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# Chapter 2

## Inside the System Unit

# How Computers Represent Data

A **bit** is a single circuit that either contains a current or does not. The binary digits of **0** and **1** are used as a means of representing the off/on state of a computer switch, or bit.

<b>Binary Digit</b>	0	1
<b>Bit (circuitry)</b>	○ no current	● current
<b>Status</b>	Off	On

A **byte** is a group of **eight** bits and is the method of representing one character of data, such as the essential numbers (0–9), the basic letters of the alphabet like the character Z (uppercase and lowercase), and the most common punctuation symbols. **Byte= 8-bits.**

Keyboard Character	Binary Number Representation
R	01010010
S	01010011
T	01010100
L	01001100
N	01001110
E	01000101

## Number of Bits

## Number of Possibilities

1

$$2^1 = 2$$

2

$$2^2 = 4$$

3

$$2^3 = 8$$

4

$$2^4 = 16$$

5

$$2^5 = 32$$

6

$$2^6 = 64$$

7

$$2^7 = 128$$

8

$$2^8 = 256$$

Unit	Abbreviation	Storage Amount
Byte	B	8 bits
Kilobyte	KB	1 thousand bytes
Megabyte	MB	1 million bytes
Gigabyte	GB	1 billion bytes
Terabyte	TB	1 trillion bytes
Petabyte	PB	1 quadrillion bytes
Exabyte	EB	1 quintillion bytes
Zettabyte	ZB	1 sextillion bytes
Yottabyte	YB	1 septillion bytes

<b>Decimal Number</b>	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Binary Number</b>	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
<b>Hexadecimal Number</b>	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

# Representing Characters



**Character code** uses an algorithm as a bridge between the computer's bit patterns and the letters, numbers, and symbols on our keyboards called characters that we're accustomed to using.

**1- ASCII code (7-bits).**

**2- Extended ASCII code (8-bits).**

**3- Unicode (16-bits).**

# ASCII code

Character	ASCII Code	Character	ASCII Code	Character	ASCII Code
!	00100001	E	01000101	e	01100101
#	00100011	P	01010000	p	01110000
\$	00100100	A	01000001	a	01100001
space	00100000	Y	01011001	y	01111001

# Extended ASCII code

P	a	y	space	\$	6.50	!
01010000	01100001	01111001	00100000	00100100	0 10000001 101000000000000000000000	00100001

**The system unit is a boxlike case that comes in a variety of shapes and sizes, and houses the computer's main hardware components.**

All-in-one system unit



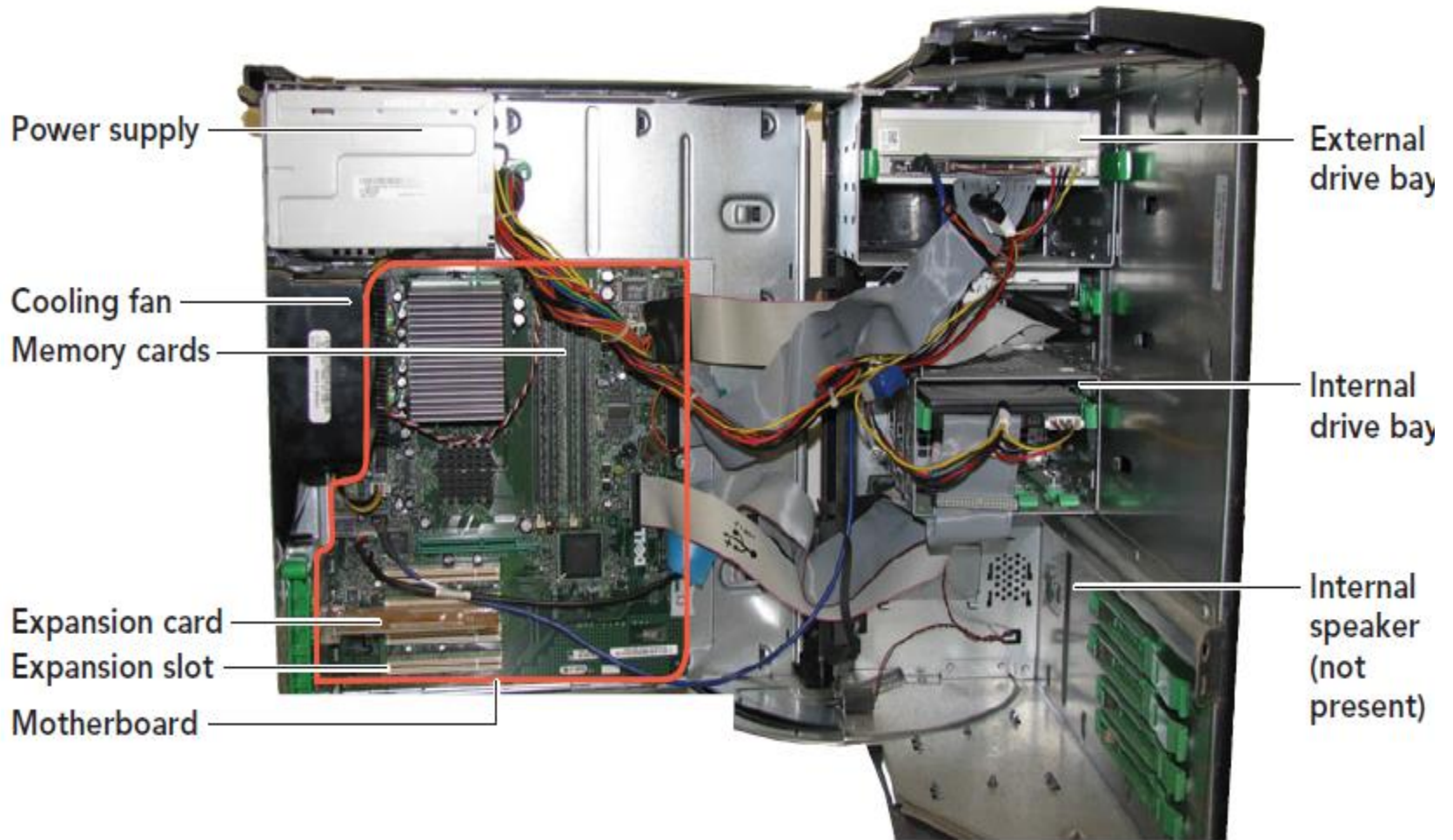
Notebook system unit



Desktop system unit

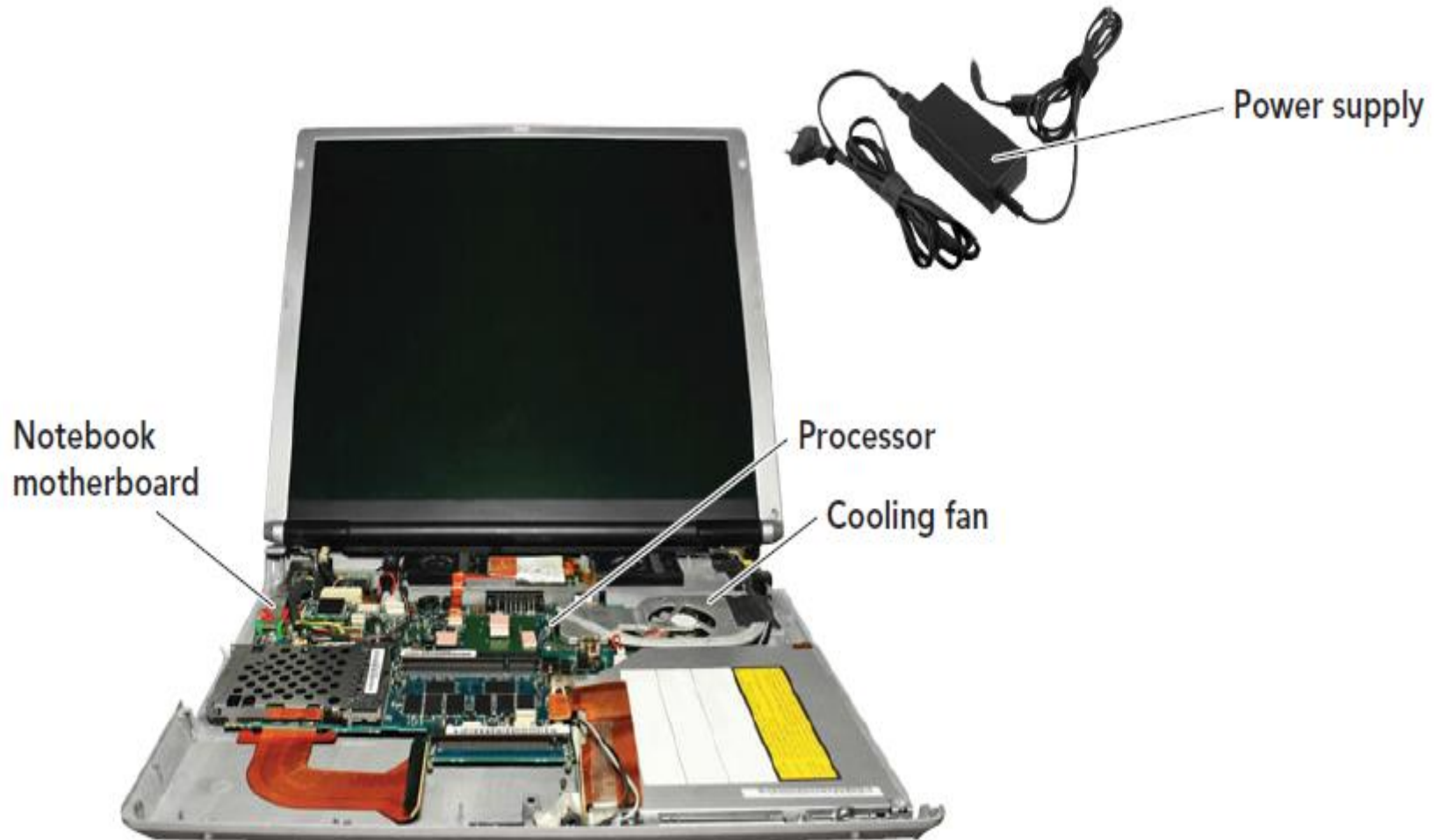


# Inside the system unit

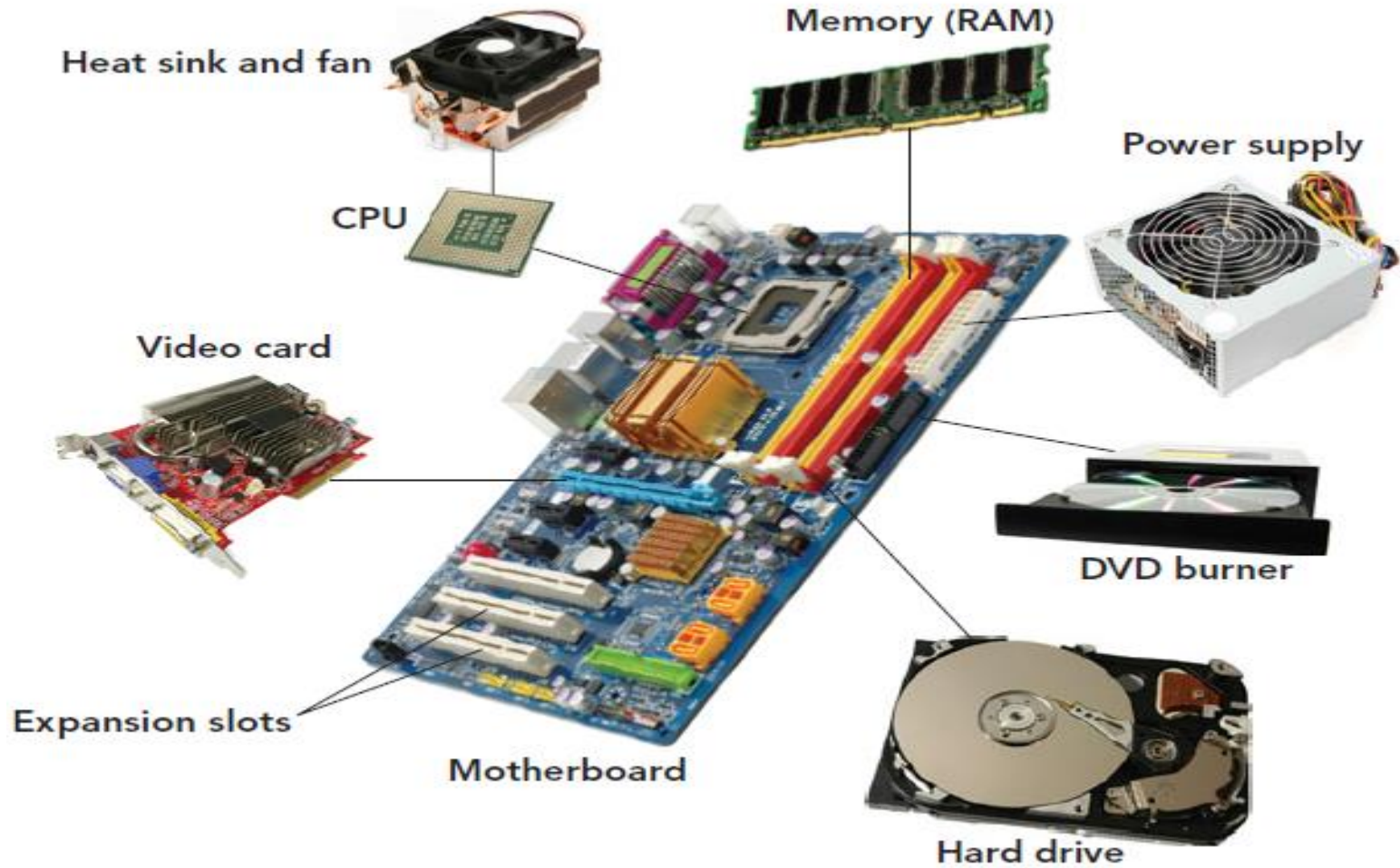




# Inside the system unit



# Motherboard

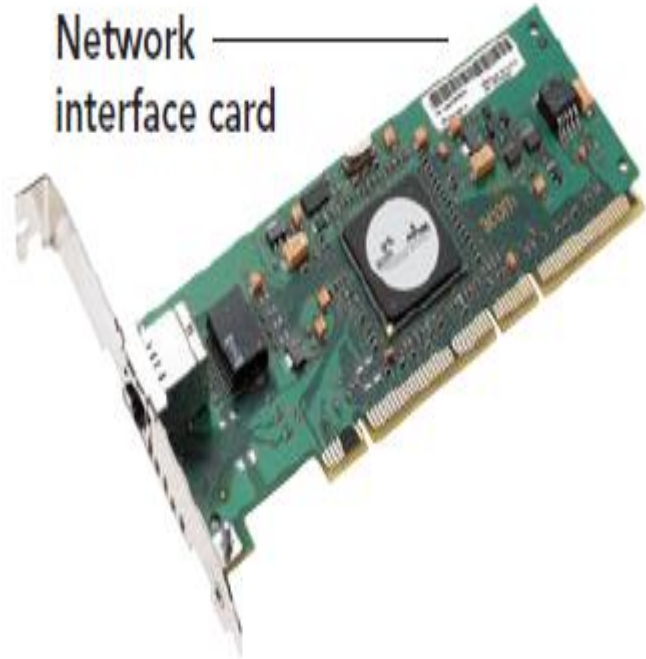


# Expansion cards

Sound card —



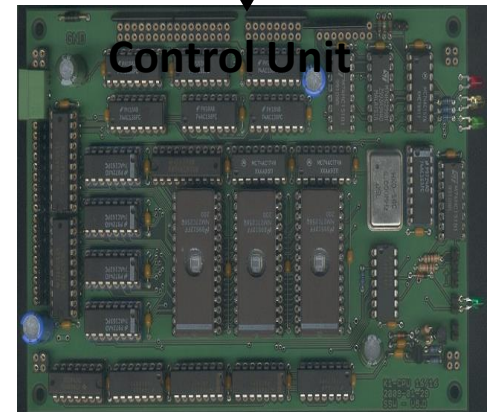
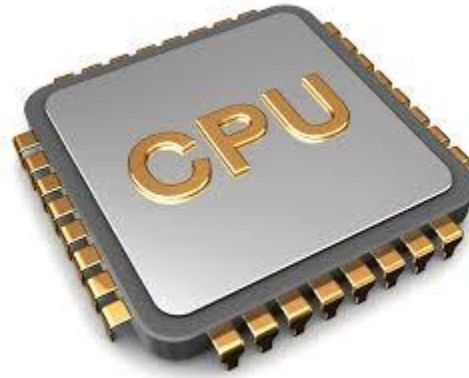
Network interface card —



**The central processing unit (CPU)** is a microprocessor (or processor for short) that interprets and carries out software instructions by processing data and controlling the rest of the computer's components.

**Embedded processors:** These processors are designed and programmed to perform only the tasks intended to be done by that device.

# Central Processing Unit



# Machine Cycle

## A) Instruction cycle

- 1. *Fetch*:** Retrieves the next program instruction from the computer's RAM or cache memory.
- 2. *Decode*:** Takes the fetched instruction and translates it into a form that the control unit understands.

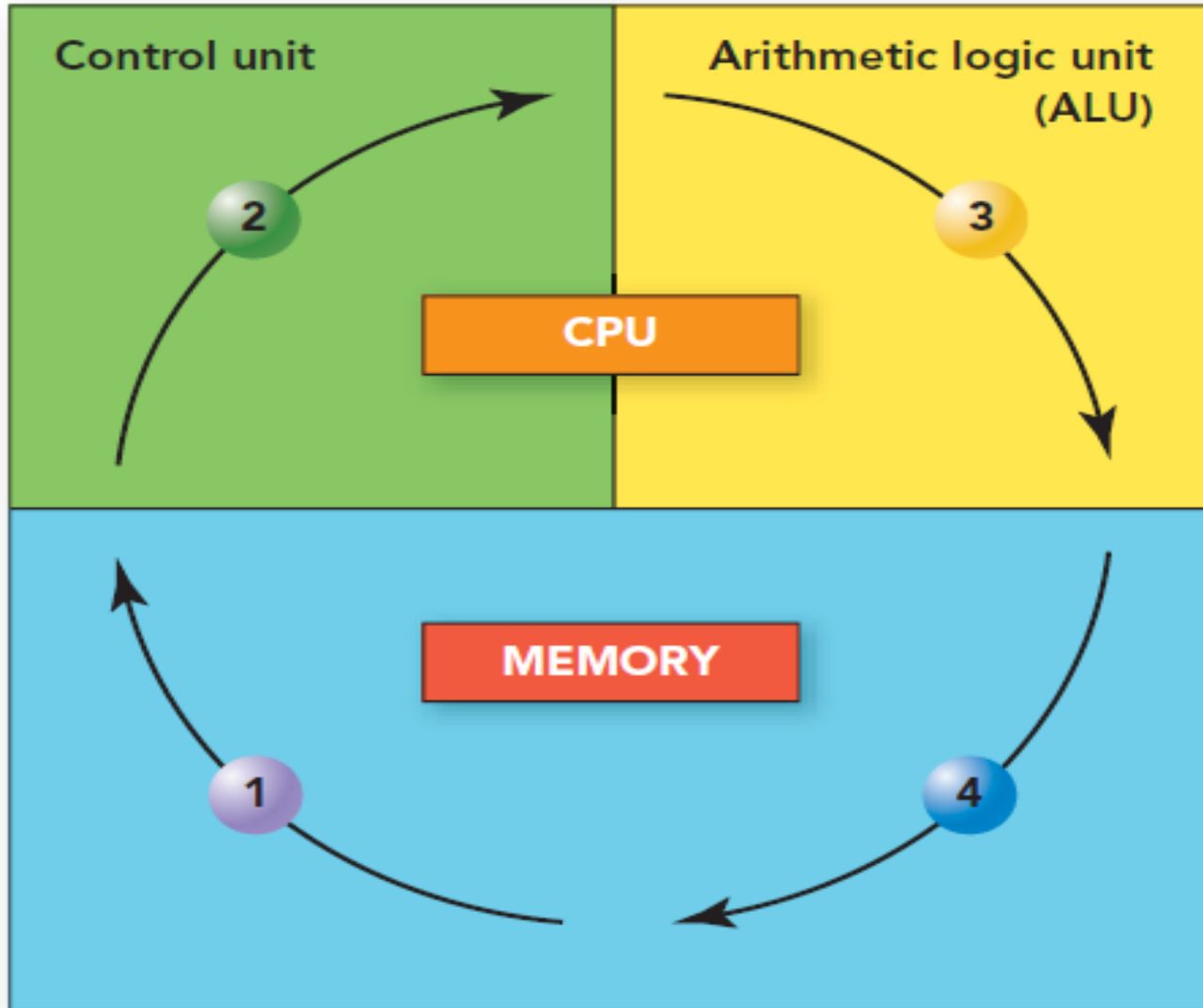
# Machine Cycle

## B) Execution cycle

**3. *Execute:*** Performs the requested instruction using the arithmetic logic unit (ALU) to perform arithmetic operations, and logical operations.

**4. *Store:*** Stores the results in an internal register (a location on the CPU) or in RAM.

# Machine Cycle





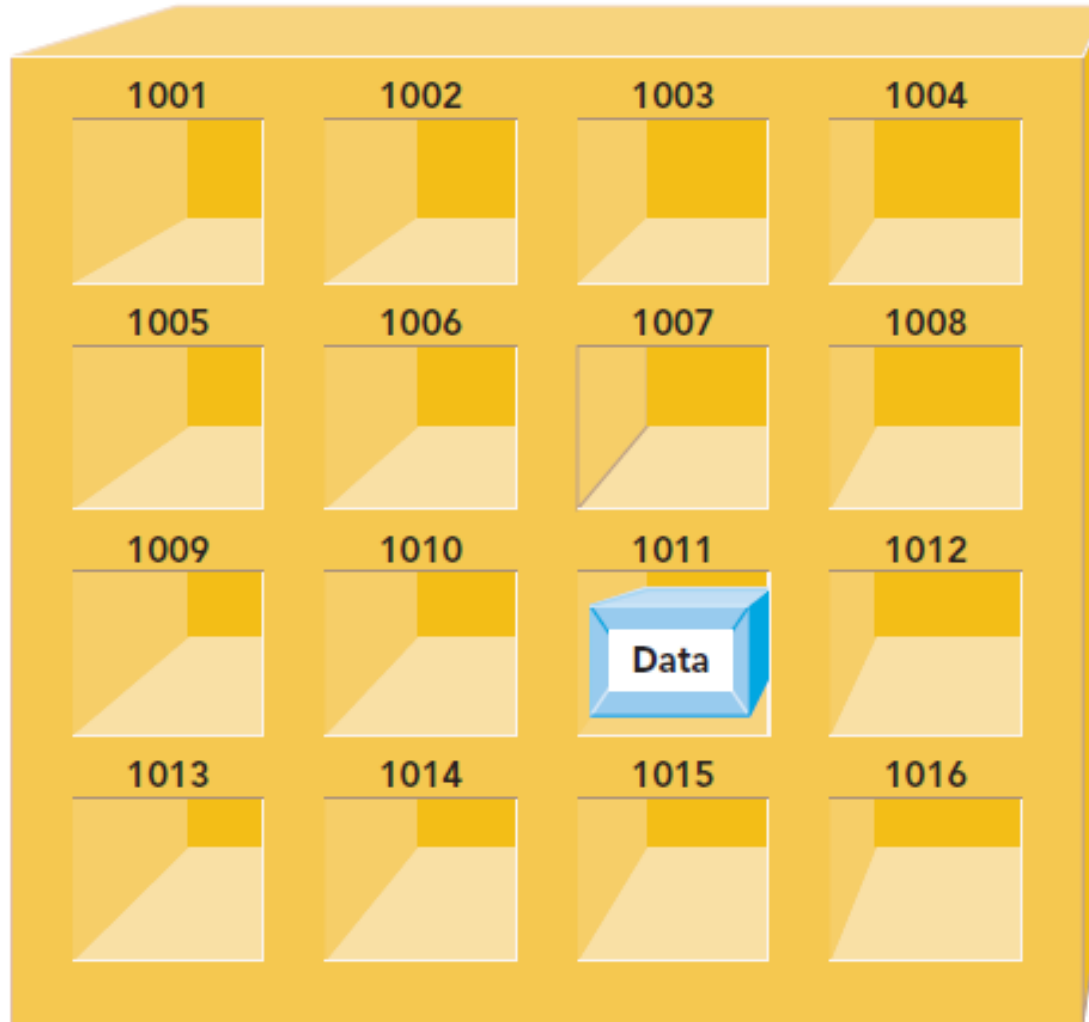
# Microprocessor Performance

- 1- The data bus width and word size
- 2- Clock speed (GHz).
- 3- Operations per microprocessor cycle.
- 4- Use of parallel processing.
- 5- Type of chips.

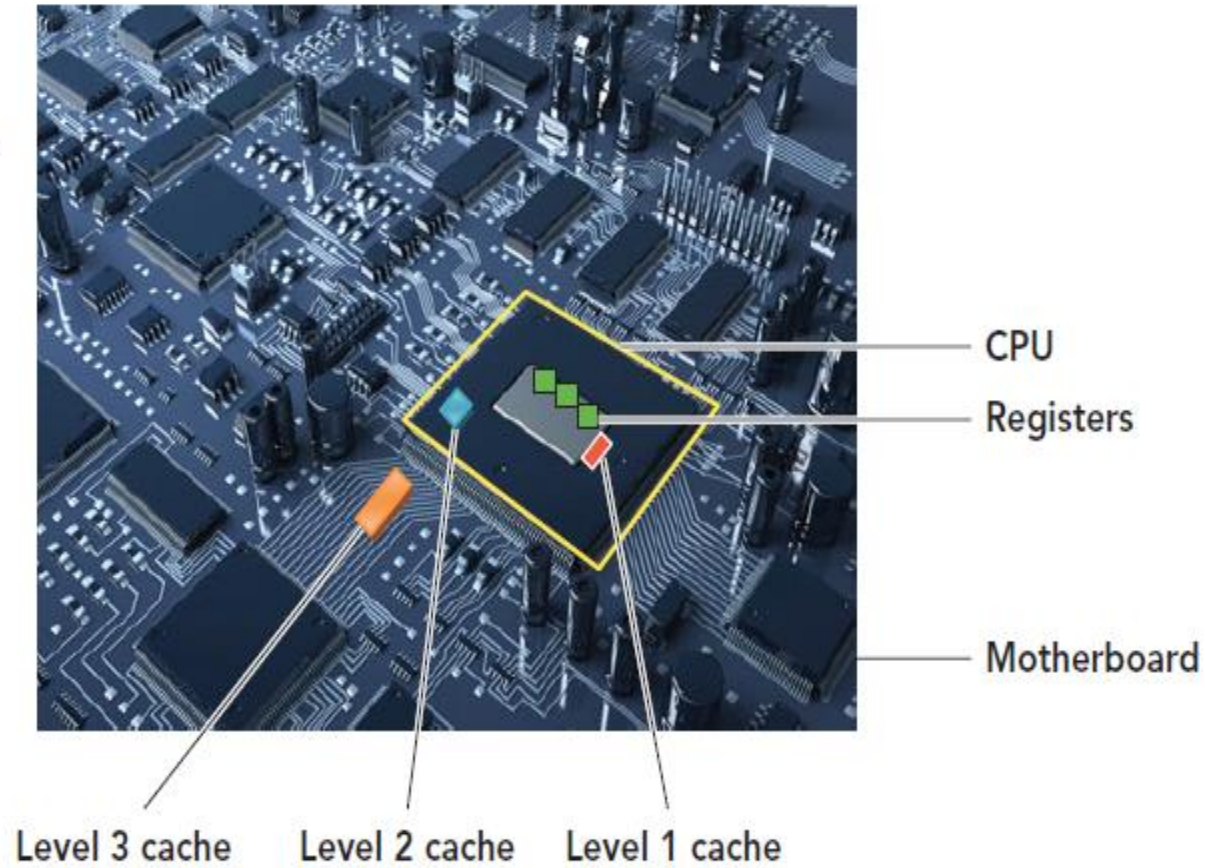
**Parallel processing:** a technique that uses more than one processor to execute a program.

**Multi-Core Processing:** In dual core and quad-core processors, access time is reduced and overall processing time improved because each core handles incoming streams of data or instructions at the same time.

# Random Access Memory (RAM)



# Cash Memory



# Read Only Memory (ROM)

**1- BIOS:** the basic input/output system the first code run when a system is powered on. It checks and initializes such devices as the keyboard, display screens, and disk drives.

**2- Bootstrap Loader:** a program that locates and loads the operating system into RAM.

# Read Only Memory (ROM)

**3- POST the power-on self test:** a program that is run when the system is started. It checks the circuitry and RAM, marking any locations that are defective so that they do not get used.

**4- CMOS complementary metal oxide semiconductor:** controls a variety of actions including starting the power-on self test and verifying that other components of the system are functioning correctly.

# Read Only Memory (ROM)

**1- PROM programmable read-only memory** that can be written on only once, but requires a special writing device. It cannot be erased and reused. It is used to hold startup programs that are never meant to be changed.

# Read Only Memory (ROM)

**2- EPROM—electrically programmable read-only memory** is erasable PROM that can be reused many times. Erasure is accomplished using a UV (ultraviolet) light source that shines through a quartz erasing window in the EPROM package. It is used primarily by programmers in the development process of programs so that errors can be corrected.



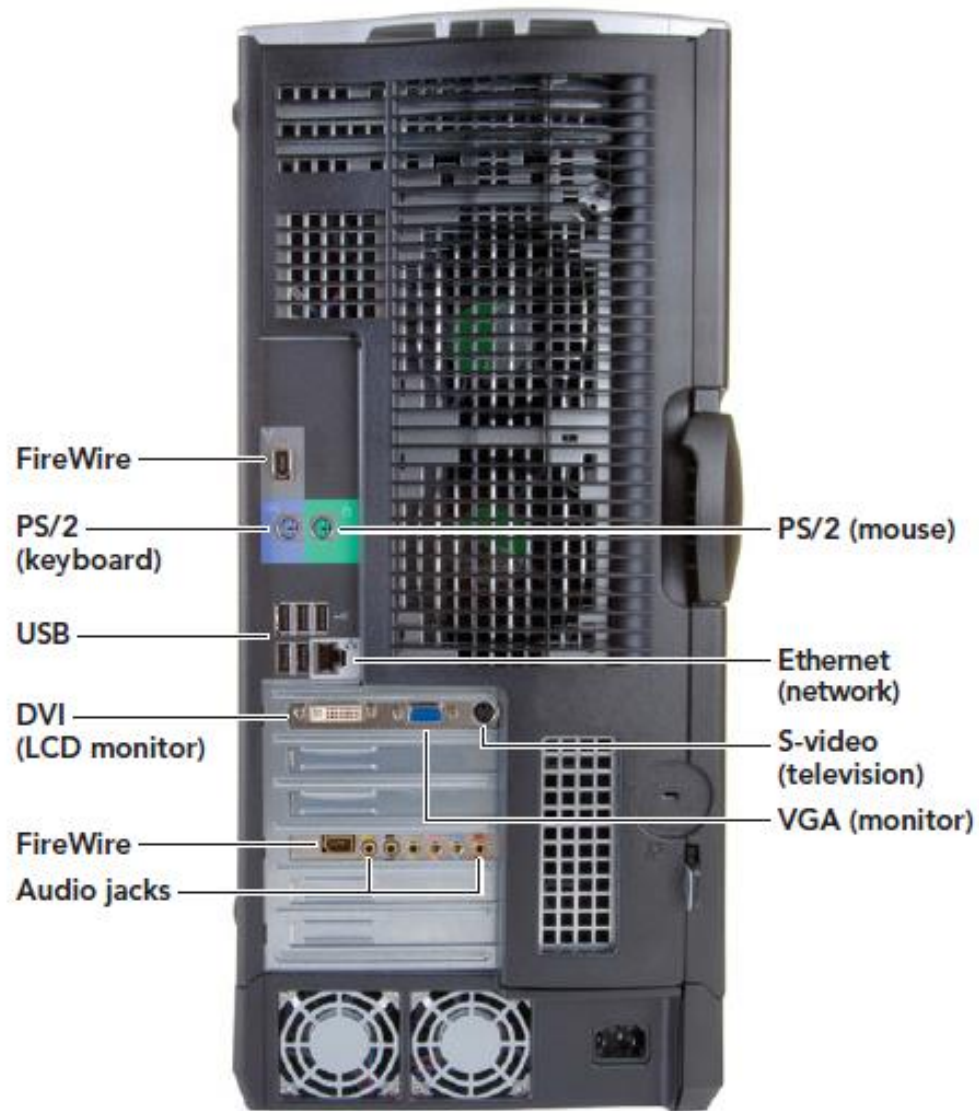
# Read Only Memory (ROM)

**3- EEPROM electrically erasable programmable read-only memory** that can be rewritten many times while the chip is in the computer. EEPROM is erased one byte at a time, using an electric field instead of an UV light source, eliminating the need for an erasing window. It is used in the development process to allow for the quick correction or editing of programs being tested.

# Read Only Memory (ROM)

**4- Flash EPROM** similar to an EEPROM except that flash EPROMs are erased in blocks, whereas regular EEPROMs erase one byte at a time. This is the type of chip that currently holds the BIOS so that it can be altered by the user during the boot process by holding down certain keys. Again, changes should be made with care only by an experienced user.

# Outside the computer



**A connector** is a physical receptacle located on the system unit or an expansion card that is visible on the outside of the unit. Each connector is designed for a specific type of plug.

**A port** is an electronically defined pathway or interface for getting information into and out of the computer.

**USB (Universal Serial Bus) ports can connect a variety of devices, including keyboards, mice, printers, and digital cameras, and were designed to replace older parallel and serial ports.**



**Hot swapping is the ability to connect and disconnect devices without shutting down your computer.**

**Plug-and-play (PnP) refers to a set of standards, jointly developed by Intel Corporation and Microsoft, which enable a computer to automatically detect the brand, model, and characteristics of a device when you plug it in and configure the system accordingly.**



**USB hub computer needs more USB ports to expand options.**

**FireWire**, an interface Apple created and standardized as the IEEE 1394 High Performance Serial Bus specification.



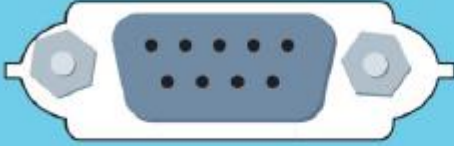





**SATA (Serial Advance Technology Attachment):** The Serial ATA International Organization (SATA IO) is responsible for developing, managing, and pushing the adoption of the serial ATA specifications. Users of the SATA interface benefit from greater speed, simpler upgradable storage devices, and easier configuration.



**Legacy technology** is an older technology, device, or application that is being phased out in favor of new advances in technology. Although legacy technology may still work, it may not be available on newer computer systems.

## Legacy Technologies

Connector	Use
 <p>Serial</p>	Dial-up modems, mice, scanners, or printers
 <p>Parallel</p>	Printers, external storage devices, or scanners
 <p>PS/2</p>	Mice and keyboards
 <p>SCSI</p>	Scanners, zip drives, and external hard drives