UNIX

BE FAST. BE ELEGANT.

Origin Story

Origins - Bell labs

Ken Thomson

- B
- Unix
- UTF8
- Go

Dennis Ritchie

- B
- Unix
- C

Origins -Bell labs

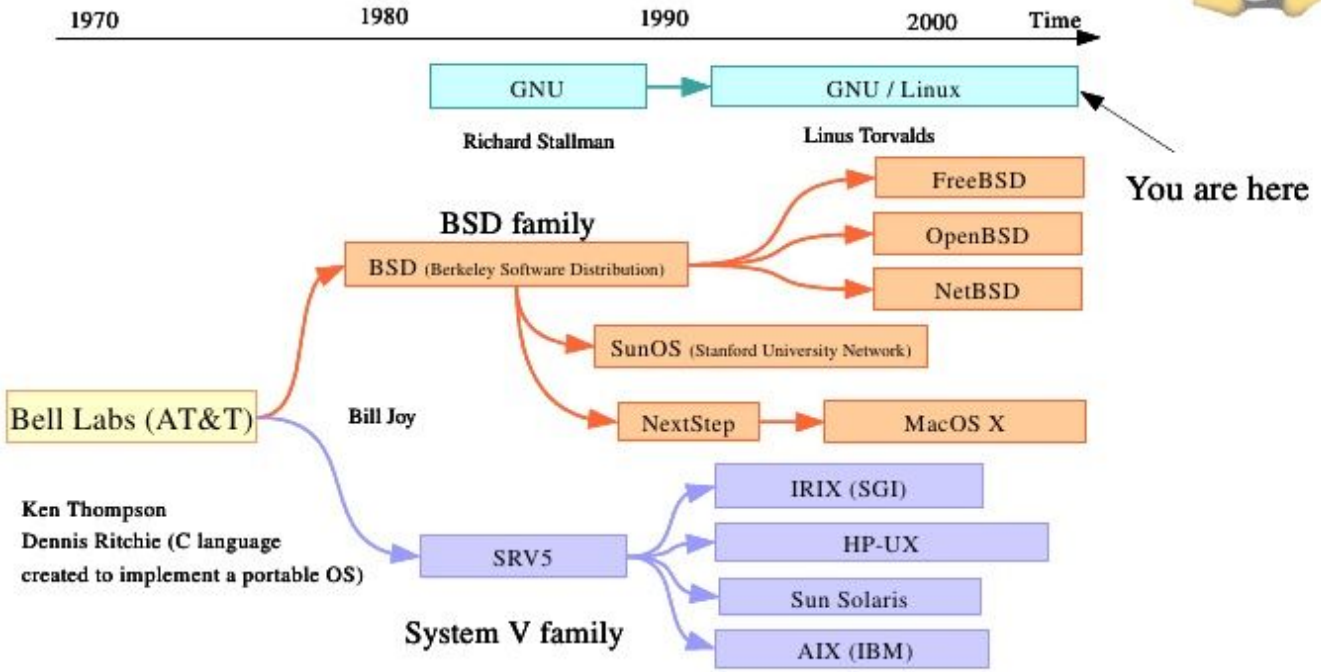
Multiplexed Information and Computer Services
MULTICS

MIT + Bell Labs

Uniplexed Information and Computer Services
UNICS

UNIX

Unix family Tree



1972

1977

+

Berkeley
UNIVERSITY OF CALIFORNIA

=BSD

Berkeley Software Distribution - BSD/Unix

Richard Stallman

FREE SOFTWARE FOUNDATION

GNU

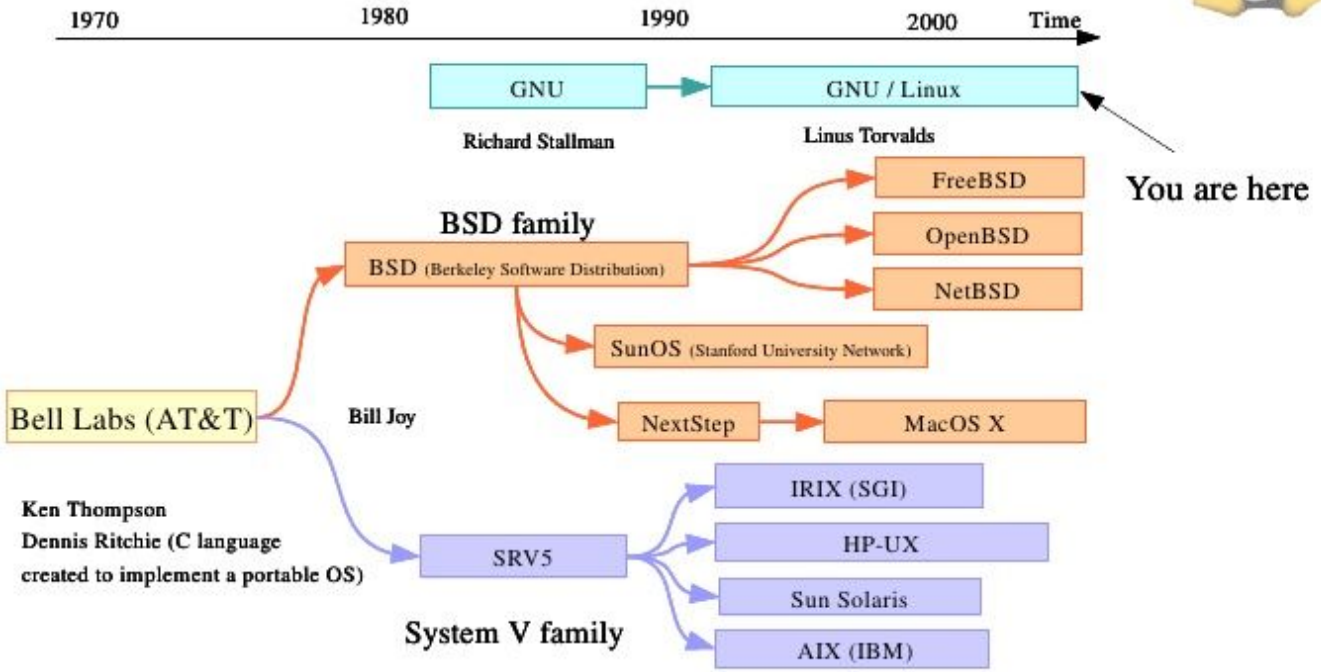
GPL v3 Free Software

Free as in Freedom

GCC

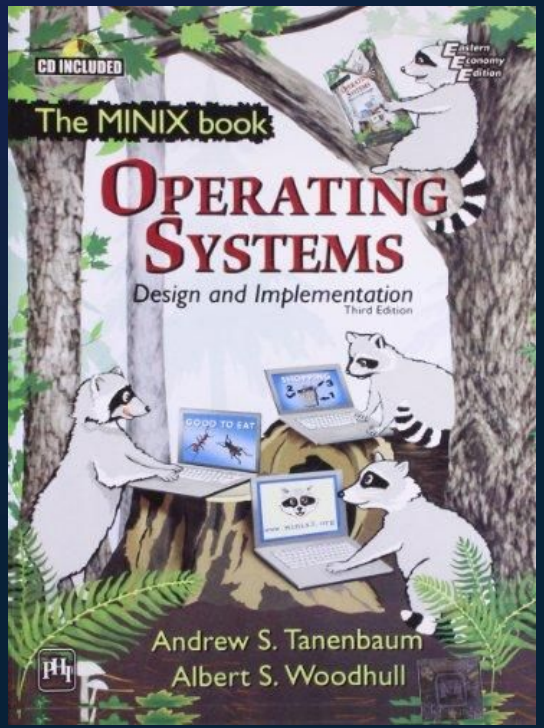
1980s

Unix family Tree



-1991

Linus Torvalds



Linux

+

X Window System (1984)

(Now X11)

Linux now comes with a graphical user interface that increases the ease of use of this operating system.

1992

=

- netBSD
- freeBSD
- openBSD

Unix philosophy

“ **Minimalist**, **modular** software development ”

Meanwhile at microsoft ...

- Λειτουργικά περιβάλλοντα 16 bit
  - **Windows 1.0** (1985)
  - **Windows 2.0** (1987)
- Υβριδικά λειτουργικά περιβάλλοντα 16/32 bit
  - **Windows 3.0** (1990)
  - **Windows 3.1** (1992)

Not scalable !

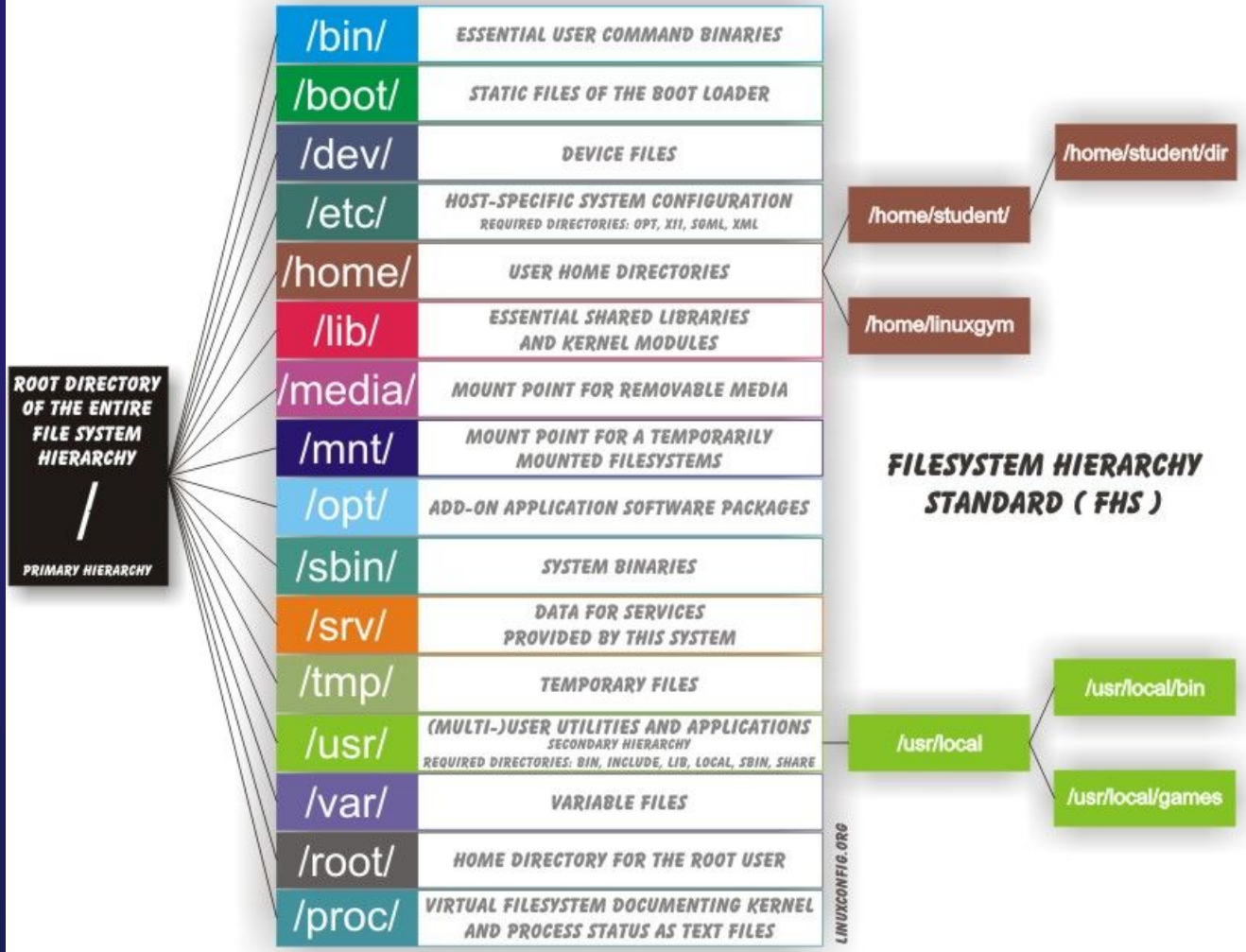
MacOs - 2001

Steve Wozniak

Posix

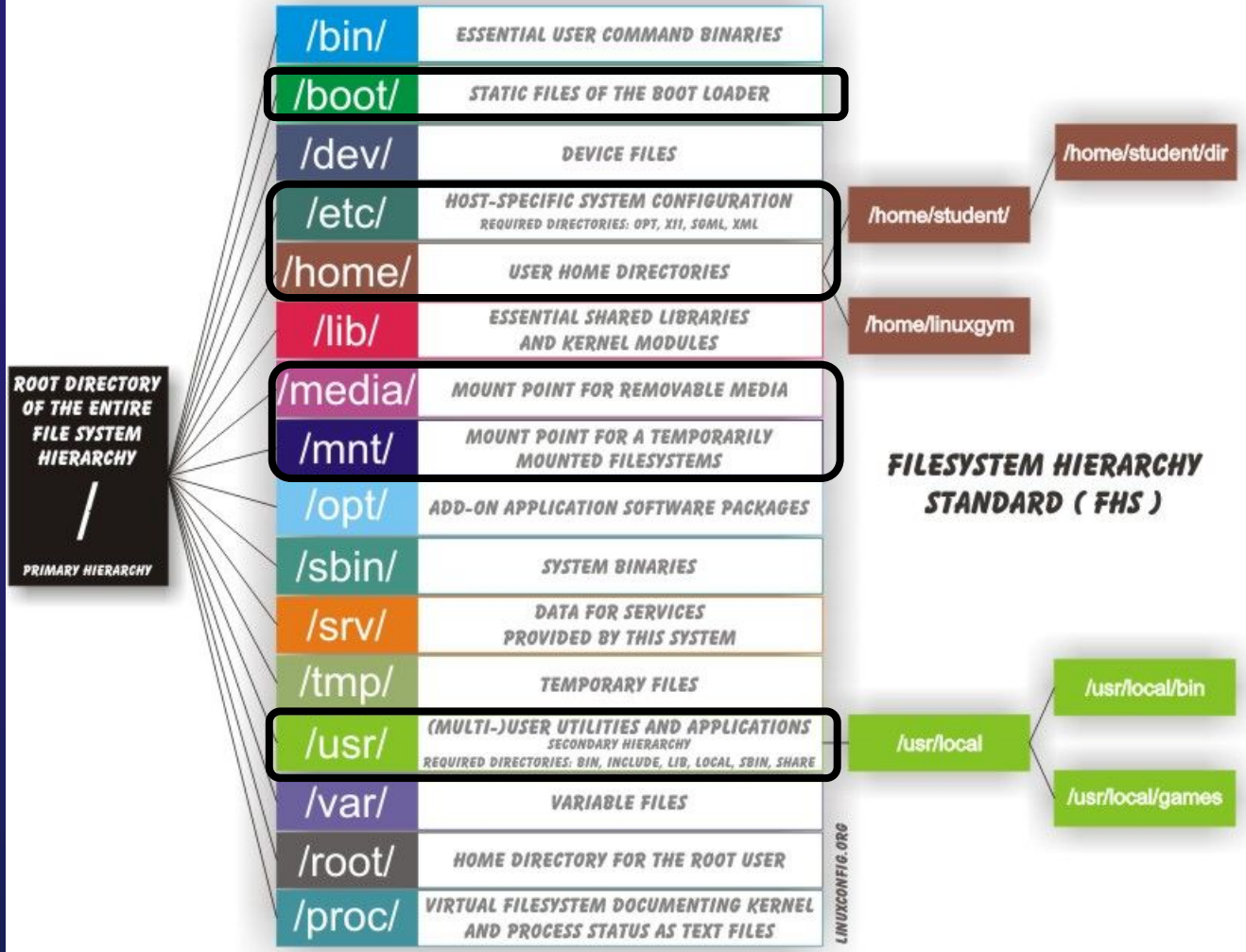
= Portable Operating System Interface

IEEE Std 1003.1-1988



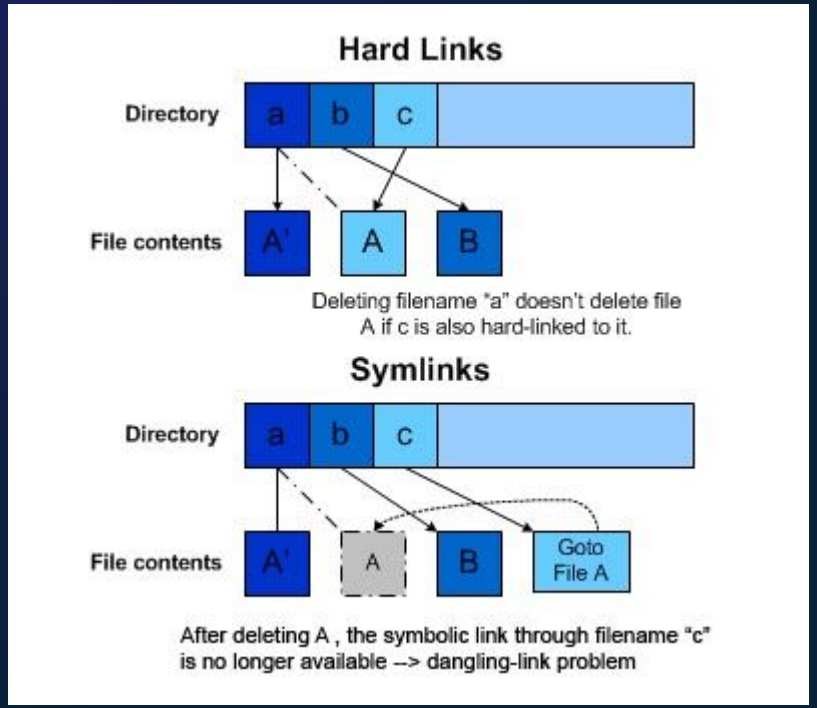
FILESYSTEM HIERARCHY STANDARD (FHS)

Demo time !


ROOT DIRECTORY OF THE ENTIRE FILE SYSTEM HIERARCHY
/
PRIMARY HIERARCHY
/bin/
ESSENTIAL USER COMMAND BINARIES
/boot/
STATIC FILES OF THE BOOT LOADER
/dev/
DEVICE FILES
/etc/
HOST-SPECIFIC SYSTEM CONFIGURATION
REQUIRED DIRECTORIES: OPT, X11, SGML, XML
/home/
USER HOME DIRECTORIES
/lib/
ESSENTIAL SHARED LIBRARIES AND KERNEL MODULES
/media/
MOUNT POINT FOR REMOVABLE MEDIA
/mnt/
MOUNT POINT FOR A TEMPORARILY MOUNTED FILESYSTEMS
/opt/
ADD-ON APPLICATION SOFTWARE PACKAGES
/sbin/
SYSTEM BINARIES
/srv/
DATA FOR SERVICES PROVIDED BY THIS SYSTEM
/tmp/
TEMPORARY FILES
/usr/
(MULTI-)USER UTILITIES AND APPLICATIONS
SECONDARY HIERARCHY
REQUIRED DIRECTORIES: BIN, INCLUDE, LIB, LOCAL, SBIN, SHARE
/var/
VARIABLE FILES
/root/
HOME DIRECTORY FOR THE ROOT USER
/proc/
VIRTUAL FILESYSTEM DOCUMENTING KERNEL AND PROCESS STATUS AS TEXT FILES
/home/student/
/home/student/dir
/home/linuxgym
/usr/local
/usr/local/bin
/usr/local/games
LINUXCONFIG.ORG
FILESYSTEM HIERARCHY STANDARD (FHS)

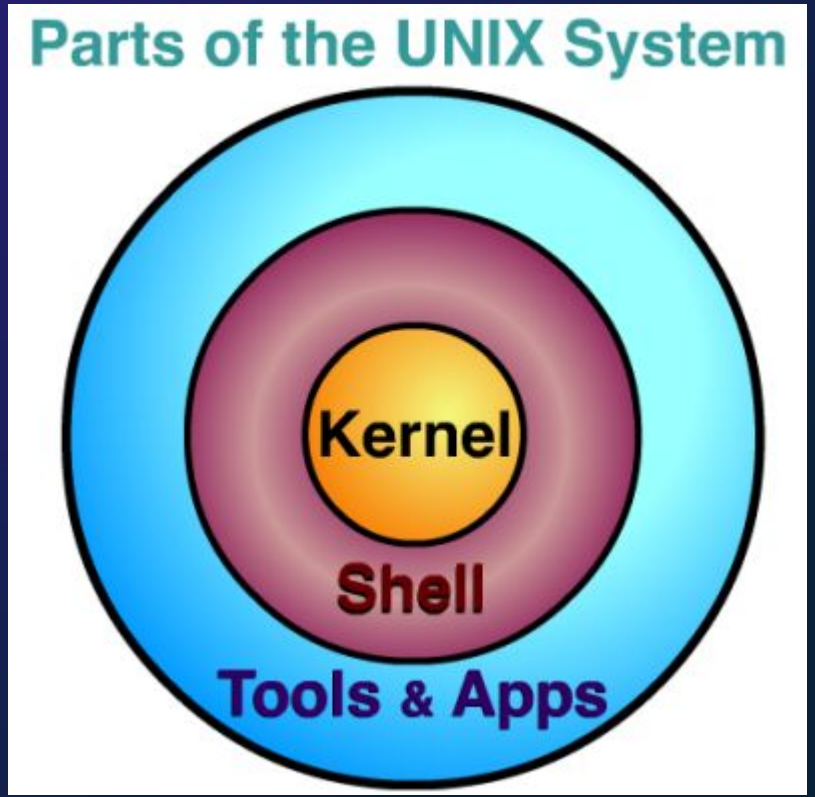
Symlinks - Symbolic links - Soft links

```
→  / l
total 112K
drwxr-xr-x  17 root root 4,0K Οκτ  25 14:02 .
drwxr-xr-x  17 root root 4,0K Οκτ  25 14:02 ..
lrwxrwxrwx   1 root root    7 Σεπ  30 10:25 bin -> usr/bin
drwxr-xr-x   4 root root 4,0K Οκτ  25 14:04 boot
-rw-r--r--   1 root root  21K Αυγ  18 18:24 desktopfs-pkgs.txt
drwxr-xr-x  20 root root 3,3K Νοε   6 23:59 dev
drwxr-xr-x  93 root root 4,0K Νοε   7  2018 etc
drwxr-xr-x   4 root root 4,0K Οκτ  25 14:43 home
lrwxrwxrwx   1 root root    7 Σεπ  30 10:25 lib -> usr/lib
lrwxrwxrwx   1 root root    7 Σεπ  30 10:25 lib64 -> usr/lib
drwx------   2 root root  16K Οκτ  25 14:39 lost+found
-rw-r--r--   1 root root    7 Αυγ  18 18:24 .manjaro-tools
drwxr-xr-x   2 root root 4,0K Απρ  27  2018 mnt
drwxr-xr-x   5 root root 4,0K Οκτ  30 19:15 opt
dr-xr-xr-x 185 root root    0 Νοε   6 22:49 proc
drwxr-x---   7 root root 4,0K Οκτ  25 15:48 root
-rw-r--r--   1 root root 3,9K Αυγ  18 18:20 rootfs-pkgs.txt
drwxr-xr-x  26 root root  640 Νοε   6 23:24 run
lrwxrwxrwx   1 root root    7 Σεπ  30 10:25 sbin -> usr/bin
drwxr-xr-x   4 root root 4,0K Αυγ  18 18:19 srv
dr-xr-xr-x  13 root root    0 Νοε   6 22:49 sys
drwxrwxrwt  14 root root  440 Νοε   7 08:16 tmp
drwxr-xr-x   9 root root 4,0K Νοε   4 19:26 usr
drwxr-xr-x  12 root root 4,0K Νοε   4 22:53 var
→  /
```

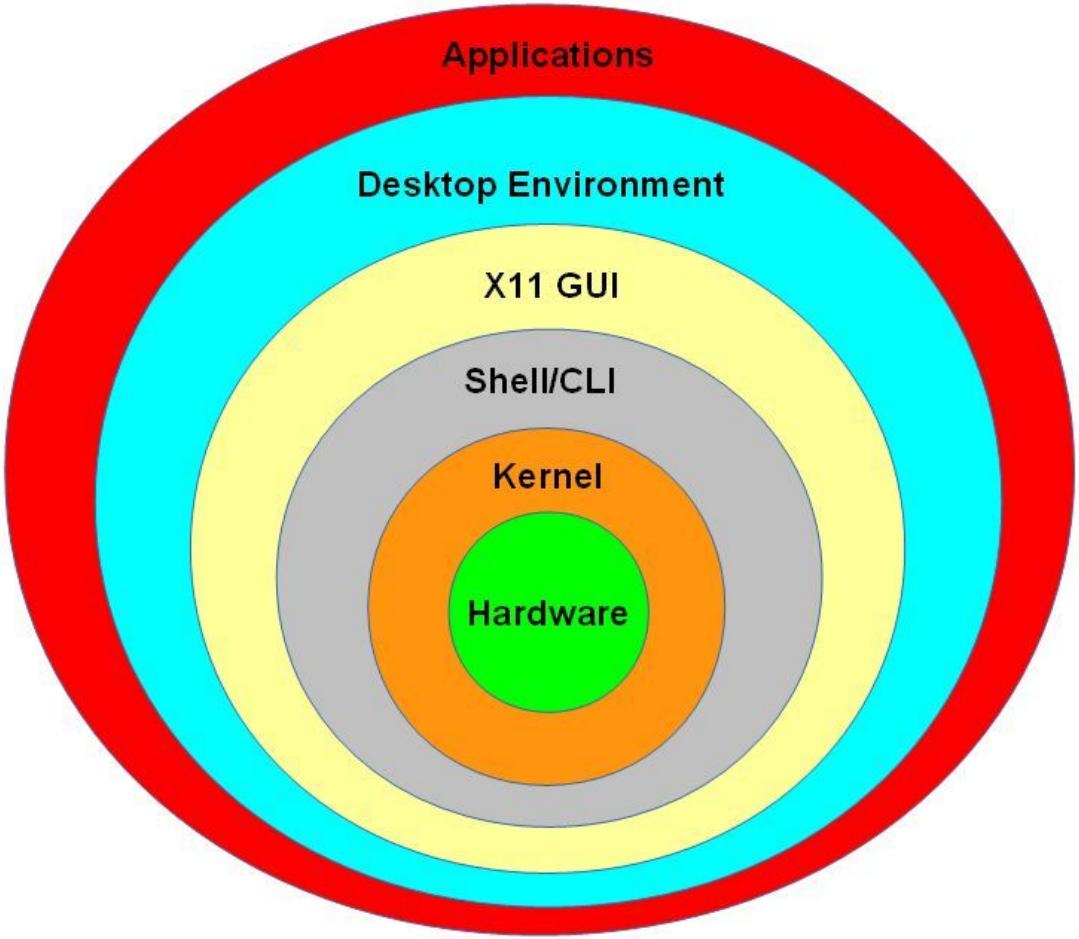


Demo time !

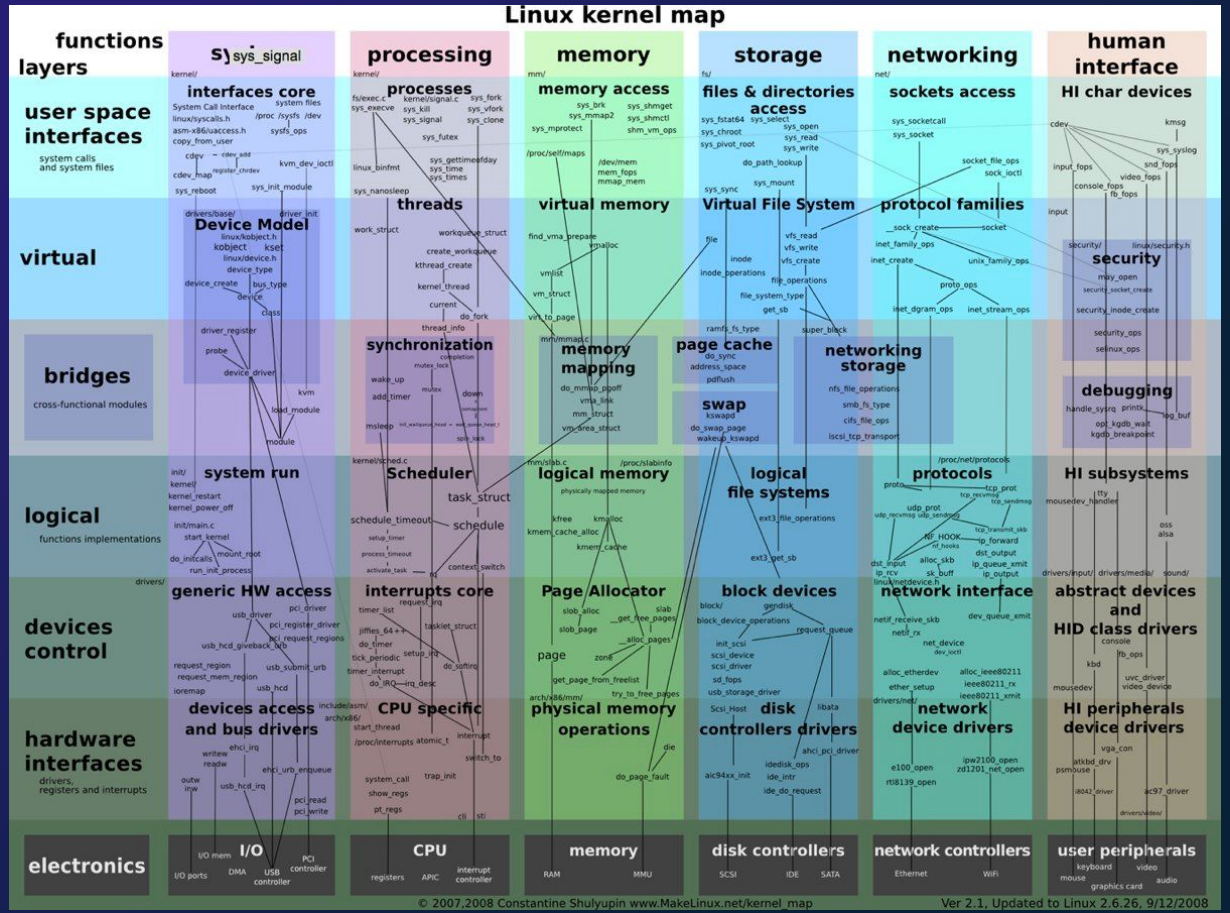
Kernel - Shell - Apps



Full Linux System Diagram



Kernel


Linux kernel map
functions
layers
sys_signal
processing
memory
storage
networking
human interface
user space interfaces
system calls and system files
interfaces core
processes
memory access
files & directories access
sockets access
HI char devices
virtual
Device Model
threads
virtual memory
Virtual File System
protocol families
security
bridges
cross-functional modules
synchronization
memory mapping
page cache
networking storage
debugging
swap
logical
functions implementations
system run
Scheduler
logical memory
logical file systems
protocols
HI subsystems
devices control
generic HW access
interrupts core
Page Allocator
block devices
network interface
abstract devices and HID class drivers
hardware interfaces
drivers, registers and interrupts
devices access and bus drivers
CPU specific
physical memory operations
disk controllers drivers
network device drivers
HI peripherals device drivers
electronics
I/O
CPU
memory
disk controllers
network controllers
user peripherals
© 2007,2008 Constantine Shulyupin www.MakeLinux.net/kernel_map
Ver 2.1, Updated to Linux 2.6.26, 9/12/2008

Shell (Bash, ZSH, ...)

Basic programs (commands) :

- **man** - Manual page for every **system command**
- **cd** - Change directory
- **ls** - List files in the current directory (l for more information)
- **grep**, **cat**, **sudo**
- Flags are options: -h (--help)

Demo time !

Shell (Bash, ZSH, ...)

mv source target - moves a file or directory

cp source target - copy file or directory (cp -R)

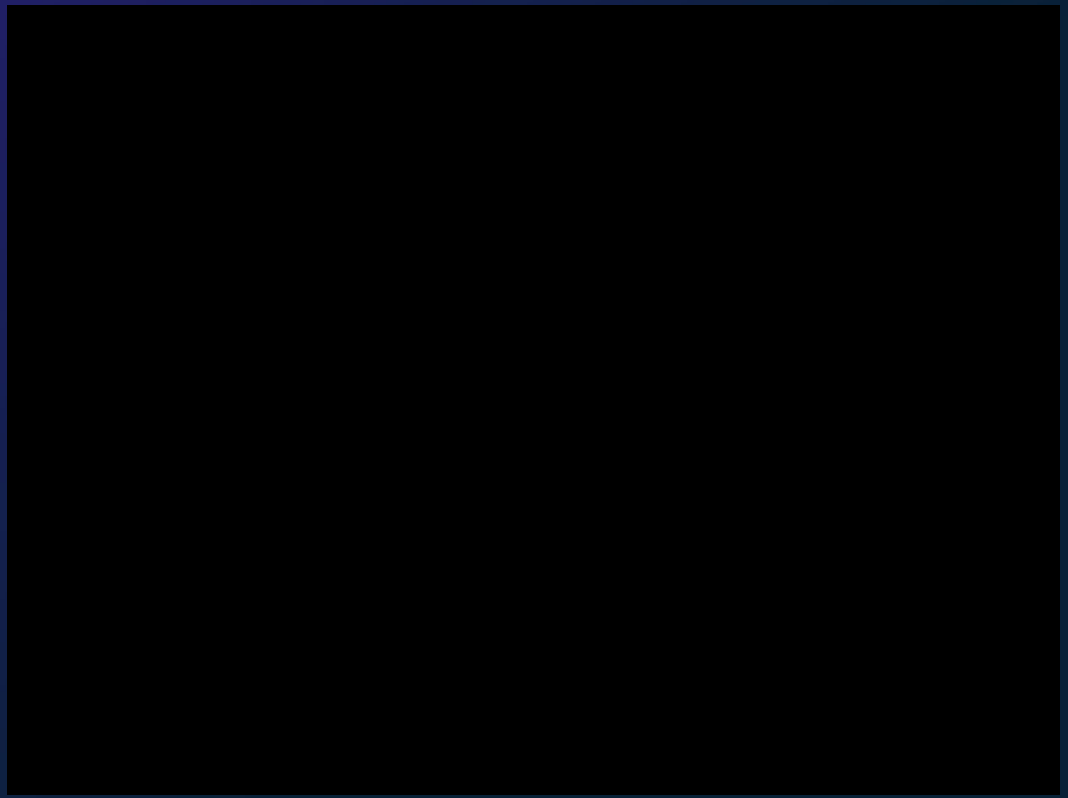
rm file1, file2, ... - remove files

rm -rf directory - recursively remove a directory

Shell (Bash, ZSH, ...)

1. **Pipes** :

cat list.txt | grep apple



Demo time !

Shell (Bash, ZSH, ...)

2. **Output Redirection <> :**

ls **>** files.txt grep **<** list.txt apple

3. **.bashrc** (alias, path variable)

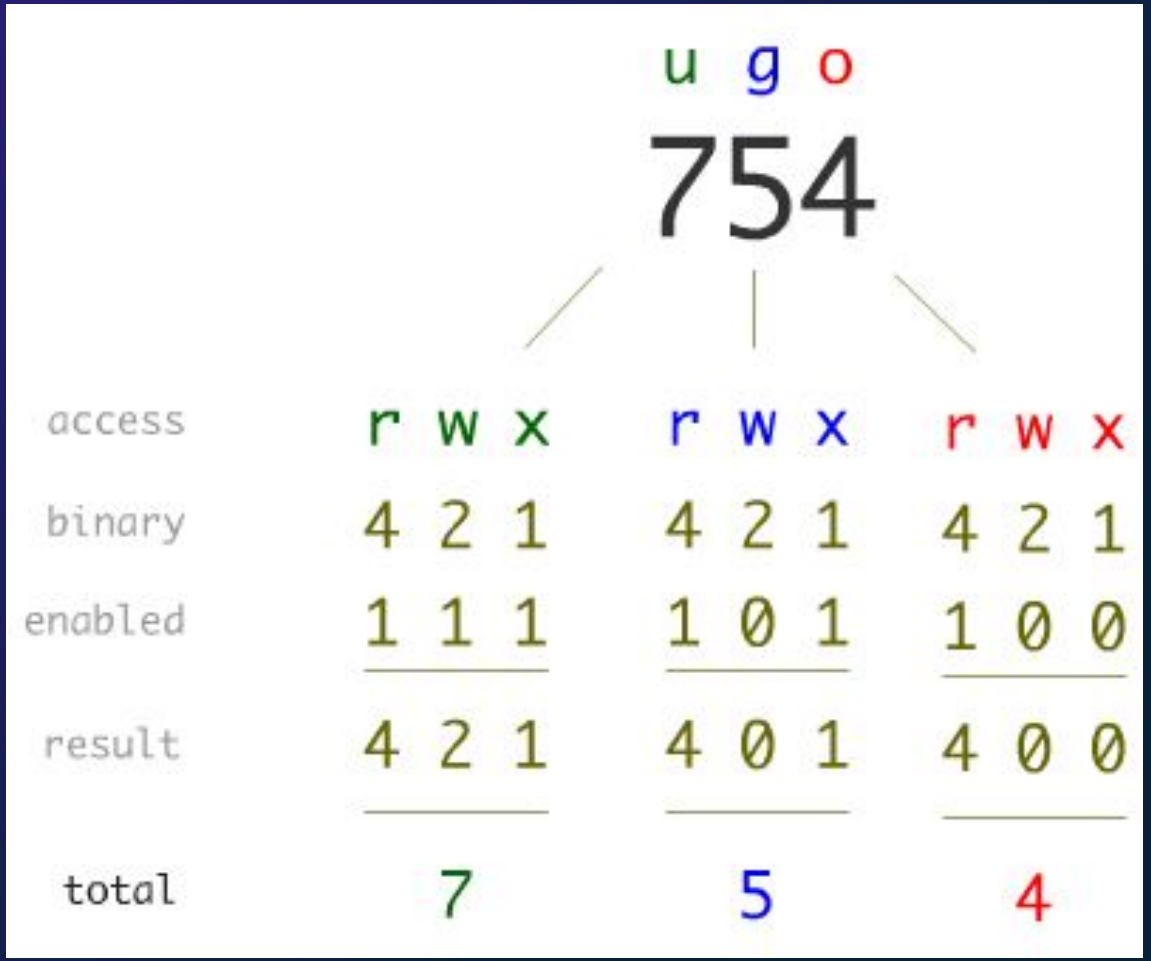
4. ***** = wildcard

Files and directories:

1. .file (dot files) are hidden. (ls -la)
2. Everything is a file.

Permissions

http://permissions-calculator.org



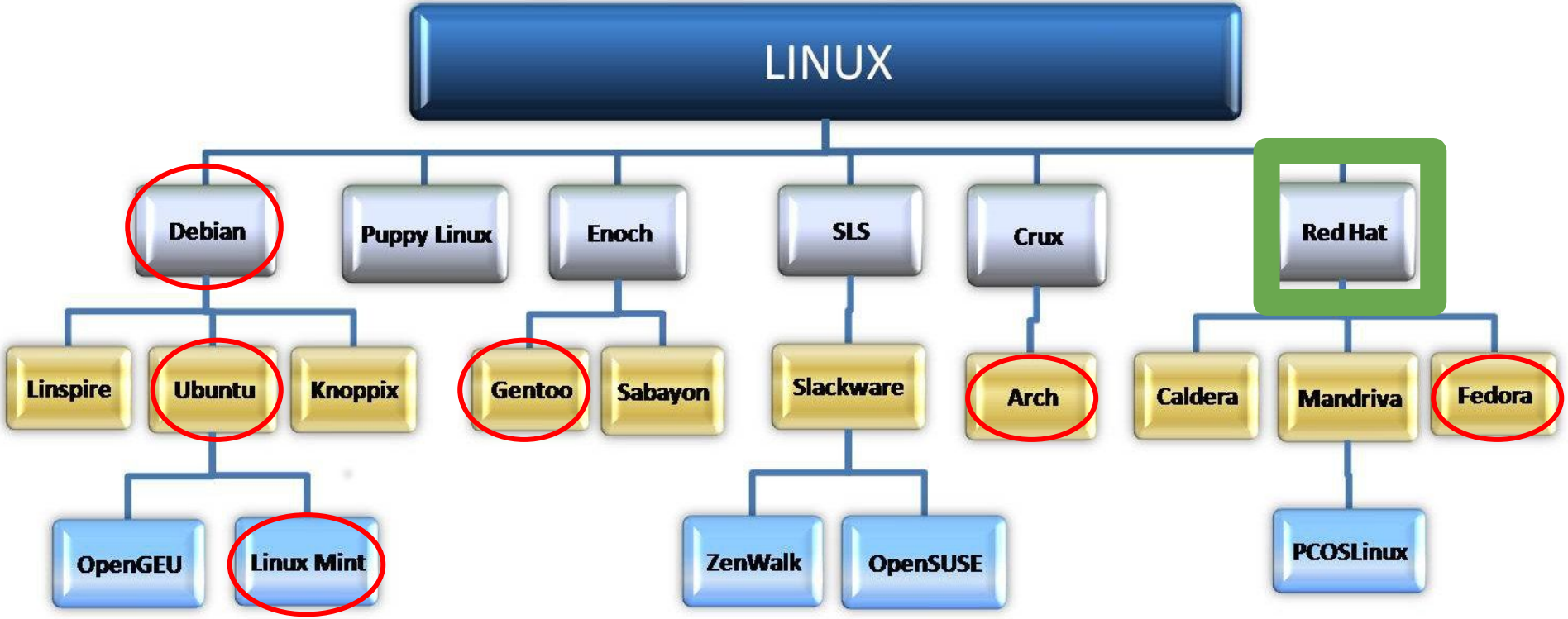
Permissions

- superuser : system admin (god)
- sudo - **su**peruser **do**
- ls -l - show files with permissions
- chmod - change file mode bits

Demo time !

Distros

https://distrowatch.com/



Forbes Billionaires Innovation Leadership Money Consumer Industry

3,503 views | Oct 31, 2018, 11:06am

IBM to Acquire Red Hat for $34 Billion -- Wow

Top 5 Tech Acquisitions

Deal	Price	Year
1. Dell buys EMC	$64B	2015
2. Avago Technologies buys Broadcom	$37B	2015
3. IBM buys Red Hat	$34	2018
4. Softbank buys ARM Holdings	$31.4B	2016
5. Microsoft buys LinkedIn	$26.2B	2016

TC

Package managers

- aptitude (apt-get ...) - Ubuntu, Debian, Mint, ...
- yum - (yum install ...) - Fedora, CentOs, ...
- pacman - (pacman ...) - Arch Linux, Manjaro, Antegros, ...

sudo apt-get install python3

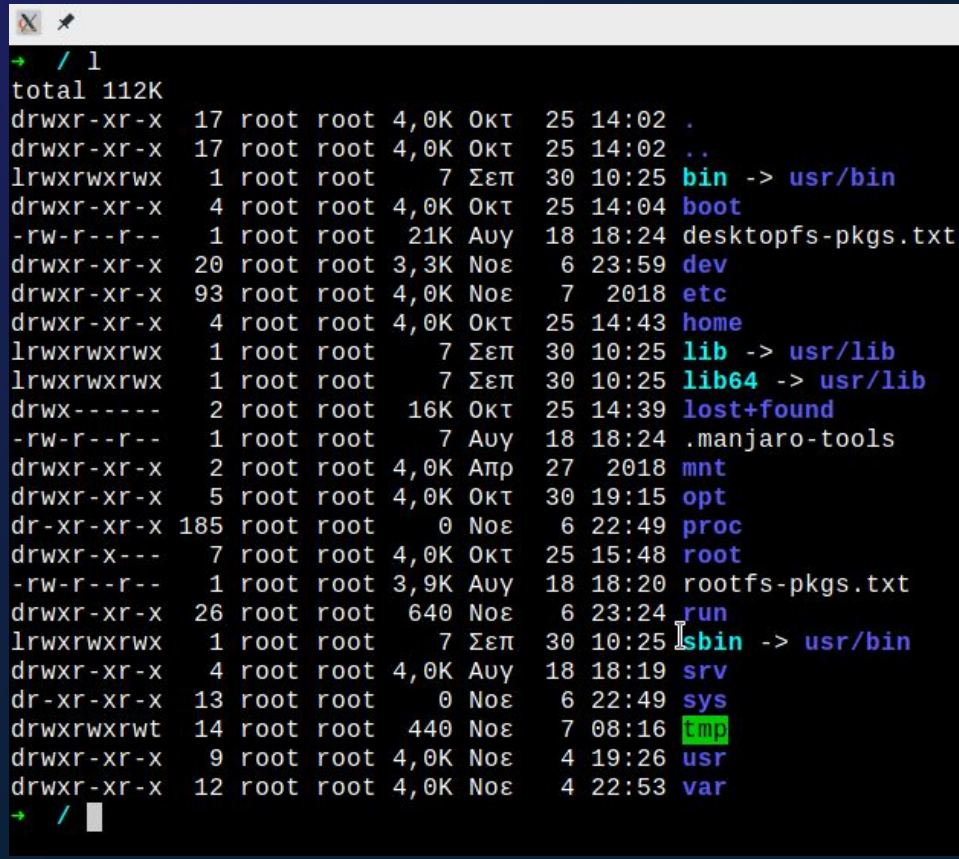
sudo yum install python3

sudo pacman -S python3

Filesystem 2 (Now)

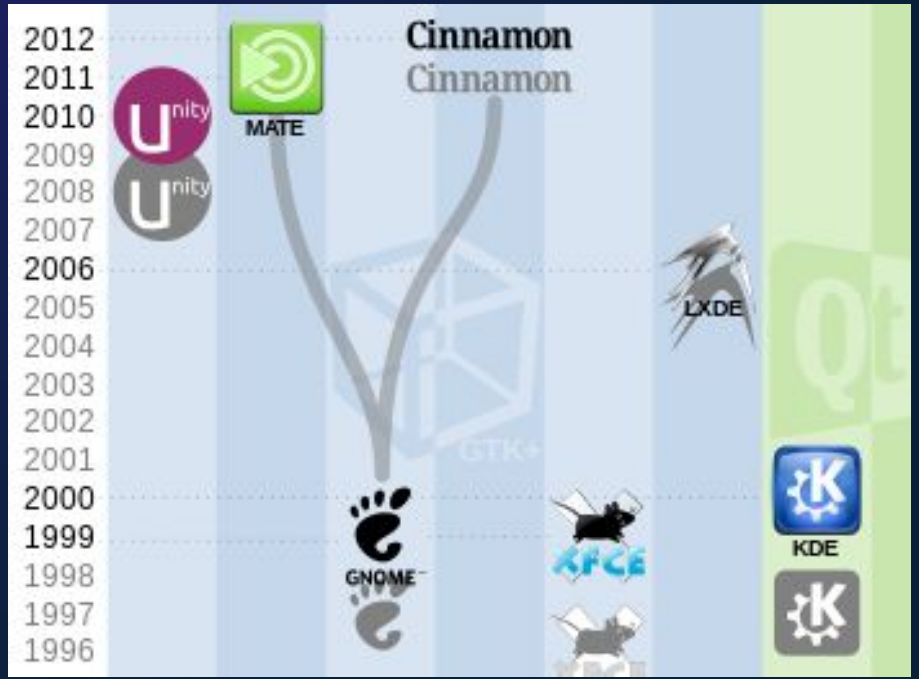
- /bin & /sbin symlinked to user/bin

- /lib & /lib64 symlinked to /usr/lib



Desktop Environments

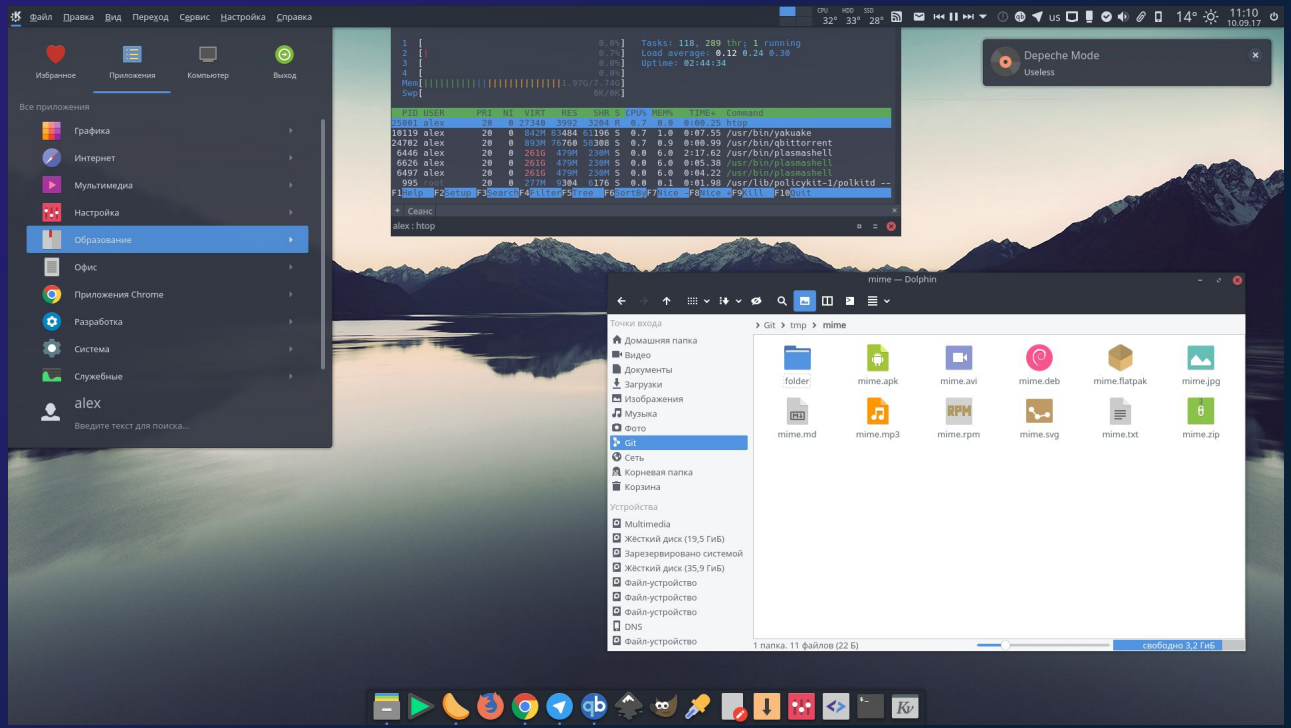
- Gnome
- Xfce
- Kde
- Unity
- Mate
- Cinnamon
- ...



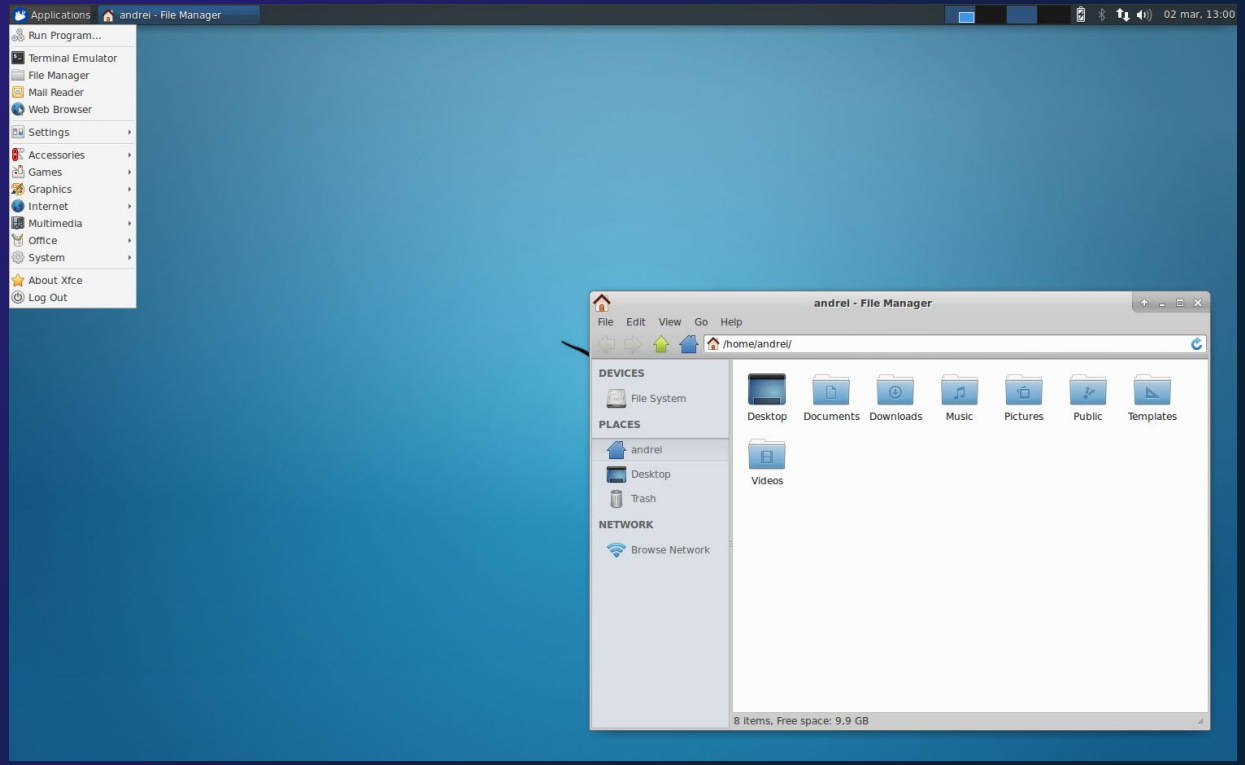
Gnome

Terminal
Mon Apr 24, 11:50 PM
47.2 °F
jfrost@eboudar:~
File Edit View Search Terminal Help
[jfrost@eboudar ~]$ neofetch
jfrost@eboudar
OS: Arch Linux x86_64
Kernel: 4.10.11-1-ARCH
Uptime: 3 hours, 46 mins
Packages: 1036
Shell: bash 4.4.12
DE: GNOME
Theme: Plano [GTK2/3]
Icons: Paper [GTK2/3]
Terminal: gnome-terminal
CPU: AMD A8-7600 Radeon R7, 10 Compute
GPU: NVIDIA GeForce GTX 1050 Ti
Memory: 3673MiB / 7988MiB
Disk (/): 46G / 238G (20%)
Song: Portugal The Man - Salt
[jfrost@eboudar ~]$

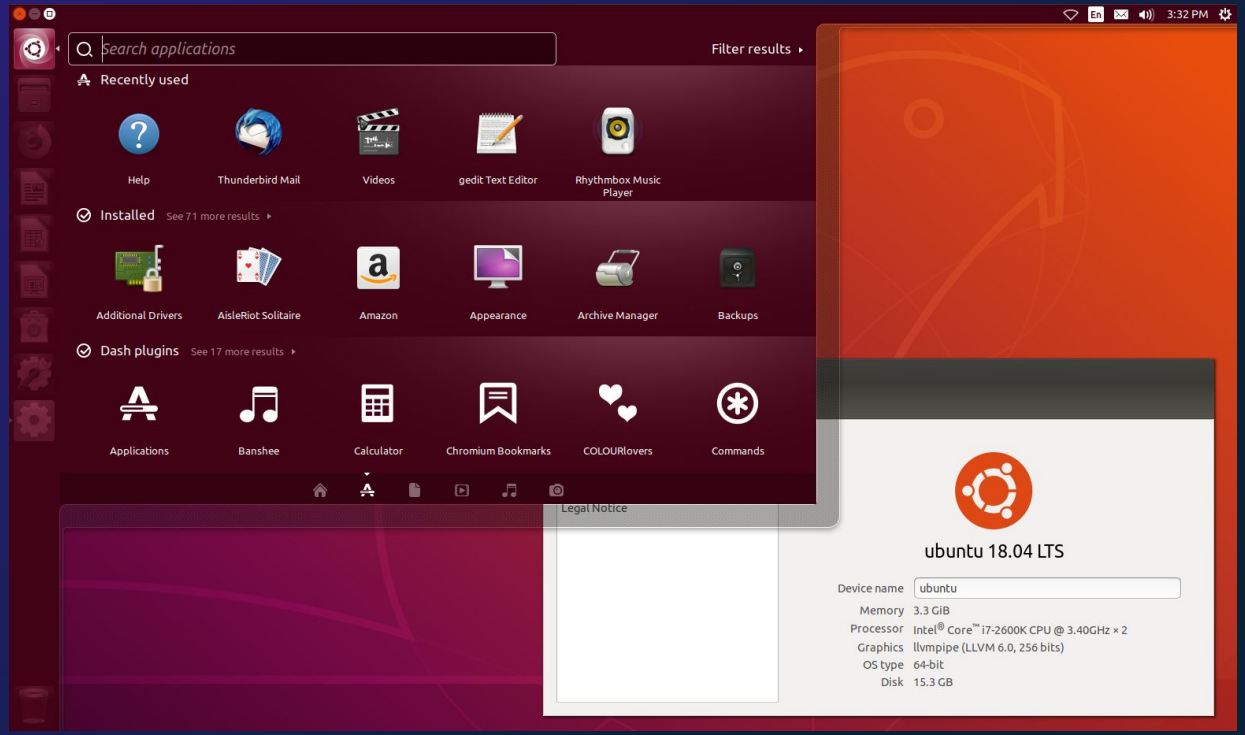
Kde


Файл Правка Вид Переход Сервис Настройка Справка
Избранное
Приложения
Компьютер
Выход
Все приложения
Графика
Интернет
Мультимедиа
Настройка
Образование
Офис
Приложения Chrome
Разработка
Система
Служебные
alex
Введите текст для поиска...
Depeche Mode
Useless
htop
mime — Dolphin
Git › tmp › mime
folder
mime.apk
mime.avi
mime.deb
mime.flatpak
mime.jpg
mime.md
mime.mp3
mime.rpm
mime.svg
mime.txt
mime.zip
1 папка, 11 файлов (22 Б)
свободно 3,2 ГиБ

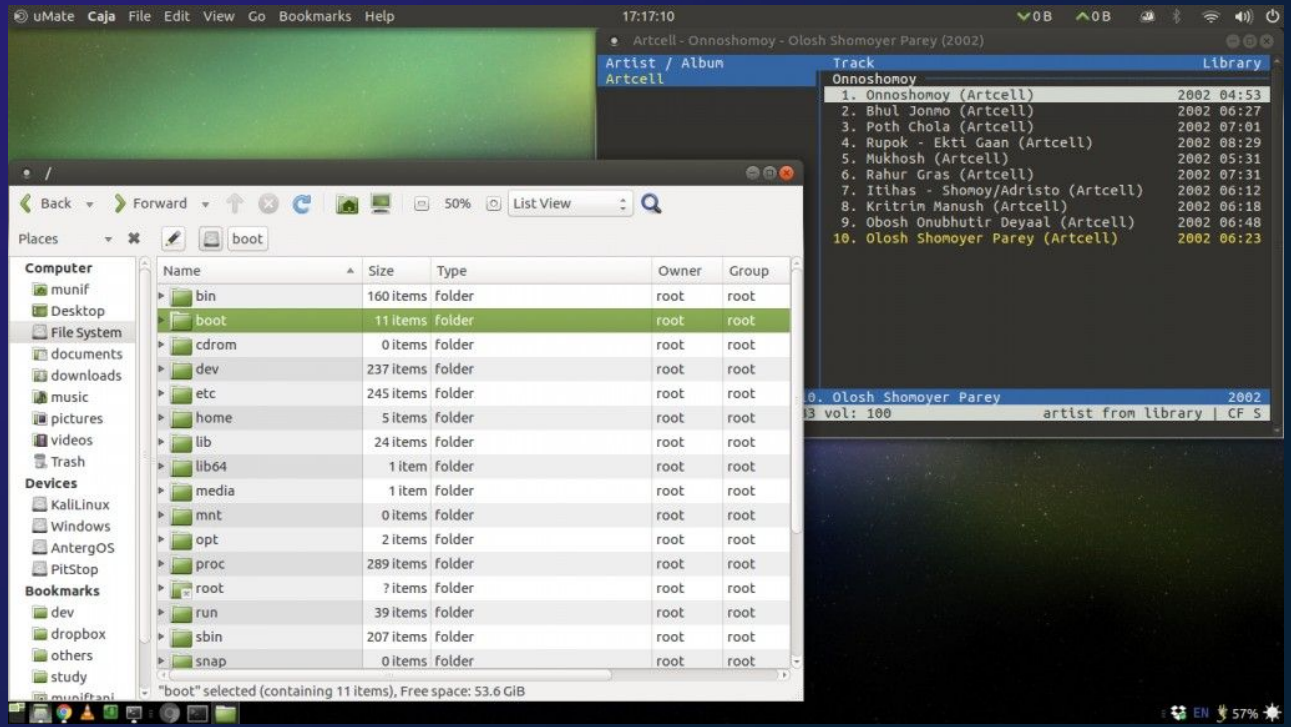
Xfce


Applications
andrei - File Manager
02 mar, 13:00
Run Program...
Terminal Emulator
File Manager
Mail Reader
Web Browser
Settings
Accessories
Games
Graphics
Internet
Multimedia
Office
System
About Xfce
Log Out
andrei - File Manager
File Edit View Go Help
/home/andrei/
DEVICES
File System
PLACES
andrei
Desktop
Trash
NETWORK
Browse Network
Desktop
Documents
Downloads
Music
Pictures
Public
Templates
Videos
8 items, Free space: 9,9 GB

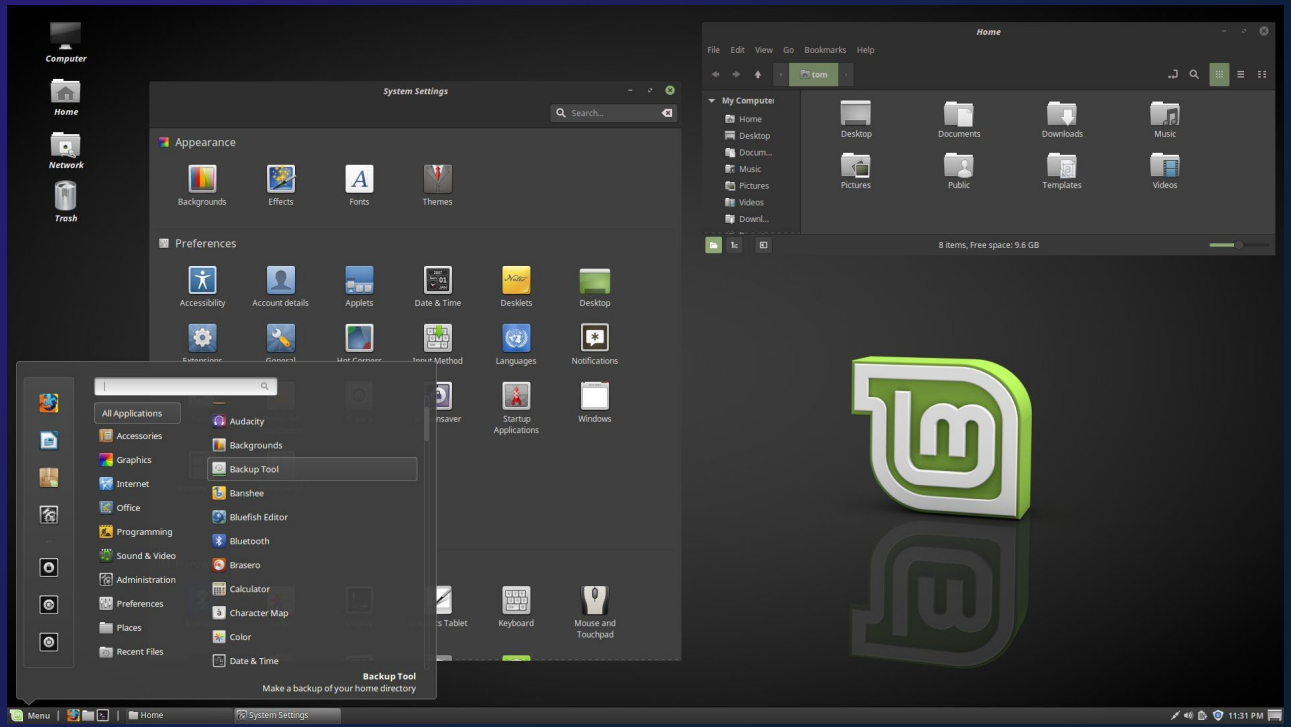
Unity


Search applications
Filter results
Recently used
Help
Thunderbird Mail
Videos
gedit Text Editor
Rhythmbox Music Player
Installed
See 71 more results
Additional Drivers
AisleRiot Solitaire
Amazon
Appearance
Archive Manager
Backups
Dash plugins
See 17 more results
Applications
Banshee
Calculator
Chromium Bookmarks
COLOURlovers
Commands
Legal Notice
ubuntu 18.04 LTS
Device name ubuntu
Memory 3.3 GiB
Processor Intel® Core™ i7-2600K CPU @ 3.40GHz × 2
Graphics llvmpipe (LLVM 6.0, 256 bits)
OS type 64-bit
Disk 15.3 GB

Mate


uMate Caja File Edit View Go Bookmarks Help
17:17:10
Artcell - Onnoshomoy - Olosh Shomoyer Parey (2002)
Artist / Album
Artcell
Track
Library
Onnoshomoy
1. Onnoshomoy (Artcell) 2002 04:53
2. Bhul Jonmo (Artcell) 2002 06:27
3. Poth Chola (Artcell) 2002 07:01
4. Rupok - Ekti Gaan (Artcell) 2002 08:29
5. Mukhosh (Artcell) 2002 05:31
6. Rahur Gras (Artcell) 2002 07:31
7. Itihas - Shomoy/Adristo (Artcell) 2002 06:12
8. Kritrim Manush (Artcell) 2002 06:18
9. Obosh Onubhutir Deyaal (Artcell) 2002 06:48
10. Olosh Shomoyer Parey (Artcell) 2002 06:23
Back
Forward
50%
List View
Places
boot
Computer
munif
Desktop
File System
documents
downloads
music
pictures
videos
Trash
Devices
KaliLinux
Windows
AntergOS
PitStop
Bookmarks
dev
dropbox
others
study
Name
Size
Type
Owner
Group
bin 160 items folder root root
boot 11 items folder root root
cdrom 0 items folder root root
dev 237 items folder root root
etc 245 items folder root root
home 5 items folder root root
lib 24 items folder root root
lib64 1 item folder root root
media 1 item folder root root
mnt 0 items folder root root
opt 2 items folder root root
proc 289 items folder root root
root ? items folder root root
run 39 items folder root root
sbin 207 items folder root root
snap 0 items folder root root
"boot" selected (containing 11 items), Free space: 53.6 GiB
EN
57%

Cinnamon


Computer
Home
Network
Trash
System Settings
Search...
Appearance
Backgrounds
Effects
Fonts
Themes
Preferences
Accessibility
Account details
Applets
Date & Time
Desklets
Desktop
Languages
Notifications
Startup Applications
Windows
Keyboard
Mouse and Touchpad
Home
File Edit View Go Bookmarks Help
My Computer
Desktop
Documents
Downloads
Music
Pictures
Public
Templates
Videos
8 items, Free space: 9.6 GB
All Applications
Accessories
Graphics
Internet
Office
Programming
Sound & Video
Administration
Preferences
Places
Recent Files
Audacity
Backgrounds
Backup Tool
Banshee
Bluefish Editor
Bluetooth
Brasero
Calculator
Character Map
Color
Date & Time
Backup Tool
Make a backup of your home directory
Menu
Home
System Settings
11:31 PM

Manjaro Installation

- MBR - GPT
- Swap
- Seperate Home
- Partition flags
- Partition formats - ext4, fat32, ntfs

sudo rm -rf /

sudo rm -rf /

The filesystem **IS** the operating system.