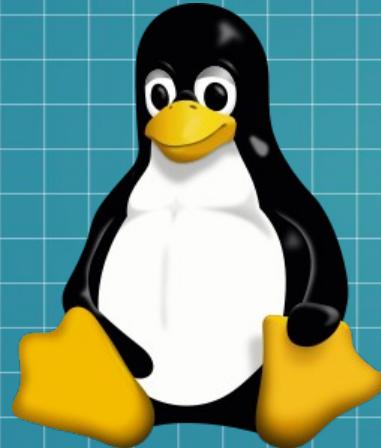
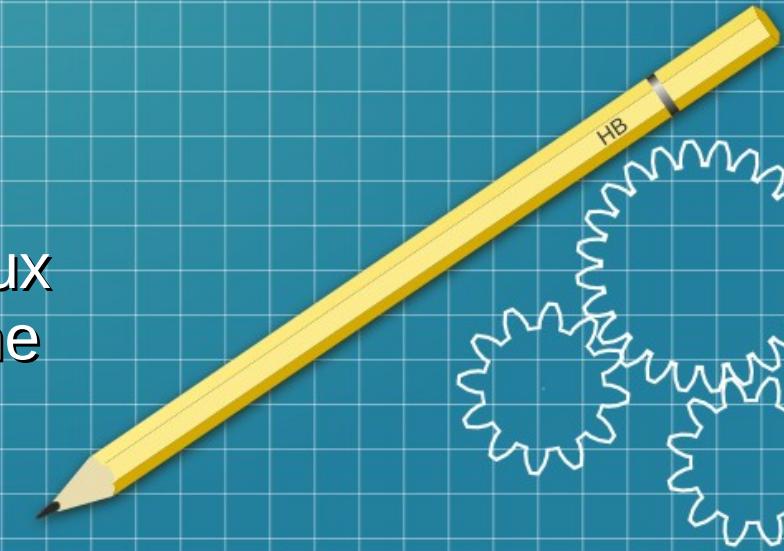


Linux



An introduction to Linux
and the command line



BIOS



- Few definitions : to understand each other !
- Live Test or Hard Drive Installation ?
- Linux Fundamentals
- Ubuntu 24.04 LTS « Noble Numbat »
- Why use Linux ?
- The command line

Definitions



Computer

Software

Operating system

Computer ?



1 – Equipment giving access to digital content

- Desktop PC, laptop PC
- Pad, smartphone
- TV, game console

2 - Equipment connected to internet

- Internet of Things (IoT)



Software ?



**« The digital tool you used to interact with
a computer »**

Synonymous of « software »

- Program
- Code
- Application
- ****ware

The 4 Essential Freedom of Software



- 1) The freedom to use a software « Execution »
 - 2) The freedom to copy a sofware « Distribution »
 - 3) **The freedom to study a software** « Source code »
 - 4) The freedom to modify a software « Edition »
-
- Depending on the access to these « freedoms »
it is possible to classify software in 2 categories ...

Software categories



- Proprietary : none or **1)**
- Free : **1)**, and/or **2)** and/or **3)** and/or **4)**

... like any other product software is (or should be) protected, by what is called a user license. There are many kind of Free (Open Source) software licenses that differ based on the access to the 4 Freedoms.

Open source software licences : GPL, BSD, Apache, Creative commons

Proprietary software



- Proprietary = someone owns the software (**not you**) and sells you access to some of the 4 Freedoms, usually only **1)**

Hack proprietary software ?



- That is ~~wrong~~ bouuuuuuhhhhhh
- Who does (did) it among you ?
- Why ?
 - Games ?
 - Anything else ?
- How much of the software capabilities where you using ?
- What if there was something better ? ...

Open Source Software



Open Source Software



A little bit of history:

- **1983** : Creation of GNU and the GPL license by **Richard M. Stallman** (RMS)
- **1985** : Creation of the **Free Software Foundation** by RMS
- **1991** : Linux is developed by **Linus Torvalds**
- **2004** : Open source software officially enter UNESCO world heritage



Open Source Software



Open Source Software

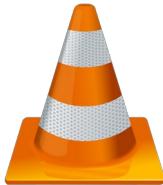


A little bit of history:

- **1983** : Creation of GNU and the GPL license by **Richard M. Stallman** (RMS)
- **1985** : Creation of the **Free Software Foundation** by RMS
- **1991** : Linux is developed by **Linus Torvalds**
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Famous Open Source Software

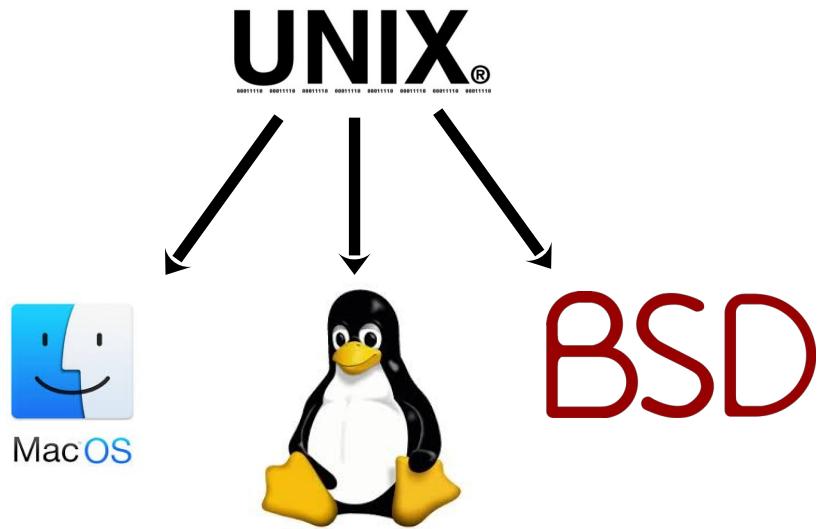
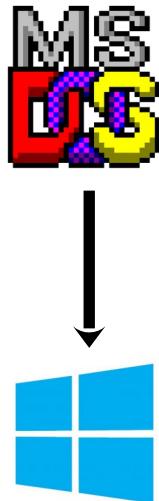


Operating System



« The first program that will start when you turn on your computer, without it is not possible to use other programs »

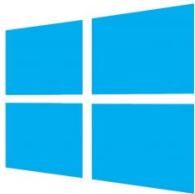
- Short name « **OS** », Système d'Exploitation « **SE** »



Operating Systems ?!



Android: 40.5%



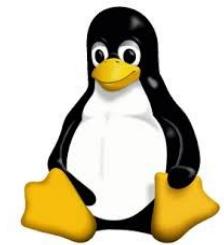
Windows: 34.2%



Mac OS



iOS



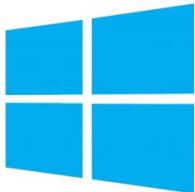
Linux: 1%

Proportion of each OS **all devices** considered

Operating Systems ?!



Android: **40.5%**



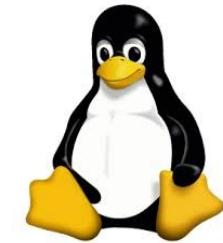
Windows: **34.2%**



Mac OS



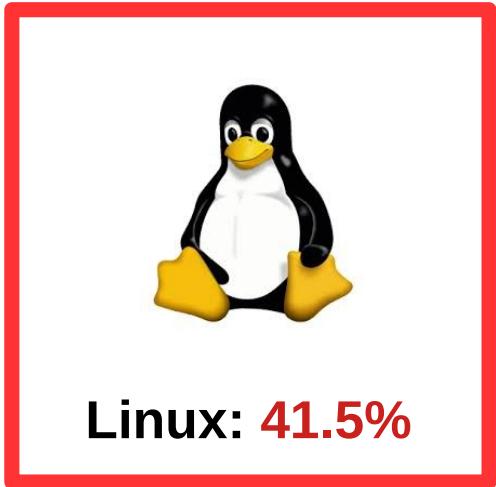
iOS



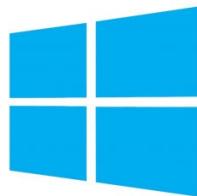
Linux: **1%**

Proportion of each OS **all devices** considered

The Operating System !



Linux: 41.5%



Windows: 34.2%



Mac OS



iOS

OSX+iOS: 22.3%

Proportion of each OS **all devices** considered

Linux Distributions: GNU/Linux

- A set of open source software composed of:
 - **Linux system** (“Kernel” or “Noyau”)
 - **Complementary and pre-installed / pre-parametrized software**
 - A graphical user interface
 - An office suite
 - Web browsers and mail readers
 - Multimedia packages ... and many more !



GNU components



Linux Distributions: GNU/Linux

- A set of open source software composed of:
 - **Linux system** (“Kernel” or “Noyau”)
 - **Complementary and pre-installed parametrized software**
 - A graphical user interface
 - An office suite
 - Web browsers and servers
 - Multimedia packages
- Up to 20 000 !!!**
- ... many more !



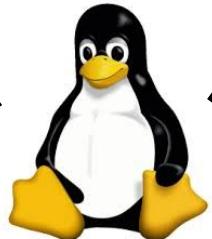
GNU components



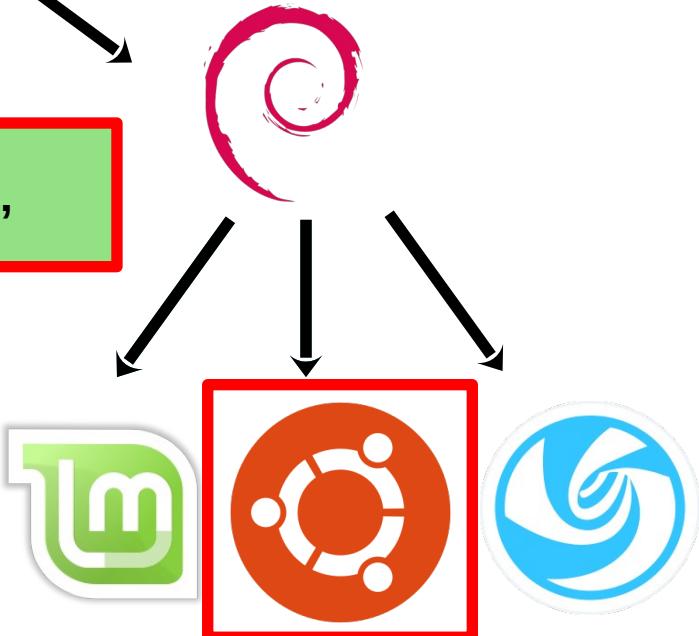
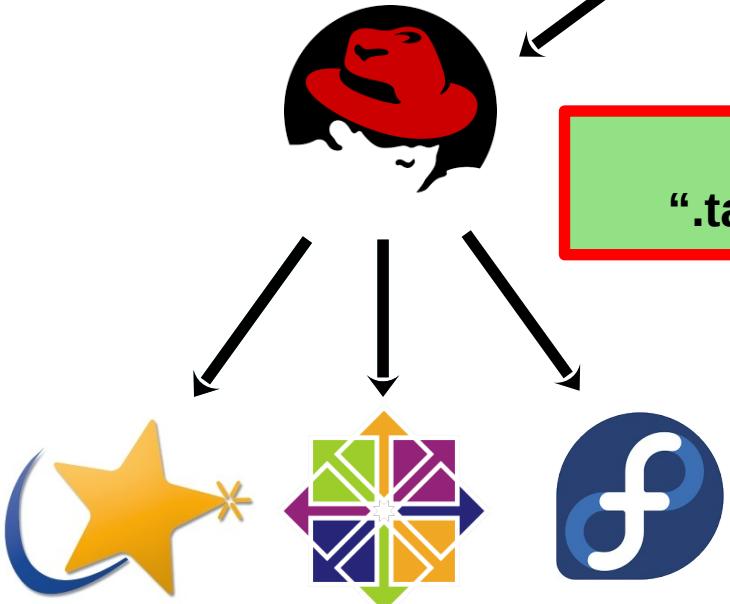
Linux Distributions

Red Hat Package Manager
“.rpm”

Debian Package Manager
“.deb”

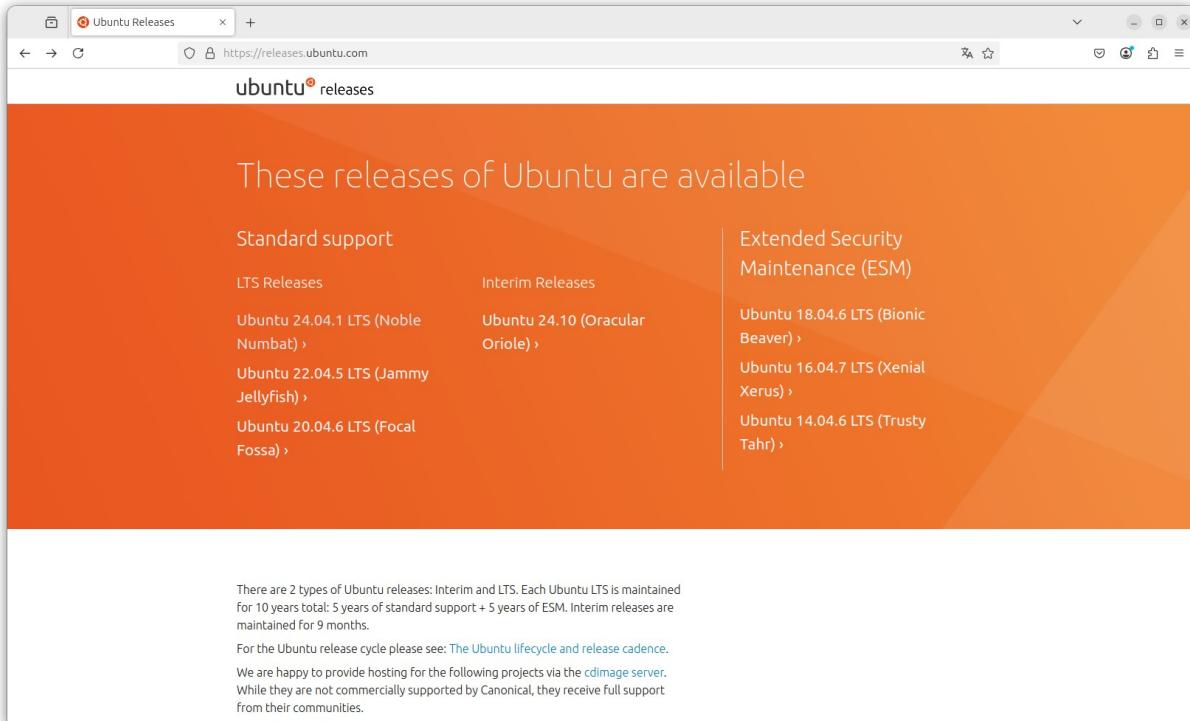


Sources Codes
“.tar.gz” or “.tar.bz2”



Linux Distribution: Which One ?

- Ubuntu is the best choice for beginners !



The screenshot shows a web browser window with the title "Ubuntu Releases" and the URL "https://releases.ubuntu.com". The page has a white header with the "ubuntu releases" logo. Below the header, there is a large orange section containing the text "These releases of Ubuntu are available". This section is divided into three columns: "Standard support", "Interim Releases", and "Extended Security Maintenance (ESM)".

| Standard support | Interim Releases | Extended Security Maintenance (ESM) |
|-------------------------------------|--|---|
| LTS Releases | Ubuntu 24.10 (Oracular Oriole) > | Ubuntu 18.04.6 LTS (Bionic Beaver) , Ubuntu 16.04.7 LTS (Xenial Xerus) , Ubuntu 14.04.6 LTS (Trusty Tahr) , |
| Ubuntu 24.04.1 LTS (Noble Numbat) > | Ubuntu 22.04.5 LTS (Jammy Jellyfish) > | |
| Ubuntu 20.04.6 LTS (Focal Fossa) > | | |

At the bottom of the orange section, there is a note: "There are 2 types of Ubuntu releases: Interim and LTS. Each Ubuntu LTS is maintained for 10 years total: 5 years of standard support + 5 years of ESM. Interim releases are maintained for 9 months." Below this note, there is a link to "The Ubuntu lifecycle and release cadence".

On the right side of the page, there is a sidebar with the text "We are happy to provide hosting for the following projects via the cdimage server. While they are not commercially supported by Canonical, they receive full support from their communities." followed by a list of project names.



<https://releases.ubuntu.com/>

or <https://ubuntu.com/download/desktop>

Linux Distribution: Which One ?



These releases of Ubuntu are available

Ubuntu 18.04.6 LTS (Bionic Beaver) ›

Ubuntu 16.04.7 LTS (Xenial Xerus) ›

Ubuntu 20.04.3 LTS (Focal Fossa) ›

Ubuntu 21.04 (Hirsute Hippo) ›

Ubuntu 21.10 (Impish Indri) ›

LTS = Long Term Support = 5 years support

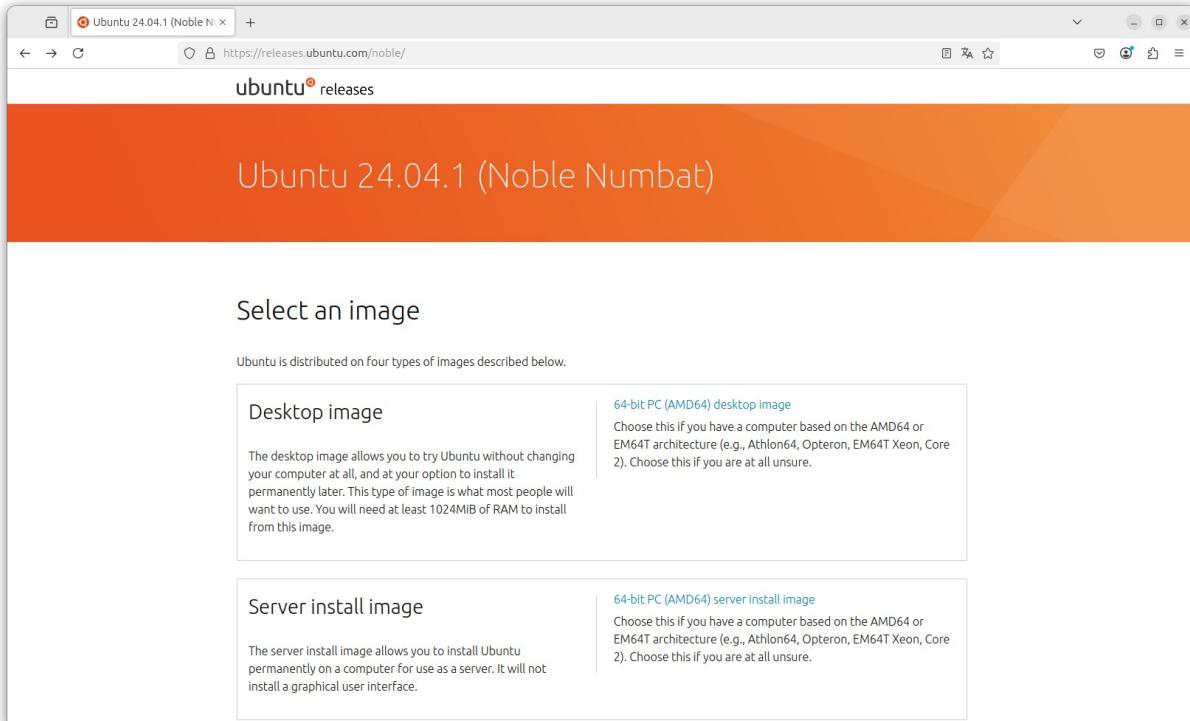


Year

Month

Linux Distribution: Ubuntu 24.04.1 LTS

- Code name “Noble Numbat”



<https://releases.ubuntu.com/focal/ubuntu-24.04.1-desktop-amd64.iso>

Linux Distribution: Ubuntu 24.04.1 LTS



A screenshot of a web browser displaying the Ubuntu 24.04.1 LTS download page. The URL in the address bar is <https://ubuntu.com/download/desktop#system-requirements-NobleNumbat>. The page features a dark header with the Canonical logo and navigation links for Products, Use cases, Support, Community, Download Ubuntu, All Canonical, Sign in, and a search icon. Below the header, there's a navigation bar with tabs for Downloads, Desktop, Server, Core, and Cloud. The main content area has a title "Download Ubuntu Desktop" and a sub-section for "Ubuntu 24.04.1 LTS". It includes a large orange crown icon, a "Download 24.04.1 LTS" button (5.8GB), and a "System requirements" section with a bulleted list of hardware requirements. A small note at the bottom says "For other versions of Ubuntu Desktop including torrents, the network installer, a list of local mirrors and past releases [check out our alternative downloads](#)".

The open source desktop operating system that powers millions of PCs and laptops around the world. Find out more about Ubuntu's features and how we support developers and organisations below.

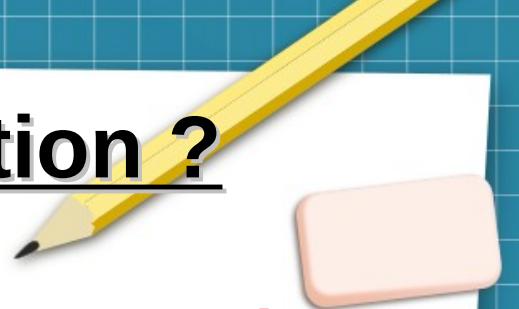
Discover Ubuntu Desktop [Check out the blog](#)

Ubuntu 24.04.1 LTS

What's new [System requirements](#) How to install

- ⓘ 2 GHz dual-core processor or better
- ⓘ 4 GB system memory
- ⓘ 25 GB of free hard drive space
- ⓘ Either a USB port or a DVD drive for the installer media
- ⓘ Internet access is helpful

Live Test or Hard Drive Installation ?



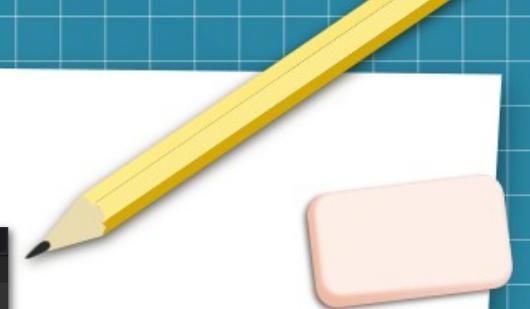
- **Live test:** no risk for your hard drive: **that's the easy way !**



Hard drive installation:

- Be careful not to wipe out everything when you install Linux !
- Multiple boot is possible (to have multiple OS on the same computer)
 - **Linux can see MS Windows partition(s)**
 - **MS Windows can not see Linux partition(s)**
- Ask for help !

Preparing the USB key



https://ubuntu.com/tutorials/create-a-usb-stick-on-windows#1-overview

CANONICAL

ubuntu® Enterprise Developer Community Download

We are hiring Products

Search Sign in

Create a bootable USB stick on Windows

Tutorials

1 Overview

2 Requirements

3 USB selection

4 Boot selection and Partition scheme

5 Select the Ubuntu ISO file

6 Write the ISO

7 Additional downloads

8 Write warnings

9 Writing the ISO

10 Installation complete

1. Overview

With a bootable Ubuntu USB stick, you can:

- Install or upgrade Ubuntu
- Test out the Ubuntu desktop experience without touching your PC configuration
- Boot into Ubuntu on a borrowed machine or from an internet cafe
- Use tools installed by default on the USB stick to repair or fix a broken configuration

Creating a bootable Ubuntu USB stick from Microsoft Windows is very simple and we're going to cover the process in the next few steps.

Alternatively, we also have tutorials to help you create a bootable USB stick from both Ubuntu and Apple macOS.



Suggest changes < >

about 15 minutes to go

<https://ubuntu.com/tutorials/create-a-usb-stick-on-windows>

Linux Fundamentals

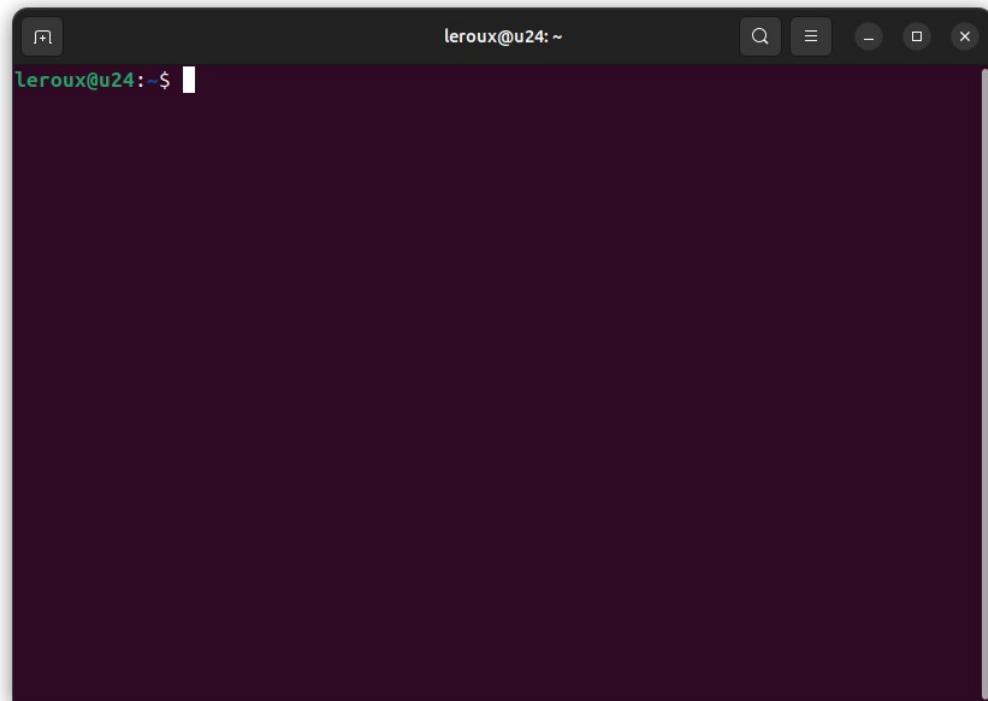


- The Terminal
- File System
- Users
- File Permissions
- Tips

Linux Fundamentals: The Terminal



- Text interface to your computer
- Often referred as
 - Shell
 - Console
 - Prompt
 - Bash ...

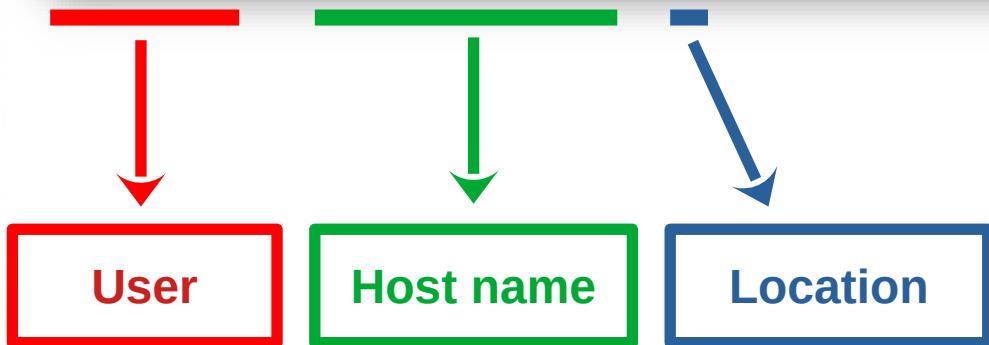


Linux Fundamentals: The Terminal



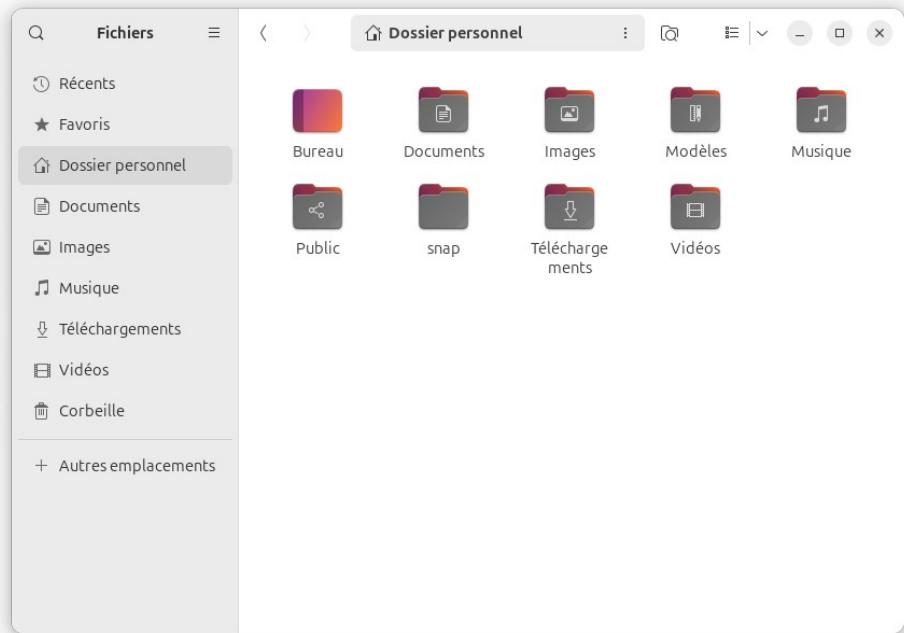
- The “Prompt” or “Invite de commandes”

```
leroux@chess-u20:~$
```



- **User** : the name of the user that opened the terminal
- **Host name**: the name of the computer
- **Location**: where you are in the file system tree

Linux Fundamentals: The Terminal



=

```
leroux@u24:~$ ls -l
total 36
drwxr-xr-x 2 leroux leroux 4096 févr. 17 11:35 Bureau
drwxr-xr-x 2 leroux leroux 4096 févr. 17 11:35 Documents
drwxr-xr-x 3 leroux leroux 4096 févr. 17 13:02 Images
drwxr-xr-x 2 leroux leroux 4096 févr. 17 11:35 Modèles
drwxr-xr-x 2 leroux leroux 4096 févr. 17 11:35 Musique
drwxr-xr-x 2 leroux leroux 4096 févr. 17 11:35 Public
drwx----- 6 leroux leroux 4096 févr. 17 13:20 snap
drwxr-xr-x 2 leroux leroux 4096 févr. 17 11:35 Téléchargements
drwxr-xr-x 2 leroux leroux 4096 févr. 17 11:35 Vidéos
leroux@u24:~$
```

Linux Fundamentals: File System

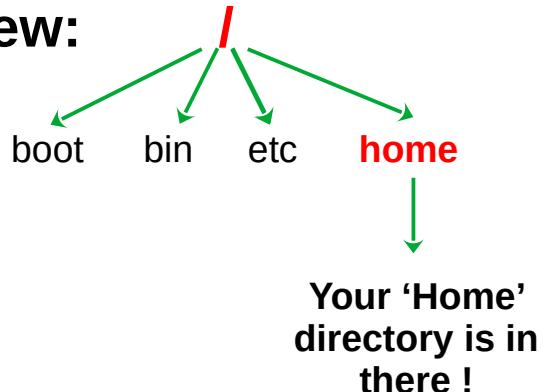
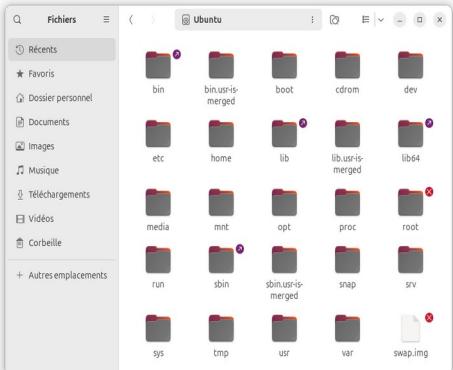


- Windows

- Letters for the hard drive(s): **C:\, D:\, E:\ ...**
- Your ‘Home’ directory: **C:\Users\leroux**

- Linux

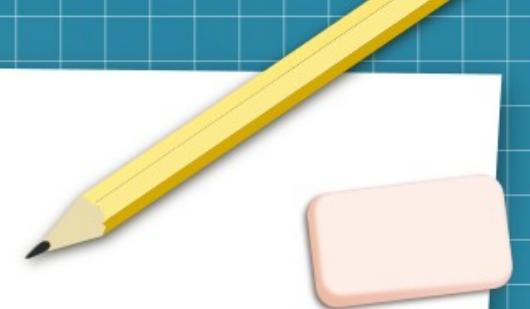
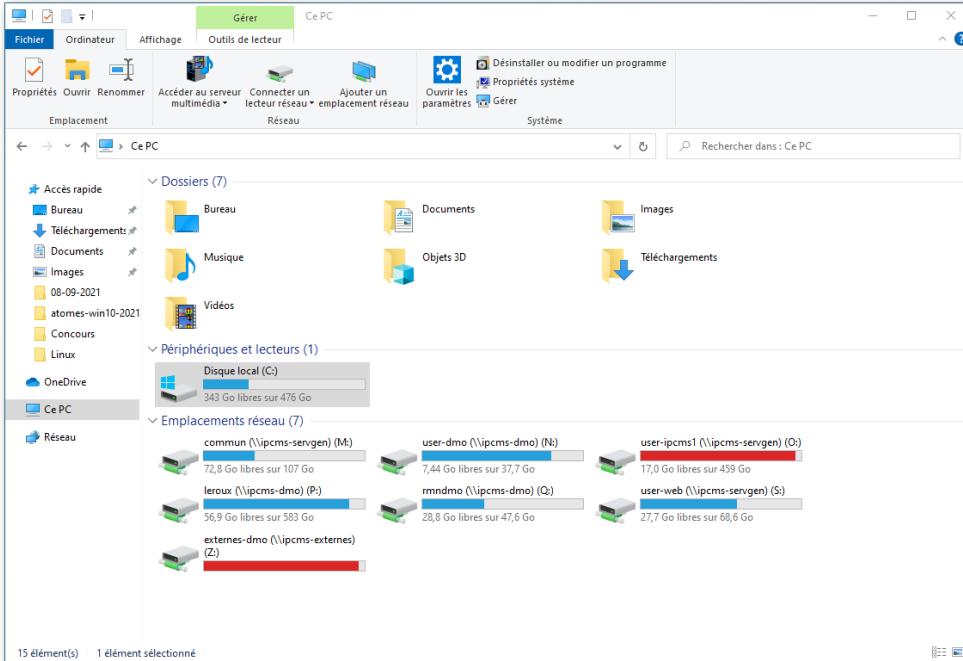
- A single tree-view:



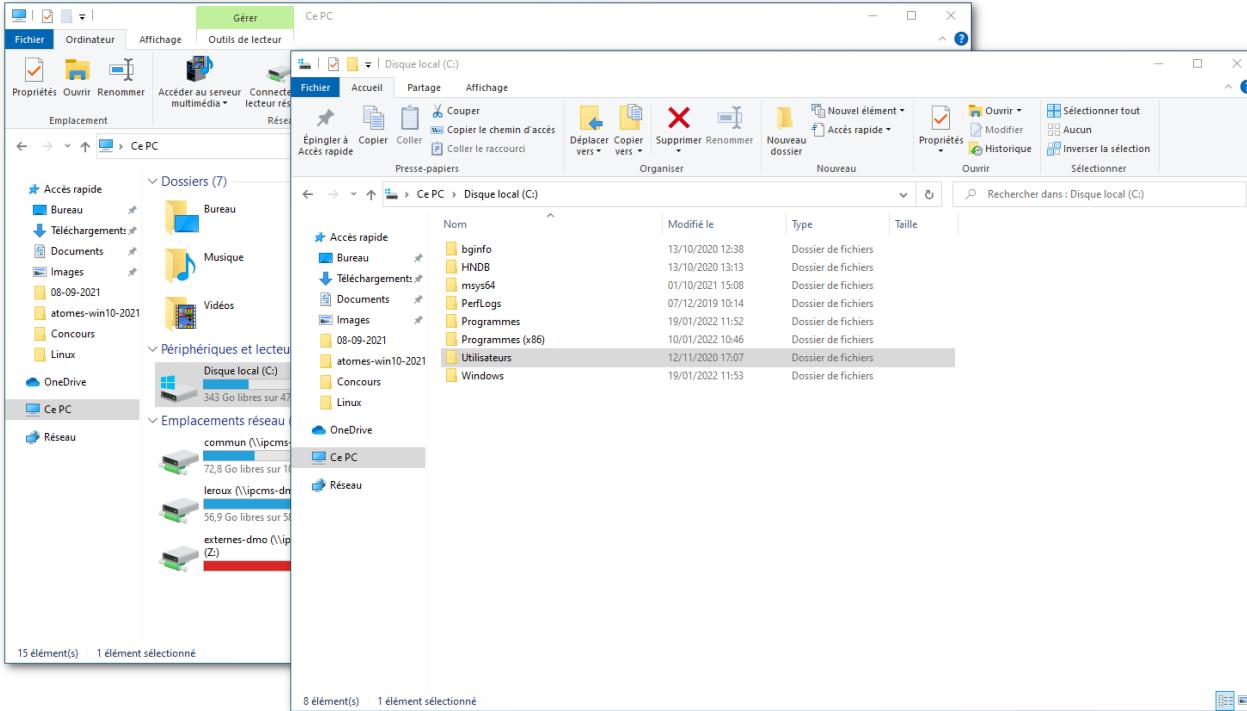
“Everything is a File”

All the hard drive(s), devices, component of your computer, is to be found somewhere in this tree-view

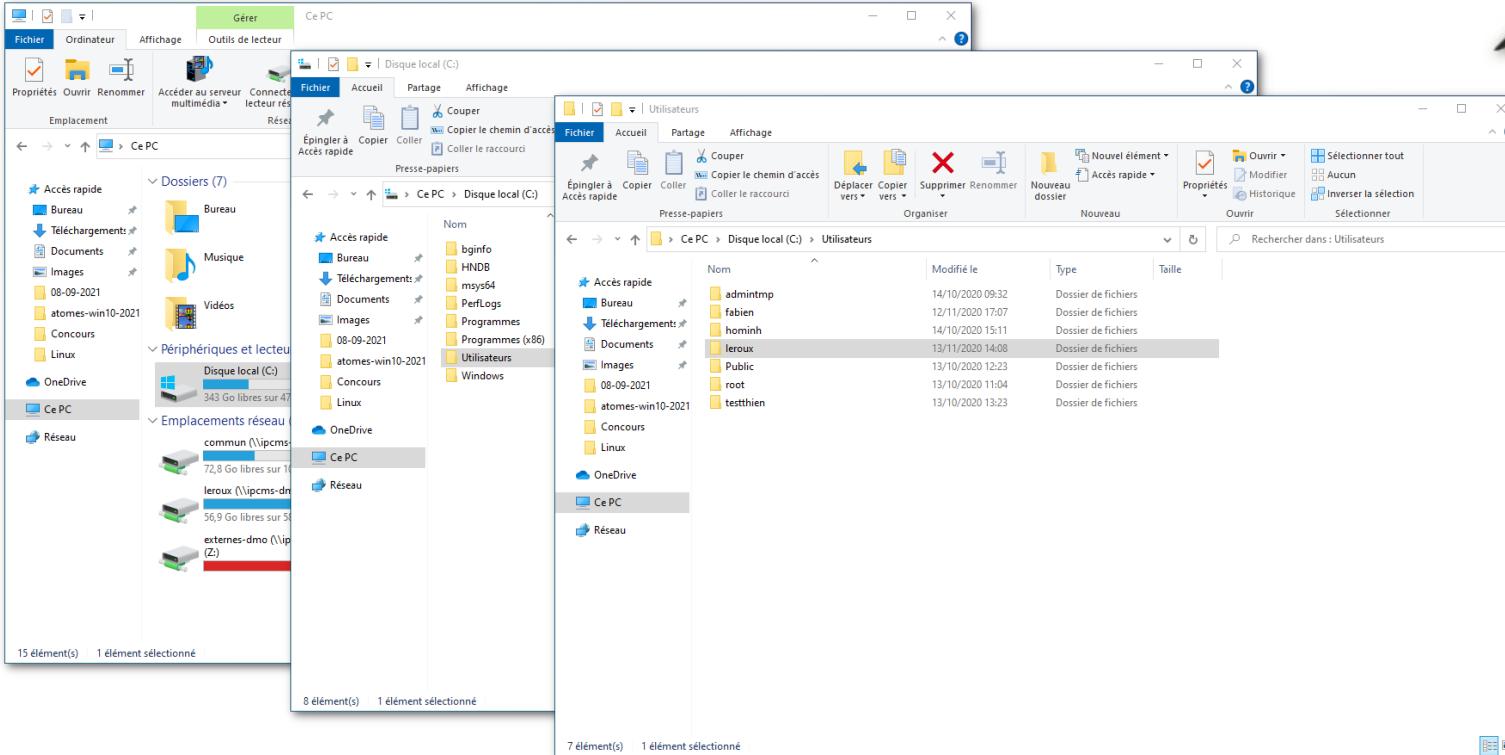
File system: windows



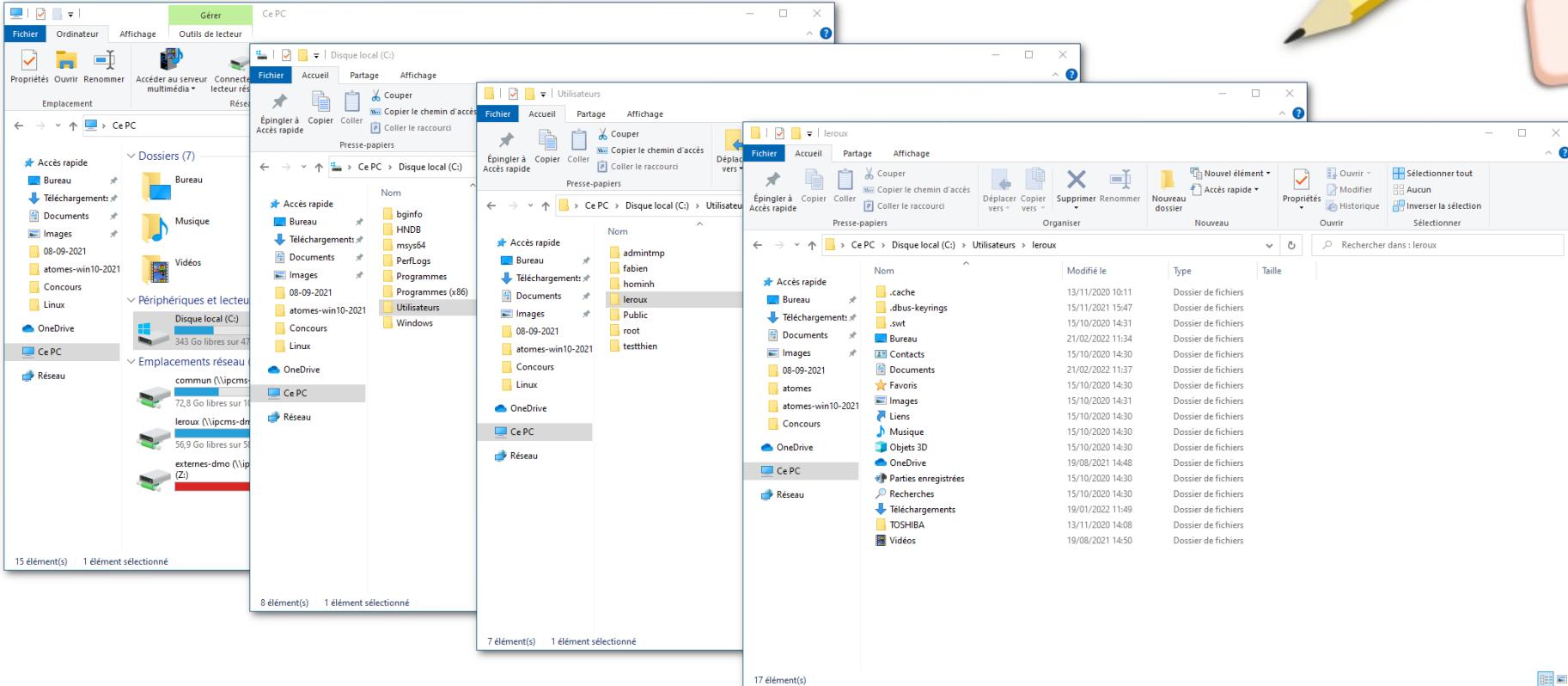
File system: windows



File system: windows

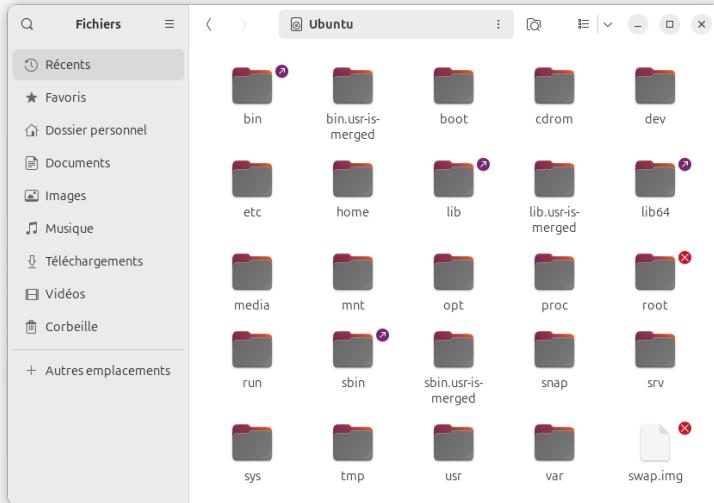


File system: windows



C:\Utilisateurs\leroux\

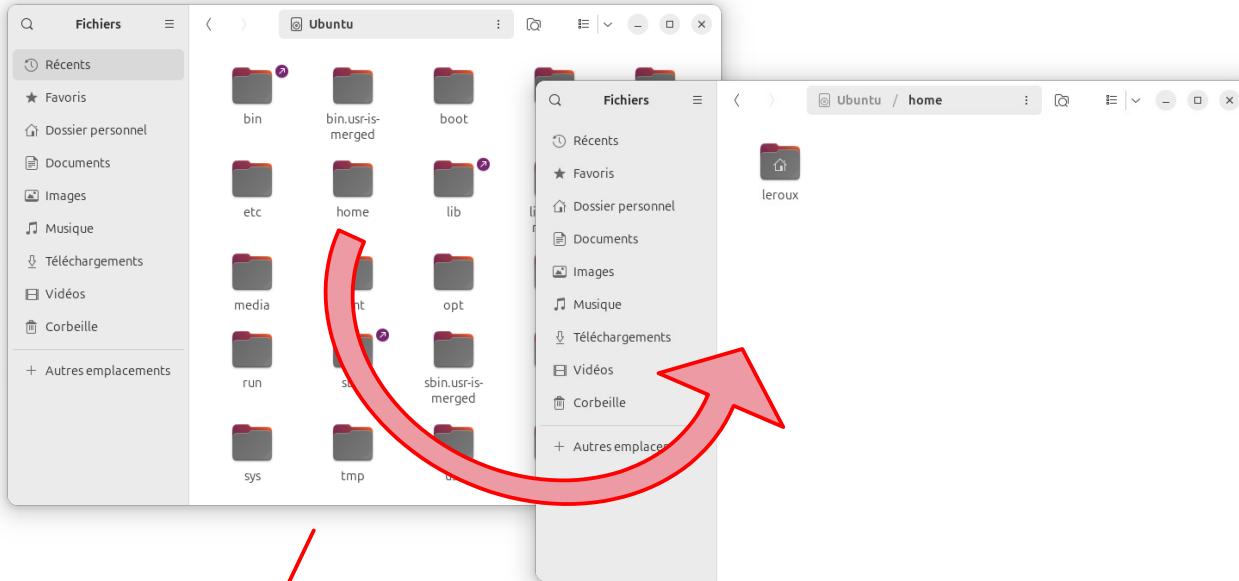
Linux Fundamentals: File System



/

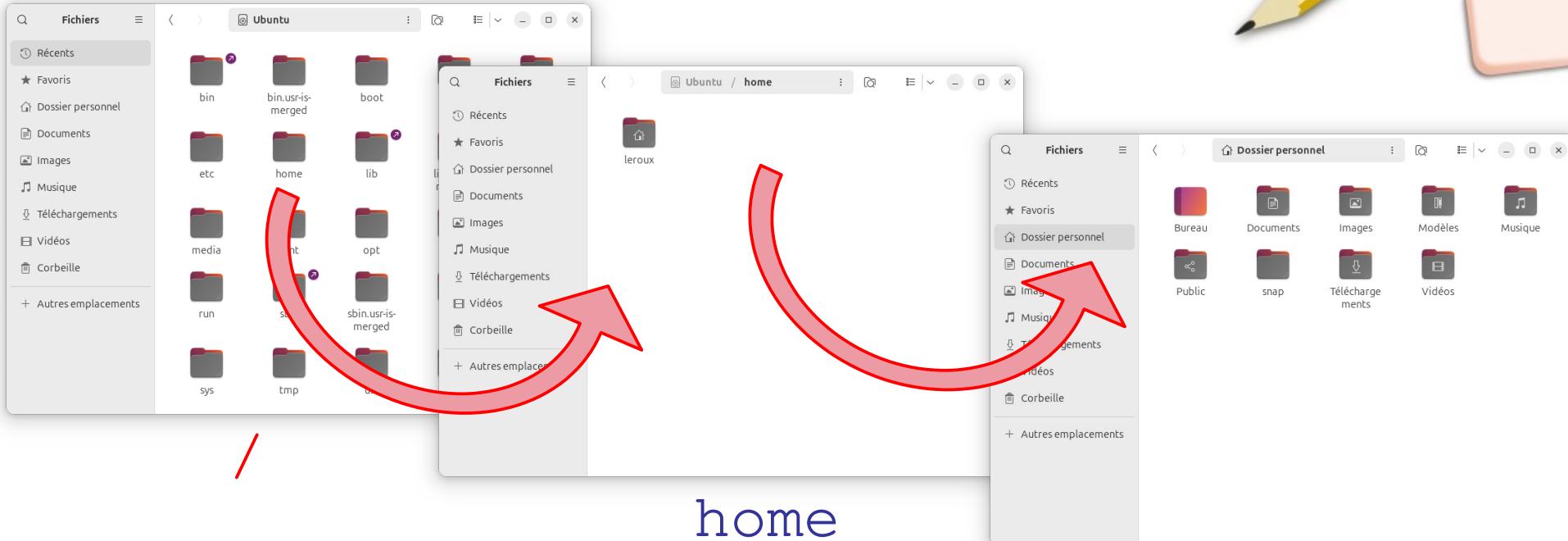


Linux Fundamentals: File System



home

Linux Fundamentals: File System

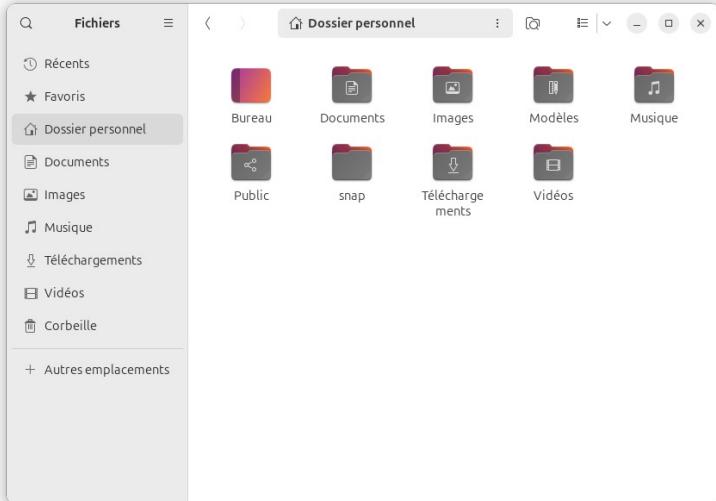


home

leroux

/home/leroux

Linux Fundamentals: File System



= /home/leroux

/home/leroux/Documents

~/Documents

Linux Fundamentals: Users



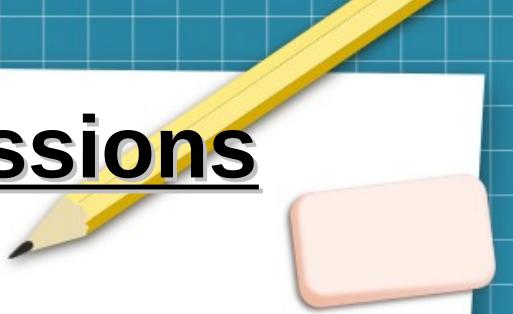
- The Administrator (**root**) “optional”
 - All privileges !
- The “**sudoers**” for “super user do”-users
 - Users that can use the **sudo** command to request admin privileges
 - When using the **sudo** command **sudoers** are required to confirm their identity by entering their user password
- The normal users

Linux Fundamentals: Users



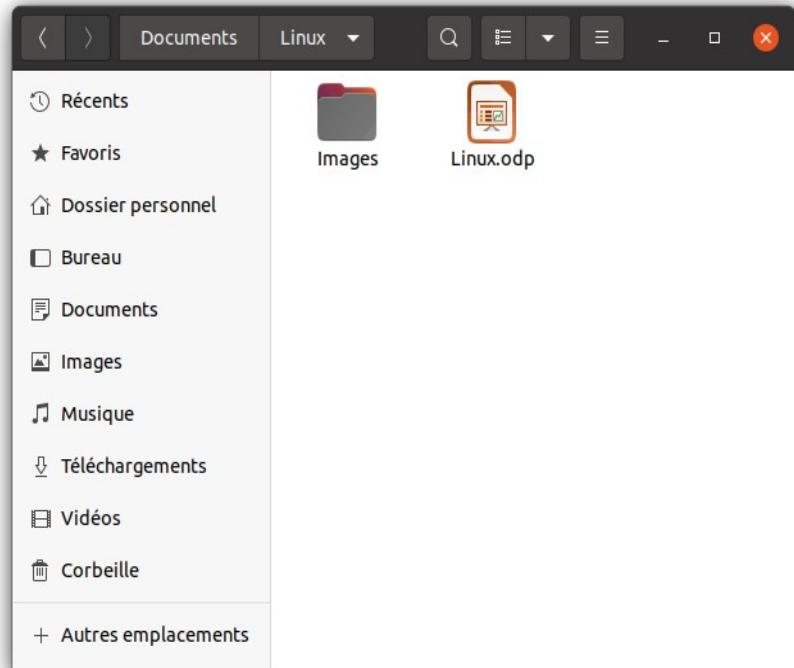
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 - All privileges !
- The “**sudoers**” for “super user do”-users
 - Users that can use the **sudo** command to request admin privileges
 - When using the **sudo** command **sudoers** are required to confirm their identity by entering their user password
- The normal users

Linux Fundamentals: File Permissions



- The different permissions that can be granted for a **file** are:
 - **read**: to visualize its content
 - **write**: to modify its content (ex: editing)
 - **execute**: to execute its content (ex: program)
- The different permissions that can be granted for a **directory** are:
 - **read**: to visualize its content
 - **write**: to modify its content (ex: adding new files)
 - **execute**: to go inside this directory (ex: changing directory)

Linux Fundamentals: File Permissions



=

A screenshot of a terminal window titled 'leroux@chess-u20: ~/Documents/Linux'. The command 'ls -l' is run, displaying the following file listing:

```
total 15108
drwxrwxr-x 2 leroux dmo 4096 oct. 20 13:40 Images
-rw-r--r-- 1 leroux dmo 15463386 oct. 20 13:55 Linux.odp
leroux@chess-u20:~/Documents/Linux$
```

Linux Fundamentals: File Permissions



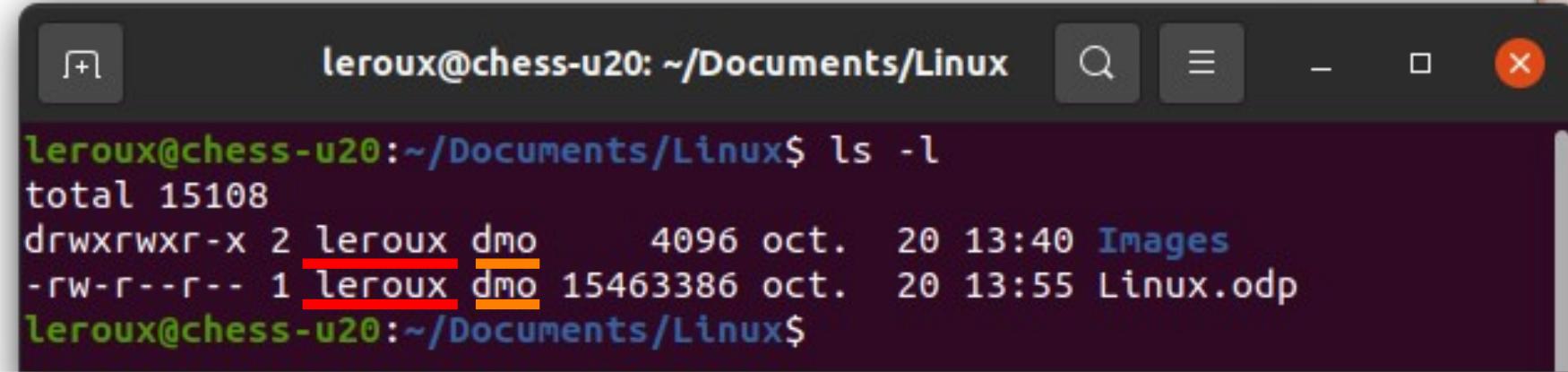
- The permissions are decomposed in **3** series of **3** letters
r (for read), **w** (for write) and **x** (for execute)
the symbol "**-**" means that the permission is denied



```
leroux@chess-u20: ~/Documents/Linux$ ls -l
total 15108
drwxrwxr-x 2 leroux dmo 4096 oct. 20 13:40 Images
-rw-r--r-- 1 leroux dmo 15463386 oct. 20 13:55 Linux.odp
leroux@chess-u20:~/Documents/Linux$
```

```
leroux@chess-u20: ~/Documents/Linux$ ls -l
total 15108
drwxrwxr-x 2 leroux dmo 4096 oct. 20 13:40 Images
-rw-r--r-- 1 leroux dmo 15463386 oct. 20 13:55 Linux.odp
leroux@chess-u20:~/Documents/Linux$
```

Linux Fundamentals: File Permissions



drwxrwxr-x

d rwx rwx r-x

-rw-r--r--

- rw- r - - r - -

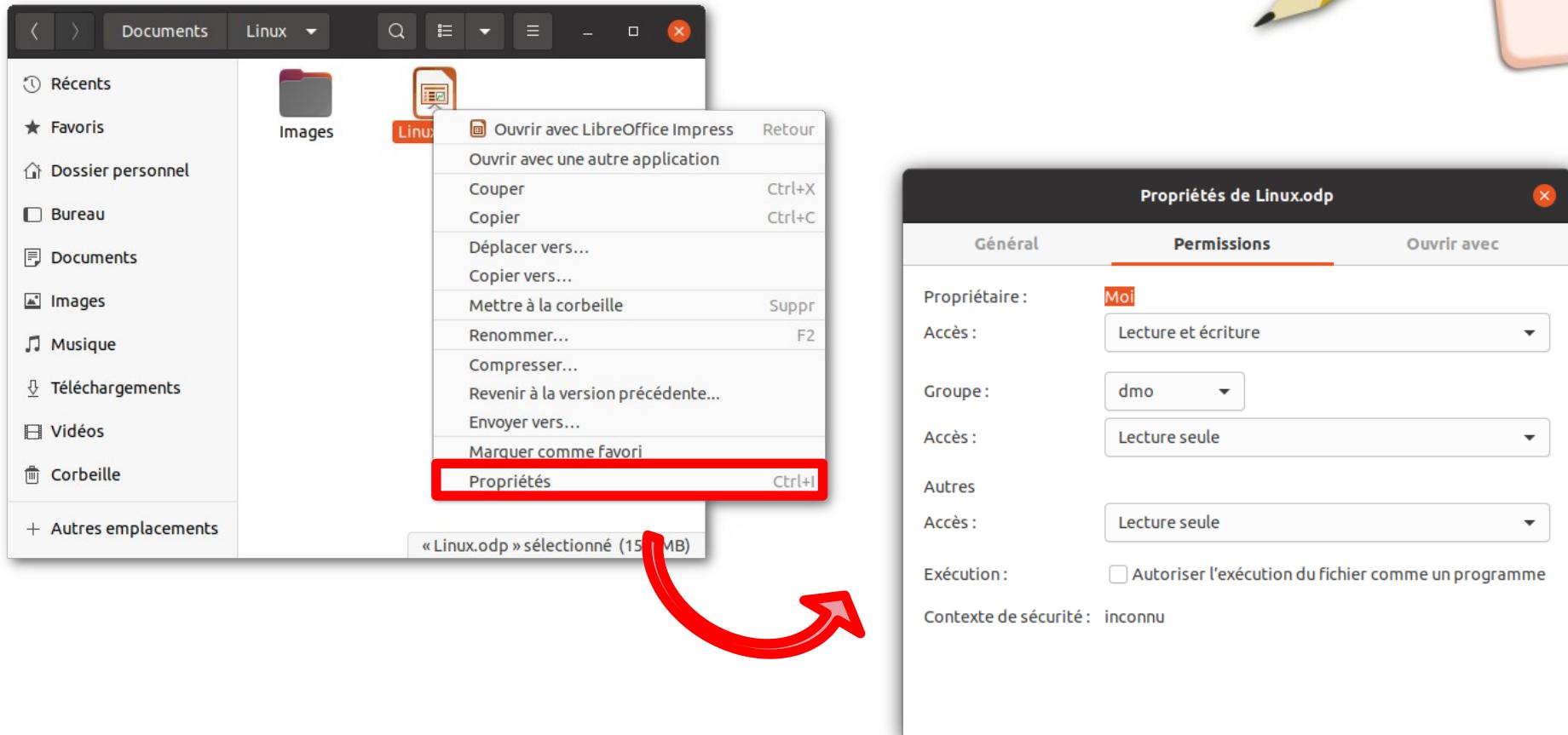
Object

Owner

Group

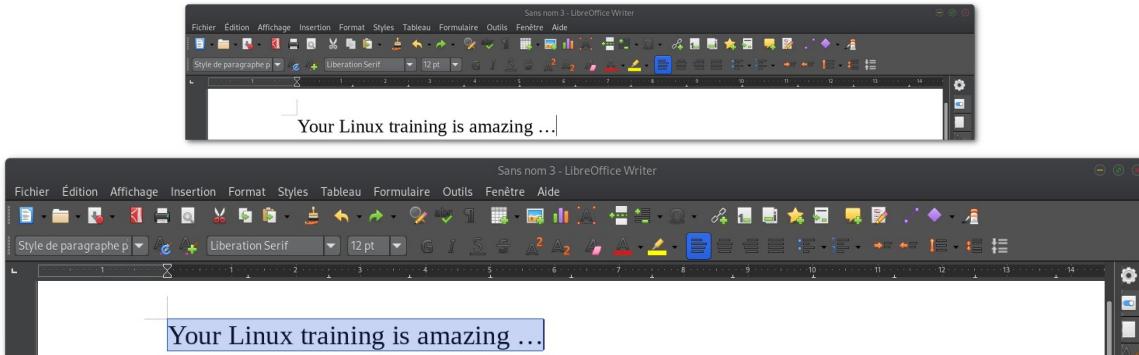
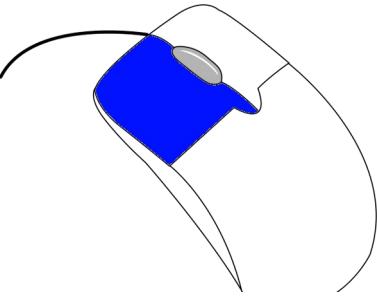
The other user(s)

Linux Fundamentals: File Permissions

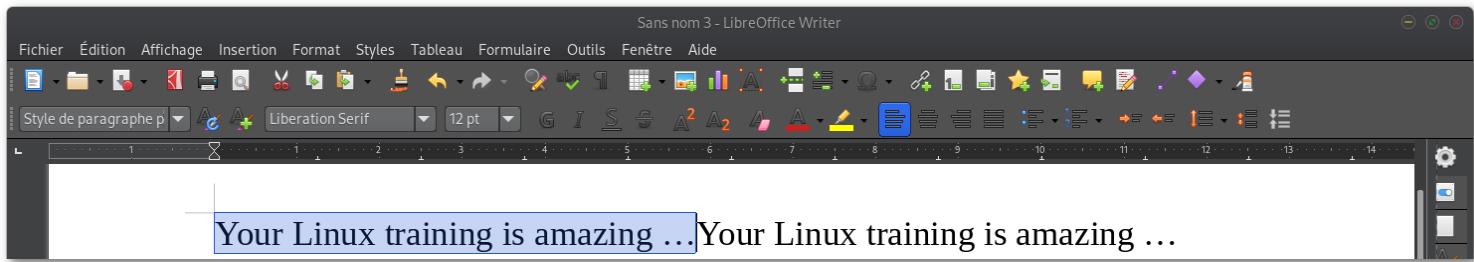
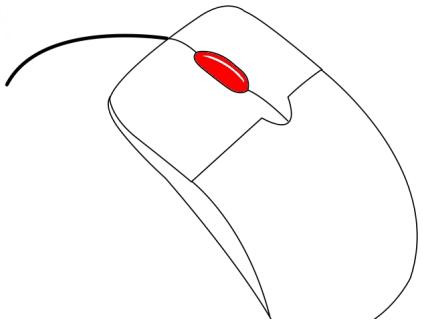


Linux Fundamentals: Mouse

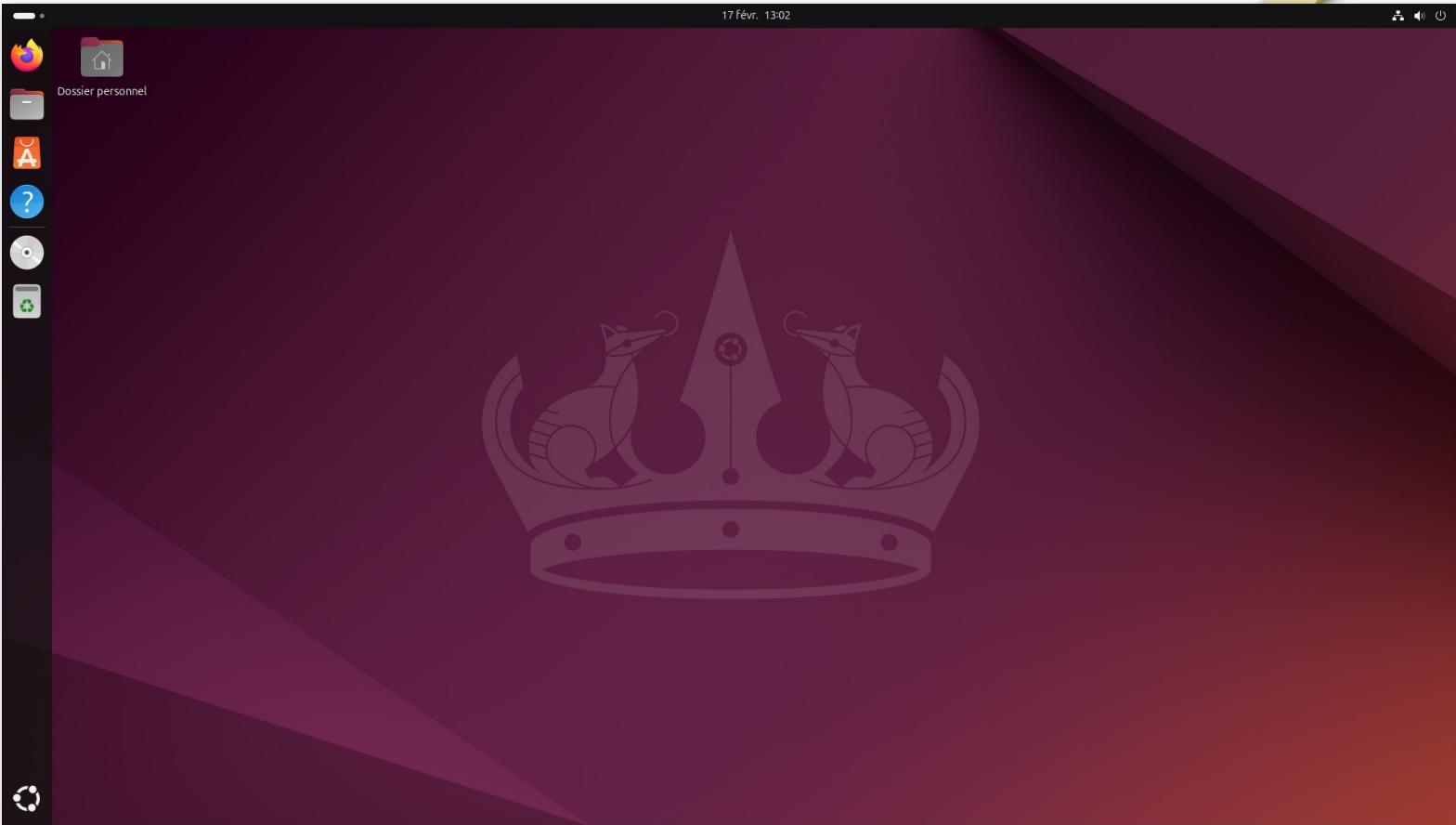
- Text selected using the left click...



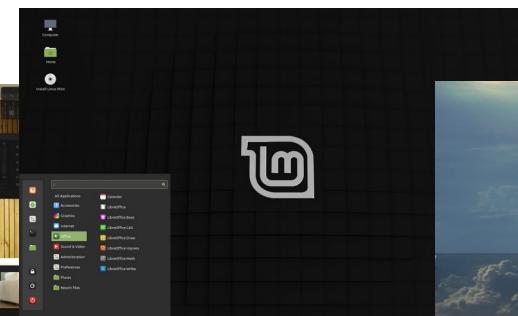
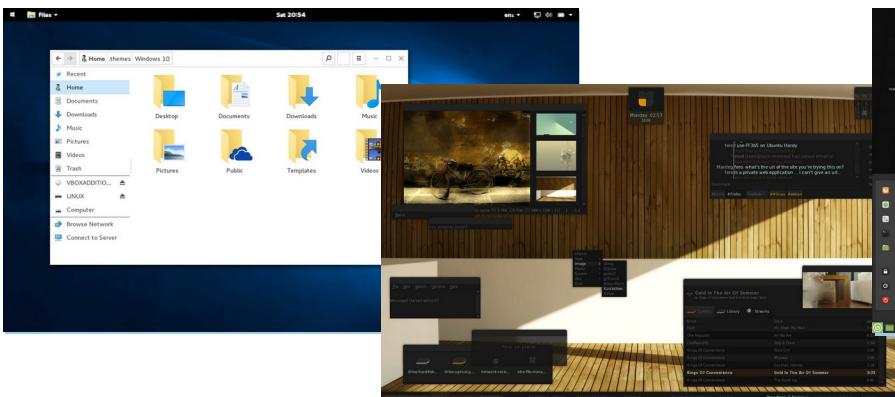
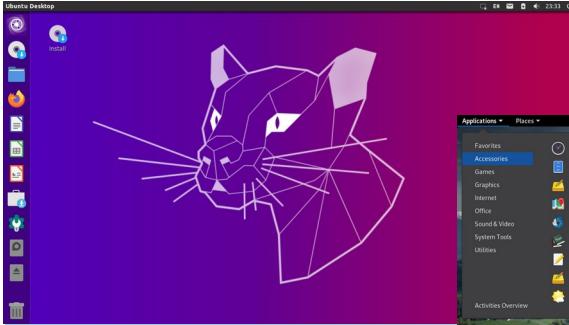
- Is copied, and can be pasted back pressing the 2nd button:



Ubuntu 24.04 LTS



Ubuntu 24.04 LTS



Ubuntu 24.04 LTS: Desktop Environments



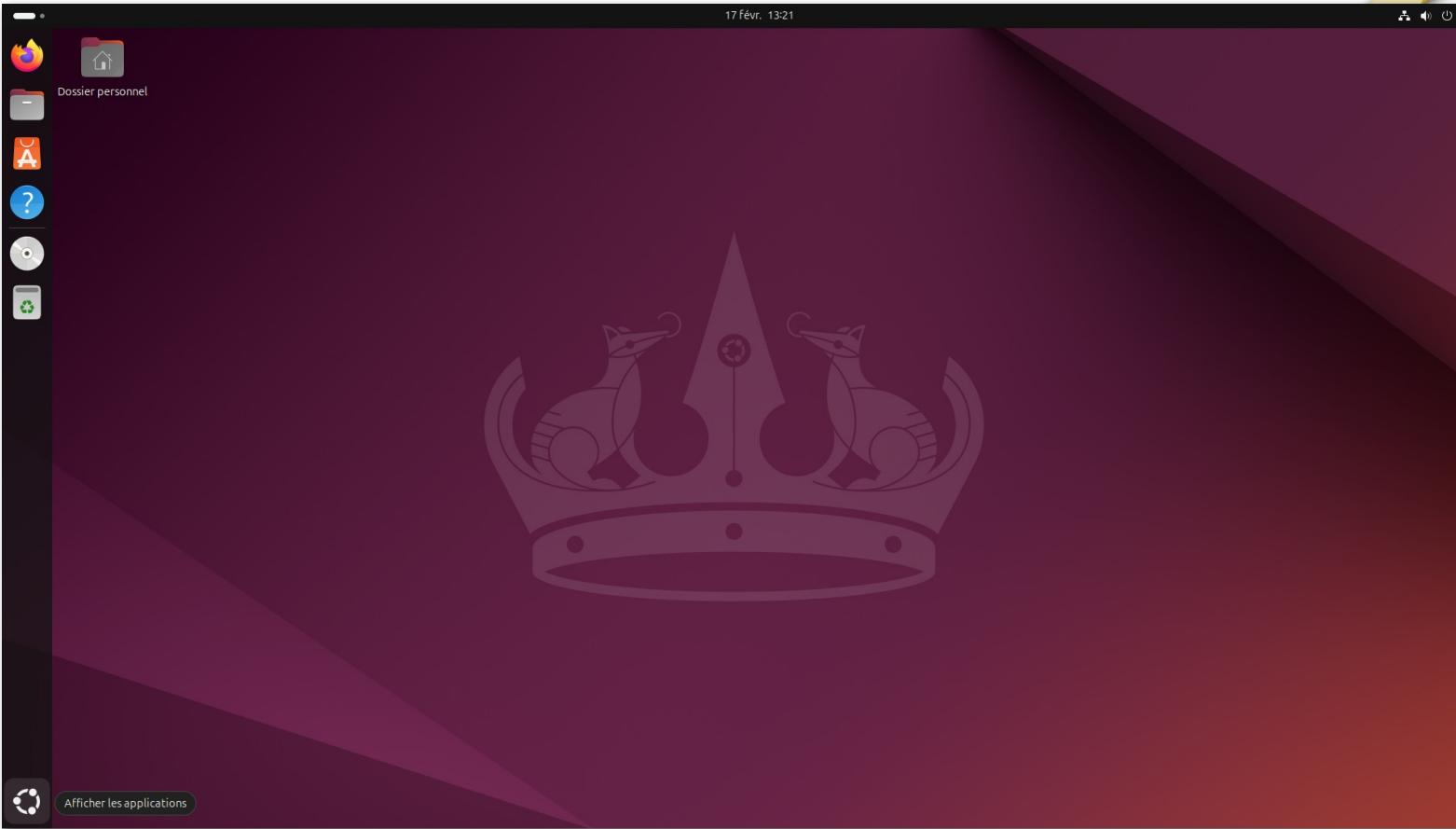
| | | |
|----------------------|---|--|
| Gnome | https://www.gnome.org/ |  |
| KDE | https://kde.org/ |  |
| Cinnamon | https://projects.linuxmint.com/cinnamon/ |  |
| Xfce | http://www.xfce.org/ |  |
| MATE | http://mate-desktop.com/ |  |
| LXQt | https://lxqt-project.org/ |  |
| Enlightenment | https://www.enlightenment.org/ |  |
| Deepin | https://www.deepin.org/ |  |
| Pantheon | https://elementary.io/ |  |

Ubuntu 24.04 LTS: Desktop Environments

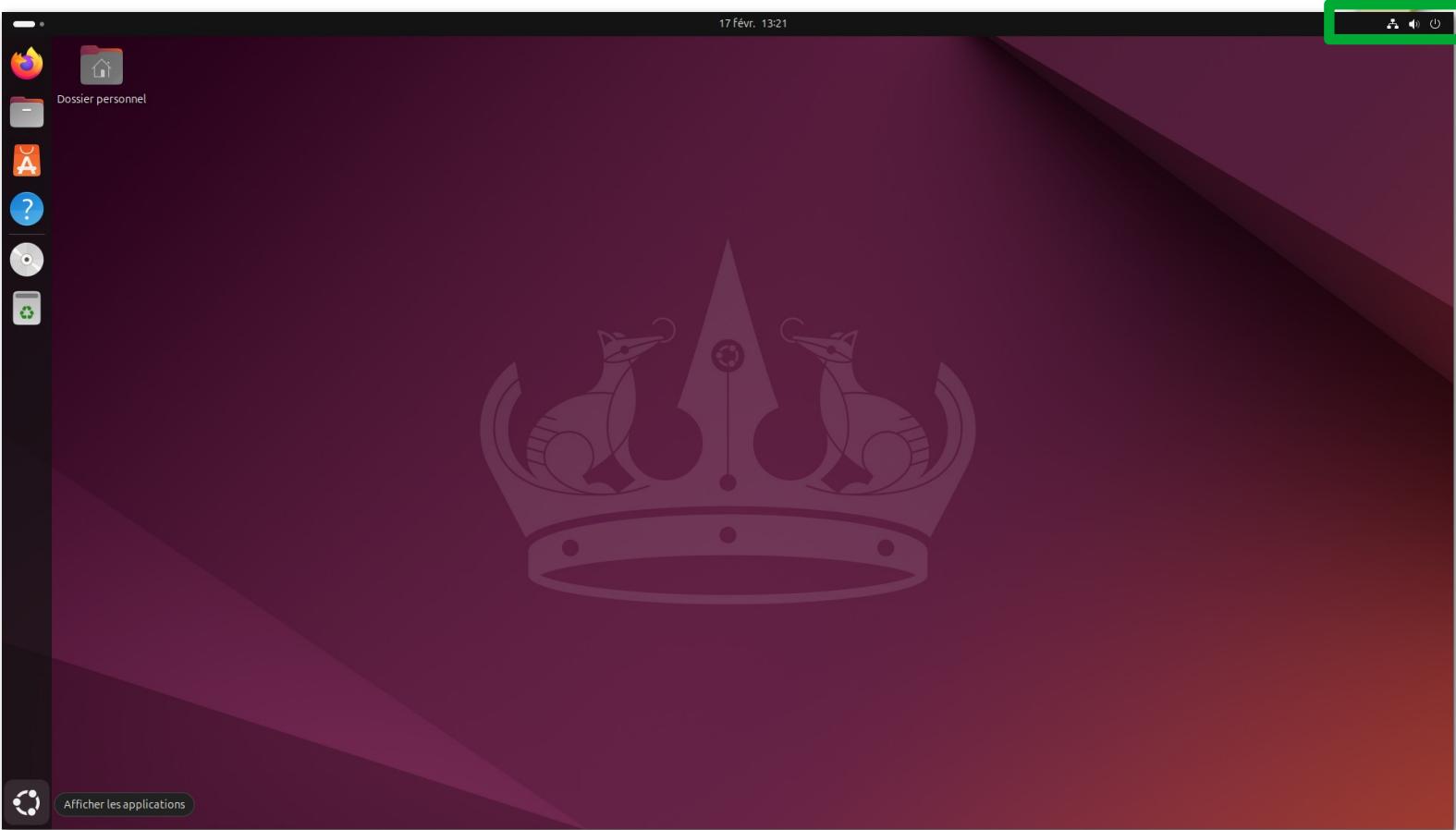


| | | |
|----------------------|---|--|
| Gnome | https://www.gnome.org/ |  |
| KDE | https://kde.org/ |  |
| Cinnamon | https://projects.linuxmint.com/cinnamon/ |  |
| Xfce | http://www.xfce.org/ |  |
| MATE | http://mate-desktop.com/ |  |
| LXQt | https://lxqt-project.org/ |  |
| Enlightenment | https://www.enlightenment.org/ |  |
| Deepin | https://www.deepin.org/ |  |
| Pantheon | https://elementary.io/ |  |

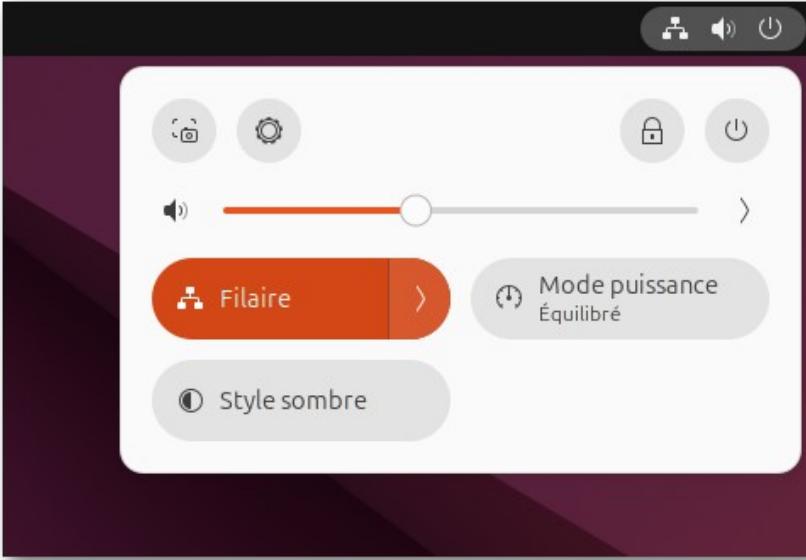
Ubuntu 24.04 LTS



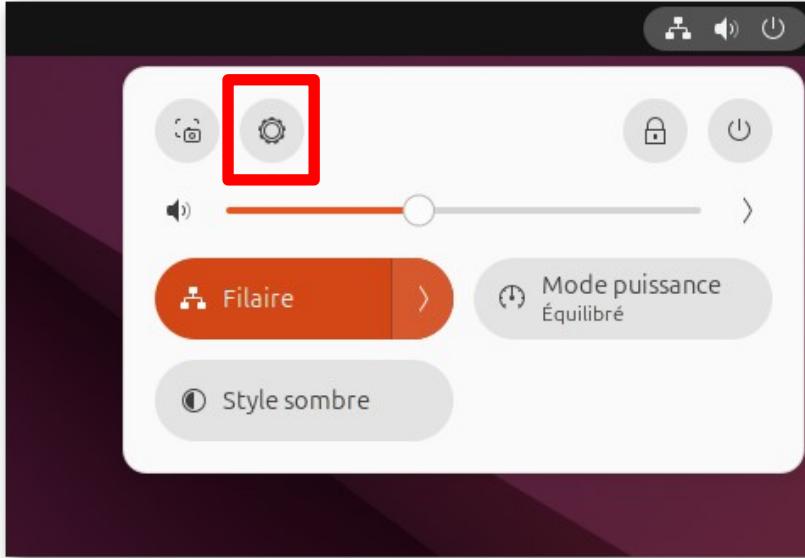
Ubuntu 24.04 LTS



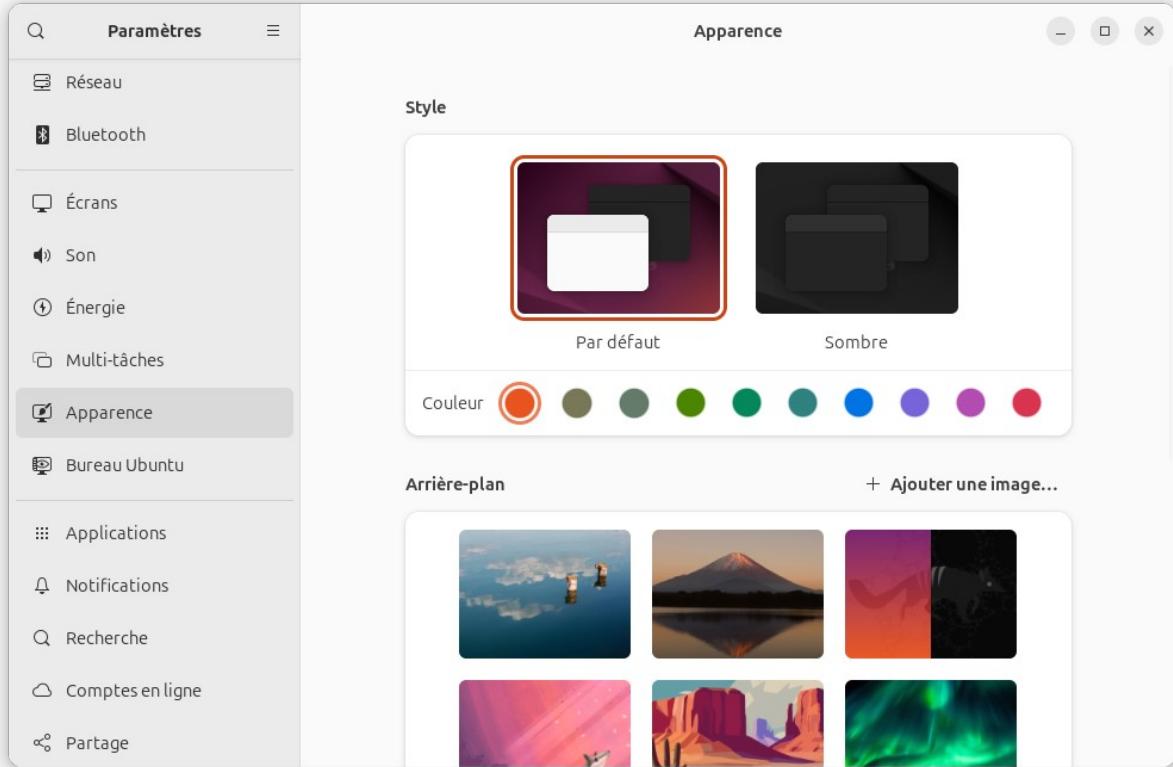
Ubuntu 24.04 LTS: Control Panel



Ubuntu 24.04 LTS: Control Panel



Ubuntu 24.04 LTS: Control Panel



Ubuntu 24.04 LTS: Control Panel



The screenshot displays the Ubuntu 24.04 LTS Control Panel interface. The main window title is "Apparence". On the left, there is a sidebar with various system settings: Réseau, Bluetooth, Écrans, Son, Énergie, Multi-tâches, **Apparence** (which is selected), Bureau Ubuntu, Applications, Notifications, Recherche, Comptes en ligne, and Partage. The "Apparence" section is expanded, showing sub-options: Applications, Notifications, Recherche, Comptes en ligne, Partage, Souris et pavé tactile, Clavier, Couleur, Imprimantes, Accessibilité, Vie privée et sécurité, and Système. The "Système" section is also expanded, listing: Pays et langue, Date et heure, Utilisateurs, Bureau distant, Shell sécurisé, À propos, and Mises à jour logicielles.

- Réseau
- Bluetooth
- Écrans
- Son
- Énergie
- Multi-tâches
- Apparence**
- Bureau Ubuntu
- Applications
- Notifications
- Recherche
- Comptes en ligne
- Partage

- Applications
- Notifications
- Recherche
- Comptes en ligne
- Partage

- Pays et langue
- Date et heure
- Utilisateurs
- Bureau distant
- Shell sécurisé
- À propos
- Mises à jour logicielles

Ubuntu 24.04 LTS: Control Panel

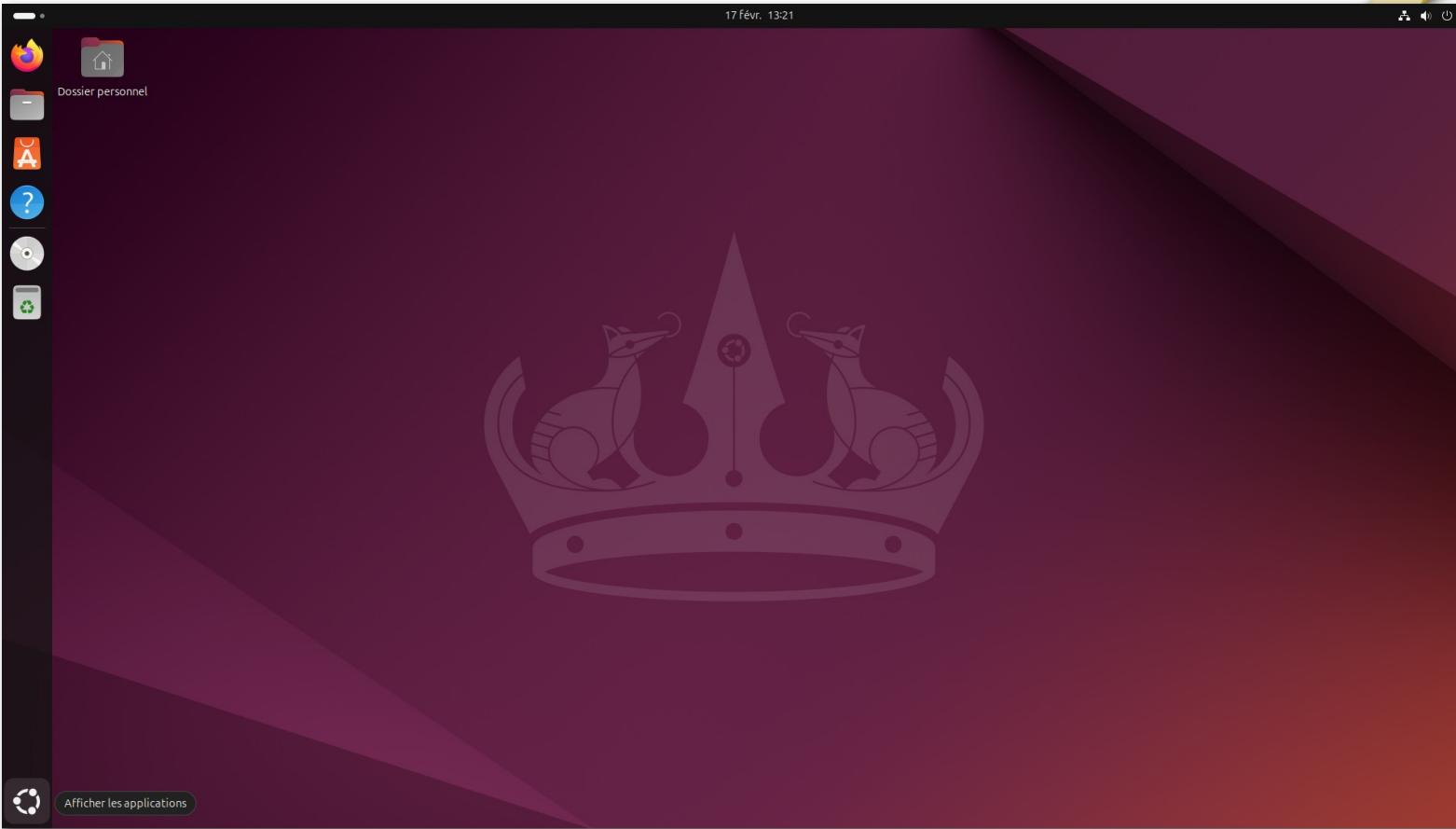


The image shows the Ubuntu 24.04 LTS Control Panel interface. It features three main windows:

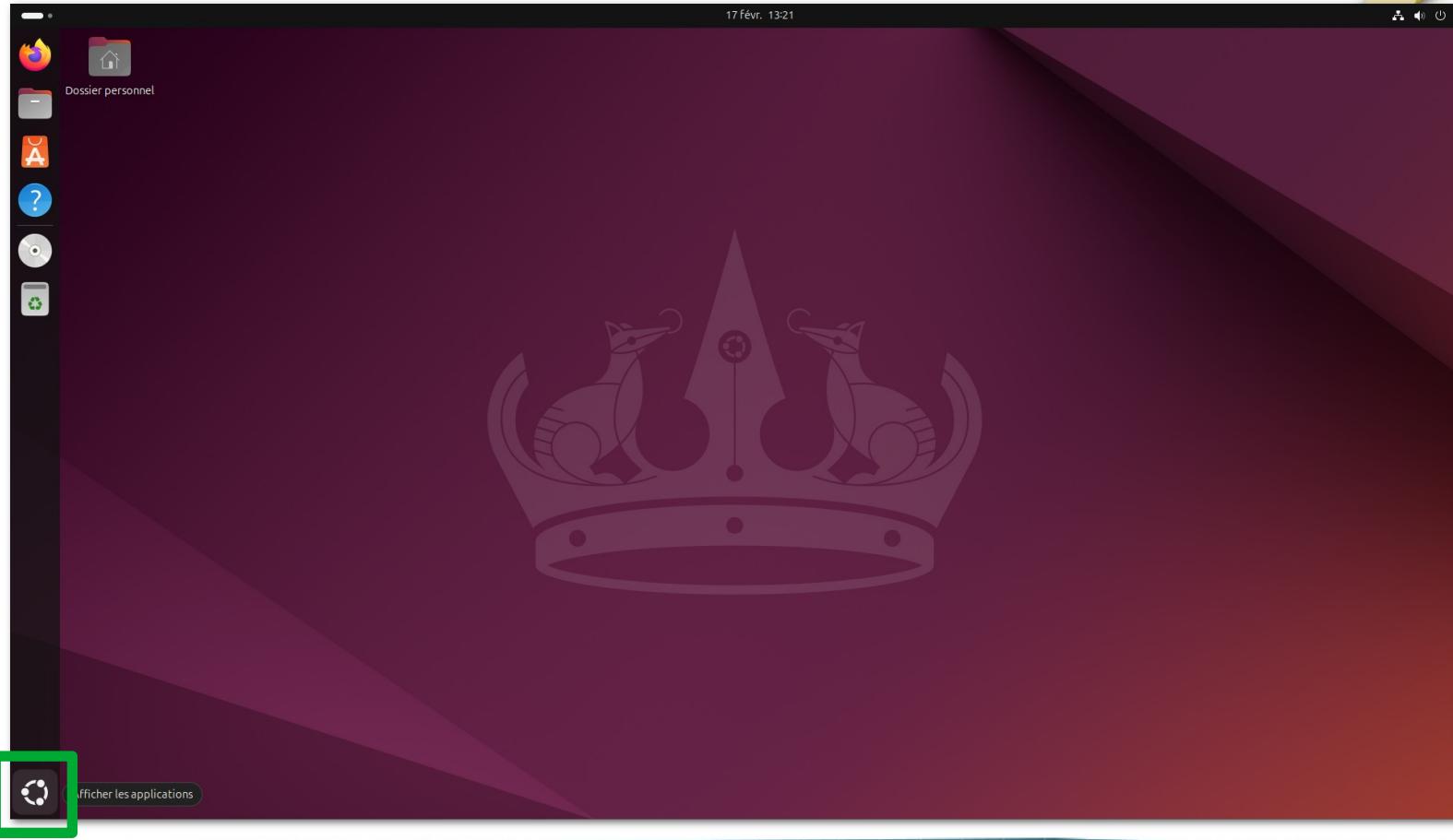
- Paramètres** window (left): Shows system settings like Réseau, Bluetooth, Écrans, Son, Énergie, Multi-tâches, Apparence, Bureau Ubuntu, Applications, Notifications, Recherche, Comptes en ligne, and Partage.
- Apparence** window (middle-left): Shows desktop settings like Applications, Notifications, Recherche, Comptes en ligne, Partage, Souris et pavé tactile, Clavier, Couleur, Imprimantes, Accessibilité, Vie privée et sécurité, and Système.
- Système** window (middle-right): Shows system details like Système d'exploitation (Ubuntu 24.04.1 LTS), Modèle du matériel (innotek GmbH VirtualBox), Processeur (Intel® Core™ i9-10900K × 4), Mémoire (19,5 Gio), Capacité du disque (53,7 Go), and Informations sur le système.

The "Apparence" window is currently active, displaying its sub-settings. The "Système" window also displays its sub-settings under the "Système" tab. A red box highlights the "Nom de l'appareil" field in the "Système" window, which contains the value "u24".

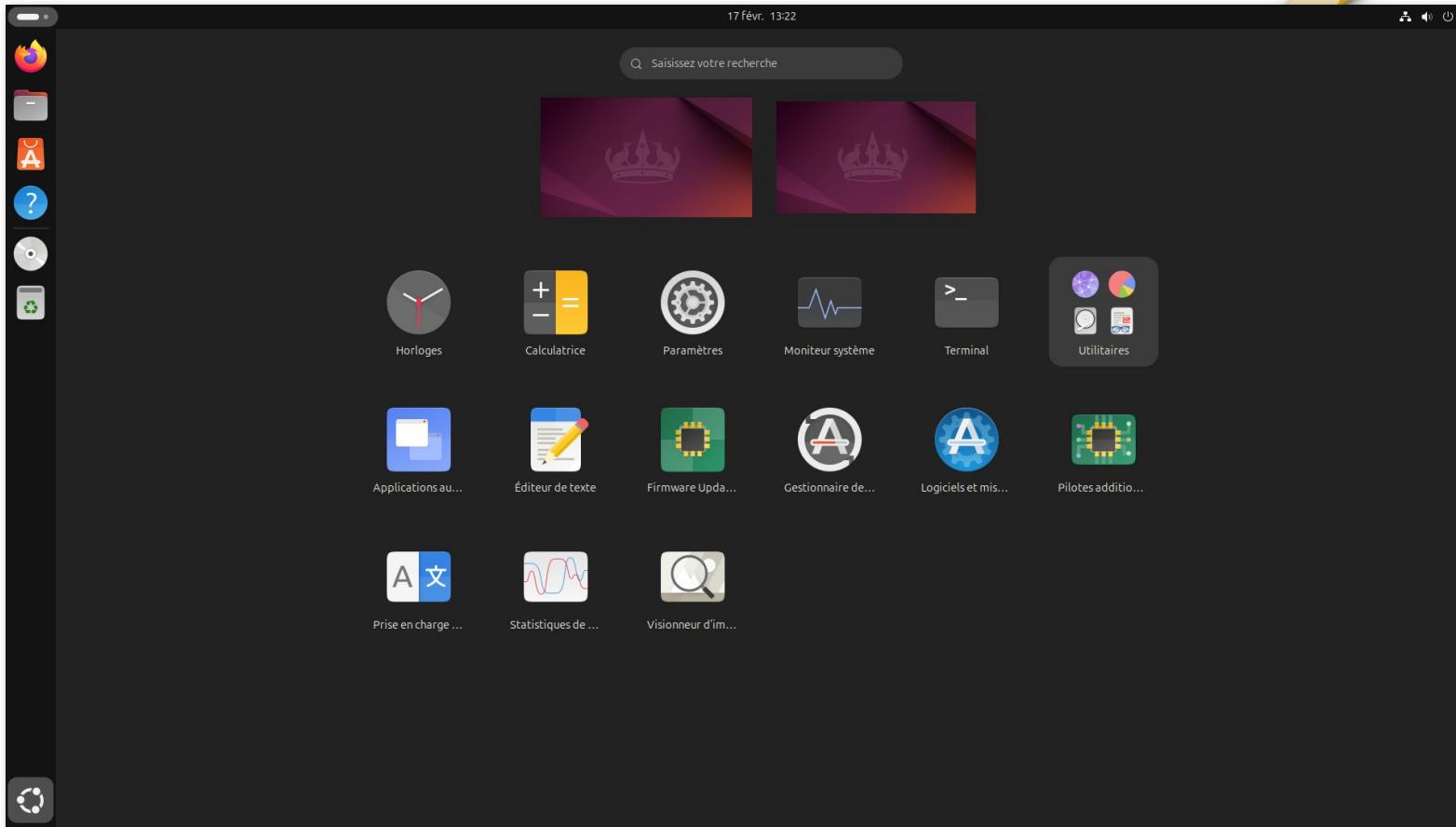
Ubuntu 24.04 LTS



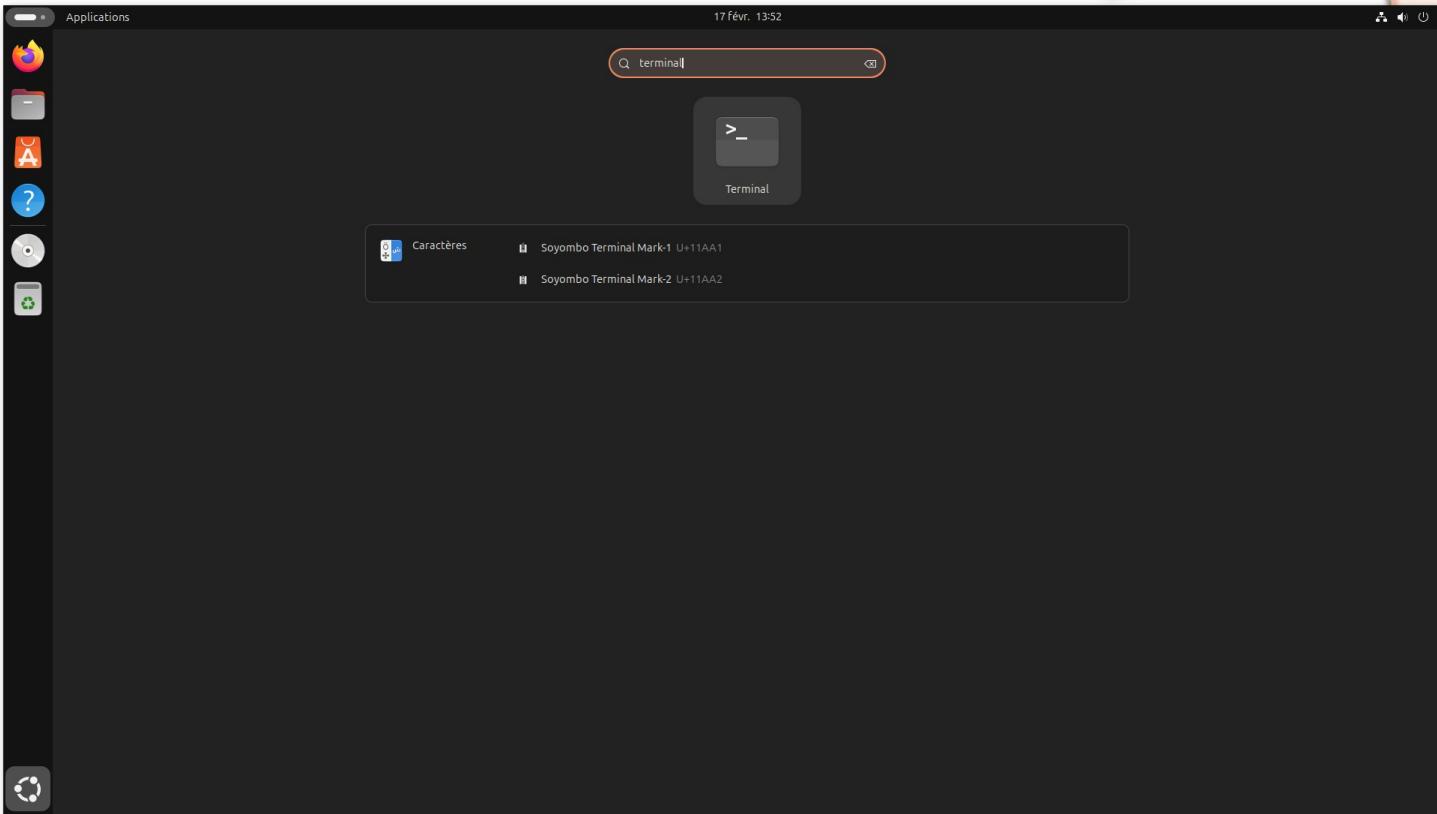
Ubuntu 24.04 LTS



U. 24.04 LTS: Applications



U. 24.04 LTS: Open the Terminal

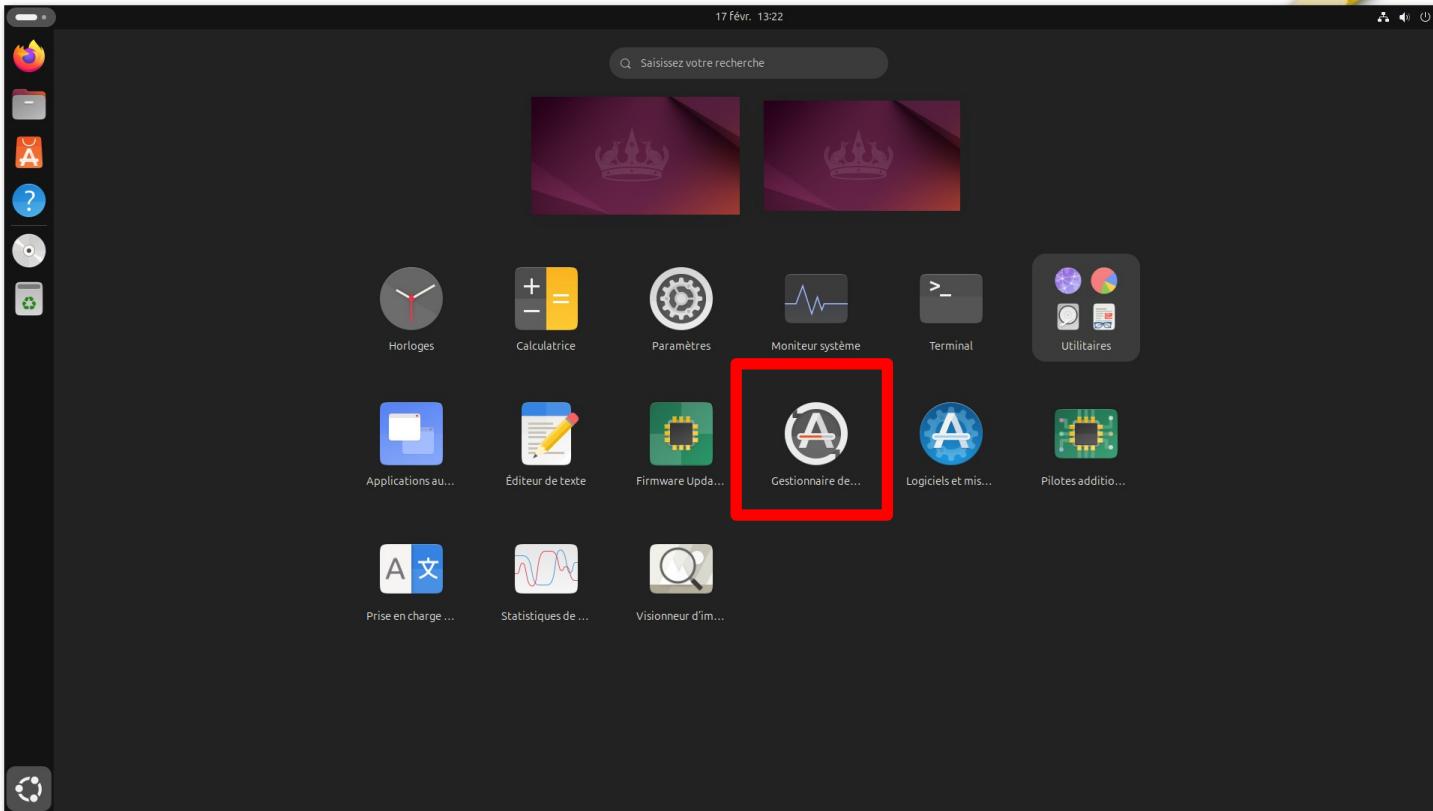


Things to do after installation



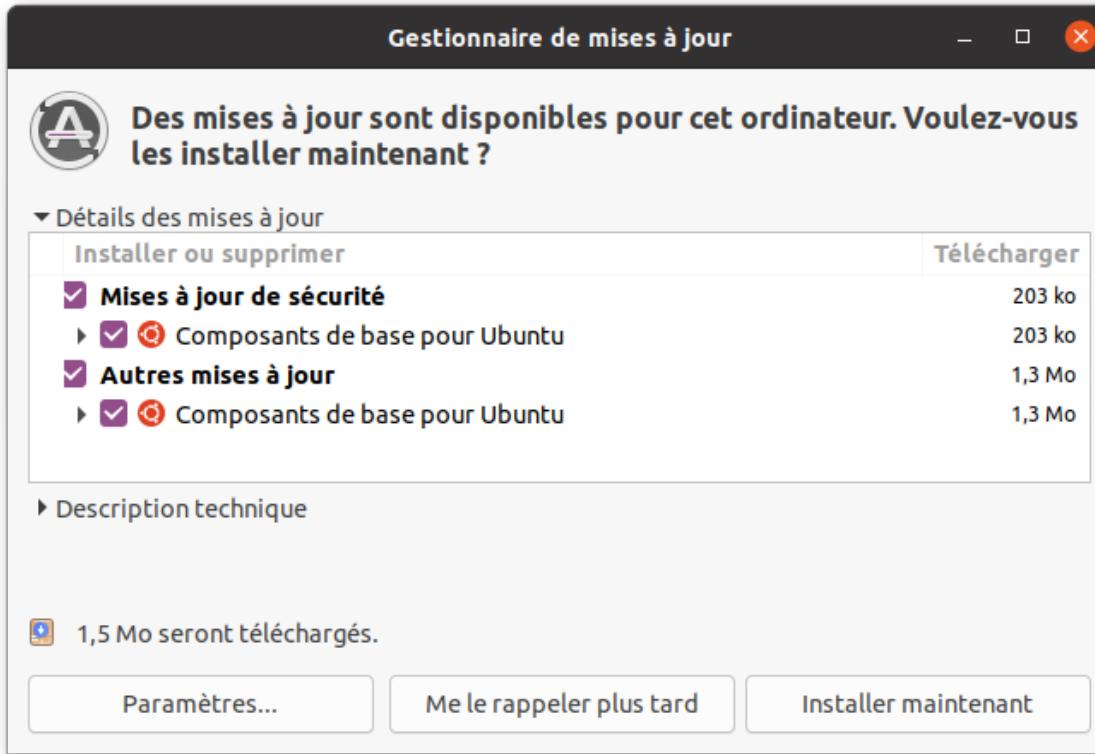
- Check for Updates (if not done during installation)
- Enable Partner Repositories
- Install Possibly Missing Graphics Drivers
- Install Extra Multimedia Codecs

U. 24.04 LTS: Check for Updates

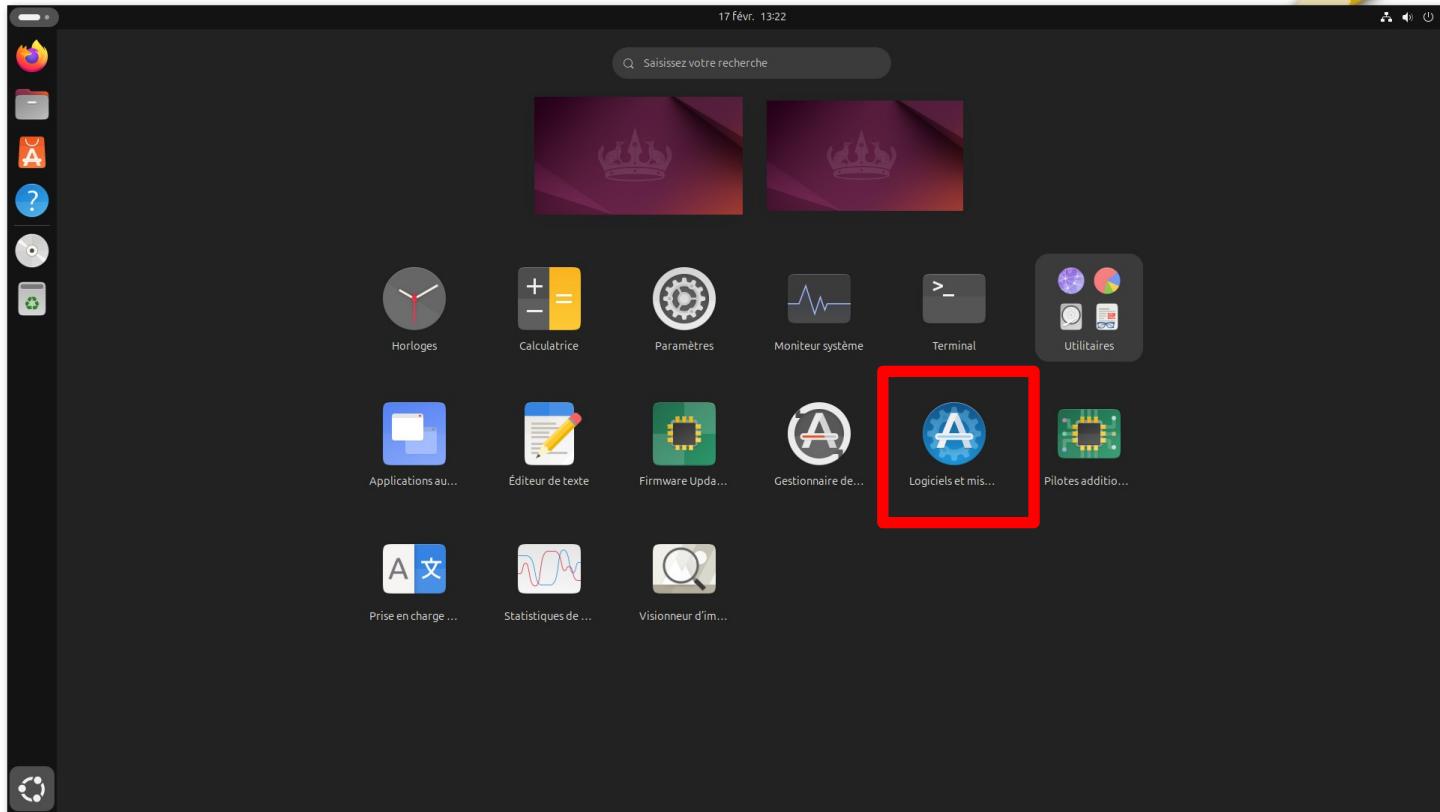


Terminal command: `update-manager`

U. 24.04 LTS: Updates

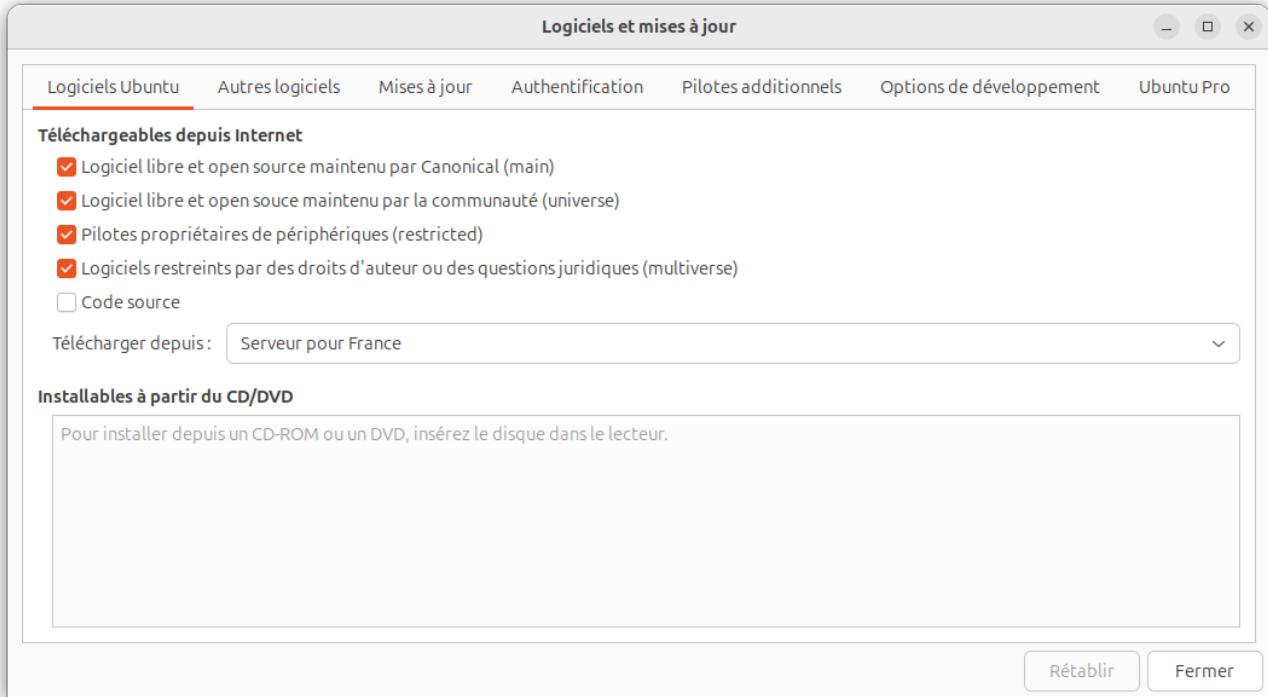


U. 24.04 LTS: Enable Repo.

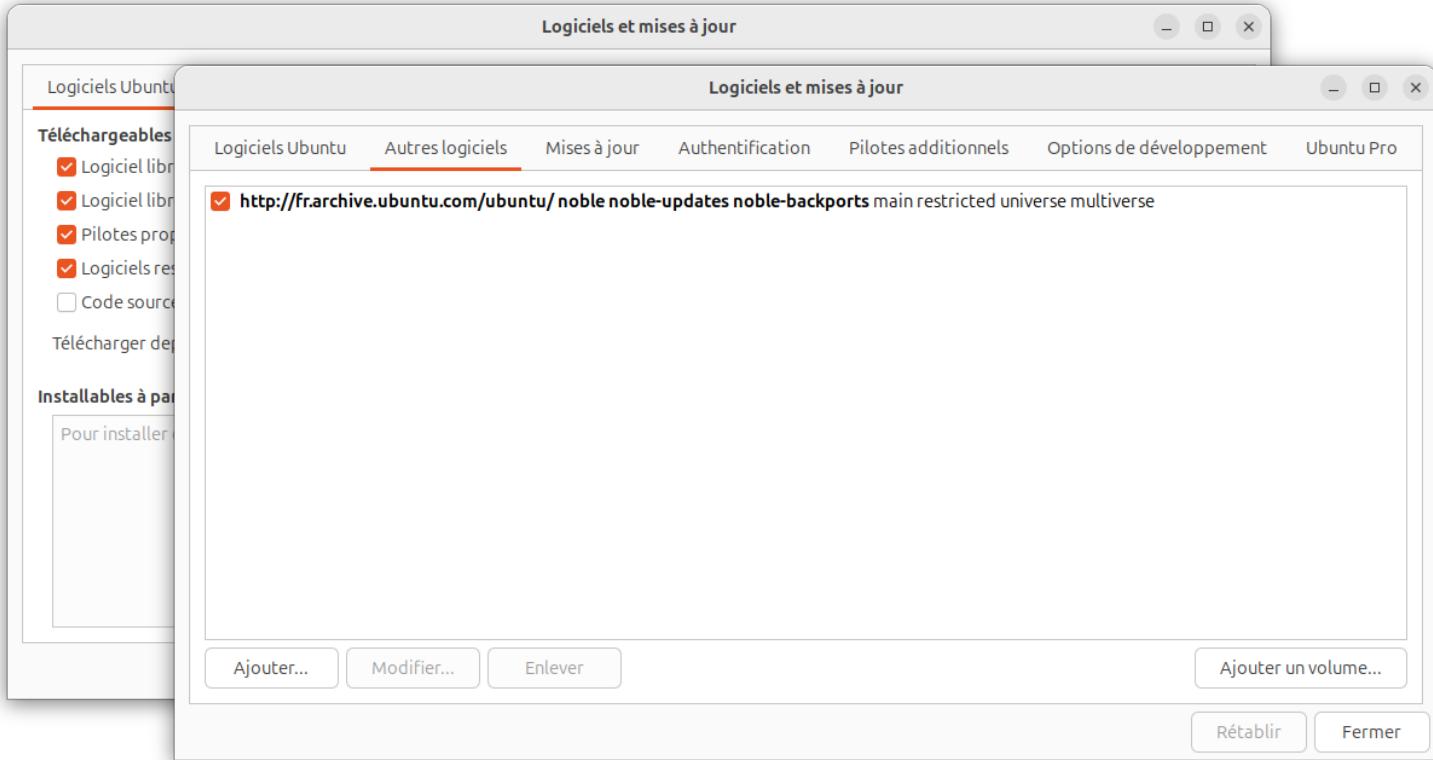


Terminal command: `software-properties-gtk`

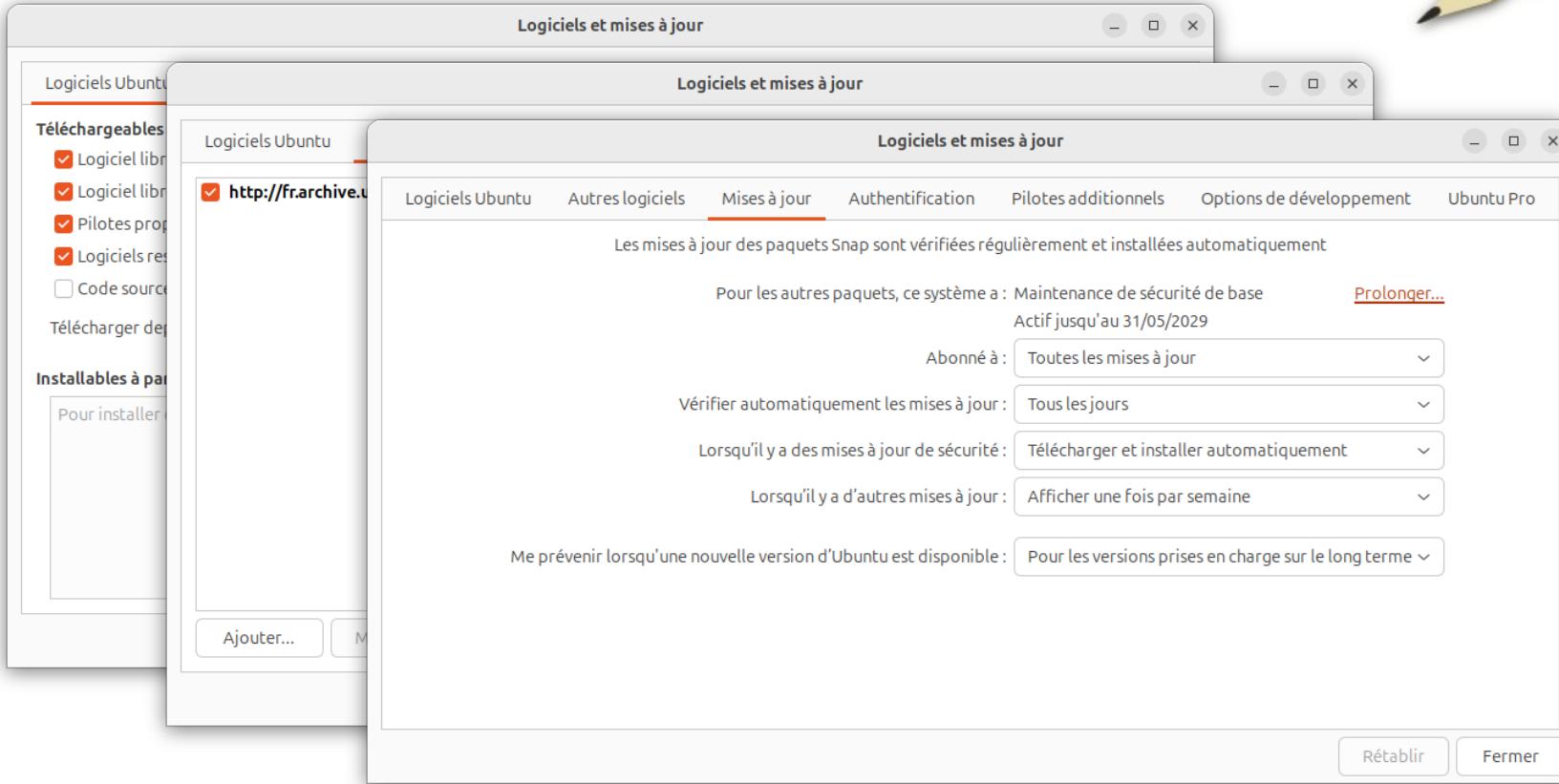
U. 24.04 LTS: Repo. and more



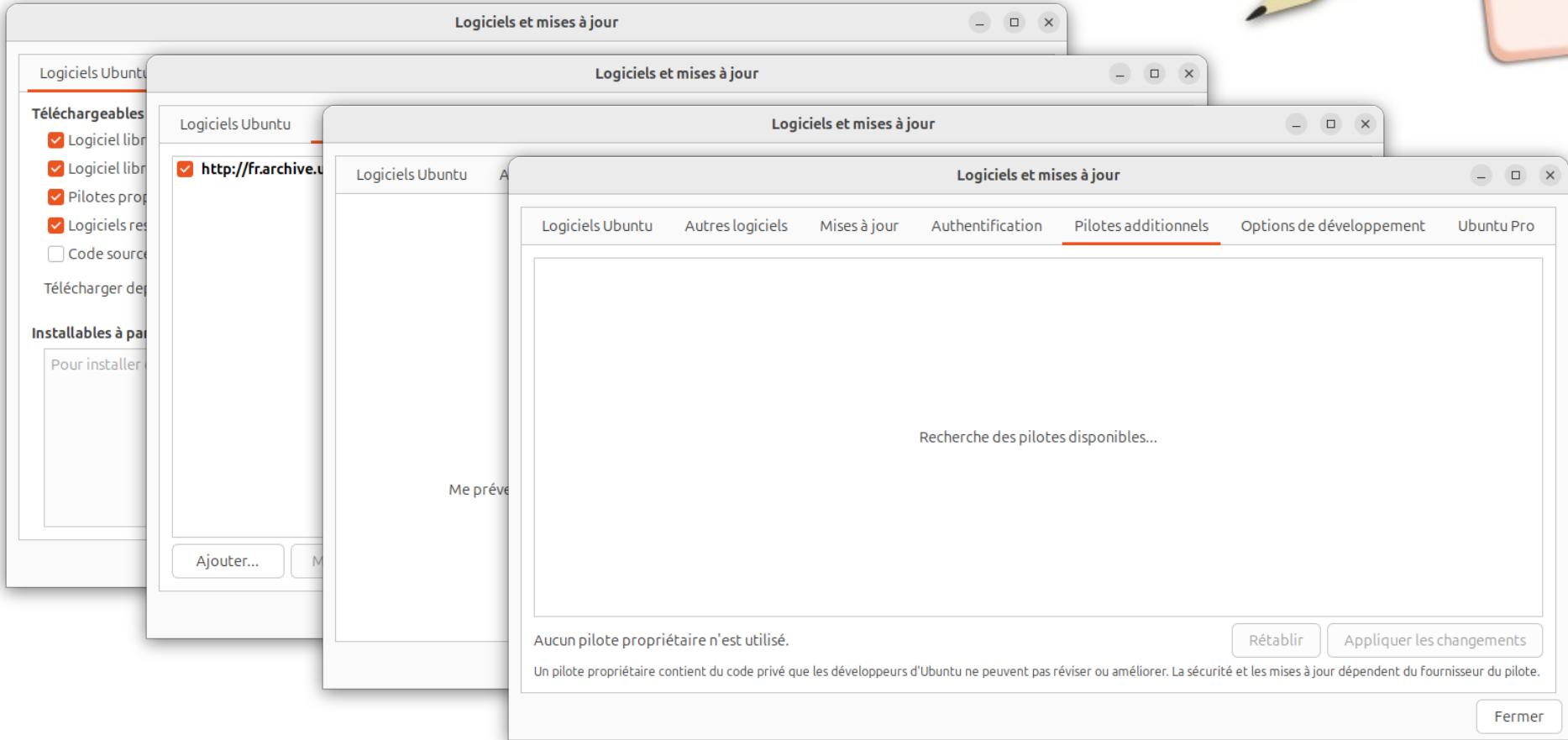
U. 24.04 LTS: Repo. and more



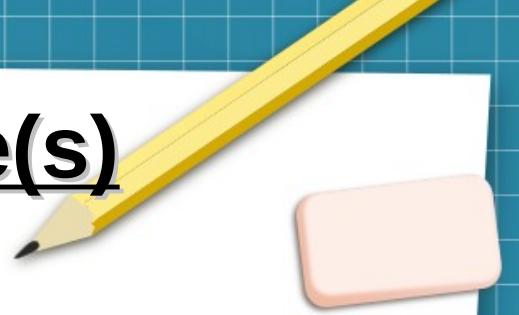
U. 24.04 LTS: Repo. and more



U. 24.04 LTS: Repo. and more



U. 24.04 LTS: Install software(s)



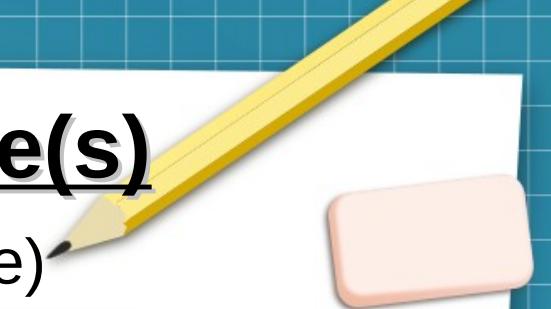
- Using the command line (the terminal)

```
$ sudo apt install package-name
```

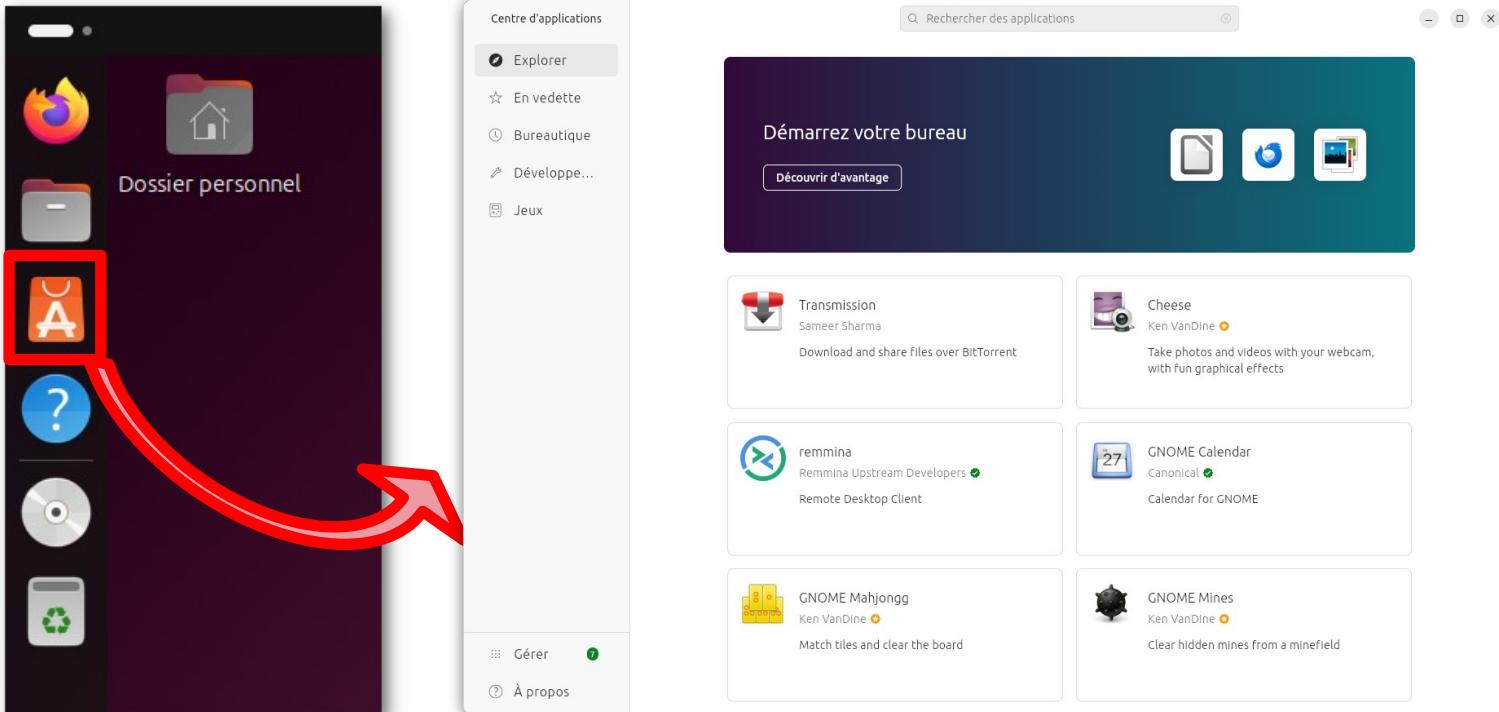
- Example:

```
$ sudo apt install synaptic
```

U. 24.04 LTS: Install software(s)

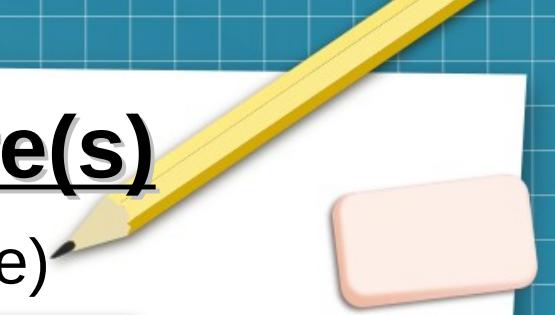


Using the “Application center” (Ubuntu software)

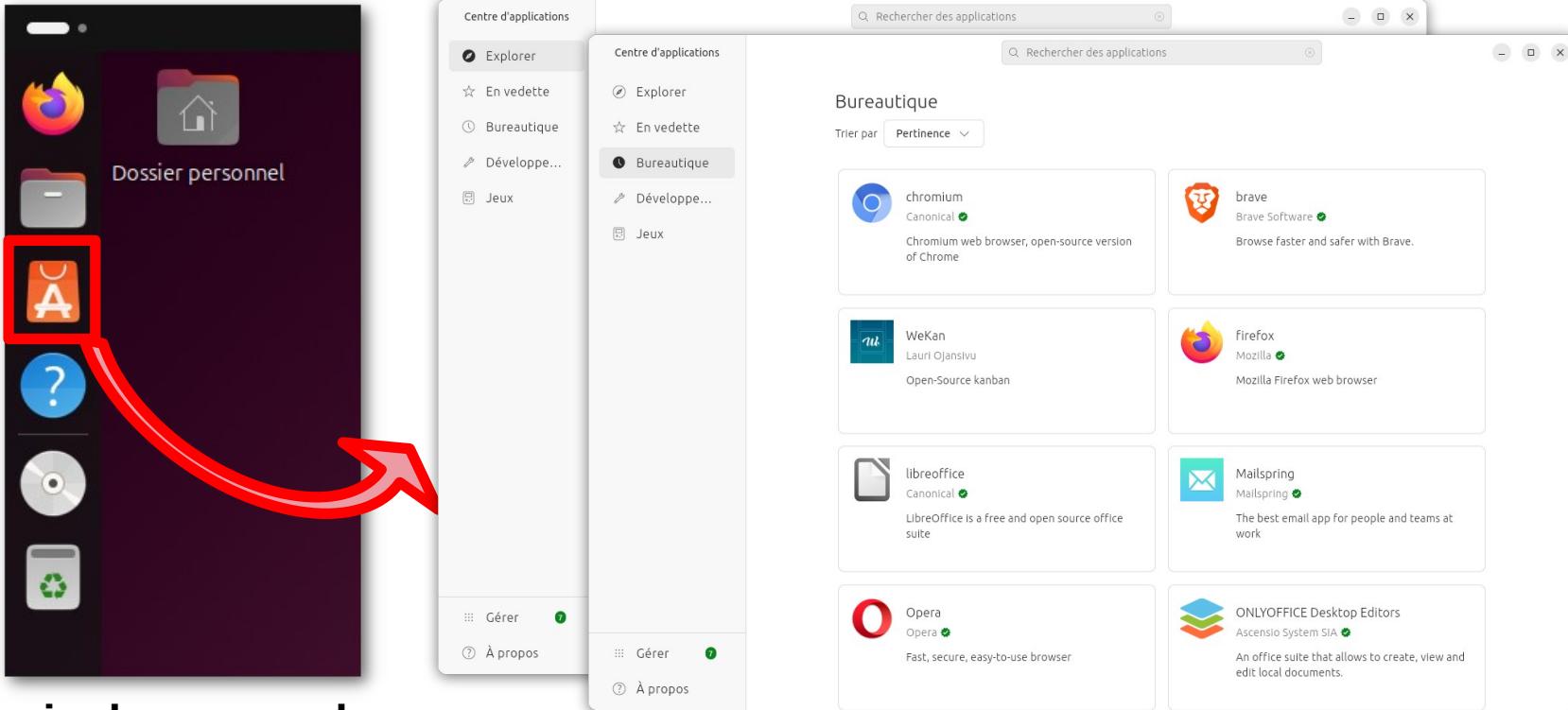


Terminal command: **snap-store**

U. 24.04 LTS: Install software(s)



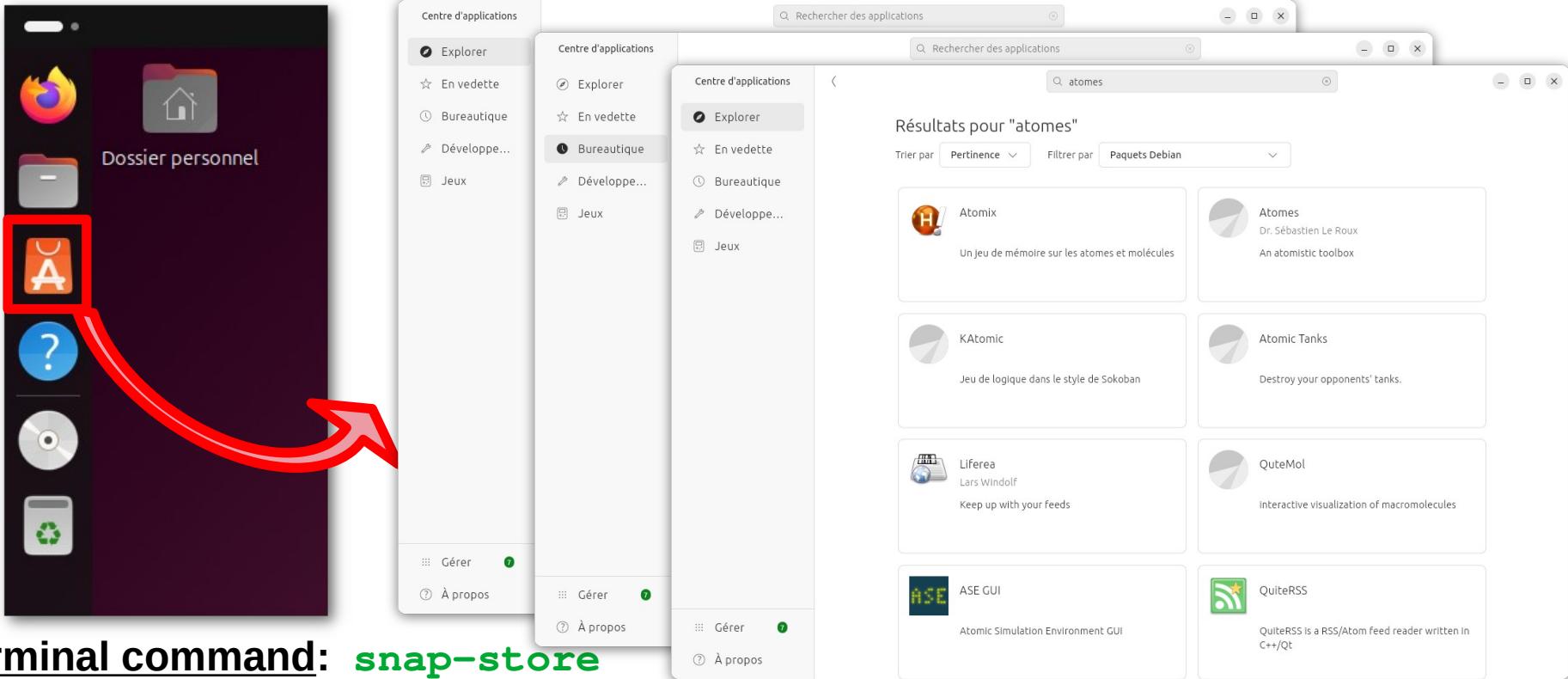
Using the “Application center” (Ubuntu software)



Terminal command: **snap-store**

U. 24.04 LTS: Install software(s)

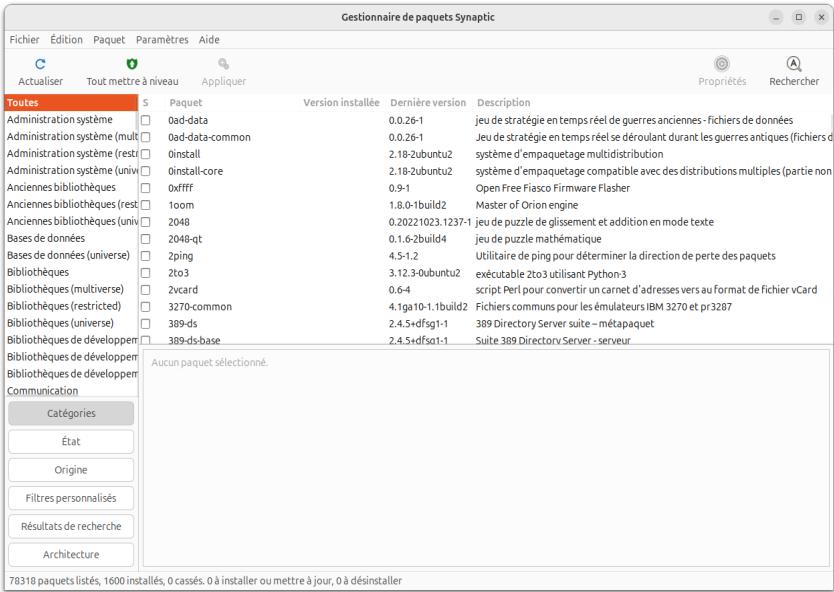
Using the “Application center” (Ubuntu software)



Terminal command: `sudo snap install atomix`

U. 24.04 LTS: Install software(s)

- Using “Synaptic”



Prerequisite: Install “Synaptic” using the “Application manager”

Terminal command: `synaptic`

U. 24.04 LTS: Install software(s)



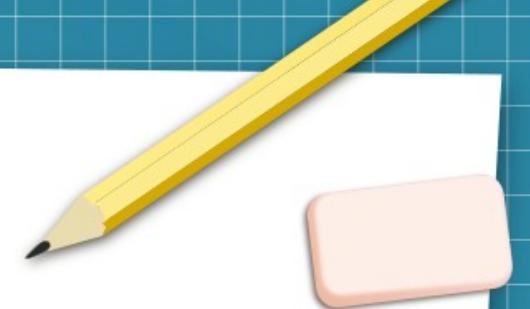
- **No matter the method, you need to have admin privileges to install a software and/or the updates !**

For Ubuntu 24.04 LTS you need to be in the “**sudoers**” group

- What if you can not find what you are looking for ?

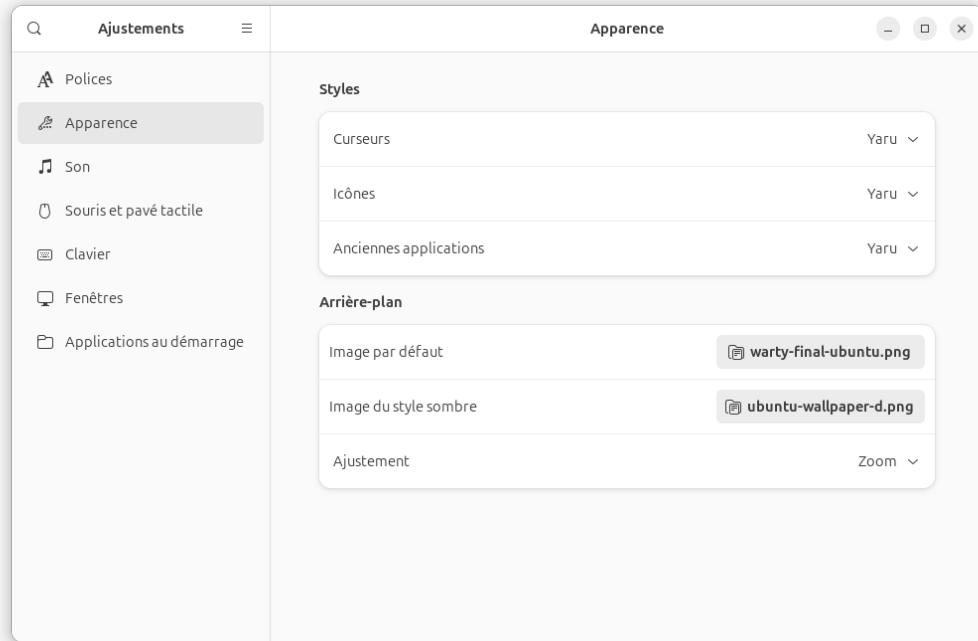
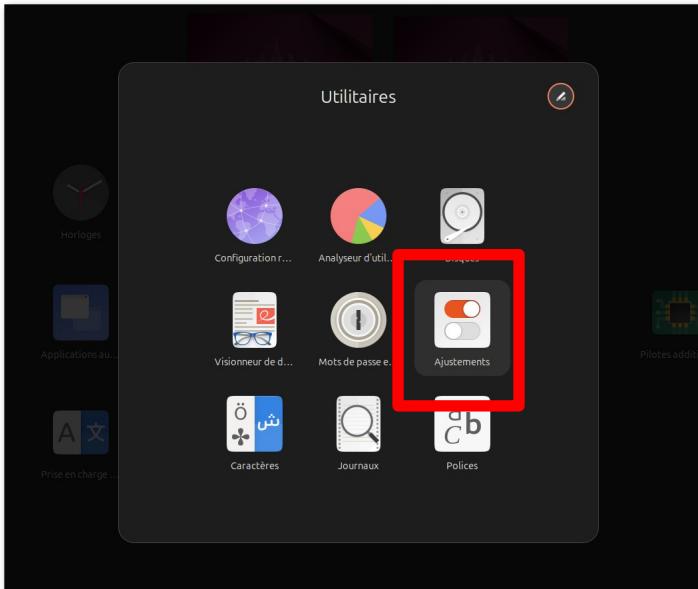
Add extra package repository: https://doc.ubuntu-fr.org/depots_focal

U. 24.04 LTS: GNOME Extras



- Tweaks “Ajustements” (gnome-tweaks)

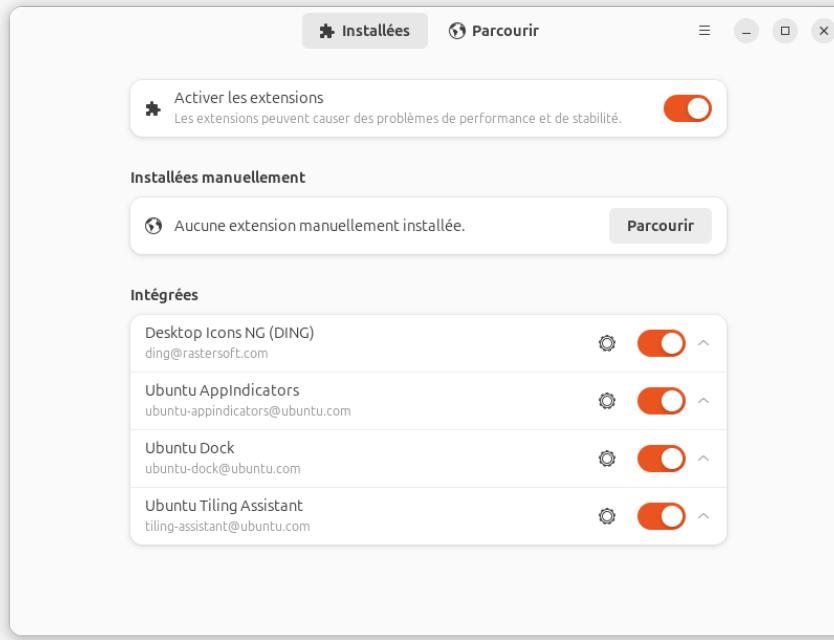
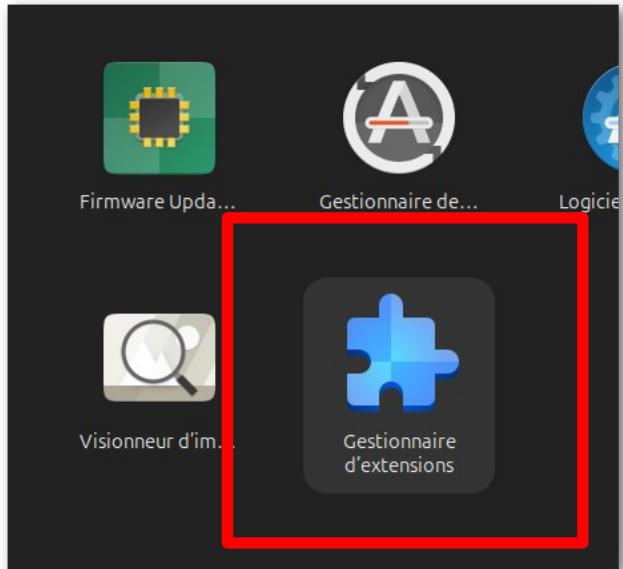
\$ sudo apt install gnome-tweaks



U. 24.04 LTS: GNOME Extras

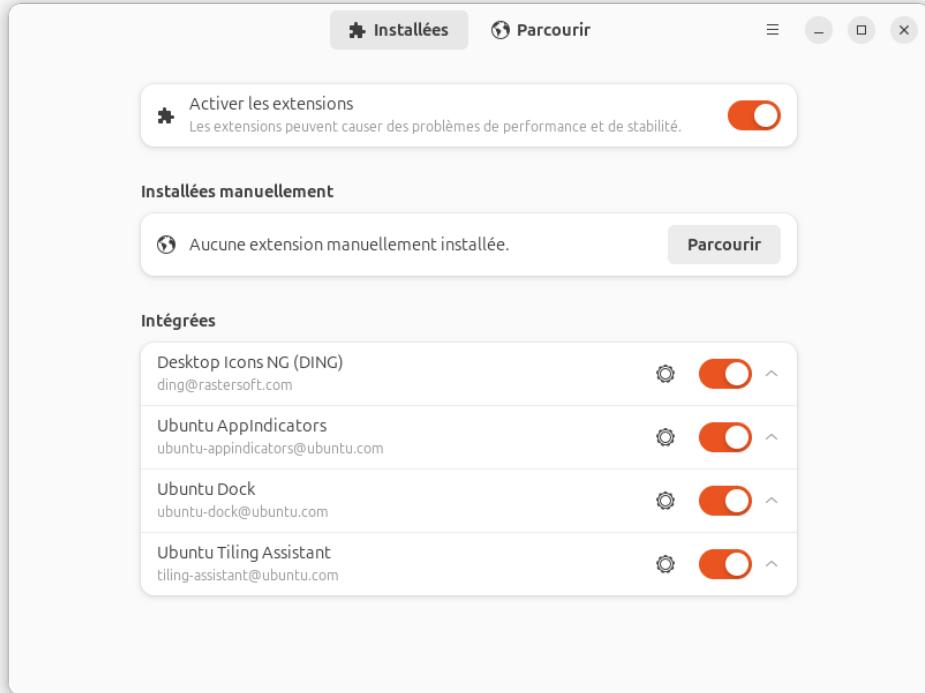
- Extension manager (gnome-shell-extension-manager)

```
$ sudo apt install gnome-shell-extension-manager
```



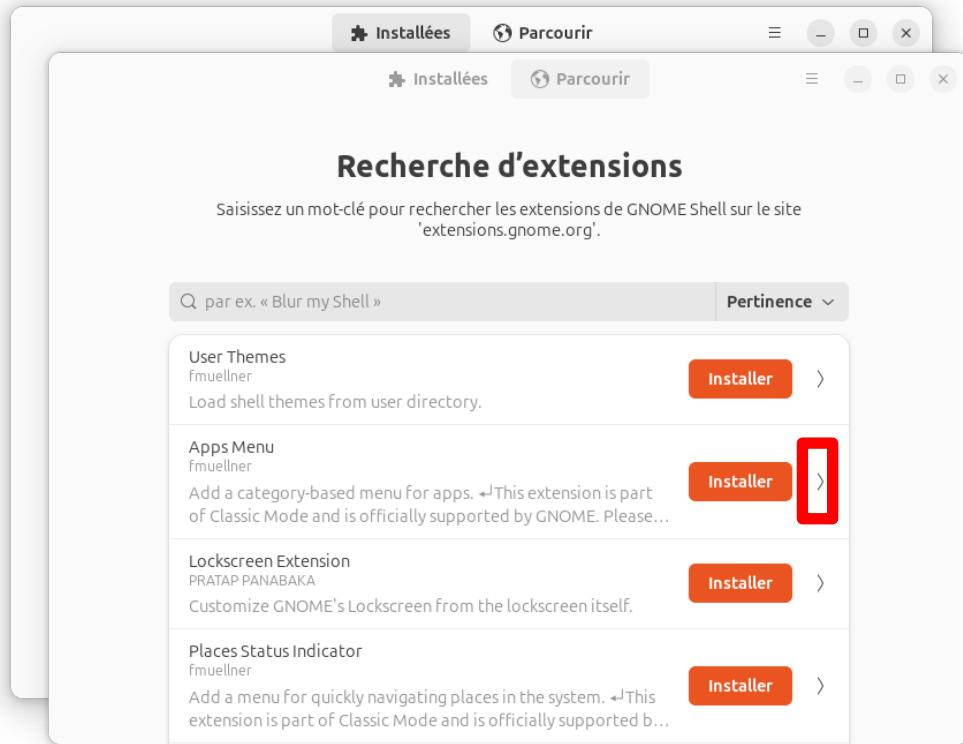
U. 24.04 LTS: GNOME Extras

- Extension manager (\$ **extension-manager**)



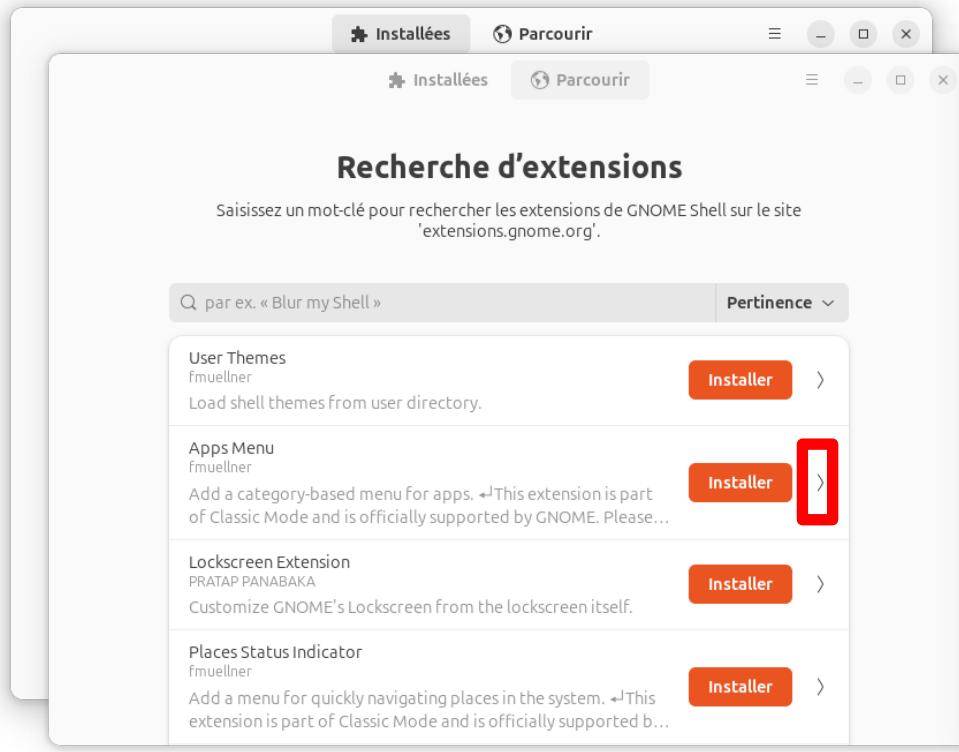
U. 24.04 LTS: GNOME Extras

- Extension manager (\$ **extension-manager**)



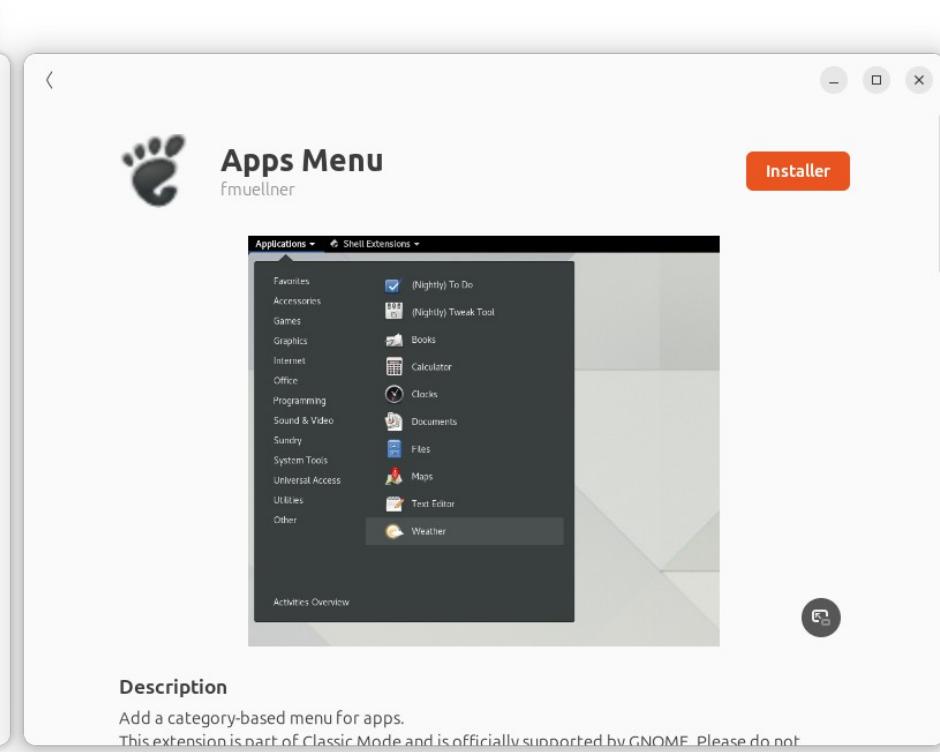
U. 24.04 LTS: GNOME Extras

- Extension manager (\$ extension-manager)



The screenshot shows the GNOME Extension Manager interface. At the top, there are two tabs: "Installées" (Installed) and "Parcourir" (Browse). Below the tabs, there are two smaller windows showing the same interface. The main window has a search bar with placeholder text "par ex. « Blur my Shell »" and a dropdown menu set to "Pertinence". It lists four extensions:

- User Themes by fmuellner: "Load shell themes from user directory." with an "Installer" button.
- Apps Menu by fmuellner: "Add a category-based menu for apps. This extension is part of Classic Mode and is officially supported by GNOME. Please..." with an "Installer" button.
- Lockscreen Extension by PRATAP PANABAKA: "Customize GNOME's Lockscreen from the lockscreen itself." with an "Installer" button.
- Places Status Indicator by fmuellner: "Add a menu for quickly navigating places in the system. This extension is part of Classic Mode and is officially supported by..." with an "Installer" button.



To the right, a larger window shows the "Apps Menu" extension installed. It features a logo, the name "Apps Menu" by fmuellner, and an "Installer" button. A preview image shows a dark-themed GNOME desktop with a new "Applications" menu item. Below the preview, a "Description" section states: "Add a category-based menu for apps. This extension is part of Classic Mode and is officially supported by GNOME. Please do not...".

Why use Linux ?



- It's free !
- No need to change your computer to use the newest Linux !

How long should you use your computer so that the CO₂ footprint of its usage ⚡ becomes as large of the CO₂ footprint of its production ?

- High security: **no viruses ... no viruses at all !**
- High stability: **the world best servers use Linux !**
- Ease of use: **you are already using it on your smartphone !**
- Its Free ! = Open Source: **the code source is available !!!**

Why use Linux ?



- It's free !
- No need to change your computer to use the newest Linux !

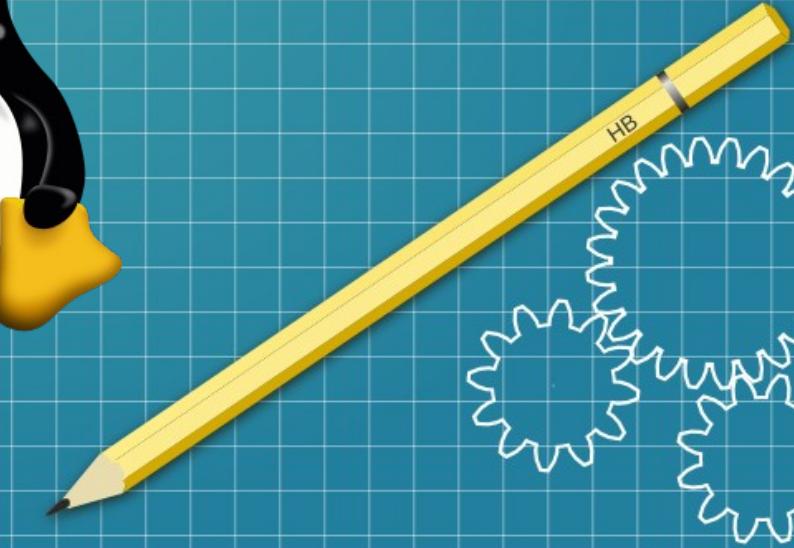
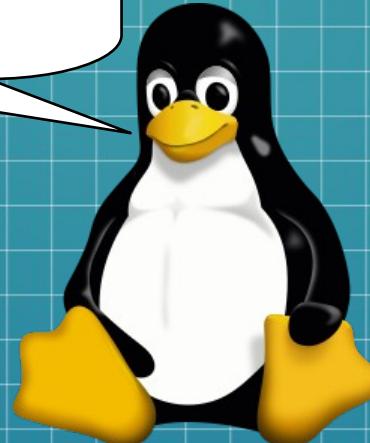
How long should you use your computer so that the CO₂ footprint of its usage becomes as large of the CO₂ footprint of its production ? 

139 years !!!

- High security: no viruses ... no viruses at all !
- High stability: the world best servers use Linux !
- Ease of use: you are already using it on your smartphone !
- Its Free ! = Open Source: the code source is available !!!

**“Astronauts use Linux ...
... because you can't open windows in space”**

Questions ?



The command line ?



- What is a command interpreter ?
- What is a command ?
- Where to find command(s) ?
- How to execute a command ?
- How to use a command ?
- How to get help ?
- What are the basic commands ?
- What are the filters ?
- What is a redirection ?
- What is scripting ?

Command interpreter ?



- A command interpreter, or **Shell**, is a program that allows users to interact with the system using the command line.
- Many shells are available: **BASH**, **KSH**, **TCSH**, **ZSH**
- **BASH** “Bourne-Again Shell”

BASH

- BASH native (built-in) commands: **echo**, **pwd**, **export** ...
- Special characters

" " (space)

\$

what follow is a variable.

*

stands for any number of any character(s) = everything.

?

any single character.

{ } () []

used to encompass expressions.

/

to define file and directory path(s).

\`

to substitute enclosed command(s).

''

to enclose command(s).

""

to enclose command(s) with variable(s) expansion.

#

to start a comment in BASH.

| & < >

redirections.

. and ..

navigation in the directory tree.

\

to “protect” the other special characters

Linux: files and terminology



- On a computer you can have **2** types of files:
 - **Text files**
 - Other types of files = files that are not text files = **binary files**

Easy to work of text files !

- Not matter the type of file, on a Linux system you have:
 - Standard files and repositories.
 - Hidden files and repositories which names, by convention, start by a “.” dot symbol.

Example: “`~/.bashrc`”

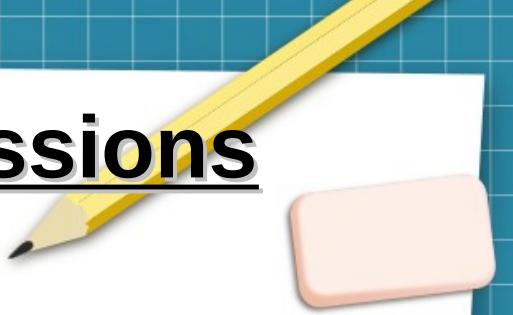
Exercise: Compare the results of the commands: `ls` and “`ls -a`”

What is a command ?



**A file that has the execute permission ! ...
... A file that you can execute.**

Linux Fundamentals: File Permissions



- The different permissions that can be granted for a **file** are:
 - **read**: to visualize its content
 - **write**: to modify its content (ex: editing)
 - **execute**: to execute its content (ex: program)
- The different permissions that can be granted for a **directory** are:
 - **read**: to visualize its content
 - **write**: to modify its content (ex: adding new files)
 - **execute**: to go inside this directory (ex: changing directory)

Linux Fundamentals: File Permissions



```
leroux@chess-u20: ~/Documents/Linux$ ls -l
total 15108
drwxrwxr-x 2 leroux dmo      4096 oct.  20 13:40 Images
-rw-r--r-- 1 leroux dmo 15463386 oct.  20 13:55 Linux.odp
leroux@chess-u20:~/Documents/Linux$
```

drwxrwxr-x

d rwx rwx r-x

-rw-r--r--

- rw- r-- r--

Object

Owner

Group

The other user(s)

Object

Owner

Group

The other user(s)

Command = Executable



- Command = “**a file that has the execute permission**”

```
leroux@chess-u24: ~/Documents
leroux@chess-u24:~/Documents$ ls -l
total 4
-rwx----- 1 leroux leroux 26 avril 3 15:23 test.sh
```

Where to find commands ?



- In the **PATH**
- Anywhere you need ...
... because you can create command(s) yourself

PATH



- **Environment variable(s) [EV]:**

“Set of dynamic named values used to create the operating environment in which a process runs”

- To access the **EV** list use the **env** command:

```
user@localhost:~$ env
```

- To display the value of a variable:

```
user@localhost:~$ echo $PATH
```

Locating a command



- To locate a command use the **which** command:

```
user@localhost:~$ which ls  
/usr/bin/ls  
user@localhost:~$
```

How to execute a command ?

- Use it name directly:

```
user@localhost:~$ ls
```

The command MUST be in the PATH

- Use the direct path + name of the executable:

```
user@localhost:~$ /usr/bin/ls
```

- Change directory to the folder of the executable and use “**“./”**

```
user@localhost:~$ cd /usr/bin  
user@localhost:/usr/bin$ ./ls $HOME
```

How to use a command ?



- A **command** can receive **argument(s)**:

```
user@localhost:~$ cd ~/Documents
```

- A **command** can receive **option(s)**:

```
user@localhost:~$ ls -l -h
```

```
user@localhost:~$ ls -lh
```

```
user@localhost:~$ ls -l --human-readable
```

How to get help



- The **-h** or **--help** option(s):

Accepted by most commands, to get basic help.

```
user@localhost:~$ ls --help
```

- The **man** command:

To access the manual pages

```
user@localhost:~$ man ls
```

Basic commands (1/6)



- File system management: **ls, pwd, cd, touch, mkdir
mv, cp, rmdir, rm**
- File printing: **wc, cat, tac, more, tail, cut**
- File management: **chown, chmod, diff, ln**

Basic commands (2/6)



```
user@localhost:~$ ls
Bureau      Images      Musique    snap          vidéo
Documents   Modèles   Public    Téléchargements
user@localhost:~$ ls -l
total 36
drwxr-xr-x. 2 user ipcms 4096 avril 12 11:04 Bureau
drwxr-xr-x. 2 user ipcms 4096 avril 12 11:04 Documents
drwxr-xr-x. 2 user ipcms 4096 avril 12 11:04 Images
drwxr-xr-x. 2 user ipcms 4096 avril 12 11:04 Modèles
drwxr-xr-x. 2 user ipcms 4096 avril 12 11:04 Musique
drwxr-xr-x. 2 user ipcms 4096 avril 12 11:04 Public
drwx----- 2 user ipcms 4096 avril 12 11:04 snap
drwxr-xr-x. 2 user ipcms 4096 avril 12 11:04 Téléchargements
drwxr-xr-x. 2 user ipcms 4096 avril 12 11:04 Vidéos
user@localhost:~$
```

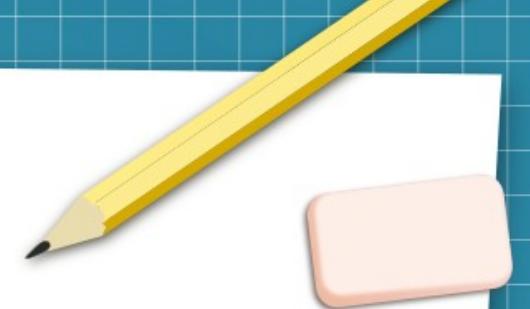
Basic commands (3/6)



```
user@localhost:~$ cd Images
user@localhost:~/Images$ ls
user@localhost:~/Images$ cd ..
user@localhost:~/..$ cd ..
user@localhost:/$ cd
user@localhost:~$ cd Documents
user@localhost:~/Documents$
```

```
user@localhost:~/Documents$ touch file
user@localhost:~/Documents$ ls
file
user@localhost:~/Documents$
```

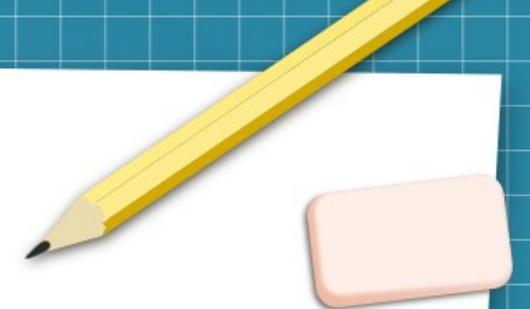
Basic commands (4/6)



- The **rm** command, important option: **-i**

```
user@localhost:~/Documents$ rm file
user@localhost:~/Documents$ ls
user@localhost:~/Documents$ touch nfile
user@localhost:~/Documents$ ls
nfile
user@localhost:~/Documents$ rm -i nfile
rm : supprimer 'nfile' du type fichier ? n
user@localhost:~/Documents$ ls
nfile
```

Basic commands (5/6)



- The **cat**, **tac** and **wc** commands

```
user@localhost:~/Documents$ cat Ethanol.xyz
      9

    C    1.0111998889    -0.0452918889    -0.0626048889
    C    -0.4620761111     0.0306281111    0.2946991111
    H    1.6265438889    -0.0376928889    0.8456121111
    H    1.3252608889     0.8030881111    -0.6846978889
    H    1.2501238889    -0.9611748889    -0.6188868889
    H    -0.7580021111    -0.8263228889    0.9315601111
    H    -0.6822251111     0.9536901111    0.8665561111
    H    -2.1126961111     0.0649821111    -0.6649928889
    O    -1.1981291111     0.0180941111    -0.9072448889

user@localhost:~/Documents$ wc -l Ethanol.xyz
11 Ethanol.xyz
user@localhost:~/Documents$
```

Basic commands (6/6)

- The **chmod** command “to change file permissions”

- **rW** - **r** - - **r** - -



Using 3 series (**owner**, **group**, **others**) of 3 numbers as well as their combinations:

| | | |
|-----------------------|----------------------|-----------------------|
| (0 = nothing = - - -) | 1 | = execute (x) = - - x |
| | 2 | = write (w) = - w - |
| | 4 | = read (r) = r - - |
| | 3 = 1 + 2 | = x + r = r - x |
| | 5 = 1 + 4 | = x + w = - w x |
| | 6 = 2 + 4 | = w + r = - w r |
| | 7 = 1 + 2 + 4 | = x + w + r = r w |

Basic commands (6/6)

- The **chmod** command “to change file permissions”

- rW- r - - r - -

Object

Owner

Group

The other user(s)

Using 3 series (**owner**, **group**, **others**) of 3 numbers as well as their combinations:

```
user@localhost:~/Documents$ ls -l Ethanol.xyz
-rw-r--r--. 1 user ipcms 525 avril 14 11:22 Ethanol.xyz
user@localhost:~/Documents$ chmod 600 Ethanol.xyz
user@localhost:~/Documents$ ls -l Ethanol.xyz
-rw-----. 1 user ipcms 525 avril 14 11:22 Ethanol.xyz
user@localhost:~/Documents$
```

What are the filters ?



- Filters are a type of command line utility designed to manipulate and process text data.
- The most common filters are **awk**, **sed** and **grep**

```
user@localhost:~$ filter option(s) 'regular expression' file
```

```
user@localhost:~$ filter option(s) "regular expression" file
```

- Filter use regular expressions or **regexp**
“Set of rules and patterns to match and manipulate text data”

grep

- To find line(s) with pattern(s) in text files

```
user@localhost:~$ grep --color=always 'C' Ethanol.xyz
C      1.0111998889      -0.0452918889      -0.0626048889
C      -0.4620761111      0.0306281111      0.2946991111
user@localhost:~$ grep -n --color=always '0' Ethanol.xyz
11:0      -1.1981291111      0.0180941111      -0.9072448889
user@localhost:~$
```

sed



- To find, substitute and delete pattern(s) in text files

```
user@localhost:~$ sed 's/0/?/g' Ethanol.xyz
9

C      1.?111998889      -?.?452918889      -?.?626?48889
C      -?.462?761111      ?.?3?6281111      ?.2946991111
H      1.6265438889      -?.?376928889      ?.8456121111
H      1.32526?8889      ?.8?3?881111      -?.6846978889
H      1.25?1238889      -?.9611748889      -?.6188868889
H      -?.758??21111      -?.8263228889      ?.93156?1111
H      -?.6822251111      ?.95369?1111      ?.8665561111
H      -2.1126961111      ?.?649821111      -?.6649928889
O      -1.1981291111      ?.?18?941111      -?.9?72448889

user@localhost:~$
```

awk



- To find pattern(s) and process line(s) in text files

```
user@localhost:~$ awk '{print $1}' Ethanol.xyz
9
C
C
H
H
H
H
H
H
H
O
user@localhost:~$
```

What is a redirection ?



- Sending a command to the background:
 - Foreground job to the background:

Ctrl + **Z**

Followed by:

```
user@localhost:~$ bg
```

- Job directly to the background, using: &

```
user@localhost:~$ gedit &
```

- Sending the output of a command to a file:

```
user@localhost:~$ cat Ethanol.xyz > Eth.xyz
user@localhost:~$ cat Ethanol.xyz >> Eth.xyz
```

- **Sending the output of a command in another command: the pipe |**

The pipe (pipeline)

- Redirecting a command in another command, using: |

```
user@localhost:~$ cat Ethanol.xyz | wc -l  
11  
user@localhost:~$
```

```
user@localhost:~$ ls -l E* | grep '^-'  
-rw-r--r--. 1 user ipcms 525 avril 14 11:22 Ethanol.xyz  
-rw-r--r--. 1 user ipcms 525 avril 14 11:23 Eth.xyz  
user@localhost:~$
```

```
user@localhost:~$ ls -l E* | grep '^-' | awk '{printf $NF" "}'  
Ethanol.xyz Eth.xyz user@localhost:~$
```

What is scripting ?



- To program a list of command(s) and action(s) in a file

```
#!/bin/bash

# This little example to say "Hello" in BASH
echo "Hello"
```

- The first line tells the system which program use to run the script.
 - The other lines describe the commands to be performed.
- To execute the script:

```
user@localhost:~$ bash MyScript
```

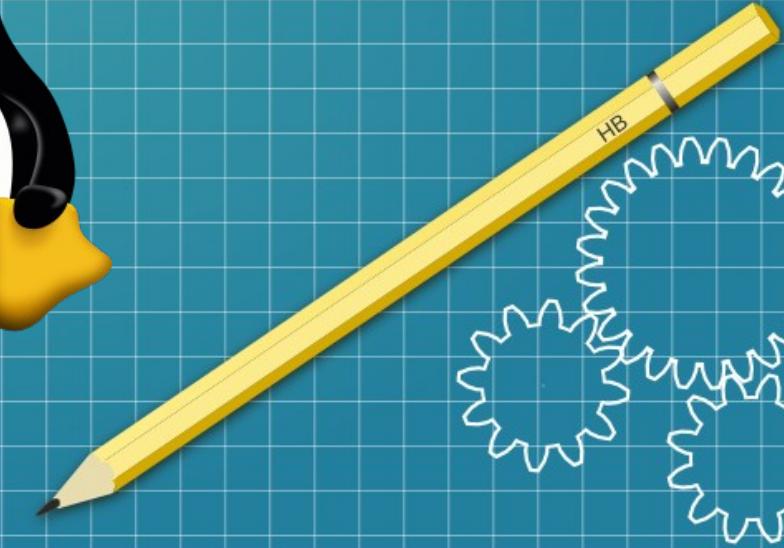
or

```
user@localhost:~$ chmod 755 MyScript
user@localhost:~$ ./MyScript
```

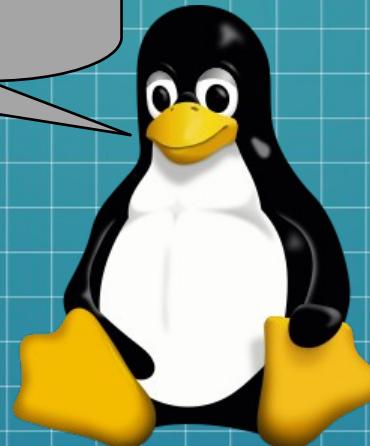
The file `~/.bashrc`

- Configuration file that BASH reads every time a shell starts
- BASH then executes the commands in `~/.bashrc`

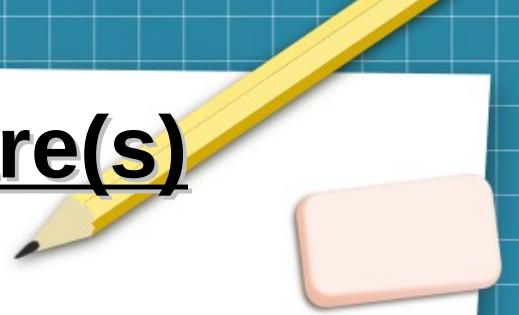
```
# Modifying the PATH environment variable:  
PATH=$PATH:~/bin  
  
# Creating aliases, using: alias name='what to do'  
  
alias ll='ls -lh'  
alias lla='ls -lha'  
  
alias rm='rm -i'  
  
alias grep='grep --color=always'
```



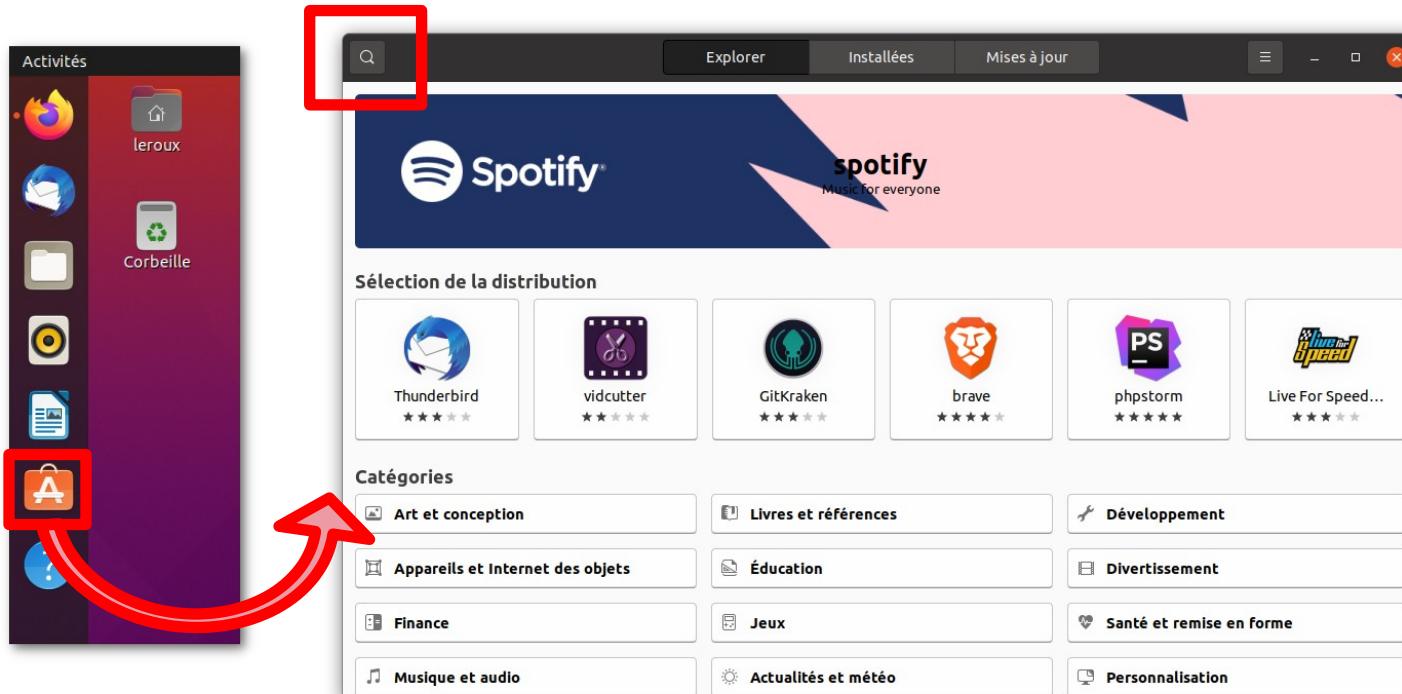
```
#!/bin/bash  
echo "Questions ?"
```



U. 2[0-2].04 LTS: Install software(s)



Using “Ubuntu Software”



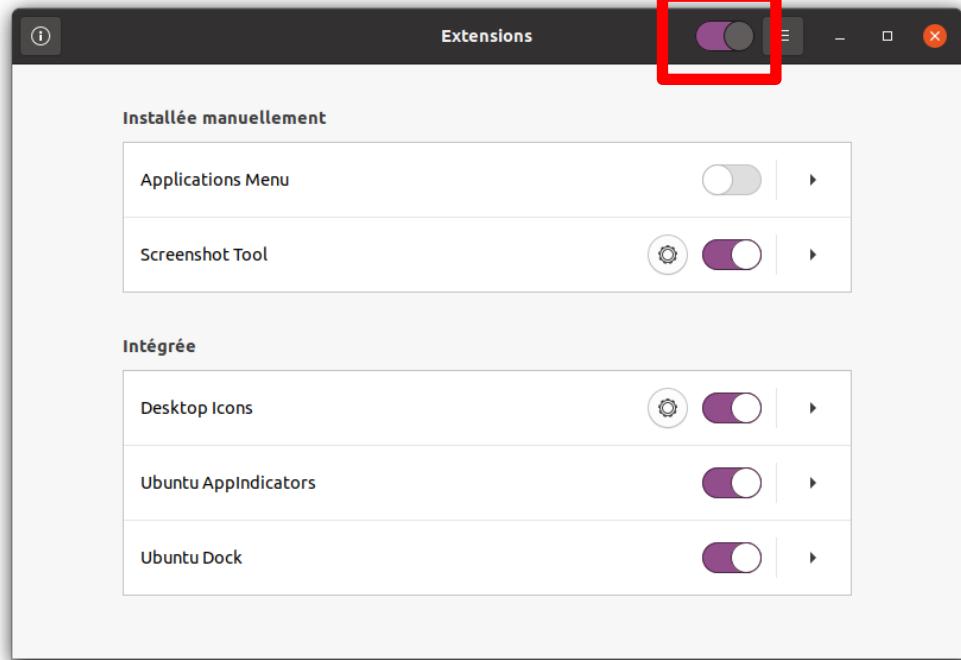
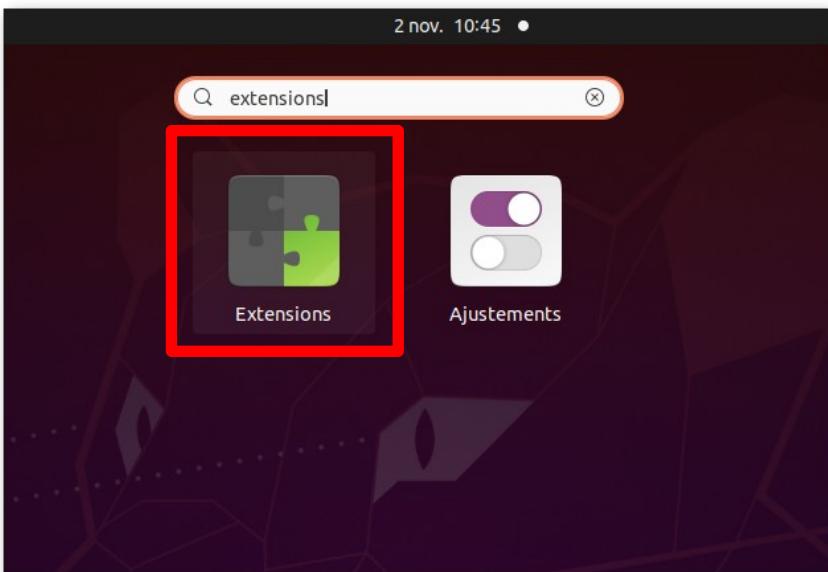
Terminal command: **snap-store**

U. 20.04 LTS: GNOME Extras



- Extension preferences (gnome-shell-extension-prefs)

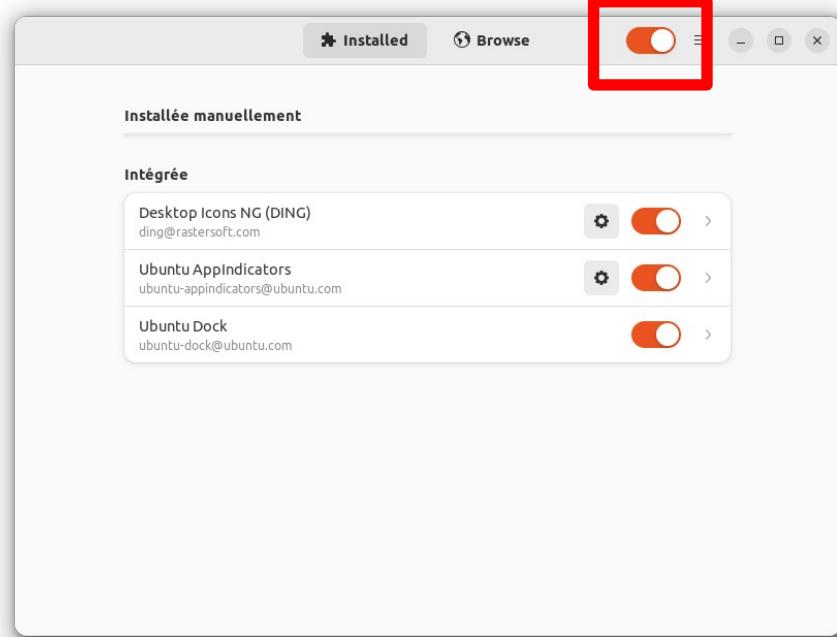
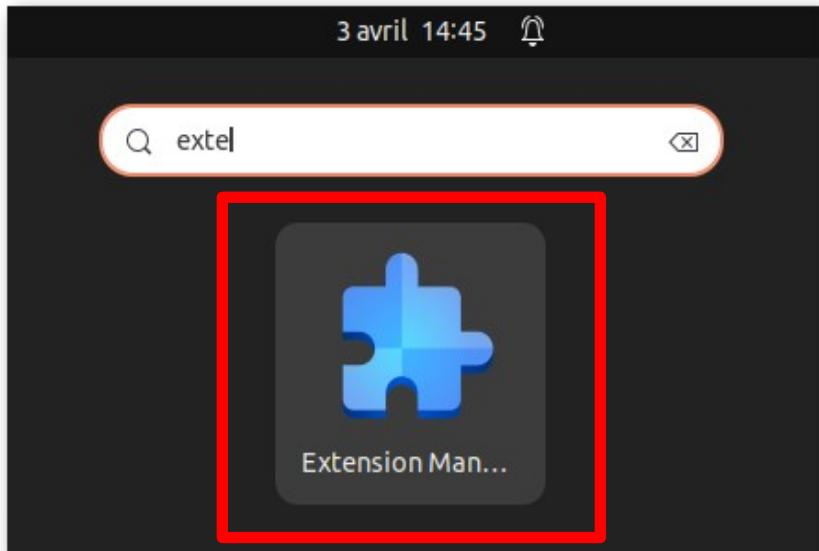
```
$ sudo apt install gnome-shell-extension-prefs
```



U. 22.04 LTS: GNOME Extras

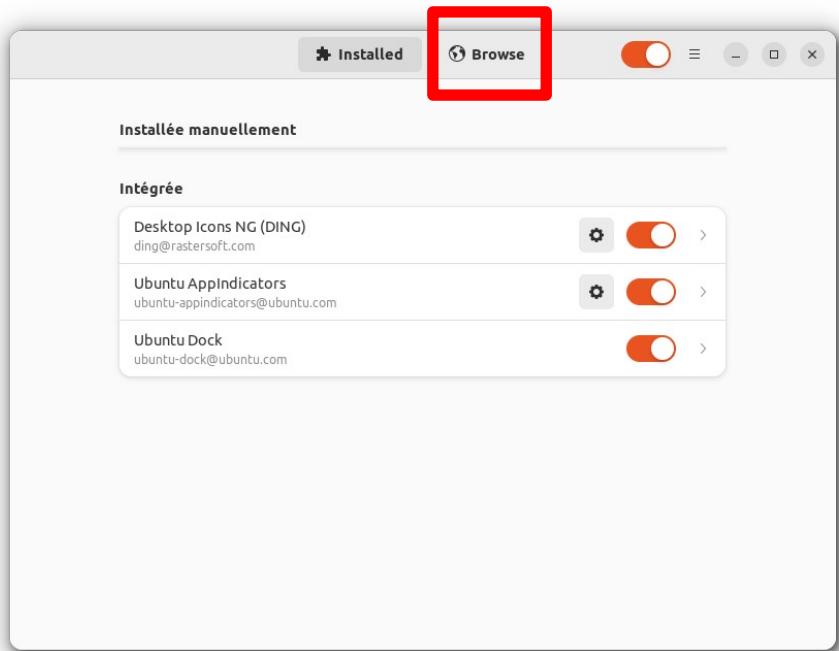
- Extension manager (gnome-shell-extension-manager)

```
$ sudo apt install gnome-shell-extension-manager
```



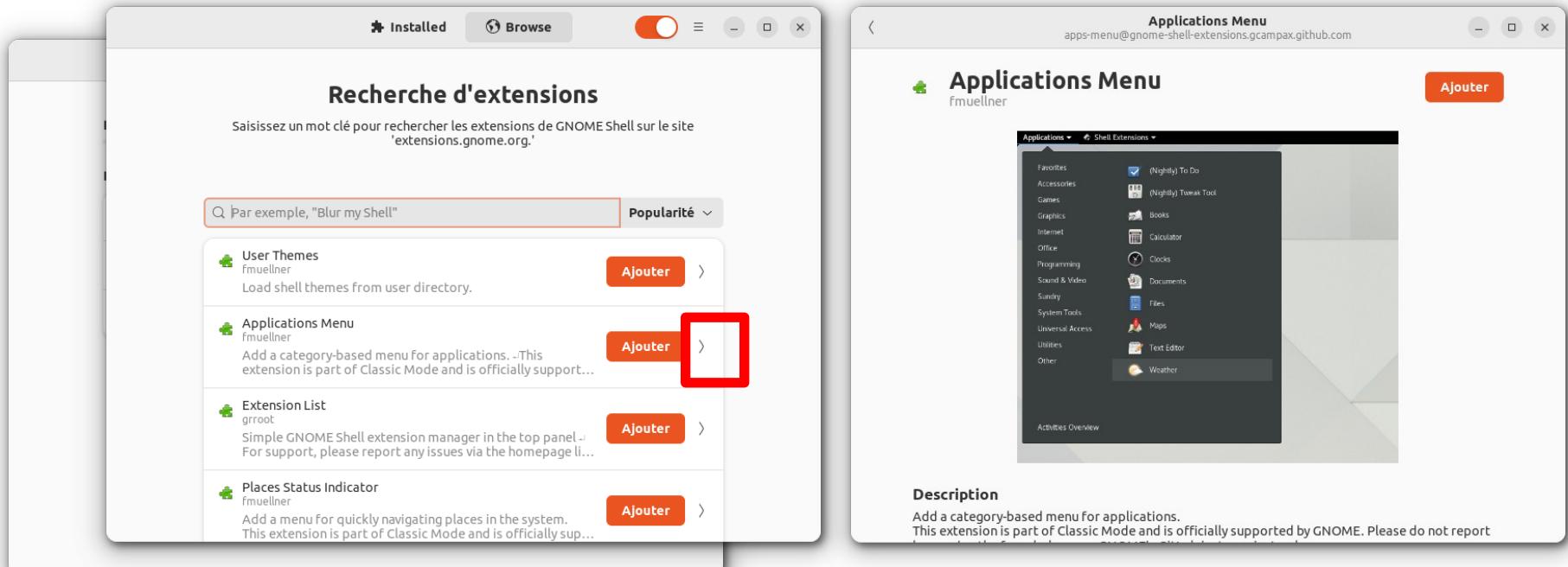
U. 22.04 LTS: GNOME™ Extras

- Extension manager (\$ **extension-manager**)



U. 22.04 LTS: GNOME Extras

- Extension manager (\$ extension-manager)



U. 20.04 LTS: GNOME Extras

- Gnome-shell extensions: <https://extensions.gnome.org/>

