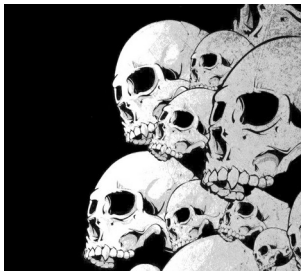
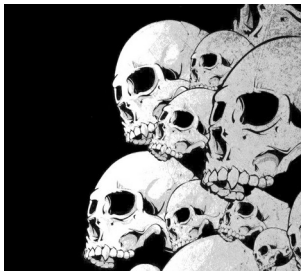


Linux Introduction

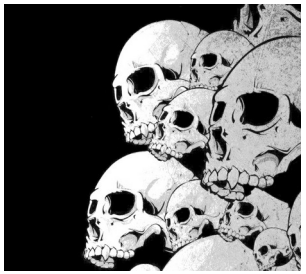
Y. Collette (ycollette.nospam@free.fr)
https://audinux.github.io/



Licenses Code

	Utiliser	Redistribuer	Modifier
Propriétaire			
Shareware			
Freeware			
Logiciel Libre			

	Code source disponible	Utilisation libre du programme	Copie du programme	Distribution du programme	Modification du programme	Paiement de royalties	Obligation de rendre libre toute modification	Compatibilité avec la GPL
BSD	oui	oui	oui	oui	oui	gratuit	non	non
Apache	oui	oui	oui	oui	oui	gratuit	oui	non
Mozilla	oui	oui	oui	oui	oui	gratuit	non	non
Netscape	oui	oui	oui	oui	oui	gratuit	non	non
Sun	oui	oui	oui	oui	oui	gratuit	oui	non
IBM	oui	oui	oui	oui	oui	gratuit	oui	non
PHP	oui	oui	oui	oui	oui	gratuit	oui	non



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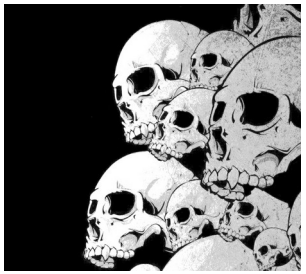
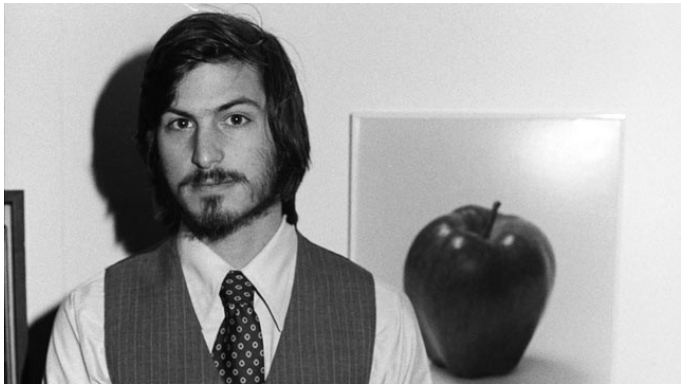
Licence CC	Bouton	Explications	Partage permis ?	Exploitation permise?	Remix permis?
Attribution	BY	• On doit citer **QUI** est l'auteur de l'oeuvre originale. • L'utilisation commerciale de l'oeuvre est permise. • Vous pouvez remixer l'oeuvre. • Le partage de l'oeuvre est (toujours) permis.	🙂	🙂	🙂
Share Alike Partage à l'identique	BY-SA	• On doit citer **QUI** est l'auteur de l'oeuvre originale. • L'utilisation commerciale de l'oeuvre est permise. • Vous pouvez remixer l'oeuvre. • Cette licence doit toujours être utilisée sur toutes vos versions dérivées de l'oeuvre originale. • Le partage de l'oeuvre est (toujours) permis.	🙂	🙂	🙂
No Derivative Modification non permise	BY-ND	• On doit citer **QUI** est l'auteur de l'oeuvre originale. • L'utilisation commerciale de l'oeuvre est permise. • Vous **NE** pouvez **PAS** remixer l'oeuvre. • Le partage de l'oeuvre est (toujours) permis.	🙂	🙂	☹
Non-Commercial Usage commercial non permis	BY-NC	• On doit citer **QUI** e st l'auteur de l'oeuvre originale. • L'utilisation commerciale de l'oeuvre n'**est PAS** permise. • Vous pouvez remixer l'oeuvre. • Le partage de l'oeuvre est (toujours) permis.	🙂	☹	🙂
Non-Commercial Usage commercial non permis + **Share Alike** Partage à l'identique	BY-NC-SA	• On doit citer **QUI** est l'auteur de l'oeuvre originale. • L'utilisation commerciale de l'oeuvre n'**est PAS** permise. • Vous pouvez remixer l'oeuvre. • Cette licence doit toujours être utilisée sur toutes vos versions dérivées de l'oeuvre originale. • Le partage de l'oeuvre est (toujours) permis.	🙂	☹	🙂
Non-Commercial Usage commercial non permis + **No Derivative** Modification non permise	BY-NC-ND	• On doit citer **QUI** est l'auteur de l'oeuvre originale. • L'utilisation commerciale de l'oeuvre n'**est PAS** permise. • Vous **NE** pouvez **PAS** remixer l'oeuvre. • Le partage de l'oeuvre est (toujours) permis.	🙂	☹	☹



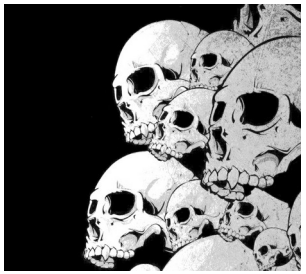
Free software



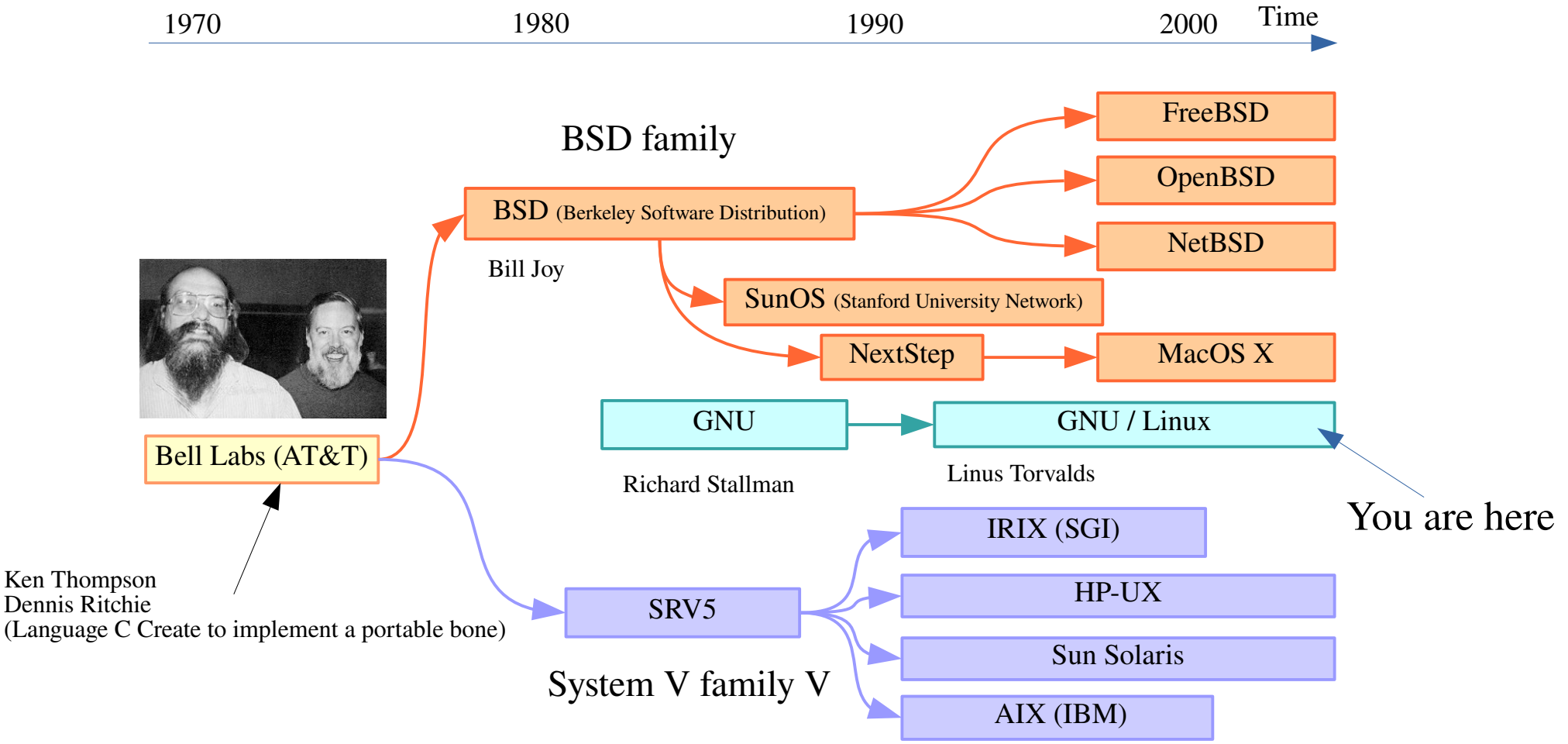
The good

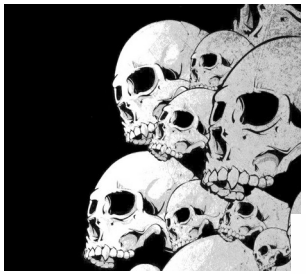
The brute

The Crook



UNIX family tree

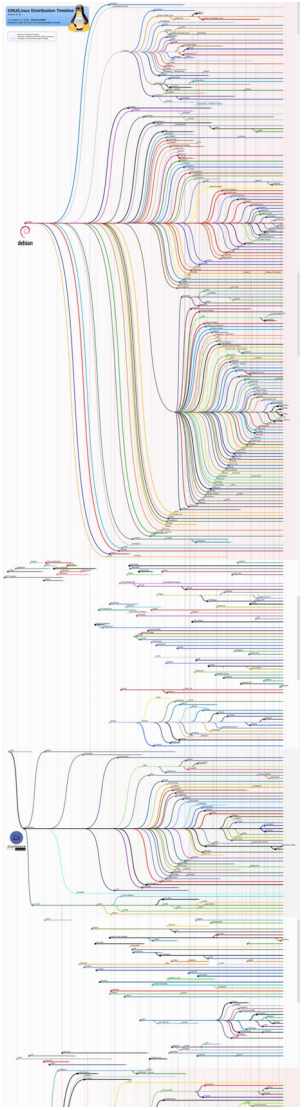


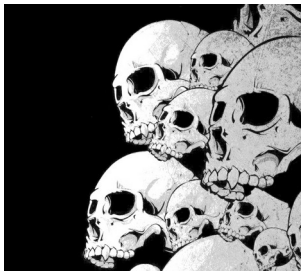


Distributions by tens

And ...
Kxstudio
Dreamstudio
APODIO GNU Linux
Librazik

Lots of distributions for computer -assisted music

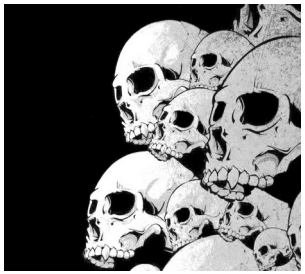




How to test Linux ?

Either we install Linux directly on the PC (to replace Windows or Dual Boot)

Either we use a virtual machine:
It's a PC in the PC
Almost the same performance as a standard PC
But not suitable for the Mao (too much latency)
But that will be enough to test ...

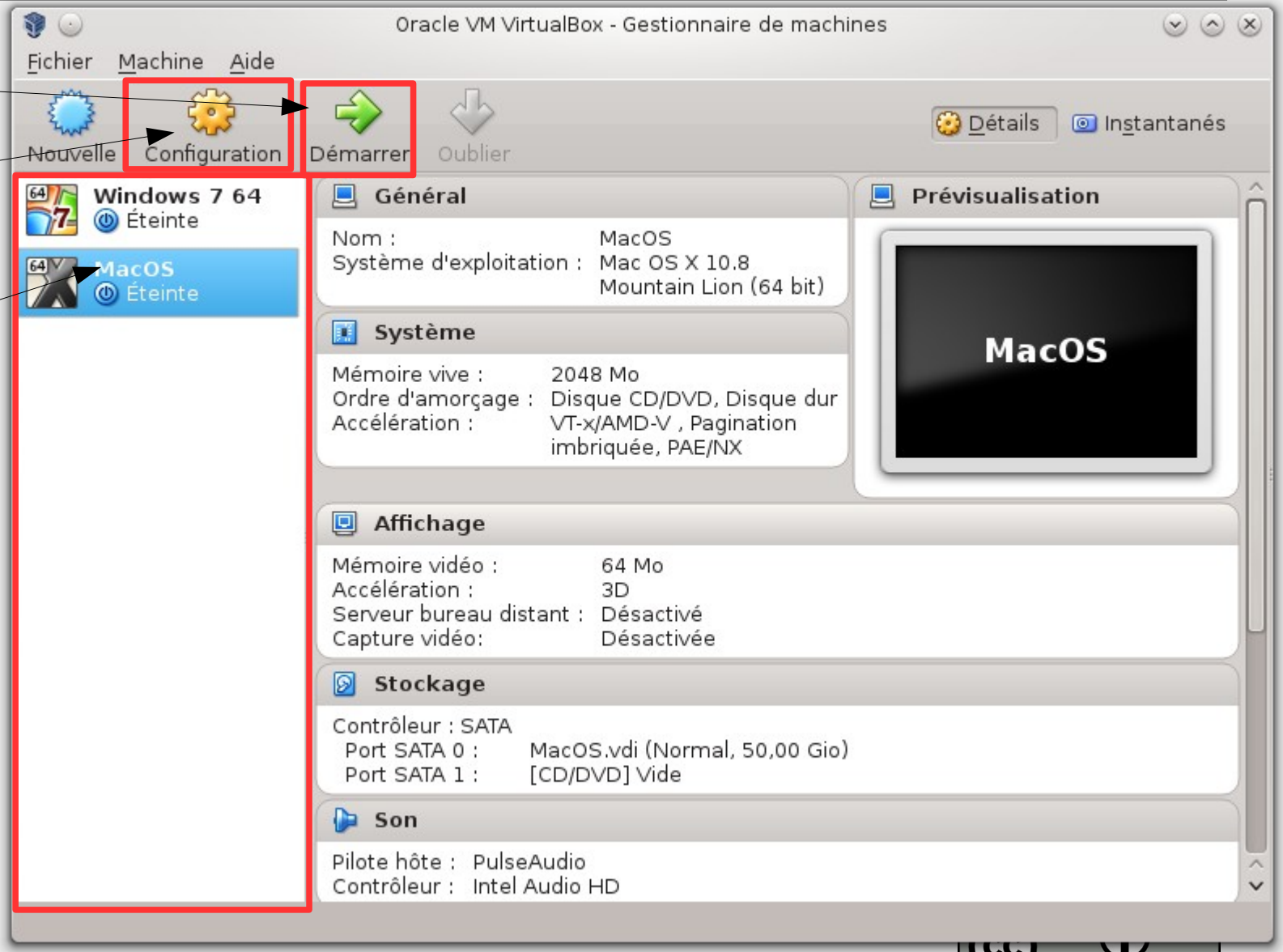


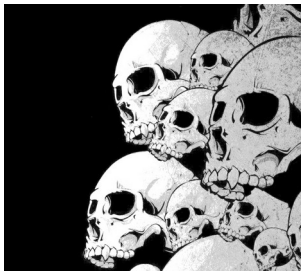
VirtualBox

Startup

Configuration

List of virtual machines

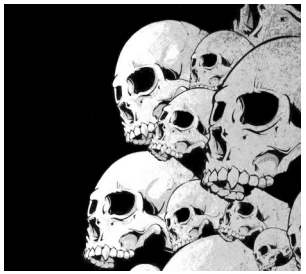




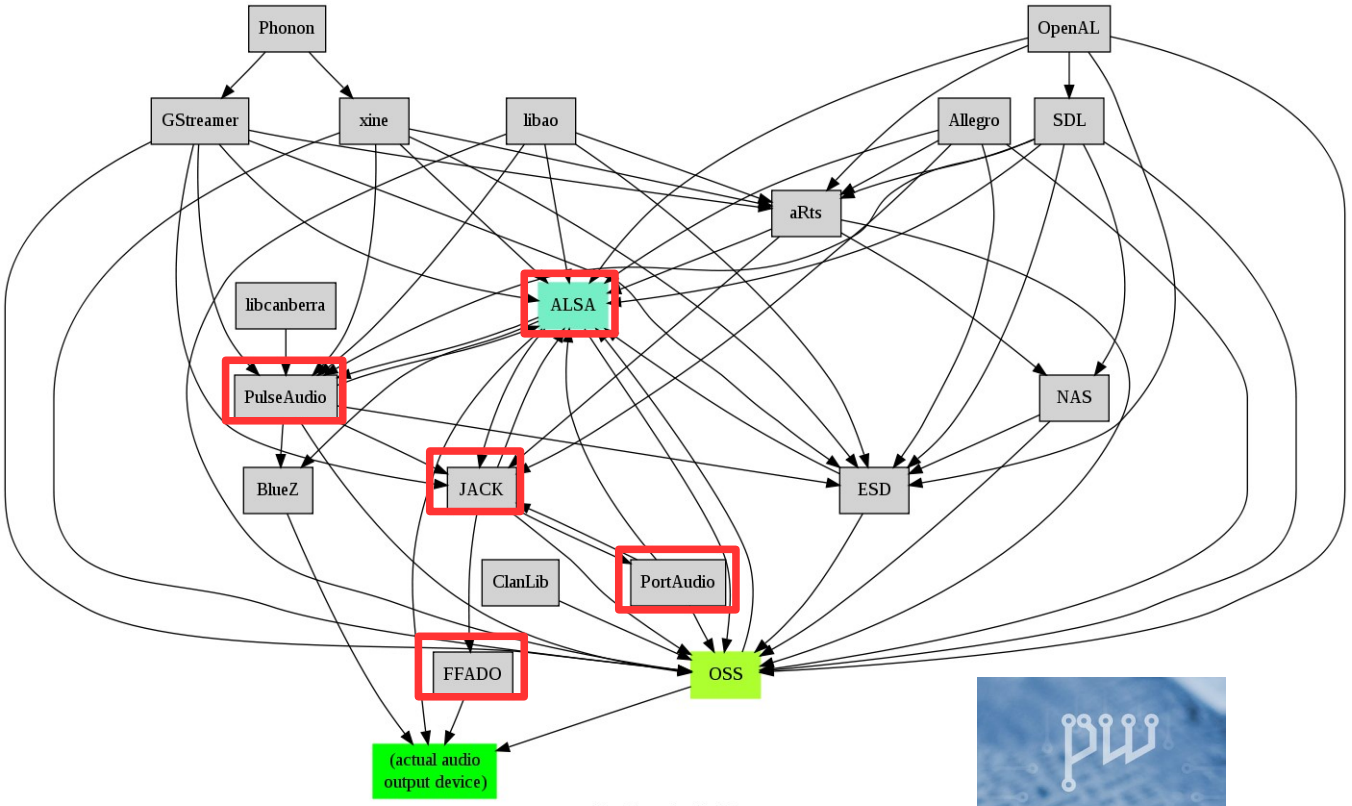
Update

When the Kernel Linux is updated, it is necessary to update the Linux Additions Virtualbox. Under the host Linux, you have to mount the CDROM, then go to the/Run/Media /.../ Vbox

```
$ su
# Go to the/Run/Media/..... directory /..
$ ./Vboxlinuxadditions
```

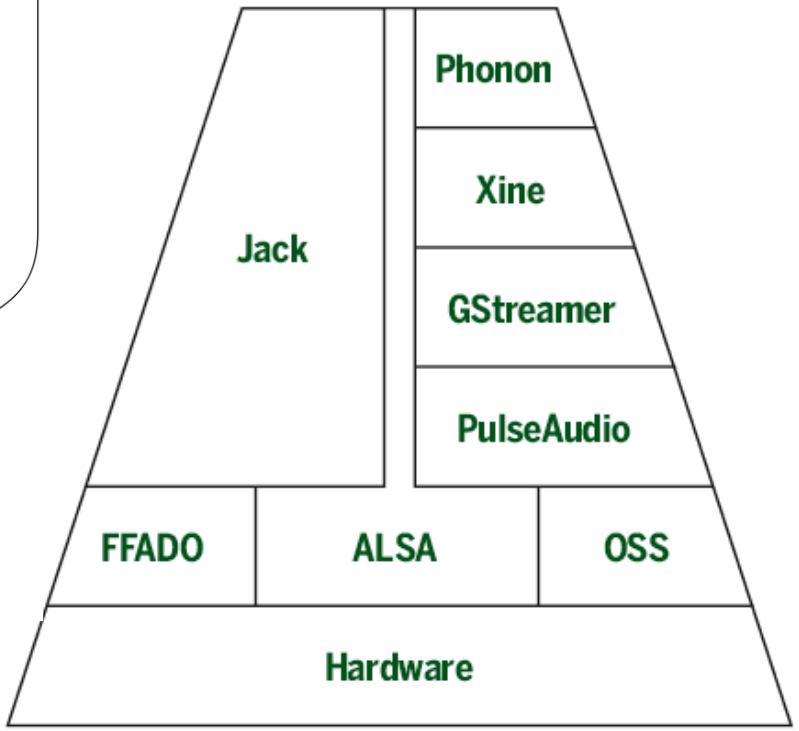


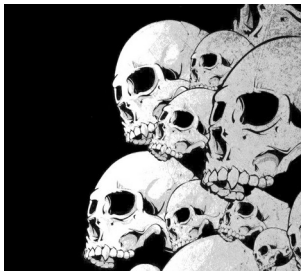
Linux audio organization
The Linux audio problem



The Linux Audio Mess
Origin: Mike Melanson, http://blogs.adobe.com/penguin.swf/
Updated October 10, 2008

PipeWire





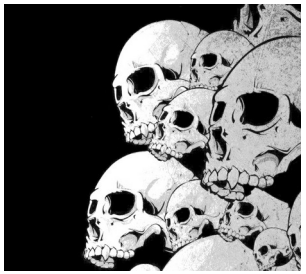
Linux Audio: equipment

Before buying equipment, have the Google reflex.
There is also http://linuxmao.org
Check that your equipment is compatible before making your purchase.
Especially if you buy an audio interface
Firewire: https://www.ffado.org

For USB sound cards, the best:

USB Class Compliant

These cards have a generic support under Linux



Linux Audio: equipment

Why buying a good preamp audio card?

Wikipedia response:

When you follow a first amplifier by a second, the latter amplifies the signal and the noise that the first sends it and he adds the noise he makes himself.

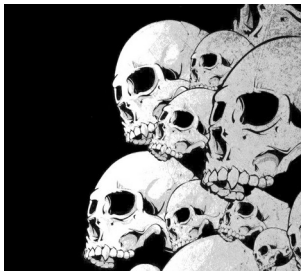
If the amplification chain includes n elements, the noise generated by the first floor is amplified by the stages 2, 3 ... n

Friis formula: $$F = F_1 + \frac{F_2 - 1}{G_1} + \frac{F_3 - 1}{G_1 \cdot G_2} + \frac{F_4 - 1}{G_1 \cdot G_2 \cdot G_3} + \cdots + \frac{F_n - 1}{G_1 \cdot G_2 \cdot G_3 \cdots G_{n-1}}$$

where Fi is the noise factor (linear and not in db) of the ith element and Gi the gain (linear and not in db) of the ith element.

The formula tells us that it is the noise factor of the 1st element of the chain which largely determines the total noise factor. It is in particular for this reason that we use a low noise amplifier in the first floor of the reception chains of weak signals. This makes it possible to recover a sufficient level signal without degrading the signal ratio over noise too much, generally low at the input of the chain.

Example of calculation of the signal / noise ratio:
http://f5zv.pagesperso-orange.fr/radio/rm/rm04/rm04c04.html

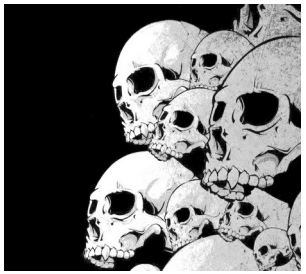


Initial settings

Configuration of the COPR Audinux repository

Definition of priorities, from memberships to groups

Installation of a real time nucleus (optional)



Fedora Repository configuration

Fedora: General distribution
CCRMA repository: A MAO application source for Fedora
CCRMA = Center for Computer Research in Music and Acoustics - Stanford
Installation of these repositories:

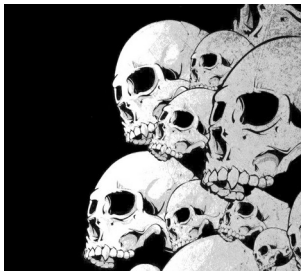
```
dnf install --nogpgcheck
http://mirrors.ircam.fr/pub/planetccrma/mirror/fedora/linux/planetccrma/21/x86_64/
planetccrma-repo-1.1-3.fc21.ccrma.noarch.rpm

dnf install --nogpgcheck
http://mirrors.ircam.fr/pub/planetccrma/mirror/fedora/linux/planetccrma/21/x86_64/
planetccrma-repo-testing-1.1-3.fc21.ccrma.noarch.rpm
```

RPM Fusion Free component:

```
dnf install --nogpgcheck http://fr2.rpmfind.net/linux/rpmfusion/free/fedora/rpmfusion-free-
release-stable.noarch.rpm
```

RPM Fusion Non -free component:

```
dnf install --nogpgcheck http://fr2.rpmfind.net/linux/rpmfusion/nonfree/fedora/rpmfusion-
nonfree-release-stable.noarch.rpm
```



Fedora Repository configuration

Audio tools in development version or not present in other repositories:

Version Fedora 41, 42, 43, rawhide:

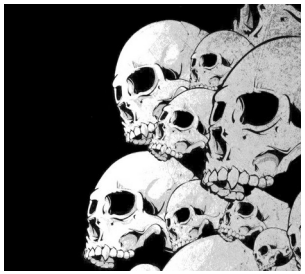
```
$ dnf coprr enable ycollet/audinux
```

Address of the COPR Audinux repository:
https://copr.fedrainfracloud.org/coprs/ycollet/audinux

Where to postpone the bugs linked to the Audinux COPR repository:
https://github.com/audinux/fedora-spec

Web site for Audinux :

https://audinux.github.io



Fedora

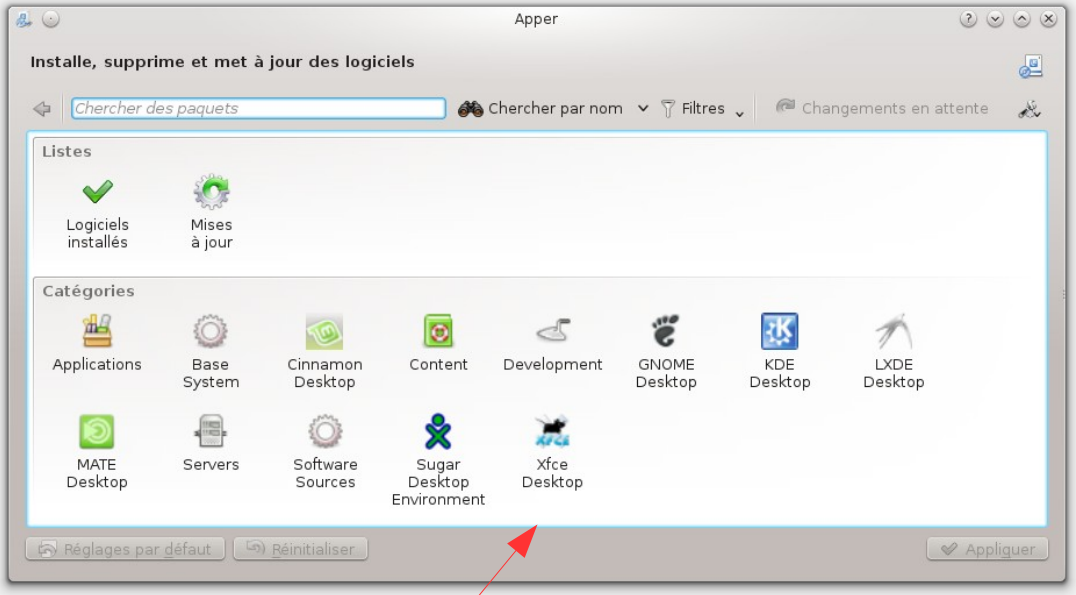
Package installation:

- Start menu → software management
- or via the 'DNF' command:

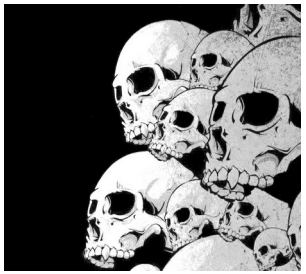
```
$ dnf search <application>
$ dnf install <application>
$ dnf remove <application>
$ dnf list installed | grep <application>
```

Update :

```
$ dnf --refresh update
```



You can use Discover as a graphical interface



Fedora
Some settings

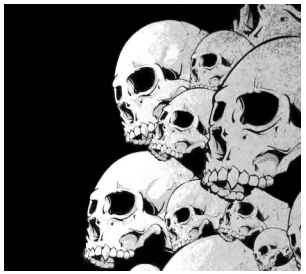
Install the real time kernel (Kernel-RT-optional).
The real -time kernel reduces latency, but is not mandatory. The standard kernel can have a low enough latency for the MAO.

Disable energy management:

```
# Become a "super user"
$ dnf install kernel-tools
$ cpupower frequency-set -g performance
```

List active services:

```
# Become a "super user"
$ su
# List all services
$ systemctl list-files
# List only active services
$ systemctl list-installed-files | grep -i enabled
# Disable certain services
$ systemctl {stop | disable} <service>
```

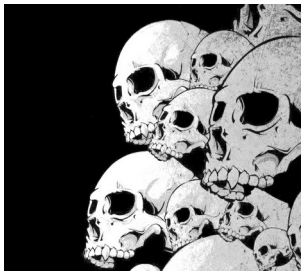


Fedora

Install the RealtimeConfigquickScan tool which allows you to check the MAO configuration of your Linux installation

```
$ dnf install realTimeConfigQuickScan
$ realTimeConfigQuickScan
```

```
== GUI-enabled checks ==
Checking if you are root... no - good
Checking filesystem 'noatime' parameter... found - warning
/ does not have the 'noatime' parameter set
/boot does not have the 'noatime' parameter set
/home does not have the 'noatime' parameter set
/vm does not have the 'noatime' parameter set

…
...

time_kernel
Checking if kernel system timer is set to 1000 hz... found - good
Checking kernel support for tickless timer... found - good
== Other checks ==
Checking filesystem types... ok.
ok.
** Set $SOUND_CARD_IRQ to the IRQ of your soundcard to enable more checks.
   Find your sound card's IRQ by looking at '/proc/interrupts' and lspci.
```

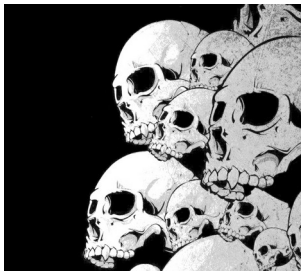


Fedora

Install RTirq: (via http://linuxmao.org)

RTirq is a bash script, intended to be started automatically when initializing the system (this type of program is called a "service").
It is used in conjunction with a time-real core to increase the time-real-level priority of the IRQ threads, in order to optimize the latency of the peripherals (Audio interfaces).
Increasing the priority of IRQ threads is a compulsory step when using a time-real core with Jack.
You must add the optional threadirqs option when starting the kernel.
We install and start Rtirq before each audio session:

```
$ su
# Install RTirq
$ dnf install rtirq
# Start Rtirq
$ systemctl {start | enable} rtirq.service
# 1st choice: starting in the spot
$ systemctl start rtirq.service
# 2nd choice: activation of the RTirq service
$ systemctl enable rtirq.service
```



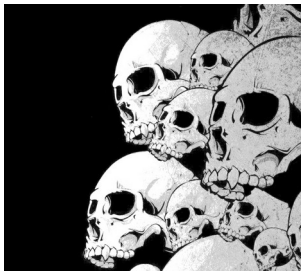
Fedora

Disable Packagekit

Packagekit is a system that allows you to check the presence of updates.
The concern: when it turns, it uses a lot of the hard drive (reconstruction of the database).
Another concern: the system system Disable Packagekit.service does not work after the reboot.
Tip: We will hide it ...

```
$ su
$ systemctl mask packagekit.service
```

Connect the sound card to a USB 2.0 port



Fedora
For Jack users

Modify the priorities of the Jack group:

```
$ su
$ cat /etc/security/limits.d/95-jack.conf
# Default limits for users of jack-audio-connection-kit

@jackuser - rtprio 90
@jackuser - nice -10
@jackuser - memlock unlimited
#@jackuser - memlock 4194304

#@pulse-rt - rtprio 10
#@pulse-rt - nice -20
```

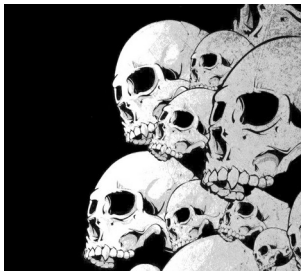
If you use VCVRACK, leave memory for video

These two lines must be deleted imperatively

In addition to the Jackuser group via:

```
$ usermod -a -G jackuser <username>
```

Then we disconnect and reconnect on our session



Fedora
For Pipewire / Jack users

Modify the priorities of the Jack group:

```
$ su
$ cat /etc/security/limits.d/25-pw-rlimits.conf

@pipewire   - rtprio  70
@pipewire   - nice    -19
@pipewire - memlock unlimited
#@pipewire - memlock 4194304
```

If you use VCVRACK, leave memory for video

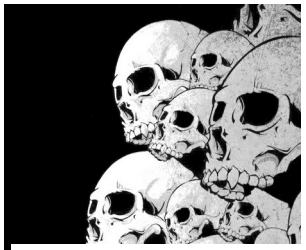
Added to the Pipewire group via:

```
$ usermod -a -G pipewire <username>
```

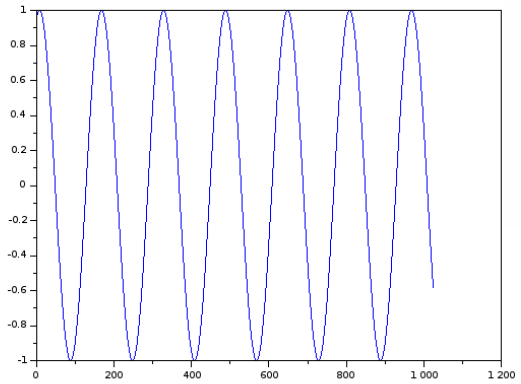
Then we disconnect and reconnect on our session

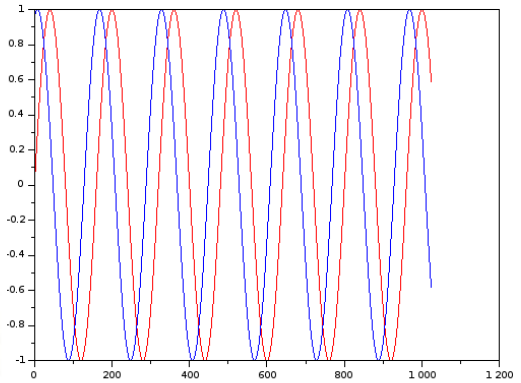
```
$ pw-metadata -n settings 0 clock.force-quantum 256
$ pw-metadata -n settings 0 clock.force-rate 44100
$ systemctl --user restart pipewire.service
$ pw-top
```

Some practical command lines



Kernel latency





Avant

Today

Kernel Standard

Kernel Pre-empt

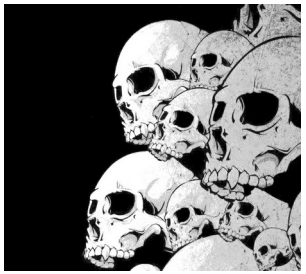
Kernel Realtime

Decreasing latency

Kernel Standard and Kernel Pre-empt

Kernel Realtime

The latency is tolerable to the ear below 10 ms



Kernels Alternatives

Kernel liquorix (Intel Only) - https://liquorix.net:

```
$ dnf install kernel-lqx-mao
```

Kernel Xanmod- https://xanmod.org:

```
$ dnf install kernel-xan-mao
```

Kernel Real Time - https://wiki.linuxfoundation.org/realtime/start:

```
$ dnf install kernel-rt-mao # Based on the last Kernel
$ dnf install kernel-rt-stable-mao # Based on Kernel 5.10
```

Boot time options (select the kernel to boot and press ‘e’ and add the following options):

```
preempt=full threadirqs
```