

Introduction to Linux Operating Systems

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Makerbox Lao

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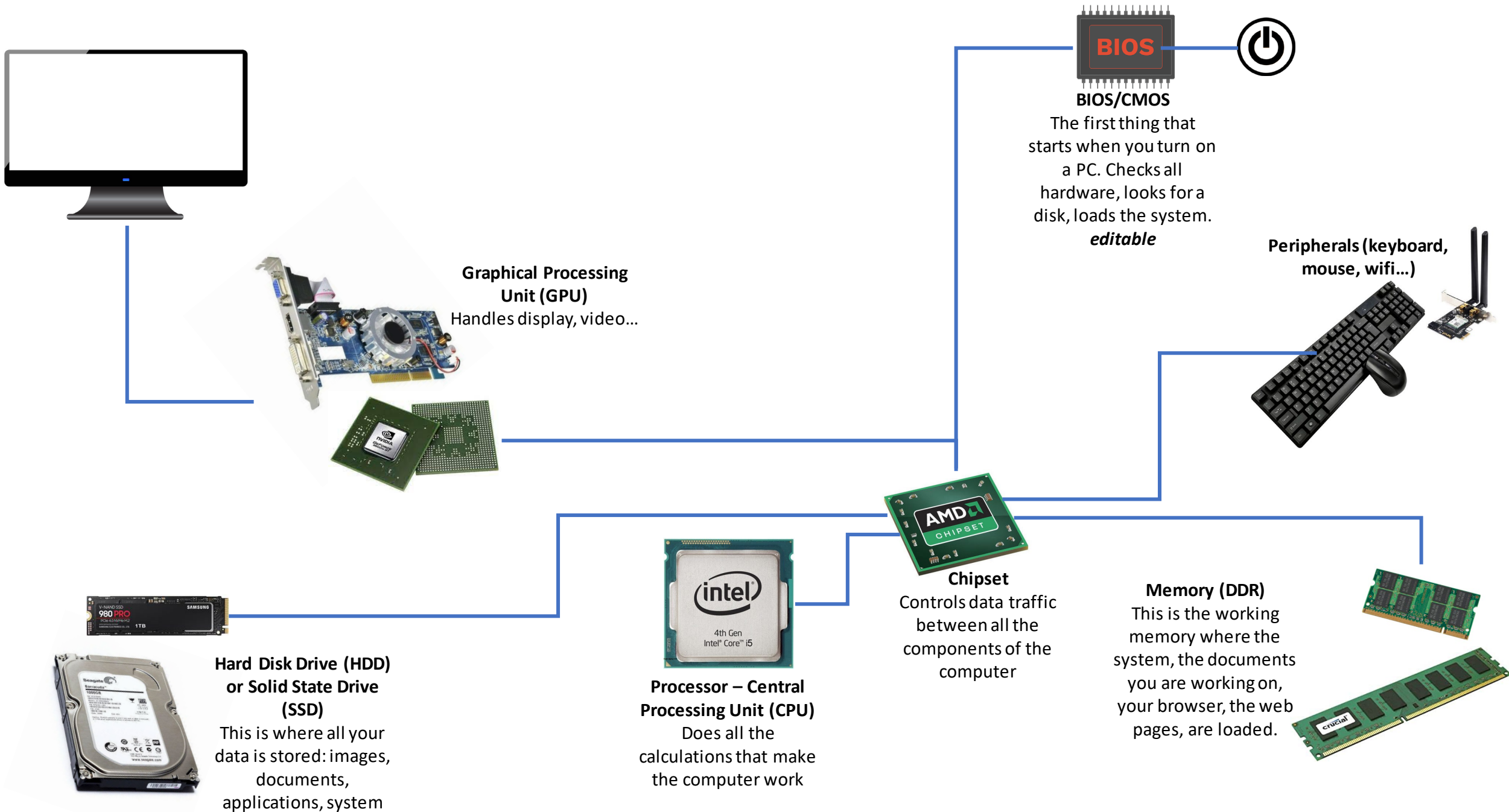


Before we start...

- Don't worry if you don't understand everything, worry if you don't understand anything!
- The workshop is for a wide audience: from non-IT employee to computer engineering students 😊
- Presentation will be in English, after each slide, you can ask questions in Lao or English

1. System architecture

How does a computer work?



The boot sequence

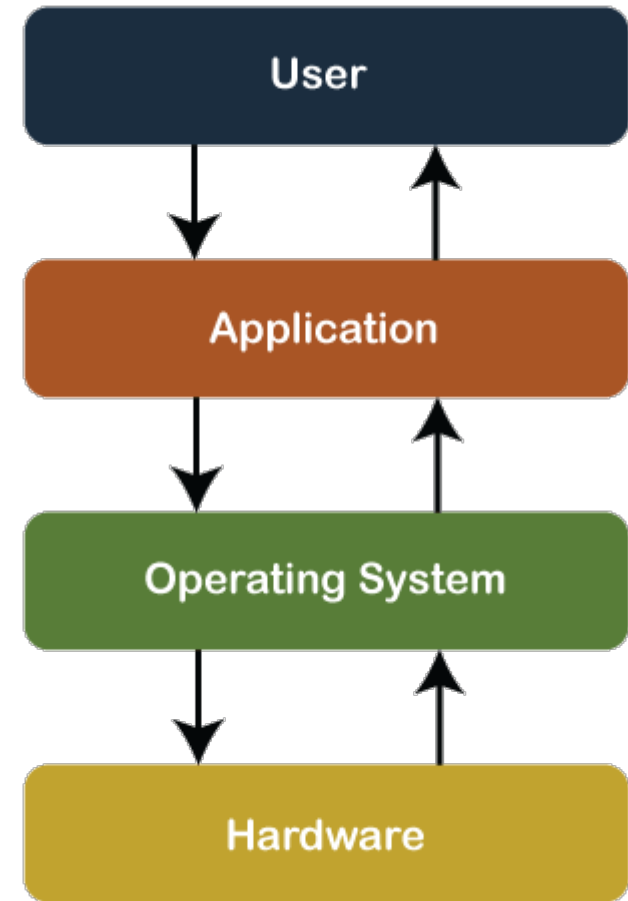
What happens when you turn on your computer

1. the BIOS tests all the components of the computer: do we have RAM, a CPU, some graphics, a keyboard?
2. The BIOS tests if there is a disk
3. If yes, search for an operating system program (bootloader) at the beginning of the disk
4. If there is, run the bootloader, run the OS

You can tell the BIOS to change this sequence.

What is an Operating System (OS)?

- Translates 0s and 1s into readable information and back
- What you see when your computer has finished starting



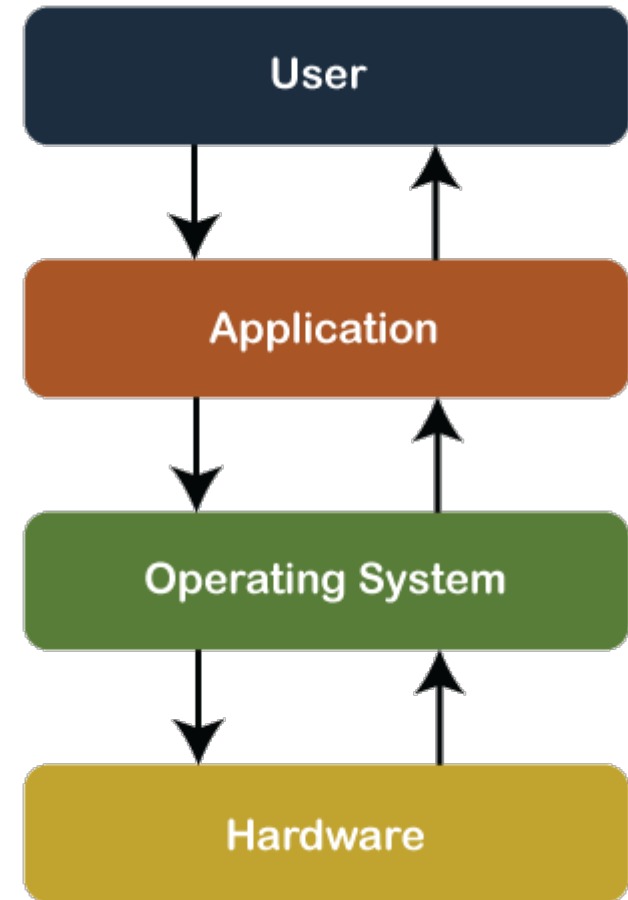
What is an Operating System (OS)?

- Translates 0s and 1s into readable information and back
- What you see when your computer has finished starting
- Examples: Windows, MacOS, Linux
- The OS is a very large computer program that manages applications (apps), provides a graphical interface, communicates with the hardware, and allows you to use your computer
- All OS ship multiple applications
 - Windows: Notepad, WordPad, Paint,...
 - MacOS: Safari...



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- All OS ship multiple applications
 - Windows: Notepad, WordPad, Paint,...
 - MacOS: Safari...
- Most computers support different OS: if you have Windows, you can replace it with Linux if you want
- You can have more than 1 operating system at the same time



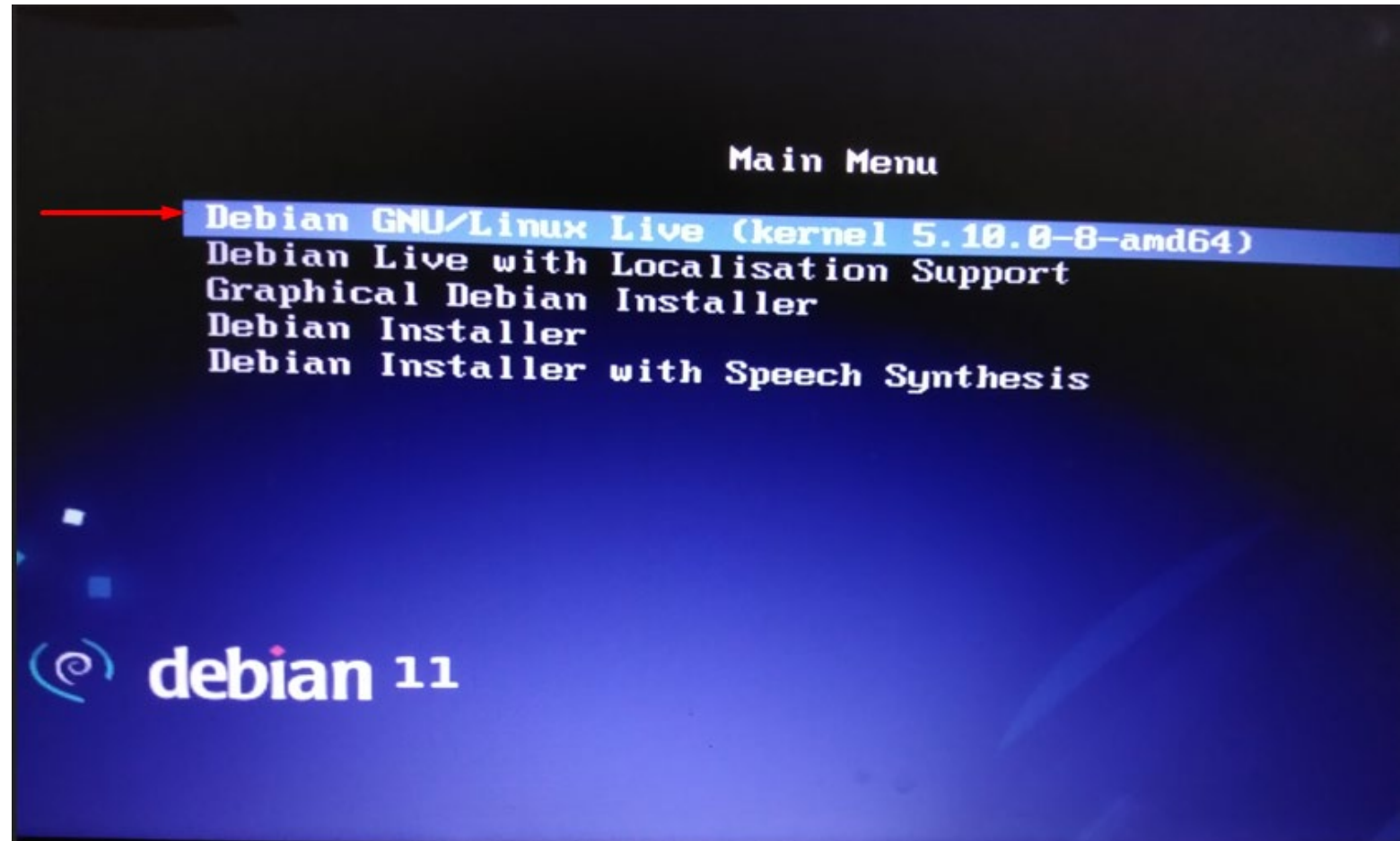
2. Linux basics

How to run Linux?

Solution 1: Live CD/USB

if you just want to try

- Many Linux distributions do not need to be installed on the disk to work
- You can put them on a USB drive, load them, play with them, then turn off the PC, remove the drive, and your PC will be like before
- The entire system is loaded in memory
- It is a bit slower than normal
- All your changes are lost when you power off the computer



How to run Linux?

Solution 2: Install alongside Windows

If you want to keep both Windows and Linux

- Most Linux flavours have this option
- This will replace the Windows bootloader with a selector where you can choose to run Windows or Linux when the computer starts
- Linux will see Windows files but not the reverse
- You will need to divide your hard drive to make room for Linux

A screenshot of the GParted application window showing the partitioning of a 238.47 GiB disk. The main view shows two yellow partitions: /dev/sda2 (161.97 GiB) and /dev/sda3 (68.10 GiB). Below this is a detailed table of the disk's partitions.

Partition	Name	Dateisystem	Einhängepunkt	Größe	Benutzt	Unbenutzt	Markierungen
/dev/sda1	EFI System Partition	fat32	/boot/efi	512.00 MiB	32.20 MiB	479.80 MiB	boot, esp
/dev/sda2		ext4	/, /var/lib/docker/aufs	161.97 GiB	78.77 GiB	83.20 GiB	
/dev/sda3	Basic data partition	ntfs		68.10 GiB	33.18 GiB	34.92 GiB	msftdata
/dev/sda4		linux-swap		7.91 GiB	0.00 B	7.91 GiB	

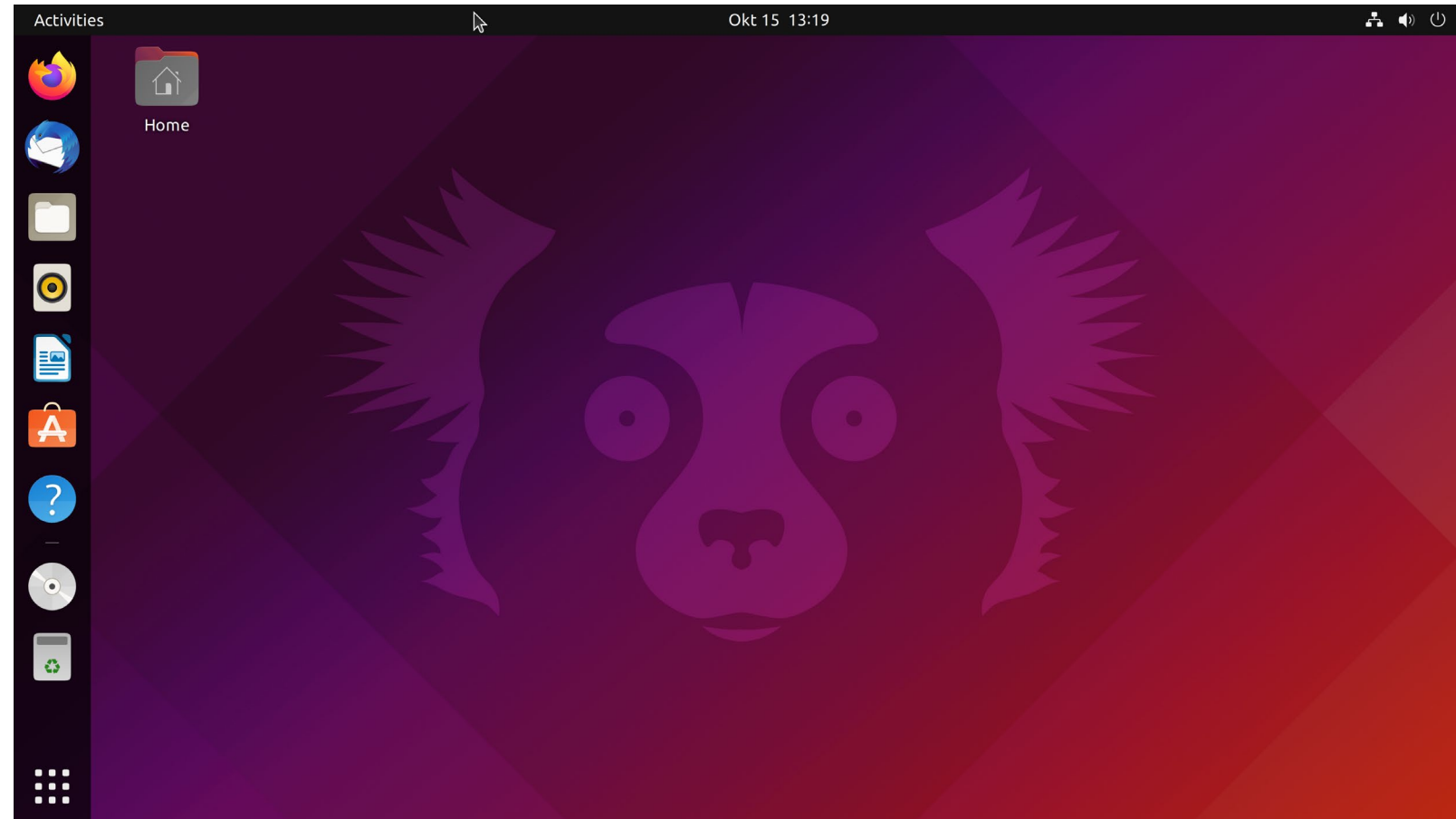
0 ausstehende Operationen

How to run Linux?

Solution 3: Erase Windows / switch to Linux

Never look back !

- Every Linux distribution has this option
- This will replace the Windows partitions entirely
- Your computer will only run Linux 😊

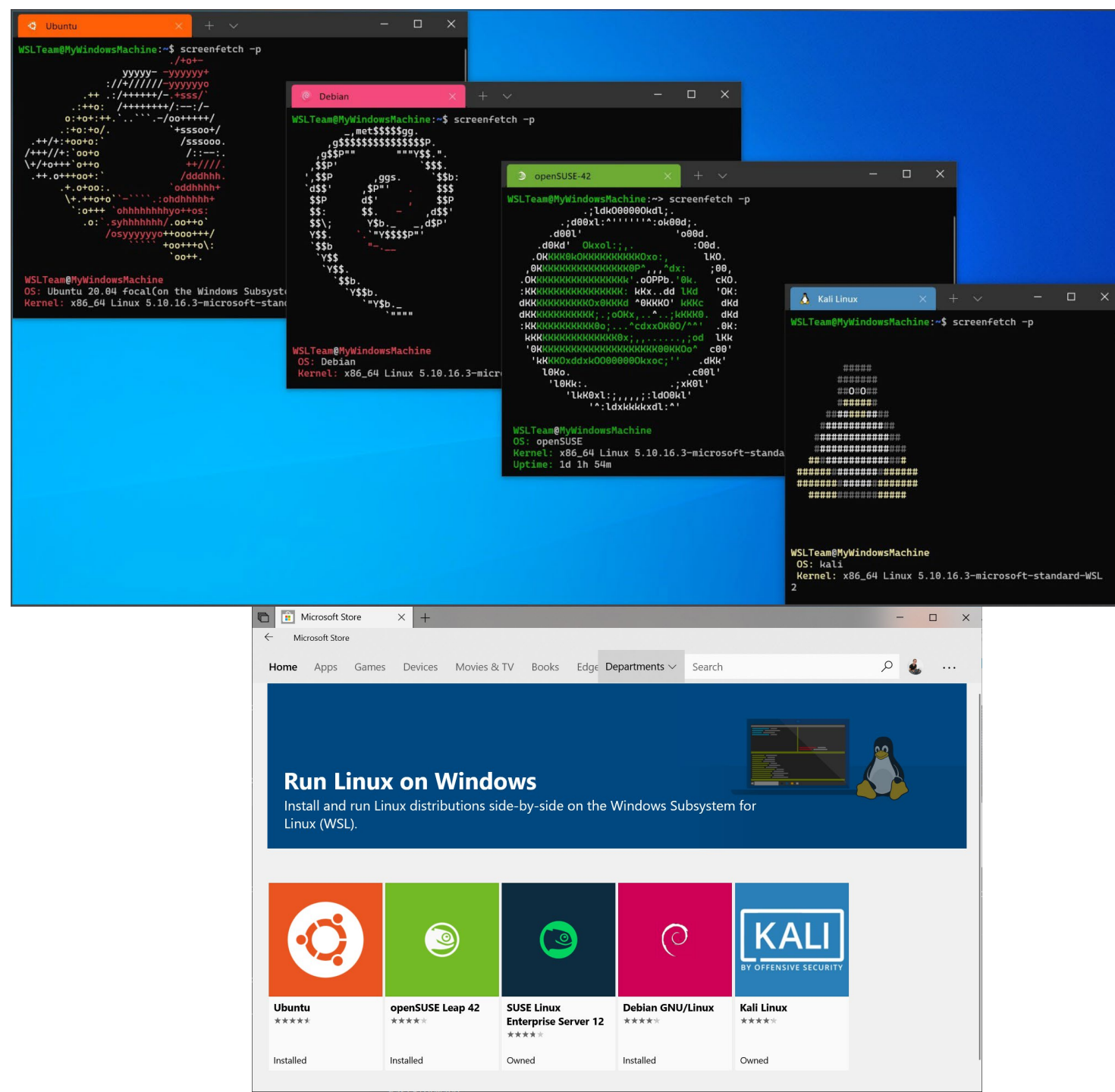


How to run Linux?

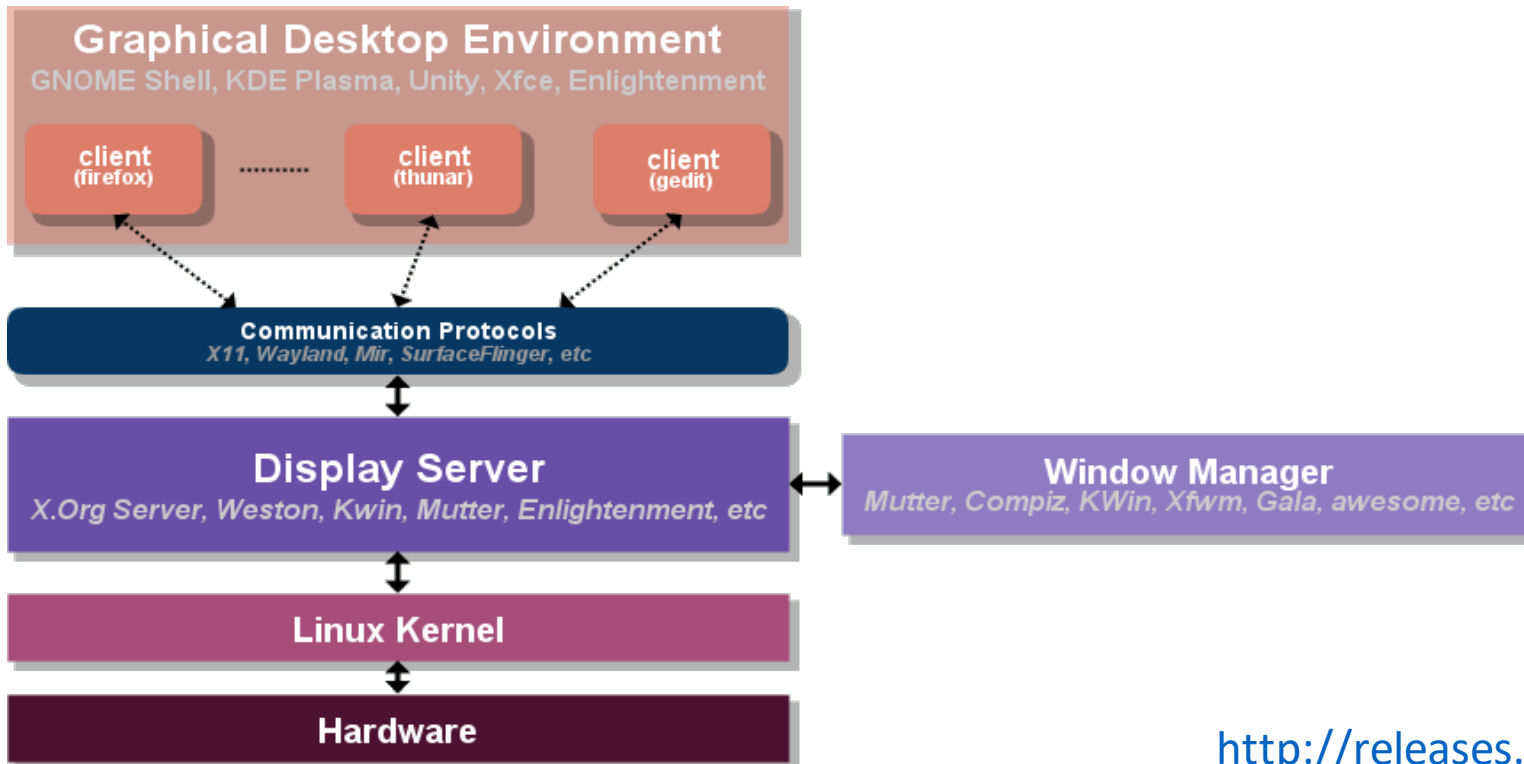
Solution 4: Use Linux within Windows

Best of both worlds

- Starting with Windows 10, you can install Linux distributions inside Windows
- Windows Subsystem for Linux
- Great if you want to use Python, learn programming, use the command line, but keep your familiar Windows environment
- demo



Fundamental differences and basic structure



- Unlike Windows, a Linux system is composed of many smaller packages, each doing a specific task:
 - Talking to the hardware
 - Managing application windows
 - Playing and recording sounds
 - Accessing the internet, etc
- It's a bit like choosing your browser: Chrome, Firefox, Edge? But for every component of the system

<http://releases.ubuntu.com/14.04/ubuntu-14.04.6-desktop-amd64.manifest>

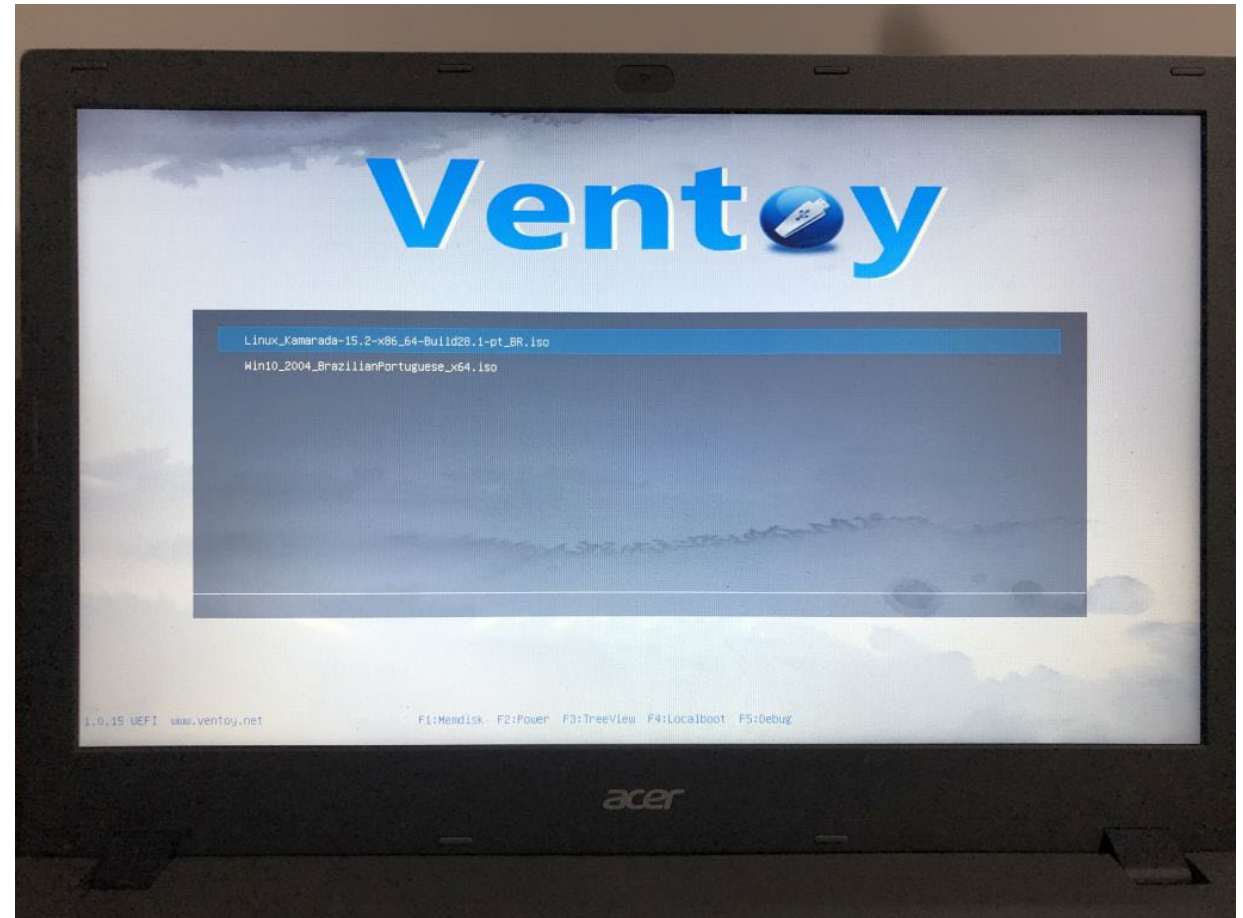
Distribution families

- Windows is written entirely by Microsoft
- Linux is written by many different volunteers, some companies, etc
- Groups of developers each want to develop their own set of packages with its own “look and feel”
- This is called a “distribution”
- Some distributions are created “from scratch”
- Others start from one particular distribution and make changes
- This creates “families” of distributions
 - Slackware
 - Red Hat (fedora, CentOS, Mandrake)
 - SuSE
 - Gentoo
 - Arch (Manjaro)
 - Debian (Ubuntu, Raspbian, Zorin, Knoppix)



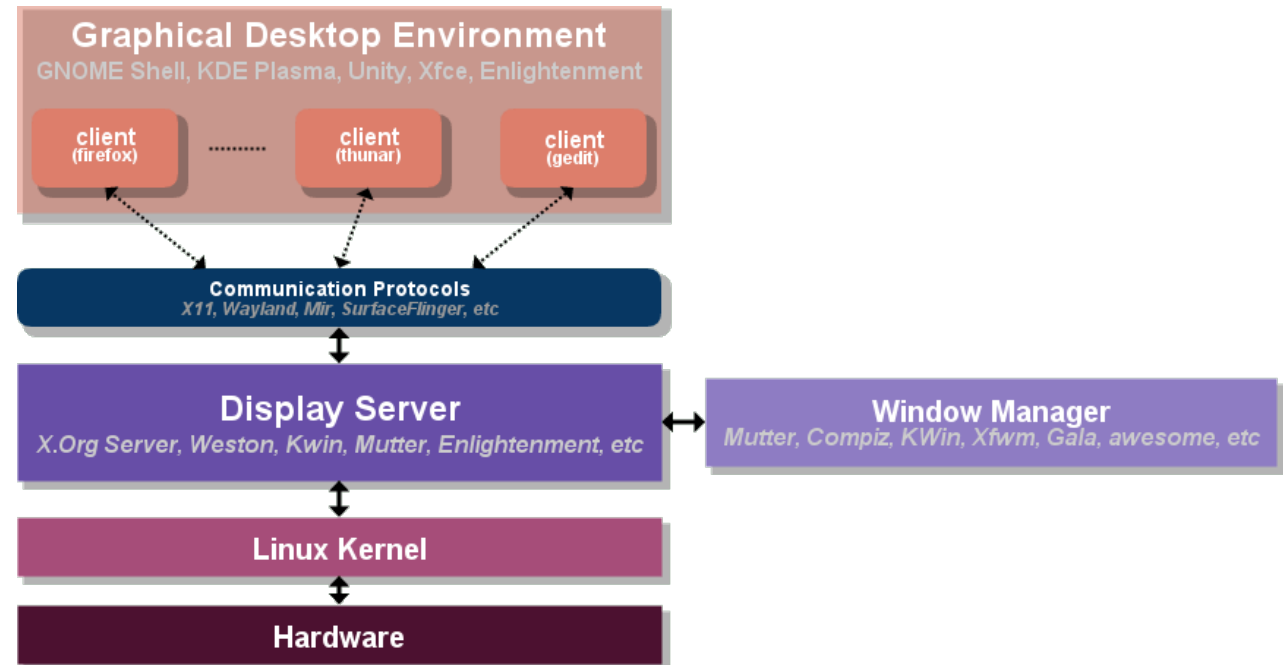
Practical / Hands-on session – wifi: MakerboxLao , password: asdasdasd

- Choose an USB Key from the basket
- Plug it into your laptop
- Turn your computer off and on again
- If your computer boots normally, turn it off again, ask for help entering and configuring the BIOS
- You will see a screen like this >
- Select a Linux distribution and press ENTER
 - Is it Live Bootable? **DO NOT PRESS INSTALL!**
 - If yes, press ENTER, if No, reboot your computer and select another one
- For each distribution, find out:
 - What is its name?
 - Does it have a graphical user interface (can you use the mouse)?
 - What family does it belong to? (search on Internet)
 - Is it meant for general use or for a specific use (search on Internet)?
 - Does it have a Word Processor (LibreOffice, OpenOffice...)
 - Connect to the internet (if you can), open a browser
 - What package manager does it use? Install a piece of software



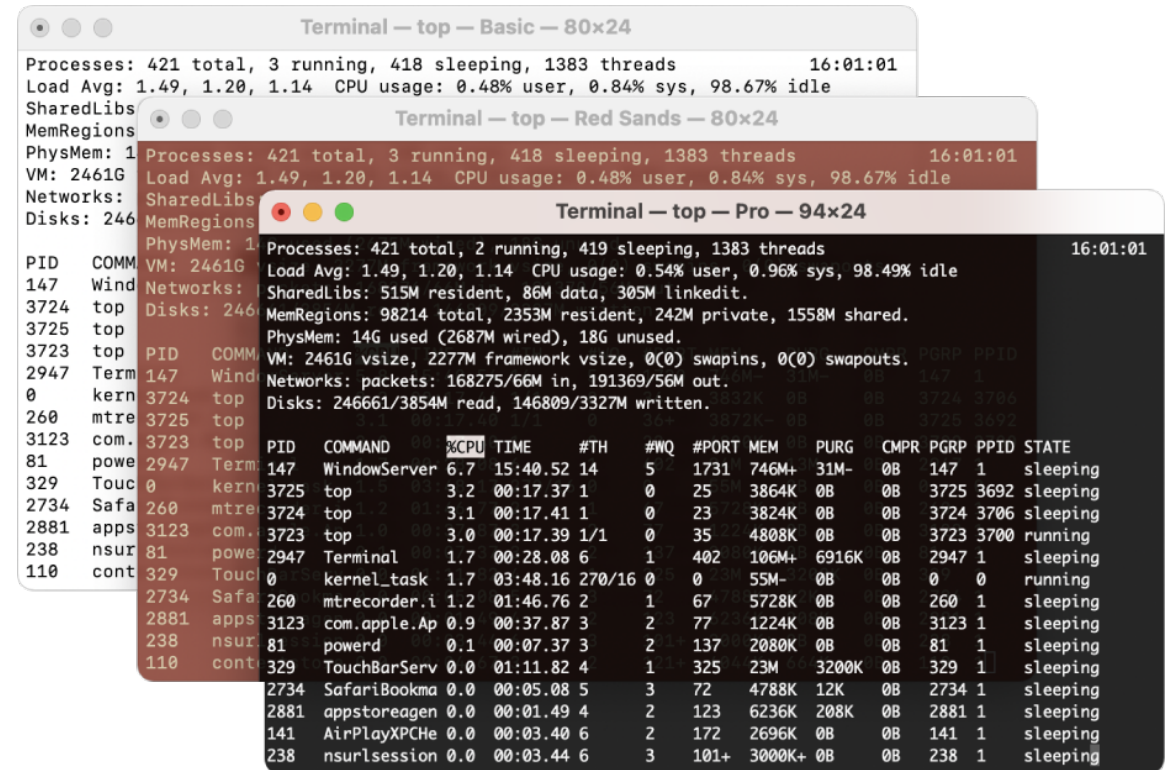
Headless/GUI

- A big part of the OS is the Window Manager (WM) and the Graphics server
- They manage the windows, buttons, what happen when you click, display images, videos, etc...
- But they are optional. Many Linux professionals do not use a Graphical User Interface (GUI) but work entirely on the command line interface (CLI)
- A system without a GUI is sometimes called “headless”
- Disadvantages: not practical, but you get used to it
- Advantages: extremely fast, simple (less bugs), can work remotely
- The CLI is the first thing that gets installed, so if there is a problem with your computer, you may end up in it



The Terminal – just another app

- What do you get without a graphical interface?
 - Not much: a question (prompt)
 - You type in a command and arguments, then press ENTER
 - If there is a problem, the command will return an error
 - If it succeeds, it will output a message (or not)
 - There is nothing else on your screen
- What if I want to look at a Python tutorial on Youtube, and switch to a Terminal ?
 - This is possible with **Terminal Emulators**
 - They allow you to talk to the low-level terminal in a window from the WM
 - This is called a PTY (pseudo terminal) as opposed to a TTY (Teletype)
 - demo

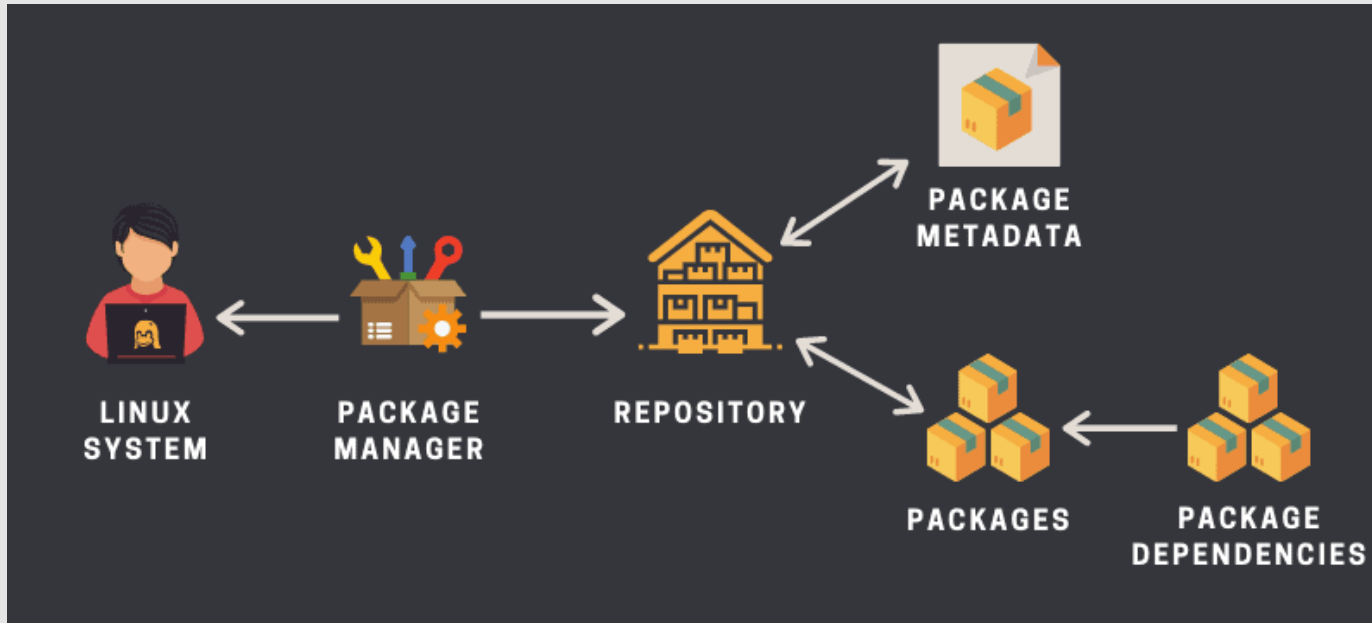


The image shows three overlapping terminal windows. The top window, titled 'Terminal — top — Basic — 80x24', displays system statistics: Processes: 421 total, 3 running, 418 sleeping, 1383 threads; Load Avg: 1.49, 1.20, 1.14; CPU usage: 0.48% user, 0.84% sys, 98.67% idle. The middle window, titled 'Terminal — top — Red Sands — 80x24', shows similar statistics. The bottom window, titled 'Terminal — top — Pro — 94x24', displays a detailed process list table.

PID	COMMAND	%CPU	TIME	#TH	#WQ	#PORT	MEM	PURG	CMPR	PGRP	PPID	STATE
147	WindowServer	6.7	15:40.52	14	5	1731	746M+	31M-	0B	147	1	sleeping
3725	top	3.2	00:17.37	1	0	25	3864K	0B	0B	3725	3692	sleeping
3724	top	3.1	00:17.41	1	0	23	3824K	0B	0B	3724	3706	sleeping
3723	top	3.0	00:17.39	1/1	0	35	4808K	0B	0B	3723	3700	running
2947	Terminal	1.7	00:28.08	6	1	402	106M+	6916K	0B	2947	1	sleeping
0	kernel_task	1.7	03:48.16	270/16	0	0	55M-	0B	0B	0	0	running
260	mtrecorder.i	1.2	01:46.76	2	1	67	5728K	0B	0B	260	1	sleeping
3123	com.apple.Ap	0.9	00:37.87	3	2	77	1224K	0B	0B	3123	1	sleeping
81	powerd	0.1	00:07.37	3	2	137	2080K	0B	0B	81	1	sleeping
329	TouchBarServ	0.0	01:11.82	4	1	325	23M	3200K	0B	329	1	sleeping
2734	SafariBookma	0.0	00:05.08	5	3	72	4788K	12K	0B	2734	1	sleeping
2881	appstoreagen	0.0	00:01.49	4	2	123	6236K	208K	0B	2881	1	sleeping
141	AirPlayXPCHe	0.0	00:03.40	6	2	172	2696K	0B	0B	141	1	sleeping
238	nsurlsession	0.0	00:03.44	6	3	101+	3000K+	0B	0B	238	1	sleeping

Installing software

Solution 1: package managers



- Linux software is community-written
- How to make sure software is compatible with a distribution?
- Prerequisites?
- Every major distribution has a package manager and software repositories
- Software is tested, validated, and dependencies documented
- One-click/one-line install

Installing software

Solution 1: package managers

Action	Arch	Red Hat/ Fedora	Debian/ Ubuntu	SLES/ openSUSE	Gentoo
Install a package(s) by name	<code>pacman -S</code>	<code>dnf install</code>	<code>apt install</code>	<code>zypper in</code>	<code>emerge [-a]</code>
Remove a package(s) by name	<code>pacman -Rs</code>	<code>dnf remove</code>	<code>apt remove</code>	<code>zypper rm</code>	<code>emerge -[a]vc</code>

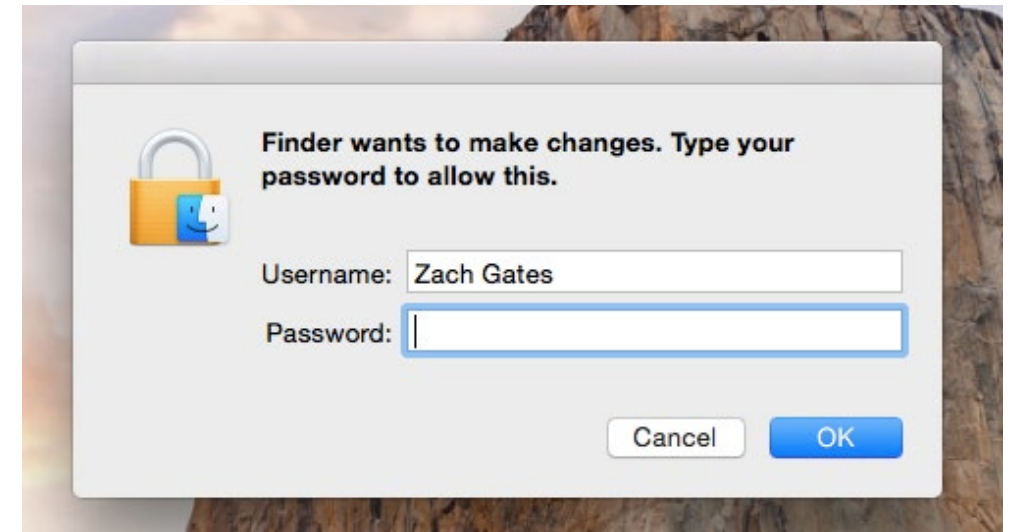
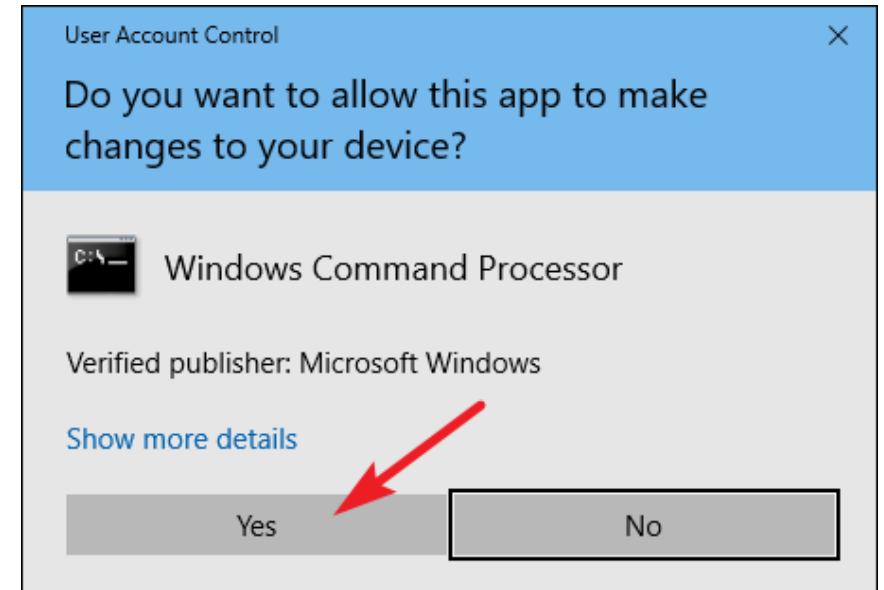
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3. Linux specificities

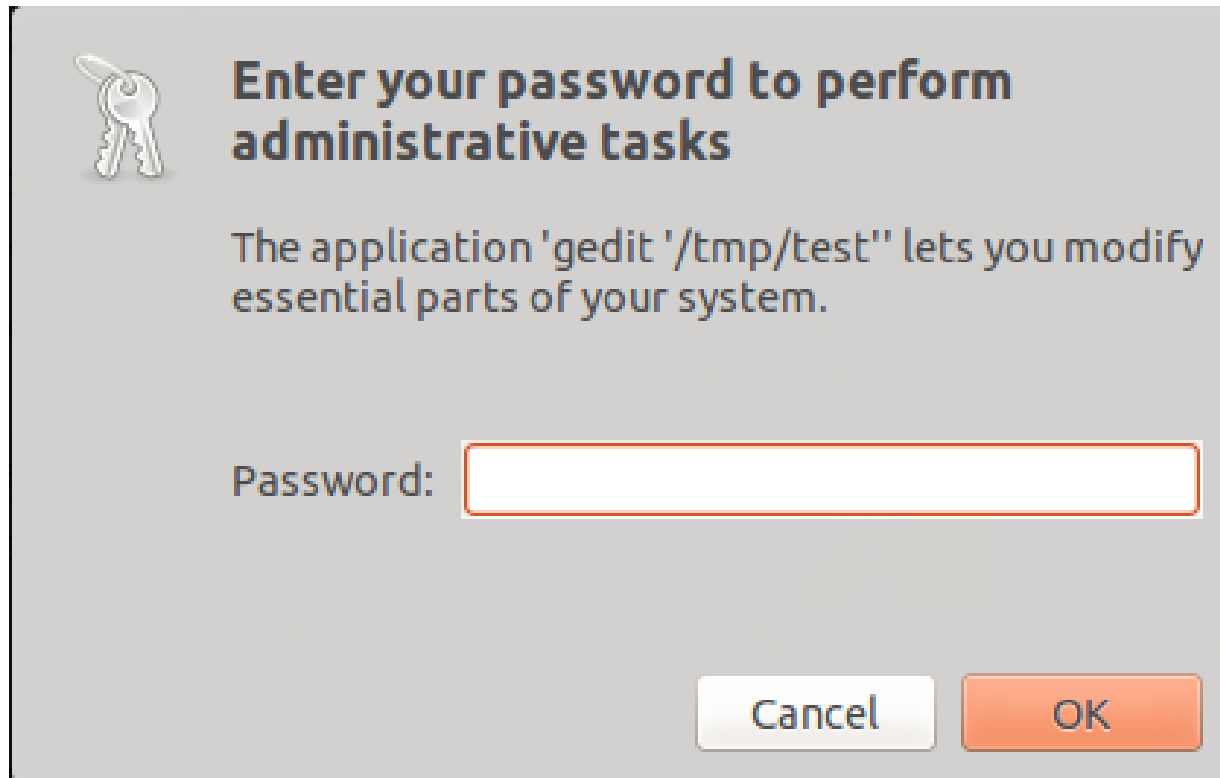
User rights, file system

The super(user)

- Everyone is used to this kind of message nowadays
- Allows any user to make dangerous changes to the computer **if they have an administrator account/password**
- Before Windows Vista, this did not exist
- Every user could modify the computer
- This is a Linux heritage, it has existed since the first days in the 1990s



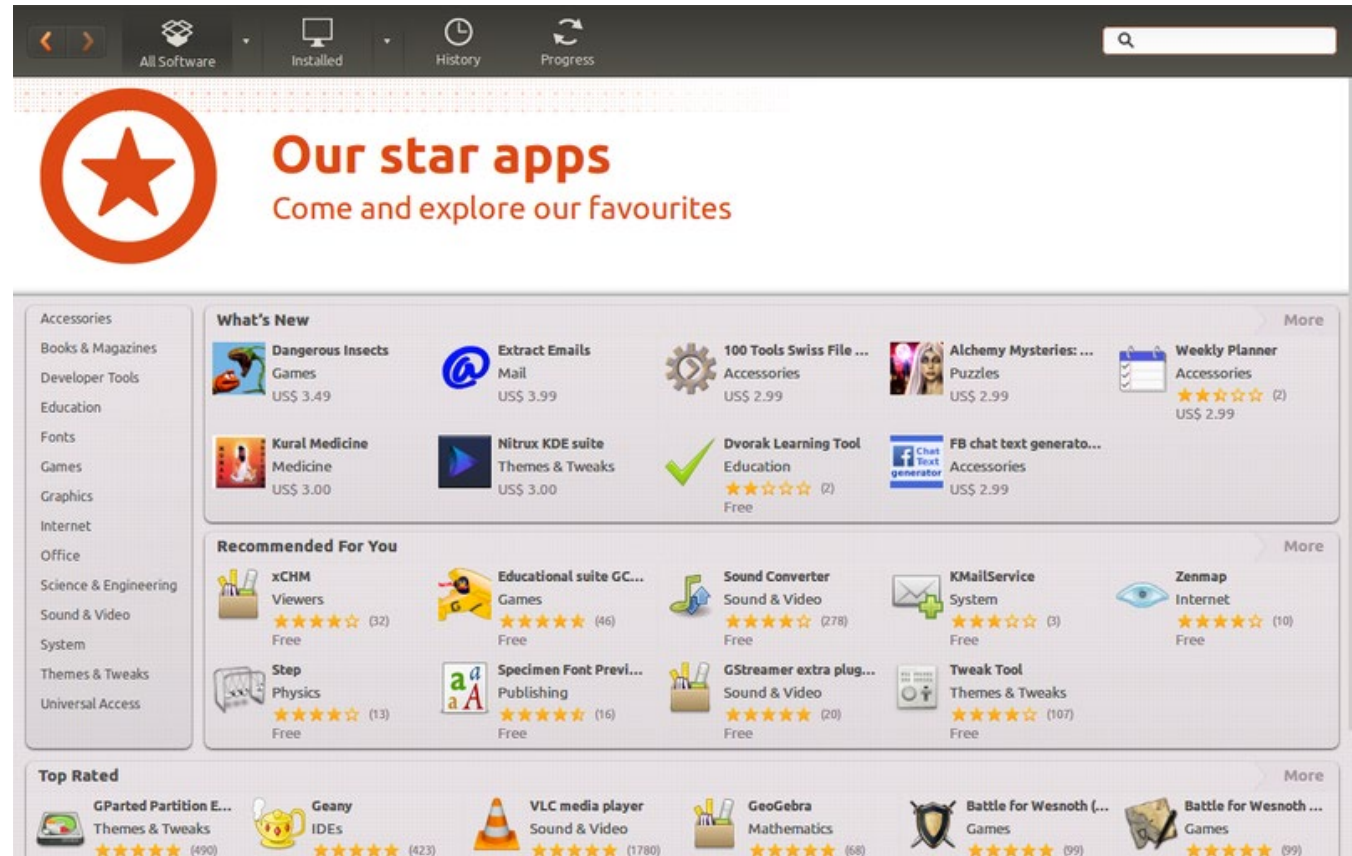
The super(user)



- In Linux, the administrator is called the superuser
- It is also called **root** because that is often the name of the superuser account
- When you do something that requires root privileges (installing software, changing configuration), most graphical systems will ask you for **your own password**

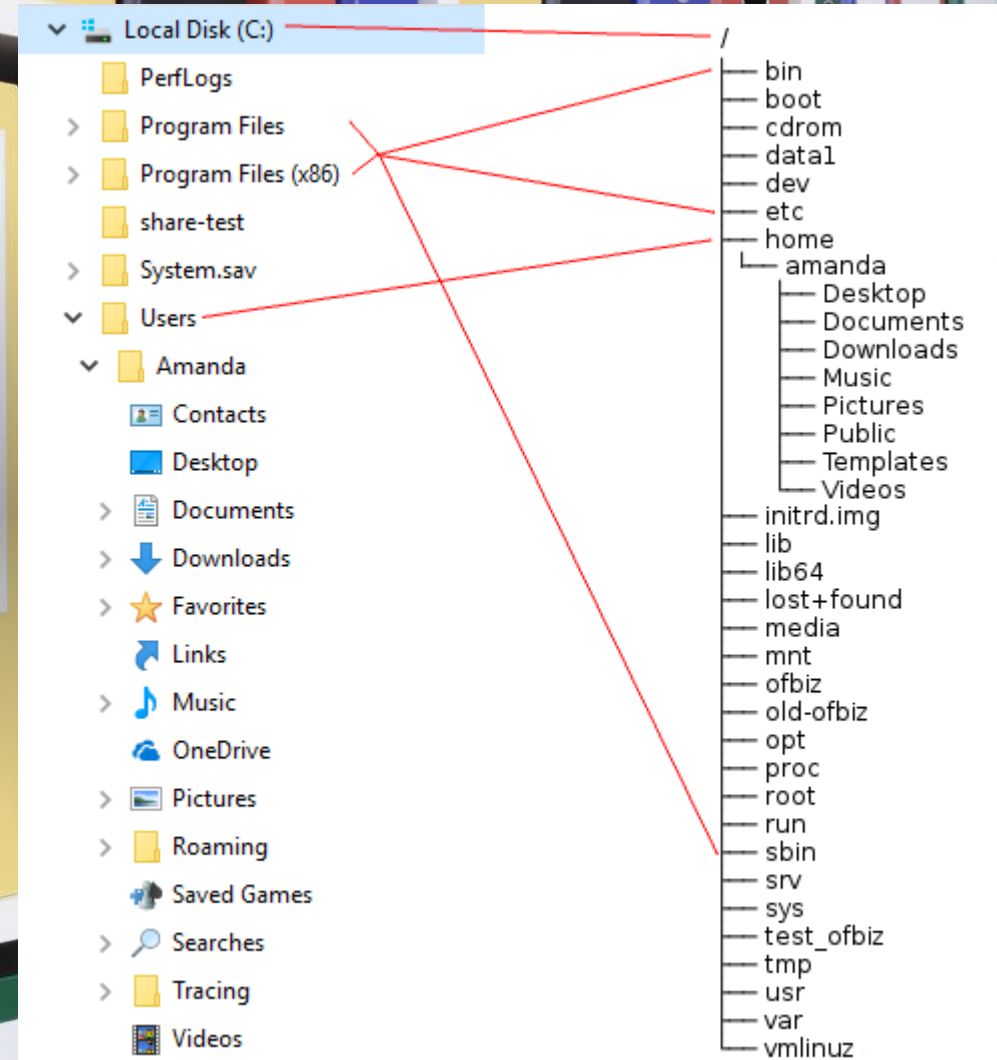
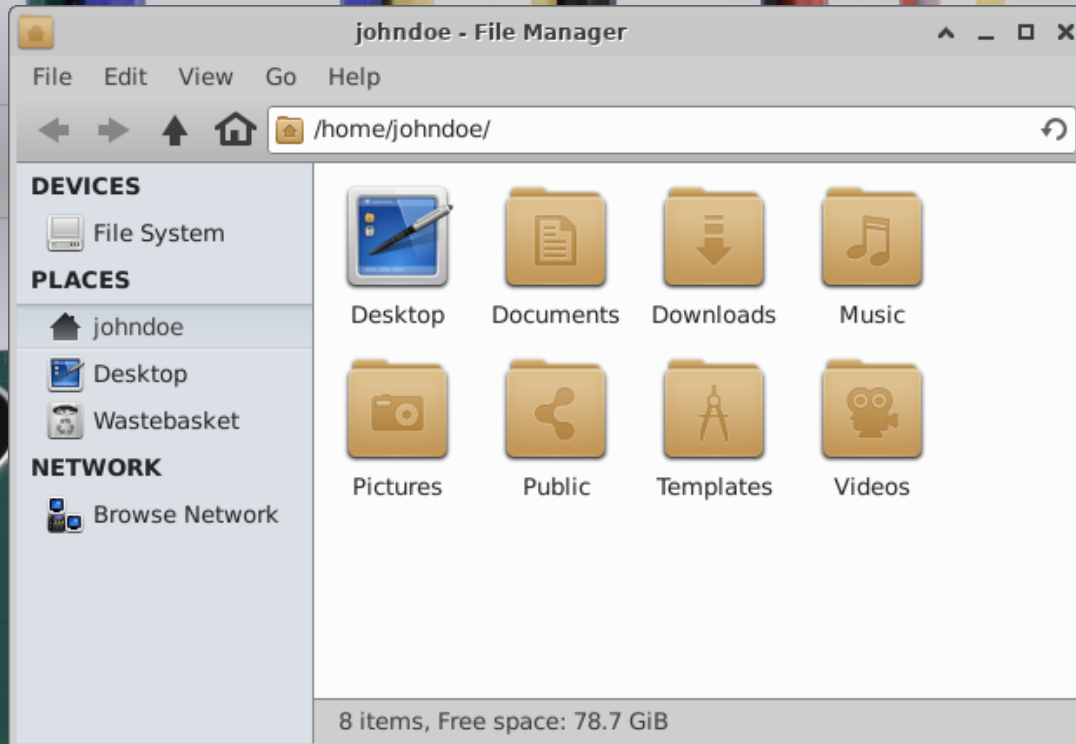
Practical / Hands-on session

- Choose a general use distribution (Debian, Ubuntu, Mint, Manjaro, OpenSuse, Fedora, Elementary...) **each key should have one!**
- Connect to the internet!
- Find the software manager (or look for it on the Internet)
- Browse the available software from the manager
- Install some software you like. Examples:
 - Abi Word, a popular word processor
 - FeatherPad/LeadPad, a popular text editor
 - Anything else
- You may be asked for a password. If yes, you will need to look for the “default live password” of your distribution



The file system

- The Linux file system is very close to that of a Mac
- 2 directories are important:
- /, which is the root of all the directories on your computer
- /home/yourname, which is the **home** of the user



The terminal – where the fun starts

- Let's start up a terminal
- Start with the commands `ls` and `pwd` : what do they do?
- In the command line, **you are always in a directory!**

The terminal – where the fun starts

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- What does `ls -l` do? Get help with `--help`
- Are the `tree` and `nano` commands installed on your system?
 - If not, find your package manager and install them!
 - You will need to use `sudo` (superuser do)
- Use `mkdir` to create a directory, `cd` to go into that directory, `nano` to write a file, `cat` to display that file, `more` to examin it, `tree` to see the directory structure

The terminal – where the fun starts

- There are also more “fun” packages. Have a look at:
- cowsay lolcat figlet sl fortune cmatrix
- telnet towel.blinkenlights.nl
- bb
- afire/cacafire

Hope you enjoyed, we welcome your feedback!



<https://bit.ly/34jLmON>