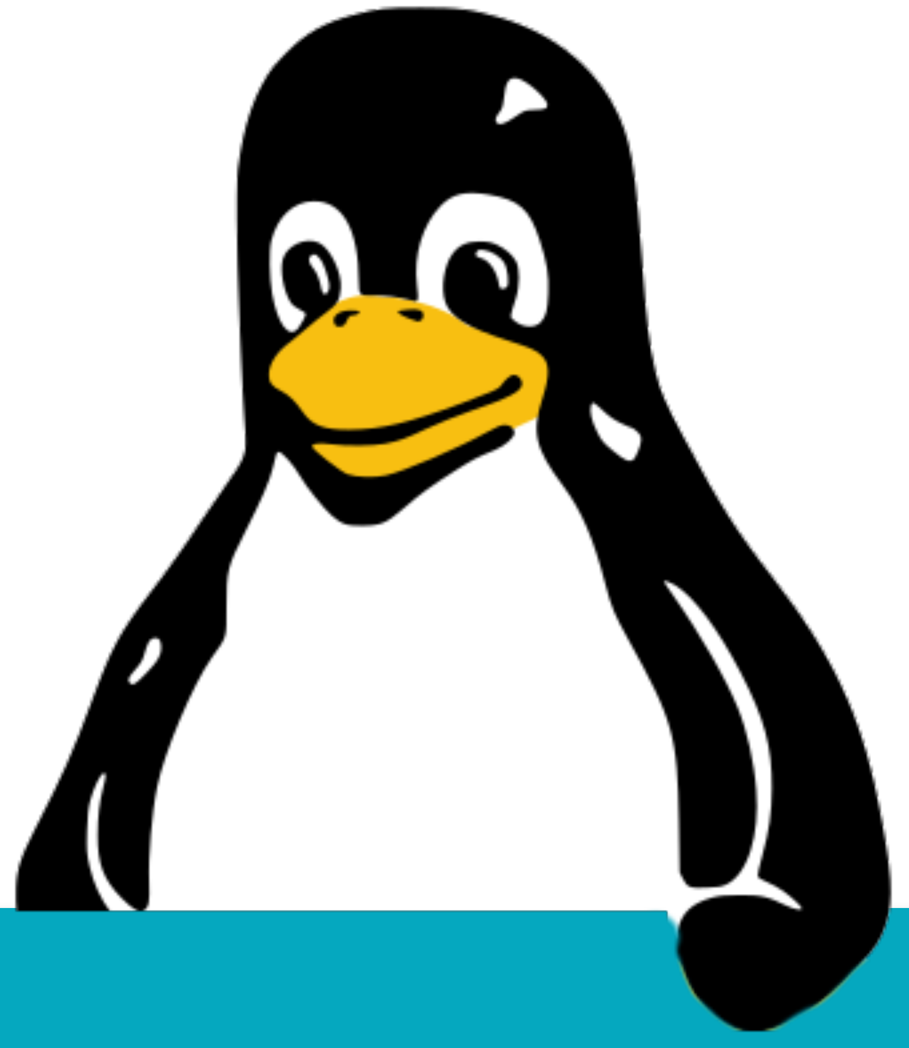
Linux, day 10



Objectives covered

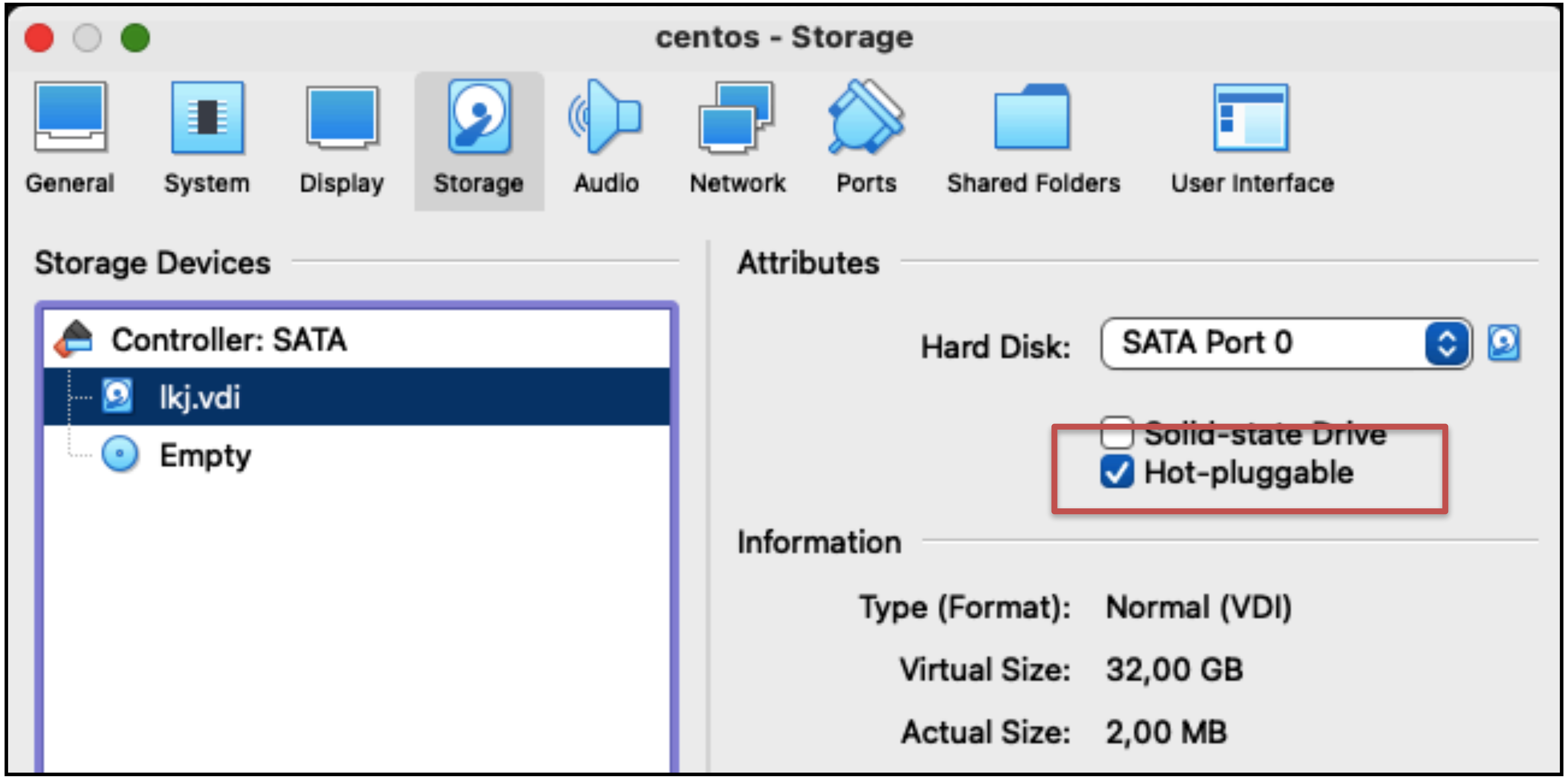
Objective	Summary	Book
1.1	Storage concepts	11
1.3	Given a scenario, manage storage in a Linux environment	11

MDadm

Prepping your lab: VBox

- In VirtualBox, change the three dummy disks.
  - Enable hot-plugging.

Prepping your lab: VBox



Storage Devices

- Controller: SATA
  - lkj.vdi
  - Empty

Attributes

Hard Disk: SATA Port 0

□ Solid-state Drive

☑ Hot-pluggable

Information

Type (Format):	Normal (VDI)
Virtual Size:	32,00 GB
Actual Size:	2,00 MB

Prepping your lab: mounts

- In the Linux VM verify the disks are unused.
  - *mount | grep "sd?"*
    - Unmount your mounts of *sdb*, *sdc* and *sdd*.
  - *grep -i "sd?" /etc/fstab*
    - Remove any lines for *sdb*, *sdc* and *sdd*.
  - *sudo mkdir /mnt/data*

Prepping disks for RAID

- Some people suggest you partition them,
  - Others say to just use the whole device.
  - *mdadm* says "partition table will be meaningless"
- Apply GPT partitioning.
  - Use partition type "*Linux RAID*" in *fdisk.*
  - Or *"FD00"* in *gdisk.*

Prepping our disks (three times)

```
$ sudo fdisk /dev/sdb
g
n   # Three times enter, y to overwrite
t   # List types,search for RAID
29  # Type RAID, number may differ!
w
```

Making a RAID1, with spare

- Remember how to use those backslashes?

```
$ sudo mdadm --create --verbose \
 --level=1 --metadata=1.2 \
 --raid-devices=2 /dev/md/MyRAID1 \
 /dev/sdb /dev/sdc \
 --spare-devices=1 /dev/sdd
```

Then use it

- Format, mount and use.

```
$ sudo mkfs.ext4 /dev/md/MyRAID1

$ sudo mount /dev/md/MyRAID1 /mnt/data

$ sudo touch /mnt/data/testfile
```

Saving your array config

- The location of the config file differs per Linux!
  - *sudo find /etc -name "mdadm.conf"*

```
$ sudo mdadm --detail --scan | \
sudo tee -a /etc/mdadm.conf
                     # Change that path!
```

Checking RAID health

- *mdadm* software RAID is pretty basic!
  - *cat /proc/mdstat*
  - *sudo mdadm --detail /dev/md/MyRAID1*
  - *journalctl | grep -e "kernel: md" -e "mdadm"*

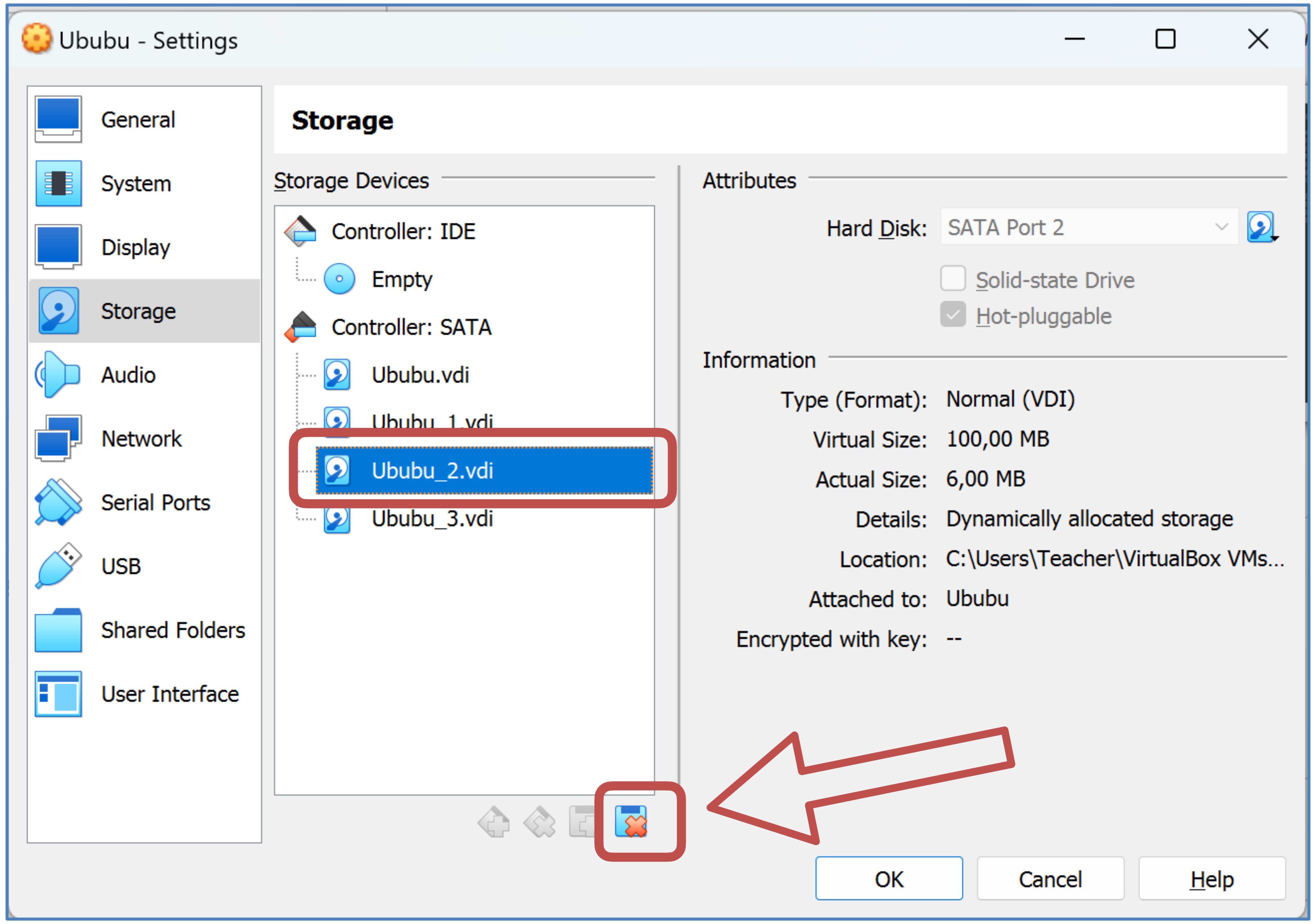
Fun time

- On the guest OS, keep an eye on RAID.

```
$ sudo mdadm --monitor /dev/md/MyRAID1
```

Let's break it!

- Remove the second 100MB virtual disk.



Hard Disk: SATA Port 2

□ Solid-state Drive

☑ Hot-pluggable

Information

Type (Format): Normal (VDI)

Virtual Size: 100,00 MB

Actual Size: 6,00 MB

Details: Dynamically allocated storage

Location: C:\Users\Teacher\VirtualBox VMs...

Attached to: Ububu

Encrypted with key: --

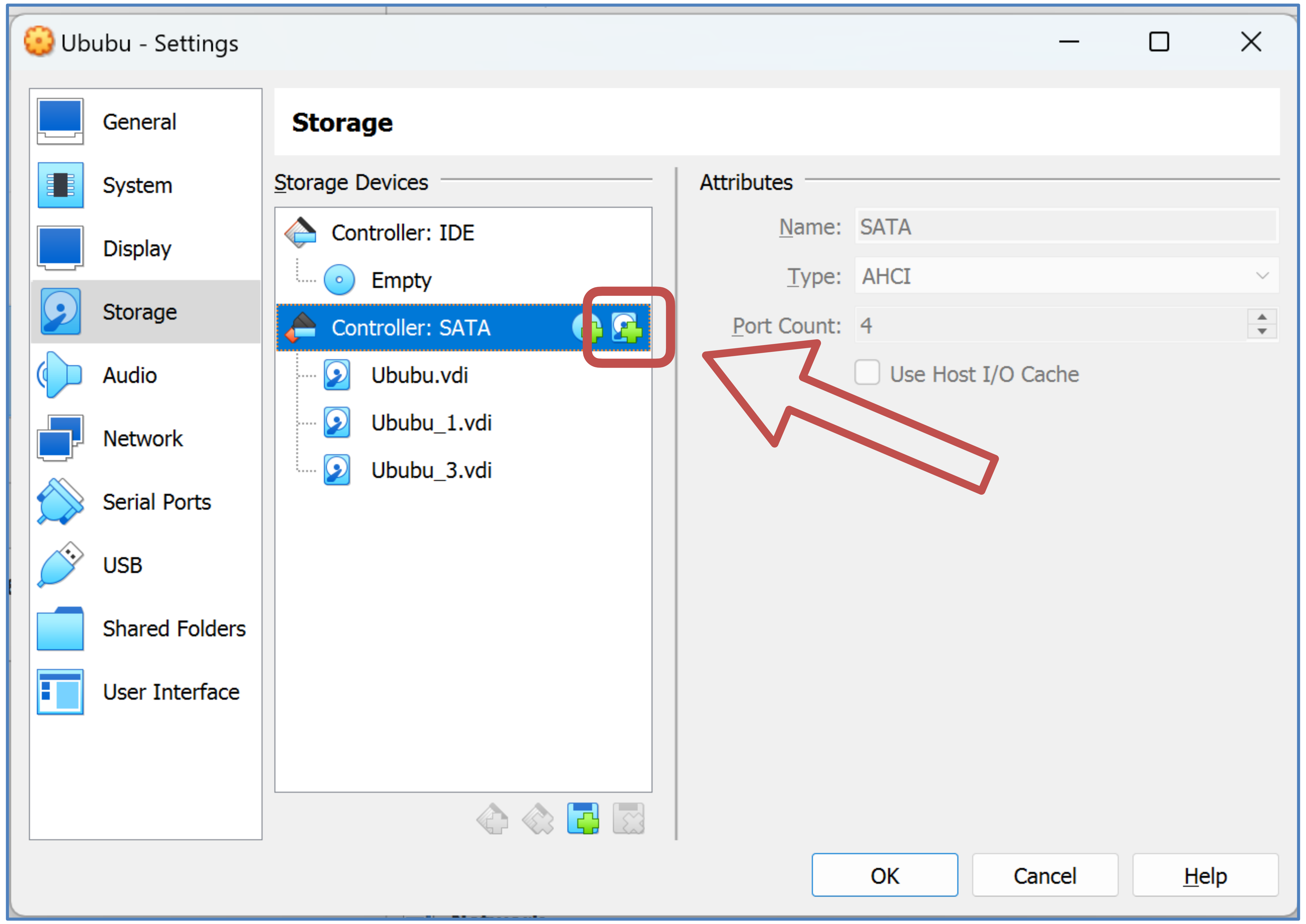
What happened?

- *mdadm* noticed the failure,
  - Grabbed the hot spare and started rebuilding.
  - The failed disk disappeared.

- Check "*/proc/mdstat*", "*mdadm*" and "*journalctl*".

Let's rebuild

- Re-attach the virtual disk you removed.



Ububu - Settings

Storage

Storage Devices

- Controller: IDE
  - Empty
- Controller: SATA
  - Ububu.vdi
  - Ububu_1.vdi
  - Ububu_3.vdi

Attributes

Name: SATA

Type: AHCI

Port Count: 4

□ Use Host I/O Cache

Let's rebuild

- And we will re-add the disk to the RAID set.

```
$ sudo mdadm --manage /dev/md/MyRAID1 \
 --add /dev/sdc

$ sudo cat /proc/mdstat
```

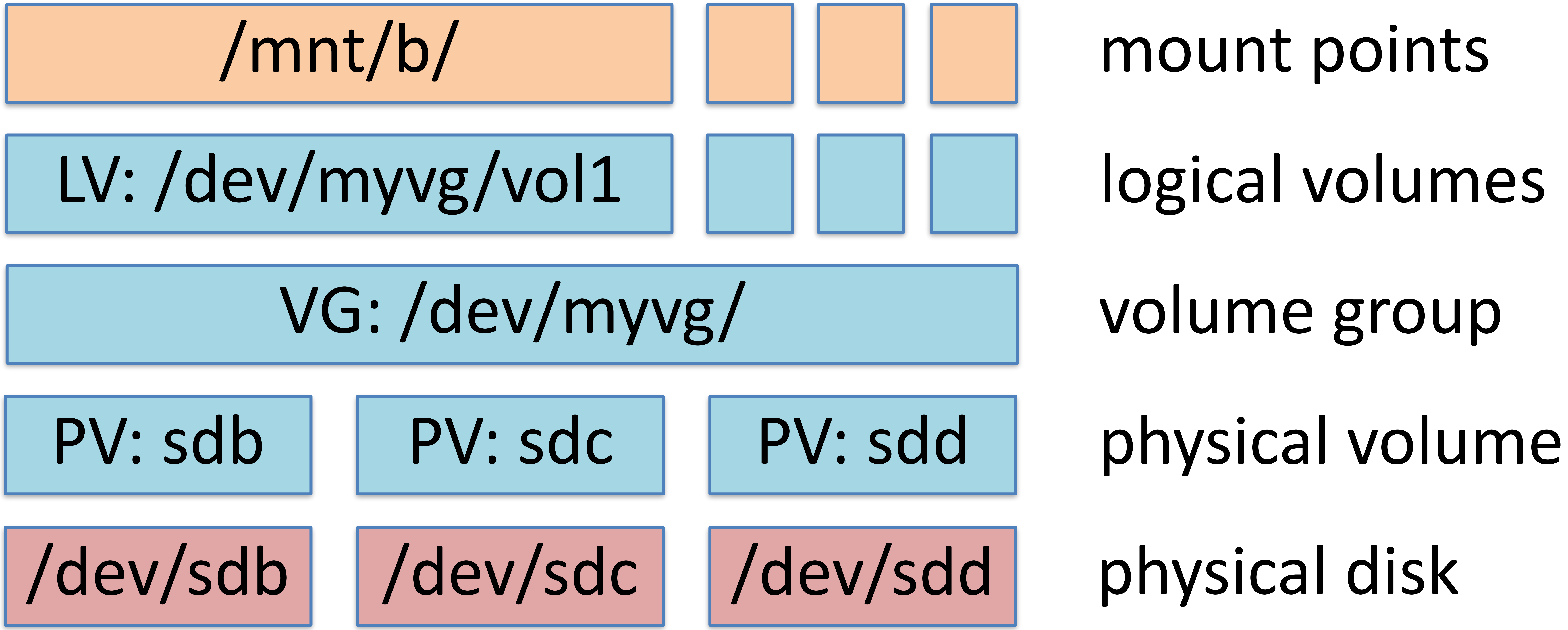
Done? Break it all.

```
$ sudo umount /mnt/data
$ sudo mdadm --stop /dev/md/MyRAID1
$ sudo rm /etc/mdadm.conf  # adjust path!

$ sudo mdadm --zero-superblock /dev/sdb
$ sudo mdadm --zero-superblock /dev/sdc
$ sudo mdadm --zero-superblock /dev/sdd
```

LVM

LVM concepts



/mnt/b/ — mount points

LV: /dev/myvg/vol1 — logical volumes

VG: /dev/myvg/ — volume group

PV: sdb | PV: sdc | PV: sdd — physical volume

/dev/sdb | /dev/sdc | /dev/sdd — physical disk

Prepping our disks (three times)

```
$ sudo fdisk /dev/sdb
g
n   # Three times enter, y to overwrite
t   # List types, search for LVM
30  # Type LVM, number may differ
```

Creating phys. volumes

- This adds the device to LVM control

```
$ sudo pvcreate /dev/sdb1
$ sudo pvcreate /dev/sdc1
$ sudo pvcreate /dev/sdd1
```

That may fail...

- "*pvcreate*" will notice if disks are re-used.
  - Wipe and try again!

```
$ sudo wipefs -a /dev/sdb
$ sudo wipefs -a /dev/sdc
$ sudo wipefs -a /dev/sdd
```

Making the volume group

- This collects the disks for usage.

```
$ sudo vgcreate myvg \
/dev/sdb1 /dev/sdc1 /dev/sdd1

$ sudo vgdisplay myvg
```

Our first volume!

- This collects the disks for usage.

```
$ sudo lvcreate -L 50M -n vol1 myvg

$ sudo vgdisplay
$ sudo lvdisplay
```

Then use it

- Format, mount and use.

```
$ sudo mkfs.ext4 /dev/myvg/vol1

$ sudo mount /dev/myvg/vol1 /mnt/data

$ sudo touch /mnt/data/testfile
```

Check things out

- The commands start with pv*, vg*, lv*.

pvdisplay	Show all physical volumes
vgdisplay	Show all volume groups
lvdisplay	Show all logical volumes

Resizing file systems

- For example, on a volume that was 50 MB.

```
$ sudo lvresize -L 70M /dev/myvg/vol1

$ sudo resize2fs /dev/myvg/vol1
```

Tear it all down!

- Breaking what we made is easy.

```
$ sudo umount /mnt/data
$ sudo lvremove /dev/myvg/vol1
$ sudo vgremove /dev/myvg
$ sudo pvremove /dev/sdb1 /dev/sdc1 \
 /dev/sdd1
```

LAB: NFS server

Time for research

- Can you make the following?
  - Setup your Ubuntu VM as NFS server.
  - Make /var/userdata on Ubuntu.
  - Make that directory an NFS file share.
  - Setup Fedora as NFS client, and mount the share.

Closing

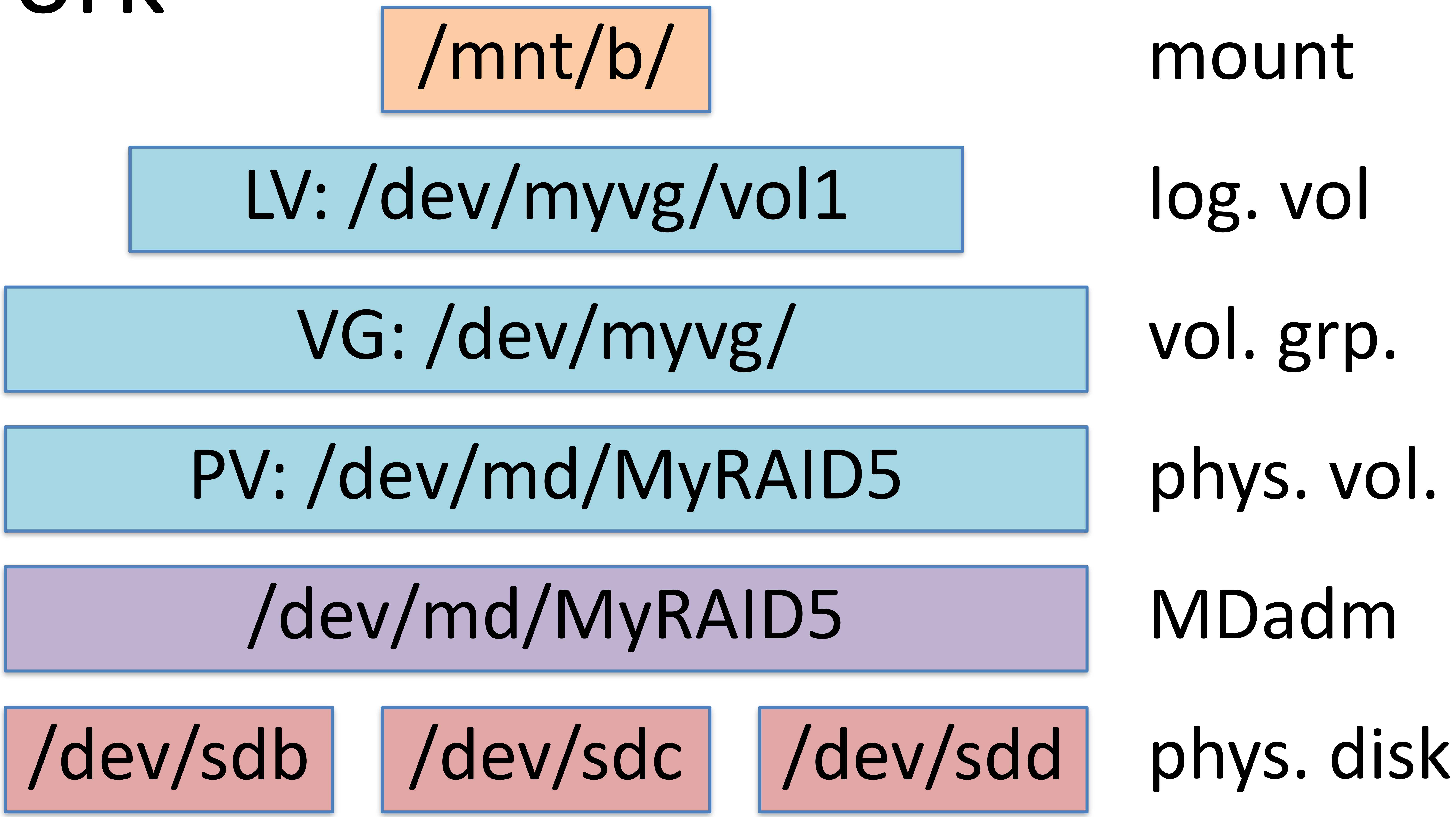
Homework

- Reading:
  - Chapter 12
  - Chapter 21
  - Chapter 23
  - Chapter 26

Homework

- Go do:
  - Retry your RAID1 setup, incl. the "failed" device.
  - Use your three disks to make one *mdadm* RAID5.
  - On the RAID5 set, make an LVM volume group
    - And a 100MB logical volume, on */mnt/data*.

Homework



/mnt/b/ — mount

LV: /dev/myvg/vol1 — log. vol

VG: /dev/myvg/ — vol. grp.

PV: /dev/md/MyRAID5 — phys. vol.

/dev/md/MyRAID5 — MDadm

/dev/sdb /dev/sdc /dev/sdd — phys. disk

Advanced homework

- Go do:
  - Take the 100MB logical volume you made.
    - And expand it to 150MB.
    - You need to grow both the logical volume,
    - as well as the file system.

Reference materials

Resources

- Example of using quota with Ubuntu
- Using autofs to mount NFS shares
- An introduction to udev device manager
- Auto-mounting a LUKS encrypted volume
- Device mapper and udev (Redhat)
- Understanding Linux dm-multipath

Resources

- How to create RAID arrays with mdadm
- mdadm cheat sheet
- A Linux user's guide to LVM
- Venafi - Diffie-Hellman vs RSA