OpenBSD as a full-featured NAS

OpenBSD is not only for Network related projects

Fosdem 2019

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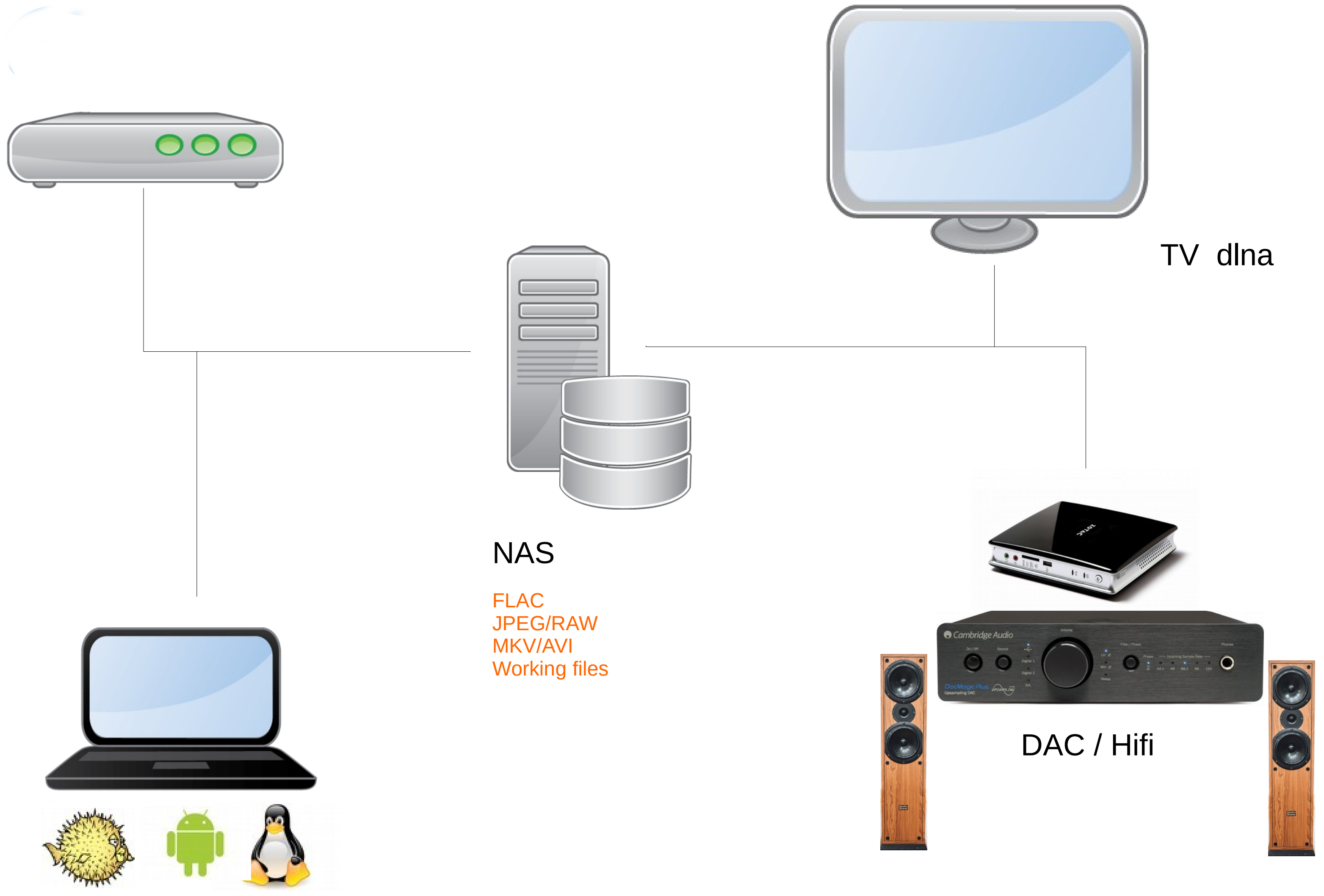
Topics for today

- What are the goals of this project
- How I’ve implemented it
- What were/are the problems
- Lesson’s learned
- The scripts developed are shared
- Conclusions

Goals

- The goals are :
  - An encrypted NAS
  - At least 2 disks (1 for long term backup and for security)
  - Have a “time-machine like” system (for short term backup)
  - Provide files via NFS, Samba and sshfs
  - Every user has his own R/W folder and several other R/O folders
  - Delivering mp3, ogg, Flac to my hifi system + remote control it via smartphone
  - Deliver multi media (video, photos) to TV (~VOD)
  - Run on cheap HW
  - Easy to maintain

Design



Speakers: photo by Goh Rhy Yan on Unsplash

NAS

- 3 main folders:
  - /mnt/sd1/share : photos, video, music. (RO)
  - /mnt/sd1/pfiles: personal files
    - Each user has his own RW folder (not visible by others)
    - Some “global folders” are RW for all users
  - /mnt/sd1/machines: all machine’s backups (not visible by std users)

Hardware (old)

- Intel(R) Atom(TM) CPU D2500 @ 1.86GHz
  - Fan less
  - OpenBSD compatible
  - 4 GB Ram
  - 2 SATA ports
  - Disks 1TB

Hardware

- After few years of good services, a new board with a better CPU
  - ASUSTeK COMPUTER INC. H110T
  - Fan
  - OpenBSD compatible
  - CPU 3.3 GHZ
  - 4GB Ram
  - 2 SATA ports
  - Same disks

Lesson’s learned HW

- Read man pages before buying

Setup OpenBSD

- Since we have 2 SATA slots:
- Install OpenBSD on an USB key
  - Normal installation process
  - Select the correct storage (USB) and follow standard installation steps
  - 16 GB is enough
- Encrypt the Disks
  - My main disk is sd1
  - Remove first blocks: dd if=/dev/urandom of=/dev/rsd1c bs=1m count=10
  - Initialize it: fdisk -iy sd1

- Partition it:

```
# disklabel -E sd1
Label editor (enter '?' for help at any prompt)
> a i
offset: [64]
size: [1953520001] *
FS type: [4.2BSD] RAID
> w
> q
```

- Encrypt it

```
# bioctl -c C -l sd1i softraid0

New passphrase:

Re-type passphrase:

sd2 at scsibus2 targ 1 lun 0: <OPENBSD, SR
CRYPTO, 005> SCSI2 0/direct fixed

sd2: 972877MB, 512 bytes/sector,  1953525168
sectors

softraid0: CRYPTO volume attached as sd2
```

- Partition it and Format it:

```
# disklable -E sd2
Label editor (enter '?' for help at any prompt)
> a i
offset: [64]
size: [1953519473] *
FS type: [4.2BSD]
> w
> q


# newfs /dev/rsd2i


# mount /dev/sd2i  /mnt
```

Points of attention

- At boot, we have to:
  - Bioctl the disk with the pass-phrase
  - Mount the filesystem (will be /dev/sd2i)
- But we have 2 disks !!! (+ the USB)
  - Are we sure that same disk will always be sd1 ?
  - If we boot with 1 disk, the decrypted filesystem will be sd2. If we boot with 2 encrypted disks, our filesystem could be sd4 or sd5.
  - Use of DUID is the solution
- At shutdown we have to umount and remove the RAID
  - Umount /mnt (dev/sd2i)
  - Bioctl -d sd2

```
#disklabel sd1

# /dev/rsd1c:
type: SCSI
disk: SCSI disk
label: WDC WD10EFRX-68P
duid: 8fbf08f1b85e8f65
flags:
bytes/sector: 512
sectors/track: 63
tracks/cylinder: 255
sectors/cylinder: 16065
cylinders: 121601
total sectors: 1953525168
boundstart: 64
boundend: 1953520065
drivedata: 0

16 partitions:
#                size           offset  fstype [fsize bsize   cpg]
  c:       1953525168                0  unused
  i:       1953520001               64    RAID
```

/etc/rc.local

```
#mkdir /mnt/sd1
logger "rc.local: bioctl the nas"
bioctl -c C -l 8fbf08f1b85e8f65.i -p /root/xxx softraid0 > /tmp/maindisk
device=$(sed   -n -e '/CRYPTO/ s/.* //p' /tmp/maindisk)
logger "rc.local: trying to mount the nas"
mountok=1
mount -o noatime,softdep /dev/${device}i /mnt/sd1
if [ $? -gt 0 ]; then
    mountok=0
    logger "rc.local: mount failed !!! start fsck -y"
    fsck -y /dev/${device}i
    logger "rc.local: retry to mount the nas"
    mountok=1
    mount -o noatime,softdep /dev/${device}i /mnt/sd1
    if [ $? -gt 0 ]; then
       mountok=0
    fi
fi
if [ "$mountok" = "1" ]; then
  ...
else
    Logger “rc.local: failed to start applications
fi
```

/etc/rc.shutdown

```
…
for i in $(mount | grep -v mfs | grep -v " / " | cut -d' ' -f1)
do
  logger "rc.shutdown: umount:$i"
  umount -f $i
  sleep 5
  sync
  logger "rc.shutdown: bioctl -d $(echo $i | cut -d '/' -f 3 |
cut -d 'i' -f1)"
  bioctl -d $(echo $i | cut -d '/' -f 3 | cut -d 'i' -f1)
done
```

Lessons learned: setup

- DUID is a must to manage correctly each disk (avoid to over-write or erase to good files)
- Attention to perform for the boot and shutdown process
- Whole setup is amazingly simple, yet efficient, on OpenBSD

Time machine

- https://sourceforge.net/projects/simple-time-machine/
- Use rsync (pkg_add rsync)
- Hard links against a reference (folder current)
- I’m running it 1x per day (but could 1x hour). If no data changed since last run, nothing performed.
- Every user’s folders and important folder (photos, music, movies, ...) have their “time machine” allowing me to retrieve old deleted or modified files.

```
obsd-nas:/mnt/sd1/machines/nas#du -h -d1 . | sort -k2
6.6M    ./20181216
6.4M    ./20181217
7.0M    ./20181220
5.2M    ./20181222
937M    ./current
```

Time machine

- Config file for /etc, /root, /var:

```
backup_type=full

historical_retention=25

folder_size=1920112 # calculated on 01-01-2019
01:31:59
```

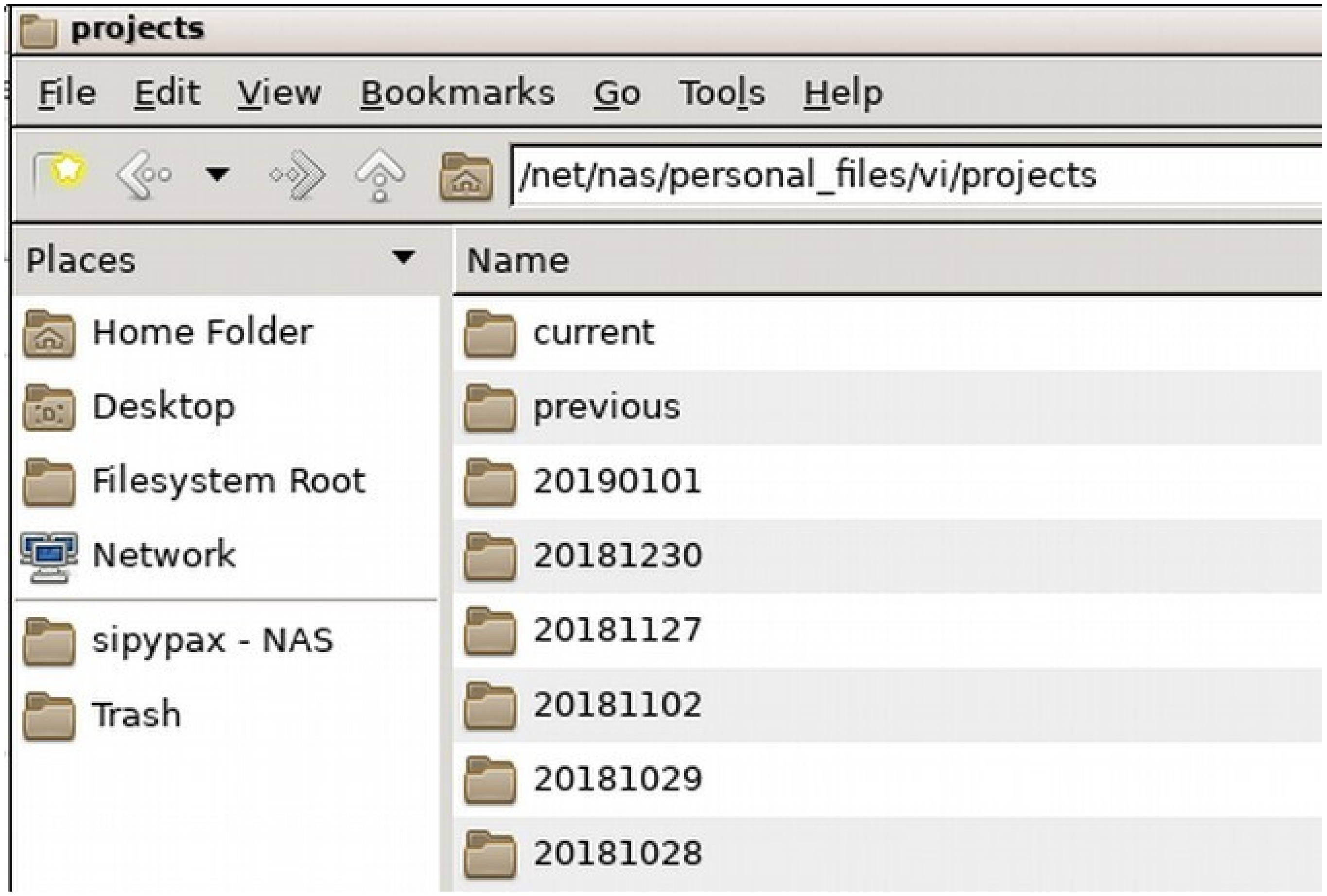
- Config file for mp3:

```
backup_type=check_only_size

historical_retention=5

folder_size=120480192 # calculated on 17-12-2017 01:38:52

folder_pattern="+%Y%m%d"
```



/net/nas/personal_files/vi/projects

current
previous
20190101
20181230
20181127
20181102
20181029
20181028

Lessons learned

- Hard links are very good for such “file based” backups. Limited storage impact
- Rsync is perfect for this job.
- Easy for the end users to retreive their old files

Sharing files

- Server side: standard configs
  - NFS server is NFSv3 in OpenBSD

```
obsd-nas:~#more /etc/exports

/mnt/sd1 -maproot=root -alldirs -network=192.168.3.0 -mask=255.255.255.0
```

- pkg_add samba + standard setup:
  - One shared folder
  - 2 home folders for users “is” and “ra”

```
#more /etc/samba/smb.conf
   [global]
   workgroup = WORKGROUP
   hosts allow = 192.168.3.
   guest account = nobody
   map to guest = Bad User
   log file = /var/log/samba/smbd.%m
   log level = 1
   max log size = 500
   dns proxy = no
#============================ Share Definitions ==============================
[share]
        path = /mnt/sd1/share
        guest ok = yes
        read only = yes
        browseable = yes
[is]
        path = /mnt/sd1/personal_files/is/current
        valid users = is
        guest ok = no
        read only = no
        browseable = yes

[ra]
        path = /mnt/sd1/personal_files/ra/current
        valid users = ra
        guest ok = no
        read only = no
        browseable = yes
```

- For sshfs
  - setup ssh keys between client and server
  - On client:
    - pkg_add sshfs-fuse
    - Mount it:

```
UID=$(id -u)

GID=$(id -g)

doas sshfs root@nas:/mnt/sd1 /net/nas  \

           -o idmap=user,uid=$UID,gid=$GID,allow_other,\

              follow_symlinks,reconnect
```

lesson's learned: Samba, NFS and sshfs

Client side:

- Performance parameters (/etc/fstab):

  nas:/mnt/sd1 /net/nas nfs rw,noauto,bg,nodev,nosuid,soft,intr,-r=4096,-w=4096 0 0

- ~~Better to not use NFS over Wifi. Works, but not reliable.~~
- Samba is really simple for OSX and Linux clients connected over wifi.
- For sshfs: run well with OpenBSD over wifi

backup

- Copy master disk to backup disk 1x per month
- Copy master disk to external disk 3x per year (paranoiac ?)
- But before make sure that we copy correct files
  - Check your files are not impacted by a bit rotation issue.
  - Yabitrot (https://sourceforge.net/projects/yabitrot/):

    a python script which store checksum’s files (based on their Inode) in an SQLite DB.

```
obsd-nas:~#more /etc/monthly.local

/usr/local/bin/python3.6 /root/yabitrot.py -p /mnt/sd1 -e "*.core" -v 0 -L /var/log/yabitrot.log
```

- Yabitrot
  - Takes into account the hardlinks
  - Written in python3 using standard modules (sqlite, zlib)
  - Use a fast hash algorithm: zlib.adler32
  - Do not cross filesystems (because of inodes)
  - Note: Adler is unsafe for protecting against intentional modification
- Restore corrupted files from backup before taking backup

```
Thu Dec  6 02:30:01 2018: DB stored on: /mnt/sd1/.cksum.db

Thu Dec  6 02:30:01 2018: Device ID:1080

Thu Dec  6 04:56:09 2018: 6298 files removed from DB

Thu Dec  6 04:56:10 2018: 6628 files added

Thu Dec  6 04:56:10 2018: 518 files updates

Thu Dec  6 04:56:10 2018: 0 files error

Thu Dec  6 04:56:10 2018: 6174625 files analyzed in 8768.73 sec, 717.907 GB

Thu Dec  6 04:56:10 2018: 773350 entries in the DB
```

backup

- Cannot use rsync to sync 2 disks because too many hardinks (cfr rsync man page)
- Do not use DD because of encryption (any feedbacks ?)
- Tested tar, cpio and pax
- Finally adopt pax:

```
cd /mnt/sd1

pax -rw -pe $VERBOSE ./machines /mnt/sd0/
```

```
bioctl -c C -I /dev/<duid>i softraid0
> passphrase
mount /dev/sdxi /mnt/sd0
... rm ...
... pax ...
umount / mnt/sd0
bioctl -d sdx

#              old hw                   new hw
MACHINE="YES" #20 minutes              4m + 10m
PFILES="YES"  #29 hours                2h10 + 4h40
SHARE="YES"   #17 hours                9m + 2h15
VERBOSE=””
```

- In case of disaster (fire, water, ...) better to not have master and backup disks in the same box.
- I perform a copy to a 2.5” disk too (??!!??):

```
bioctl -c C -I /dev/<duid>i softraid0

> passphrase

mount /dev/sdxi /mnt/sd0

... rm ...

... pax ...

umount / mnt/sd0

bioctl -d sdx
```

Lessons learned: backup

- Be verify sure of the good status of files before putting them on backup devices (overwrite)
- Pax is perfect for this job
- Powerful cpu is required because of encryption

Hifi

- mpd is running on NAS: pkg_add mpd
- Adapt /etc/mpd.conf:

```
music_directory         "/mnt/sd1/share/music/current"
bind_to_address         "nas"
audio_output {
        type            "sndio"
        name            "sndio output"
        mixer_type      "software"
}
```

Hifi

- Thanks to sndio, audio output is redirected to small machine located close to an hifi-DAC
- Smartphone app like MALP allow you to manage your sounds
- As web based mgt system, I propose ympd (runs on openbsd).

Hifi

- Normal OpenBSD installation (I’m using my usb read-only setup to allow poweroff)
- ZOTAC ZBOX-ID18 with 4GBRam, no disk.
- Have a digital output: mixerctl shows outputs.SPDIF_source=dig-dac-0:1

```
# more /etc/rc.local

sleep 2
rcctl stop sndiod
mixerctl outputs.mode=digital
rcctl start sndiod
sleep 2
/usr/bin/ssh vi@nas /home/vi/start_mpd.sh
sleep 2
/usr/local/bin/ympd -h nas -w 80  &
```

```
obsd-nas:~#more start_mpd.sh

#!/bin/sh
DESTINATION=”hifi”
export AUDIODEVICE="snd@$DESTINATION/0"
echo "$AUDIODEVICE"
doas rcctl restart mpd
sleep 2
mpc -q -h nas play           #play last songs
```

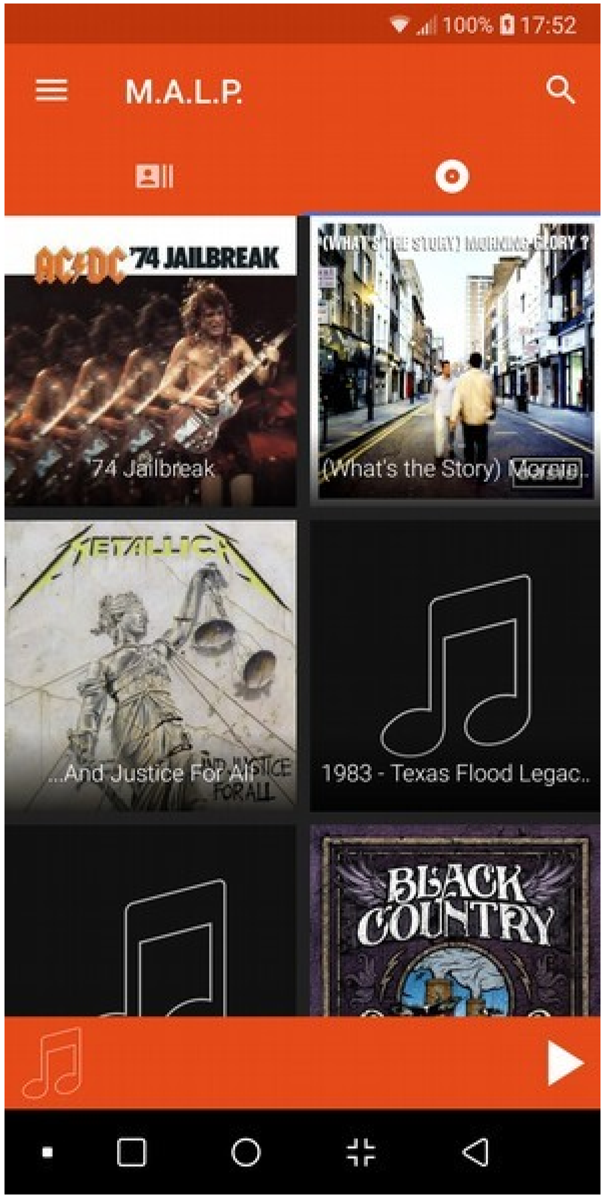
YMPD

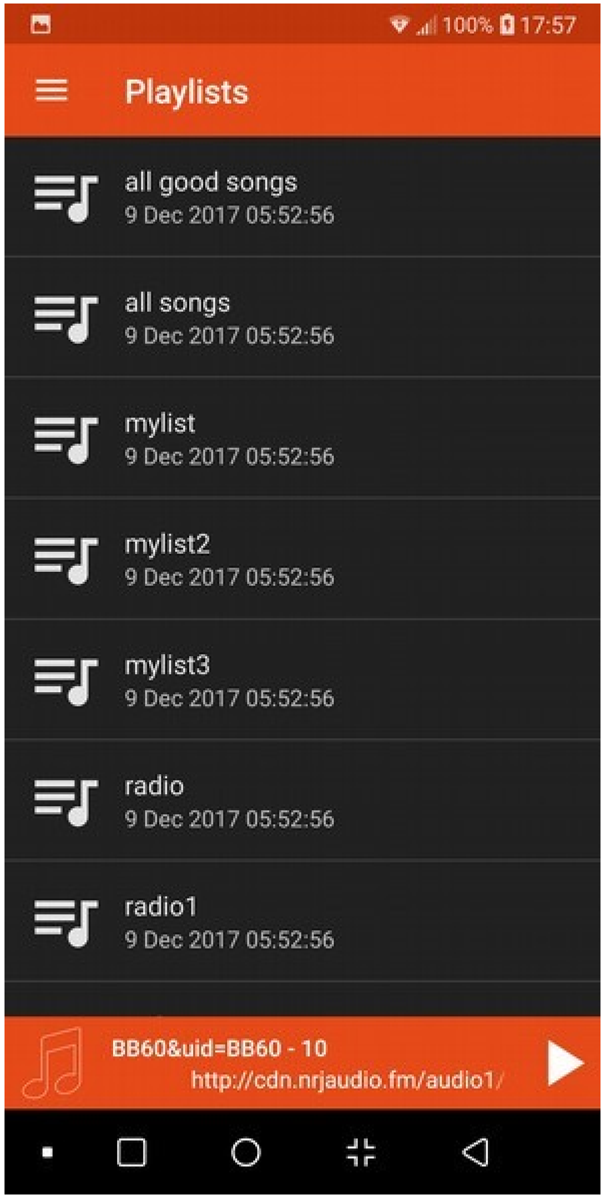
- https://www.ympd.org/
- pkg_add ympd (release 1.3.0)
- MPD Web GUI - written in C, utilizing Websockets and Bootstrap/JS
- Put the address of your NAS and the mpd port (6600) in the settings of ympd

  ;-)

Cambridge Audio
Volume
On / Off
Source
Digital 1
Digital 2
Ext.
Lin Ø
Min Ø
Steep
Filter / Phase
Phase
Incoming Sample Rate
44.1
48
88.2
96
192
Phones
DacMagic Plus
Upsampling DAC
LISTEN
TAPE
DIRECT
BASS
TREBLE
BALANCE

Mpd on android: MALP





all good songs
9 Dec 2017 05:52:56

all songs
9 Dec 2017 05:52:56

mylist
9 Dec 2017 05:52:56

mylist2
9 Dec 2017 05:52:56

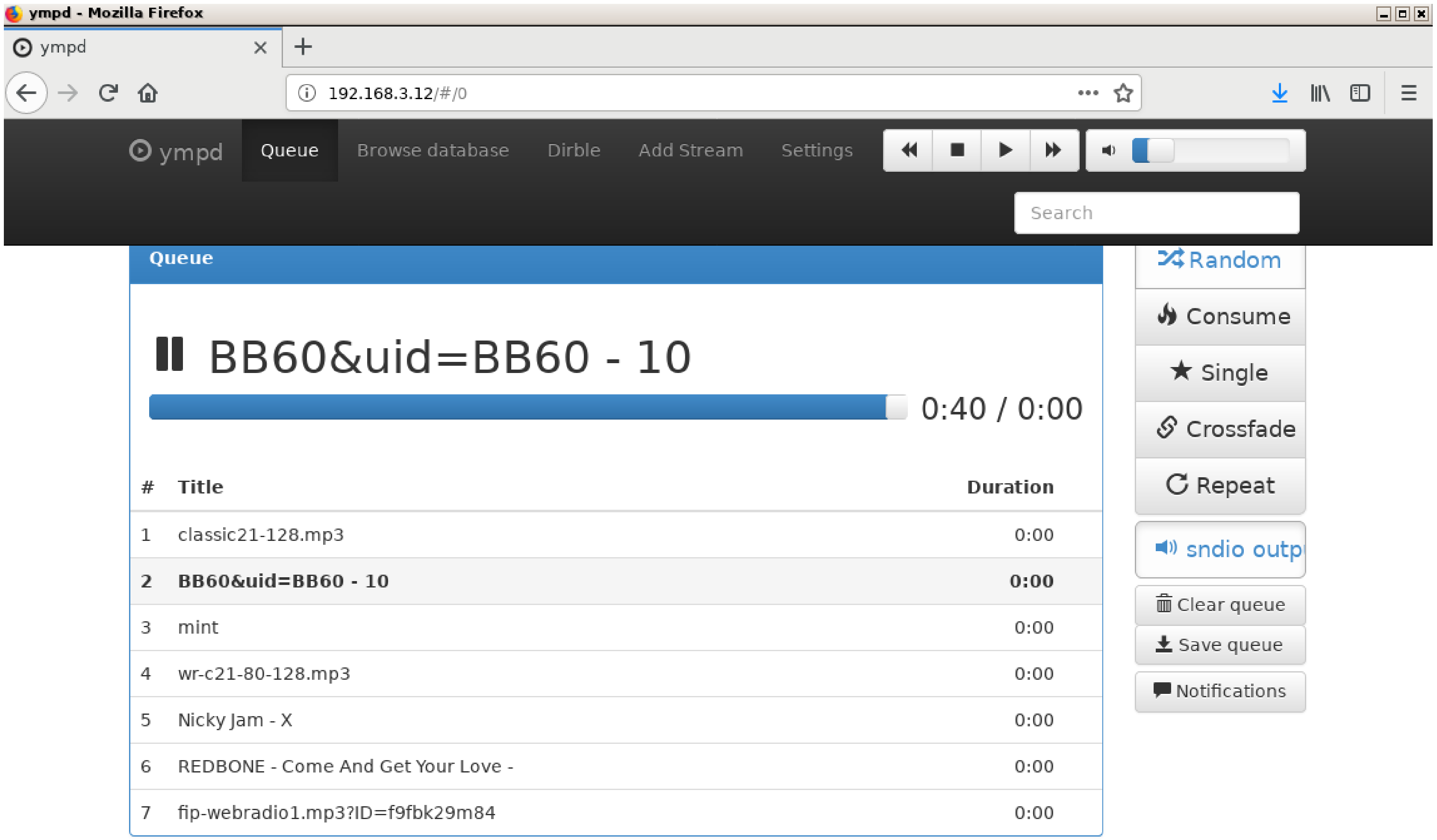
mylist3
9 Dec 2017 05:52:56

radio
9 Dec 2017 05:52:56

radio1
9 Dec 2017 05:52:56

BB60&uid=BB60 - 10
http://cdn.nrjaudio.fm/audio1/

YMPD



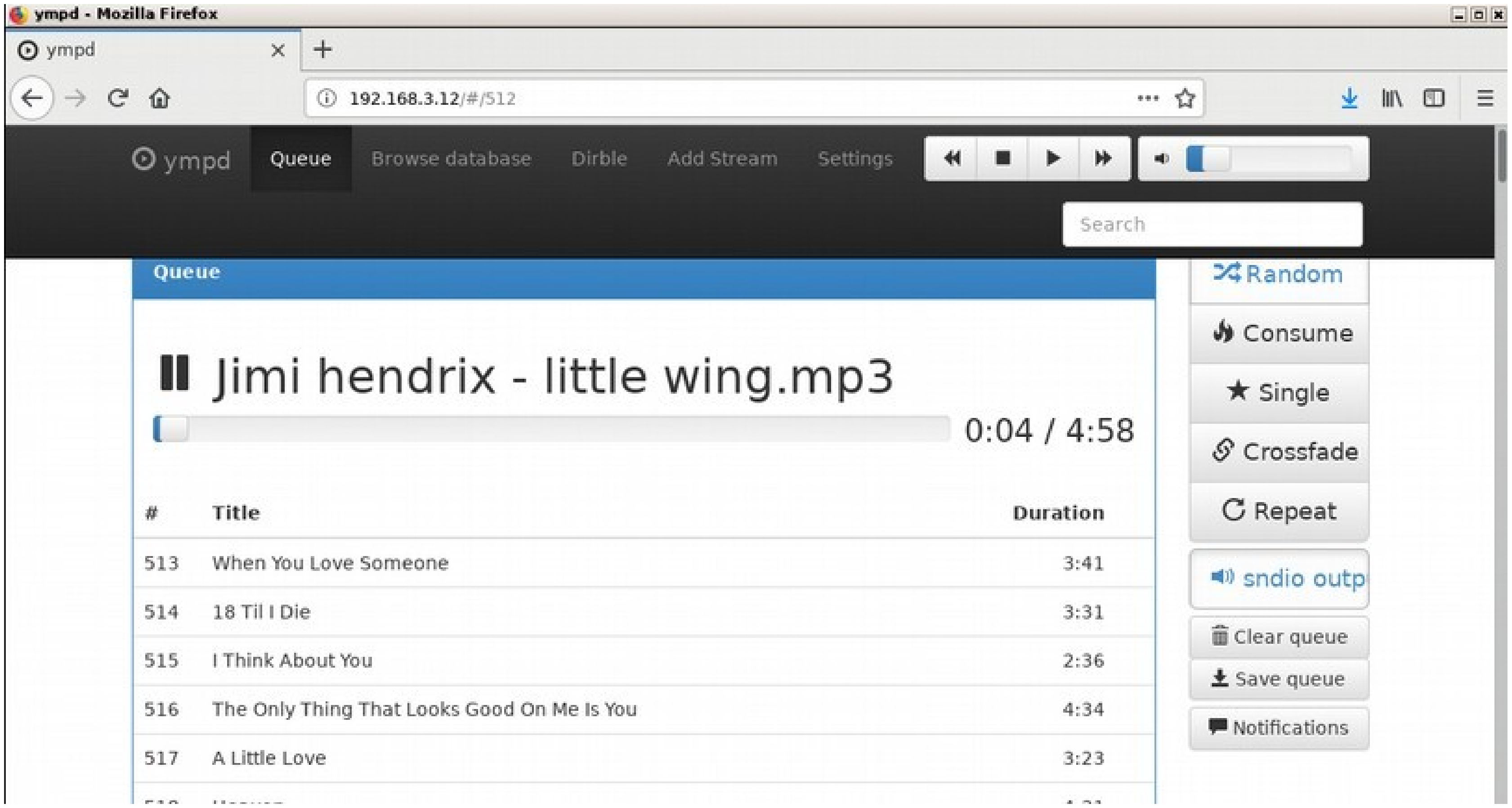
Queue

BB60&uid=BB60 - 10

0:40 / 0:00

#	Title	Duration
1	classic21-128.mp3	0:00
2	**BB60&uid=BB60 - 10**	**0:00**
3	mint	0:00
4	wr-c21-80-128.mp3	0:00
5	Nicky Jam - X	0:00
6	REDBONE - Come And Get Your Love -	0:00
7	fip-webradio1.mp3?ID=f9fbk29m84	0:00

YMPD



Queue

Jimi hendrix - little wing.mp3

0:04 / 4:58

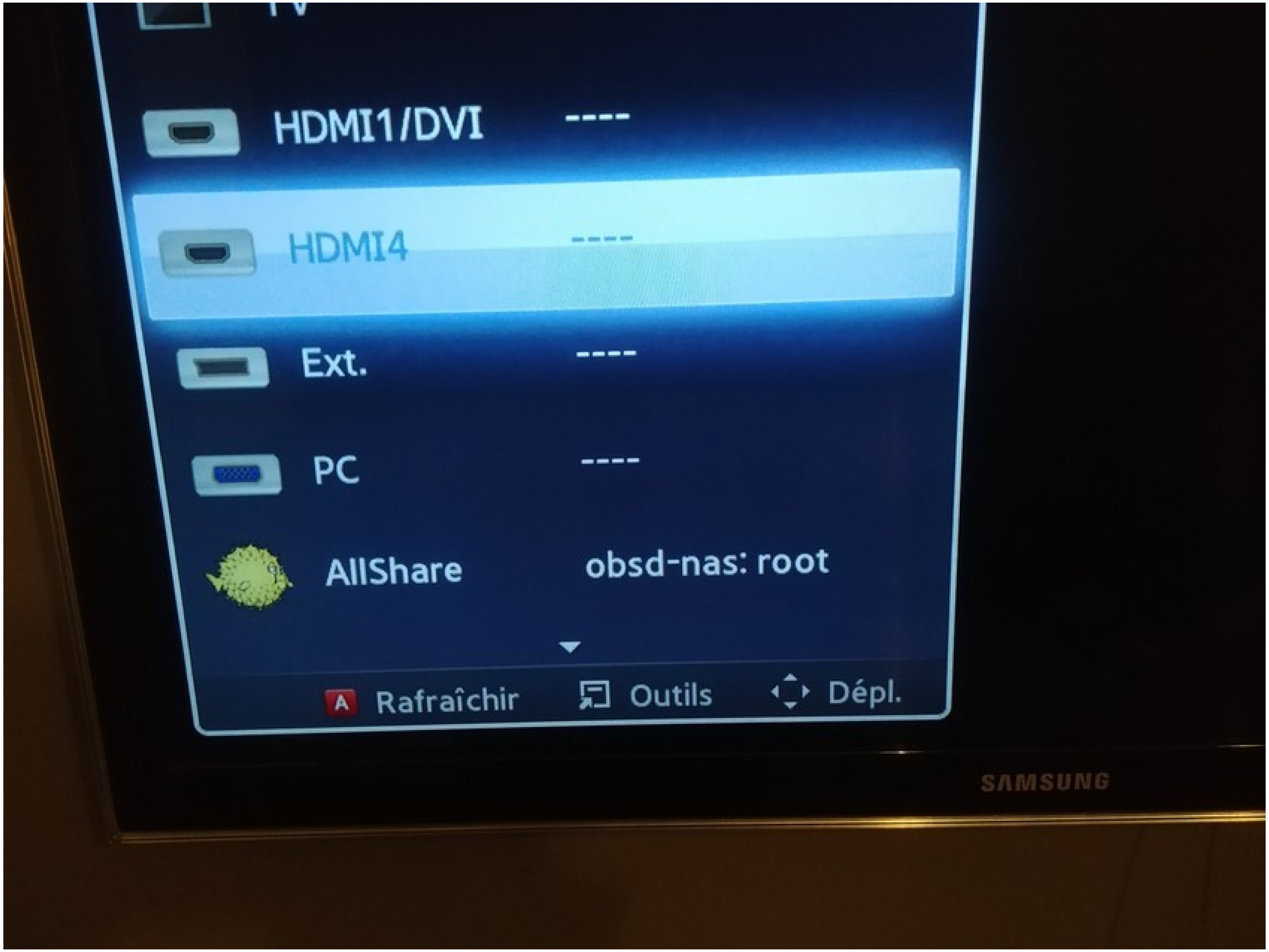
#	Title	Duration
513	When You Love Someone	3:41
514	18 Til I Die	3:31
515	I Think About You	2:36
516	The Only Thing That Looks Good On Me Is You	4:34
517	A Little Love	3:23

VOD

- Minidald is installed on the NAS server (pkg_add minidlna) require xbase.tgz
- Adapt /etc/minidlna.conf

```
network_interface=re0
media_dir=V,/mnt/sd1/share/films/current
media_dir=PV,/mnt/sd1/share/photo/current
```

My TV screen


HDMI1/DVI ----
HDMI4 ----
Ext. ----
PC ----
AllShare obsd-nas: root
A Rafraîchir
Outils
Dépl.
SAMSUNG

Lessons learned

- OpenBSD offers all required plumbing for sharing multimedia files.
- Sndiod is awesome good.

Keep system up2date

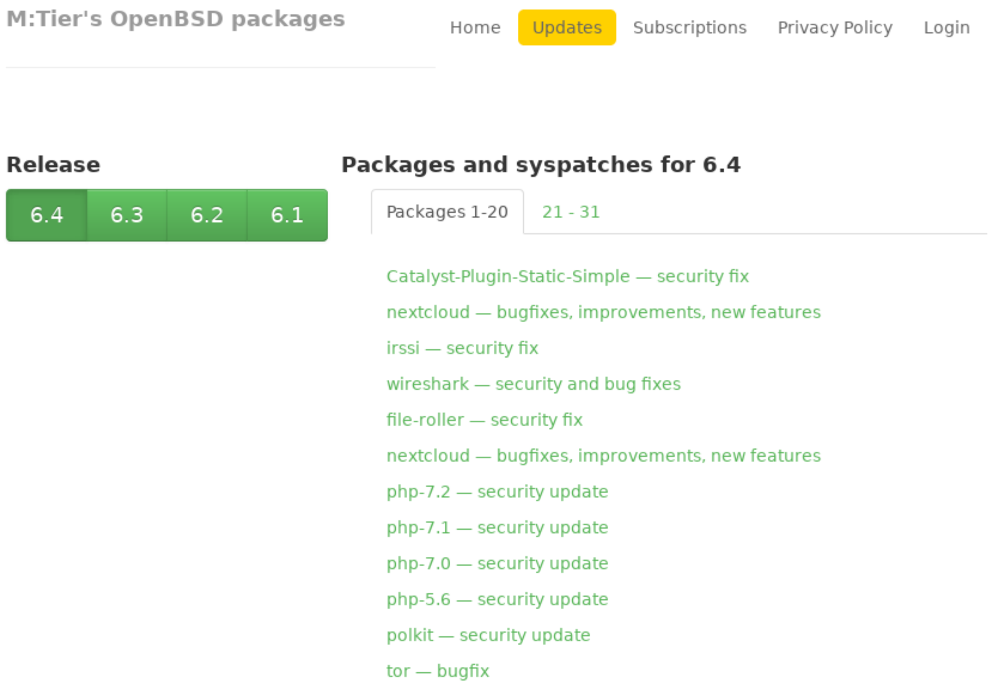
- Syspatch

For base's security updates

- Openup

Use mtier services if you want to have your software adapted

https://stable.mtier.org/updates

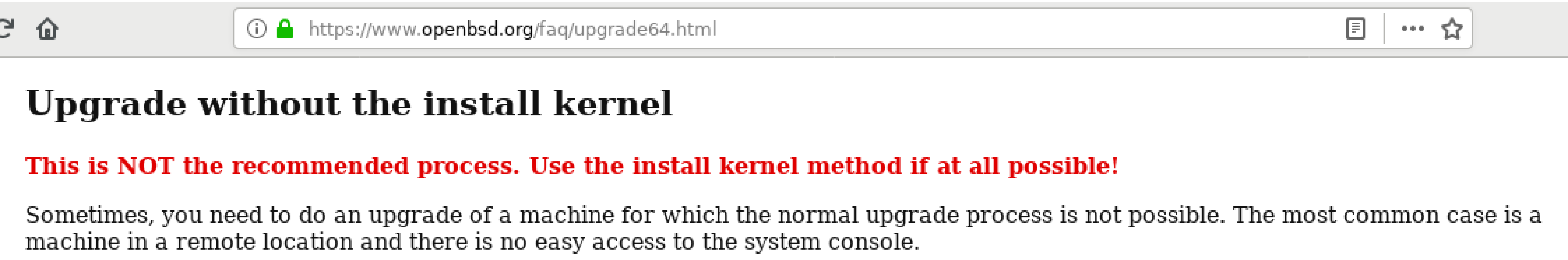

M:Tier's OpenBSD packages

Packages and syspatches for 6.4

Catalyst-Plugin-Static-Simple — security fix
nextcloud — bugfixes, improvements, new features
irssi — security fix
wireshark — security and bug fixes
file-roller — security fix
nextcloud — bugfixes, improvements, new features
php-7.2 — security update
php-7.1 — security update
php-7.0 — security update
php-5.6 — security update
polkit — security update
tor — bugfix

Openbsd upgrades every 6 months

- I’m not following the standard upgrade process, because I do not have easy access to the consoles



https://www.openbsd.org/faq/upgrade64.html

Upgrade without the install kernel

This is NOT the recommended process. Use the install kernel method if at all possible!

Sometimes, you need to do an upgrade of a machine for which the normal upgrade process is not possible. The most common case is a machine in a remote location and there is no easy access to the system console.

Upgrade

```
VERSION="64"  # The version you want to install
SRC="https://cdn.openbsd.org"
set -A SETS xbase xfont xserv xshare man game comp base #base should always be the last
DEST="/tmp/upgrd"
# Download OpenBSD kernel files and sets
MAJ=${VERSION%?}; MIN=${VERSION#${VERSION%?}}; DWNLD="$SRC/pub/OpenBSD/$MAJ.$MIN/amd64/"
[ -d "$DEST" ] || mkdir -p "$DEST"; cd "$DEST"
echo == Temporary folder $DEST ==
[ -f SHA256.sig ] || ftp ${DWNLD}SHA256.sig
for COMPO in bsd.rd bsd bsd.mp;do
    echo == Treating $COMPO ==
    [ -f $COMPO ] || ftp $DWNLD$COMPO
    signify -C -p /etc/signify/openbsd-$VERSION-base.pub -x SHA256.sig $COMPO || exit 1
done
for COMPO in ${SETS[@]}; do
    echo == Treating $COMPO$VERSION.tgz ==
    [ -f $COMPO$VERSION.tgz ] || ftp $DWNLD$COMPO$VERSION.tgz
    signify -C -p /etc/signify/openbsd-$VERSION-base.pub -x SHA256.sig $COMPO$VERSION.tgz || exit 1
done
# install kernel files (cfr FAQ)
ln -f /bsd /obsd && cp bsd.mp /nbsd && mv /nbsd /bsd
cp bsd.rd /
cp bsd /bsd.sp
sha256 -h /var/db/kernel.SHA256 /bsd
# install the selected sets (Cfr FAQ)
[ -f /sbin/oreboot ] || cp /sbin/reboot /sbin/oreboot || exit 1
for _f in ${SETS[@]}; do
    echo "tar -C / -xzphf $_f"
    tar -C / -xzphf "$_f" || exit 1
done
echo "== DONE =="; echo "After reboot, please follow the remaining tasks list on https://www.openbsd.org/faq/upgrade$VERSION.html#NoInstKern"
echo "When ready, perform: /sbin/oreboot"
```

Upgrade software

- pkg_add -uv

Conclusion

- ✓ An encrypted NAS
- ✓ At least 2 disks (1 for long term backup and for security)
- ✓ Have a “time-machine like” system (for short term backup)
- ✓ Provide files via NFS, Samba and sshfs
- ✓ Delivering mp3, ogg, Flac to my hifi system + remote control it via smartphone
- ✓ Deliver multi media (video, photos) to TV (~VOD)
- ✓ Easy to maintain

BSD index

- Beard, Scare & Difficulty index *

Picture from www.pexels.com adapted by me

* Inspired by: https://www.youtube.com/watch?v=bg4-fJNWoiU

BSD index

- This project is at Level 1 of the index

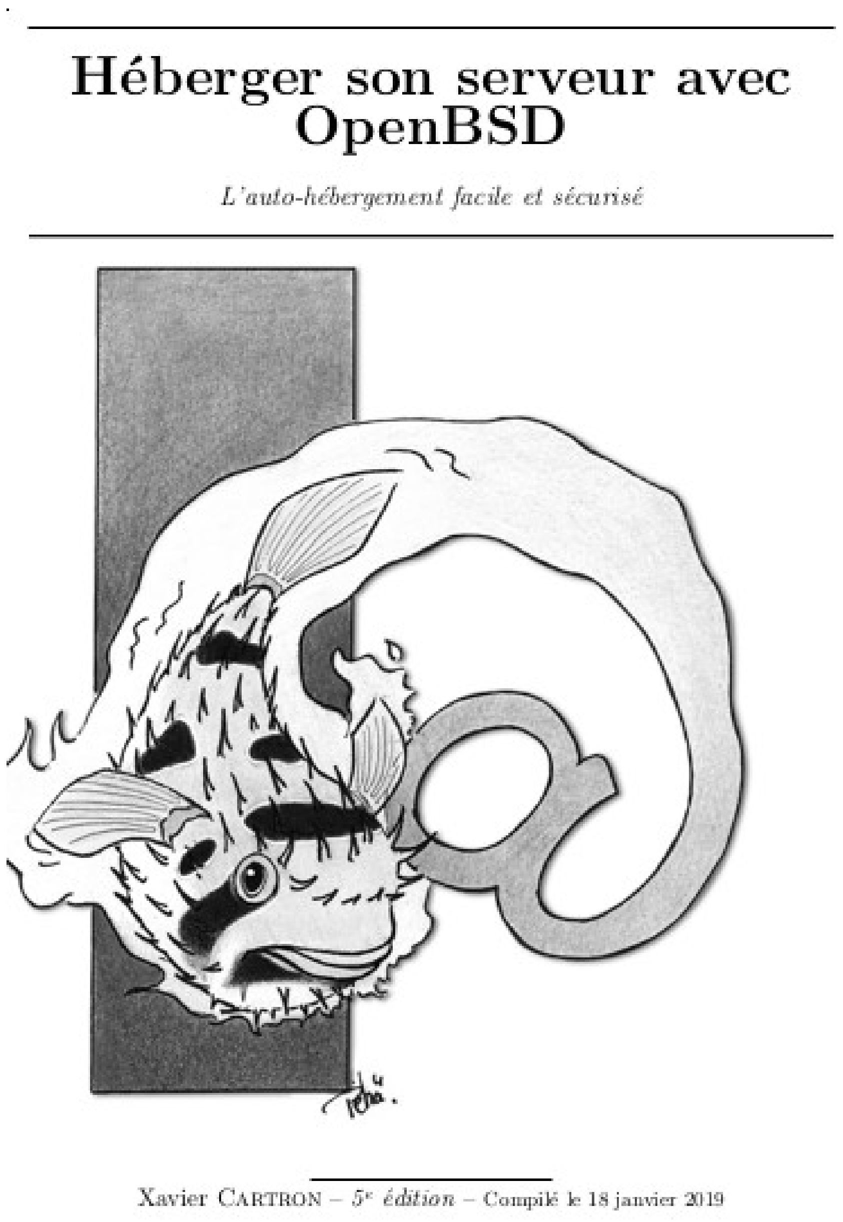
Lessons learned

- Verify that your Hardware has drivers in openbsd before buying it (read man pages)
- Look for required softwares on the OpenBSD packages repository (http://openports.se)
- Upgrades are fun to perform because very few surprises

- OpenBSD is matching perfectly this use case
- OpenBSD is really fun to use

For french speaking persons

https://www.atramenta.net/books/heberger-son-serveur-avec-openbsd/613



Héberger son serveur avec OpenBSD

L'auto-hébergement facile et sécurisé

Xavier Cartron – *5e édition* – Compilé le 18 janvier 2019

Questions ?

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