NASA HW2 - 金哲安(B12902118)

1.

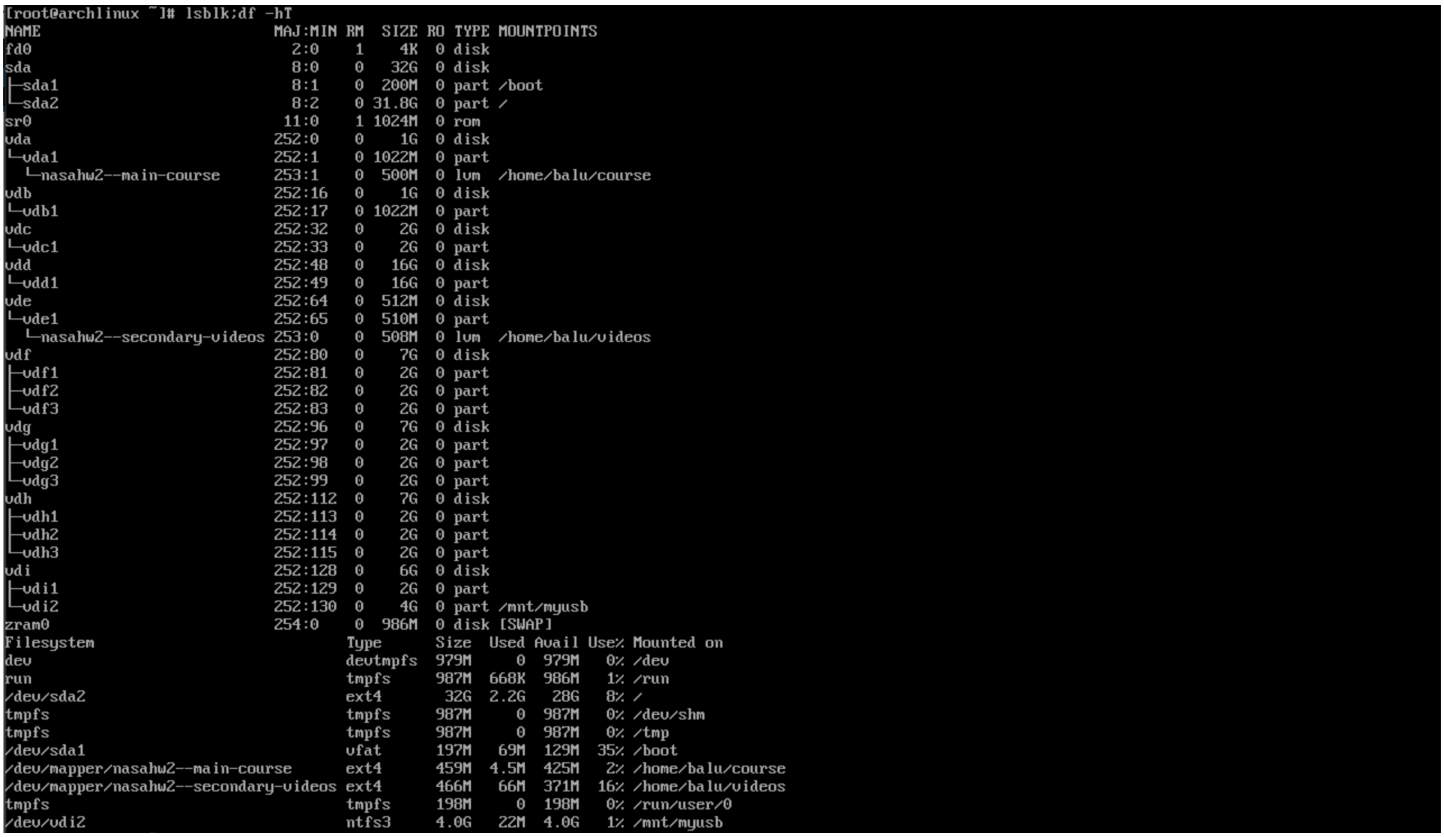
References

- https://www.lijyyh.com/2016/11/windows-linux-os-x.html?m=1
- https://bbs.archlinux.org/viewtopic.php?id=293546
- 宋和峻（B12902066）
- 林靖昀（B12902116）

Steps

1. Execute `sudo pacman -S ntfs-3g`
2. Execute `mkfs.ntfs -Q /dev/vdi2`
3. Execute `mkdir /mnt/myusb`
4. Execute `mount -t ntfs3 /dev/vdi2 /mnt/myusb`
5. Execute `lsblk -f` to see the UUID
6. `vim /etc/fstab` to add an entry to enable auto mount on startup

Screenshots



```
[root@archlinux ~]# lsblk;df -hT
NAME                          MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
fd0                             2:0    1    4K  0 disk
sda                             8:0    0   32G  0 disk
├─sda1                          8:1    0  200M  0 part /boot
└─sda2                          8:2    0 31.8G  0 part /
sr0                            11:0    1 1024M  0 rom
vda                           252:0    0    1G  0 disk
└─vda1                        252:1    0 1022M  0 part
  └─nasahw2--main-course      253:1    0  500M  0 lvm  /home/balu/course
vdb                           252:16   0    1G  0 disk
└─vdb1                        252:17   0 1022M  0 part
vdc                           252:32   0    2G  0 disk
└─vdc1                        252:33   0    2G  0 part
vdd                           252:48   0   16G  0 disk
└─vdd1                        252:49   0   16G  0 part
vde                           252:64   0  512M  0 disk
└─vde1                        252:65   0  510M  0 part
  └─nasahw2--secondary-videos 253:0    0  508M  0 lvm  /home/balu/videos
vdf                           252:80   0    7G  0 disk
├─vdf1                        252:81   0    2G  0 part
├─vdf2                        252:82   0    2G  0 part
└─vdf3                        252:83   0    2G  0 part
vdg                           252:96   0    7G  0 disk
├─vdg1                        252:97   0    2G  0 part
├─vdg2                        252:98   0    2G  0 part
└─vdg3                        252:99   0    2G  0 part
vdh                           252:112  0    7G  0 disk
├─vdh1                        252:113  0    2G  0 part
├─vdh2                        252:114  0    2G  0 part
└─vdh3                        252:115  0    2G  0 part
vdi                           252:128  0    6G  0 disk
├─vdi1                        252:129  0    2G  0 part
└─vdi2                        252:130  0    4G  0 part /mnt/myusb
zram0                         254:0    0  986M  0 disk [SWAP]
Filesystem                             Type      Size  Used Avail Use% Mounted on
dev                                    devtmpfs  979M     0  979M   0% /dev
run                                    tmpfs     987M  668K  986M   1% /run
/dev/sda2                              ext4       32G  2.2G   28G   8% /
tmpfs                                  tmpfs     987M     0  987M   0% /dev/shm
tmpfs                                  tmpfs     987M     0  987M   0% /tmp
/dev/sda1                              vfat      197M   69M  129M  35% /boot
/dev/mapper/nasahw2--main-course       ext4      459M  4.5M  425M   2% /home/balu/course
/dev/mapper/nasahw2--secondary-videos  ext4      466M   66M  371M  16% /home/balu/videos
tmpfs                                  tmpfs     198M     0  198M   0% /run/user/0
/dev/vdi2                              ntfs3     4.0G   22M  4.0G   1% /mnt/myusb
```

```
[root@archlinux ~]# cat /etc/fstab
# Static information about the filesystems.
# See fstab(5) for details.

# <file system> <dir> <type> <options> <dump> <pass>
# /dev/sda2
UUID=d1daff5a-54da-43b8-a88e-83fa4e94a0b1       /               ext4            rw,relatime     0 1

# /dev/sda1
UUID=711C-6167          /boot           vfat            rw,relatime,fmask=0022,dmask=0022,codepage=437,iocharset=ascii,shortname=mixed,utf8,errors=remount-ro  0
 2


/dev/nasahw2-main/course        /home/balu/course       ext4    defaults        0 2
/dev/nasahw2-secondary/videos   /home/balu/videos       ext4    defaults        0 2
UUID=5C300C2C73AB704C /mnt/myusb ntfs3 defaults 0 2
```

2.

References

- https://wiki.archlinux.org/title/Swap
- 宋和峻（B12902066）

Steps

1. Execute `sudo fallocate -l 4G /newswap`
2. Execute `sudo chmod 600 /swapfile`
3. Execute `sudo mkswap -U clear /newswap`
4. Execute `sudo swapon /newswap`

Screenshot

3.

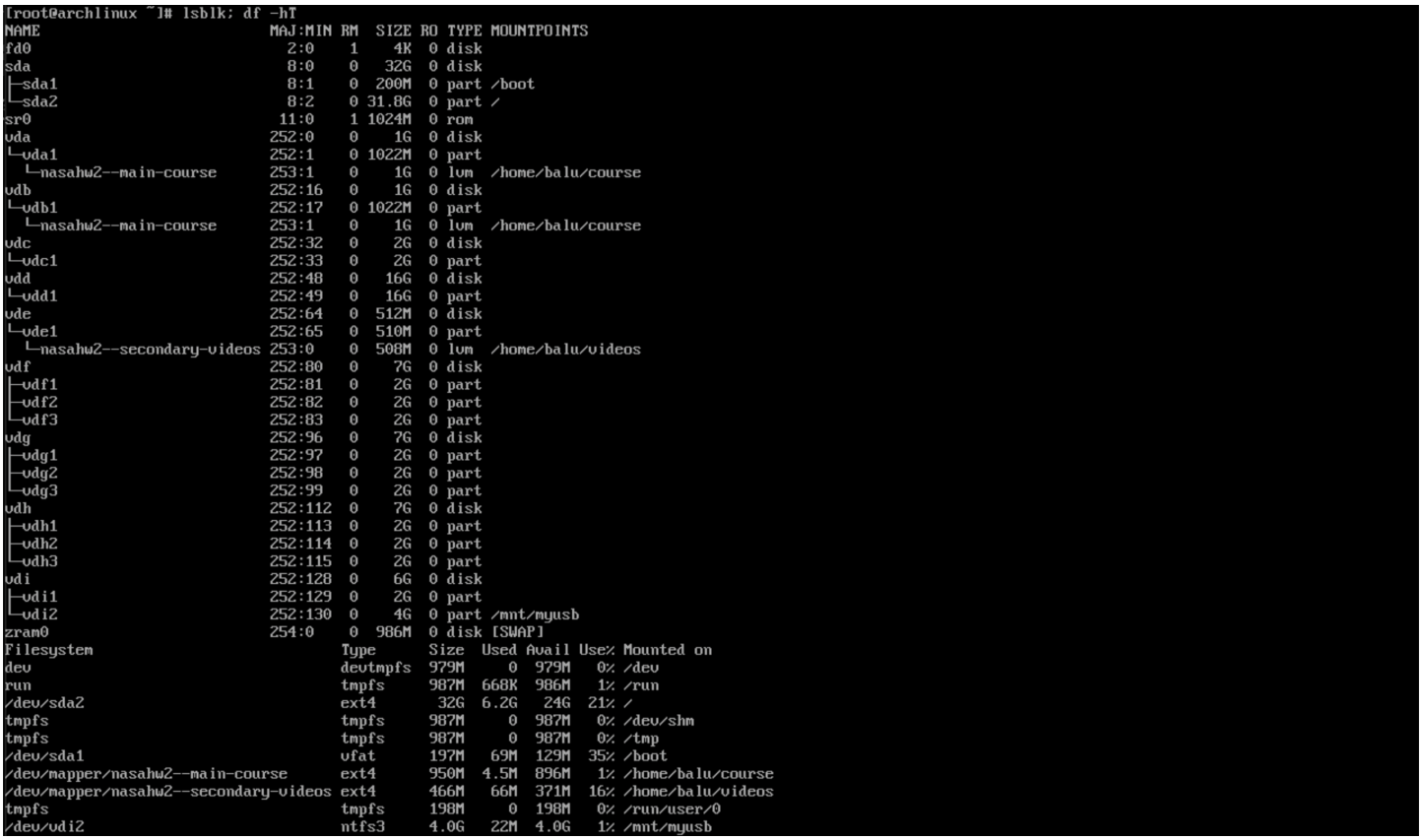
References

- https://hackmd.io/@Mqvhsb9VRYSU2scAkRqGIQ/S147zK8dJx#/6/7
- 宋和峻（B12902066）

Steps

1. Execute `vgdisplay` to see the volume group information
2. Execute `lvresize -L 1G --resizefs nasahw2-main/course` to resize

Screenshot



```
[root@archlinux ~]# lsblk; df -hT
NAME                              MAJ:MIN RM  SIZE RO TYPE MOUNTPOINTS
fd0                                 2:0    1    4K  0 disk
sda                                 8:0    0   32G  0 disk
├─sda1                              8:1    0  200M  0 part /boot
└─sda2                              8:2    0 31.8G  0 part /
sr0                                11:0    1 1024M  0 rom
vda                               252:0    0    1G  0 disk
└─vda1                            252:1    0 1022M  0 part
  └─nasahw2--main-course          253:1    0    1G  0 lvm  /home/balu/course
vdb                               252:16   0    1G  0 disk
└─vdb1                            252:17   0 1022M  0 part
  └─nasahw2--main-course          253:1    0    1G  0 lvm  /home/balu/course
vdc                               252:32   0    2G  0 disk
└─vdc1                            252:33   0    2G  0 part
vdd                               252:48   0   16G  0 disk
└─vdd1                            252:49   0   16G  0 part
vde                               252:64   0  512M  0 disk
└─vde1                            252:65   0  510M  0 part
  └─nasahw2--secondary-videos     253:0    0  508M  0 lvm  /home/balu/videos
vdf                               252:80   0    7G  0 disk
├─vdf1                            252:81   0    2G  0 part
├─vdf2                            252:82   0    2G  0 part
└─vdf3                            252:83   0    2G  0 part
vdg                               252:96   0    7G  0 disk
├─vdg1                            252:97   0    2G  0 part
├─vdg2                            252:98   0    2G  0 part
└─vdg3                            252:99   0    2G  0 part
vdh                               252:112  0    7G  0 disk
├─vdh1                            252:113  0    2G  0 part
├─vdh2                            252:114  0    2G  0 part
└─vdh3                            252:115  0    2G  0 part
vdi                               252:128  0    6G  0 disk
├─vdi1                            252:129  0    2G  0 part
└─vdi2                            252:130  0    4G  0 part /mnt/myusb
zram0                             254:0    0  986M  0 disk [SWAP]
Filesystem                              Type      Size  Used Avail Use% Mounted on
dev                                     devtmpfs  979M     0  979M   0% /dev
run                                     tmpfs     987M  668K  986M   1% /run
/dev/sda2                               ext4       32G  6.2G   24G  21% /
tmpfs                                   tmpfs     987M     0  987M   0% /dev/shm
tmpfs                                   tmpfs     987M     0  987M   0% /tmp
/dev/sda1                               vfat      197M   69M  129M  35% /boot
/dev/mapper/nasahw2--main-course        ext4      950M  4.5M  896M   1% /home/balu/course
/dev/mapper/nasahw2--secondary-videos   ext4      466M   66M  371M  16% /home/balu/videos
tmpfs                                   tmpfs     198M     0  198M   0% /run/user/0
/dev/vdi2                               ntfs3     4.0G   22M  4.0G   1% /mnt/myusb
```

4.

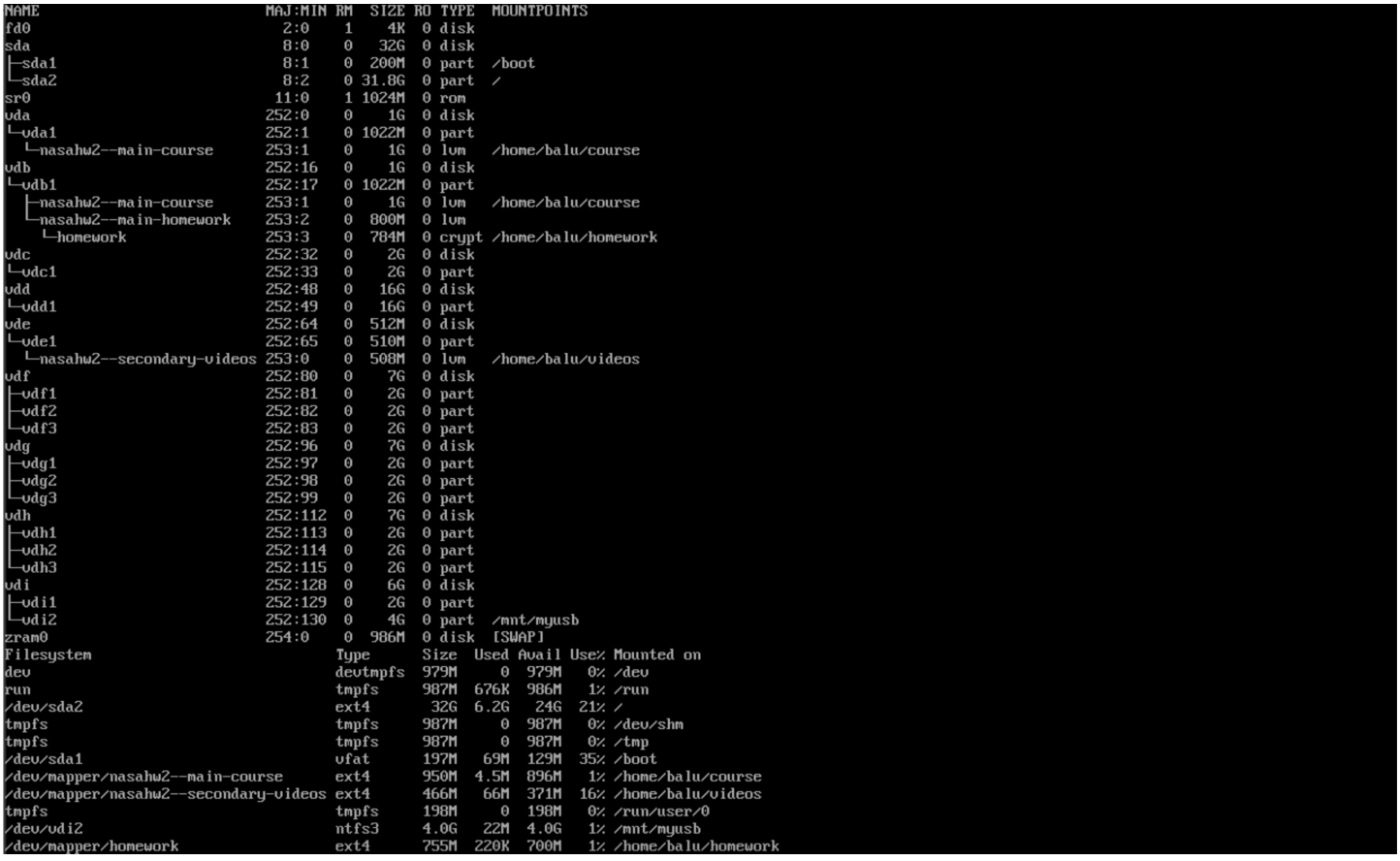
References

- https://osslab.tw/books/linux-administration/page/加密你的隨身碟---cryptsetup
- https://stackoverflow.com/questions/40026555/how-do-i-make-cryptsetup-automatically-use-a-key-file-during-mount-time
- 林靖昀（B12902116）

Steps

1. `lvcreate -L 800M -n homework nasahw2-main`
2. `sudo cryptsetup luksFormat /dev/nasahw2-main/homework`
3. Enter a passphrase
4. `cryptsetup luksOpen /dev/nasahw2-main/homework homework`
5. `mkfs.ext4 /dev/mapper/homework`
6. `cryptsetup luksAddKey /dev/nasahw2-main/homework /home/balu/lvm_key`
7. `echo "homework UUID=$(cryptsetup luksUUID /dev/nasahw2-main/homework) /home/balu/lvm_key" >>/etc/crypttab`
8. `lsblk -f` to get the UUID
9. Add an entry to `/etc/fstab`
10. `mount /dev/mapper/homework /home/balu/homework`

Screenshot



```
NAME                          MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINTS
fd0                             2:0    1    4K  0 disk
sda                             8:0    0   32G  0 disk
├─sda1                          8:1    0  200M  0 part  /boot
└─sda2                          8:2    0 31.8G  0 part  /
sr0                            11:0    1 1024M  0 rom
vda                           252:0    0    1G  0 disk
└─vda1                        252:1    0 1022M  0 part
  └─nasahw2--main-course      253:1    0    1G  0 lvm   /home/balu/course
vdb                           252:16   0    1G  0 disk
└─vdb1                        252:17   0 1022M  0 part
  ├─nasahw2--main-course      253:1    0    1G  0 lvm   /home/balu/course
  └─nasahw2--main-homework    253:2    0  800M  0 lvm
    └─homework                253:3    0  784M  0 crypt /home/balu/homework
vdc                           252:32   0    2G  0 disk
└─vdc1                        252:33   0    2G  0 part
vdd                           252:48   0   16G  0 disk
└─vdd1                        252:49   0   16G  0 part
vde                           252:64   0  512M  0 disk
└─vde1                        252:65   0  510M  0 part
  └─nasahw2--secondary-videos 253:0    0  508M  0 lvm   /home/balu/videos
vdf                           252:80   0    7G  0 disk
├─vdf1                        252:81   0    2G  0 part
├─vdf2                        252:82   0    2G  0 part
└─vdf3                        252:83   0    2G  0 part
vdg                           252:96   0    7G  0 disk
├─vdg1                        252:97   0    2G  0 part
├─vdg2                        252:98   0    2G  0 part
└─vdg3                        252:99   0    2G  0 part
vdh                           252:112  0    7G  0 disk
├─vdh1                        252:113  0    2G  0 part
├─vdh2                        252:114  0    2G  0 part
└─vdh3                        252:115  0    2G  0 part
vdi                           252:128  0    6G  0 disk
├─vdi1                        252:129  0    2G  0 part
└─vdi2                        252:130  0    4G  0 part  /mnt/myusb
zram0                         254:0    0  986M  0 disk  [SWAP]
Filesystem                    Type      Size  Used Avail Use% Mounted on
dev                           devtmpfs  979M     0  979M   0% /dev
run                           tmpfs     987M  676K  986M   1% /run
/dev/sda2                     ext4       32G  6.2G   24G  21% /
tmpfs                         tmpfs     987M     0  987M   0% /dev/shm
tmpfs                         tmpfs     987M     0  987M   0% /tmp
/dev/sda1                     vfat      197M   69M  129M  35% /boot
/dev/mapper/nasahw2--main-course      ext4      950M  4.5M  896M   1% /home/balu/course
/dev/mapper/nasahw2--secondary-videos ext4      466M   66M  371M  16% /home/balu/videos
tmpfs                         tmpfs     198M     0  198M   0% /run/user/0
/dev/vdi2                     ntfs3     4.0G   22M  4.0G   1% /mnt/myusb
/dev/mapper/homework          ext4      755M  220K  700M   1% /home/balu/homework
```

5.

References

- https://github.com/facebook/zstd/issues/1526
- 林靖昀（B12902116）

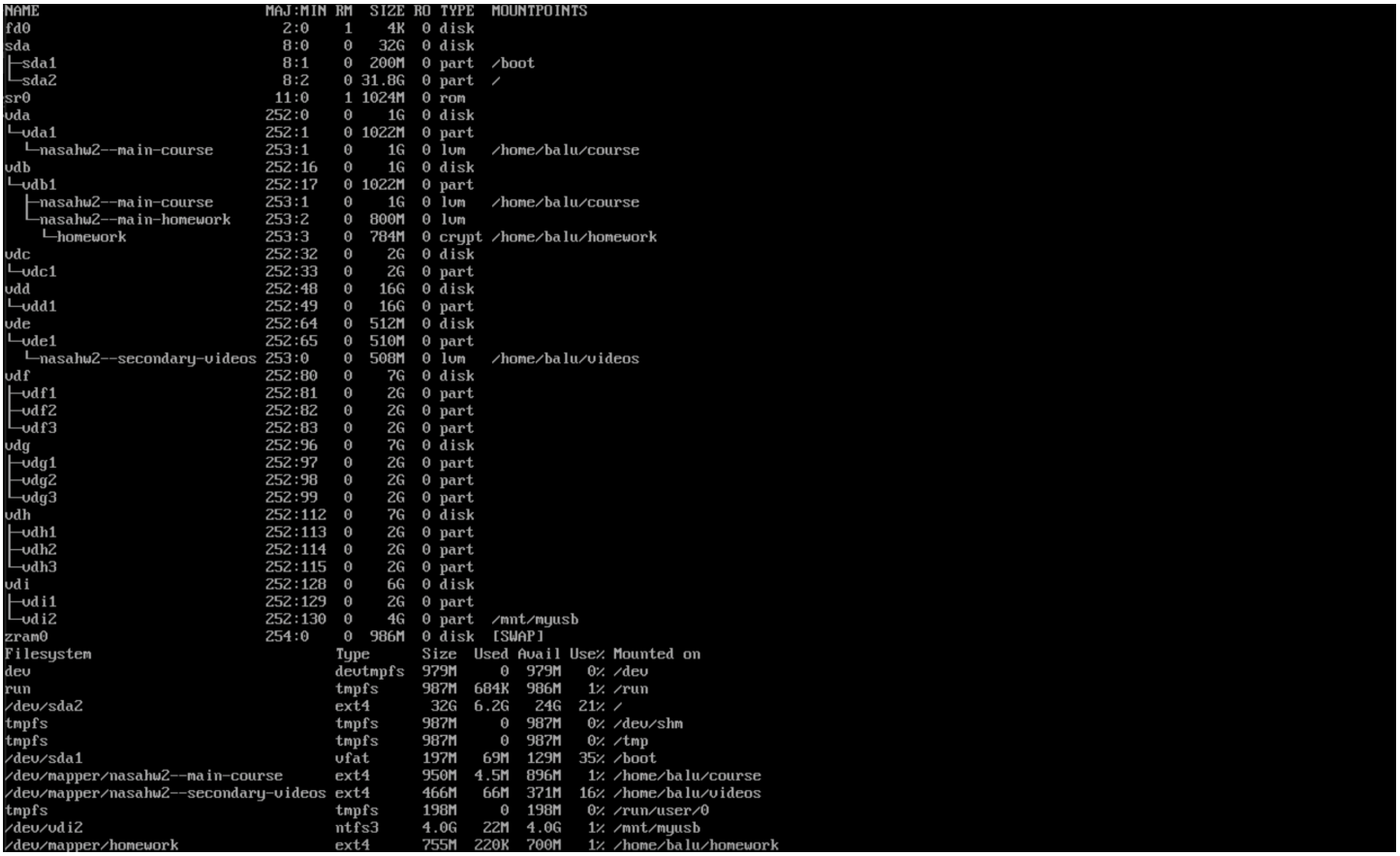
Steps

1. `vgextend nasahw2-main /dev/vdc1`
2. `lvcreate --size 1G --snapshot --name backup /dev/nasahw2-main/course`
3. `mkdir /mnt/backup`
4. `mount /dev/nasahw2-main/backup /mnt/backup`
5. `lsblk`

```
[root@archlinux homework]# lsblk
NAME                          MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINTS
fd0                             2:0    1    4K  0 disk
sda                             8:0    0   32G  0 disk
├─sda1                          8:1    0  200M  0 part  /boot
└─sda2                          8:2    0 31.8G  0 part  /
sr0                            11:0    1 1024M  0 rom
vda                           252:0    0    1G  0 disk
└─vda1                        252:1    0 1022M  0 part
  └─nasahw2--main-course-real 253:4    0    1G  0 lvm
    ├─nasahw2--main-course    253:1    0    1G  0 lvm   /home/balu/course
    └─nasahw2--main-backup    253:6    0    1G  0 lvm   /mnt/backup
vdb                           252:16   0    1G  0 disk
└─vdb1                        252:17   0 1022M  0 part
  ├─nasahw2--main-homework    253:2    0  800M  0 lvm
  │ └─homework                253:3    0  784M  0 crypt /home/balu/homework
  └─nasahw2--main-course-real 253:4    0    1G  0 lvm
    ├─nasahw2--main-course    253:1    0    1G  0 lvm   /home/balu/course
    └─nasahw2--main-backup    253:6    0    1G  0 lvm   /mnt/backup
vdc                           252:32   0    2G  0 disk
└─vdc1                        252:33   0    2G  0 part
  └─nasahw2--main-backup-cow  253:5    0    1G  0 lvm
    └─nasahw2--main-backup    253:6    0    1G  0 lvm   /mnt/backup
vdd                           252:48   0   16G  0 disk
└─vdd1                        252:49   0   16G  0 part
vde                           252:64   0  512M  0 disk
└─vde1                        252:65   0  510M  0 part
  └─nasahw2--secondary-videos 253:0    0  508M  0 lvm   /home/balu/videos
vdf                           252:80   0    7G  0 disk
├─vdf1                        252:81   0    2G  0 part
├─vdf2                        252:82   0    2G  0 part
└─vdf3                        252:83   0    2G  0 part
vdg                           252:96   0    7G  0 disk
├─vdg1                        252:97   0    2G  0 part
├─vdg2                        252:98   0    2G  0 part
└─vdg3                        252:99   0    2G  0 part
vdh                           252:112  0    7G  0 disk
├─vdh1                        252:113  0    2G  0 part
├─vdh2                        252:114  0    2G  0 part
└─vdh3                        252:115  0    2G  0 part
vdi                           252:128  0    6G  0 disk
├─vdi1                        252:129  0    2G  0 part
└─vdi2                        252:130  0    4G  0 part  /mnt/myusb
zram0                         254:0    0  986M  0 disk  [SWAP]
```

6. `cd /home/balu`
7. `tar --zstd -cf backup.tar.zst /mnt/backup`
8. `umount /mnt/backup`
9. `lvremove /dev/nasahw2-main/backup`
10. type `y` to confirm

Screenshot



```
NAME                          MAJ:MIN RM  SIZE RO TYPE  MOUNTPOINTS
fd0                             2:0    1    4K  0 disk
sda                             8:0    0   32G  0 disk
├─sda1                          8:1    0  200M  0 part  /boot
└─sda2                          8:2    0 31.8G  0 part  /
sr0                            11:0    1 1024M  0 rom
vda                           252:0    0    1G  0 disk
└─vda1                        252:1    0 1022M  0 part
  └─nasahw2--main-course      253:1    0    1G  0 lvm   /home/balu/course
vdb                           252:16   0    1G  0 disk
└─vdb1                        252:17   0 1022M  0 part
  ├─nasahw2--main-course      253:1    0    1G  0 lvm   /home/balu/course
  └─nasahw2--main-homework    253:2    0  800M  0 lvm
    └─homework                253:3    0  784M  0 crypt /home/balu/homework
vdc                           252:32   0    2G  0 disk
└─vdc1                        252:33   0    2G  0 part
vdd                           252:48   0   16G  0 disk
└─vdd1                        252:49   0   16G  0 part
vde                           252:64   0  512M  0 disk
└─vde1                        252:65   0  510M  0 part
  └─nasahw2--secondary-videos 253:0    0  508M  0 lvm   /home/balu/videos
vdf                           252:80   0    7G  0 disk
├─vdf1                        252:81   0    2G  0 part
├─vdf2                        252:82   0    2G  0 part
└─vdf3                        252:83   0    2G  0 part
vdg                           252:96   0    7G  0 disk
├─vdg1                        252:97   0    2G  0 part
├─vdg2                        252:98   0    2G  0 part
└─vdg3                        252:99   0    2G  0 part
vdh                           252:112  0    7G  0 disk
├─vdh1                        252:113  0    2G  0 part
├─vdh2                        252:114  0    2G  0 part
└─vdh3                        252:115  0    2G  0 part
vdi                           252:128  0    6G  0 disk
├─vdi1                        252:129  0    2G  0 part
└─vdi2                        252:130  0    4G  0 part  /mnt/myusb
zram0                         254:0    0  986M  0 disk  [SWAP]
Filesystem                     Type      Size  Used Avail Use% Mounted on
dev                            devtmpfs  979M     0  979M   0% /dev
run                            tmpfs     987M  684K  986M   1% /run
/dev/sda2                      ext4       32G  6.2G   24G  21% /
tmpfs                          tmpfs     987M     0  987M   0% /dev/shm
tmpfs                          tmpfs     987M     0  987M   0% /tmp
/dev/sda1                      vfat      197M   69M  129M  35% /boot
/dev/mapper/nasahw2--main-course      ext4      950M  4.5M  896M   1% /home/balu/course
/dev/mapper/nasahw2--secondary-videos ext4      466M   66M  371M  16% /home/balu/videos
tmpfs                          tmpfs     198M     0  198M   0% /run/user/0
/dev/vdi2                      ntfs3     4.0G   22M  4.0G   1% /mnt/myusb
/dev/mapper/homework           ext4      755M  220K  700M   1% /home/balu/homework
```

6.

References

- https://wiki.archlinux.org/title/LVM

Steps

1. `pvcreate /dev/vdd1`
2. `vgextend nasahw2-secondary /dev/vdd1`
3. `pvmove /dev/vde1 /dev/vdd1`
4. `vgreduce nasahw2-secondary /dev/vde1`
5. `pvremove /dev/vde1`

Screenshot

7.

References

Steps

`umount /dev/nasahw2-secondary/videos`

`vgchange -a n nasahw2-secondary`

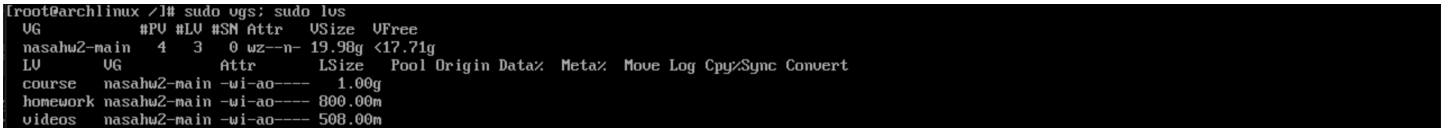
`vgsplit nasahw2-secondary nasahw2-main /dev/vdd1`

`vgchange -a y nasahw2-main`

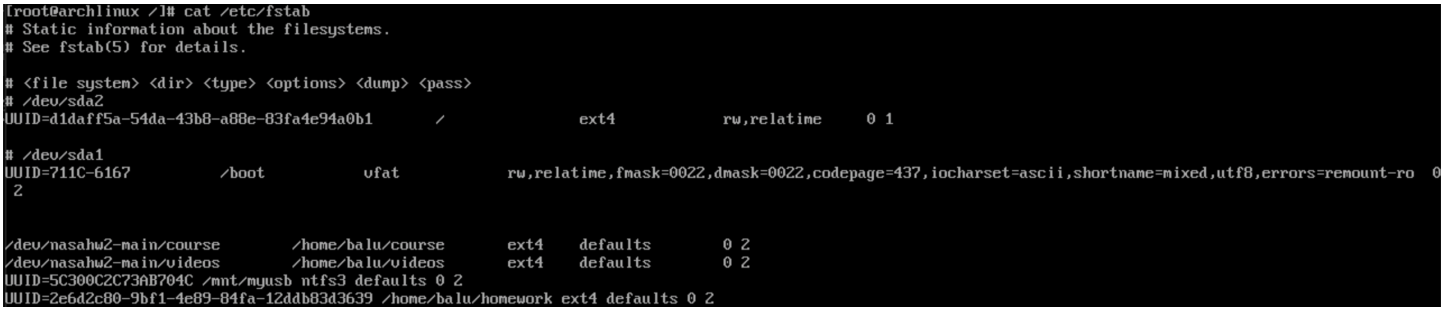
`vim /etc/fstab` to change `/dev/nasahw2-secondary` to `/dev/nasahw2-main`

`mount -a`

Screenshots



```
[root@archlinux /]# sudo vgs; sudo lvs
  VG          #PV #LV #SN Attr   VSize  VFree
  nasahw2-main   4   3   0 wz--n- 19.98g <17.71g
  LV       VG          Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  course   nasahw2-main -wi-ao----   1.00g
  homework nasahw2-main -wi-ao---- 800.00m
  videos   nasahw2-main -wi-ao---- 508.00m
```



```
[root@archlinux /]# cat /etc/fstab
# Static information about the filesystems.
# See fstab(5) for details.

# <file system> <dir> <type> <options> <dump> <pass>
# /dev/sda2
UUID=d1daff5a-54da-43b8-a88e-83fa4e94a0b1       /               ext4            rw,relatime     0 1

# /dev/sda1
UUID=711C-6167          /boot           vfat            rw,relatime,fmask=0022,dmask=0022,codepage=437,iocharset=ascii,shortname=mixed,utf8,errors=remount-ro  0
 2


/dev/nasahw2-main/course        /home/balu/course       ext4    defaults        0 2
/dev/nasahw2-main/videos        /home/balu/videos       ext4    defaults        0 2
UUID=5C300C2C73AB704C /mnt/myusb ntfs3 defaults 0 2
UUID=2e6d2c80-9bf1-4e89-84fa-12ddb83d3639 /home/balu/homework ext4 defaults 0 2
```

8.

References

- https://www.youtube.com/watch?v=rBGhTluGNyA
- https://www.osslab.com.tw/btrfs-vs-zfs-snapshot/
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1

Btrfs and ZFS are all Copy-on-Write filesystems that support snapshots, file compression, and RAID. Btrfs is natively supported on Linux and uses the GPL license, while ZFS is supported on FreeBSD and Sun Solaris and uses the CDDL license.

2

FUSE (Filesystem in Userspace) is a software interface for Unix and Unix-like computer operating systems that lets non-privileged users create their own file systems without editing kernel code. This is achieved by running file system code in user space while the FUSE module provides only a bridge to the actual kernel interfaces.
Pro: FUSE allows non-privileged users to create and mount their own filesystems without modifying kernel code, enhancing system stability and security.
Con: FUSE filesystems can experience performance limitations due to the context switching between user space and kernel space, leading to higher CPU usage, especially on embedded or older systems.

3

GPT is GUID Partition Table, and MBR is Master Boot Record.
GPT supports more than 4 primary partitions while MBR supports up to 4.
GPT uses 64-bit addressing while MBR uses 32-bit.

4

1 MB = 1,000,000 = 10^6 Bytes
1 MiB = 1,048,576 = 2^{20} Bytes
The default unit is KiB or MiB (base 2)

5

RAID 0 consists of block-level striping, but no mirroring or parity. It stores contents of each file across all drives.
RAID 1 consists of data mirroring, without parity or striping. Data is written identically to two or more drives, thereby producing a "mirrored set" of drives.
RAID 5 consists of block-level striping with distributed parity. It stores contents of each file and their parity blocks across all drives.
RAID 10 is RAID 1+0. It uses striping in RAID 0 and uses data mirroring in RAID 1. RAID 10 is a stripe of mirrors.