



Topic 1

Computer Organization

In January 2018, Apple published this TV spot showing its vision of the future...

How do you think this commercial was received?





What's a computer?





PlayStation®5



PlayStation®5 Digital Edition





G-SHOCK

CASIO VIBE ALARM

* 10 PORT ELIZABETH_Z

↑ 6:18
↓ P 6:26

3:03
196cm



1.0



HOME

P 10:58 SUN 30
SN2 DOD VIB LT

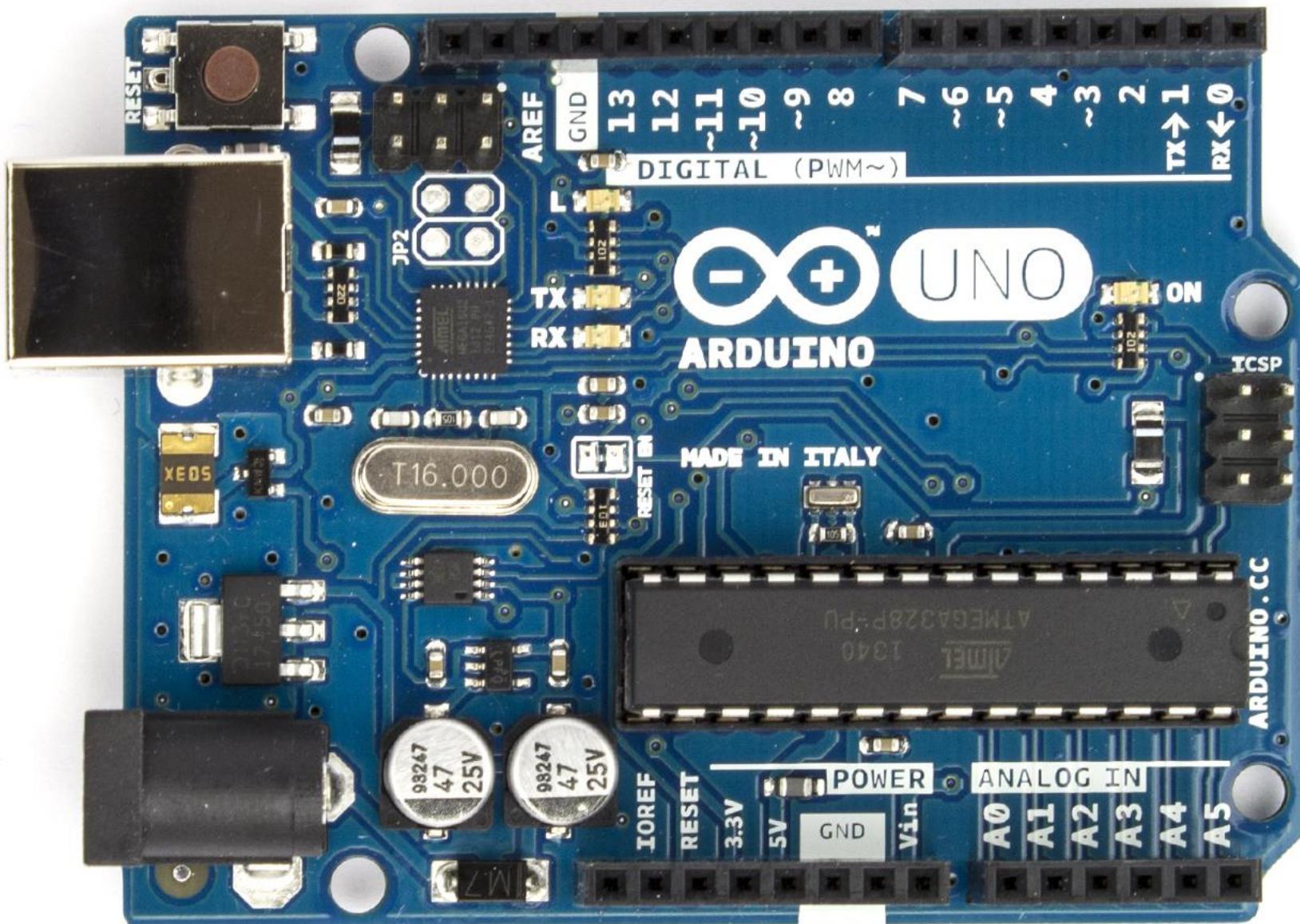
WE20BAR

MODE DISP

STANDBY LAP



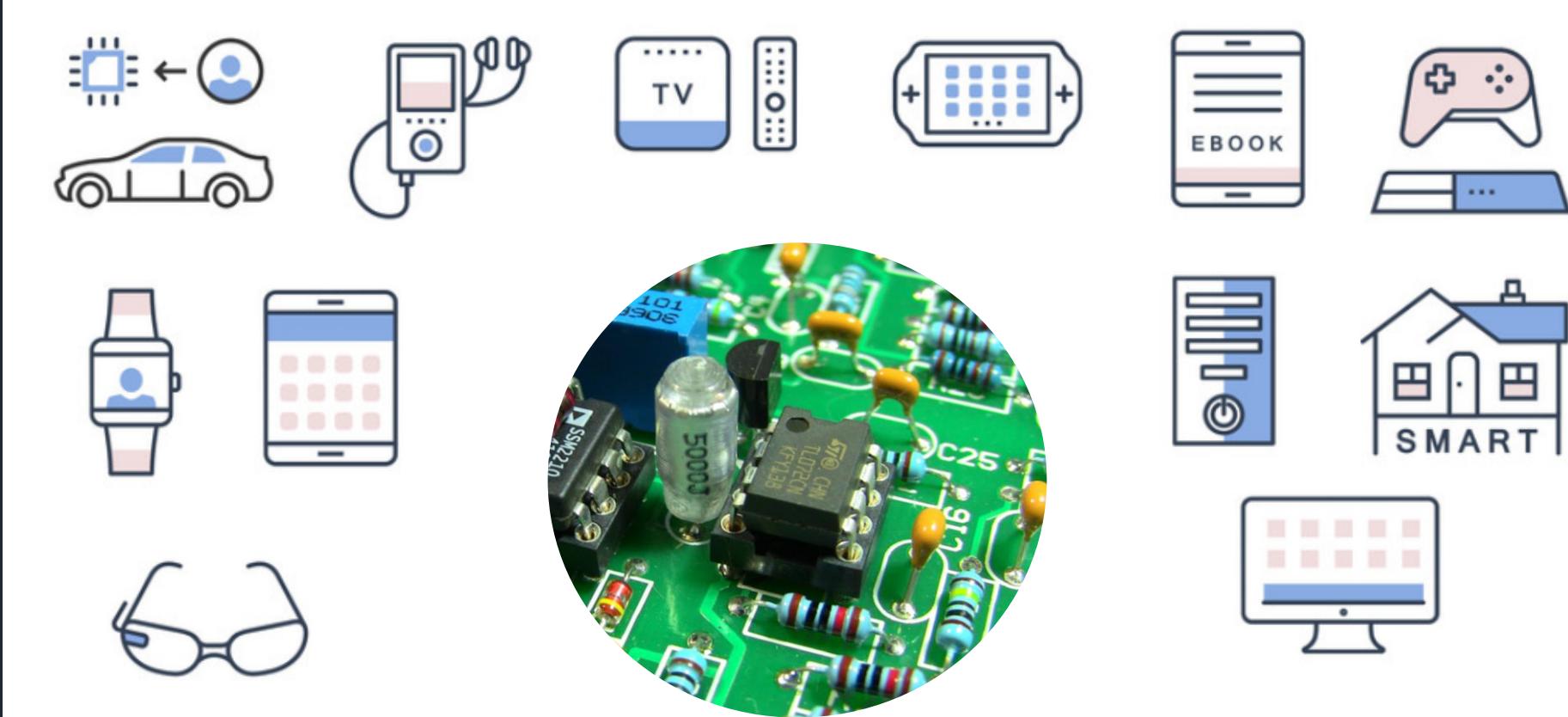






What is a computer?

An electronic device



Made up of electronic components (chips, transistors, capacitors, resistors, cables).

What is a computer?

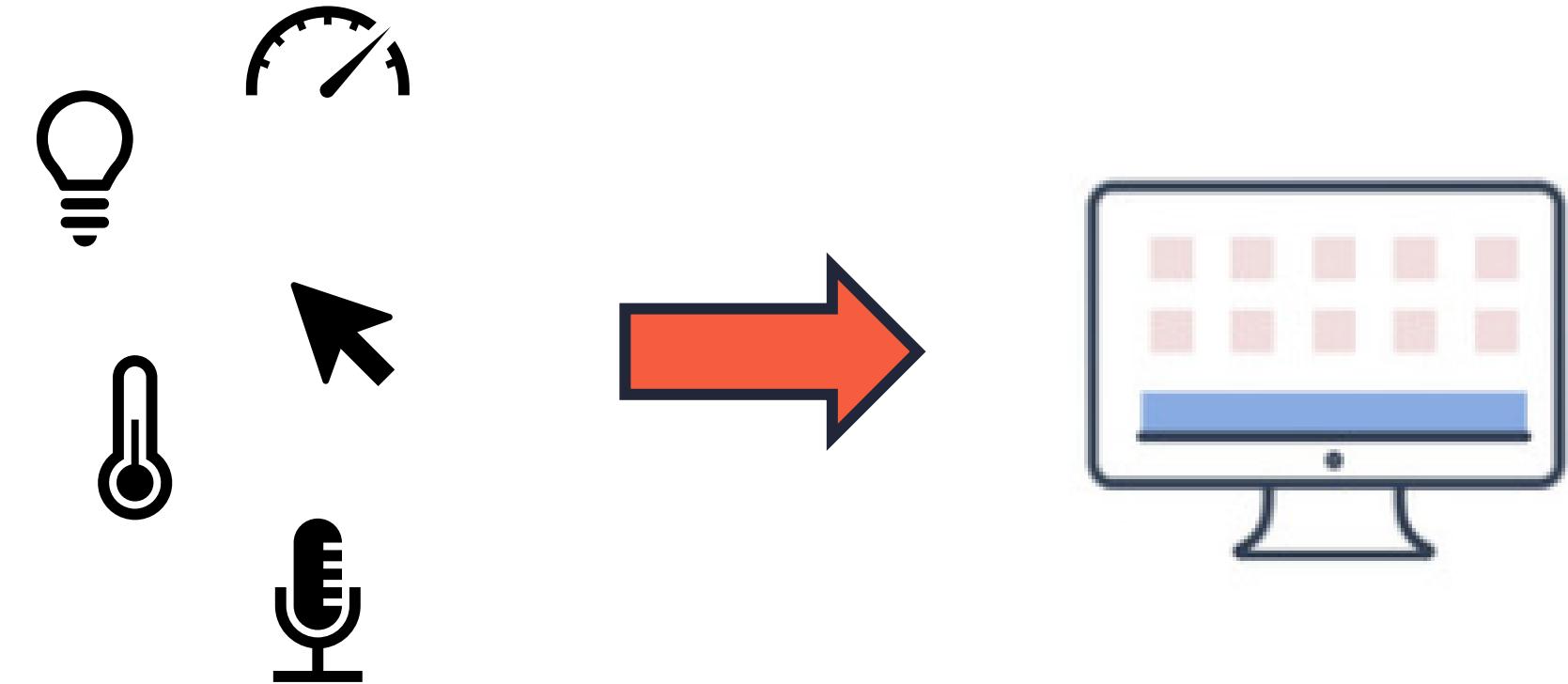
programmable



The behavior of the device can be changed without switching any of its parts

What is a computer?

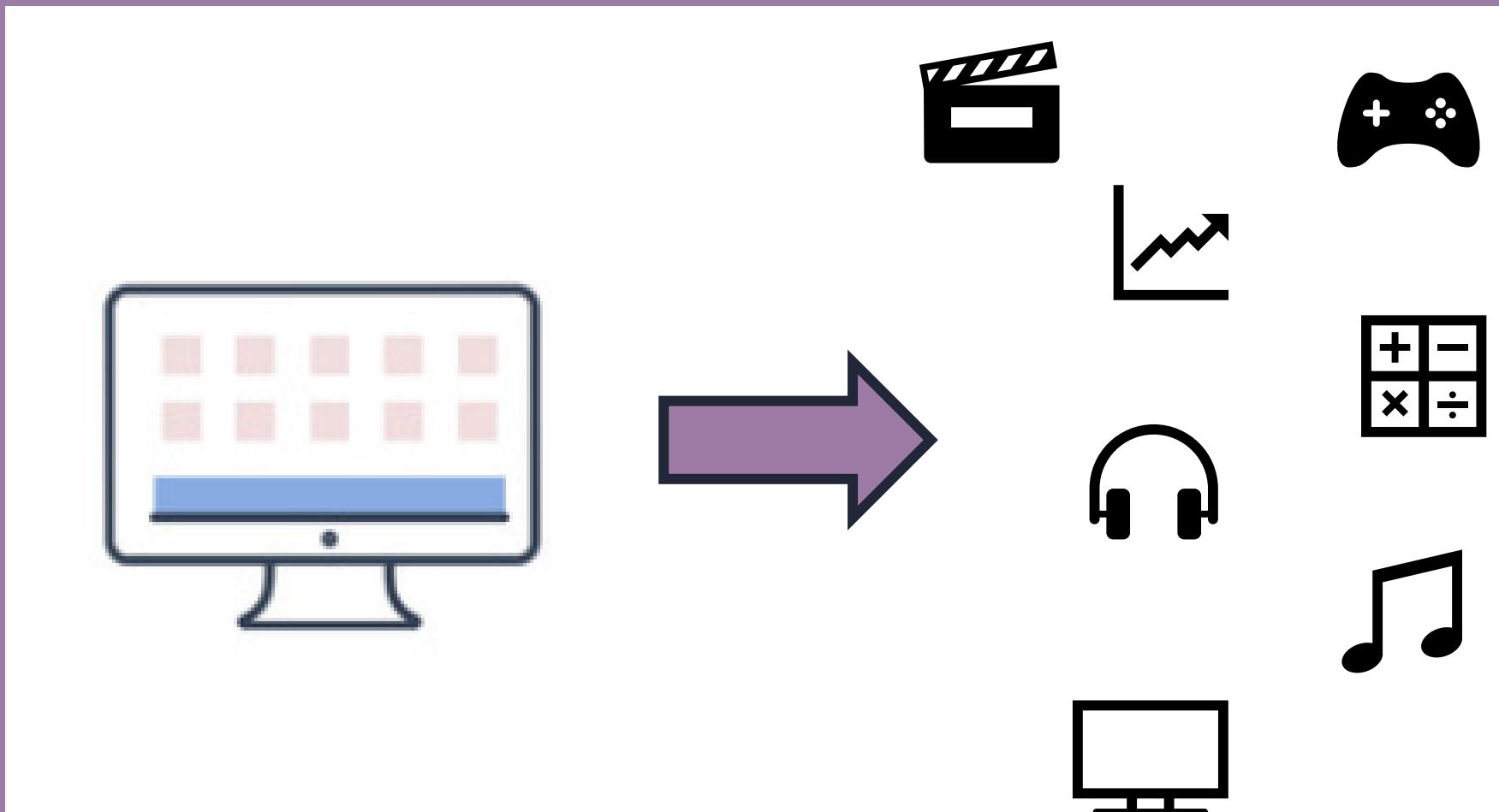
can receive
inputs



Interacts with its surroundings through sensors:
microphones, mouse, thermometer, camera...

What is a computer?

and process a result



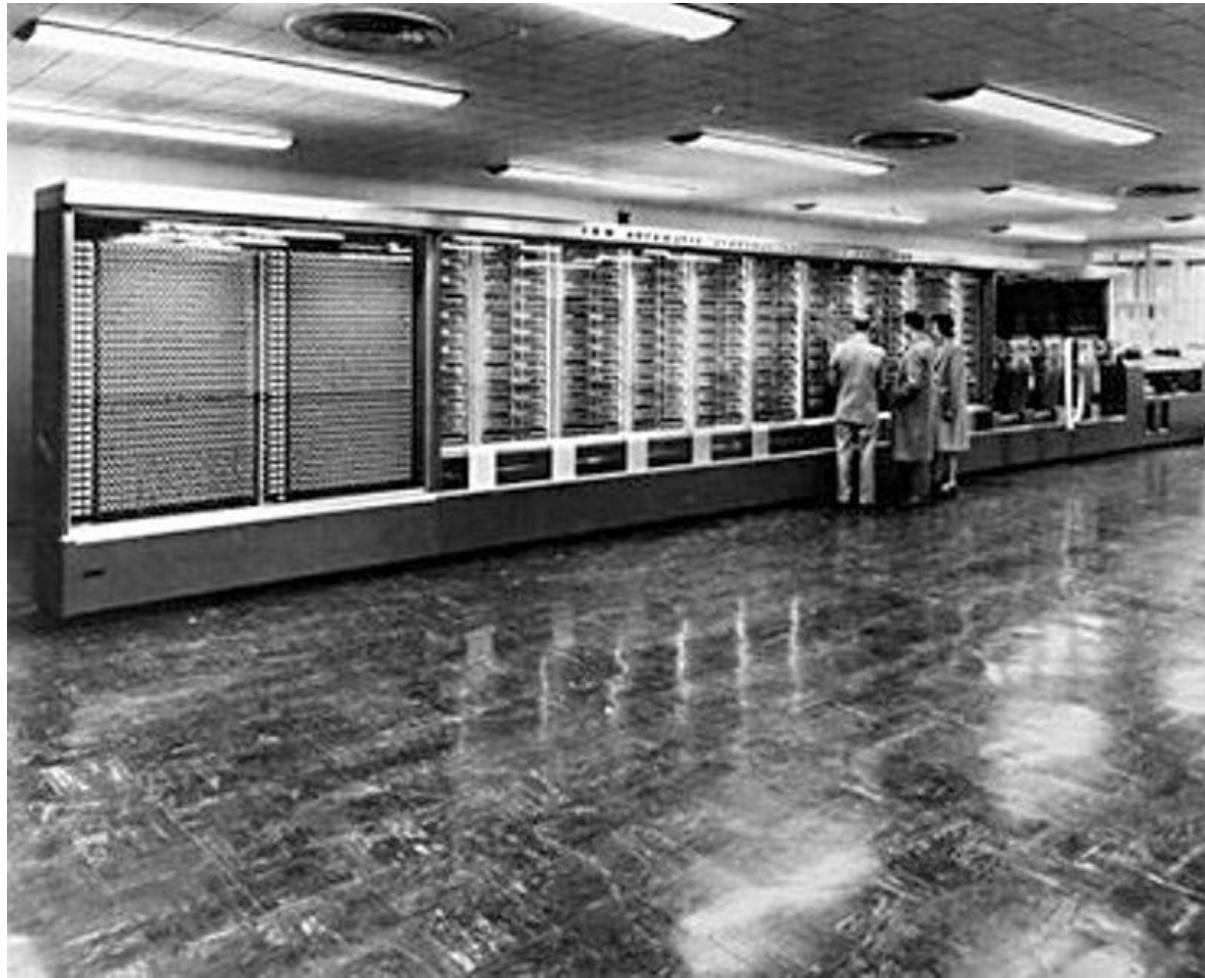
Produces audio, video, games, calculations, analysis, images, etc.

Hardware and Software

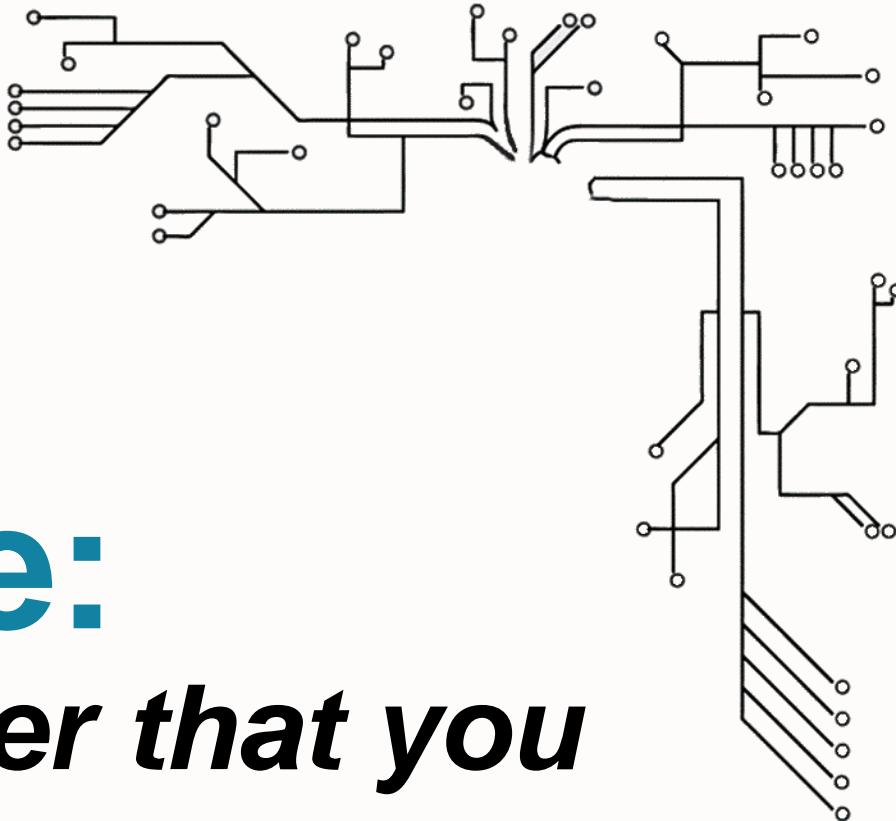
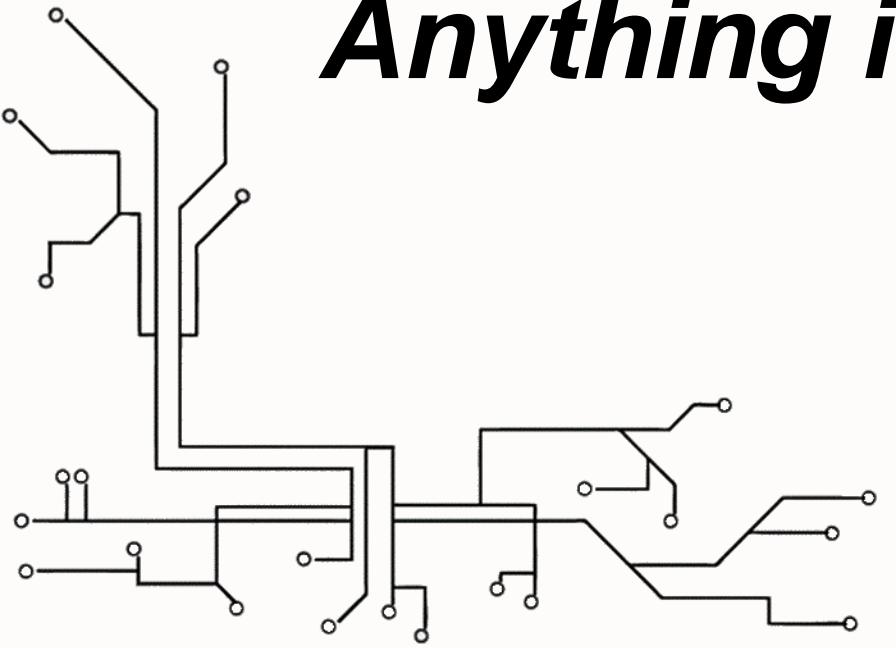
Modern computers are made up of a combination of hardware and software.

- **Hardware** includes all physical parts of a computer: **processor, cables, storage devices, mouse, screen, etc.**
- **Software** is made up of programs: **operating system, word processors, graphics editor, etc.**

Harvard Mark I – 1944



Hardware



Hardware:

*Anything in a computer that you
can touch*

1. Motherboard

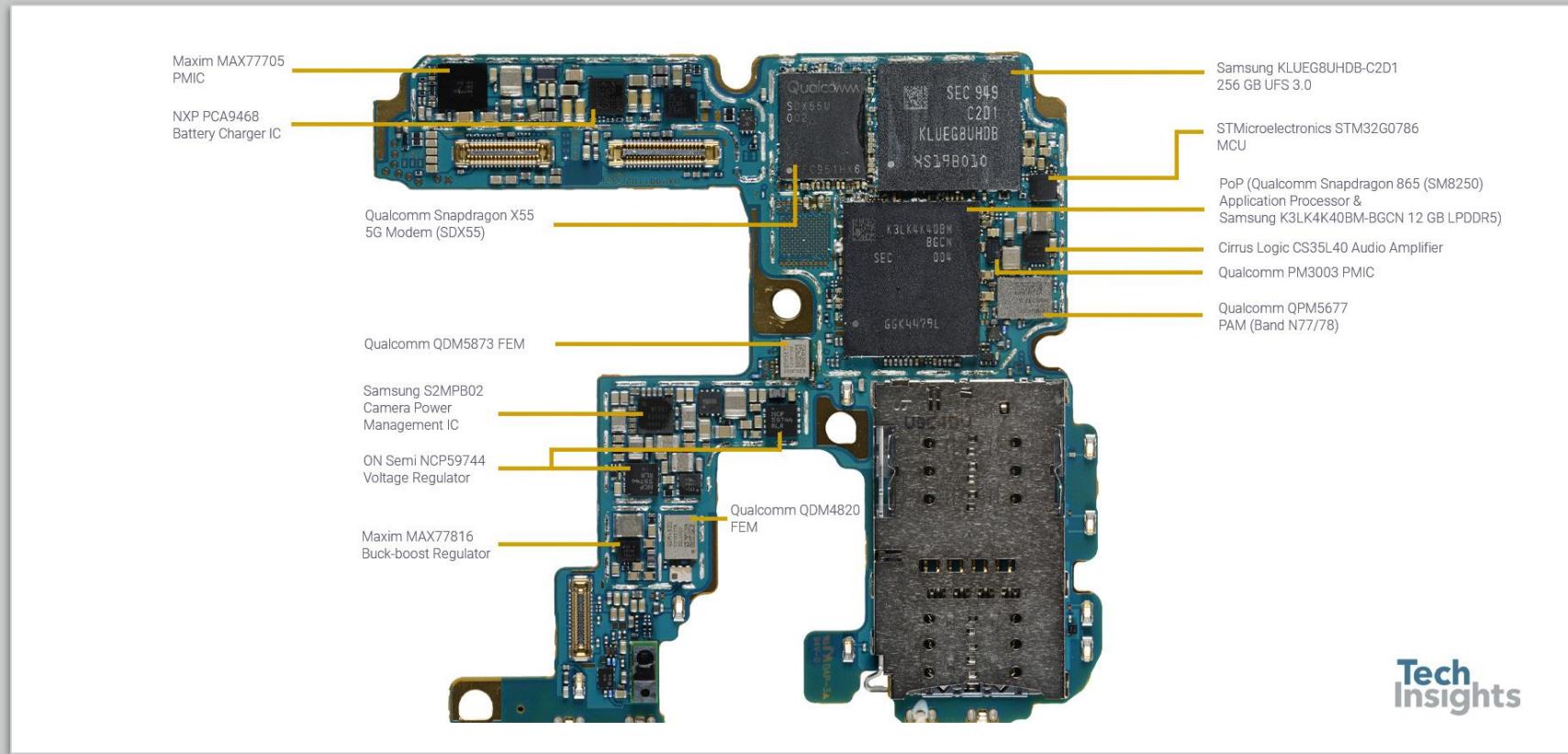


1. Motherboard

The **motherboard** is the computer part that integrates all other computer components.

It allows communication between the electric components of a system.



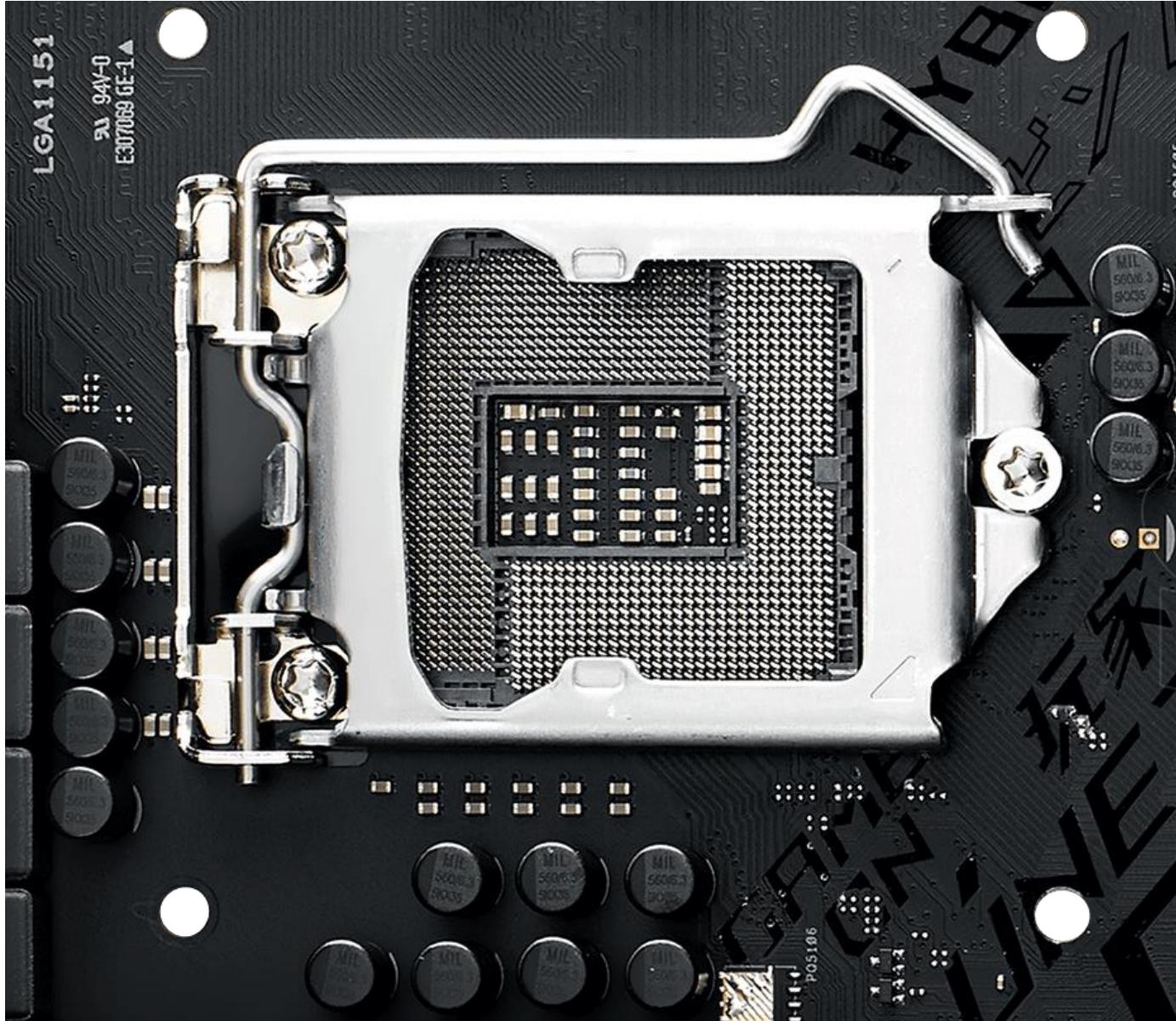


Samsung S20 motherboard. In mobile devices, **the motherboard can also be known as the logic board**

1. Motherboard



2. CPU – Central Processing Unit



2. CPU – Central Processing Unit

The CPU (**Central processing unit**) is the brain of the computer. It is an electronic circuit that executes program instructions.

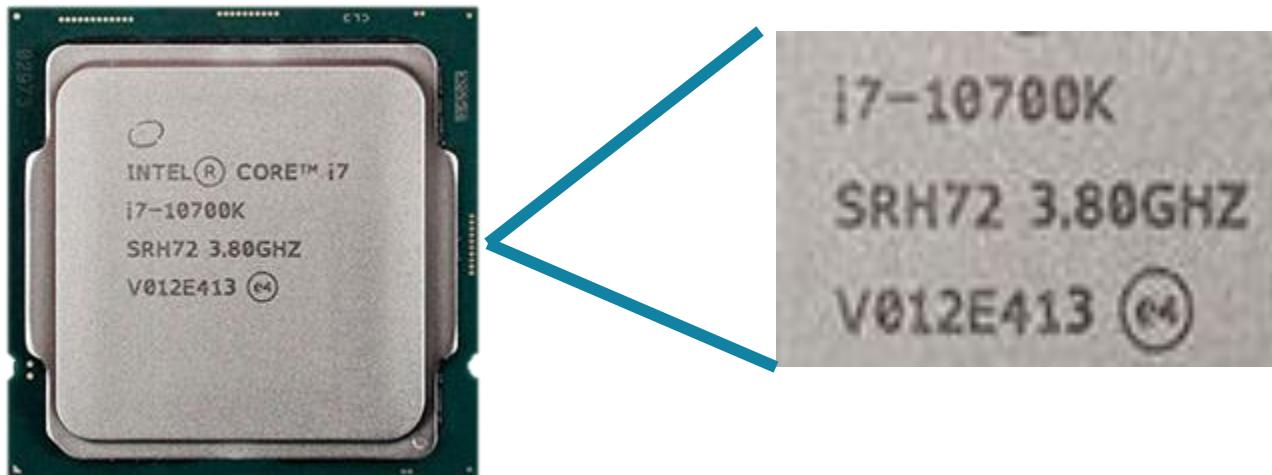
Its main responsibilities are:

1. Executing operations
2. Controlling the program flow
3. Turning on/off internal circuits



2. CPU – Central Processing Unit

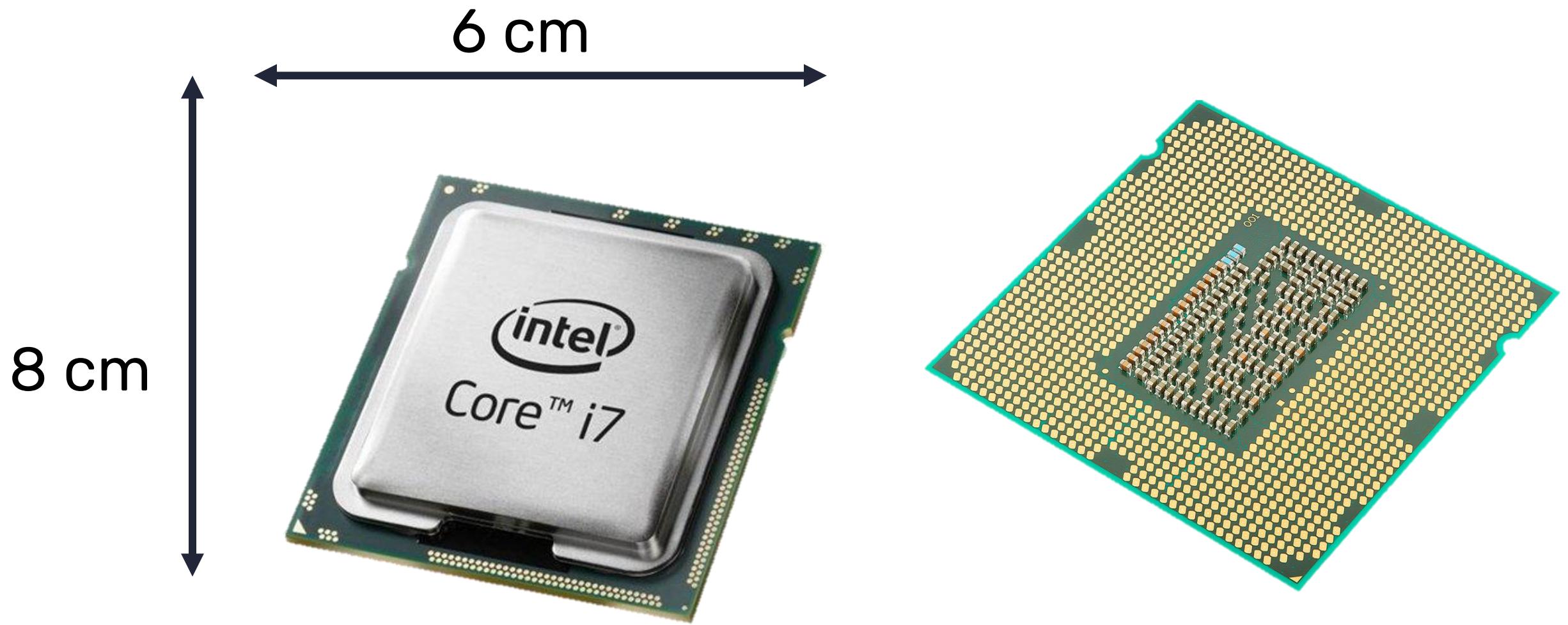
The processor speed is measured in hertz (Hz), which is cycles per second



An 3.8 GHz processor can execute 3,800,000,000 operations each second

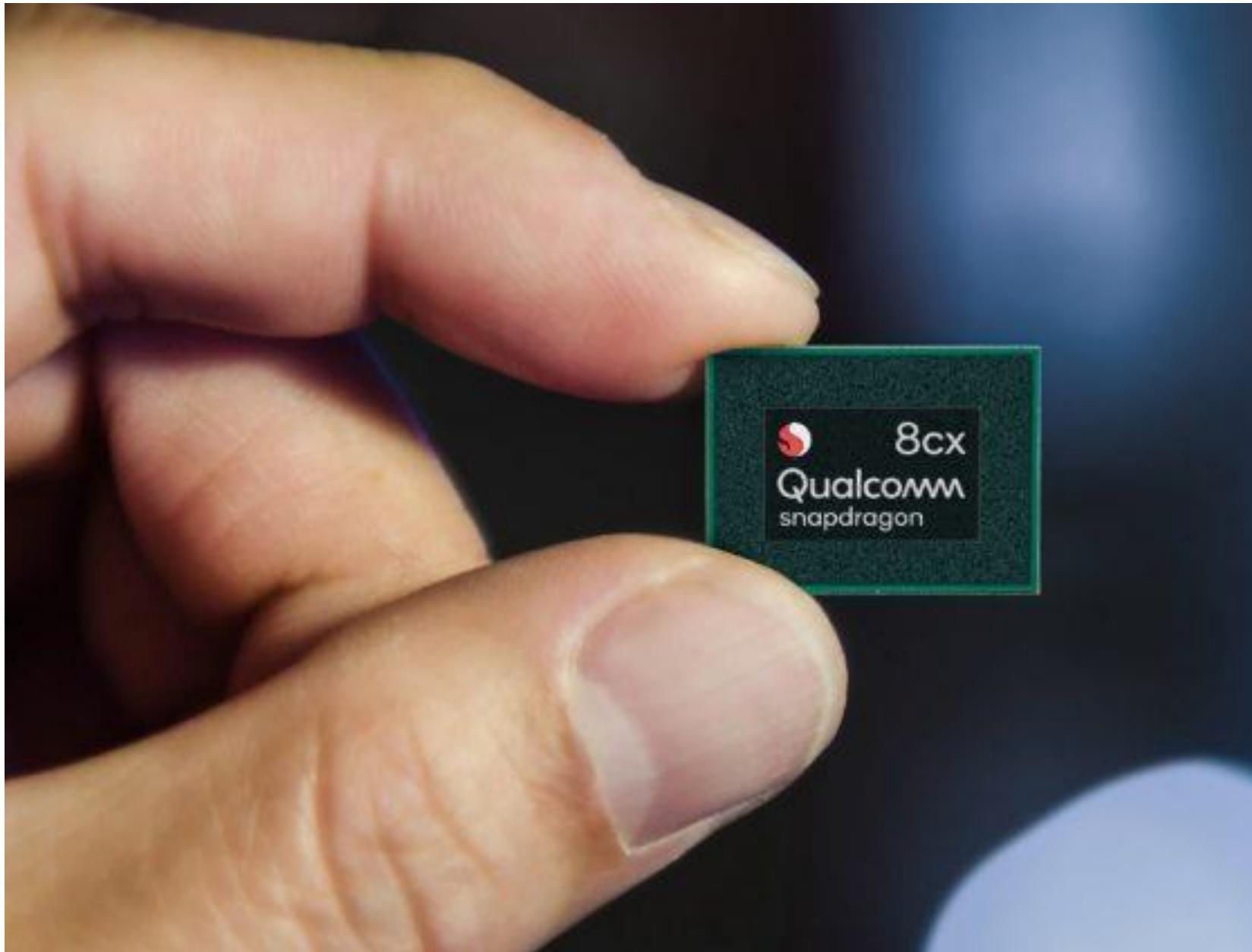
Remeber that

$$1 \text{ GHz} = 1 \times 10^9 \text{ Hz}$$

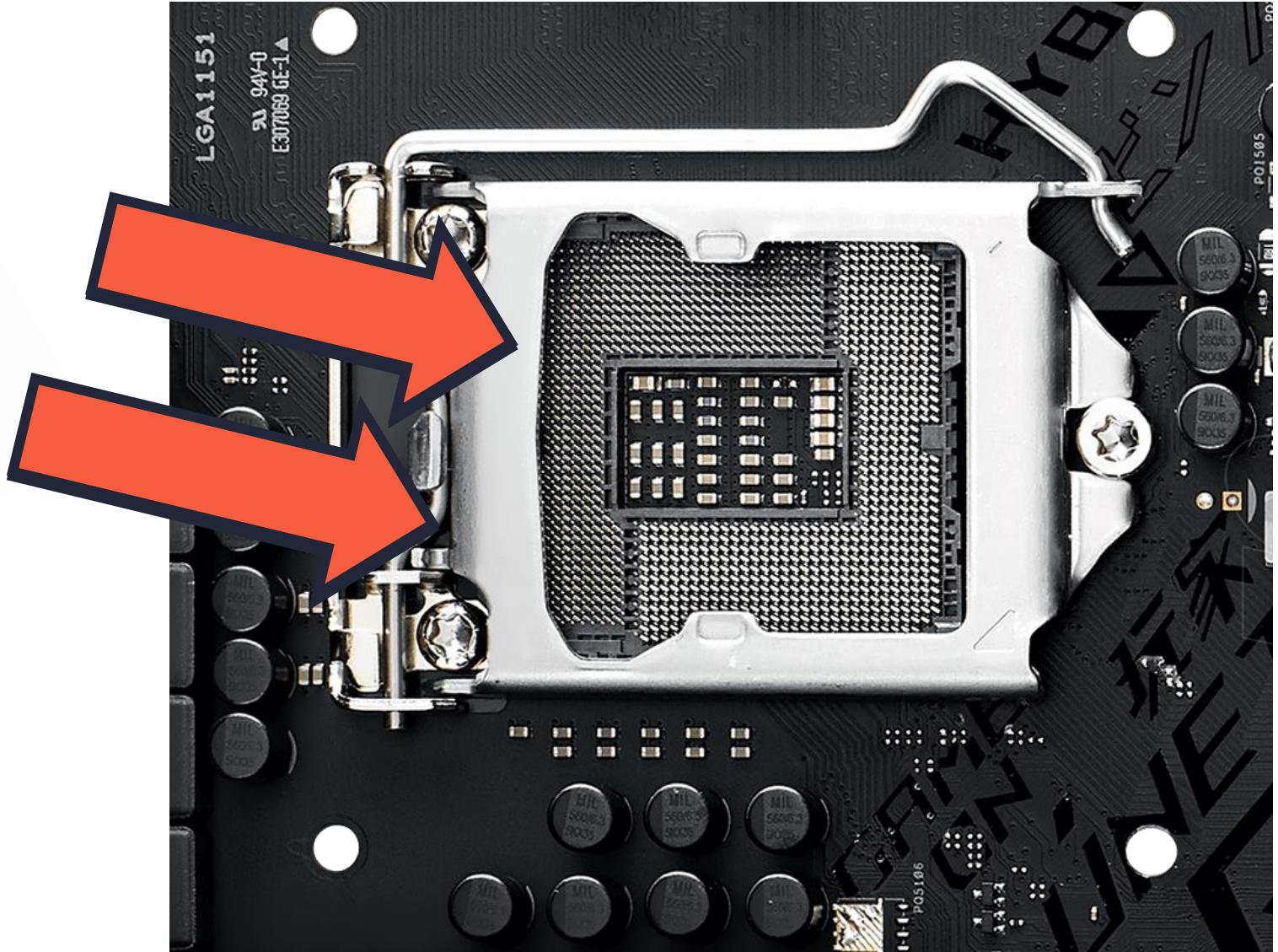


Intel i7 desktop computer CPU



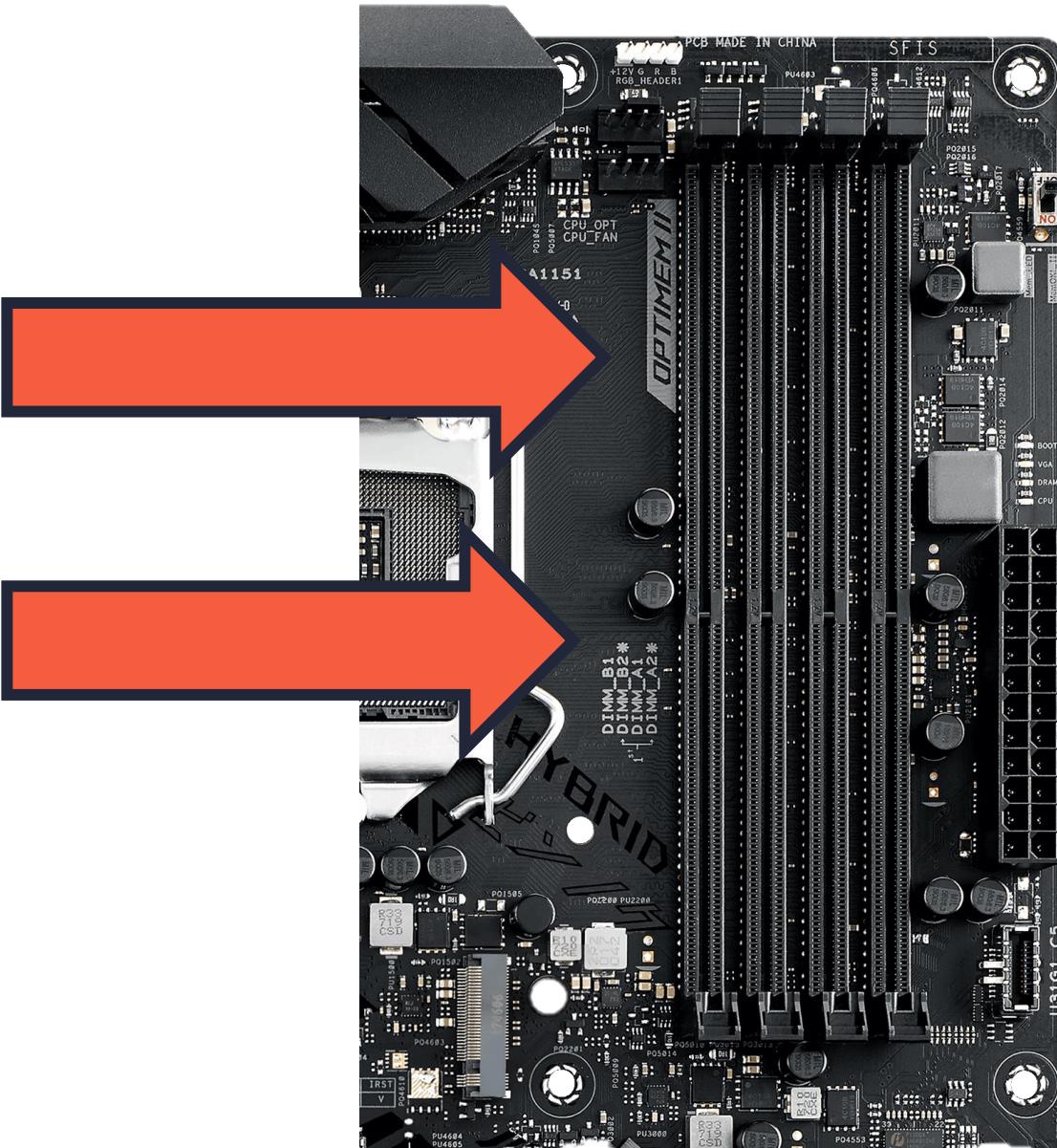
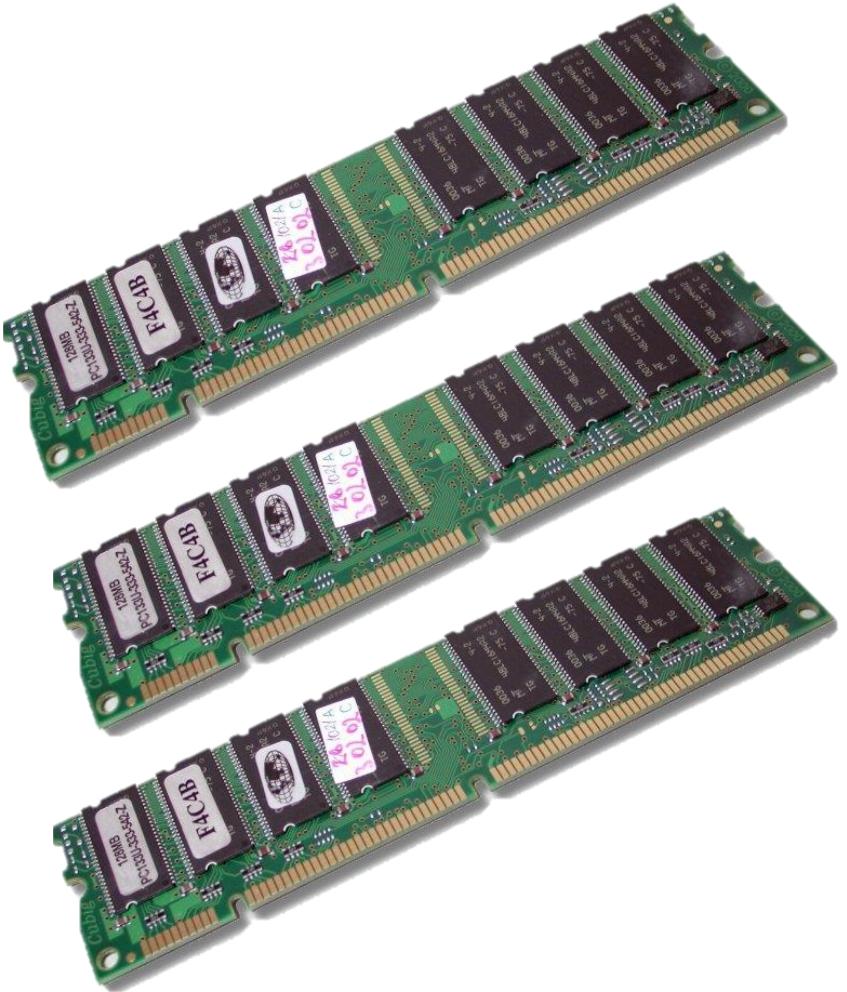


Qualcomm
Snapdragon
processor for a
mobile device





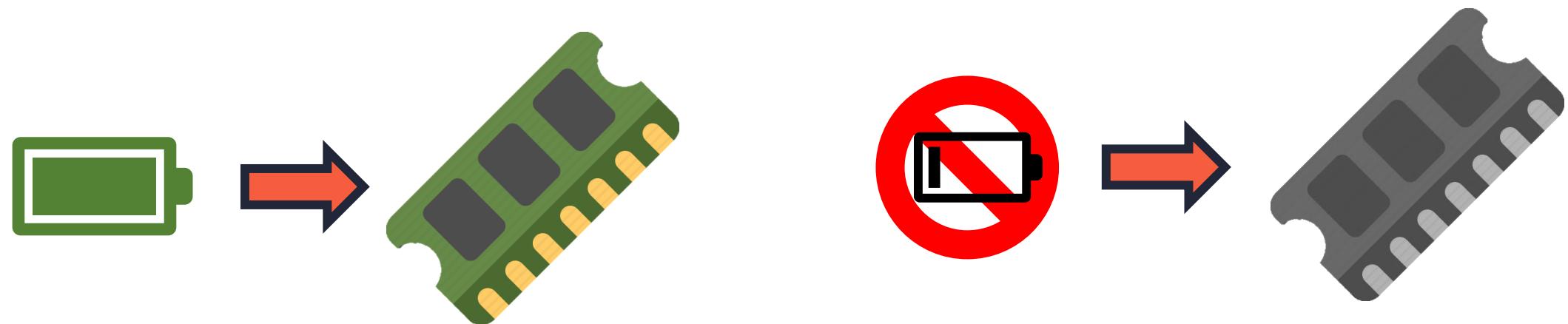
3. RAM – Random Access Memory



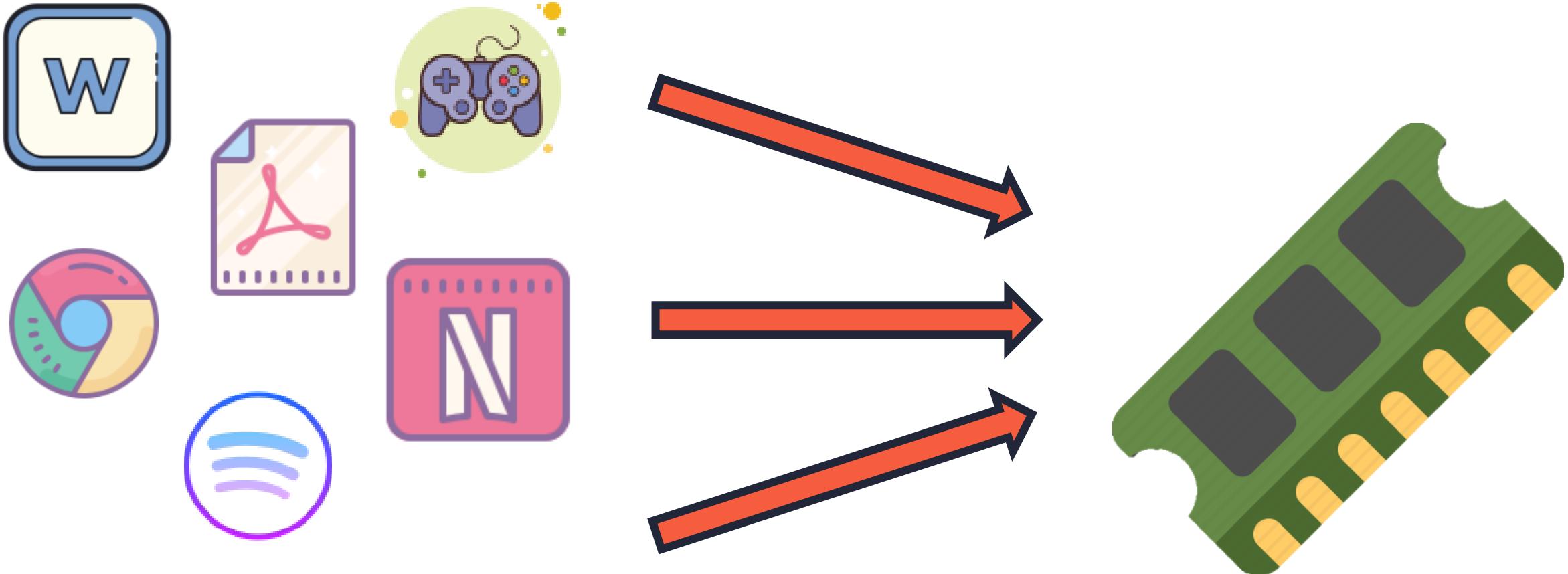
3. RAM – Random Access Memory

RAM memory (random access memory) is part of the computer main memory, or **principal memory**. It is used to load and execute the operating system, programs, and applications.

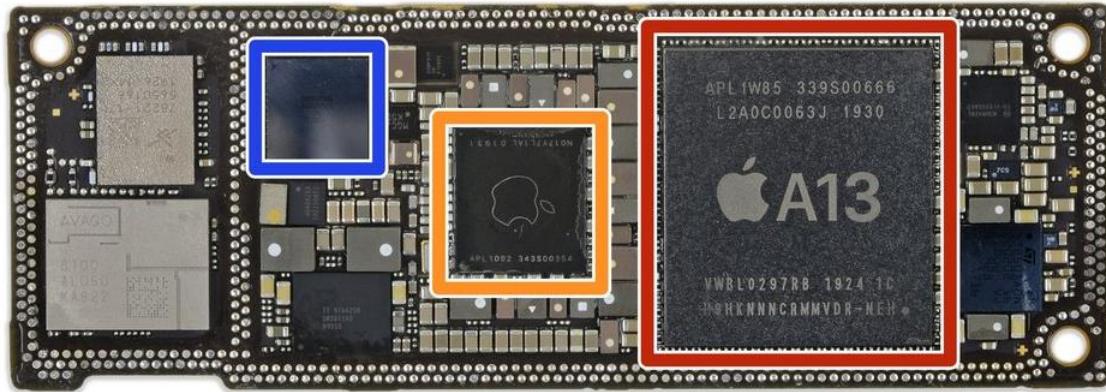
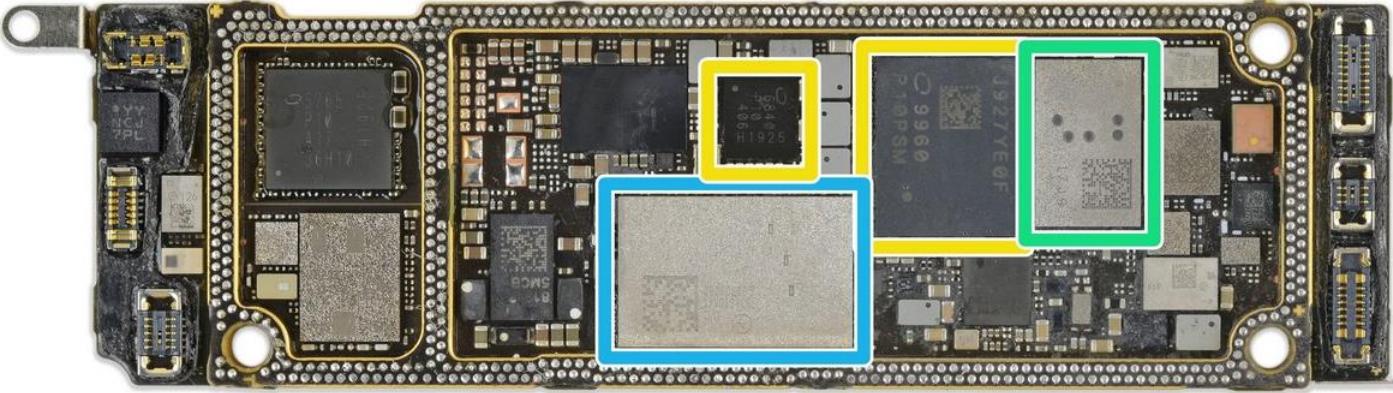
It is **volatile memory**, which means that it requires electricity to operate. If you power off the computer, data will be lost.



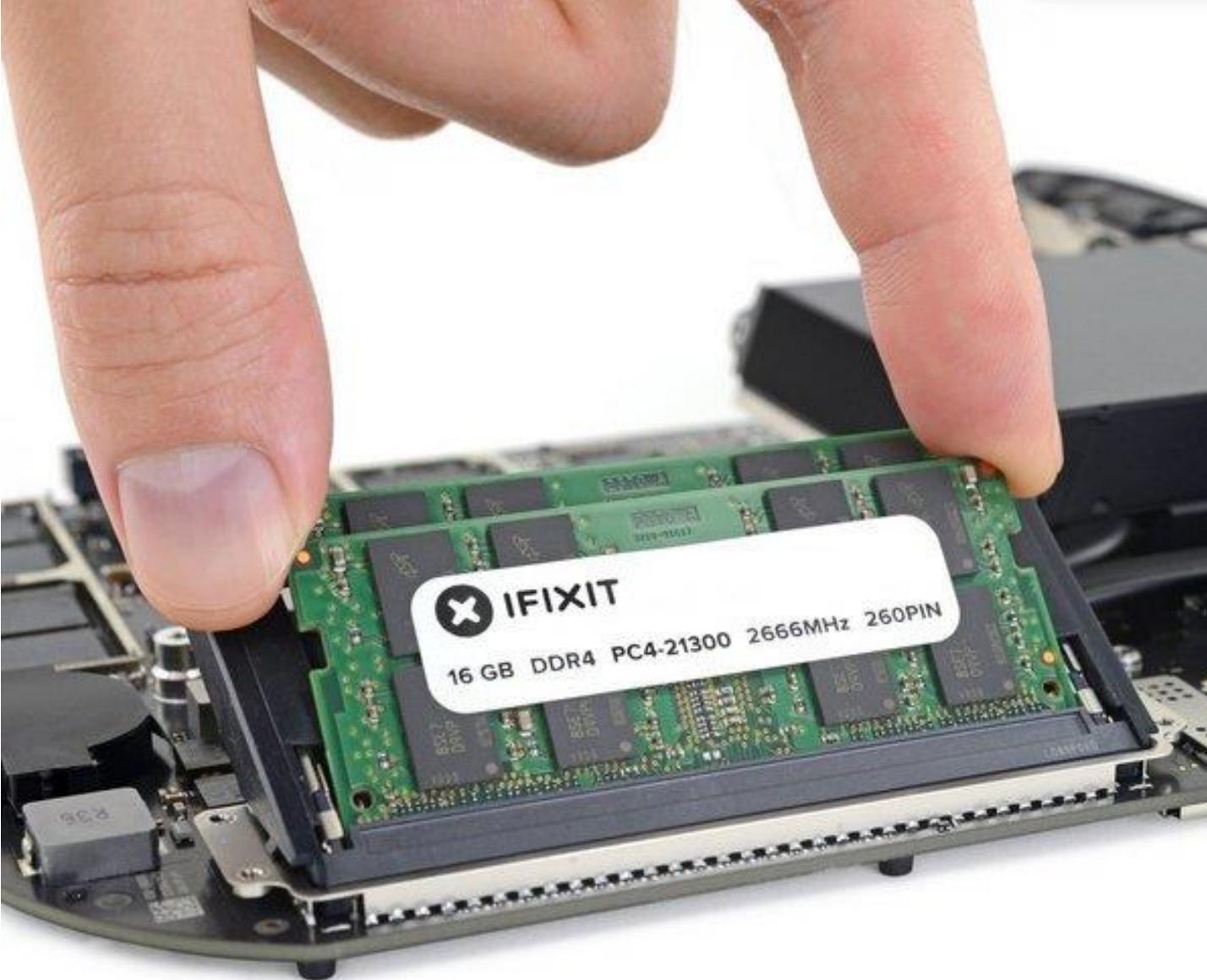
3. RAM – Random Access Memory



During runtime, all program data is stored in RAM memory.



- APL1W85: Apple's A13 Bionic system-on-chip, layered over SK Hynix LPDDR4X RAM. SK Hynix's documentation doesn't contain a decoder for this model number, but it's seemingly 4GB of the stuff.



RAM memory is usually measured in Gigabytes (GB).

A modern computer usually has around 8 GB of RAM.



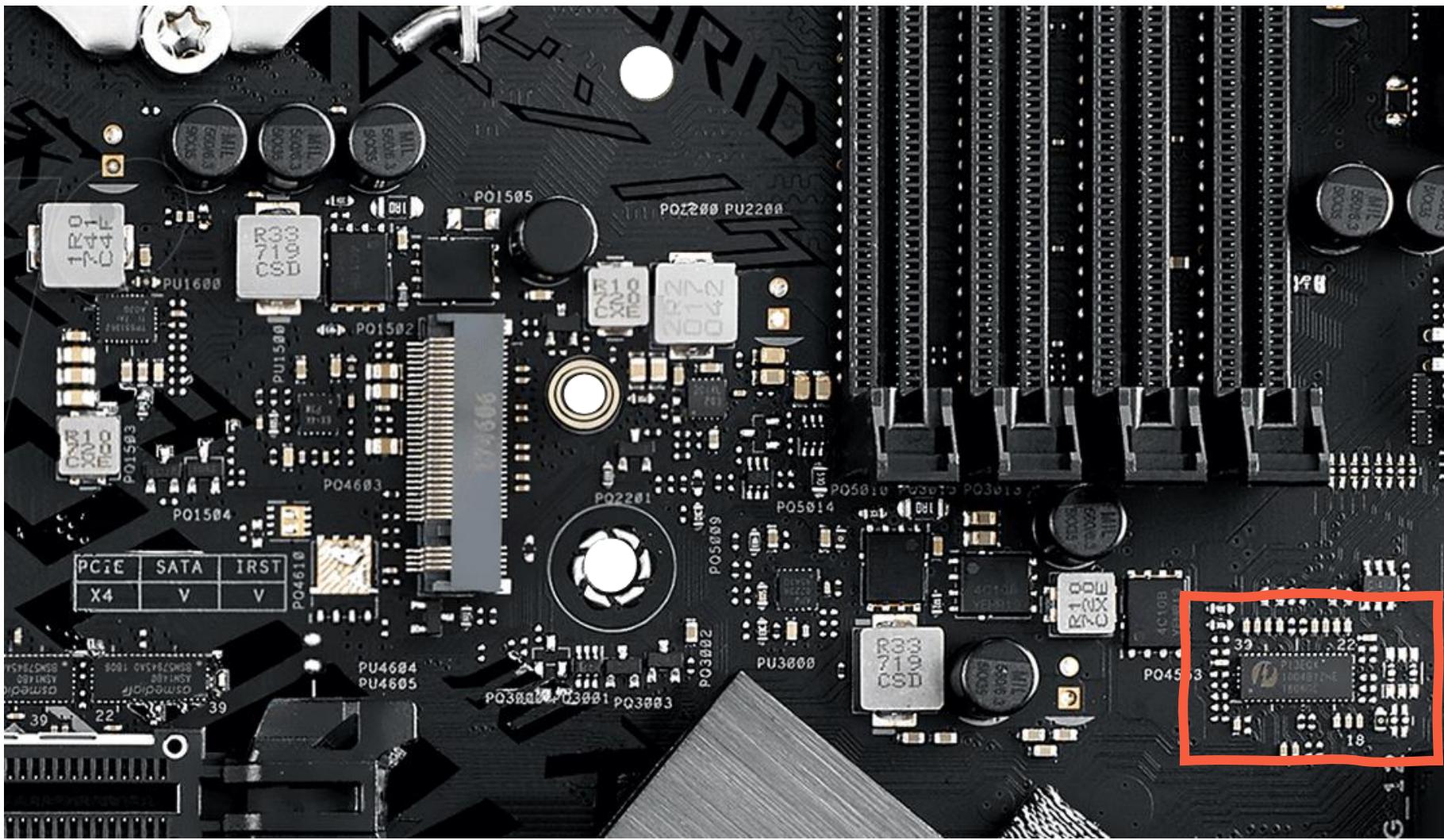
A woman with long dark hair, wearing a maroon t-shirt and a small necklace, is looking down at a green circuit board she is holding in her hands. She appears to be working on it or examining it closely.

¿CUÁNTA RAM
NECESITAS?

DIY@5



3. ROM – Read Only Memory



4. ROM – Read Only Memory

ROM memory is part of the **main computer memory**. It stores critical information for the operation of any computer.

Contradictory to its name, "read-only" comes from **not being able to change what this memory is used for**.

It is **persistent memory**, also called non-volatile, which means it does not require energy to store its contents.

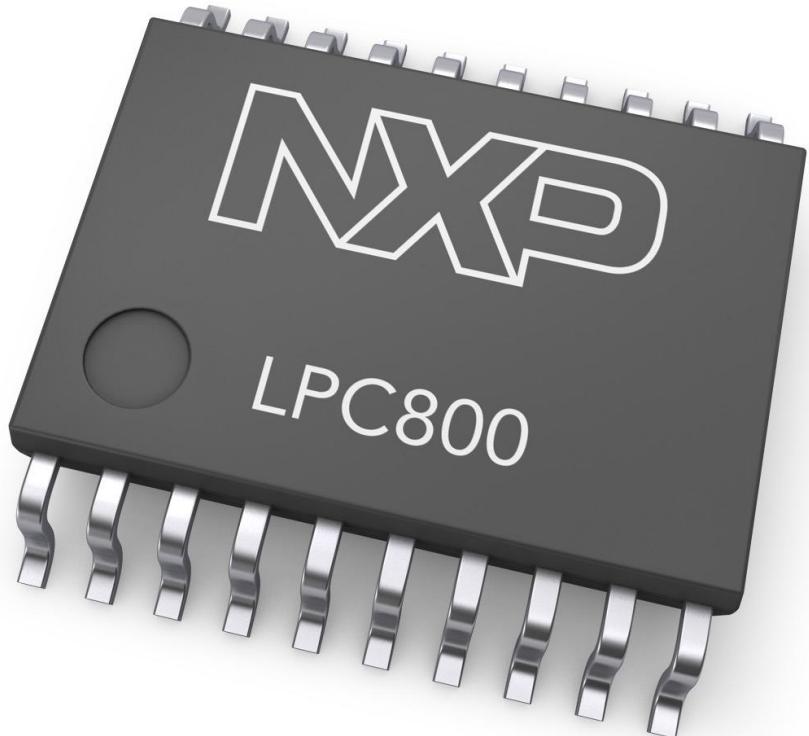
4. ROM – Read Only Memory

Stores the **BIOS (Basic Input / Output System)**, which includes things like:

- Processor configuration
- Boot sequence
- Fan profile

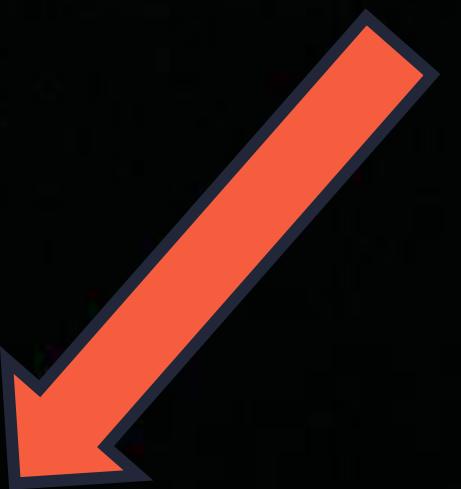


4. ROM – Read Only Memory



A modern computer usually has 1 MB of ROM memory

msi



Press to enter setup
Press F11 key for Boot Menu
Press F3 key to run Recovery

BIOS from a 2000 computer

Boot Manager

Boot normally

Windows Boot Manager

EFI VMware Virtual SCSI Hard Drive (0.0)

EFI VMware Virtual SATA CDROM Drive (1.0)

EFI Network

EFI Internal Shell (Unsupported option)

Enter setup

Reset the system

Shut down the system

Continue to boot using
the default boot order.

↑↓=Move Highlight

<Enter>=Select Entry



UEFI BIOS Utility – Advanced Mode

04/05/2019
Friday

18:02

English

MyFavorite(F3)

Qfan Control(F6)

EZ Tuning Wizard(F11)

Search(F9)

AURA ON/OFF(F4)

My Favorites

Main

Ai Tweaker

Advanced

Monitor

Boot

Tool

Exit

Hardware Monitor

BIOS Information

BIOS Version

4207 x64

Build Date

12/07/2018

EC Version

MBEC-X470-0110

LED EC1 Version

AUMA0-E6K5-0106

LED EC2 Version

AULA1-S072-0203

CPU Information

Brand String

AMD Ryzen 7 2700X Eight-Core Processor

Speed

3700 MHz

Total Memory

16384 MB (DDR4)

Speed

3200 MHz

System Language

English

System Date

04/05/2019

System Time

18:02:34



Choose the default language

CPU

Frequency Temperature

3700 MHz 48°C

APU Freq Ratio

100.0 MHz 37x

Core Voltage

1.380 V

Memory

Frequency Voltage

3200 MHz 1.360 V

Capacity

16384 MB

Voltage

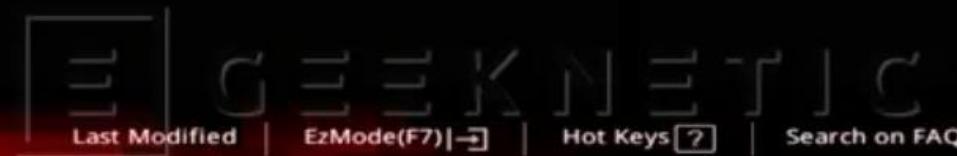
+12V +5V

12.033 V 4.959 V

+3.3V

3.357 V

Version 2.17.1246 Copyright (C) 2018 American Megatrends, Inc.



BIOS of a modern computer



5. Secondary Memory



5. Secondary Memory

Secondary memory includes all persistent storage devices that can be connected to a computer.

- Hard disk drive. (HDD)
- *Solid state drive*. (SSD)
- *USB flash drive*
- *SD Card* (SD)

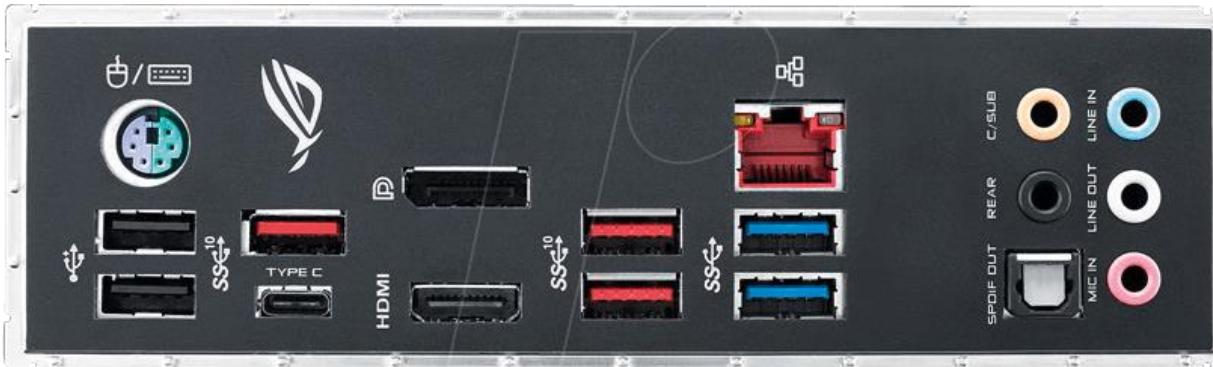


5. Secondary Memory

Stores pictures, documents, images, text files, video files, etc.



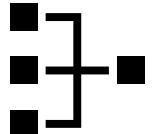
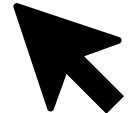
6. Peripheral Devices



6. Peripheral Devices

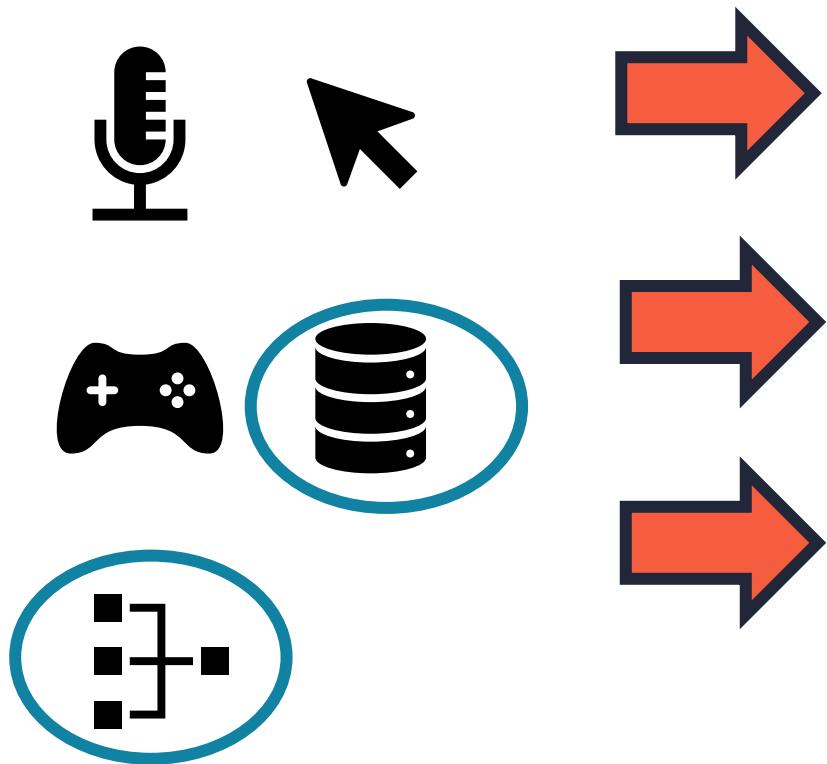
A hardware device that is connected to a computer to transfer information into and out of a computer is considered a **peripheral device**. They are also called I/O devices (input/output).

- Mouse and keyboard
- Microphone
- Gamepad
- Network controller

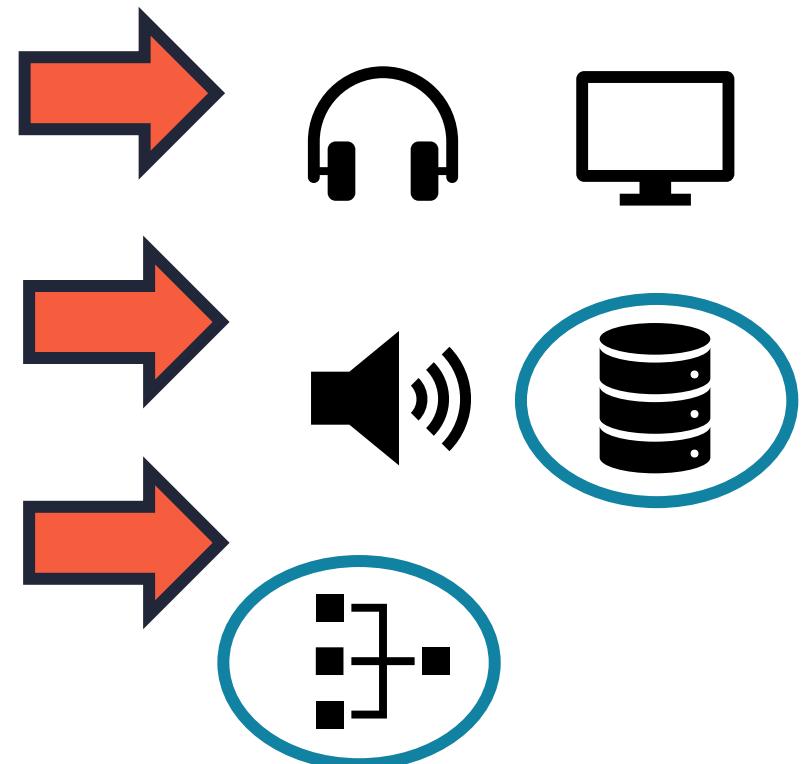


6. Peripheral Devices

Input Devices



Output Devices



Some devices work as both input / output

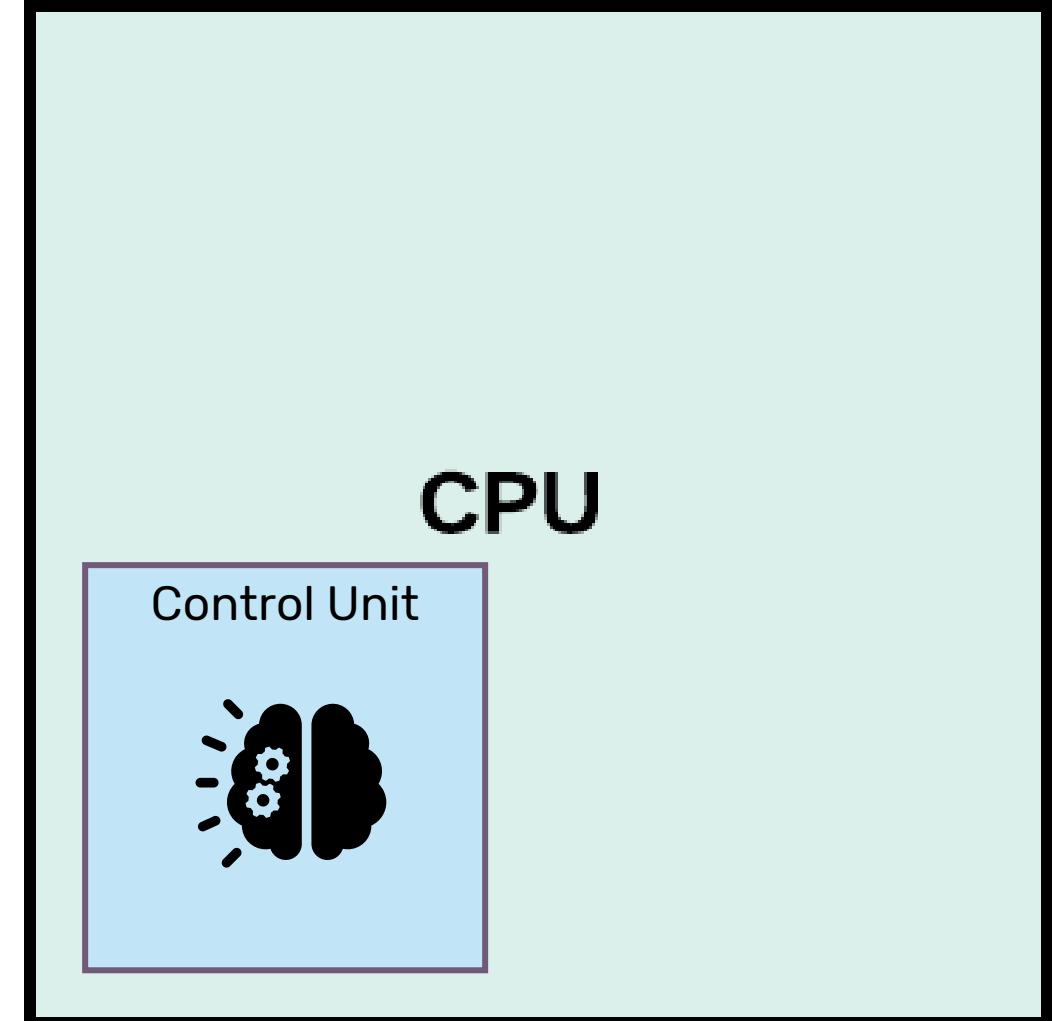


Von Neumann computer architecture

CPU

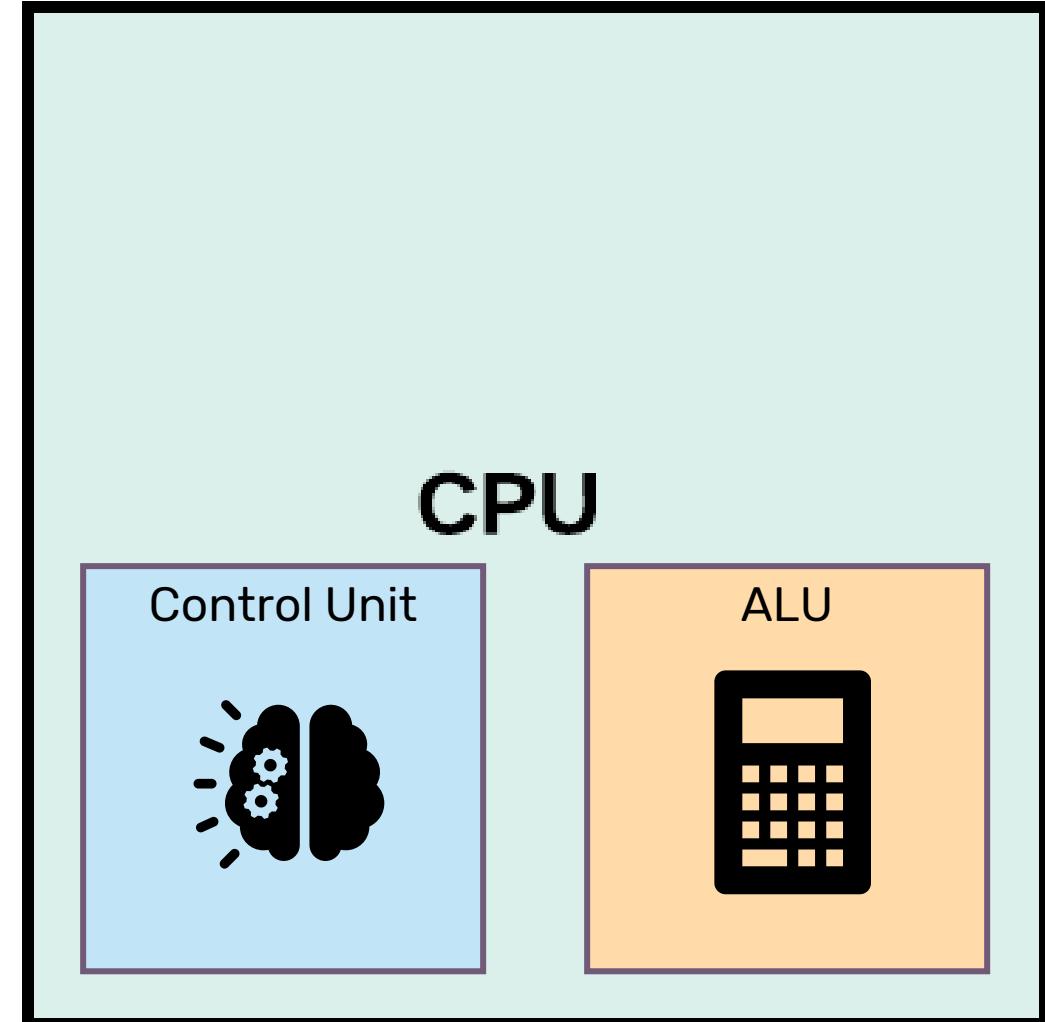
Control Unit

- It **controls the instructions to execute**, and in which order.
- Interprets every instruction
- Keeps track of the computer clockrate (like a metronome!)



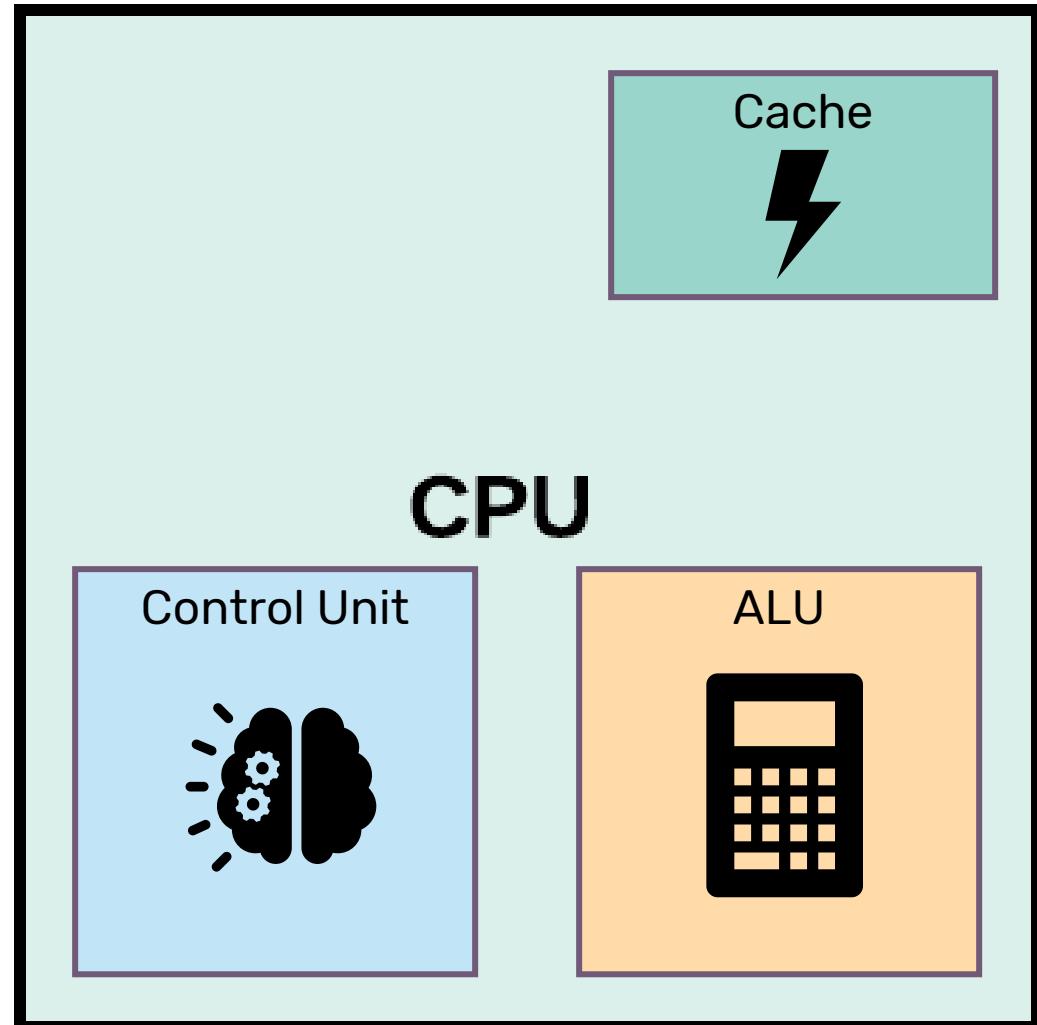
ALU — Arithmetic Logical Unit

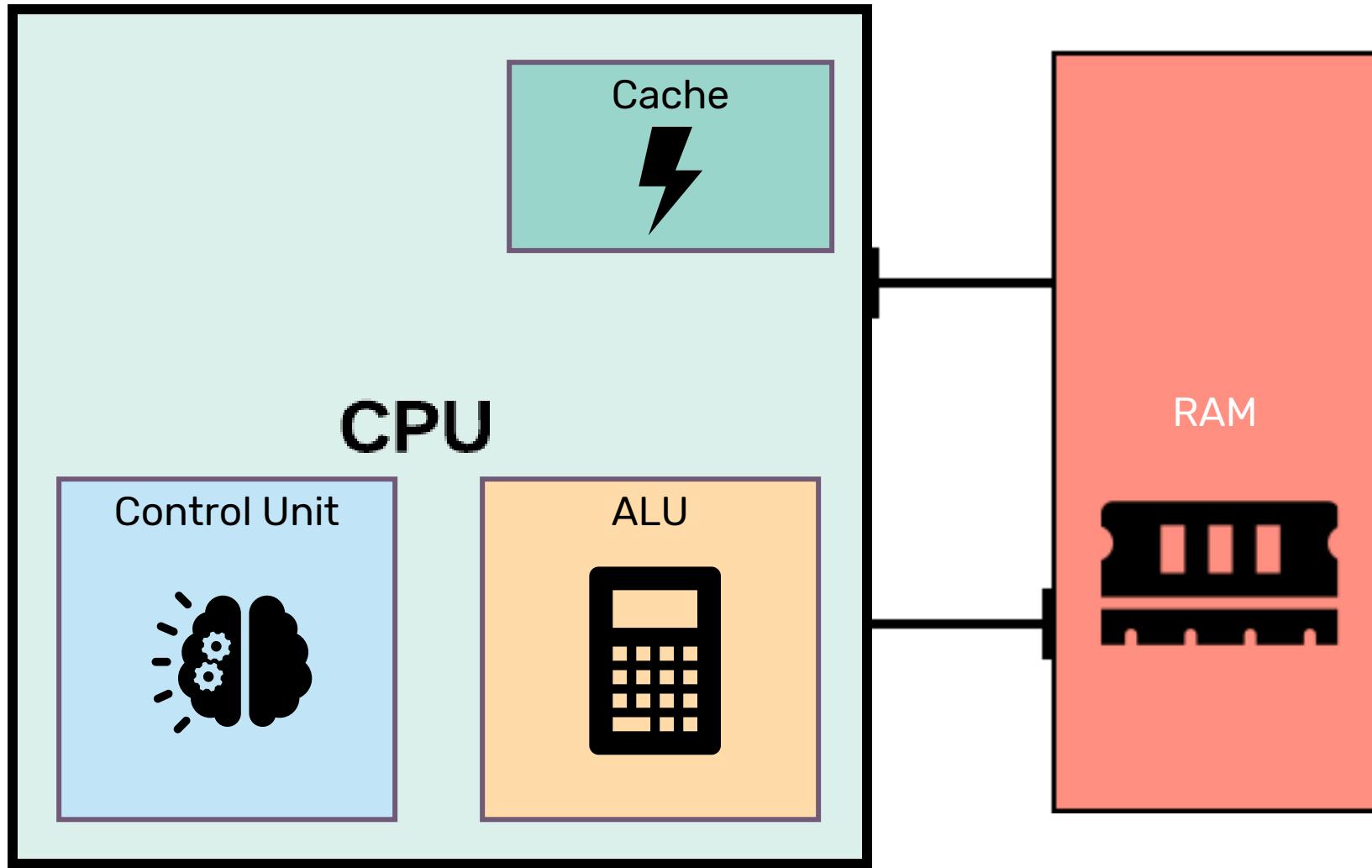
- It performs logical operations (ANDs, ORs, NOTs).
- Executes comparisons
- Executes **arithmetic operations** such as additions, subtractions, etc.



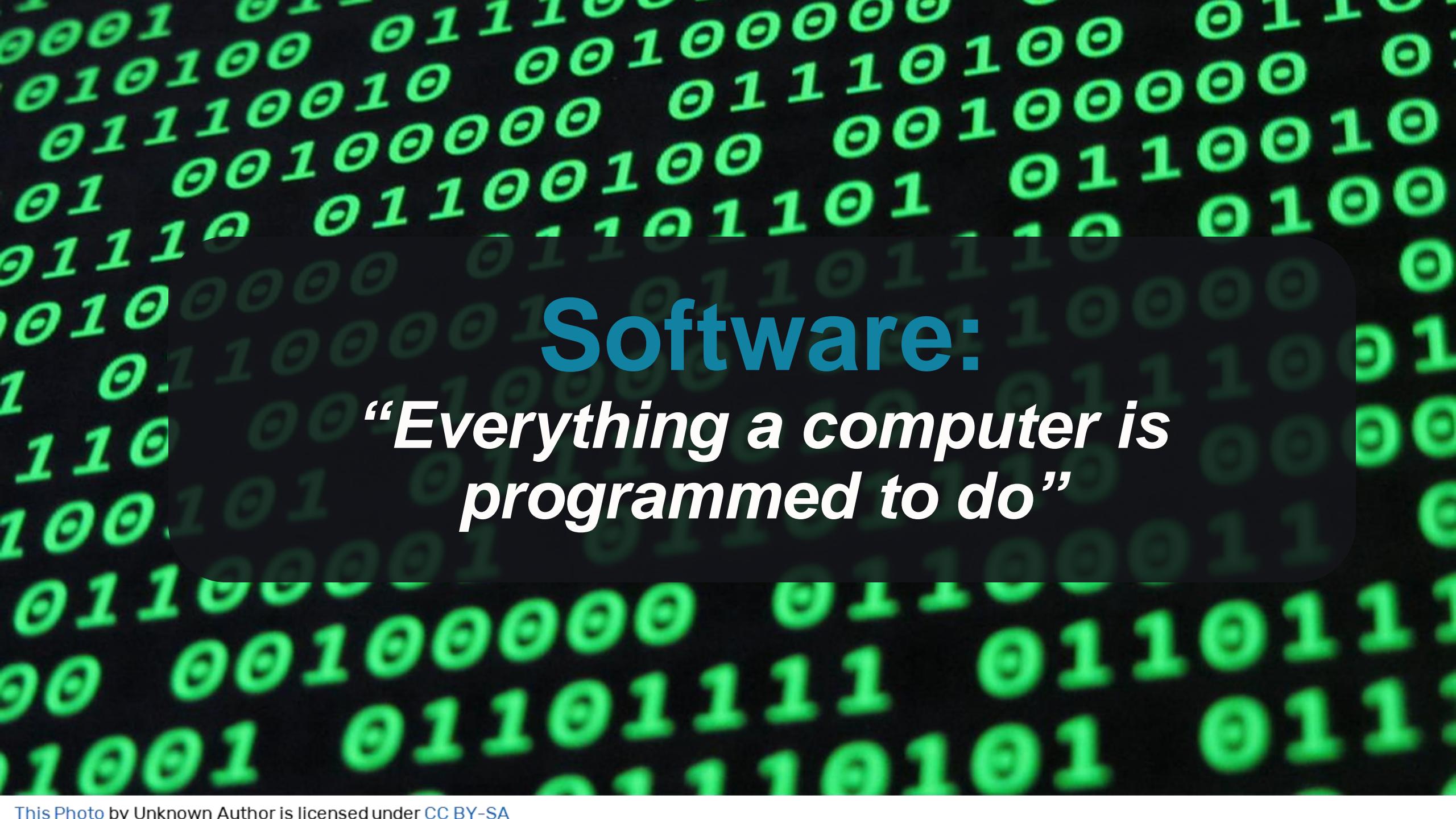
Cache memory

- Cache is a small amount of memory that is used to **store frequently accessed data and instructions.**
- Cache memory is faster but has a smaller capacity than RAM





Software



Software:
*“Everything a computer is
programmed to do”*

Software

Software is a set of instructions that is executed by a computer to perform a result.

Software complexity can vary widely – it can be a simple math calculation, or an operating system with hundreds of thousands of lines of code.

Software can be mainly classified into two groups:

- 1. System software**
- 2. Application software**

System software

How many operating systems can you name?



System Software – Operating Systems

An operating system is the bundle of programs in charge of administrating and managing a set of hardware resources

All operating systems manage four main resources:

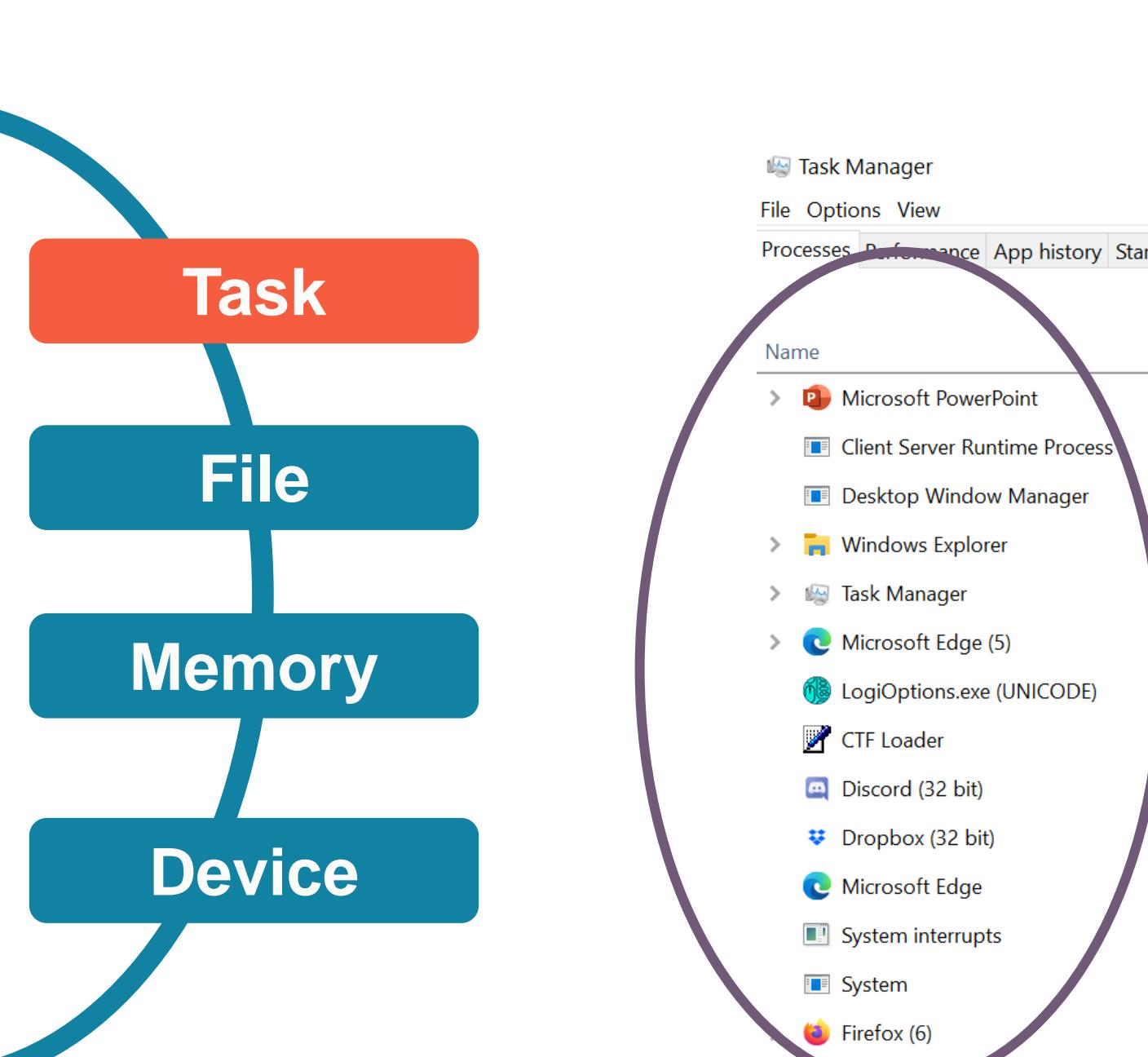
Task

File

Memory

Device

Task Manager



The diagram illustrates a conceptual model where four system components—Task, File, Memory, and Device—are interconnected. Each component is represented by a colored box (orange for Task, teal for File, Memory, and Device) with a curved line connecting it to a central purple circle. This central circle is overlaid on a screenshot of the Windows Task Manager, specifically the Processes tab, which displays a list of running applications and their resource usage.

Task Manager Processes:

Name	Status	5% CPU	39% Memory	0% Disk	0% Network
Microsoft PowerPoint		3.7%	373.4 MB	0 MB/s	0 Mbps
Client Server Runtime Process		0.4%	0.9 MB	0 MB/s	0 Mbps
Desktop Window Manager		0.3%	26.6 MB	0 MB/s	0 Mbps
Windows Explorer		0.2%	73.1 MB	0 MB/s	0 Mbps
Task Manager		0.1%	22.4 MB	0 MB/s	0 Mbps
Microsoft Edge (5)		0.1%	203.8 MB	0.1 MB/s	0 Mbps
LogiOptions.exe (UNICODE)		0.1%	1.8 MB	0 MB/s	0 Mbps
CTF Loader		0.1%	4.1 MB	0 MB/s	0 Mbps
Discord (32 bit)		0.1%	128.7 MB	0 MB/s	0 Mbps
Dropbox (32 bit)		0.1%	216.9 MB	0 MB/s	0 Mbps
Microsoft Edge		0.1%	35.9 MB	0 MB/s	0 Mbps
System interrupts		0.1%	0 MB	0 MB/s	0 Mbps
System		0%	0.1 MB	0.1 MB/s	0 Mbps
Firefox (6)		0%	908.6 MB	0.1 MB/s	0 Mbps

Task Manager Buttons:

- File Options View
- Processes Performance App history Startup Users Details Services
- End task

Task Manager Status Bar:

- Fewer details

Task Manager

Task

File

Memory

Device

- The task manager is in charge of all tasks or processes **running in a computer**.
- **Balances the CPU load** so that multiple programs can be executed simultaneously
- Orders and executes tasks based on **priority**.



Mayor prioridad



Menor prioridad



File Manager

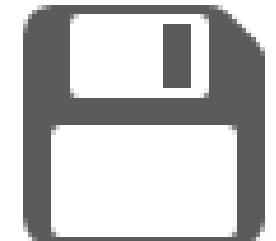
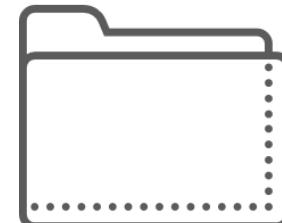
Task

File

Memory

Device

- This manager is in charge of **controlling access to** all files.
- It **organizes data** stored in secondary memory
- It has tools to **visualize and interpret** files.



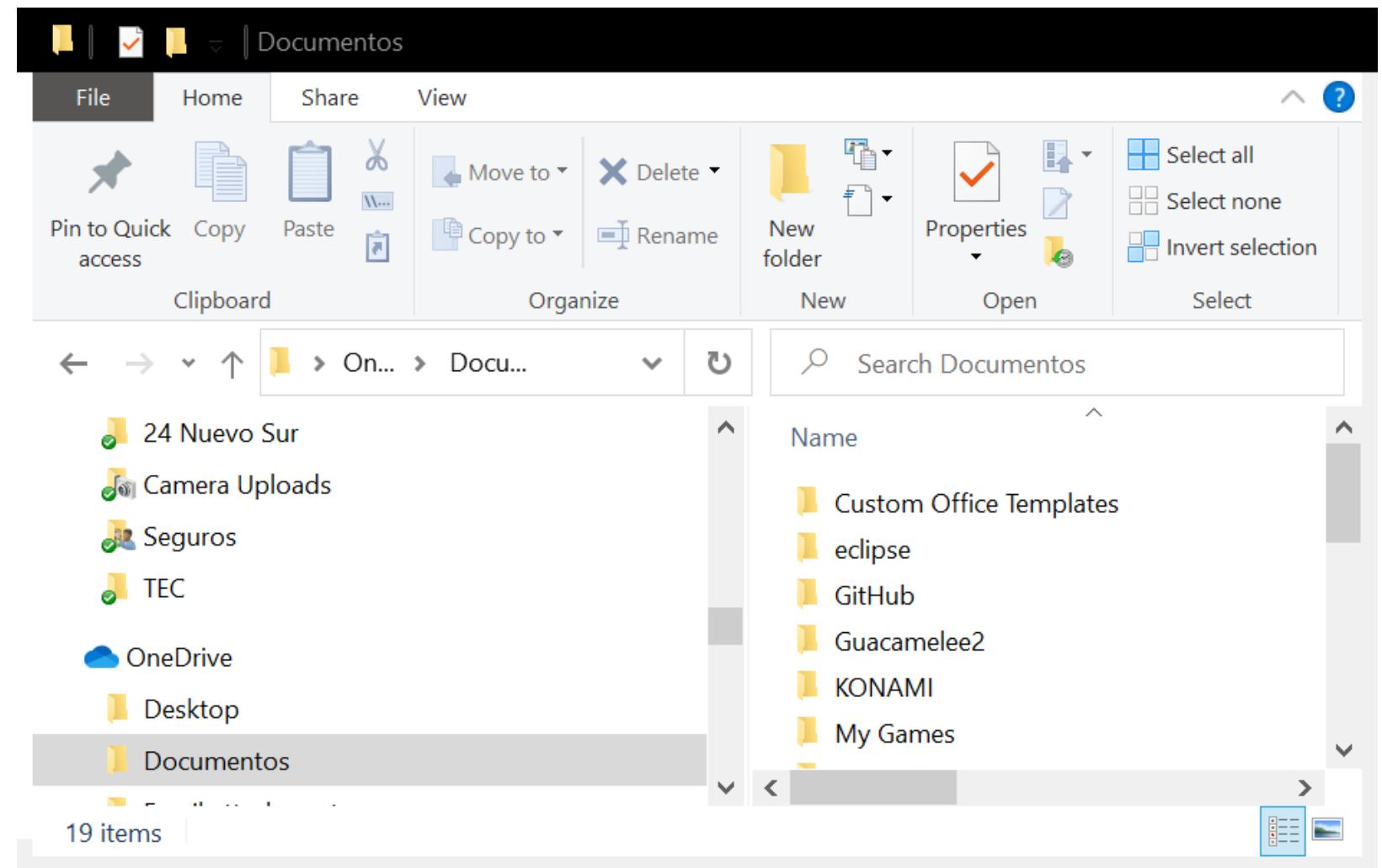
File Manager

Task

File

Memory

Device



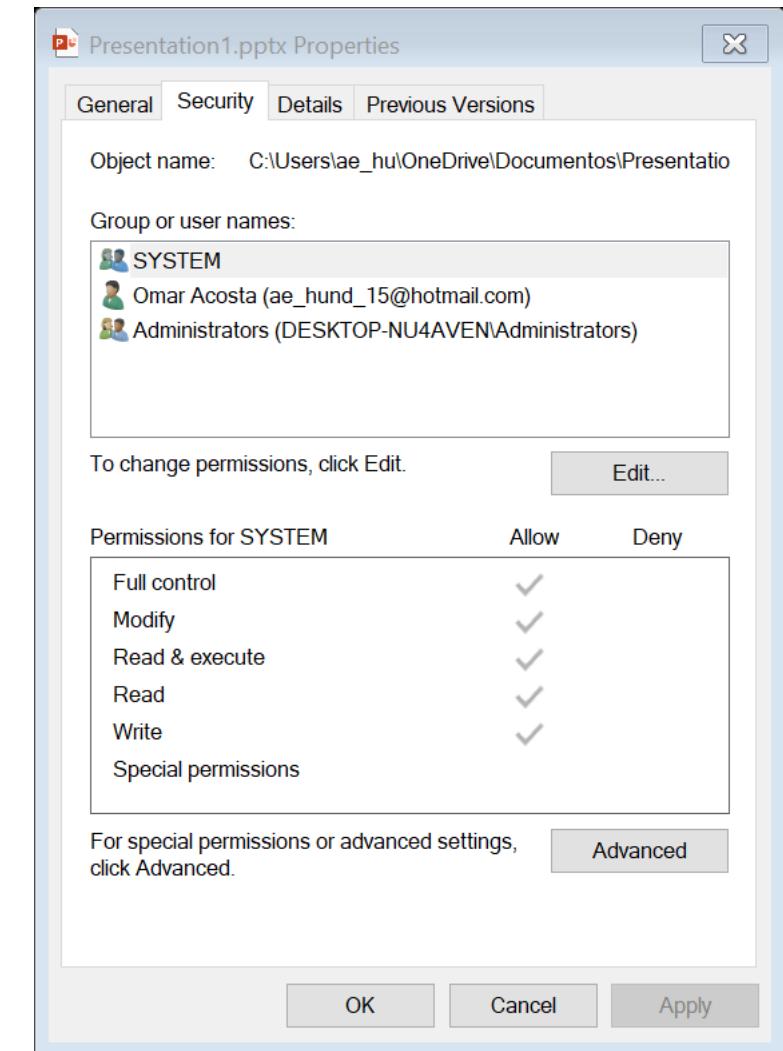
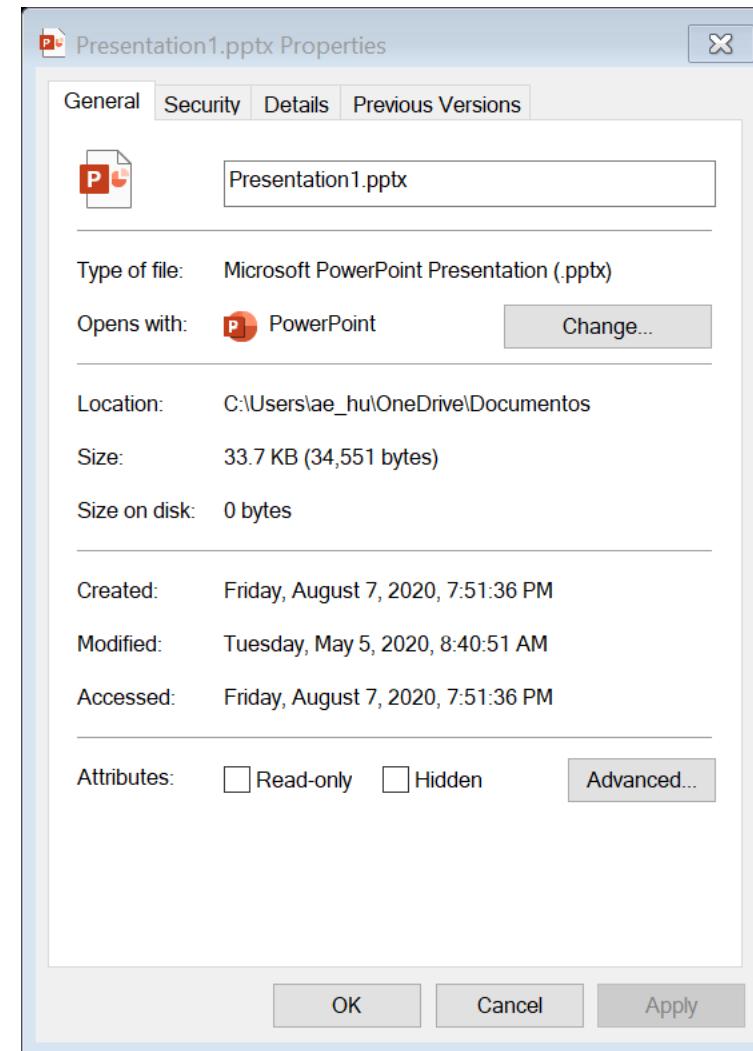
File Manager

Task

File

Memory

Device



Memory Manager

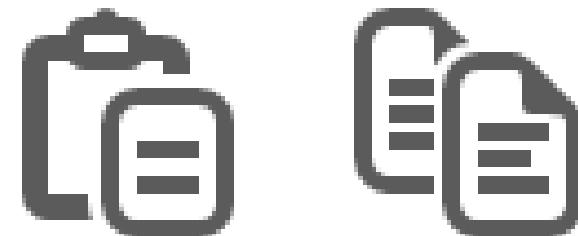
Task

File

Memory

Device

- Memory manager handles **RAM** allocation on each process.
- Since RAM is a finite resource, it is important to **assign and free it intelligently.**



Memory Manager

Task

File

Memory

Device

Task Manager

File Options View

Processes Performance App history Startup Users Details Services

Name	Status	6%	41%
		CPU	Memory
> Microsoft PowerPoint		4.2%	584.0 MB
Client Server Runtime Process		0.8%	0.9 MB
Desktop Window Manager		0.3%	32.7 MB
Discord (32 bit)		0.2%	133.4 MB
> Task Manager		0.1%	23.8 MB
System		0.1%	0.1 MB
> Windows Explorer		0.1%	78.0 MB
System interrupts		0.1%	0 MB
> Service Host: Connected Device...		0.1%	7.6 MB
LogiOptions.exe (UNICODE)		0.1%	1.8 MB
> Antimalware Service Executable		0.1%	280.0 MB
Dropbox (32 bit)		0.1%	218.3 MB
CTF Loader		0%	5.0 MB
> Service Host: Remote Procedure...		0%	7.9 MB

< More details End task

Device Manager

Task

File

Memory

Device

- It is the **translator** between each hardware device and its operating system
- Utilizes **drivers** to communicate effectively
- Some peripheral devices (mice, keyboards) support generic drivers, such as **HID – Human Interface Device**.



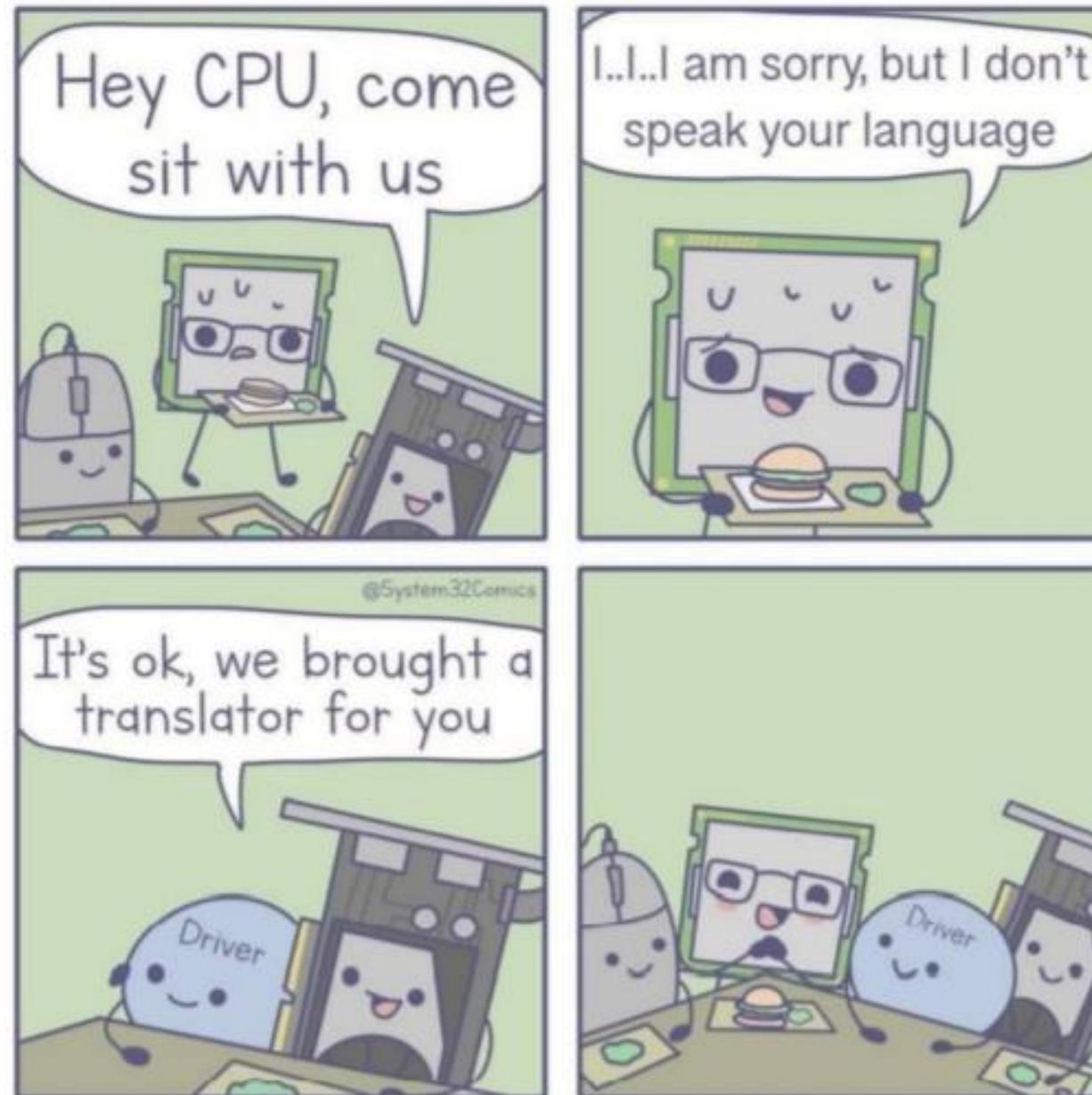
Device Manager

Task

File

Memory

Device



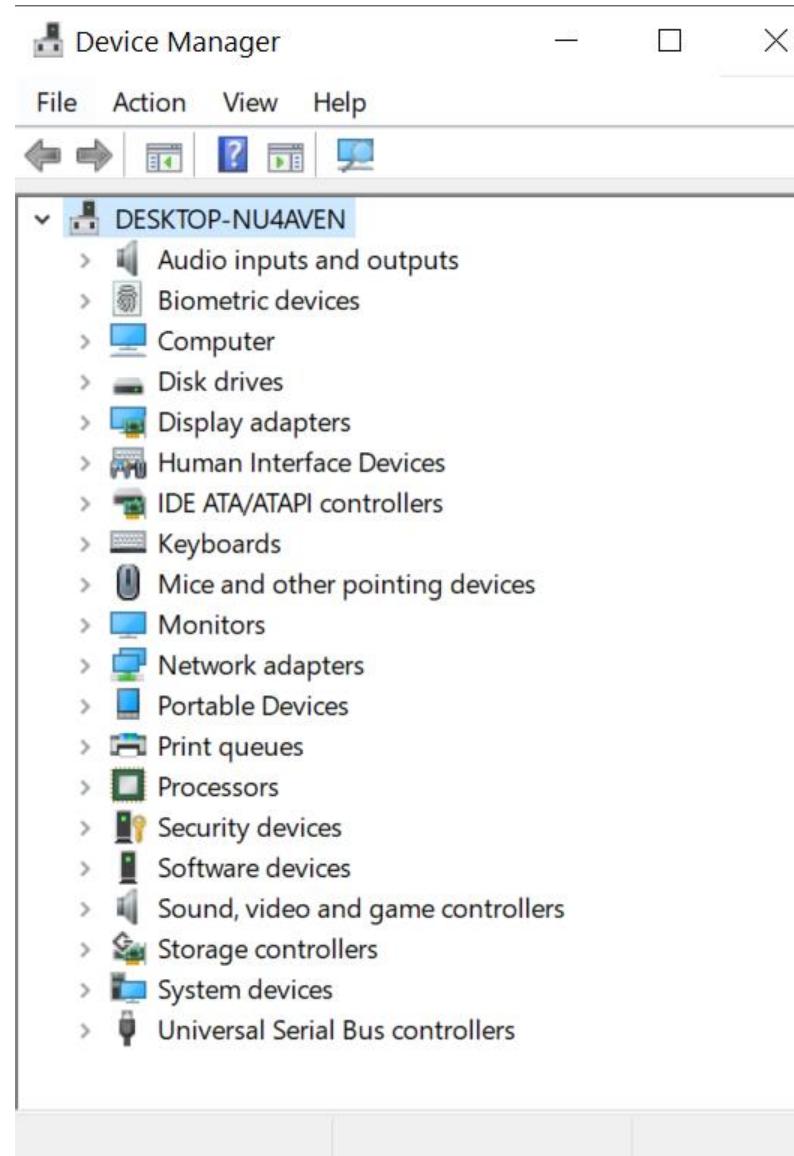
Device Manager

Task

File

Memory

Device



Application Software

How many applications can you name?



Application Software



Company



Recreational



Security



Learning



Admin

....y muchos mas!!!



ANATOMY OF A COMPUTER VIRUS

Malware (Malicious Software)

Computer that makes its way to a computer with the intention of **damaging the user**.



It copies and replicates by itself, infecting other programs and files

Virus



Replicates to other devices connected in the same network

Worm



Infiltrates a computer to spy on its users, stealing sensible information

Spyware

Malware (Malicious Software)



Enters your computer disguised as an unoffensive file

Trojan



Blocks access to your computer until a ransom is payed

Ransomware



Displays unwanted publicity while the computer is operated

Adware

Malware (Malicious Software)



Logs and stores all

Keylogger



Gains admin access
to a device, allowing
it to install other
malicious software

Rootkit



Modulo 1

FEFCFB



coolors