

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

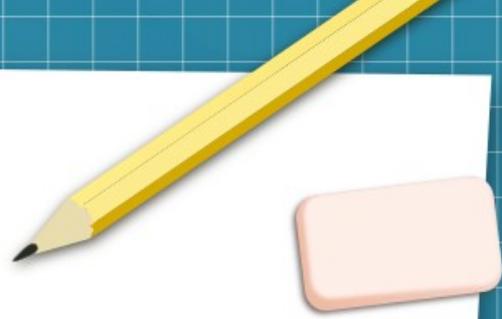
- Desktop PC, laptop PC
- Pad, smartphone
- TV, game console

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

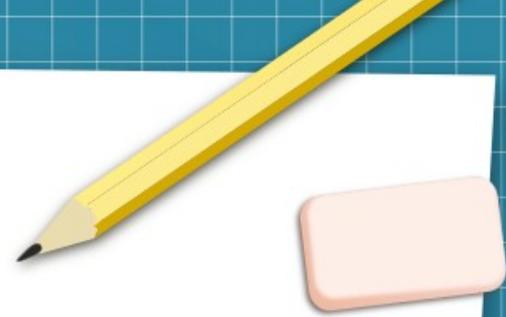
The 4 Essential Freedom of Software



- | | |
|---|------------------|
| 0) The freedom to use a software | « Execution » |
| 1) The freedom to copy a software | « Distribution » |
| 2) The freedom to study a software | « Source code » |
| 3) 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 **0)**
- Free : **0)**, and/or **1)** and/or **2)** and/or **3)**

... 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.

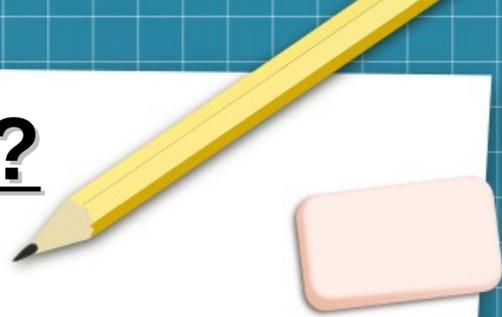
Open source software licences : GPL, BSD, Apache, Creative commons

Proprietary software



- Proprietary = someone owns the software (**not you**) and sells you access to some of the 4 Freedoms, usually only **0)**

Hack proprietary software ?



- ~~That is wrong bouuuuuuhhhhh~~
- 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 ? ...

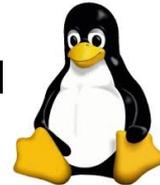
Open Source Software



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 Torvald**
- **2004** : Open source software officially enter UNESCO world heritage



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Famous Open Source Software



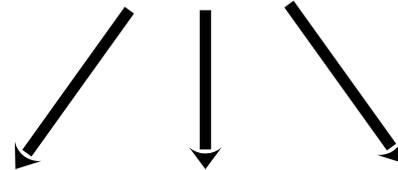
Operating System

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

- Short name « **OS** », **S**ystème d'**E**xploitation « **SE** »



UNIX[®]

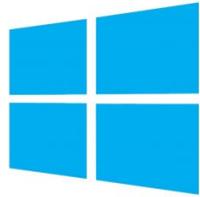


BSD

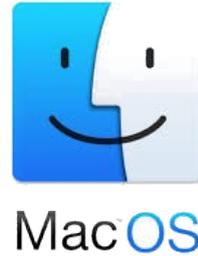
Operating Systems ?!



Android: 40.5%



Windows: 34.2%



Mac OS



iOS

OSX+iOS: 22.3%



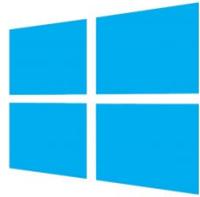
Linux: 1%

Proportion of each OS **all devices** considered

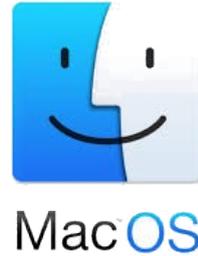
Operating Systems ?!



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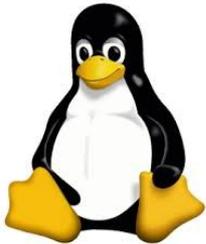
OSX+iOS: 22.3%



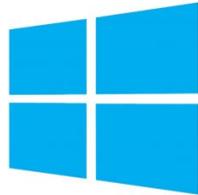
Linux: 1%

Proportion of each OS **all devices** considered

The Operating System !



Linux: 41.5%



Windows: 34.2%



Mac OS



iOS

OSX+iOS: 22.3%

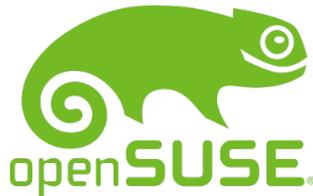
Proportion of each OS **all devices** considered

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

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Up to 20 000 !!!



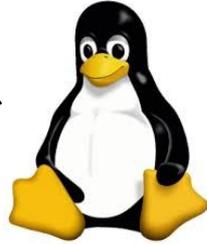
GNU components



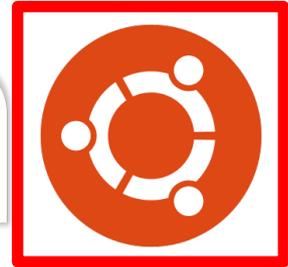
Linux Distributions

Red Hat Package Manager
“.rpm”

Debian Package Manager
“.deb”

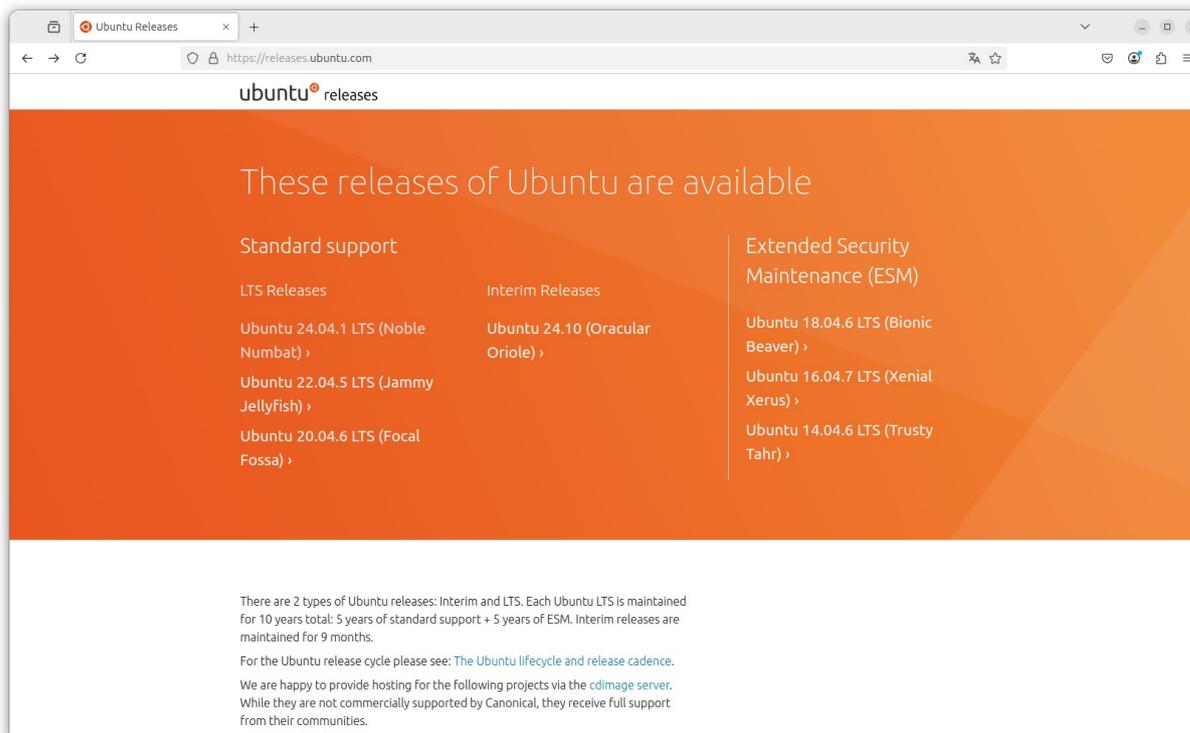


Sources Codes
“.tar.gz” or “.tar.bz2”



Linux Distribution: Which One ?

- Ubuntu is the best choice for beginners !



<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



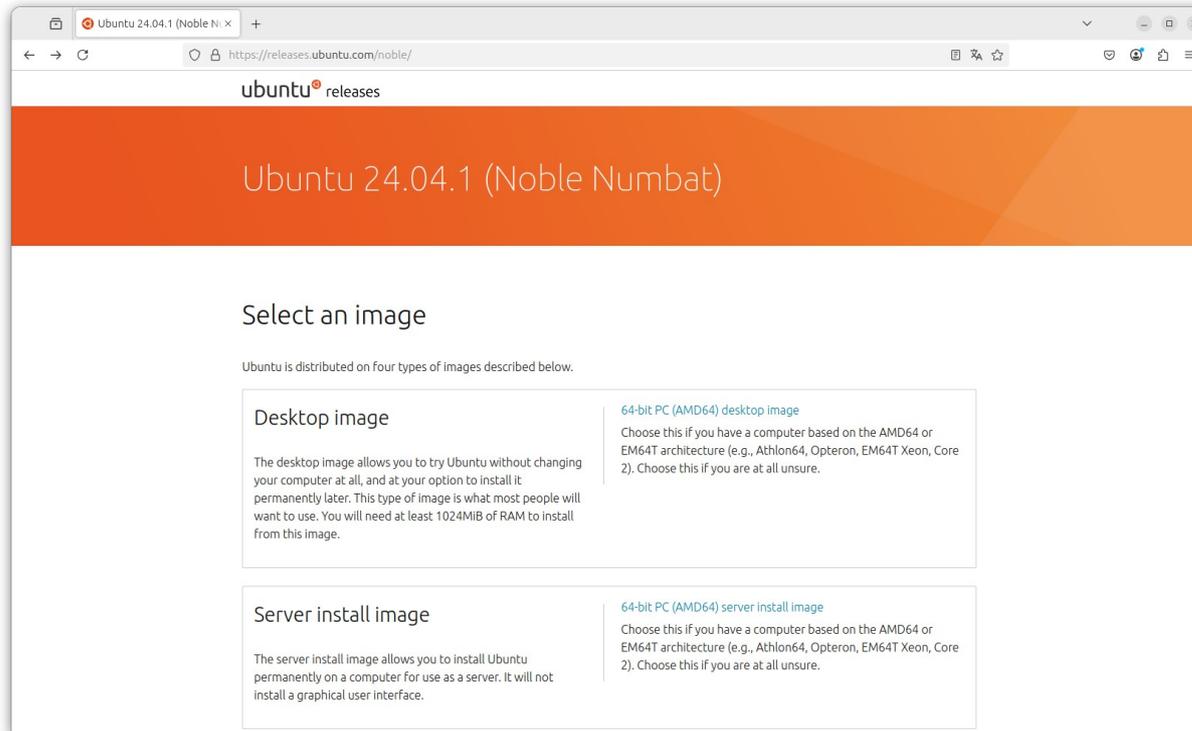
Year



Month

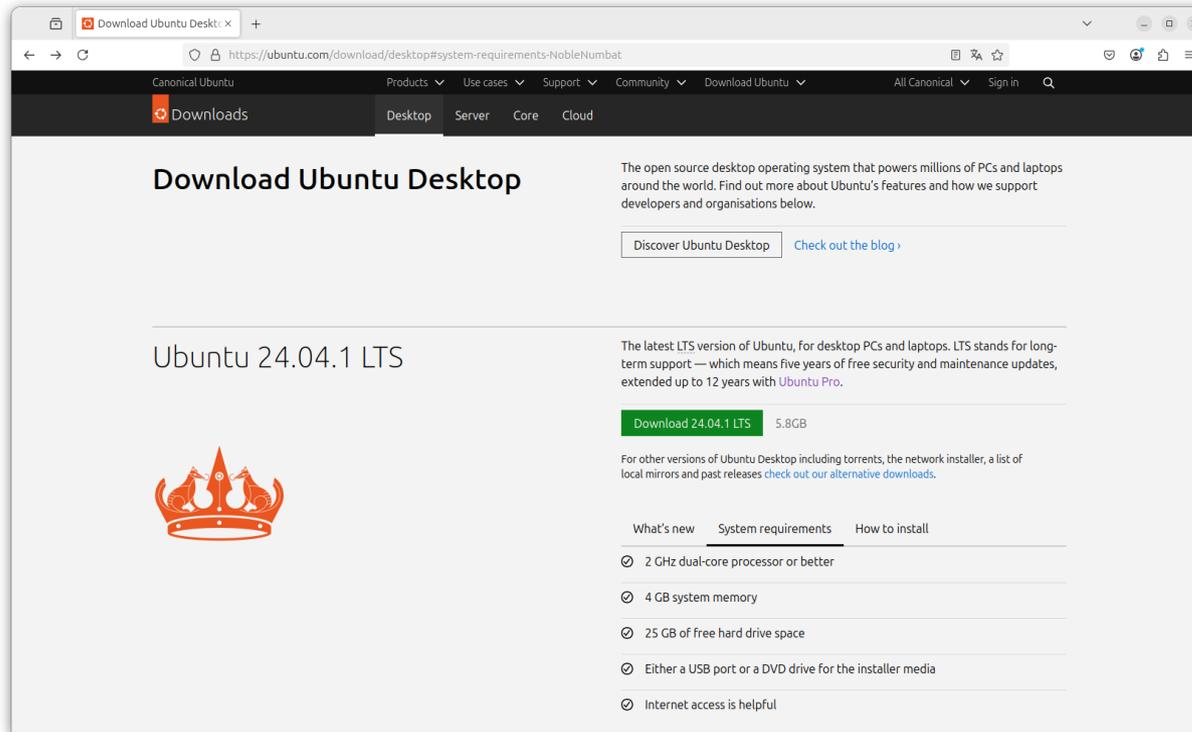
Linux Distribution: Ubuntu 24.04.1 LTS

- Code name “Noble Numbat”



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

Linux Distribution: Ubuntu 24.04.1 LTS



The screenshot shows the Ubuntu website's download page for the desktop version. The browser address bar shows the URL: <https://ubuntu.com/download/desktop#system-requirements-NobleNumbat>. The navigation menu includes 'Downloads', 'Desktop', 'Server', 'Core', and 'Cloud'. The main heading is 'Download Ubuntu Desktop'. Below this, there is a description of Ubuntu as an open-source desktop operating system, followed by buttons for 'Discover Ubuntu Desktop' and 'Check out the blog'. The section for 'Ubuntu 24.04.1 LTS' features the Ubuntu logo (a crown with two birds) and a 'Download 24.04.1 LTS' button indicating a 5.8GB size. Below this, there are links for 'What's new', 'System requirements', and 'How to install'. The system requirements are listed as follows:

- 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 ?

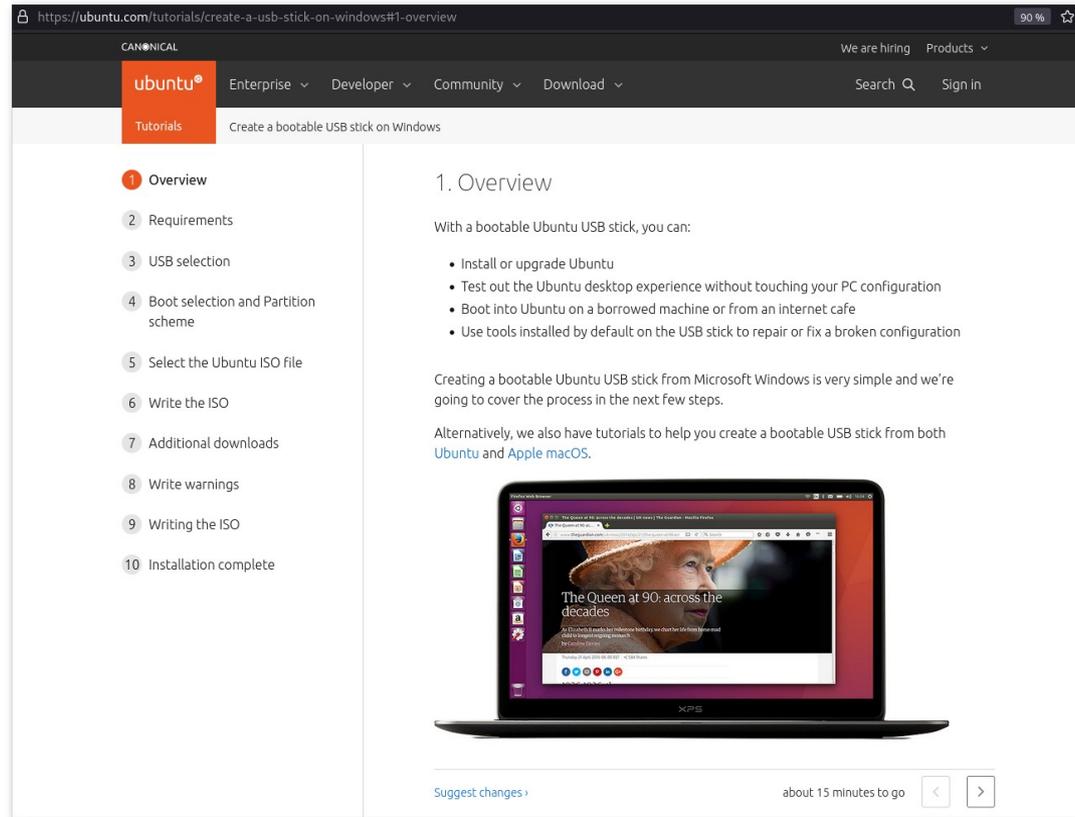
- **Live test:** no risk for your hard drive: **that's the easy way !**



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 We are hiring Products

ubuntu Enterprise Developer Community Download Search Sign in

Tutorials Create a bootable USB stick on Windows

- 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](#).

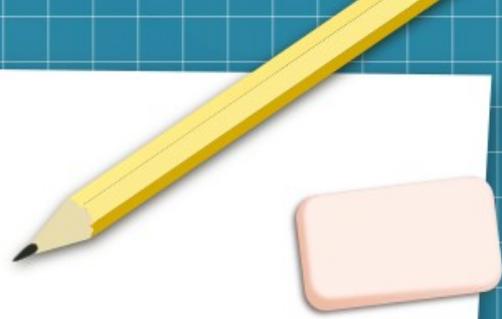


Suggest changes about 15 minutes to go

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

S

Linux Fundamentals

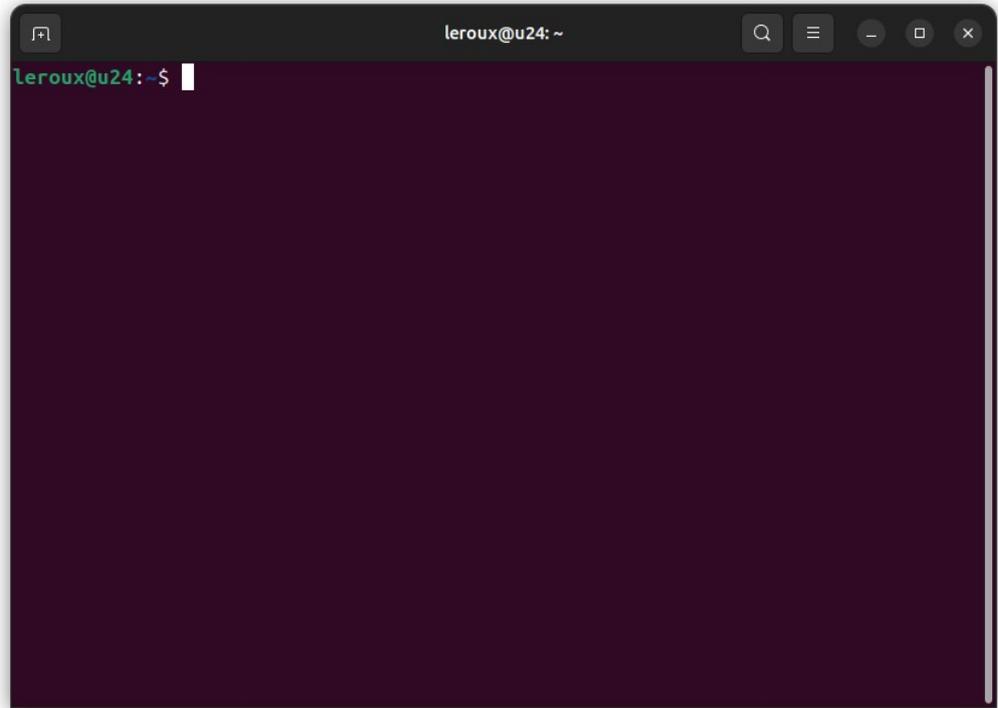


- The Terminal
- File System
- Users
- File Permissions
- Tips

Linux Fundamentals: The Terminal



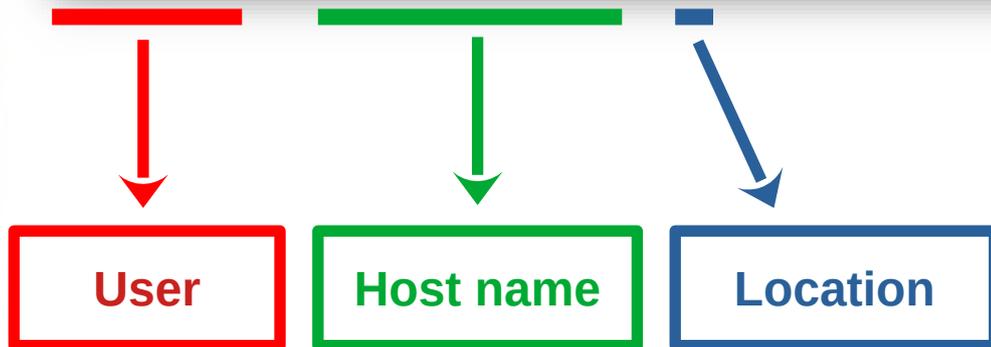
- Text interface to your computer
- Often referred as
 - Shell
 - Console
 - Prompt
 - Bash ...



Linux Fundamentals: The Terminal

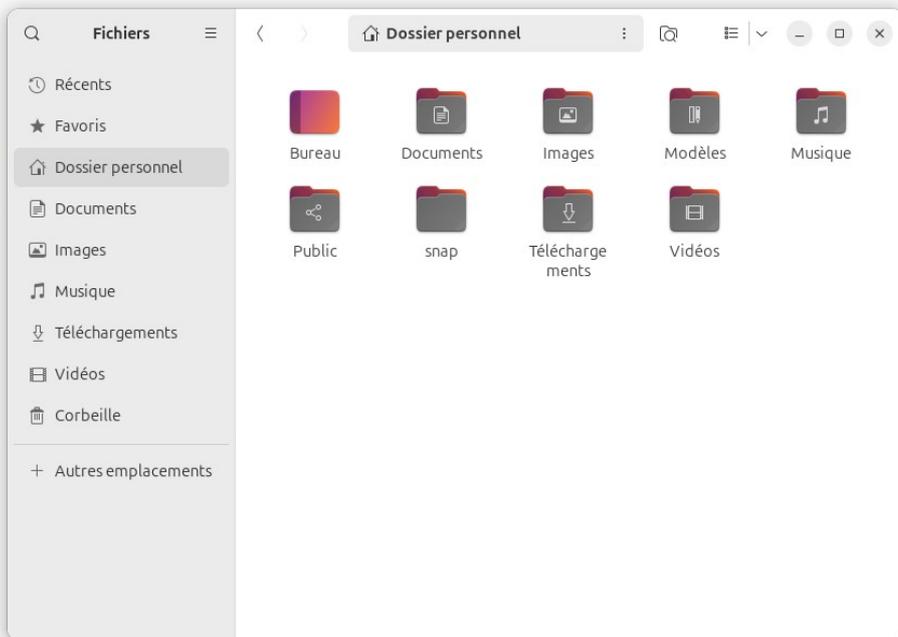
- The “Prompt” or “Invite de commandes”

```
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: ~  
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

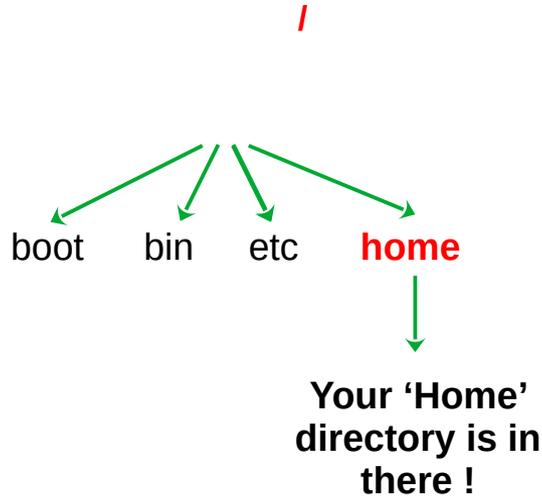
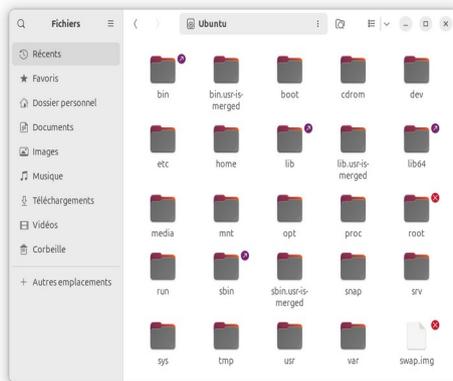
- Letters for the hard drive(s):
...
- Your 'Home' directory:
`Users\leroux`

C:\, D:\, E:\

C:

- Linux

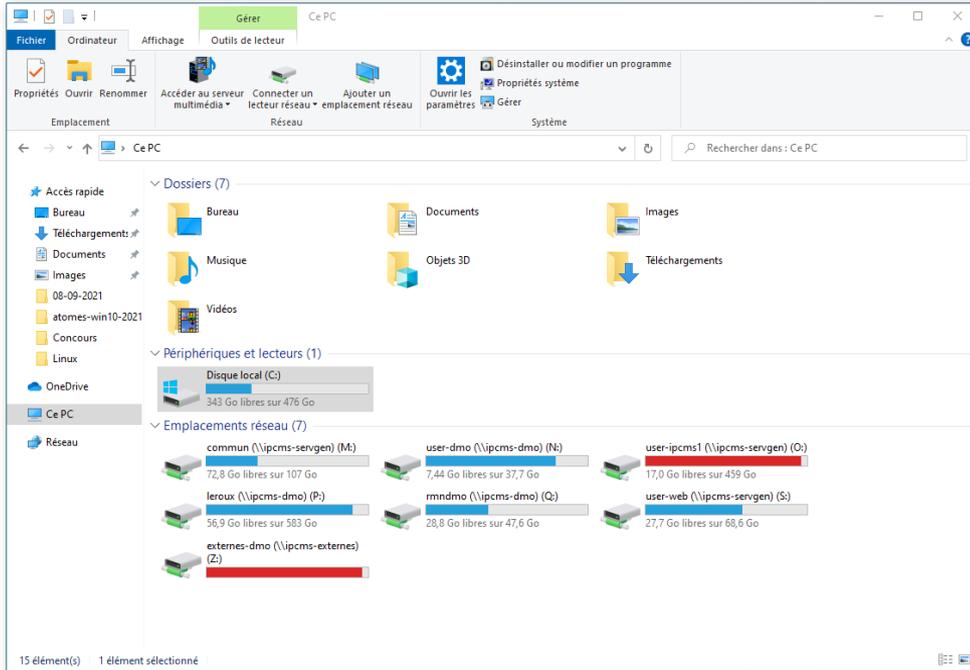
- A single tree-view:



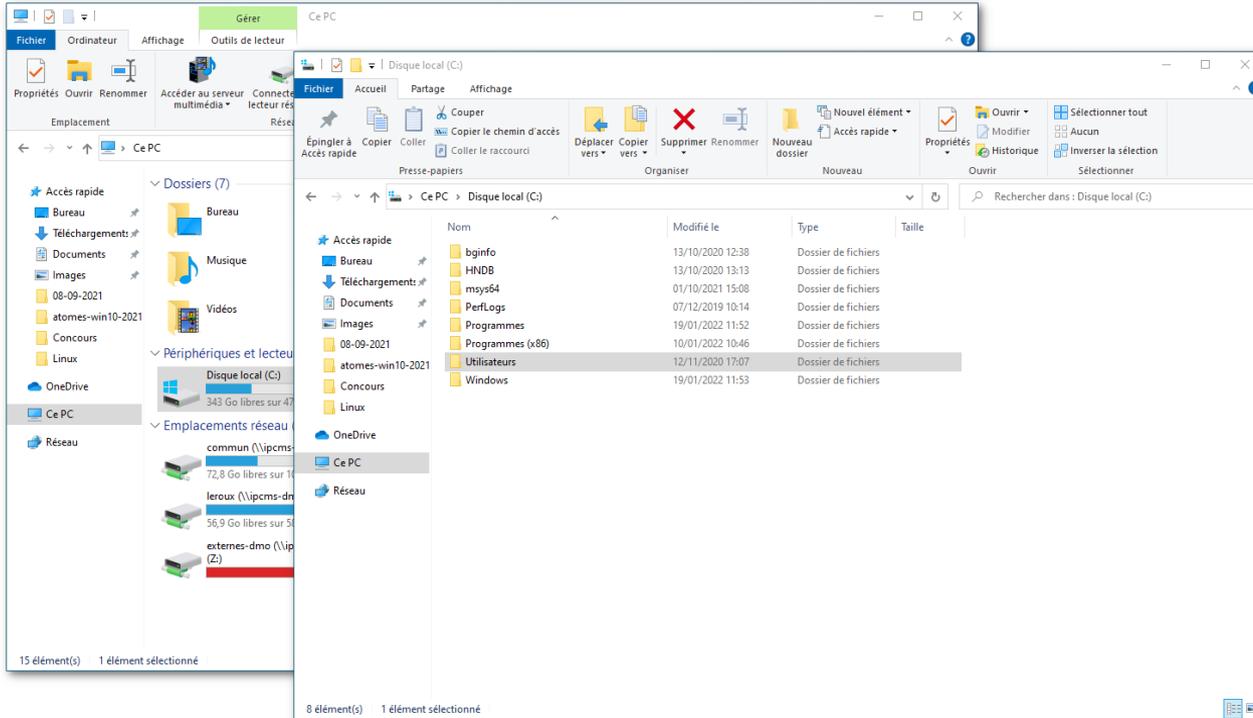
“Everything is a File”

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

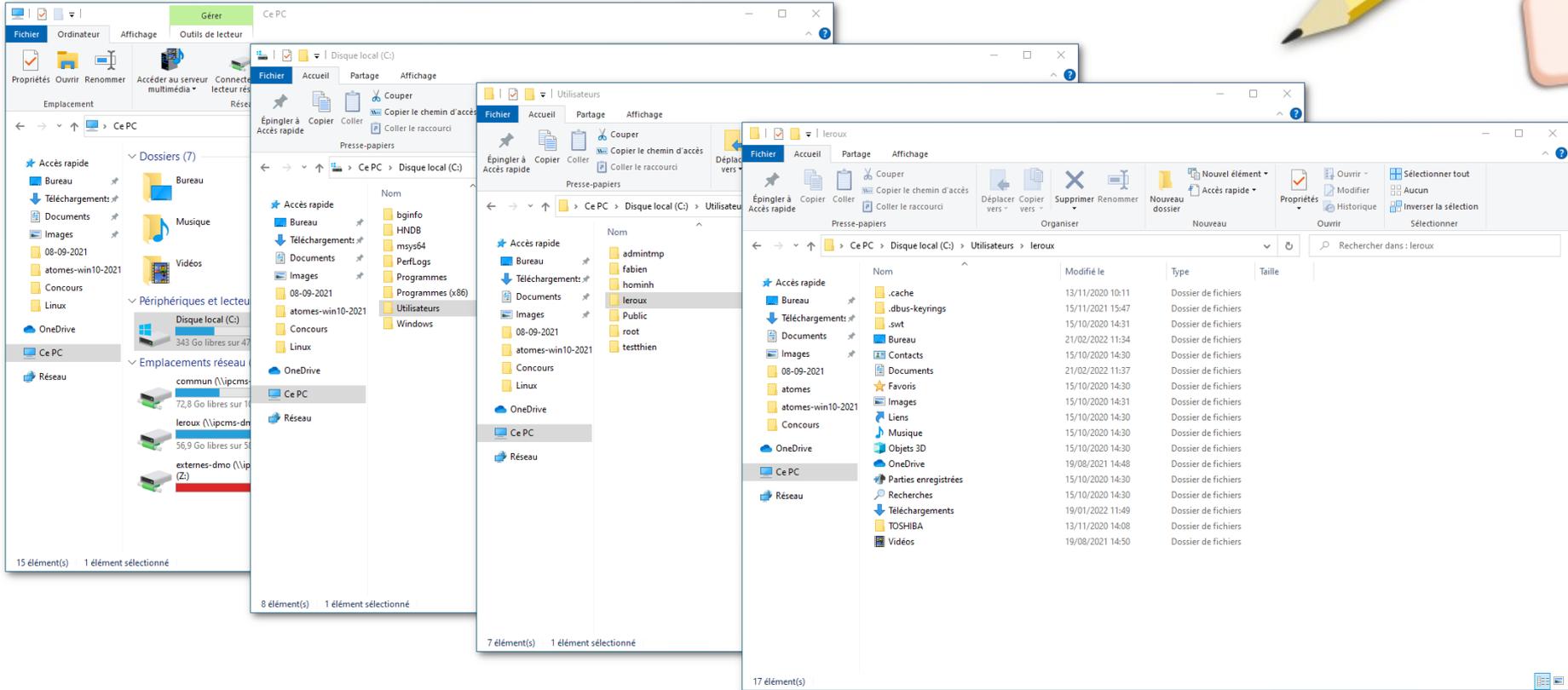
The image displays three overlapping Windows File Explorer windows illustrating the file system structure:

- Top-left window:** Shows the 'Ce PC' view with the left sidebar expanded to 'Emplacements réseau'. It lists network locations like 'commun (\\ipcms...)', '72,8 Go libres sur 1...', 'leroux (\\ipcms-dn...)', '56,9 Go libres sur 5...', and 'externes-dmo (\\lip... (Z))'.
- Middle window:** Shows the 'Disque local (C:)' view with the left sidebar expanded to 'Dossiers (7)'. It lists folders such as 'Bureau', 'Téléchargements', 'Documents', 'Images', '08-09-2021', 'atomes-win10-2021', 'Concours', 'Linux', 'Périphériques et lecteurs', 'Disque local (C:)', 'OneDrive', 'Ce PC', and 'Réseau'.
- Bottom-right window:** Shows the 'Utilisateurs' view under 'Disque local (C:)'. It displays a table of user profiles:

Nom	Modifié le	Type	Taille
admintmp	14/10/2020 09:32	Dossier de fichiers	
fabien	12/11/2020 17:07	Dossier de fichiers	
hominh	14/10/2020 15:11	Dossier de fichiers	
leroux	13/11/2020 14:08	Dossier de fichiers	
Public	13/10/2020 12:23	Dossier de fichiers	
08-09-2021	13/10/2020 11:04	Dossier de fichiers	
atomes-win10-2021	13/10/2020 13:23	Dossier de fichiers	
Concours			
Linux			
OneDrive			
Ce PC			
Réseau			

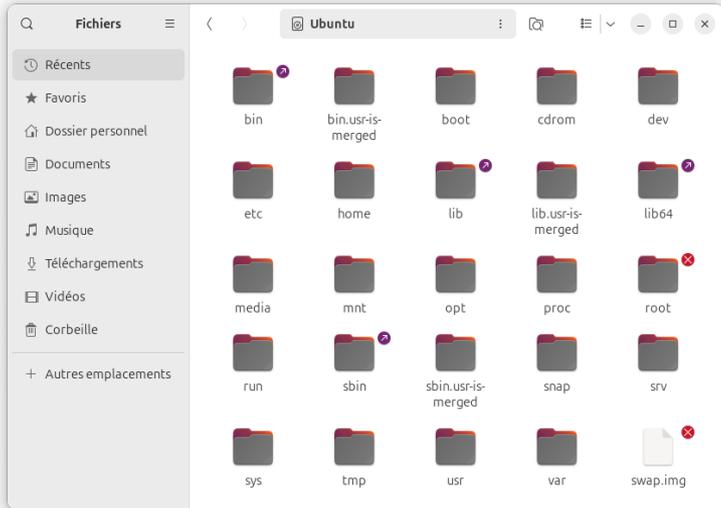


File system: windows

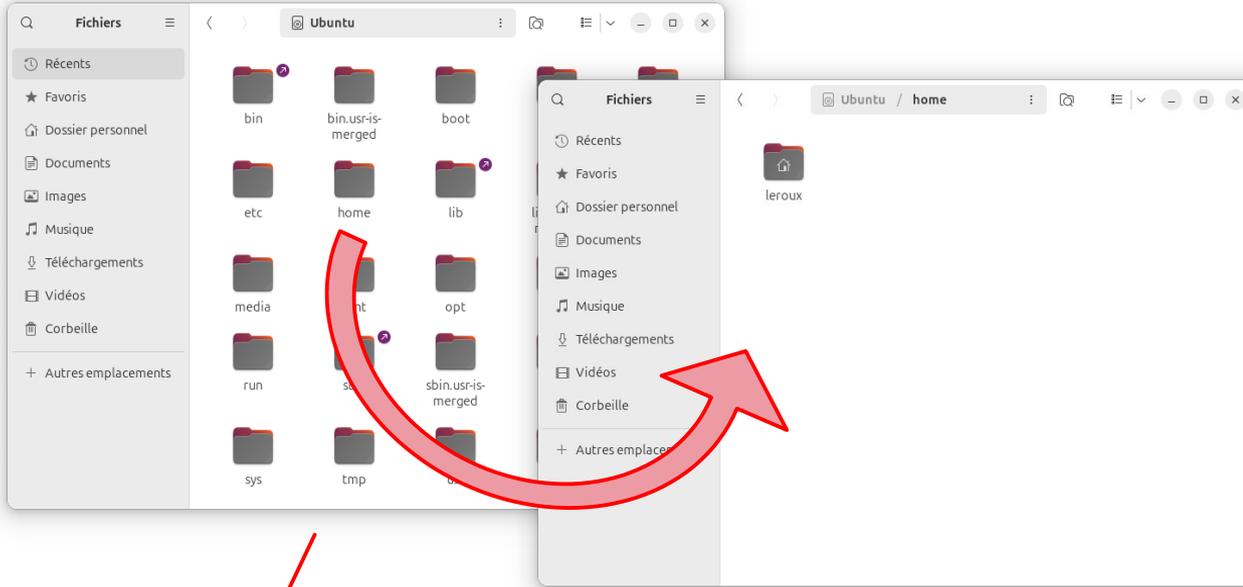


C:\Utilisateurs\leroux\

Linux Fundamentals: File System



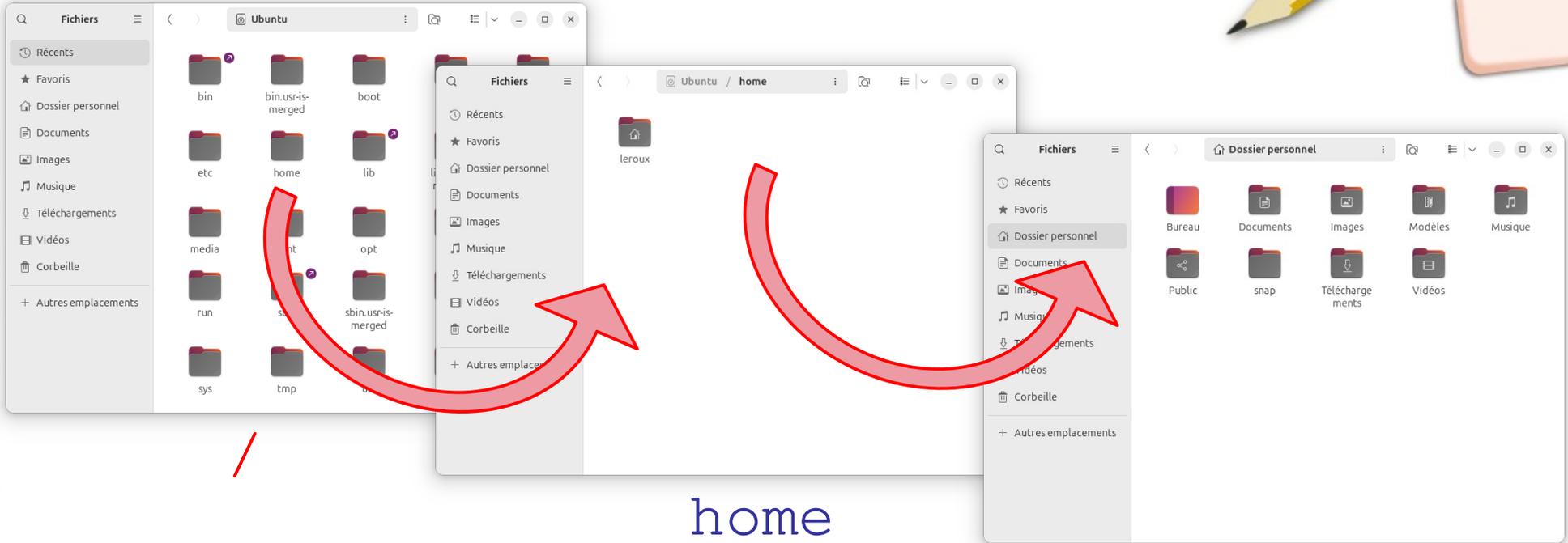
Linux Fundamentals: File System



home



Linux Fundamentals: File System

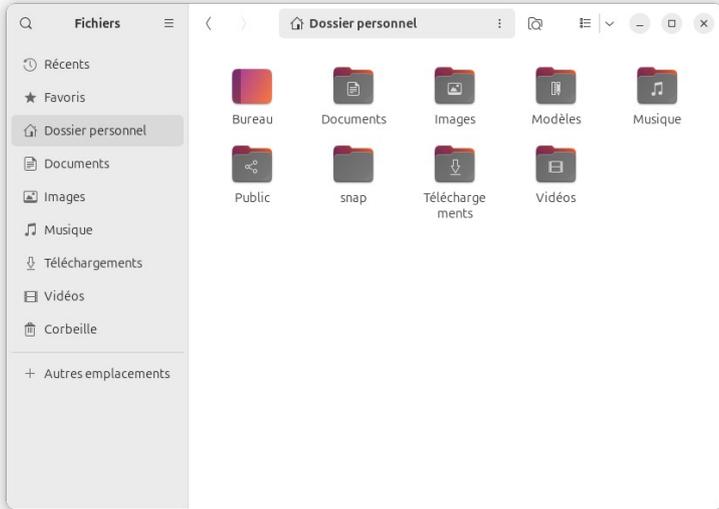


home

leroux

`/home/leroux`

Linux Fundamentals: File System

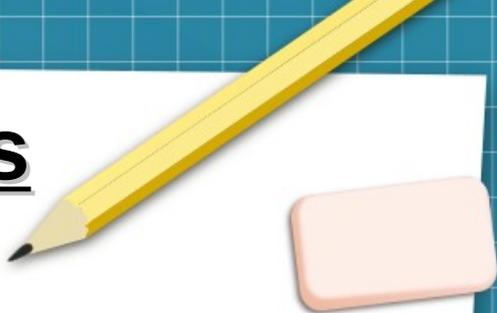


= /home/leroux

/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



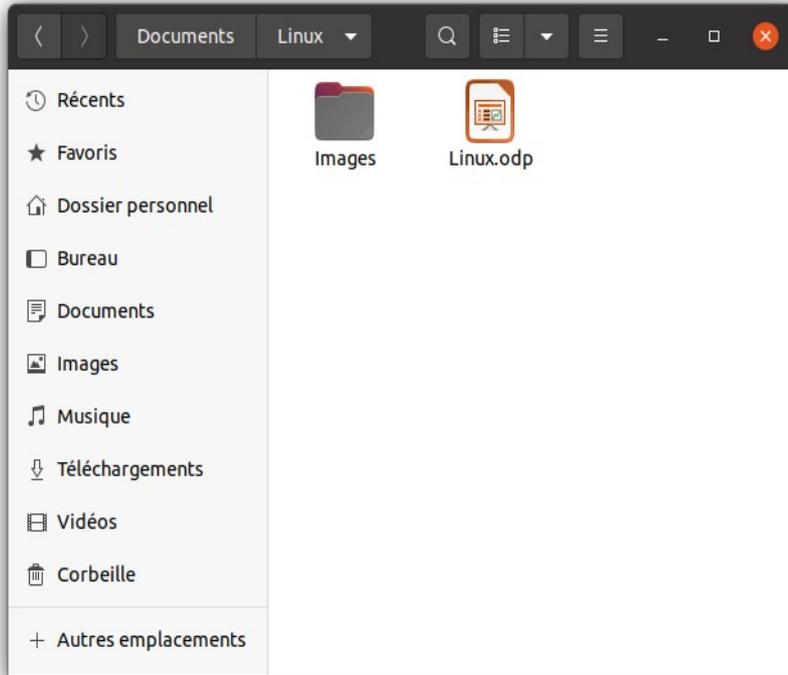
- The **Administrative (root)** “optional”
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- The “**sudoers**” for “**super user do**”-users
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 - When using the **sudo** command **sudoers** are required to confirm their identity by entering their 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



=

```
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

- 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
leroux@chess-u20:~/Documents/Linux$ ls -l
total 15108
drwxrwxr-x 2 leroux dmo      4096
-rw-r--r-- 1 leroux dmo 15463386
leroux@chess-u20:~/Documents/Linux
```

```
leroux@chess-u20: ~/Documents/Linux
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-rw-r--r-- 1 leroux dmo 15463386 oct. 20 13:55 Linux.odp
leroux@chess-u20:~/Documents/Linux$
```

Linux Fundamentals: File Permissions

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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--

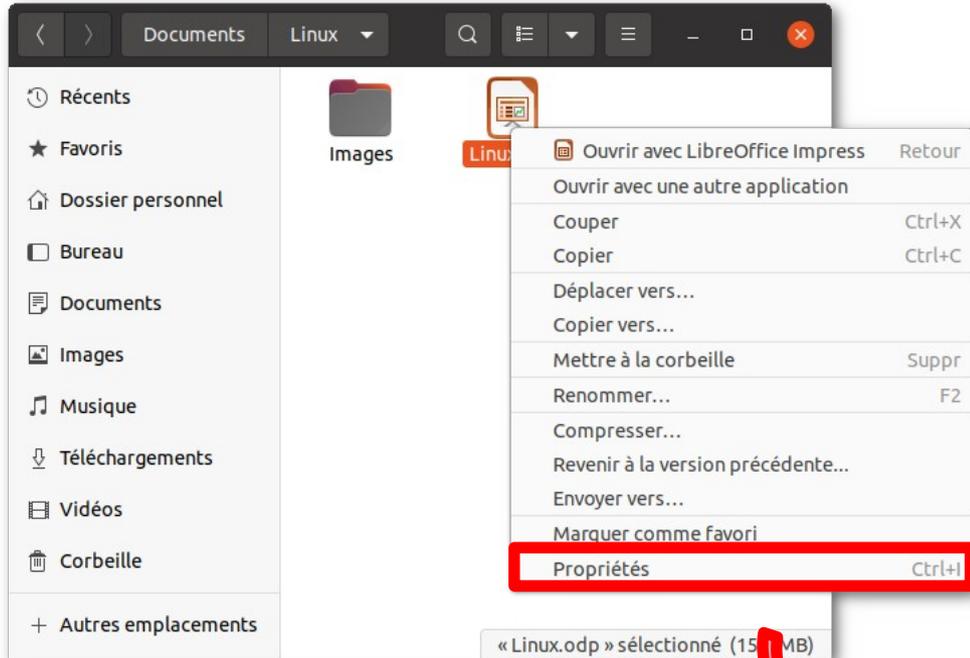
Object

Owner

Group

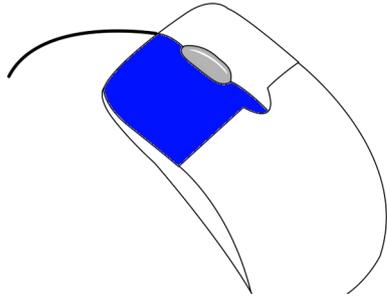
The other user(s)

Linux Fundamentals: File Permissions

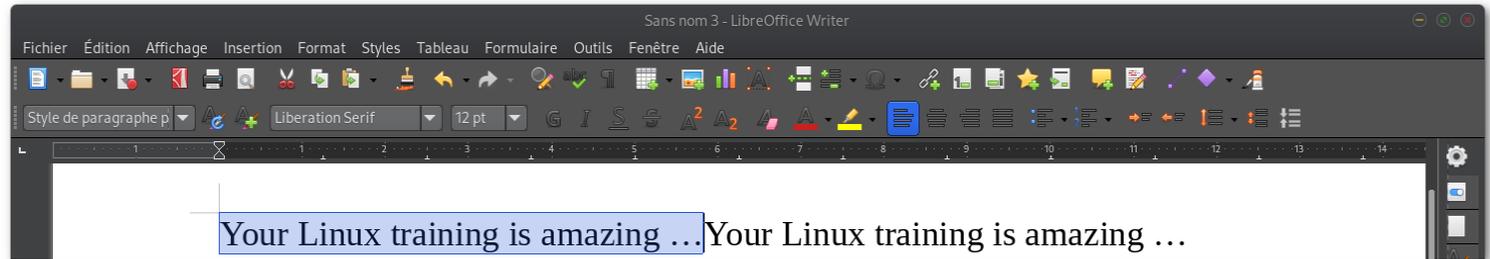
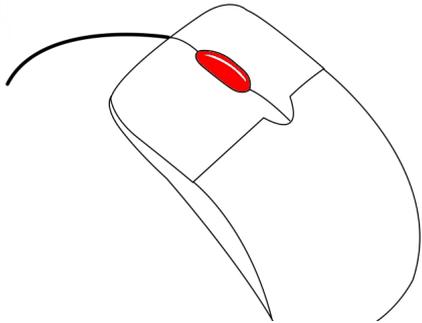


Linux Fundamentals: Mouse

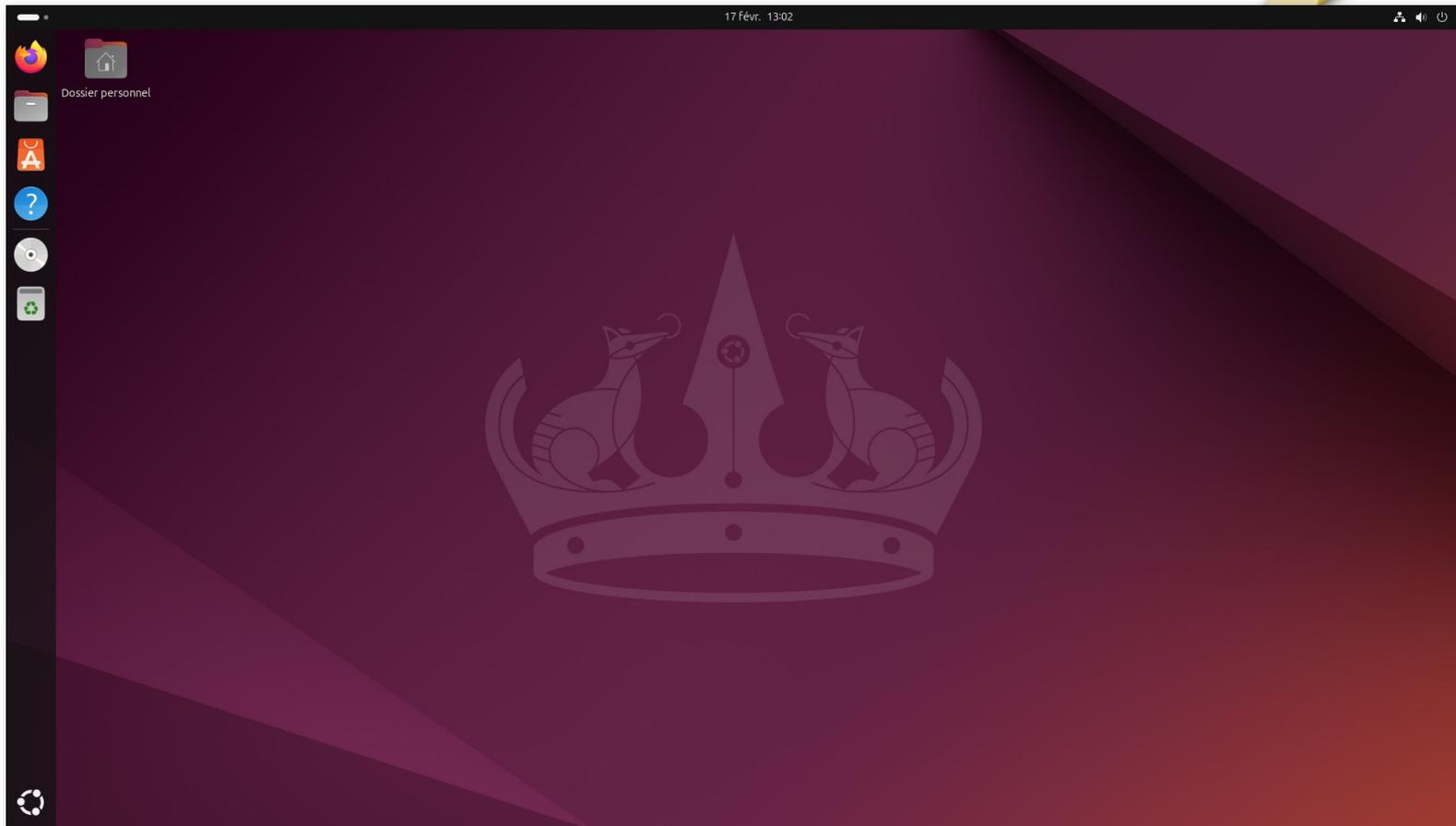
- Text selected using the left click...



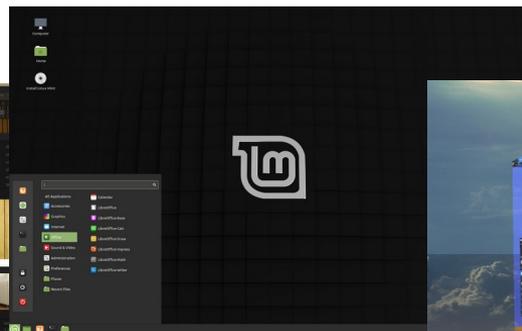
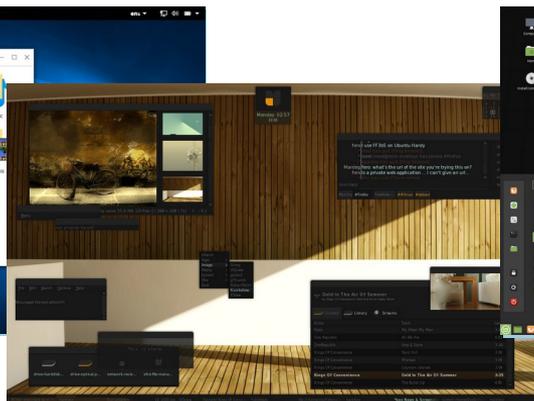
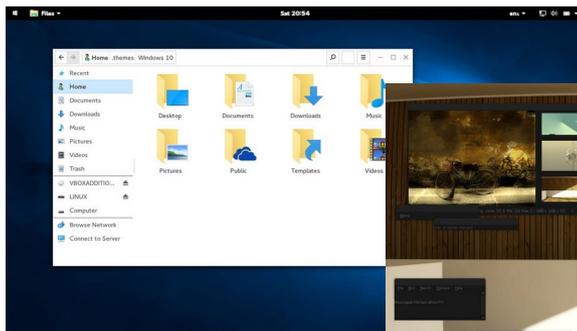
- Is copied, and can be pasted back pressing the 2nd button:



Ubuntu 24.04 LTS



Ubuntu 24.04 LTS



Ubuntu 24.04 LTS: Desktop Environments



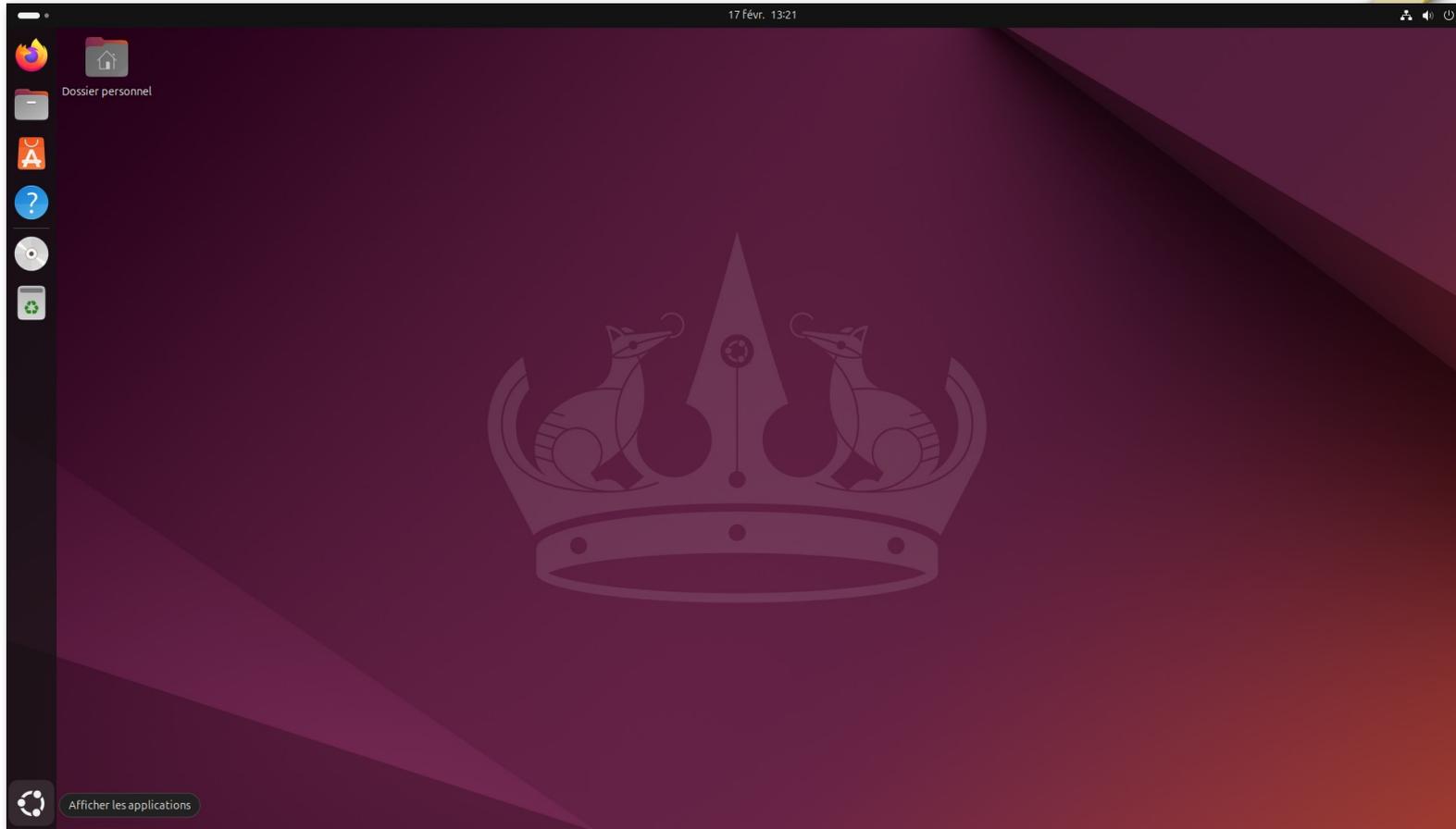
Gnome	https://www.gnome.org/	
KDE	https://kde.org/	
Cinnamon	https://projects.linuxmint.com/cinnamon/	
Xfce	http://www.xfce.org/	
MATE	http://mate-desktop.com/	
LXQt	https://lxqt-project.org/	
Enlightenment	https://www.enlightenment.org/	
Deepin	https://www.deepin.org/	
Pantheon	https://elementary.io/	

Ubuntu 24.04 LTS: Desktop Environments

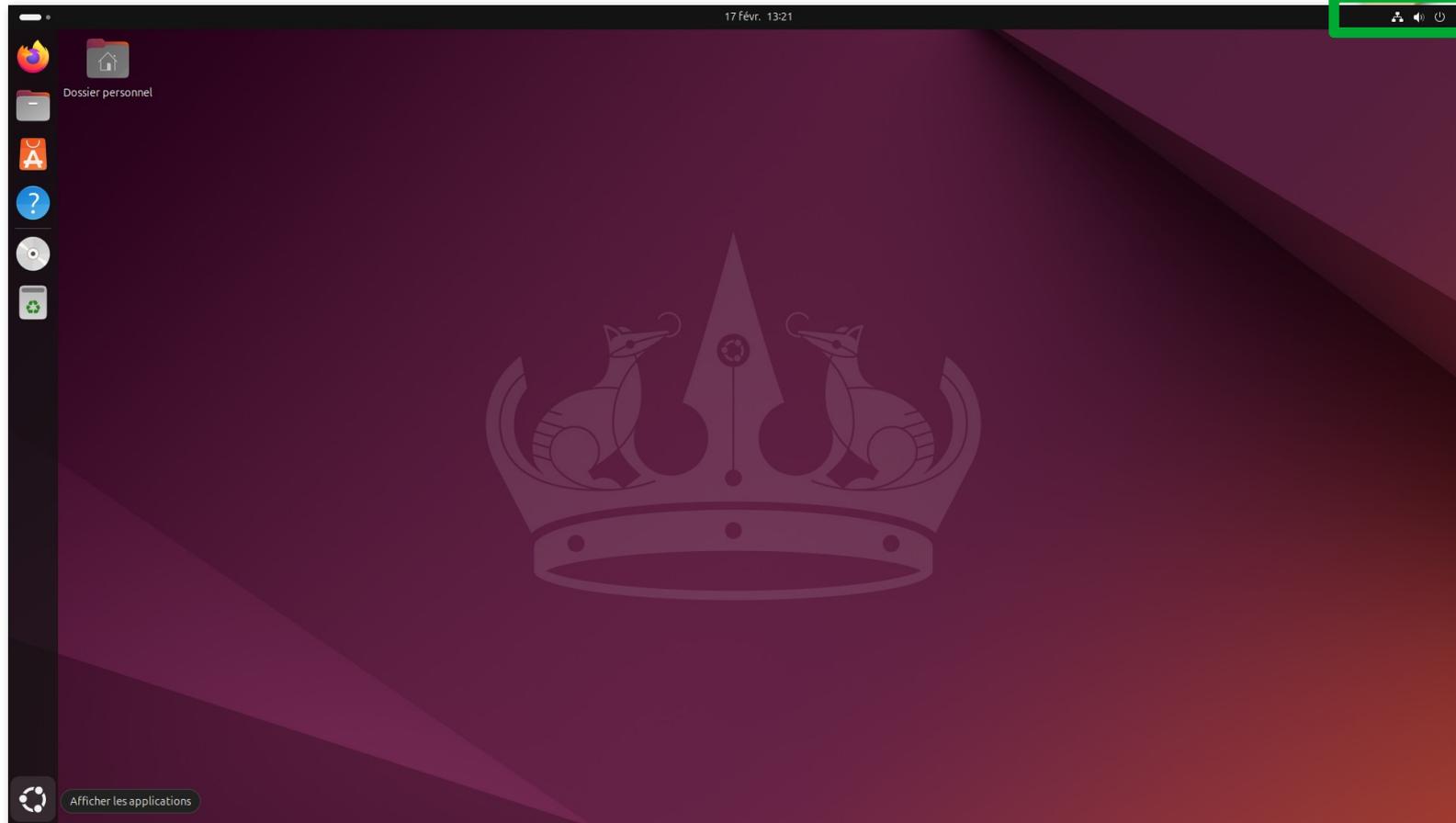


Gnome	https://www.gnome.org/	
KDE	https://kde.org/	
Cinnamon	https://projects.linuxmint.com/cinnamon/	
Xfce	http://www.xfce.org/	
MATE	http://mate-desktop.com/	
LXQt	https://lxqt-project.org/	
Enlightenment	https://www.enlightenment.org/	
Deepin	https://www.deepin.org/	
Pantheon	https://elementary.io/	

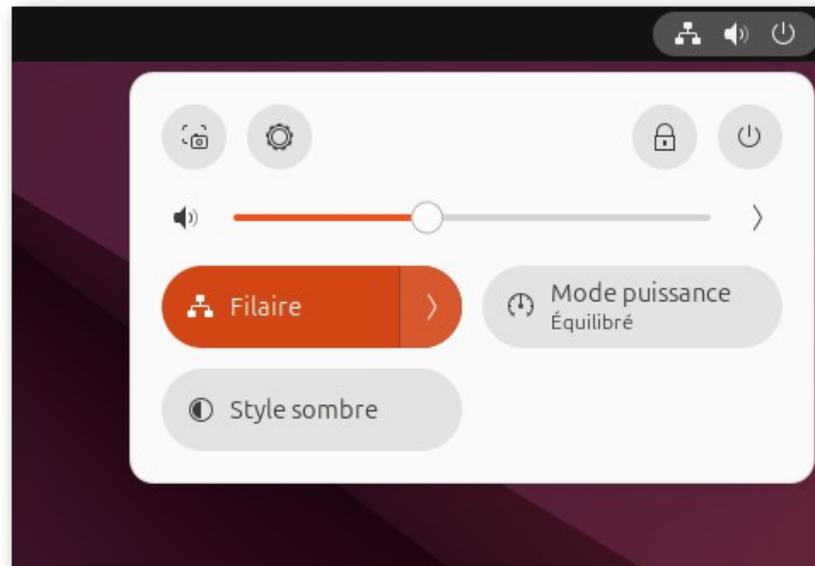
Ubuntu 24.04 LTS



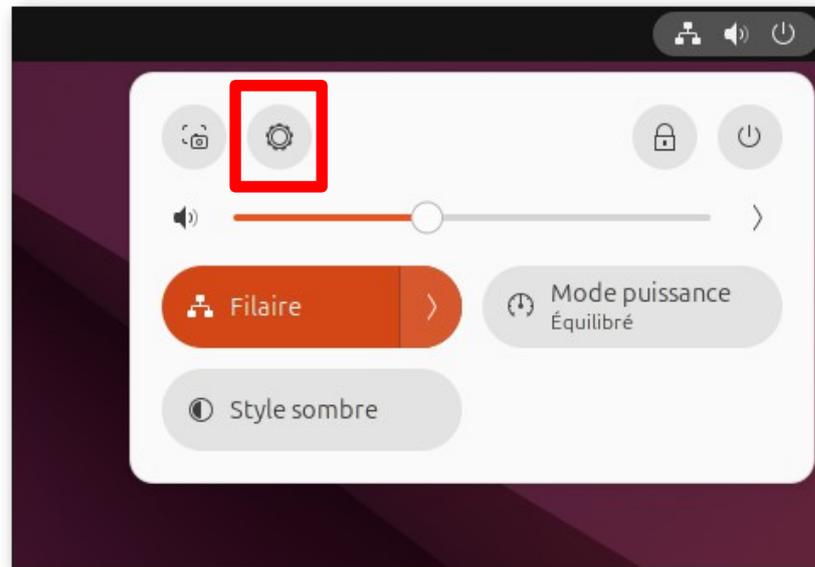
Ubuntu 24.04 LTS



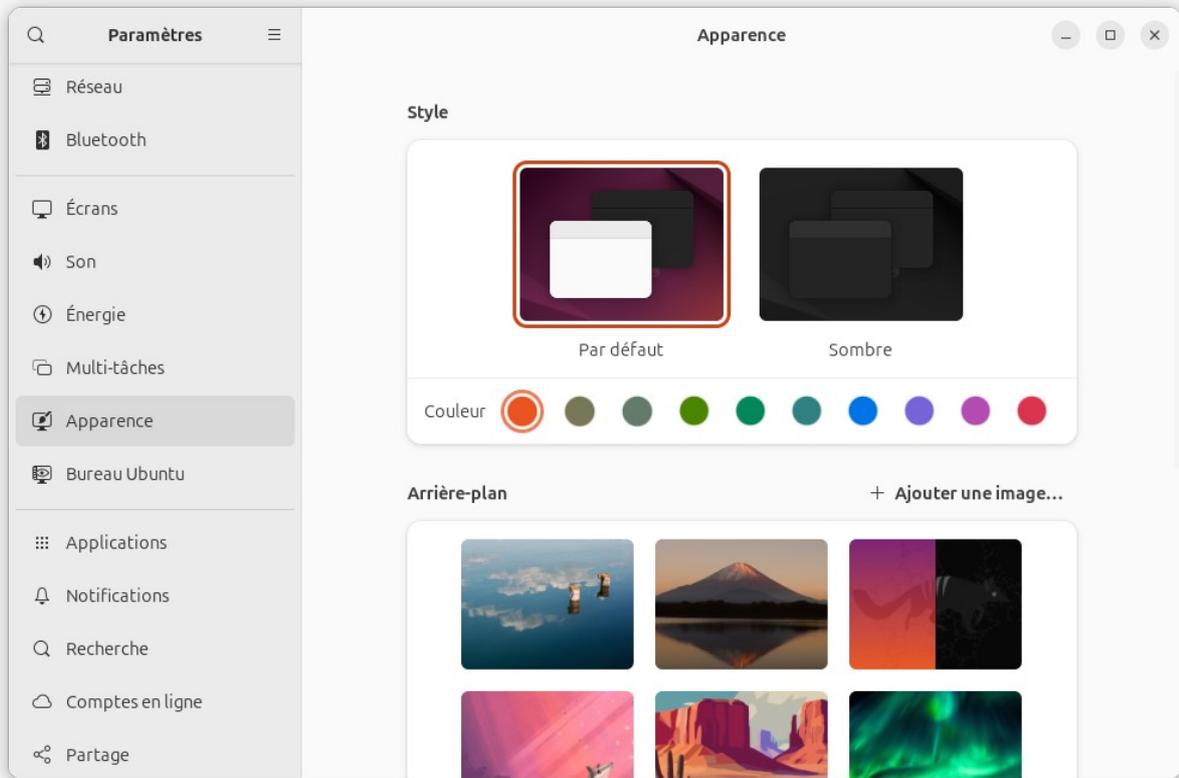
Ubuntu 24.04 LTS: Control Panel



Ubuntu 24.04 LTS: Control Panel



Ubuntu 24.04 LTS: Control Panel



Ubuntu 24.04 LTS: Control Panel



The image displays the Ubuntu 24.04 LTS Control Panel interface. It features three overlapping windows:

- Paramètres (Settings):** The main settings window on the left, with a sidebar menu containing: Réseau, Bluetooth, Écrans, Son, Énergie, Multi-tâches, Apparence, Bureau Ubuntu, Applications, Notifications, Recherche, Comptes en ligne, and Partage.
- Apparence (Appearance):** A window in the middle ground, currently empty.
- Système (System):** The foreground window, showing system-level settings with the following options:
 - Pays et langue:** Langue du système et régionalisation
 - Date et heure:** Paramètres de fuseau horaire et de l'horloge
 - Utilisateurs:** Ajouter et supprimer des comptes utilisateurs, changer des mots de passe
 - Bureau distant:** Autoriser l'utilisation à distance de cet appareil
 - Shell sécurisé:** Accès au réseau par SSH
 - À propos:** Informations matérielles et versions de logiciels
 - Mises à jour logicielles:** Software updates

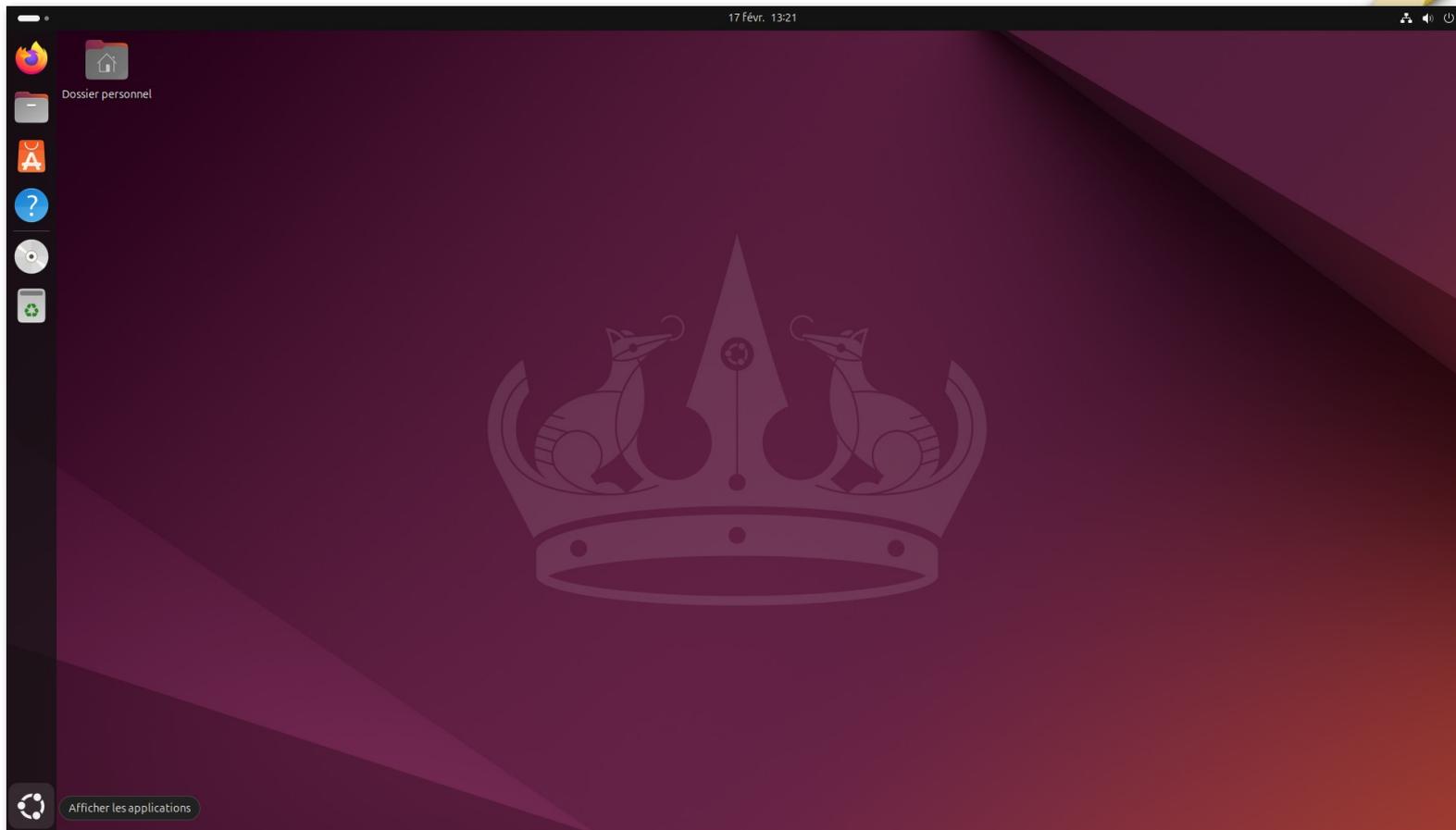
Ubuntu 24.04 LTS: Control Panel



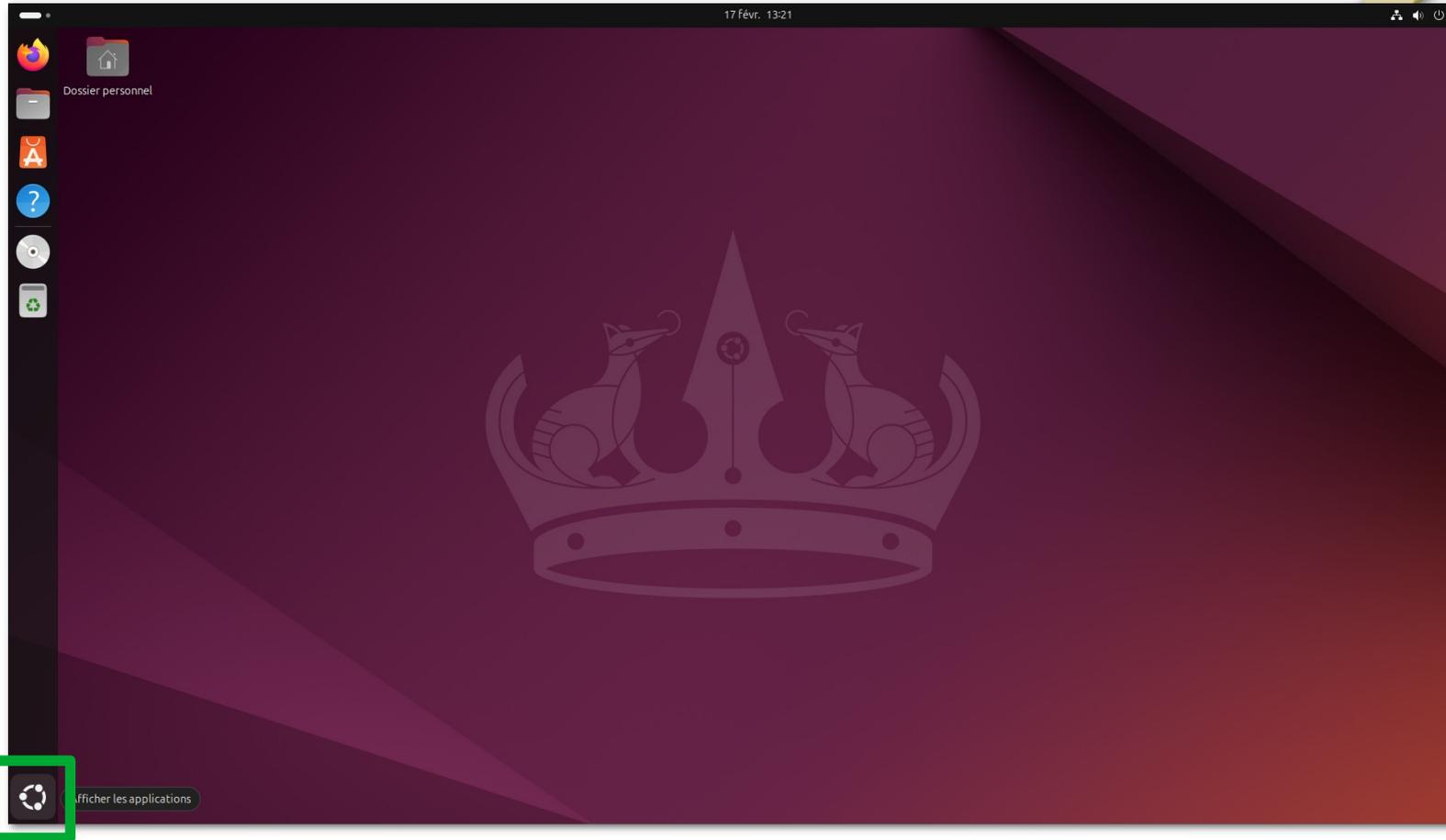
The image displays the Ubuntu 24.04 LTS Control Panel interface. The 'À propos' (About) window is open, showing system information. The desktop environment is 'GNOME' and the window title is 'À propos'. The system name is 'u24'. The system information table is as follows:

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
Informations sur le système	>

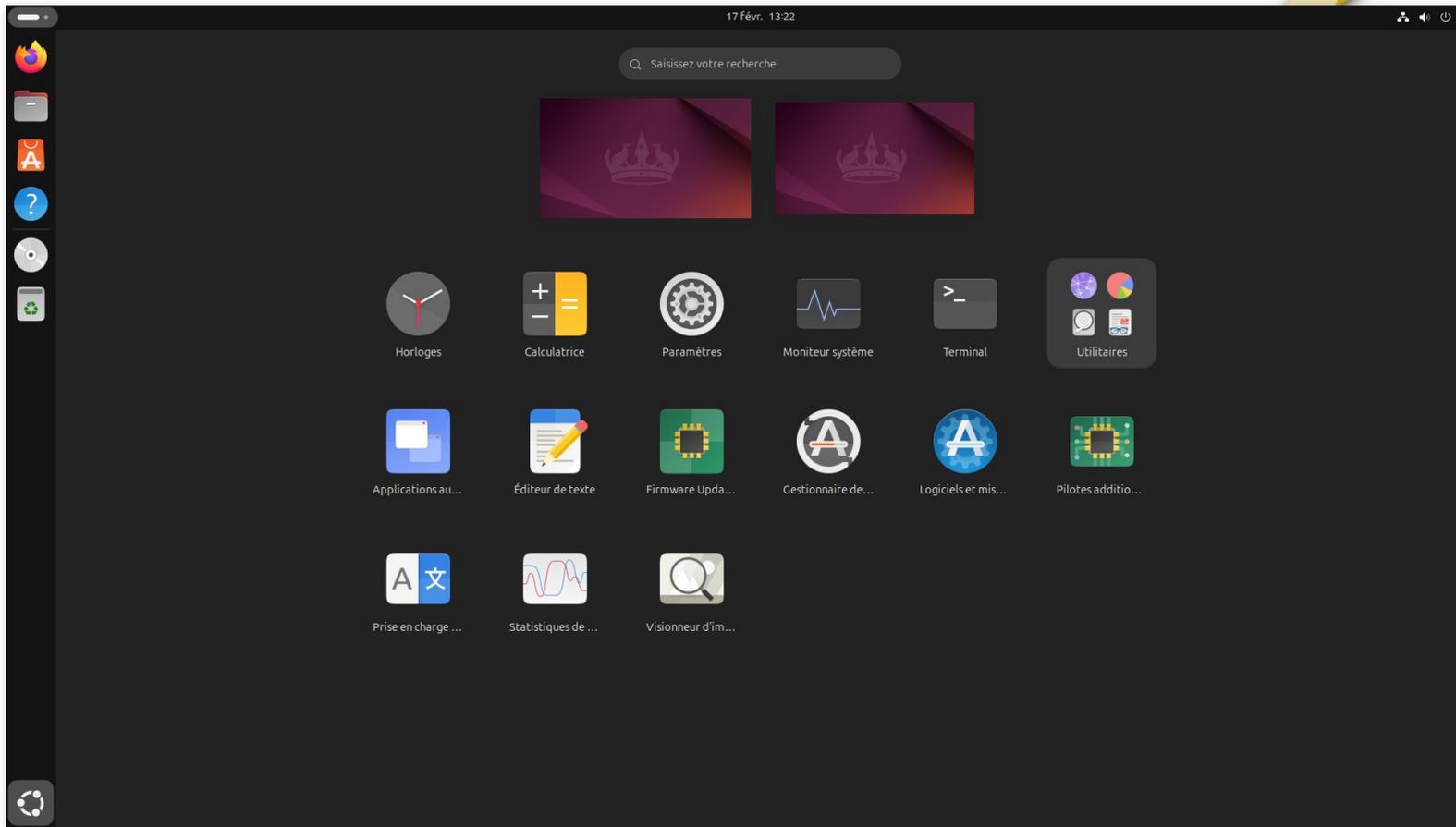
Ubuntu 24.04 LTS



Ubuntu 24.04 LTS

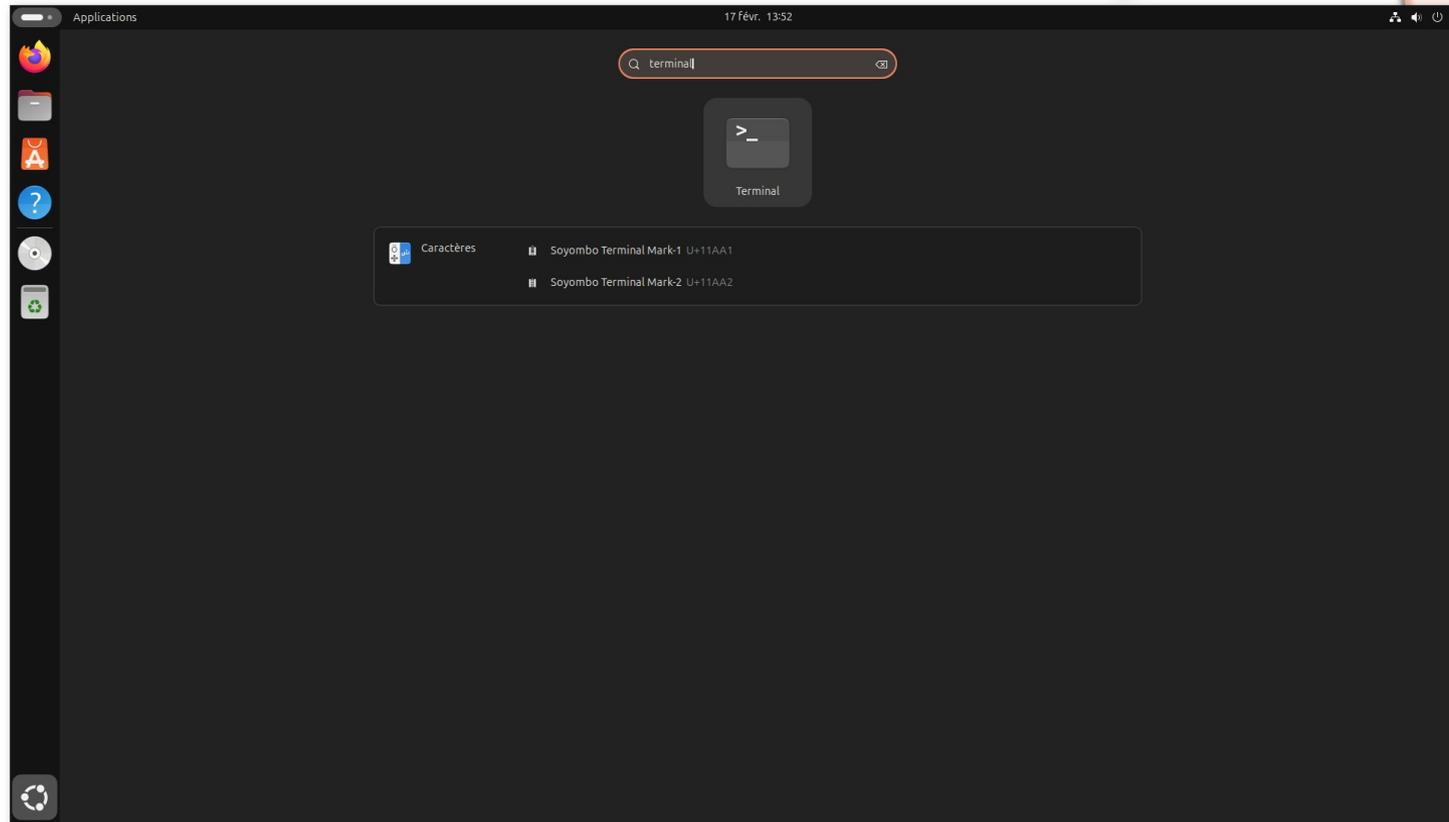


U. 24.04 LTS: Applications



U. 24.04 LTS: Open the Terminal

Ctrl + Alt + t

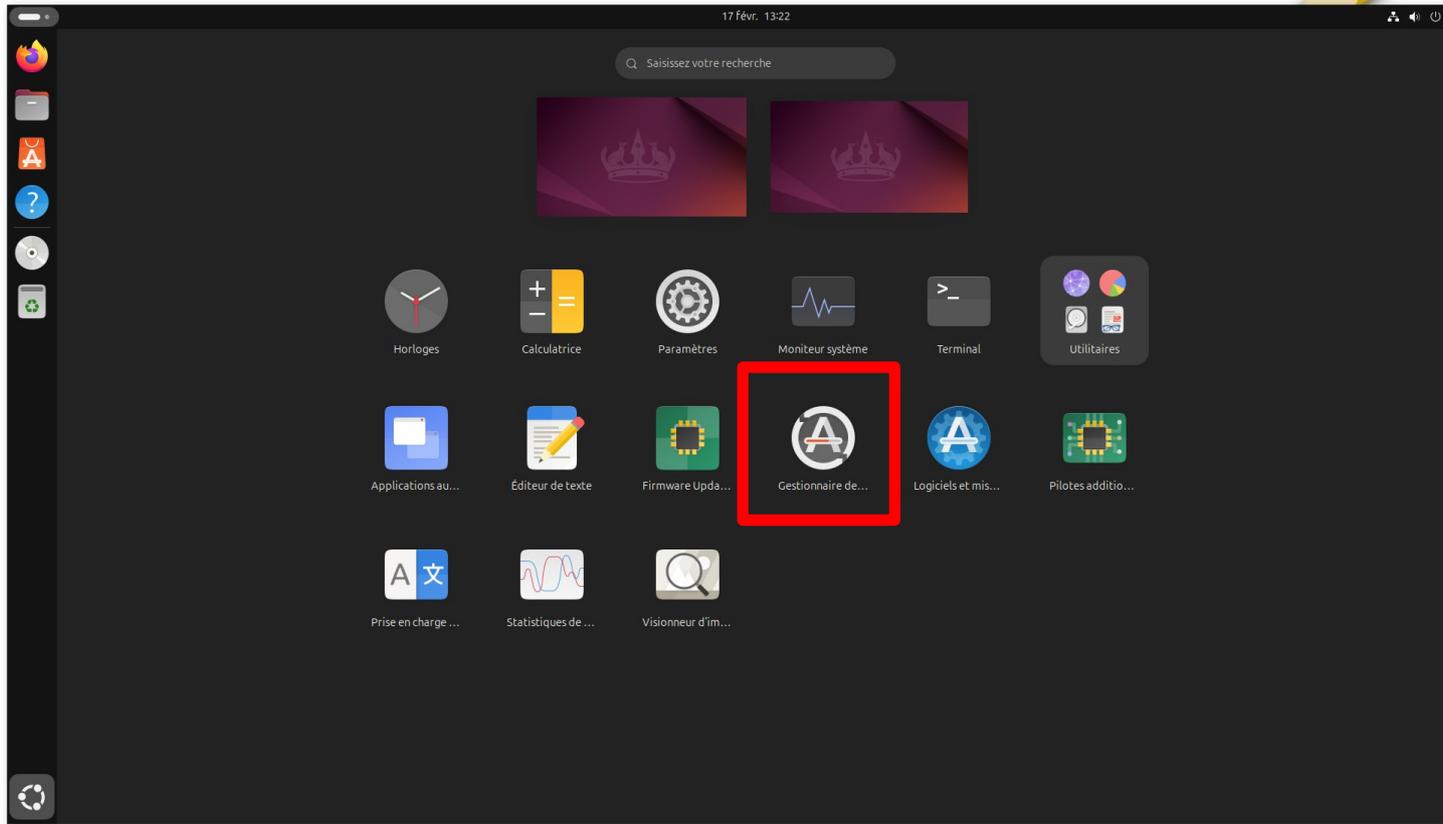


Things to do after installation

A yellow pencil and a pink eraser are positioned in the top right corner of the slide, appearing to be on a white sheet of paper against a blue grid background.

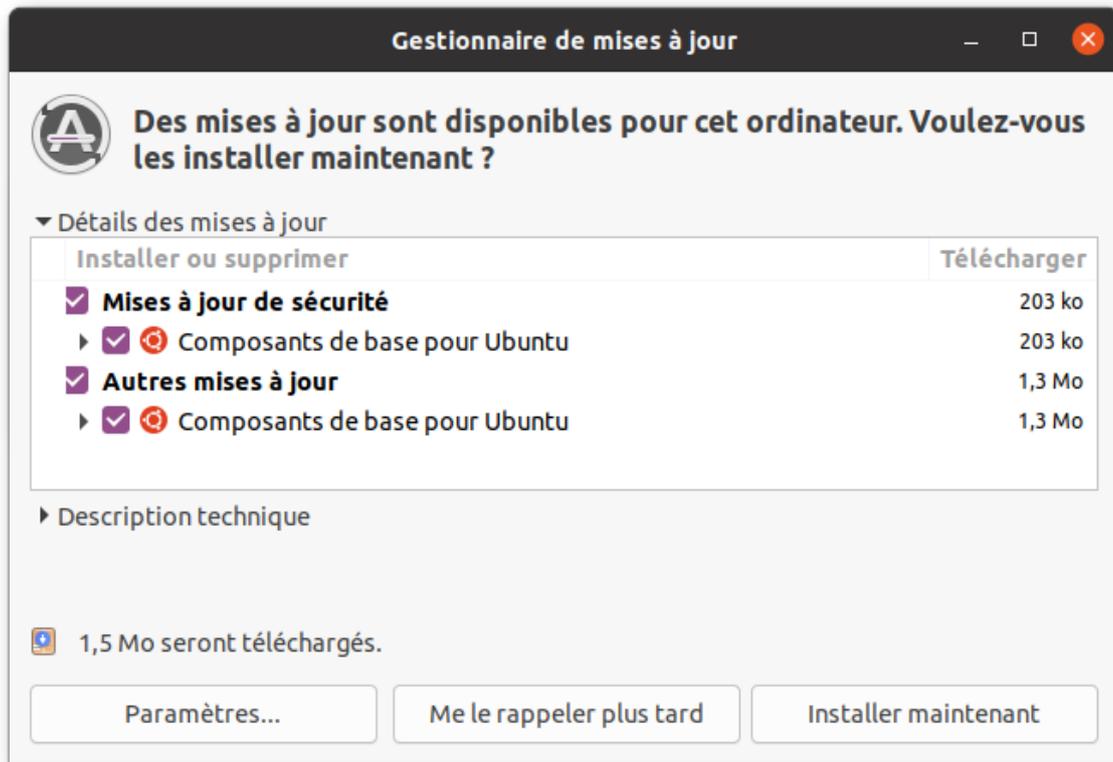
- Check for Updates (if not done during installation)
- Enable Partner Repositories
- Install Possibly Missing Graphics Drivers
- Install Extra Multimedia Codecs

U. 24.04 LTS: Check for Updates



Terminal command: `update-manager`

U. 24.04 LTS: Updates



Gestionnaire de mises à jour

 Des mises à jour sont disponibles pour cet ordinateur. Voulez-vous les installer maintenant ?

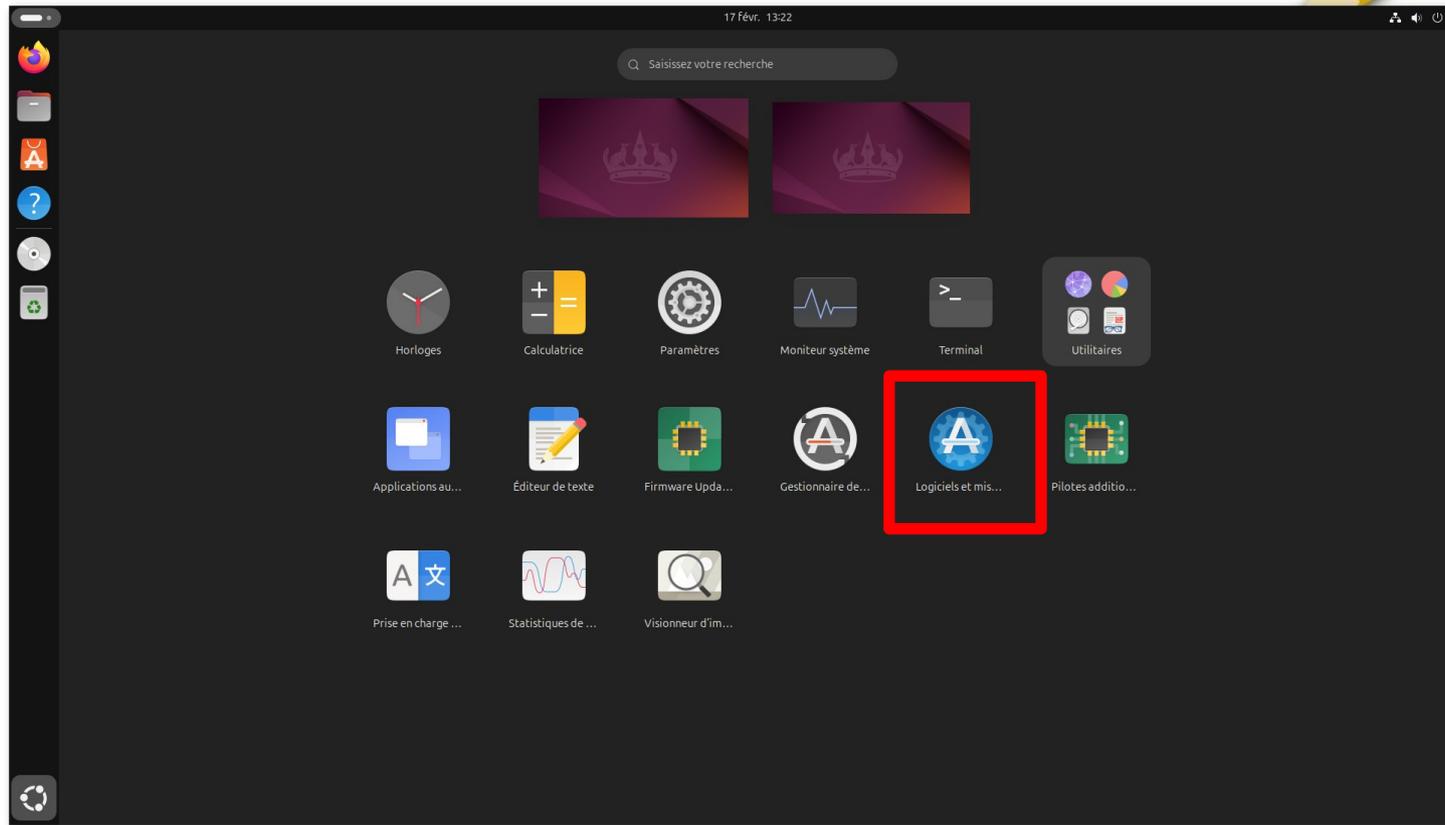
▼ Détails des mises à jour

Installer ou supprimer	Télécharger
<input checked="" type="checkbox"/> Mises à jour de sécurité	203 ko
▶ <input checked="" type="checkbox"/>  Composants de base pour Ubuntu	203 ko
<input checked="" type="checkbox"/> Autres mises à jour	1,3 Mo
▶ <input checked="" type="checkbox"/>  Composants de base pour Ubuntu	1,3 Mo

▶ Description technique

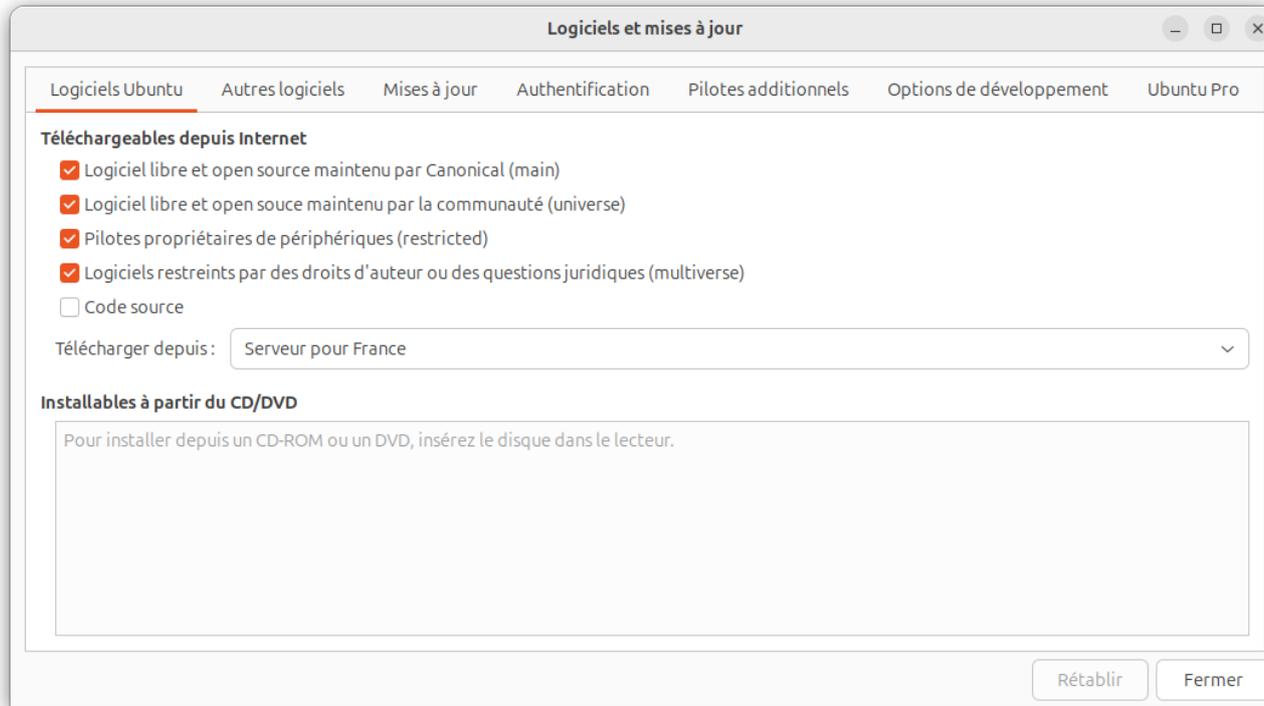
 1,5 Mo seront téléchargés.

U. 24.04 LTS: Enable Repo.

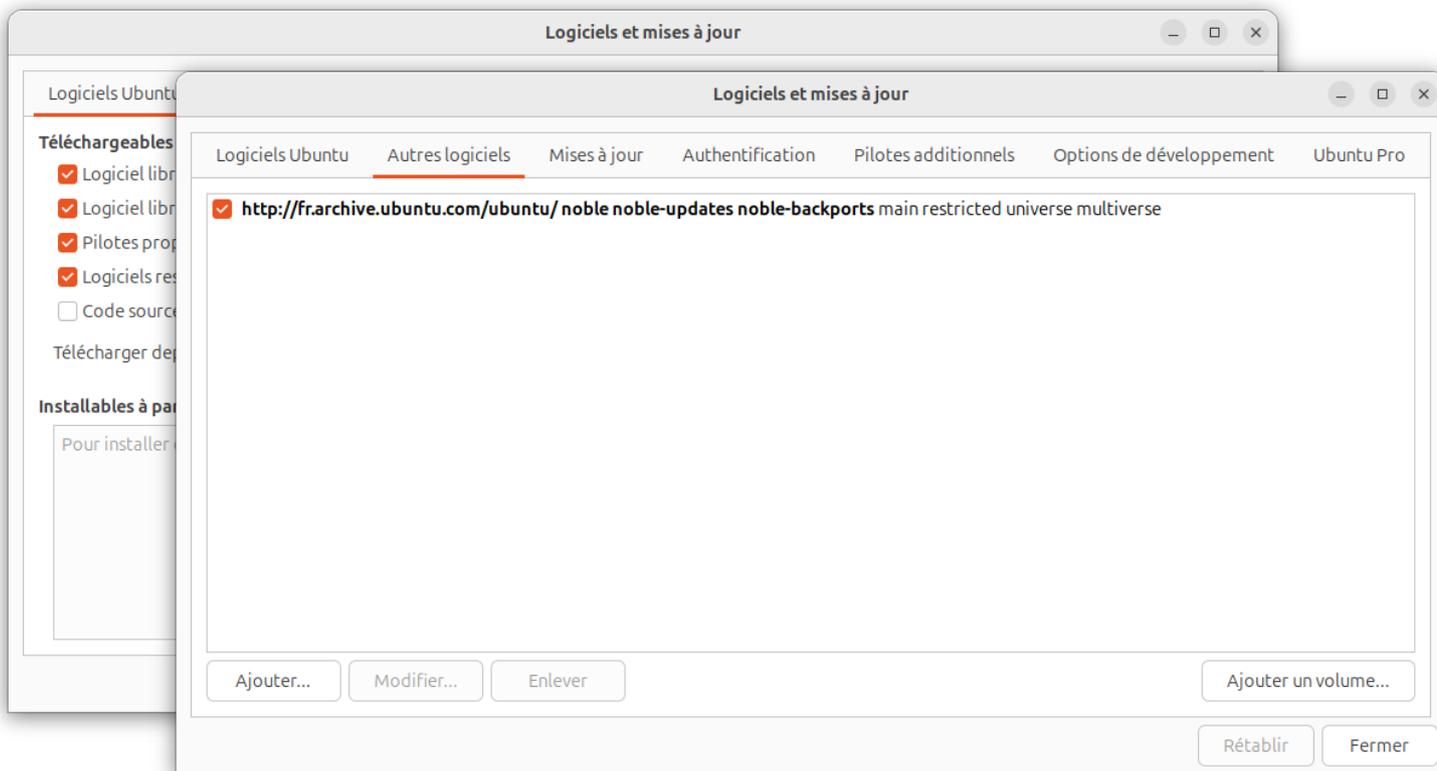


Terminal command: `software-properties-gtk`

U. 24.04 LTS: Repo. and more



U. 24.04 LTS: Repo. and more



U. 24.04 LTS: Repo. and more

Logiciels et mises à jour

Logiciels Ubuntu

http://fr.archive.u

Logiciels et mises à jour

Logiciels Ubuntu | Autres logiciels | Mises à jour | Authentification | Pilotes additionnels | Options de développement | Ubuntu Pro

Les mises à jour des paquets Snap sont vérifiées régulièrement et installées automatiquement

Pour les autres paquets, ce système a : Maintenance de sécurité de base [Prolonger...](#)
Actif jusqu'au 31/05/2029

Abonné à : Toutes les mises à jour

Vérifier automatiquement les mises à jour : Tous les jours

Lorsqu'il y a des mises à jour de sécurité : Télécharger et installer automatiquement

Lorsqu'il y a d'autres mises à jour : Afficher une fois par semaine

Me prévenir lorsqu'une nouvelle version d'Ubuntu est disponible : Pour les versions prises en charge sur le long terme

Rétablir Fermer

Logiciels Ubuntu

Téléchargeables

- Logiciel libre
- Logiciel libre
- Pilotes propriétaires
- Logiciels réservés
- Code source

Télécharger depuis

Installables à partir de

Pour installer

Ajouter...

U. 24.04 LTS: Repo. and more

Logiciels et mises à jour

Logiciels Ubuntu

Téléchargeables

- Logiciel libre
- Logiciel libre
- Pilotes propriétaires
- Logiciels réservés
- Code source

Télécharger des

Installables à pa

Pour installer

Me préve

Ajouter...

Logiciels et mises à jour

Logiciels et mises à jour

Logiciels et mises à jour

Logiciels Ubuntu

Autres logiciels

Mises à jour

Authentification

Pilotes additionnels

Options de développement

Ubuntu Pro

Recherche des pilotes disponibles...

Aucun pilote propriétaire n'est utilisé.

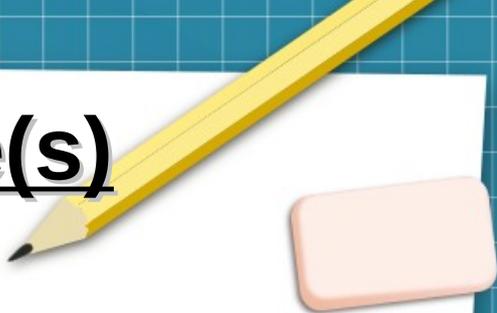
Un pilote propriétaire contient du code privé que les développeurs d'Ubuntu ne peuvent pas réviser ou améliorer. La sécurité et les mises à jour dépendent du fournisseur du pilote.

Rétablir

Appliquer les changements

Fermer

U. 24.04 LTS: Install software(s)



- Using the command line (the terminal)

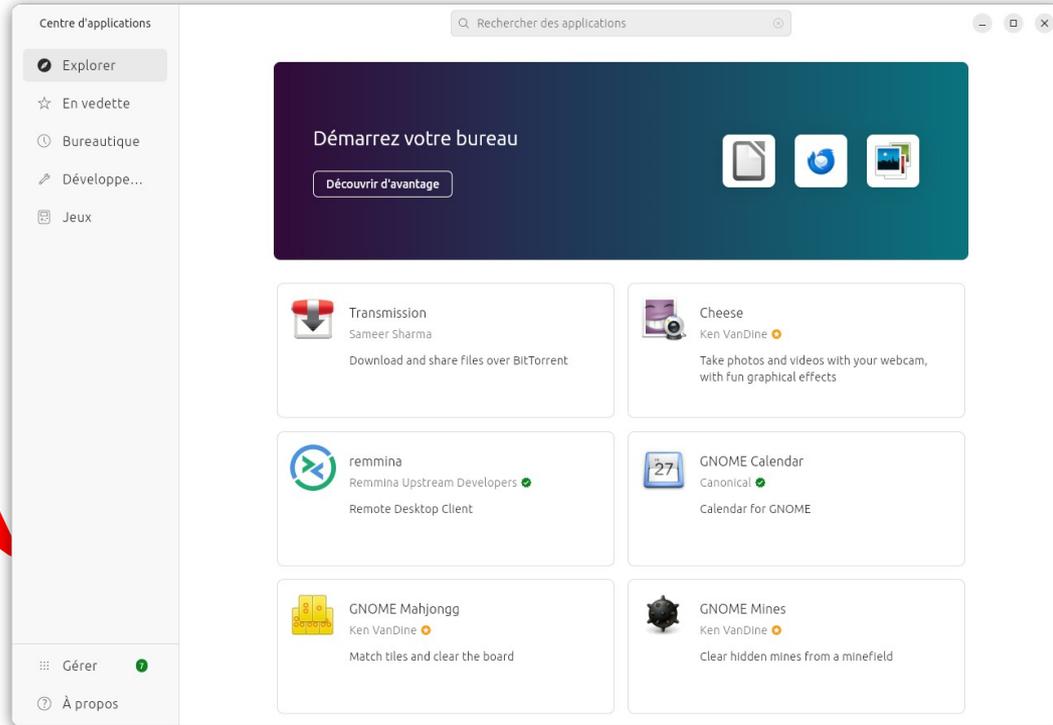
```
$ sudo apt install package-name
```

- Example:

```
$ sudo apt install synaptic
```

U. 24.04 LTS: Install software(s)

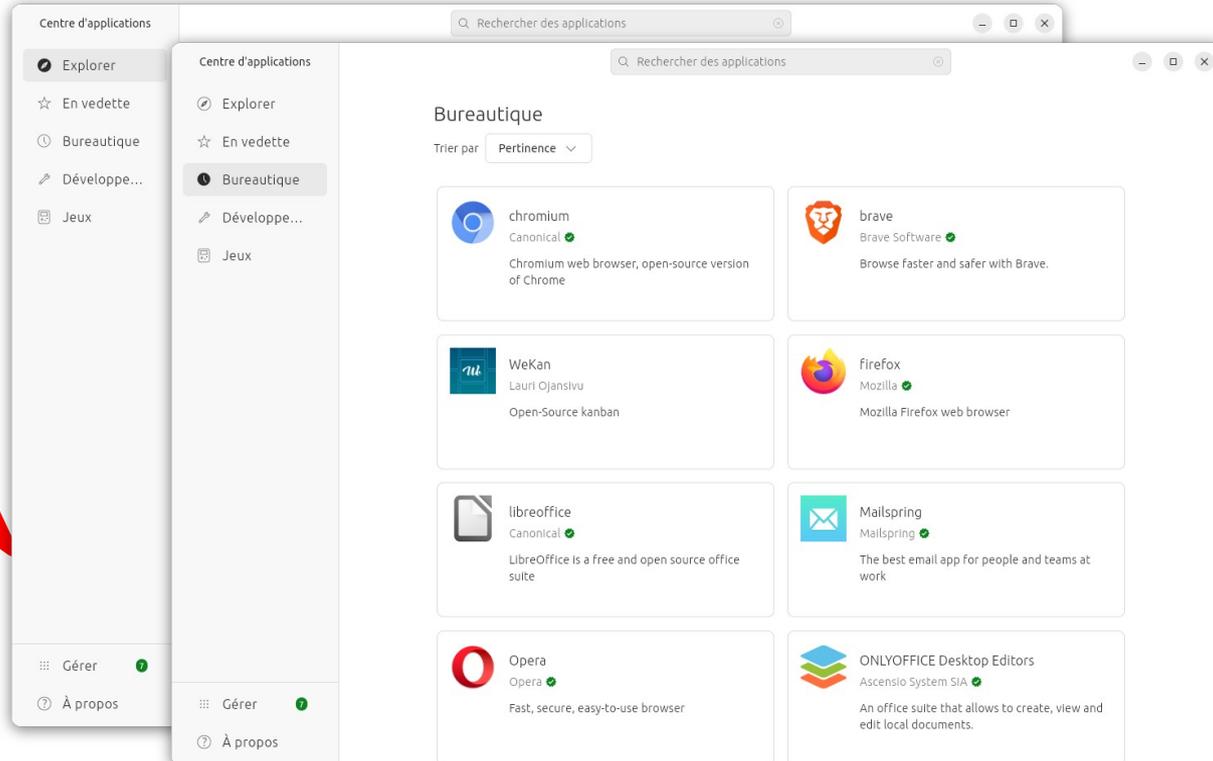
Using the “Application center” (Ubuntu software)



Terminal command: `snap-store`

U. 24.04 LTS: Install software(s)

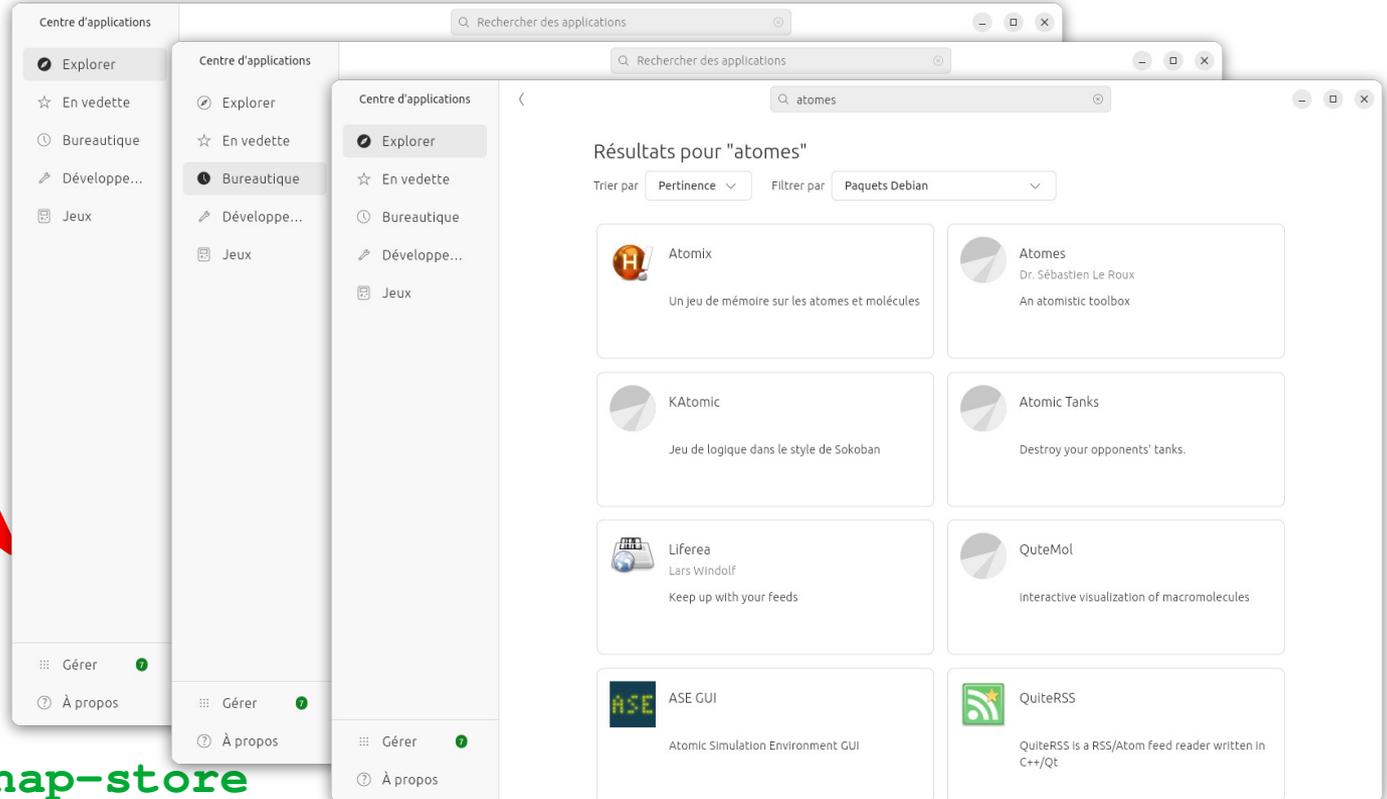
Using the “Application center” (Ubuntu software)



Terminal command: `snap-store`

U. 24.04 LTS: Install software(s)

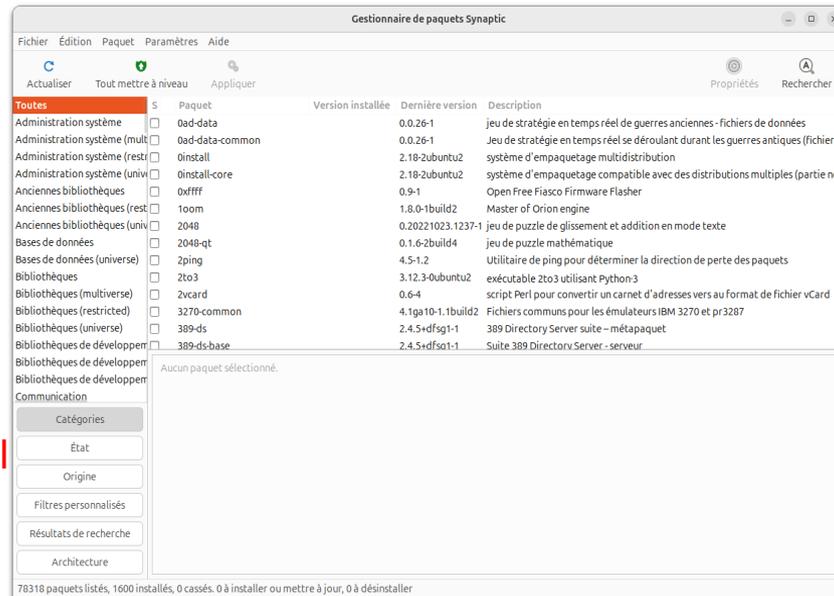
Using the “Application center” (Ubuntu software)



Terminal command: `snap-store`

U. 24.04 LTS: Install software(s)

- Using “Synaptic”



Prerequisite: Install

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 ?

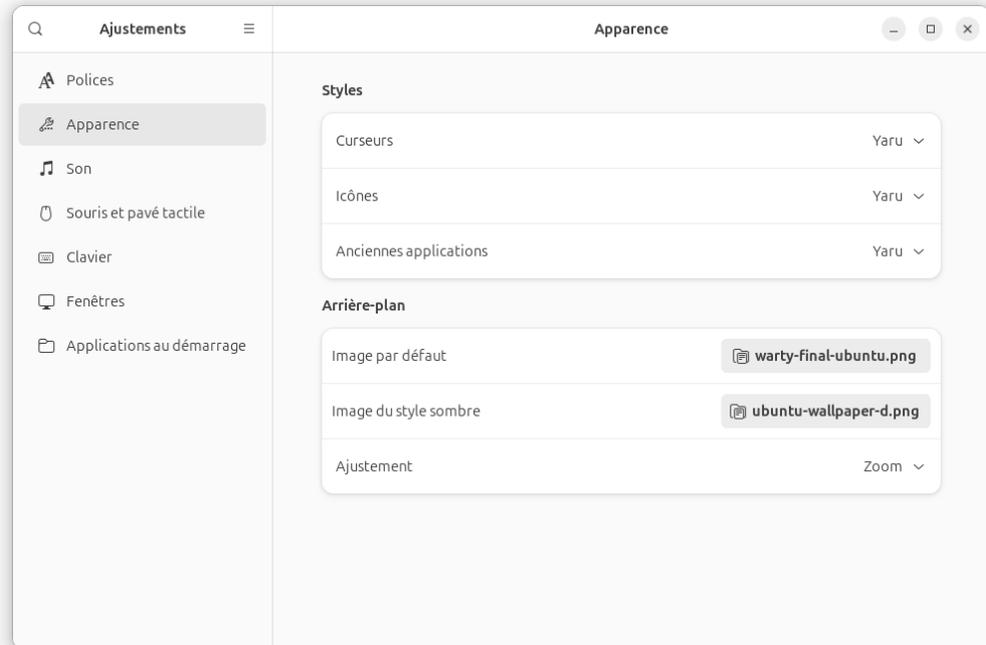
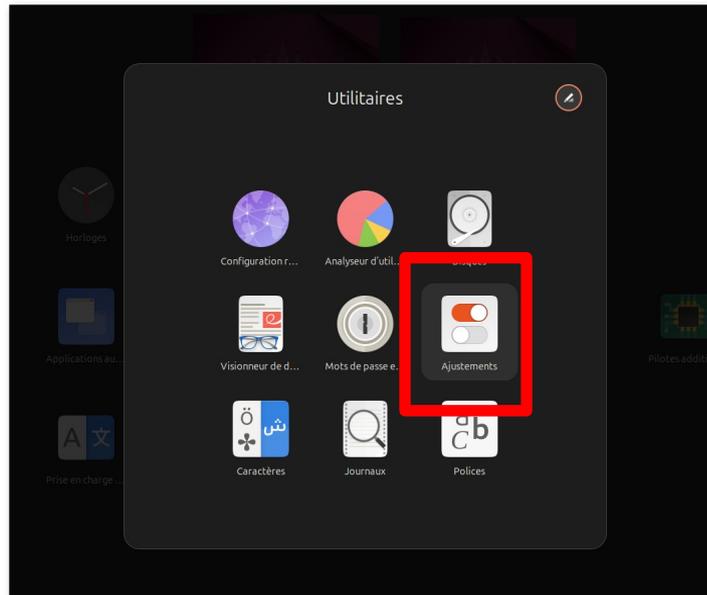
Add extra package repository: https://doc.ubuntu-fr.org/depots_focal

U. 24.04 LTS: Extras



- Tweaks “Ajustements” (gnome-tweaks)

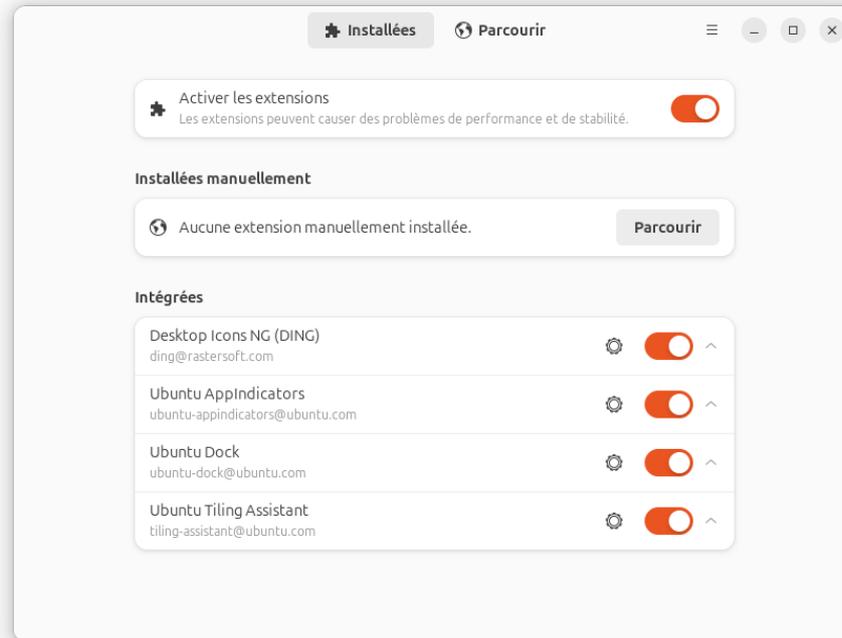
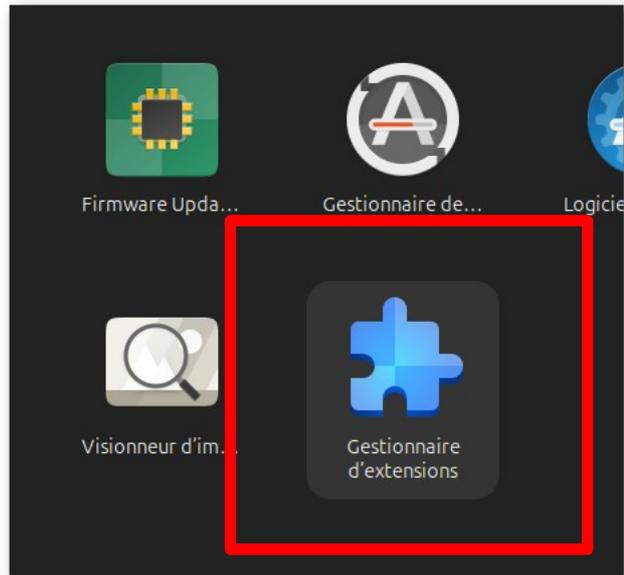
\$ **sudo apt install** **gnome-tweaks**



U. 24.04 LTS: Extras

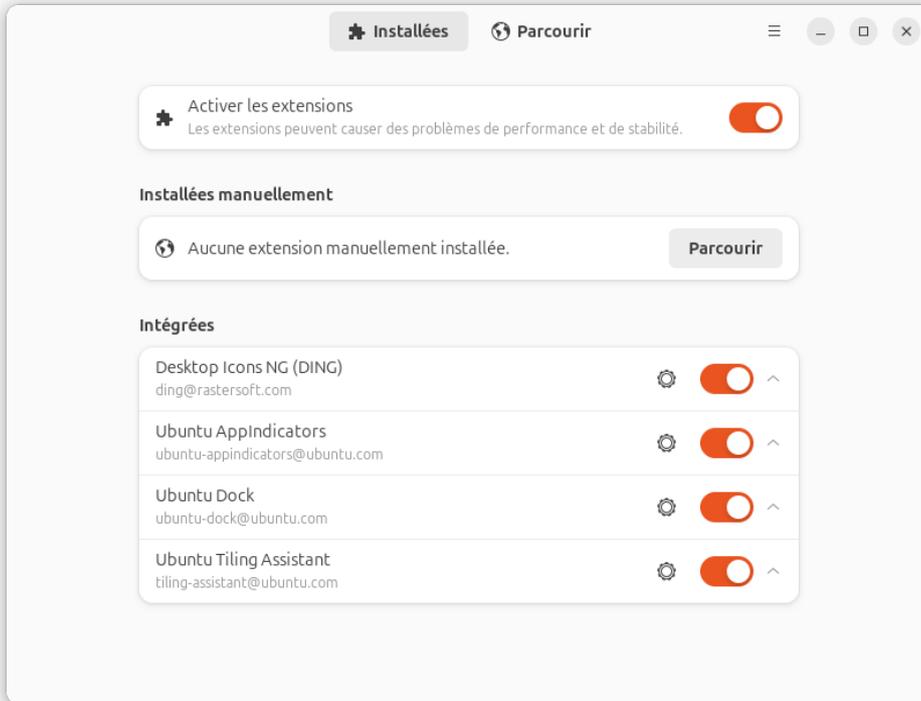
- Extension manager (gnome-shell-extension-manager)

\$ **sudo apt install** **gnome-shell-extension-manager**



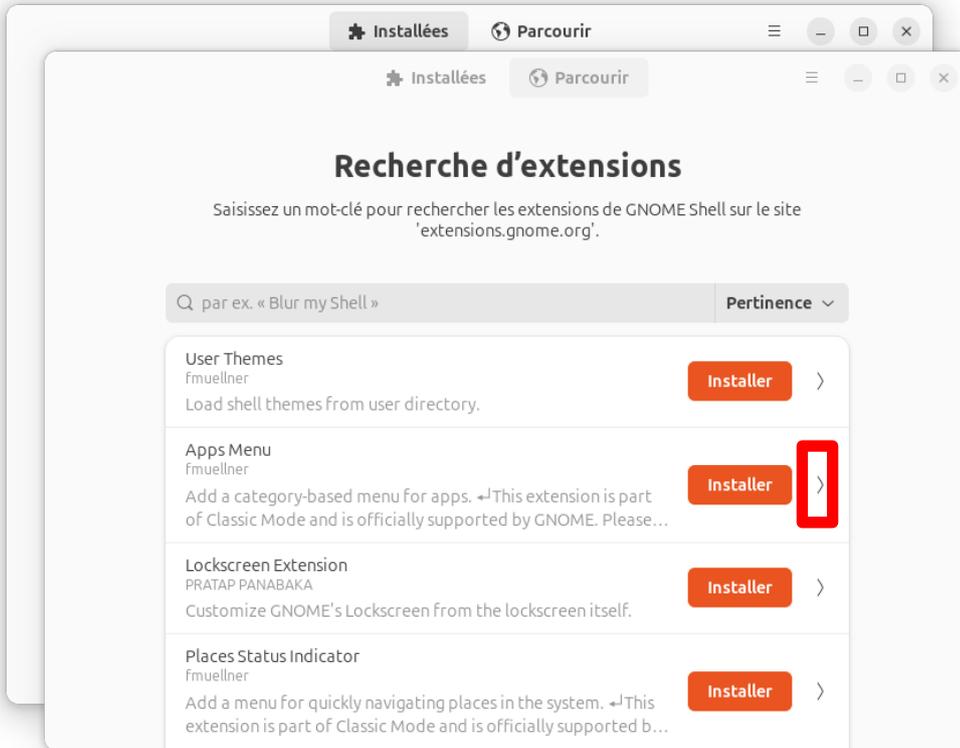
U. 24.04 LTS: Extras

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



U. 24.04 LTS: Extras

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



U. 24.04 LTS: Extras

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



The screenshot shows the GNOME Extension Manager search results page. The title is "Recherche d'extensions". Below the title, there is a search bar with the text "par ex. « Blur my Shell »" and a dropdown menu set to "Pertinence". A list of extensions is displayed, each with an "Installer" button and a right-pointing arrow. The "Apps Menu" extension by fmuellner is highlighted with a red box around its right arrow.

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

The screenshot shows the detail page for the "Apps Menu" extension by fmuellner. It features the GNOME logo, the extension name, and an "Installer" button. A preview window shows the "Applications" menu with various categories like Favorites, Accessories, Games, Graphics, Internet, Office, Programming, Sound & Video, Sundry, System Tools, Universal Access, Utilities, and Other. The "Description" section at the bottom states: "Add a category-based menu for apps. This extension is part of Classic Mode and is officially supported by GNOME. Please do not..."

Apps Menu
fmuellner

Installer

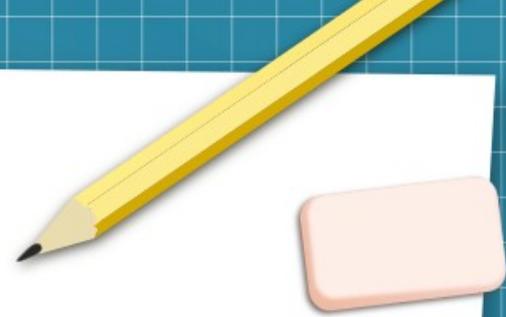
Description
Add a category-based menu for apps.
This extension is part of Classic Mode and is officially supported by GNOME. Please do not...

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 cant 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)

\$

*

?

{ } () []

/

``

''

"""

#

| & < >

. and ..

\

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.

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 !

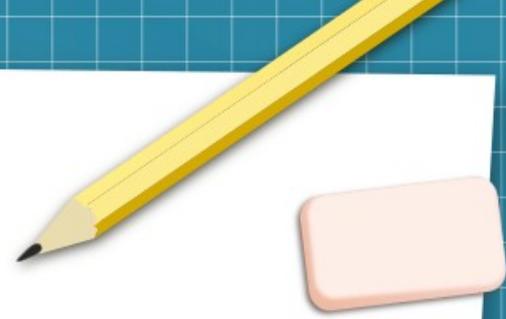
- Not matter the type of file, on a Linux system you have:
 - Standard files and repositories.
 - Hidden files and repositories which names, by convention, start by a “.” dot symbol.

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
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--

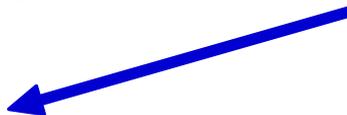
- rw- r-- r--

Object

Owner

Group

The other user(s)



Command = Executable

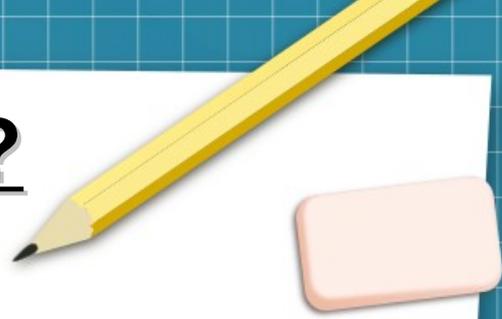


- Command = “**a file that has the execute permission**”

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

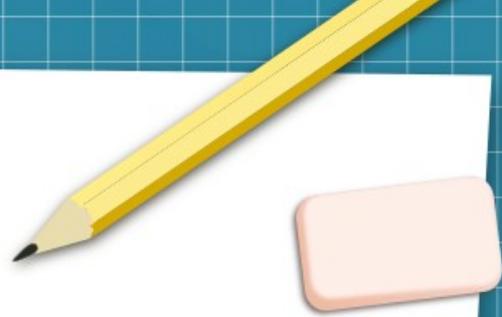


Where to find commands ?



- 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”

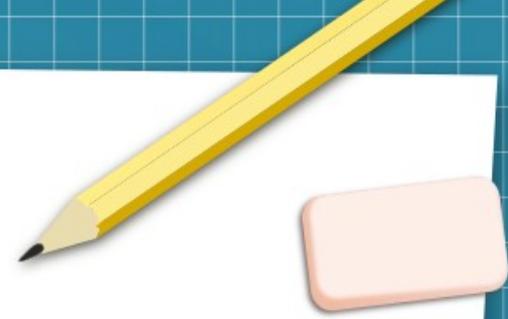
- To access the **EV** list use the **env** command:

```
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 ?



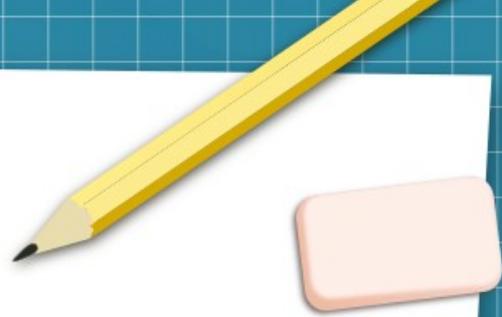
- A **command** can receive **argument(s)**:

```
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.

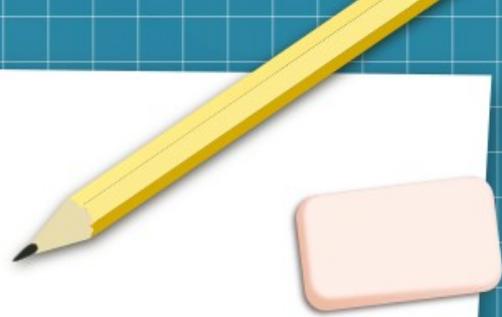
```
user@localhost:~$ ls --help
```

- 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:

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

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
```

```
O
```

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

What is a redirection ?



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



Followed by:

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

- Job directly to the background, using: **&**

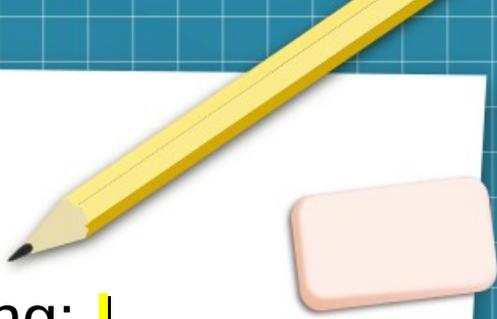
```
user@localhost:~$ gedit &
```

- 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
```

- The first
- The other

```
echo "Hello"
```

- To execute the script:

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

or

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

The file ~/ .bashrc



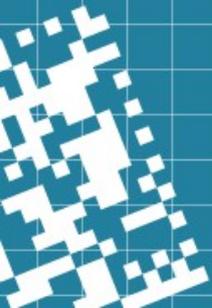
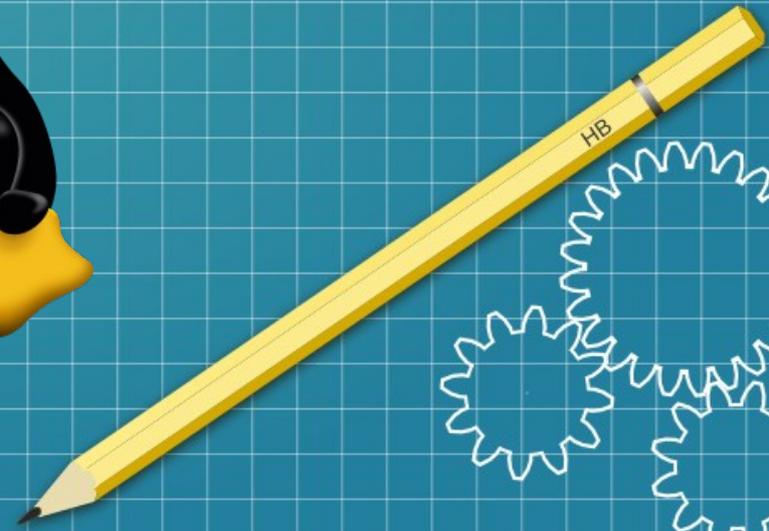
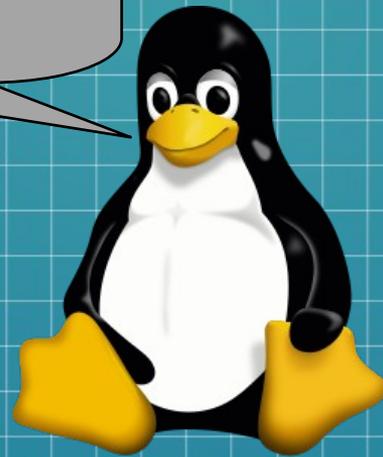
- Configuration file that BASH reads every time a shell starts
- BASH then executes the commands in ~/ .bashrc

```
# 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'
```



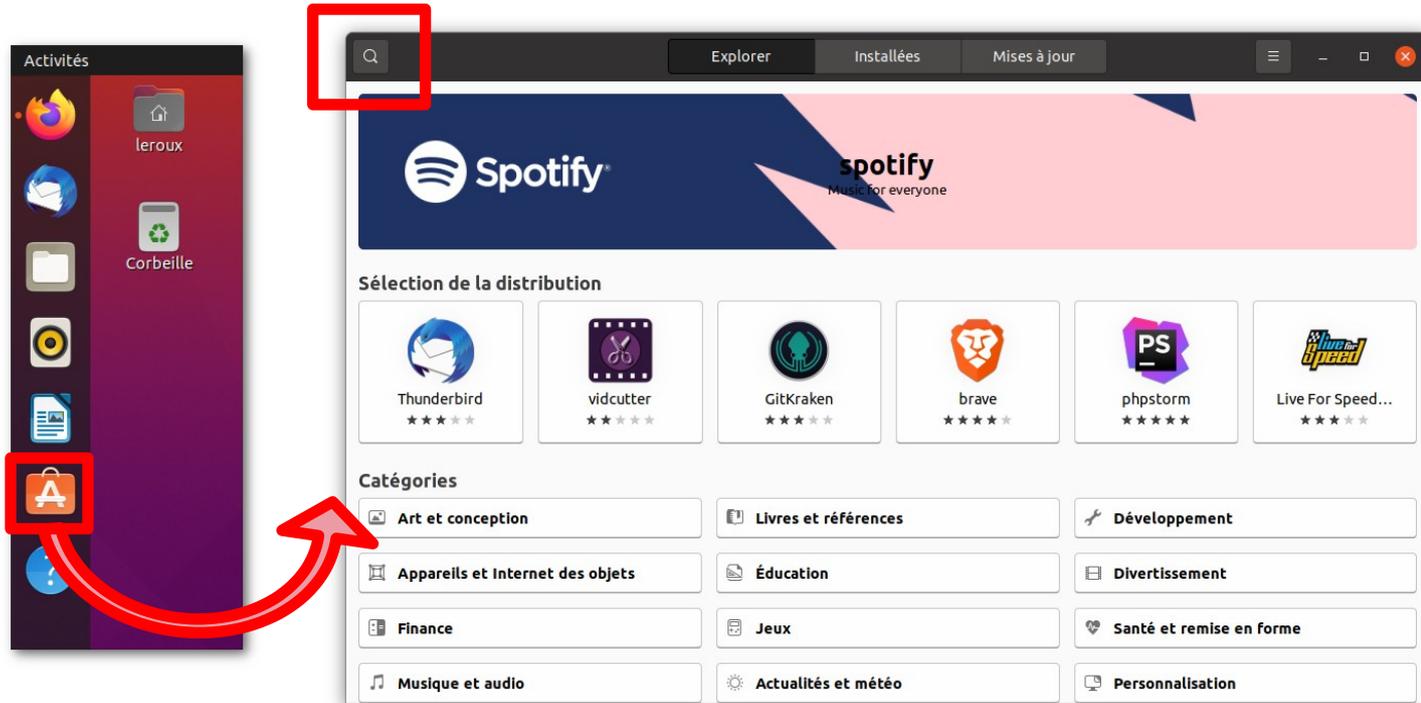
```
#!/bin/bash
```

```
echo "Questions ?"
```



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

Using “Ubuntu Software”

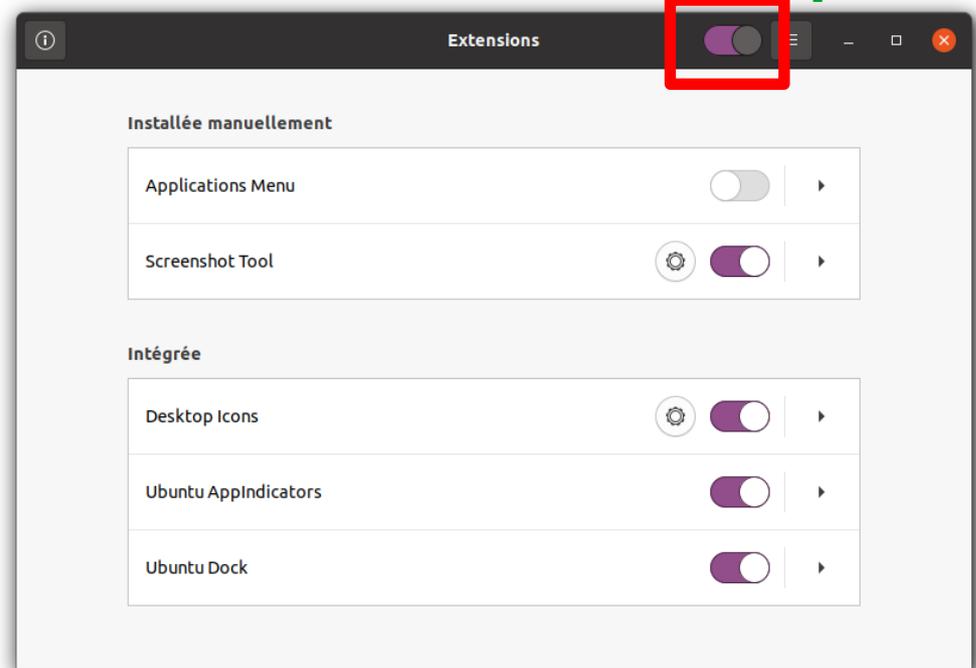
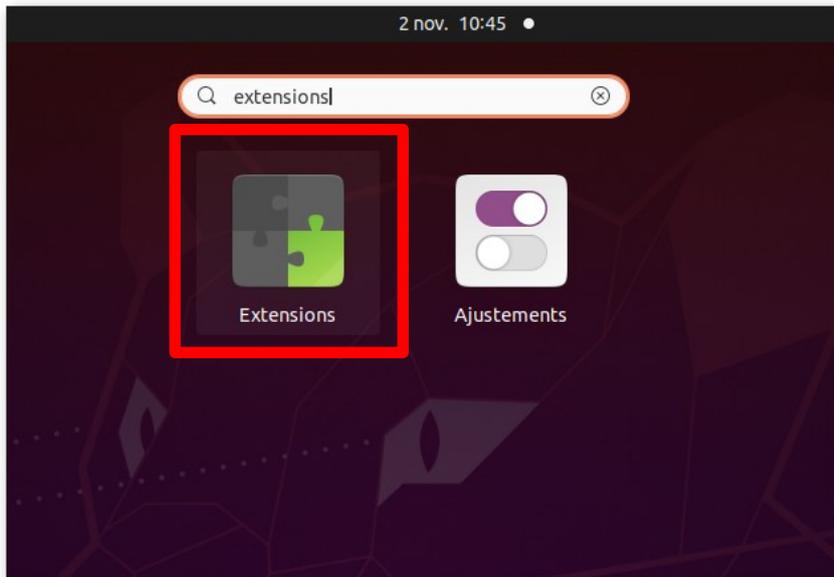


Terminal command: `snap-store`

U. 20.04 LTS: Extras

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

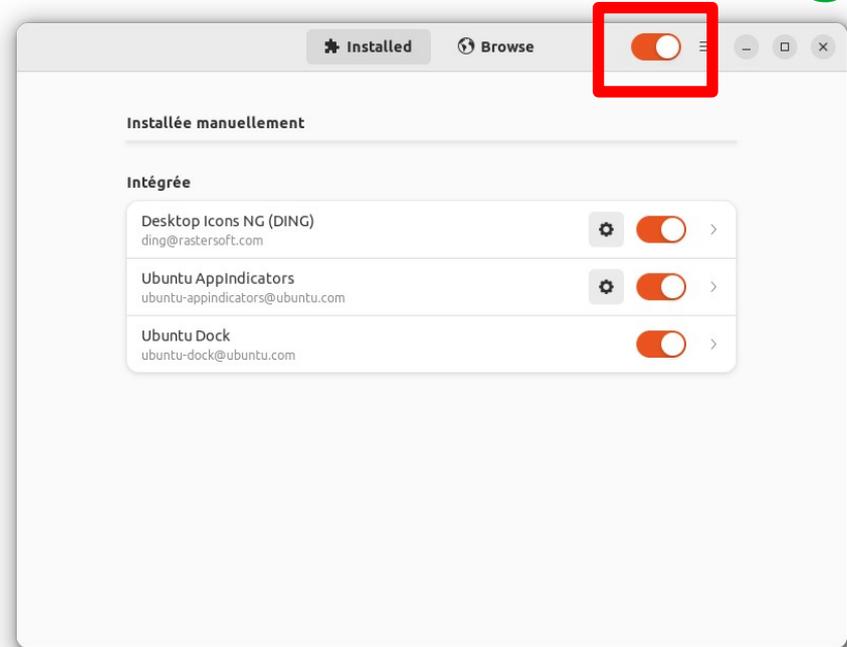
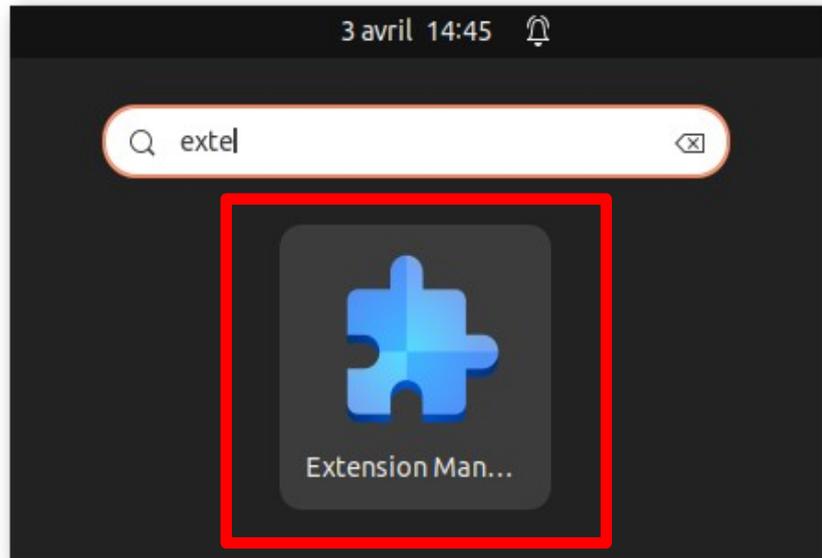
\$ **sudo apt install** **gnome-shell-extension-prefs**



U. 22.04 LTS: Extras

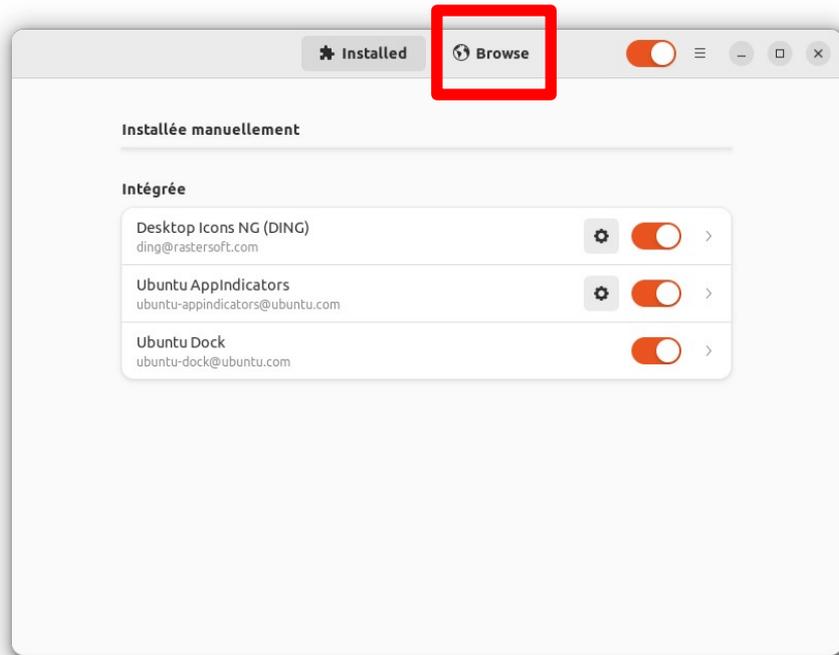
- Extension manager (gnome-shell-extension-manager)

\$ **sudo apt install** **gnome-shell-extension-manager**



U. 22.04 LTS: Extras

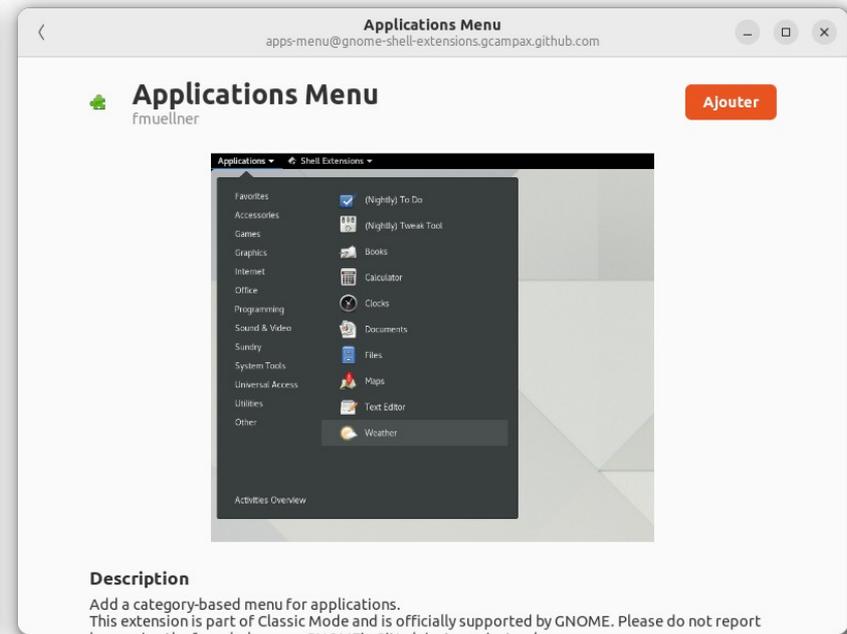
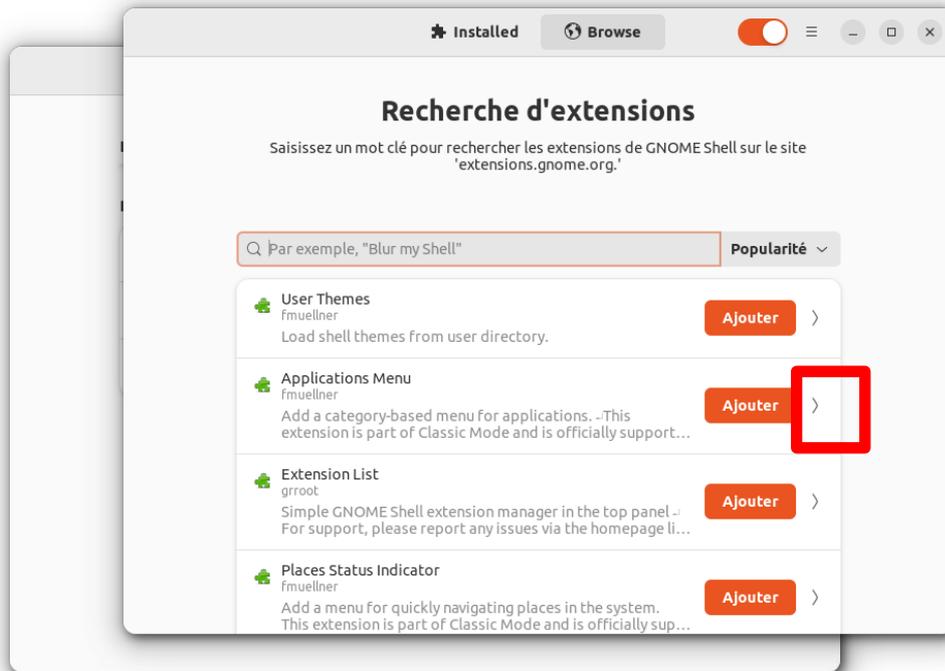
- Extension manager (\$ **extension-manager**)



U. 22.04 LTS: GNOME™ Extras



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



U. 20.04 LTS: GNOME™ Extras

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

