③ Debian family:

- uses the DPKG-based APT package (using apt, apt-get, apt-cache, etc. to install update, and remove packages in the system.
- Ubuntu has been widely used for cloud deployments.
- While Ubuntu is built on top of Debian and is GNOME-based under the hood, it differs in interface.

Side knowledge:

- Linux: software comes in packages (.exe/.msi Windows)
- DPKG = low-level tool that installs those Installer proj. packages
  - Unpacks and installs software on your system.
  - Very basic - you need to tell it which pack to install and where
- APT (Advanced Package Tool)
  - smarter tool that uses dpkg for you
  - smarter software store manager

App store Manager - goes online, finds apps, used the installer for you.

- apt, apt-get, apt-cache = commands you run in the terminal
  - apt install something → install a package
  - apt update → refresh the list of available software

SUSE Family:

- openSUSE is the reference distribution for the SUSE family
- SLES - SUSE Enterprise Server
  ↓
  Linux
- SLES - is widely used in retail and many other sectors

Debian family

The Debian distribution is the source/original project (upstream) from which other projects (called downstream projects) derive their code.

Upstream = the source of the software
Downstream = projects based on that source.

Commonly used on:
- servers
- desktop computers

Debian is a pure open source comunity project (not owned by any corporation) and has a strong focus on stability.
- provides the largest and most complete software repository to its users of any Linux distro.

Ubuntu LTS (long term support) as the reference for the Debian family distributions.

LINUX

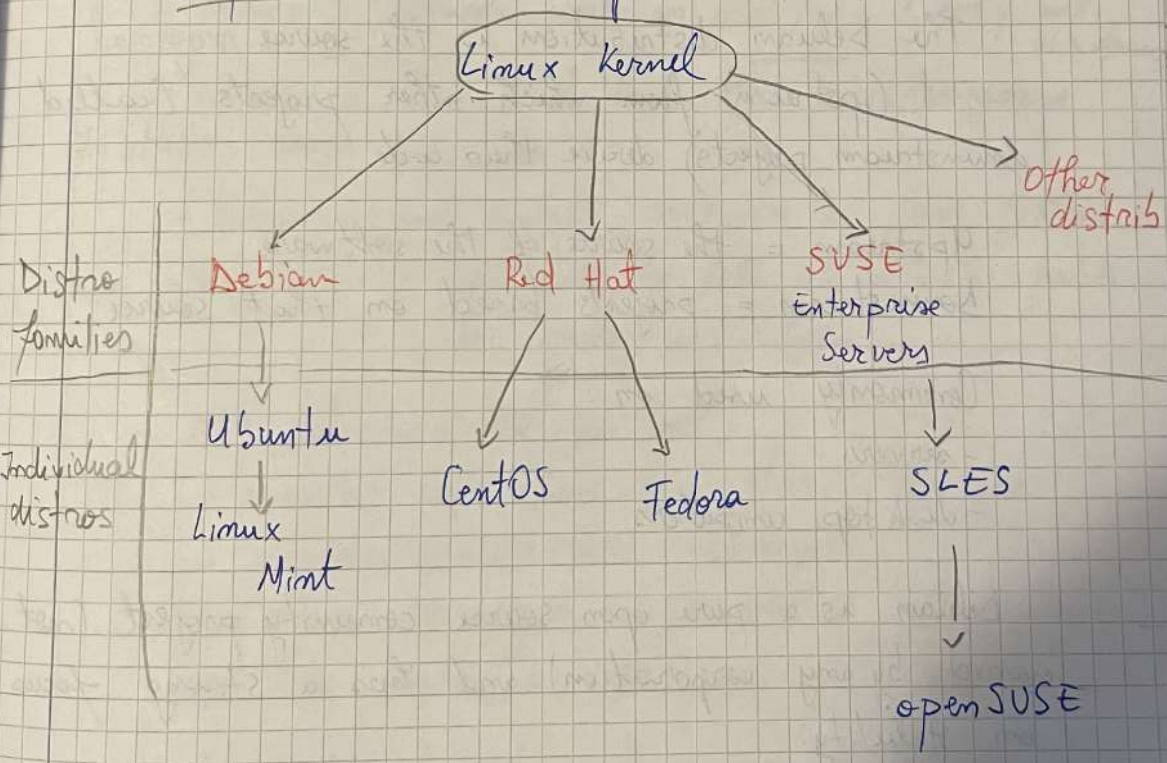
1) - linux foundation - Linus Torvalds

edEx → Harvard, MIT

Linux distributions

Families and representative distributions used here:
- Red Hat Family Systems (including CentOS & Fedora)
- SUSE Family Systems (including openSUSE)
- Debian Family Systems (incl. Ubuntu & Linux Mint)

Components that make-up a Linux distribution:



SUSE - software and systems Development
RHEL - Red Hat Enterprise Linux
- widely used by enterprises which host their own systems

4) Main Bootloader Responsalilities

- load the LINUX kernel into memory
- load the initrd / initramfs (initial RAM disk or file system) - a temporary root filesystem used to bootstrap drivers and prepare the real root system
- optionally: present a menu to choose between multiple OS or kernel versions.

RECAP

BOOTLOADER = small program that loads your OS into memory after the computer powers on.

1. Power ON -> BIOS / UEFI runs (hardware check)
2. Control passes to the Bootloader
3. Bootloader loads the Kernel into memory RAM (Linux, Windows etc)
4. Kernel takes over -> OS starts running

Bootlooder's job:

- find the OS on the disk
- load the Kernel + temporary drivers / system
- offer a menu if you have multiple OS (dual boot)

Bootloader phase

1) where is the bootloader stored?

10)

- BIOS/MBR systems → in the Master Boot Record first 512 bytes of the boot disk

- UEFI systems → in the EFI system partition formatted with FA32 file system.

  32 bit version of File Allocation Table (FAT) file system.
  (hard drives, memory cards, USB drives).

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2) Before accessing mass storage:
The system reads configuration values (date, time, device order) from CMOS.

CMOS - a technology for making low power integrated circuits
= a small battery backed memory chip.

3) LINUX bootloaders:

- GRUB → most popular, supports multiple OSs and advanced configs (dual-boot / pick kernel)
- ISOLINUX → for booting from CDs/DVDs/USBs
- U-boot → for embedded systems like routers an IoT (internet of things) devices. (Raspberri, IoT, routers)

1. BIOS = low level firmware on a chip on the motherboard

- x86 hardware family (basis of almost all desktop and laptop PCs)

x86 = family of instructions set architectures (ISAs), based on the Intel 8086 microprocessors and its variants.
- 16-bit

naming convention because Intel processors had names ending in "86." (8086, 80286, etc)

- Steps:
  - when the computer is powered ON, the Basic Input/Output System (BIOS) initializes the hardware, screen, keyboard and tests the main memory.

Process also named POST (Power on Self Test)
- The BIOS software is stored on a read-only memory (ROM) chip on the motherboard.
- After this, the remainder of the boot process is controlled by the OS.

BIOS Boot or UEFI Boot (for modern devices).

Once the POST (power on self test) is completed, system control passes from the BIOS to the boot loader.

8) A full Linux distribution consists of the kernel + a number of other software tools for file-related operations, user management and software package management.

vid

9)

Linux Basics & System startup

The Boot Process = initializing the system
- everything from power ON to a fully operational user interface

BOOT PROCESS

POWER ON
↓
BIOS
↓
Master Boot Record (MBR) or EFI Partition
↓
Boot Loader (eg. GRUB)
↓
Kernel
↓
Initial RAM disk (initramfs)
↓
/sbin/init (parent process)
↓
Command Shell (getty)
↓
Graphical Unit Interface (X Windows / Wayland)

1)

Linux Terms

- kernel OS brain
- distribution
- boot loader
- service
- file system
- X Windows System
- Desktop environment
- command line

Distribution = collection of software making up a Linux-based OS

Boot Loader = program that boots the OS

Service = program that runs as a background process

File system = method for storing and organizing files in Linux

X Windows System = graphical subsystem on almost all Linux systems
Provides the standard toolkit and protocol to build GUI on almost all Linux systems.

Command Line interface = interface for typing commands on top of the OS.

Shell program brain = command line interpreter that interprets the command line input and instructs the OS to perform any necessary tasks and commands. (bash, tcsh, zsh)

Bash is a shell on Linux.
PowerShell → shell on Windows

UNIX → multitasking, multi-user computer OS

6)

Linux files

- stored in a hierarchical files system

Top node of the system → root (/)

Linux is a fully multitasking (i.e. multiple threads of execution are performed simultaneously), multi user OS with built-in networking and service processes known as daemons in the Unix World.

Daemon = background process that runs continuously and performs system or service-related tasks, without direct user interaction.
greek

- invisible worker spirit that worked tirelessly behind the scenes.
- sshd, systemd, httpd, mysqld - ending in d is usually a daemon

OPEN source products:

- Android → built on top of the Linux kernel
- Apache Web Server → httpd (about half of all web servers are running Apache)
- Social Media platforms use open source products
- Search engines
- Weather forecasting
- Fitness devices: FitBit

1)

Linux

- kerne
- distr
- boot
- ser

Dist

Boo

Ser

Fi

2) The Desktop Environment (GNOME)

- the graphical interface (windows, buttons, menus) that makes it feel like a "normal" computer.

- when you drag windows, click icons or open Settings that's all GNOME doing the work. (when you click around -> u're interacting with GNOME)

But under the hood, GNOME sends instructions to the Ubuntu core to actually do things.

Linux = just a Kernel (OS)
- talks to the hardware, it makes the hardware work, run programs etc.

Sudo - to gain temporary root privileges safely

Holy wars - strong disaggreements in the community

man <topic> : in the command line if you want to know more about a command, prompt, program, topic or utility

Linux is used to power:

- over 96% of the world's top web servers
- majority of smartphones (via Android) Linux The Android system is built on top of Android
- more than 90% of the public cloud workload
- all of the world's most powerful supercomputers

- apt upgrade -> update installed software to the latest version

- apt-cache search smth -> search for a package

(the buttons you press to talk to the app store manager).

Debian (and Ubuntu) use a tool called APT, which is like a built-in app store for Linux.

You can type commands like apt install to install apps, apt update to refresh the software list, or apt remove to uninstall things.

Under the hood, APT uses another tool called dpkg to actually put the software on your system.

GNOME - desktop environment (DE) for Linux.
= cum arată desktopul în acest OS
Desktop, taskbar, menus, icons, window buttons, setfings apps -> all of this is handled by DE

Ubuntu uses GNOME as its default DE.

1) Ubuntu = the core system, the actual operating system (based on Debian)

- mostly command-line stuff: managing files, installing software, controlling hardware, networking.
- if you ran Ubuntu without a DE, you'd just get a black terminal screen (like a server).