

1 Hardware

1.1 Main components

1.1.1 Memory

Description Used to store the data related to running softwares. Can be described by:

1. Capacity (GB): amount of stored data
2. Frequency (MHz) / generation: transfer speed
3. Format: tower/laptop
4. ...



Figure 1: RAM modules: DDR5 - laptop

Photos

1.1.2 CPU

Description Performs base operations (sum, division, etc...) using data stored in memory. Can be described by:

1. Number of cores
2. Operating frequency, generation, engraving width, supported instructions
3. *TDP* (W)
4. Cached memory
5. ...

Multithreading Idea: perform many tasks simultaneously on a same physical cores
Chez *Intel*: *Hyper-Threading*.

$$\# \text{logical cores} = \# \text{physical cores} \times \frac{\# \text{threads}}{\# \text{physical core}}$$

Photos



CPU



CPU cooler

Figure 2: CPU components

1.1.3 Storage

Description Save data on the long term. Can be described by:

1. Capacity (GB)
2. Reading/Writing speed, latency
3. Type
4. ...



HDD



SSD (old technology)



SSD (new technology)

Figure 3: Stockage

Photos

1.1.4 GPU

Description Similar to GPU. Performs graphical operations and produces an image to display. More broadly, performs some highly parallelizable tasks. Can be described by:

1. Memory: capacity (GB) and generation (i.e.: frequency)
2. External connectors

GPU and graphic card The word "GPU" describes the computation unit only (not the fans, memory, ...).

Integrated GPU For computers having small graphics needs, the GPU is a small unit dedicated to graphics integrated into the CPU.



Figure 4: Graphic card

Photos

1.2 Typical configurations

Component	Typical hardware properties	
	Personnal computer	Shared working station
Memory	8 GB	64-256 GB
CPU	4-8 logical cores 2GHz	16-128 logical cores 2-4 GHz
Disk	SSD 500 GB	HDD 10 TB SSD 1 TB
GPU	Integrated	2-8 GB memory

1.3 Howto: compare two computers

Before any comparison, first ask yourself about the software you want to run:

- Can it be parallelizable?
- Is it eunning on GPU or CPU?
- Does it need to write or read a lot of data from the disk?

Two computers can be compared using one of these two methods:

- Compare the date they were bought together with the price at that times
- Compare main characteristics:
 1. CPU: number of logical cores
(if a GPU exists: generation, memory capacity)

2. CPU: frequency
3. RAM: capacity

Some websites host a component comparator; typical result is an averaged score built from different categorical scores (ex: number of cores for a CPU).

2 Software

2.1 Operating systems (*OS*)

An operating system is a software that makes hardware resources available through interfaces.

We usually make a distinction between low-level component of the OS (e.g.: kernel, handles the hardware) and those that provide applications the user can interact with.

2.1.1 Many OS

Main OS are:

- Windows (Microsoft)
- OS X (Apple)
- Linux

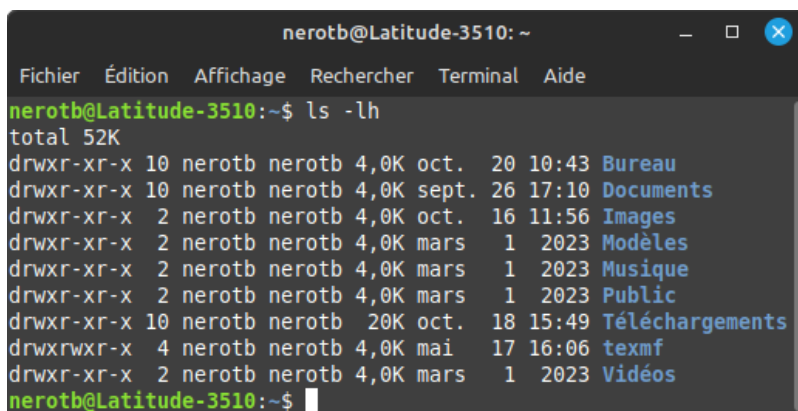
2.1.2 GUI and CLI

GUI : *Graphic User Interface*

Interface that describes software components using drawings. One can interact with a GUI mainly using a mouse.

CLI : *Command Line Interface*

Interface that describes software components using text. One can interact with a CLI using a keyboard.



```
nerotb@Latitude-3510: ~  
Fichier  Édition  Affichage  Rechercher  Terminal  Aide  
nerotb@Latitude-3510:~$ ls -lh  
total 52K  
drwxr-xr-x 10 nerotb nerotb 4,0K oct. 20 10:43 Bureau  
drwxr-xr-x 10 nerotb nerotb 4,0K sept. 26 17:10 Documents  
drwxr-xr-x  2 nerotb nerotb 4,0K oct. 16 11:56 Images  
drwxr-xr-x  2 nerotb nerotb 4,0K mars  1 2023 Modèles  
drwxr-xr-x  2 nerotb nerotb 4,0K mars  1 2023 Musique  
drwxr-xr-x  2 nerotb nerotb 4,0K mars  1 2023 Public  
drwxr-xr-x 10 nerotb nerotb 20K oct. 18 15:49 Téléchargements  
drwxrwxr-x  4 nerotb nerotb 4,0K mai 17 16:06 texmf  
drwxr-xr-x  2 nerotb nerotb 4,0K mars  1 2023 Vidéos  
nerotb@Latitude-3510:~$
```

Figure 5: Linux console (CLI)

GUI is built on the top of CLI The visual aspect rendered by a GUI is often a simplified version of what can be achieved using the CLI. In the background, most of GUI-related actions are translated to CLI commands at run time.

2.2 Processes

A process is a set of instructions processed by the hardware as asked by a running software. Some processes create several threads that use all the available logical cores. Processes are identified using a *PID* (Process Identifier).

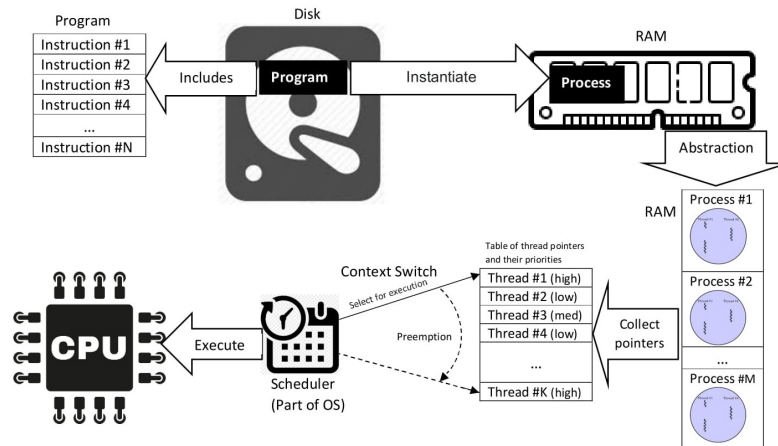


Figure 6: Simplified running scheme of a software

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2.3 Programing language

[...] A programming language is a system of notation for writing computer programs.

A programming language is described by its syntax (form) and semantics (meaning). It gets its basis from formal languages.

source: Wikipedia

2.3.1 Compiled vs interpreted

Compiled language A software written using a compiled language is directly translated into something the OS can handle. Examples of compiled languages: Fortran, C++

interpreted language A software written using an interpreted language is split into pieces that make a sense for a master language which handles the execution. Examples of interpreted languages: Python, Matlab