ANNEX A · PRACTICAL 4.5 — A VOLUME THAT GROWS, A DISK THAT DIES

NAME _____ **DATE** _____

Two requests at **Tramuntana Apps. Joan** (design) needs a place for videos that can grow when it fills up. **Aina** (admin) needs the invoices to survive a dead disk. You work in `deb-lab` with **four new disks**, called `vdc`, `vdd`, `vde`, `vdf` in this sheet: if yours have other names, use yours. Do **not** touch the disk of the last days (`vdb`).

TASKS 1–4 · 27 MIN

TASK 1 Four new disks

In virt-manager, open `deb-lab` → Show virtual hardware details → Add Hardware → Storage → **1 GiB**, bus **VirtIO** → Finish. Four times. Then, in the VM:

```
lsblk
sudo apt install lvm2 mdadm
```

Names of the four new disks: _____

DONE WHEN `lsblk` shows four disks of `1G` with nothing under them.

TASK 2 Build the video volume

One disk becomes a physical volume, goes into a volume group, and you cut a logical volume of 800 MB from it:

```
sudo pvcreate /dev/vdc
sudo vgcreate vg_tram /dev/vdc
sudo lvcreate -n lv_media -L 800M vg_tram
sudo mkfs.ext4 /dev/vg_tram/lv_media
sudo mkdir /srv/media
sudo mount /dev/vg_tram/lv_media /srv/media
sudo chown $USER: /srv/media
df -h /srv/media
```

Size of `/srv/media`: _____

DONE WHEN `df -h` shows a line that contains `vg_tram-lv_media`.

TASK 3 Friday, 18:00

Joan saves a 700 MB video, then another one of 200 MB:

```
cd /srv/media
head -c 700M /dev/urandom > campaign.mp4
df -h /srv/media
head -c 200M /dev/urandom > more.mp4
```

Use%: _____ Error message of the last command:

_____

```
rm more.mp4
```

DONE WHEN you copied an error that says there is no space.

TASK 4 Grow it without stopping

Add the second disk to the group, then grow the volume **and** its file system (`-r`) by 1 GB:

```
sudo vgextend vg_tram /dev/vdd
sudo vgs
sudo lvextend -r -L +1G vg_tram/lv_media
df -h /srv/media
head -c 200M /dev/urandom > more.mp4
lsblk
```

VFree in `vgs`: _____ New size of `/srv/media`: _____

Did you unmount the folder at any moment? _____
Under which disks does `lsblk` show `lv_media` now?

_____

DONE WHEN the 200 MB file is saved and the size is about 1.8G.

TASK 5 · 10 MIN · IN PAIRS

TASK 5 RAID on paper

Fill in. All disks are 4 TB.

	Array	Usable space	Disks that may die
a	RAID 0 · 2 disks		
b	RAID 1 · 2 disks		
c	RAID 5 · 4 disks		
d	RAID 6 · 4 disks		
e	RAID 10 · 4 disks		

The Tramuntana server has 4 bays and 4 TB disks. They need at least 10 TB and one disk may die. Which level? _____

Parity: disk A holds `1011`, the parity disk holds `1100`. Disk B died. What was on it? _____

DONE WHEN every cell has a number and you chose one level.

TASKS 6–8 · 25 MIN

TASK 6 Aina's mirror

```
sudo mdadm --create /dev/md0 --level=1 \
  --raid-devices=2 /dev/vde /dev/vdf
```

One command on two lines: the `\` at the end means "it goes on". It asks two questions. First one (bitmap): press **Enter**. Second one (Continue creating array?): type **y**.

```
cat /proc/mdstat
sudo mkfs.ext4 /dev/md0
sudo mkdir /srv/admin
sudo mount /dev/md0 /srv/admin
sudo chown $USER: /srv/admin
echo '1200 EUR' > /srv/admin/invoice-001.txt
df -h /srv/admin
```

The two letters between brackets in `/proc/mdstat`: _____ Size of `/srv/admin`: _____
Two disks of 1 GB. Why is the size not 2 GB?

DONE WHEN `/proc/mdstat` shows `md0 : active raid1` with two disks.

TASK 7 Kill a disk

```
sudo mdadm /dev/md0 --fail /dev/vdf
cat /proc/mdstat
cat /srv/admin/invoice-001.txt
```

Brackets now: _____ Can you still read the invoice? _____
Now "replace" the disk. Then repeat the last command quickly (arrow up, Enter) until the brackets are healthy again:

```
sudo mdadm /dev/md0 --remove /dev/vdf
sudo mdadm /dev/md0 --add /dev/vdf
cat /proc/mdstat
```

What did you see in between? (a word, a letter in brackets, a percentage…)

DONE WHEN the brackets are back to the two letters of task 6.

TASK 8 The other accident

Pau, the intern, cleans the wrong folder:

```
rm /srv/admin/invoice-001.txt
ls /srv/admin
cat /proc/mdstat
```

Is the array healthy? _____ On which of the two disks is the invoice now?

RAID protects against: _____
RAID does **not** protect against: _____
DONE WHEN you wrote one thing on each line.

TASK 9 · 7 MIN

TASK 9 Clean up

Leave the four disks empty and connected. You need one on 03/02.

```
cd ~
sudo umount /srv/admin /srv/media
sudo mdadm --stop /dev/md0
sudo mdadm --zero-superblock /dev/vde /dev/vdf
sudo lvremove -y vg_tram/lv_media
sudo vgremove vg_tram
sudo pvremove /dev/vdc /dev/vdd
sudo rmdir /srv/admin /srv/media
lsblk
```

DONE WHEN `vdc`, `vdd`, `vde`, `vdf` have nothing under them, and `vdb1` and `vdb2` are still mounted under `/srv/tramuntana`.

Hand in on Classroom, by Friday 05/02 at 23:59: `practical-4.5-surname.md`. One section per task: the command, the evidence and one sentence in your own words. Add a drawing or a list of the three LVM layers with **your** names, and your two lines of task 8.

Marking (10): tasks 1–4 with evidence 3 · task 5 correct 2 · tasks 6–7 with the three states of `/proc/mdstat` 3 · task 8 explained 1 · clear Markdown, your own words 1.

EXIT TICKET

1. In LVM, which piece do you format and mount?
- ☐ **A** The physical volume
- ☐ **B** The volume group
- ☐ **C** The logical volume
- ☐ **D** The partition table

2. What does `sudo lvextend -r -L +1G vg_tram/lv_media` do?
- ☐ **A** Adds a new disk of 1 GB to the group
- ☐ **B** Grows the volume and its file system by 1 GB
- ☐ **C** Makes a copy of the volume
- ☐ **D** Shrinks the volume to 1 GB

3. RAID 5 with four disks of 2 TB. Usable space?
- ☐ **A** 2 TB
- ☐ **B** 4 TB
- ☐ **C** 8 TB
- ☐ **D** 6 TB

4. `/proc/mdstat` shows `[2/1] [U_]`. What does it mean?
- ☐ **A** One disk of the mirror is missing; it still works
- ☐ **B** The array is stopped
- ☐ **C** Both disks are healthy
- ☐ **D** All the data is lost

5. A RAID 1 is healthy. Marta deletes a folder by mistake. Where can she get it back from?
- ☐ **A** From the second disk of the mirror
- ☐ **B** From `/proc/mdstat`
- ☐ **C** From neither disk: it was deleted on both
- ☐ **D** From the parity