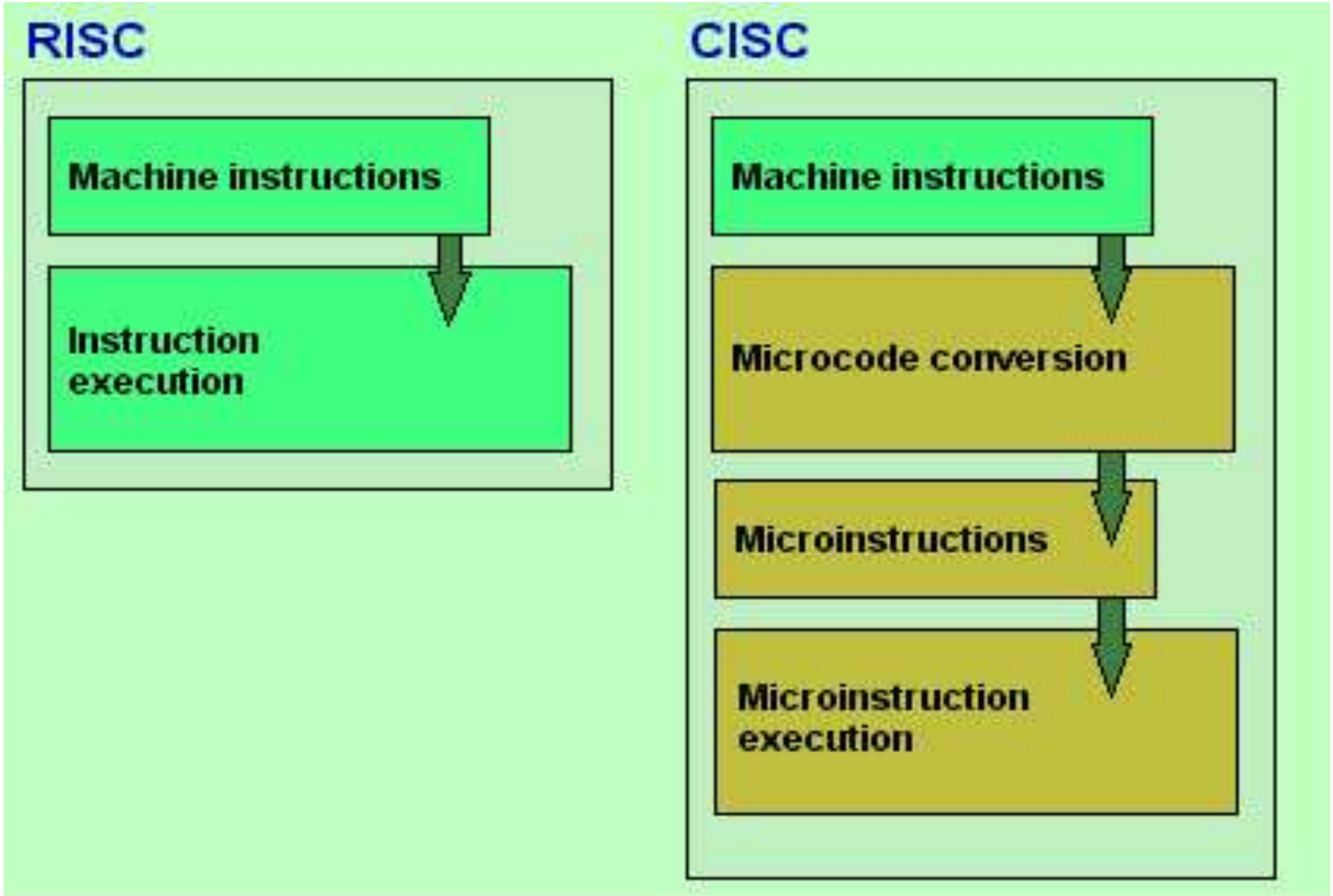
1. The compiler requires little effort to translate high-level programs or statement languages into assembly or machine language in CISC processors.
2. The code length is quite short, which minimizes the memory requirement.
3. To store the instruction on each CISC, it requires very less RAM.
4. Execution of a single instruction requires several low-level tasks.
5. CISC creates a process to manage power usage that adjusts clock speed and voltage.
6. It uses fewer instructions set to perform the same instruction as the RISC.

Disadvantages of CISC Processors

1. CISC chips are slower than RSIC chips to execute per instruction cycle on each program.
2. The performance of the machine decreases due to the slowness of the clock speed.
3. Executing the pipeline in the CISC processor makes it complicated to use.
4. The CISC chips require more transistors as compared to RISC design.
5. In CISC it uses only 20% of existing instructions in a programming event.

Difference between the RISC and CISC Processors

RISC	CISC
It is a Reduced Instruction Set Computer.	It is a Complex Instruction Set Computer.
It emphasizes on software to optimize the instruction set.	It emphasizes on hardware to optimize the instruction set.
It is a hard wired unit of programming in the RISC Processor.	Microprogramming unit in CISC Processor.
It requires multiple register sets to store the instruction.	It requires a single register set to store the instruction.
RISC has simple decoding of instruction.	CISC has complex decoding of instruction.
Uses of the pipeline are simple in RISC.	Uses of the pipeline are difficult in CISC.
It uses a limited number of instruction that requires less time to execute the instructions.	It uses a large number of instruction that requires more time to execute the instructions.
It uses LOAD and STORE that are independent instructions in the register-to-register a program's interaction.	It uses LOAD and STORE instruction in the memory-to-memory interaction of a program.
RISC has more transistors on memory registers.	CISC has transistors to store complex instructions.
The execution time of RISC is very short.	The execution time of CISC is longer.
RISC architecture can be used with high-end applications like telecommunication, image processing, video processing, etc.	CISC architecture can be used with low-end applications like home automation, security system, etc.
It has fixed format instruction.	It has variable format instruction.
The program written for RISC architecture needs to take more	Program written for CISC architecture tends to take less space


RISC
Machine instructions
Instruction execution
CISC
Machine instructions
Microcode conversion
Microinstructions
Microinstruction execution

ANY ?