

## Session 1.2 – Linux environment review

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Programa Formación Continua, ISCIII

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## Linux environment review:

- Linux OS
- Linux file system
- Linux users and privileges
- Basic commands
- Command line syntax

# Index

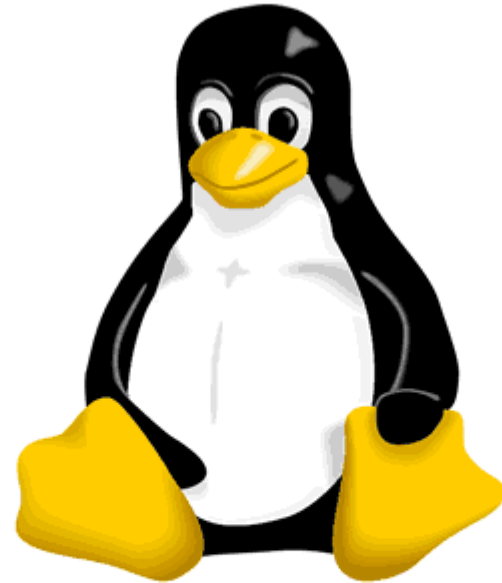
## Linux environment review:

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- Command line syntax

# Linux OS - Introduction

## Linux is:

- Operative system
- Open source
- Multi-task
- Multi-user



Linux

# Linux OS - Introduction

## Linux is:

- Operative system
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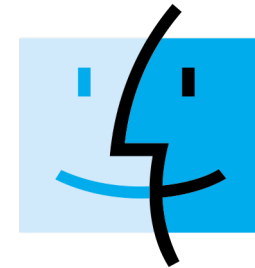
Linux

# Linux OS – Operating System I

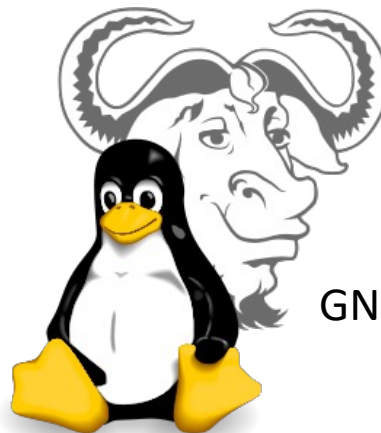
Operative System (OS):



Windows



Mac<sup>TM</sup> OS



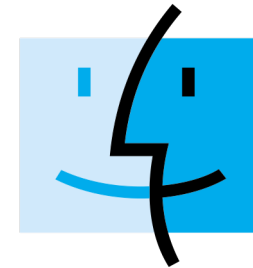
GNU/Linux

# Linux OS – Operating System I

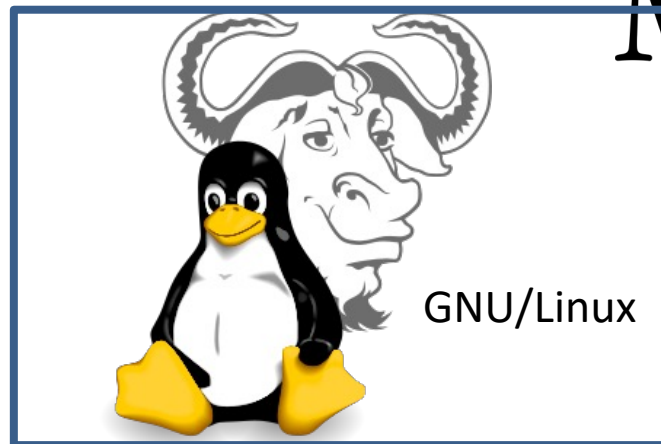
## Operative System (OS):



Windows



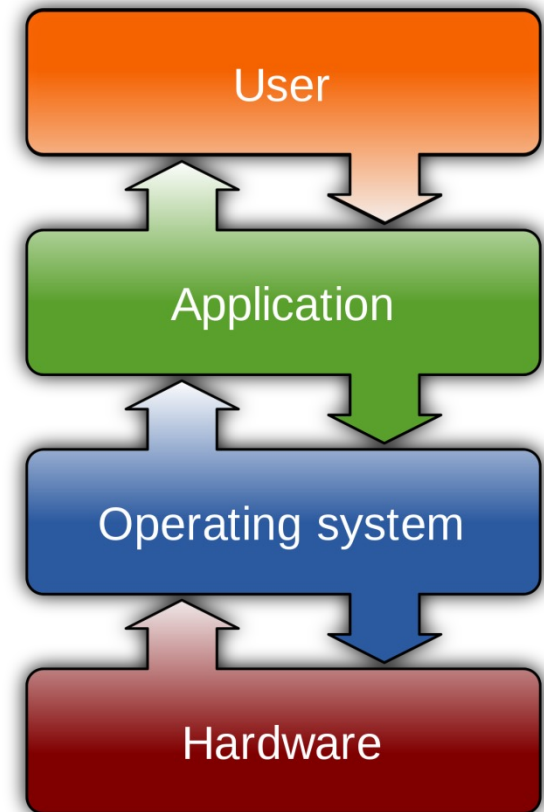
Mac<sup>TM</sup> OS



# Linux OS – Operating System I

## Operative System (OS):

- Software that manages computer hardware and software resources and provides common services for computer programs





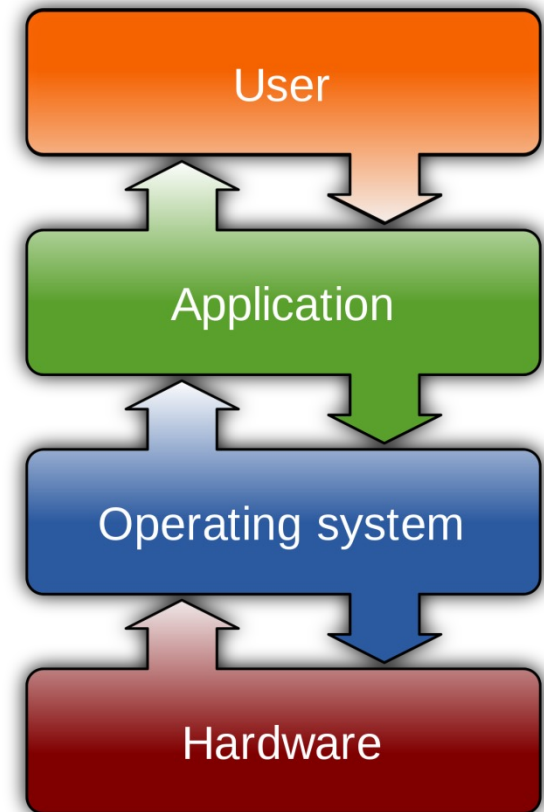
# Linux OS – Operating System I

## Operative System (OS):

- Software that manages computer hardware and software resources and provides common services for computer programs

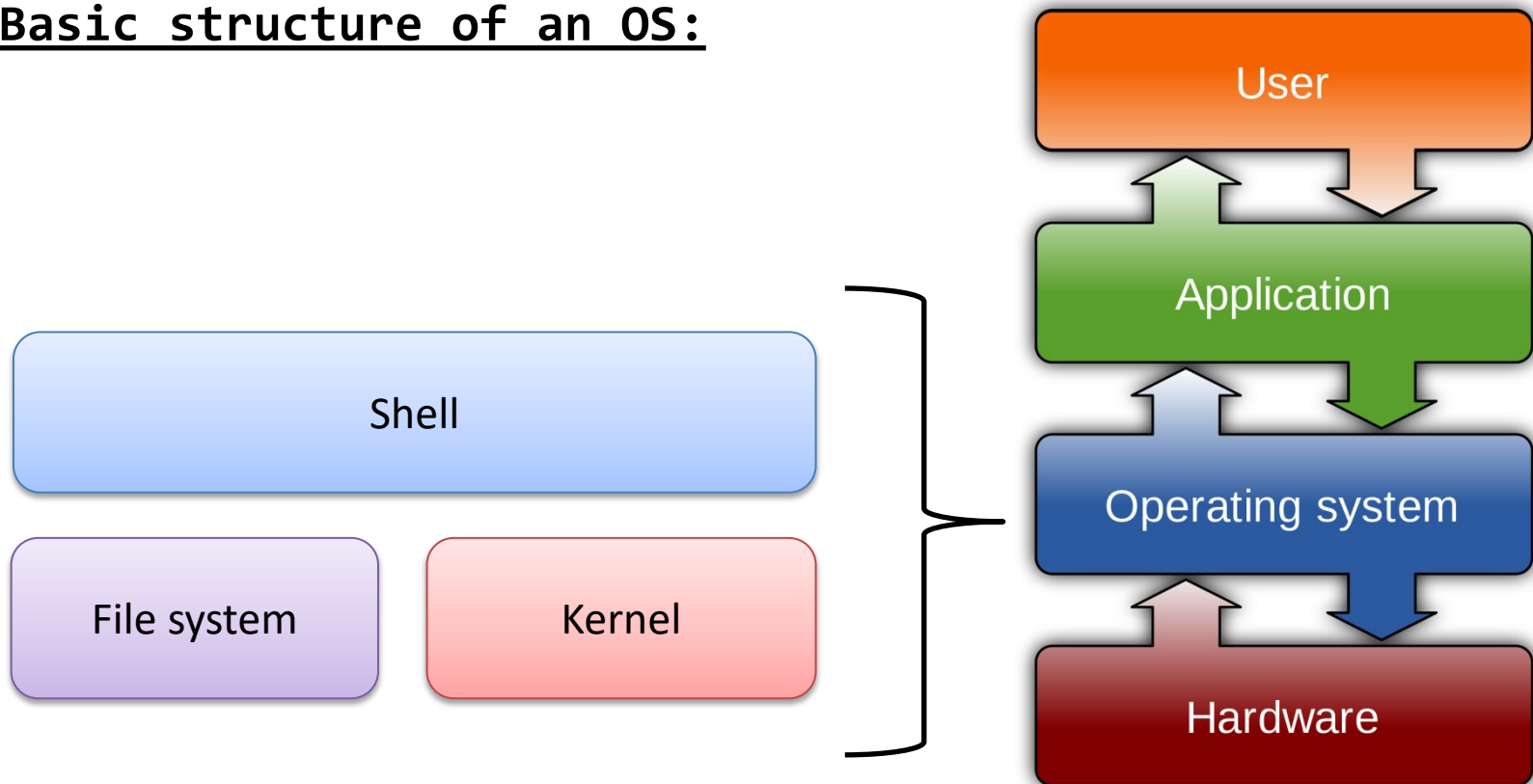
## Functions:

- Program execution control and oversee
- Administrate peripherals
- User and permission management
- Error and security management



# Linux OS – Operating System II

## Basic structure of an OS:



# Linux OS – Operating System III

Shell

Program that provides the traditional, text-only user interface.

# Linux OS – Operating System III

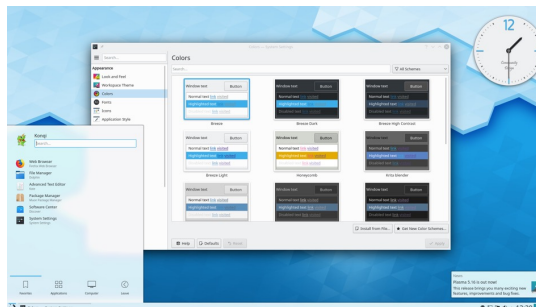
Shell

Command line

Program that provides the traditional, text-only user interface.

```
svanona@MacBook-Air-de-Sorai:~$ echo "I am the command line interface"
I am the command line interface
svanona@MacBook-Air-de-Sorai:~$ ls -l
total 9888
drwxr-xr-x  6 svanona  staff   192 16 nov  2020 500x
drwxr-xr-x  6 svanona  staff   192  6 oct  11:35 Applications
drwxr-xr-x  27 svanona  staff   864  8 sep  10:28 Desktop
drwxr-xr-x  31 svanona  staff   992  6 oct  13:00 Documents
drwxr-xr-x  56 svanona  staff  1792 23 oct  13:44 Downloads
drwxr-xr-x  71 svanona  staff  2272 28 sep  2021 Dropbox
-rw-r--r--  1 svanona  staff 3793847  8 may  13:18 IICIT-2021-2027.pdf
drwxr-xr-x  21 svanona  staff   672 28 jun  11:25 Genious 2022.1 Data
drwxr-xr-x  10 svanona  staff   320 23 abr  2022 IG
drwxr-xr-x  74 svanona  staff  2368  5 oct  2021 Library
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drwxr-xr-x  4 svanona  staff   128  4 jun  2020 Music
drwxr-xr-x  15 svanona  staff   480 15 feb  2022 Pictures
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drwxr-xr-x  7 svanona  staff   224 22 sep  13:42 Regalo_E25
drwxr-xr-x 14 svanona  staff   448  6 oct  13:39 Repositories
drwxr-xr-x 24 svanona  staff   768 23 oct  13:44 Teletubiojo
drwxr-xr-x  9 svanona  staff   288 28 oct  2020 Zotero
drwxr-xr-x  2 svanona  staff    64 16 abr  2022 bu-isccc_test
-rw-r--r--  1 svanona  staff 11174 23 may  15:44 dia_libra_SanIsidro_2022.xlsx
-rw-r--r--  1 svanona  staff   415  2 abr  2022 followers
-rw-r--r--  1 svanona  staff   5475  2 abr  2022 following
drwxr-xr-x 15 svanona  staff   480  2 mar  2021 miniconda2
-rw-r--r--  1 svanona  staff   154  1 sep  2021 update_saves_to_local.sh
-rw-r--r--  1 svanona  staff   162  1 sep  2021 upload_saves_to_dropbox.sh
svanona@MacBook-Air-de-Sorai:~$
```

Graphical user interface



# Linux OS – Operating System III

Shell

File system

Program that provides the traditional, text-only user interface.

It controls how data is stored, manipulated and retrieved.

# Linux OS – Operating System III

Shell

File system

Program that provides the traditional, text-only user interface.

It controls how data is stored, manipulated and retrieved.

Kernel

It is the foundational layer of an operating system (OS).  
It functions at a basic level, communicating with hardware and managing resources.

# Linux OS - Introduction

## Linux is:

- Operative system
- Open source
- Multi-task
- Multi-user



Linux

# Linux OS – Open source I

**The distribution terms of open-source software must comply with the following criteria:**

- Free Redistribution
- Source Code
- Derived Works
- Integrity of the Author's Source Code
- No Discrimination Against Persons or Groups
- No Discrimination Against Fields of Endeavour
- Distribution of license
- License Must Not Be Specific to a Product
- License Must not Restrict Other Software
- License Must Be Technology-Neutral



# Linux OS – Open source II

## Linux Distributions

- A distro is a Linux kernel based operating system made from a software collection and sometimes a package management system.
- There are distros for a wide variety of platforms.
- A typical Linux distro comprises a Linux kernel, GNU tools and libraries, additional software, documentation, a window system, a window manager, and a desktop environment.
- Most of the included software is free and open-source software made available both as compiled binaries and in source code form, allowing modifications to the original software. Usually, Linux distributions optionally include some proprietary software that may not be available in source code form, such as binary blobs required for some device drivers.

# Linux OS – Open source II

## Linux Distributions



ubuntu

# Linux OS – Open source II

## Linux Distributions

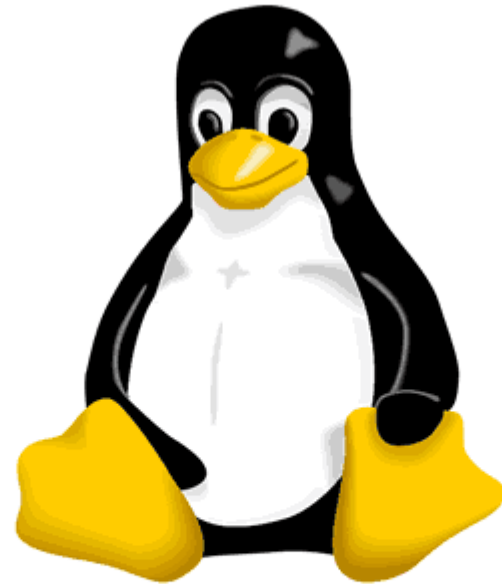


Ubuntu 20.04 LTS

# Linux OS - Introduction

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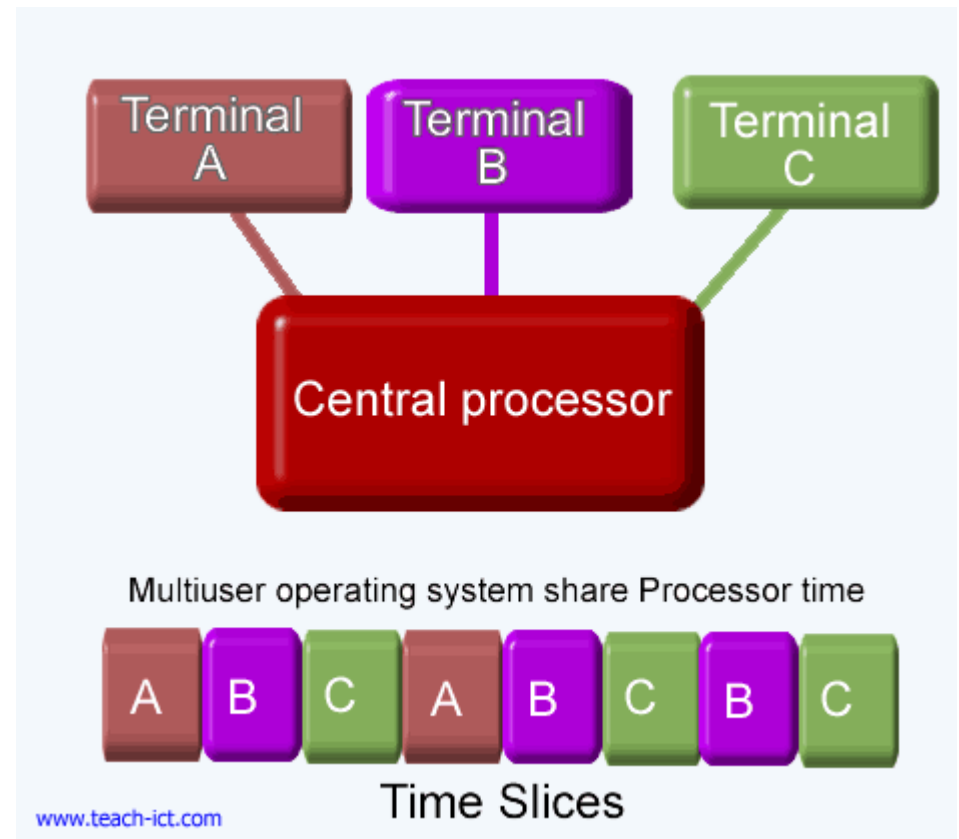


Linux

# Linux OS - Multi-task

A multi-task operative systems allows a user to perform more than one computer task (such as the operation of an application program) at a time.

The operating system is able to keep track of where you are in these tasks and go from one to the other without losing information.



# Linux OS - Introduction

## Linux is:

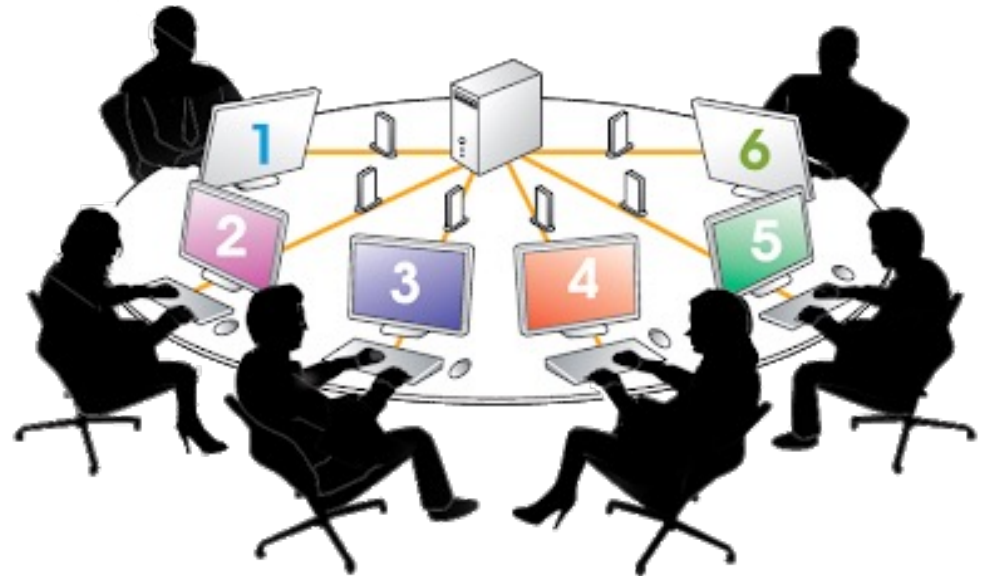
- Operative system
- Open source
- Multi-task
- Multi-user



Linux

# Linux OS – Multi-user I

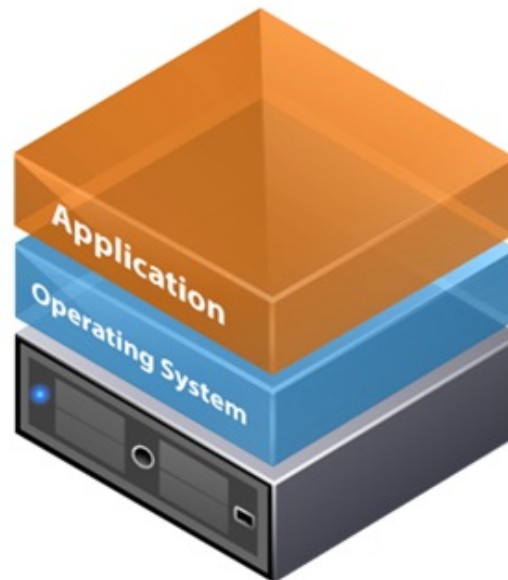
- Multi-user software is software that allows access by multiple users of a computer.
- An example is a Unix server where multiple remote users have access (such as via a serial port or Secure Shell) to the Unix shell prompt at the same time.



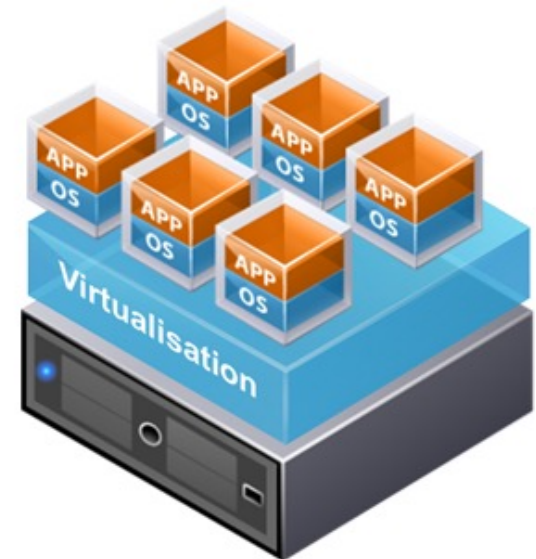
# Linux OS - Multi-user II

## Virtualisation:

the act of creating a virtual (rather than actual) version of something, including virtual computer hardware platforms, storage devices, and computer network resources.



Traditional Architecture



Virtual Architecture



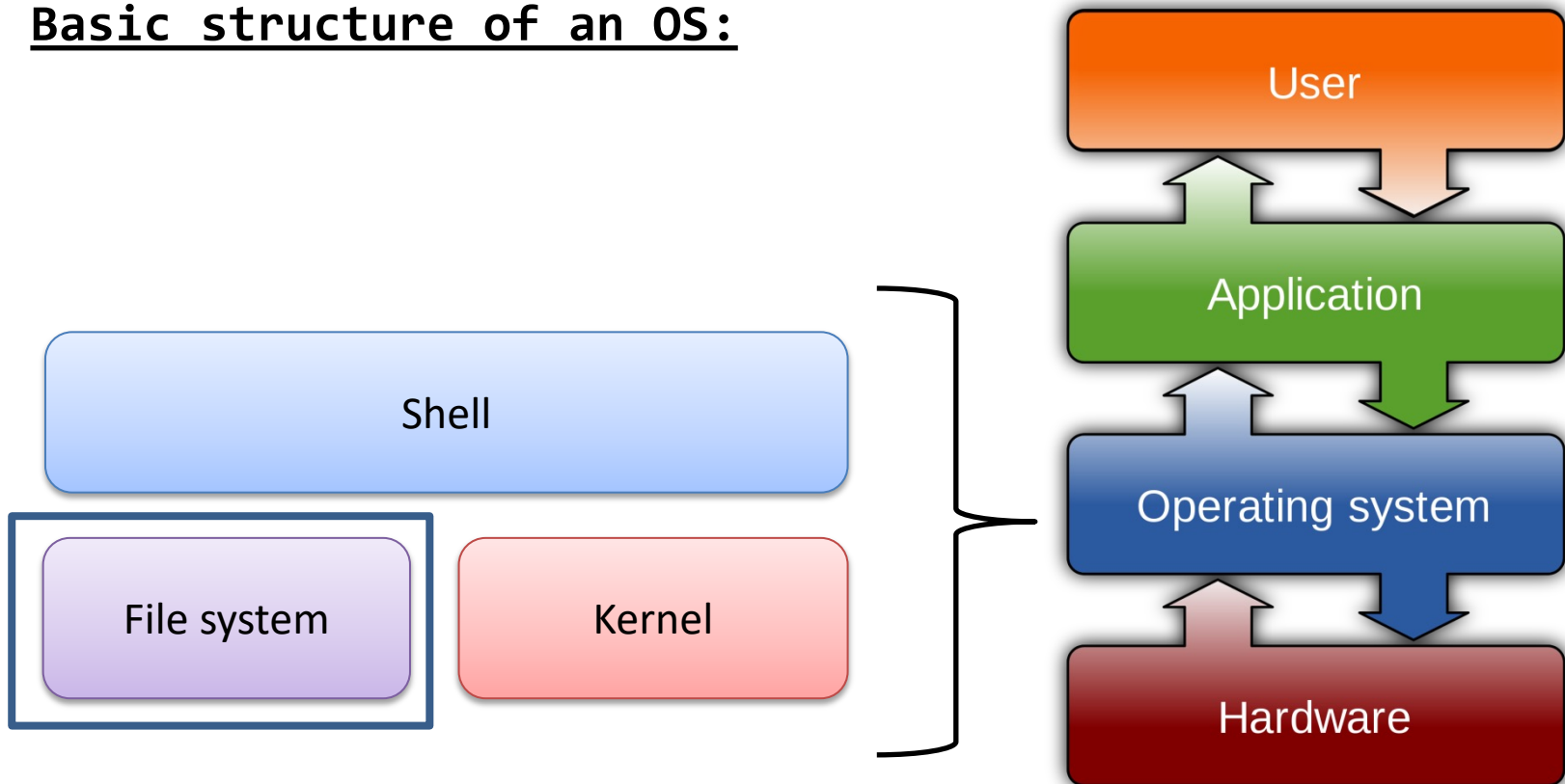
# Index

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# Linux OS – Operating System II

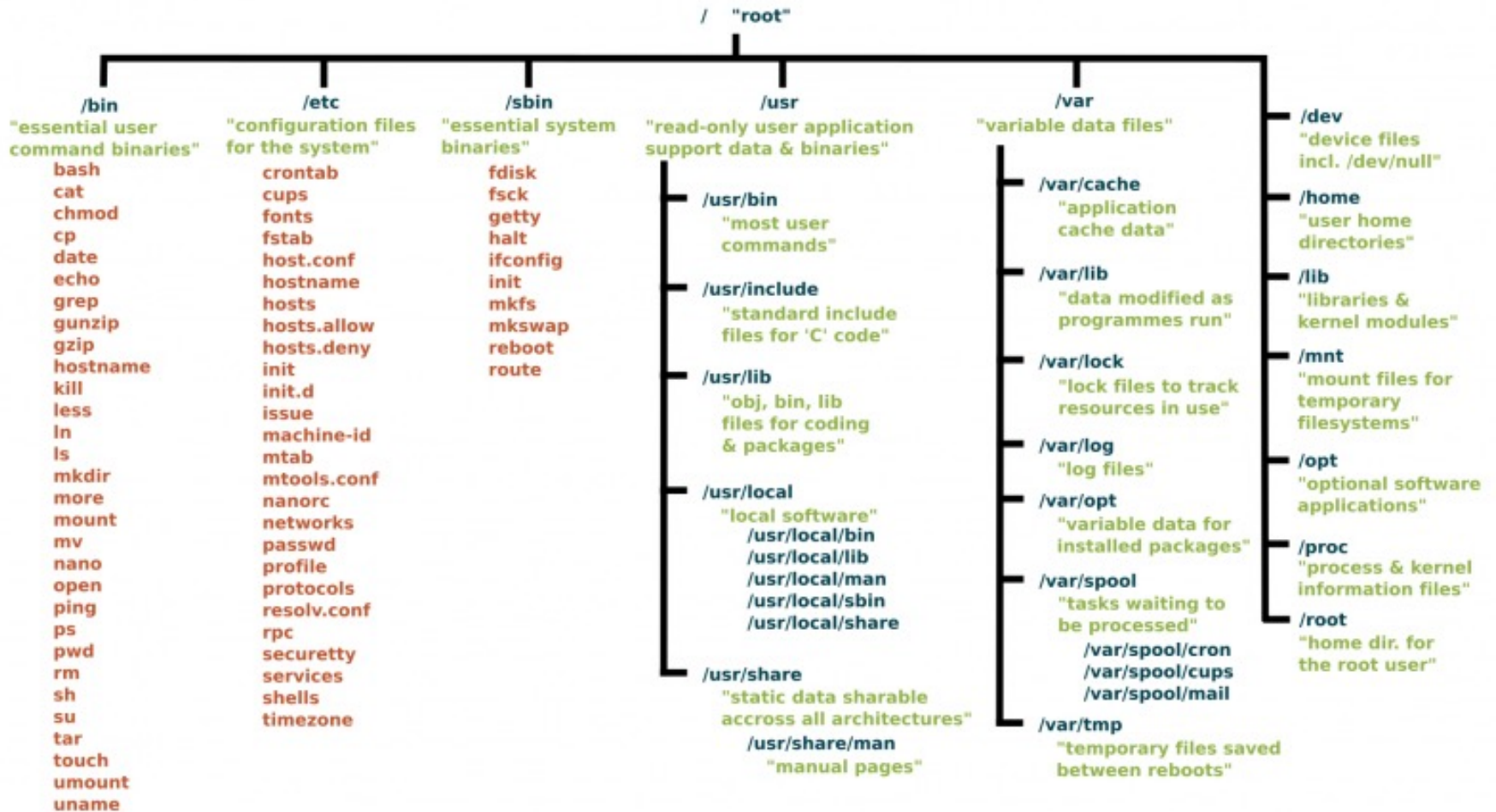
## Basic structure of an OS:



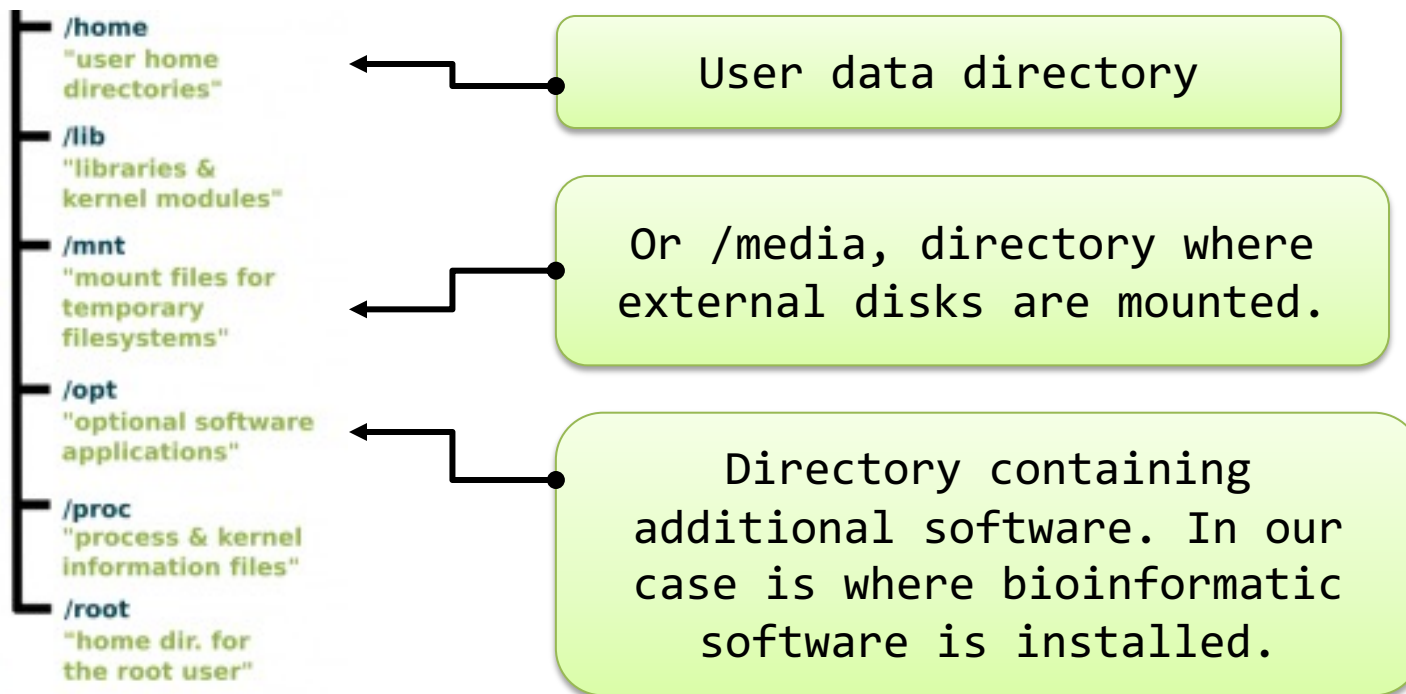
# Linux File System – Key Features

- Everything is a File
- Specifying Paths
- Case-Sensitive
- File Extensions and Hidden Files
- Permissions
- Root directory (/)

# Linux File System - Structure

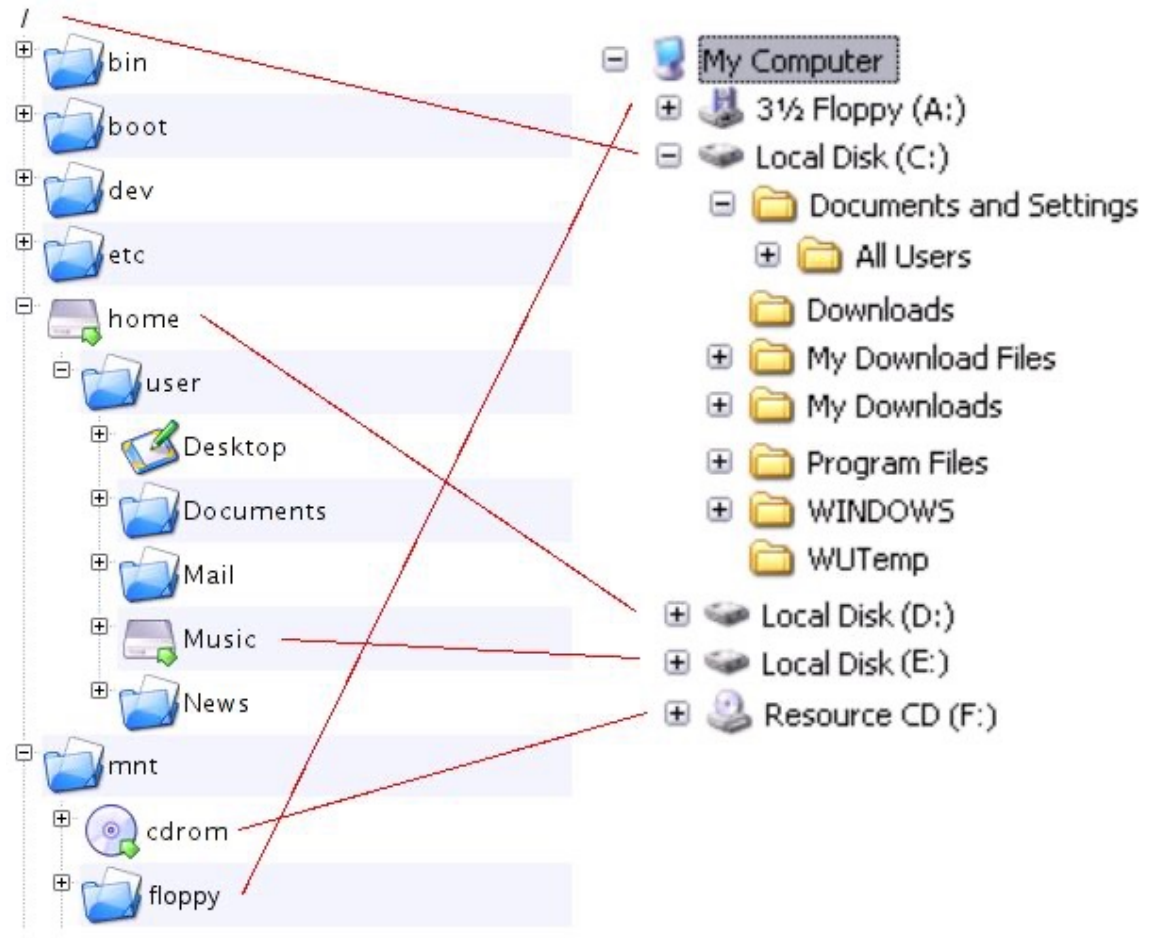


# Linux File System - Structure



# Linux File System - Comparison

- Everything “hangs” from root
- Files are classified by type / role instead of unit location
- Files locations in disks are invisible for users

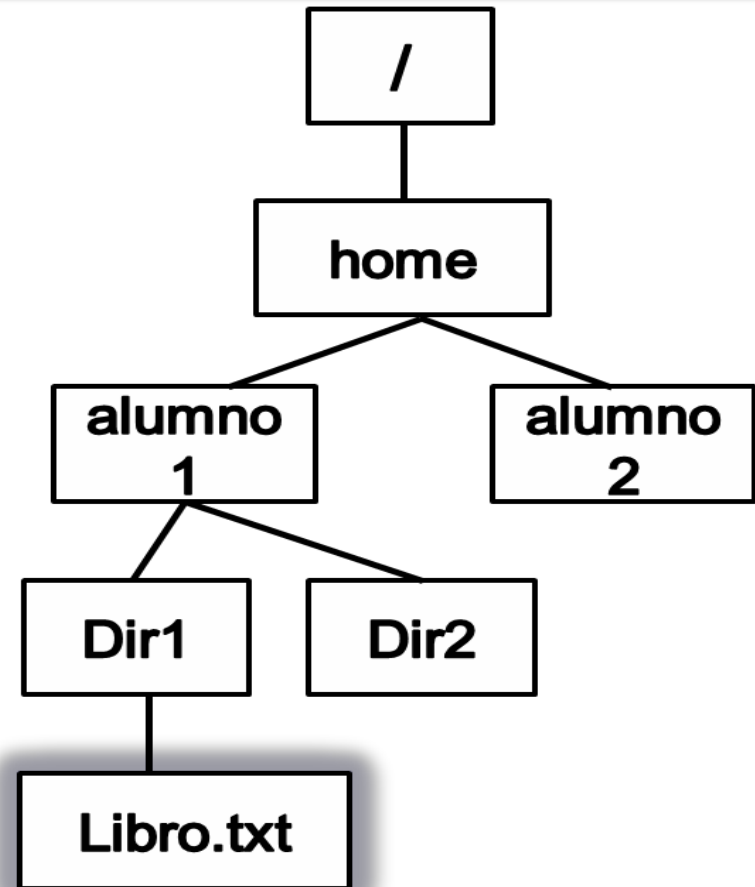


# Linux File System – Paths

- PATH:
  - **Absolute path:**
    - Location of a file or directory from the root directory (/).
    - Static.
    - Ej: /home/alumno1/dir1/book.txt
  - Relative path:
    - Path related to the present working directory (pwd).
    - Variable
    - Actual pwd = “.”
    - Parent directory = “..”
    - Ej:
      - from /home: alumno1/dir1/book.txt or ./alumno1/dir1/book.txt
      - from /home/alumno1: dir1/book.txt or dir1/book.txt
      - from /home/alumno1/dir1: book.txt ./book.txt

# Linux File System - Paths

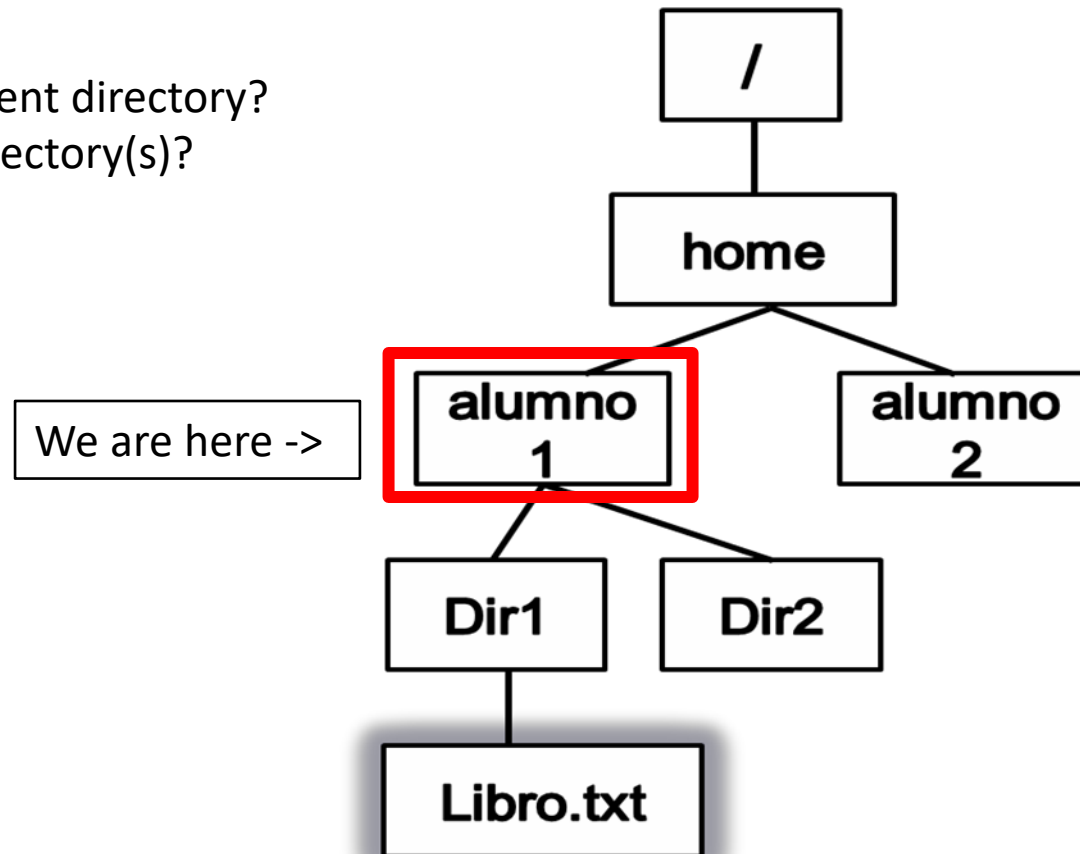
- Example
  - `../..` To go *home* from *Dir1* or *Dir2*
  - `../..alumno2` To go *alumno2* from *Dir1* o *Dir2*.
  - `../Dir2` To go from *Dir1* to *Dir2*.



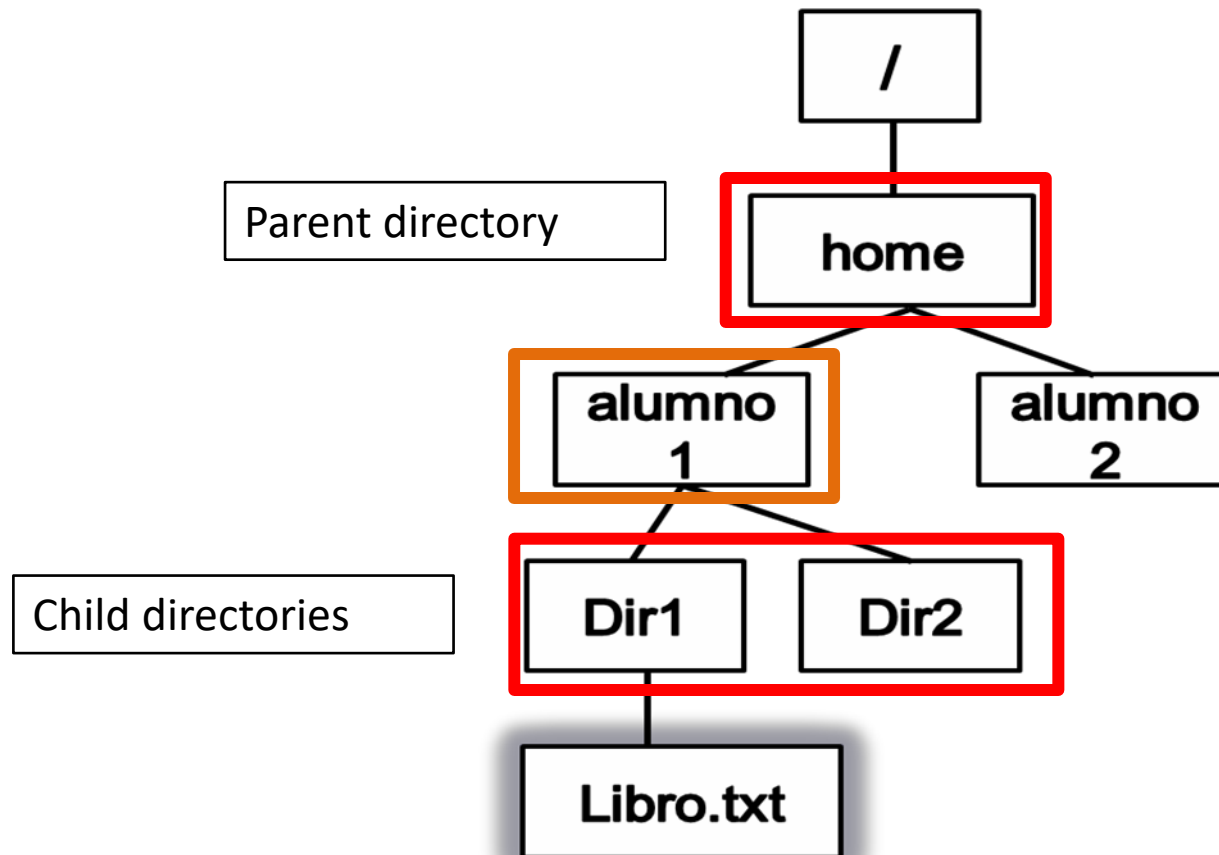


# Linux File System - Paths

Which is parent directory?  
And child directory(s)?

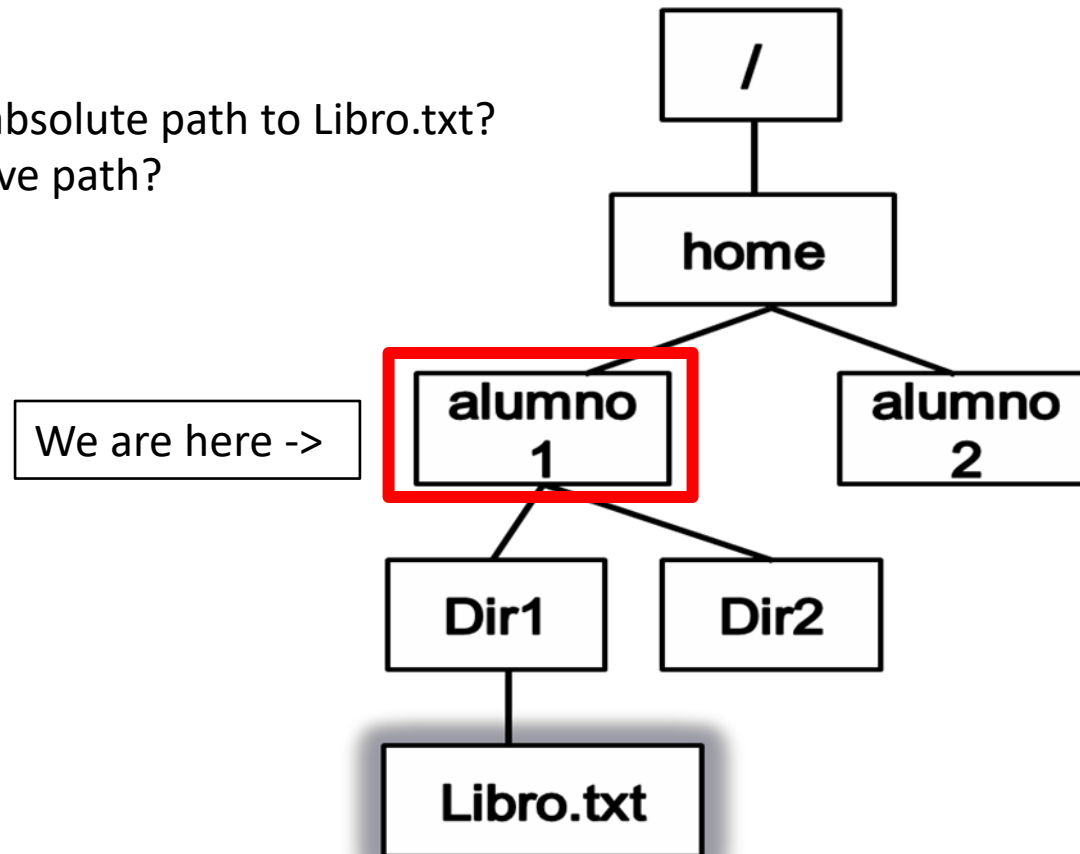


# Linux File System - Paths



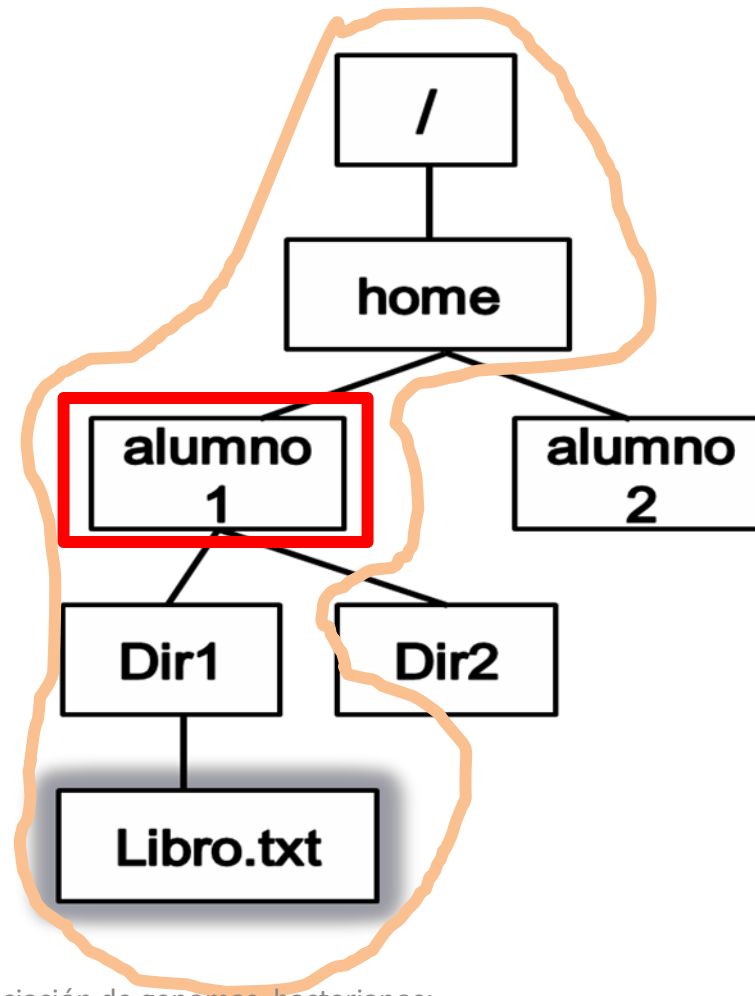
# Linux File System - Paths

Which is the absolute path to Libro.txt?  
And the relative path?



# Linux File System - Paths

No matter where we are

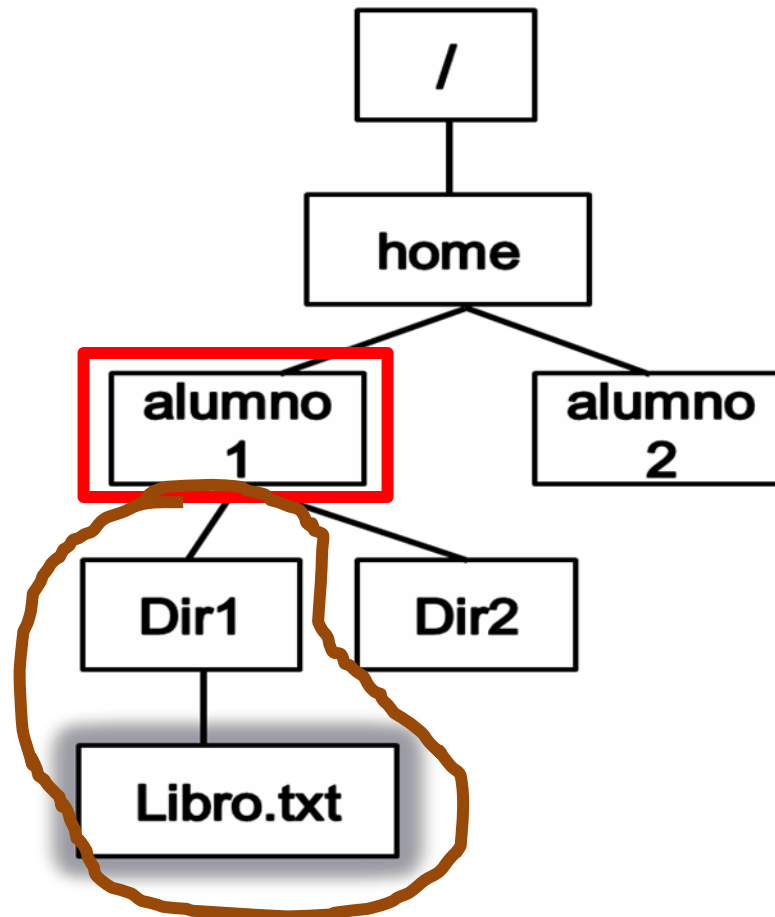


Absolute path  
/home/alumno1/Dir1/Libro.txt

# Linux File System - Paths

Important pwd or “.”

Relative path  
./Dir1/Libro.txt



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# Linux Users and Privileges - Users

- Users can be linked to a person or computer process
- Every user may belong to one or more groups
- Every user may have a home folder inside /home
- Users own the files they create, directly or indirectly
- Users can change permissions on files they own
- Users also own processes they execute
- Root rules over them all
- Root home folder is in /root

# Linux Users and Privileges - Permissions

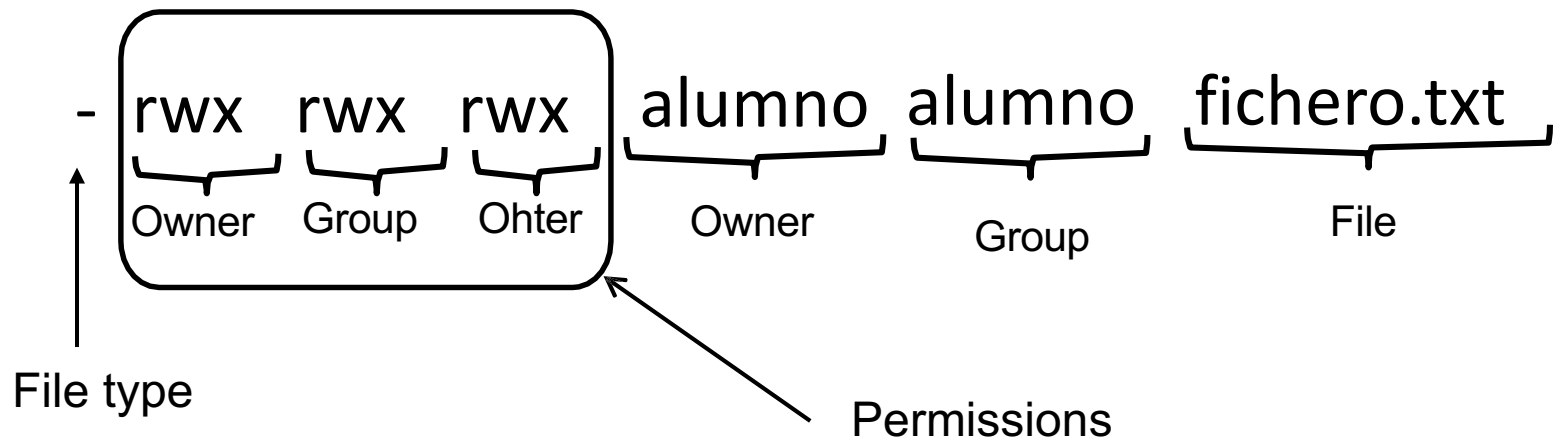
Permissions are the “rights” to act on a file or directory. There are only 3 basic permissions:

- **Read (r)** - allows the contents of the file to be viewed. A read permission on a directory allows you to list the contents of a directory.
- **Write (w)** - allows you to modify the contents of that file. For a directory, the write permission allows you to edit the contents of a directory.
- **Execute (x)** - for a file, the executable permission allows you to run the file and execute a program or script. For a directory, the execute permission allows you to change to a different directory and make it your current working directory (pwd or “.”).



# Linux Users and Privileges - Permissions

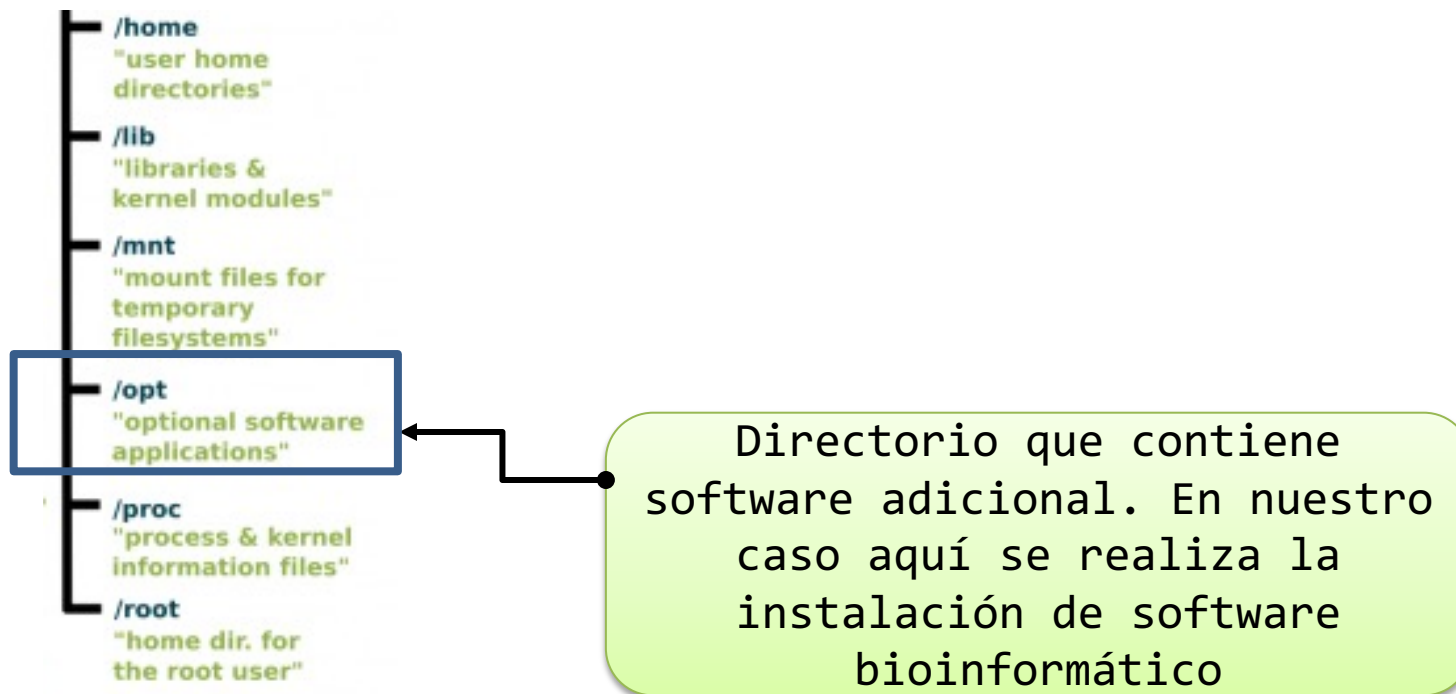
- A file's rights can only be modified by the owner of the file, the group owning the file and the root
- The system stores this right information in a 9 bits sequence.
- This sequence has a sequence of 3 elements for each 3 groups:



# Linux Users and Privileges - Permissions

- Examples:
  - Example 1: /opt directory

# Linux File System - Structure



# Linux Users and Privileges - Permissions

- Examples:
  - Example 1: /opt directory
    - `drwxr-xr-x root root opt`
    - Owner (root) can read, write and execute
    - Group (root) and rest can only read and execute

# Linux Users and Privileges - Permissions

- Examples:
  - Example 1: /opt directory
    - `drwxr-xr-x root root opt`
    - Owner (root) can read, write and execute
    - Group (root) and rest can only read and execute
  - Example 2: personal directory
    - `drwx----- alumno clase alumno`
    - Owner can read, modify and access the directory
    - Group and others can't do anything

# Linux Users and Privileges - Permissions

- Examples:
  - Example 1: /opt directory
    - `drwxr-xr-x root root opt`
    - Owner (root) can read, write and execute
    - Group (root) and rest can only read and execute
  - Example 2: personal directory
    - `drwx----- alumno clase alumno`
    - Owner can read, modify and access the directory
    - Group and others can't do anything
  - Example 3: tmp
    - `drwxrwxrwx root root tmp`
    - Everybody has permissions for everything

# Linux Users and Privileges – Check Permissions I

To view file permissions and ownership on files and directories, use the `ls -al` command. For example:

```
drwxr-xr-x 2 user user 4096 Jan  9 10:11 documents
```

`drwxr-xr-x` are the permissions

`2` is the number of files or directories

`user` is the owner

`user` is the group

`4096` is the size

`Jan 9 10:11` is the date/time of last access

`documents` is the directory

# Linux Users and Privileges – Check Permissions II

Following previous example:

```
drwxrw-r-- 2 user user 4096 Jan  9 10:11 documents
```

Permissions are listed in the first 10 characters-dash section.

?????



# Linux Users and Privileges – Check Permissions II

Following previous example:

```
drwxrw-r-- 2 user user 4096 Jan  9 10:11 documents
```

Permissions are listed in the first 10 characters-dash section. The section can be read as follows:

`d` is a directory (`-` for files)

`rwx` the user has read, write, and execute permissions

`rw-` the group has read and write permissions

`r--` all others have read only permissions

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# Linux OS – Operating System III

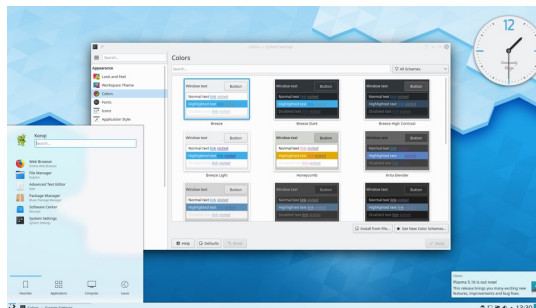
Shell

Program that provides the traditional, text-only user interface.

Command line

```
svanona@MacBook-Air-de-Saraei-2 ~ % echo "I am the command line interface"
I am the command line interface
svanona@MacBook-Air-de-Saraei-2 ~ % ls -l -l
total 9888
drwxr-xr-x  6 svanona  staff   192 16 nov 2020 SRA0X
drwxr-xr-x  6 svanona  staff   192  6 oct 11:35 Applications
drwxr-xr-x 27 svanona  staff   864 30 sep 13:58 Desktop
drwxr-xr-x 31 svanona  staff   992  6 oct 13:00 Documents
drwxr-xr-x 36 svanona  staff  1152 23 oct 13:48 Downloads
drwxr-xr-x 71 svanona  staff  2272 28 sep 2021 Dropbox
-rw-r--r--  1 svanona  staff 3793847  8 may 13:16 ECTI-2021-2027.pdf
drwxr-xr-x 21 svanona  staff   672 28 jun 11:15 genomica_2022.1 Data
drwxr-xr-x 10 svanona  staff   320 23 abr 2022 IG
drwxr-xr-x 74 svanona  staff   2304  5 oct 2021 Library
drwxr-xr-x 13 svanona  staff   416  7 may 2021 Movies
drwxr-xr-x  4 svanona  staff   128  4 jun 2020 Music
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drwxr-xr-x 24 svanona  staff   768 23 oct 13:48 Teleradiops
drwxr-xr-x  9 svanona  staff   288 28 oct 2020 Zotero
drwxr-xr-x  2 svanona  staff    64 14 abr 2022 bu-isciii.test
-rw-r--r--  1 svanona  staff 11174 23 may 15:44 dia_libre_Sonlida_2022.xlsx
-rw-r--r--  1 svanona  staff   416  2 abr 2022 followers
-rw-r--r--  1 svanona  staff   512  2 abr 2022 following
drwxr-xr-x 15 svanona  staff   480  2 mar 2021 miniconda2
-rw-r--r--  1 svanona  staff   154  1 sep 2021 update_saves_to_local.sh
-rw-r--r--  1 svanona  staff   162  1 sep 2021 upload_saves_to_dropbox.sh
svanona@MacBook-Air-de-Saraei-2 ~ %
```

Graphical user interface



# Basic Commands – Shell's prompt

- Shell waits for the user to write commands in a line called prompt.
- Prompt line gives some important information that can be easily understood:

`profesor@VM-NGS01:~/Documentos$`

Annotations for the prompt:

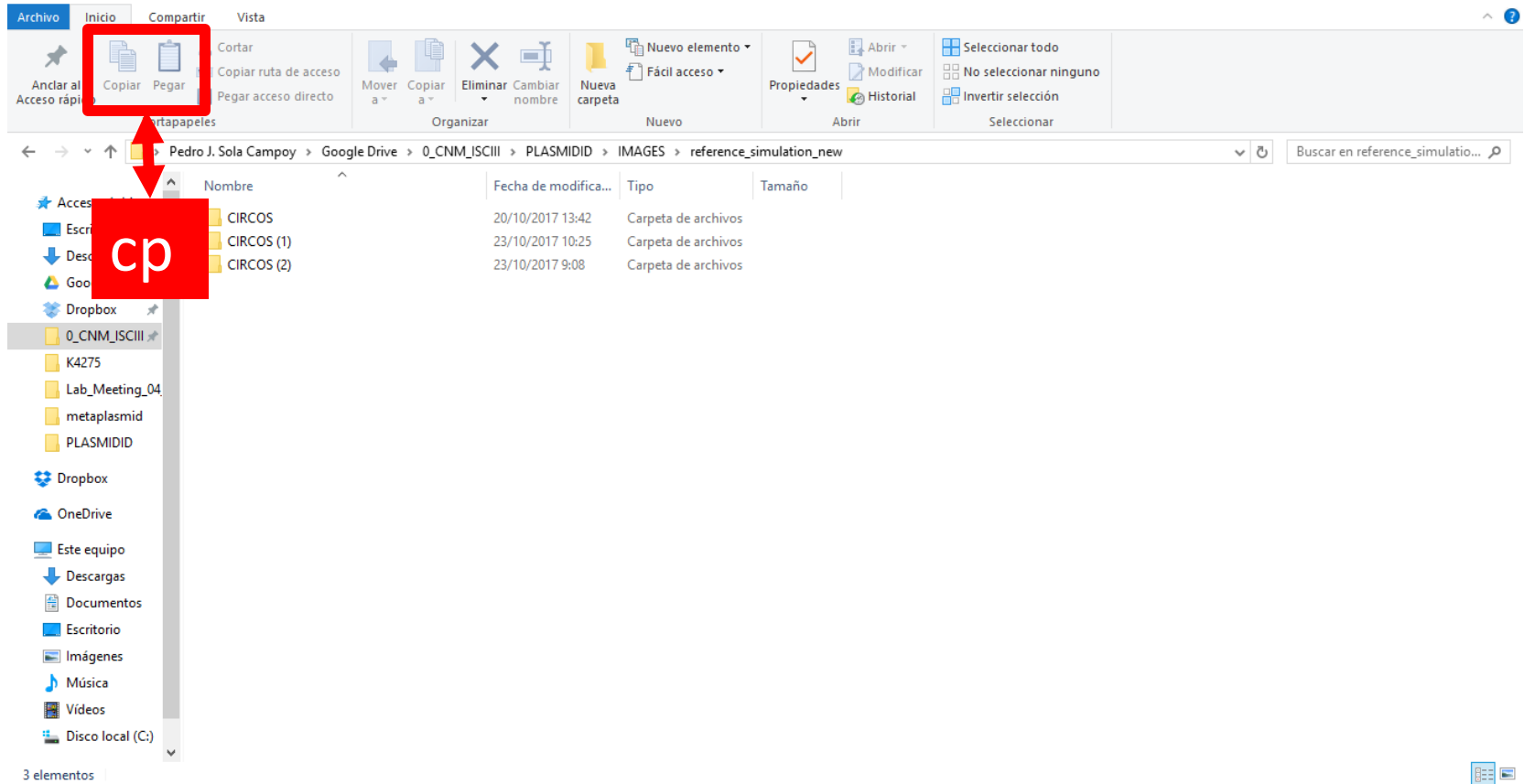
- `profesor`: User name
- `VM-NGS01`: Hostname (machine's name)
- `~/Documentos`: Current directory (pwd)
- `$`: no privileges
- `#`: privileges

- This example prompt gives the information that the user is profesor, which has no admin privileges, which is connected to VM-NGS01 machine, and whose directory where the user is located is the folder Documentos.

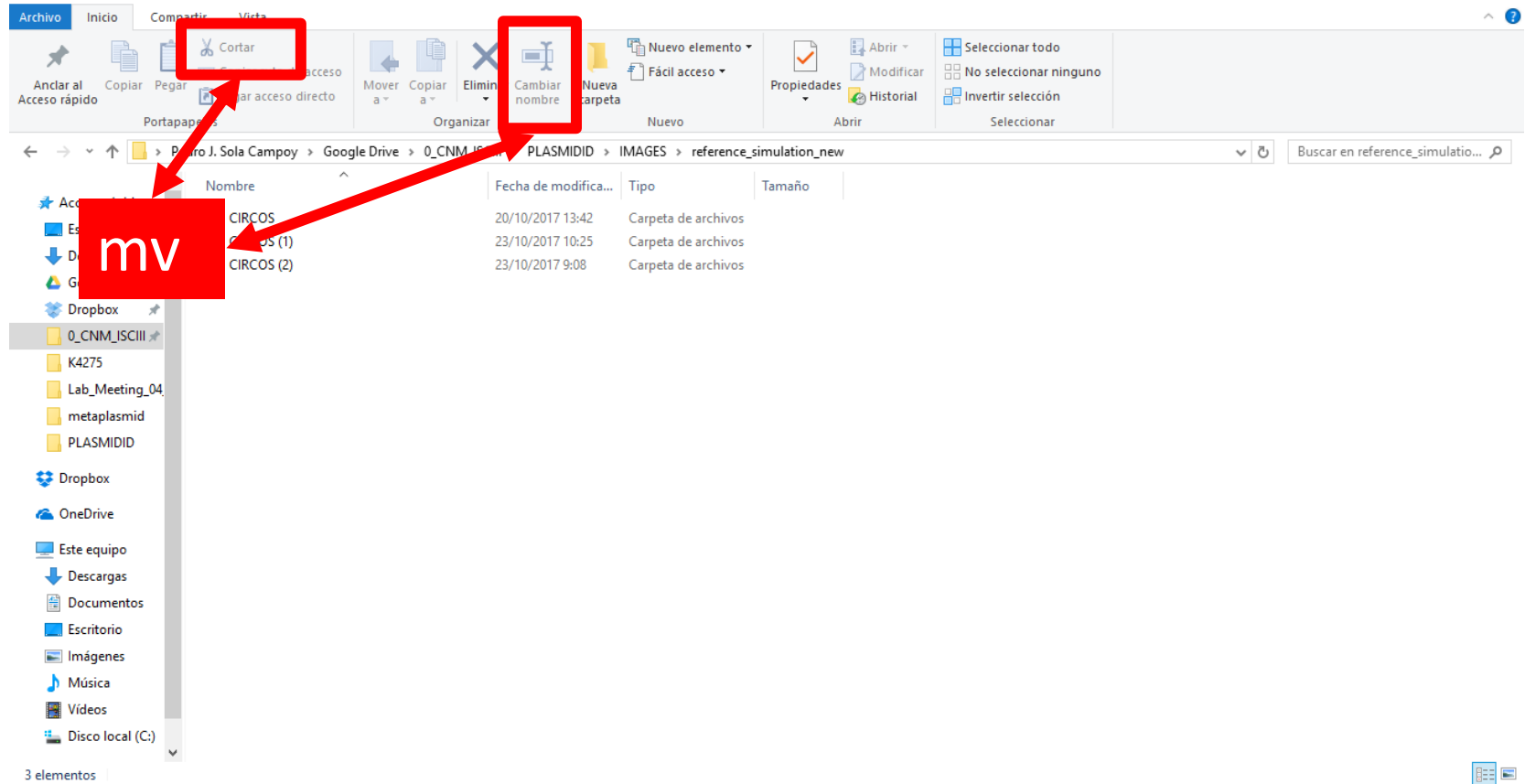
# Basic Commands

- ``pwd`` - display your present working directory
- ``ls`` - list contents
- ``cd`` - change directory
- ``mkdir`` - make directory
- ``rm`` - remove file
- ``rmdir`` - remove directory
- ``less`` - display contents of file
- ``nano`` - text editor on the terminal
- ``man`` - displays the manual of a command

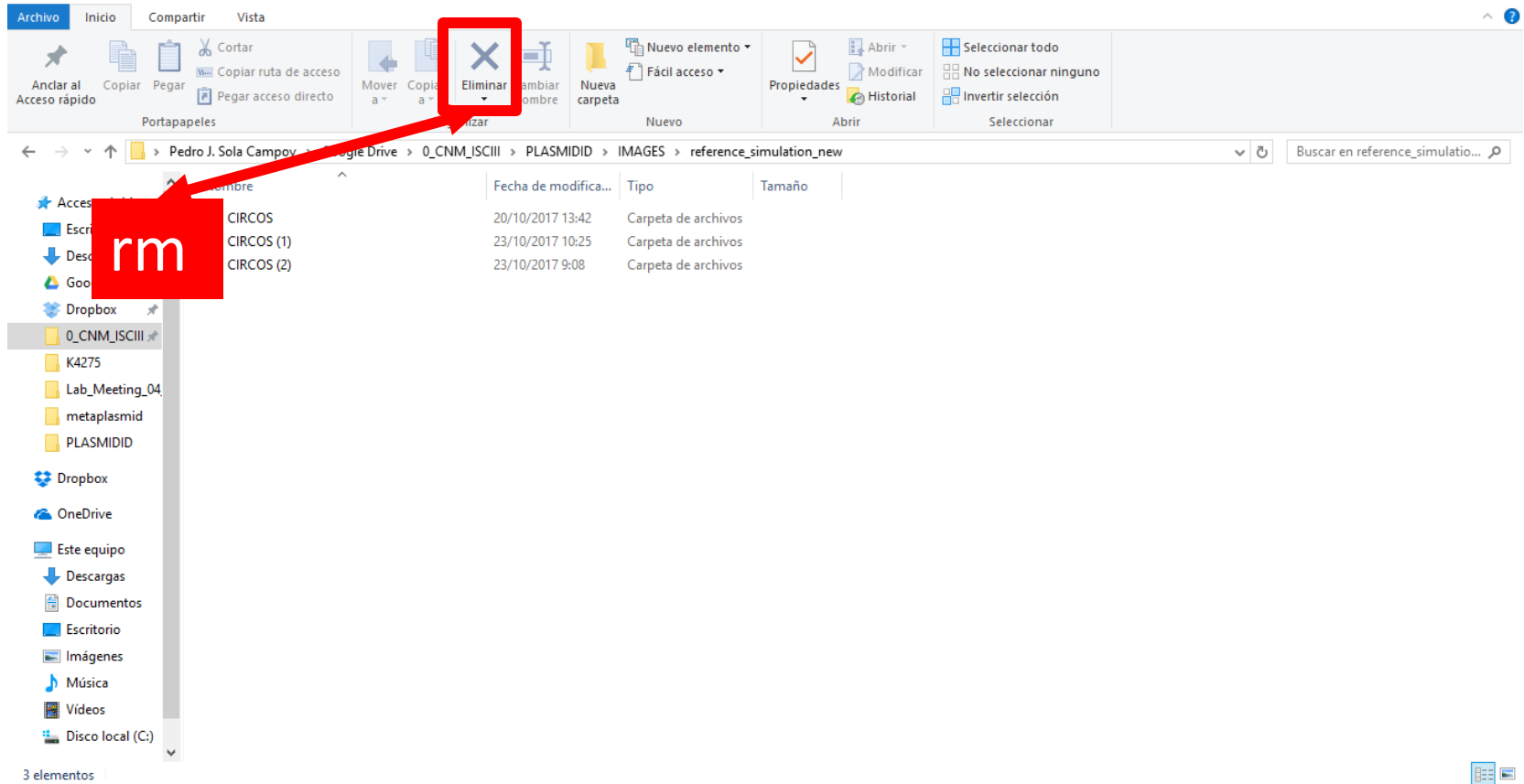
# Basic Commands



# Basic Commands

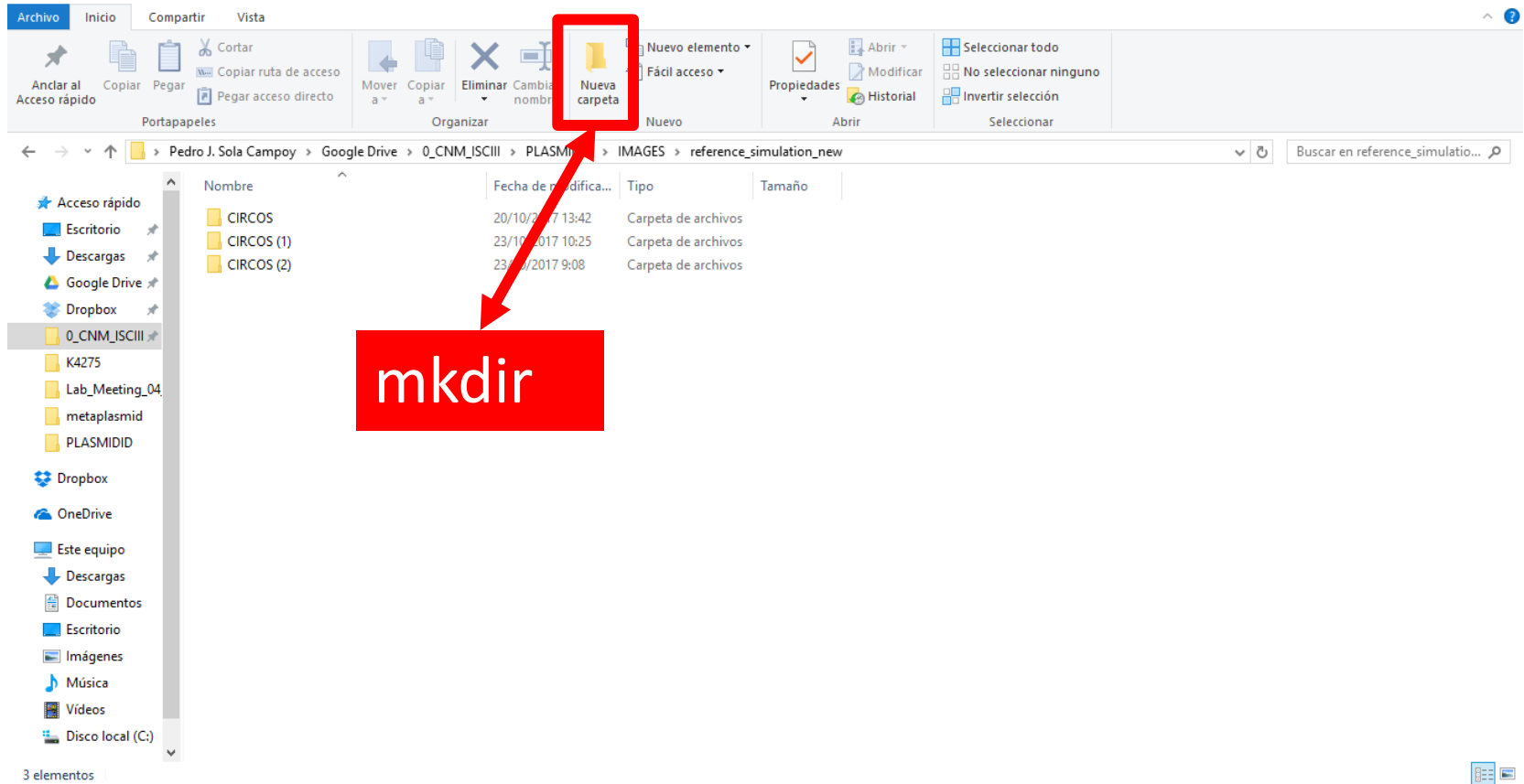


# Basic Commands

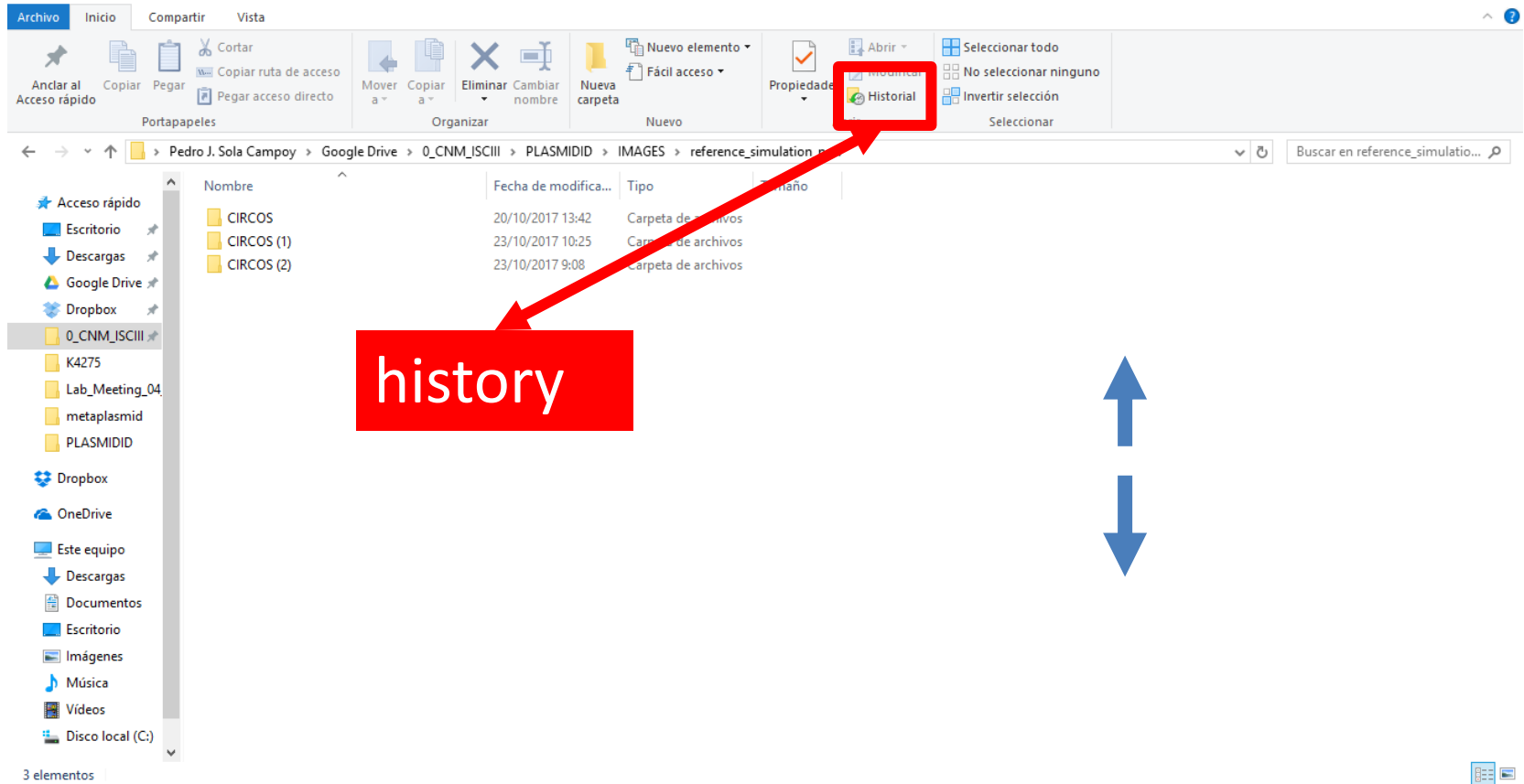




# Basic Commands



# Basic Commands



# Basic Commands

**REMEMBER:**

**TAB is your friend!**

**Hit it to autocomplete a command, file,  
path or get suggestion to do it**

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# Command Line Syntax

Linux command line follows a simple syntax common to every command and program you can execute on it:

Command [option(s)] [parameter(s)]

- Options or flags are characters or words preceded by a dash (`ls -la`). They change the way a program works by default.
- Parameters are other attributes that the program may need to run. The most common ones usually are the input files.
- REMEMBER: most programs have a `-h` or `--help` option which displays a short description and usage guide.

# Thanks for your attention!

