Network Administration/System Administration (NTU CSIE, Spring 2024) Homework #3

B12902110 呂承諺

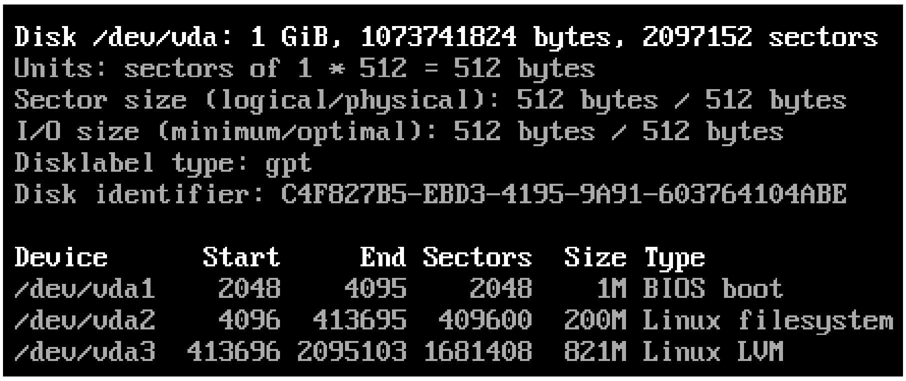
1 Initial partition

Steps

1. Run `fdisk /dev/vda`.
2. Run the following commands inside `fdisk`:

```
Command (m for help): g
Created a new GPT disklabel (GUID: C55CEE8B-500E-4F53-BD71-CD40DA22FBE1).

Command (m for help): n
Partition number (1-128, default 1):
First sector (2048-2097118, default 2048):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (2048-2097118, default 2095103): +1M

Created a new partition 1 of type 'Linux filesystem' and of size 1 MiB.

Command (m for help): t
Selected partition 1
Partition type or alias (type L to list all): 4
Changed type of partition 'Linux filesystem' to 'BIOS boot'.

Command (m for help): n
Partition number (2-128, default 2):
First sector (4096-2097118, default 4096):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (4096-2097118, default 2095103): +100M

Created a new partition 2 of type 'Linux filesystem' and of size 100 MiB.

Command (m for help): n
Partition number (3-128, default 3):
First sector (208896-2097118, default 208896):
Last sector, +/-sectors or +/-size{K,M,G,T,P} (208896-2097118, default 2095103):

Created a new partition 3 of type 'Linux filesystem' and of size 921 MiB.

Command (m for help): t
Partition number (1-3, default 3): 3
Partition type or alias (type L to list all): 44

Changed type of partition 'Linux filesystem' to 'Linux LVM'.

Command (m for help): w
```

Result Below is the output of `fdisk -l /dev/vda`:



```
Disk /dev/vda: 1 GiB, 1073741824 bytes, 2097152 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: C4F827B5-EBD3-4195-9A91-603764104ABE

Device       Start     End Sectors  Size Type
/dev/vda1     2048    4095    2048    1M BIOS boot
/dev/vda2     4096  413695  409600  200M Linux filesystem
/dev/vda3   413696 2095103 1681408  821M Linux LVM
```

References

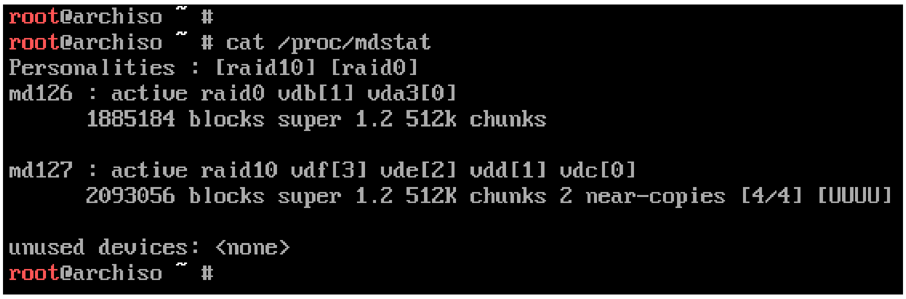
- `fdisk` partition types

2 RAID Setup

Steps Run the following commands:

```
mdadm --create /dev/md127 --level 10 --name data --raid-devices 4 \
  /dev/vdc /dev/vdd /dev/vde /dev/vdf
mdadm --create /dev/md126 --level 0 --name linux --raid-devices 2 \
  /dev/vda3 /dev/vdb
```

Result Below is the output of `cat /proc/mdstat`:



```
root@archiso ~ #
root@archiso ~ # cat /proc/mdstat
Personalities : [raid10] [raid0]
md126 : active raid0 vdb[1] vda3[0]
      1885184 blocks super 1.2 512k chunks

md127 : active raid10 vdf[3] vde[2] vdd[1] vdc[0]
      2093056 blocks super 1.2 512K chunks 2 near-copies [4/4] [UUUU]

unused devices: <none>
root@archiso ~ #
```

References

- `mdadm --create --help`

3 Disk encryption

Steps

1. Encrypt `/dev/vda2` and map it to `/dev/mapper/cryptboot`:

   ```
   cryptsetup luksFormat --type luks1 /dev/vda2
   cryptsetup open /dev/vda2 cryptboot
   ```

2. Generate a random 256-bit key, and add it as a key of `/dev/mapper/cryptboot`:

```
dd if=/dev/random of=b12902110.key bs=256 count=1
cryptsetup luksAddKey /dev/vda2 b12902110.key
```

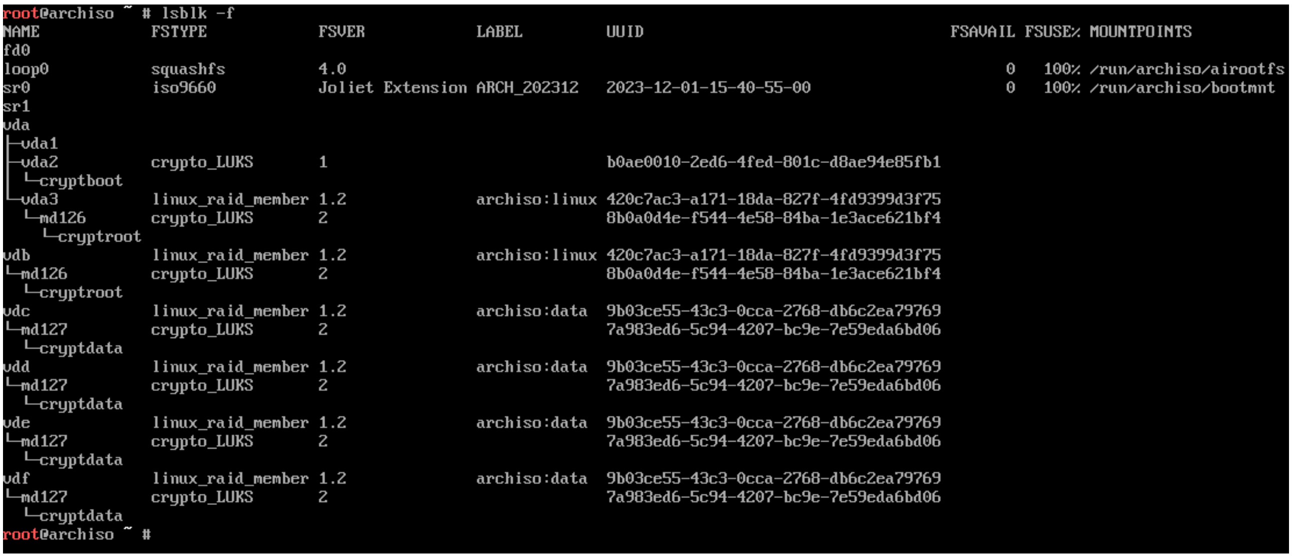
3. Encrypt `/dev/md/linux` and map it to `/dev/mapper/cryptroot`:

```
cryptsetup luksFormat --type luks2 /dev/md/linux b12902110.key
cryptsetup open /dev/md/linux cryptroot
```

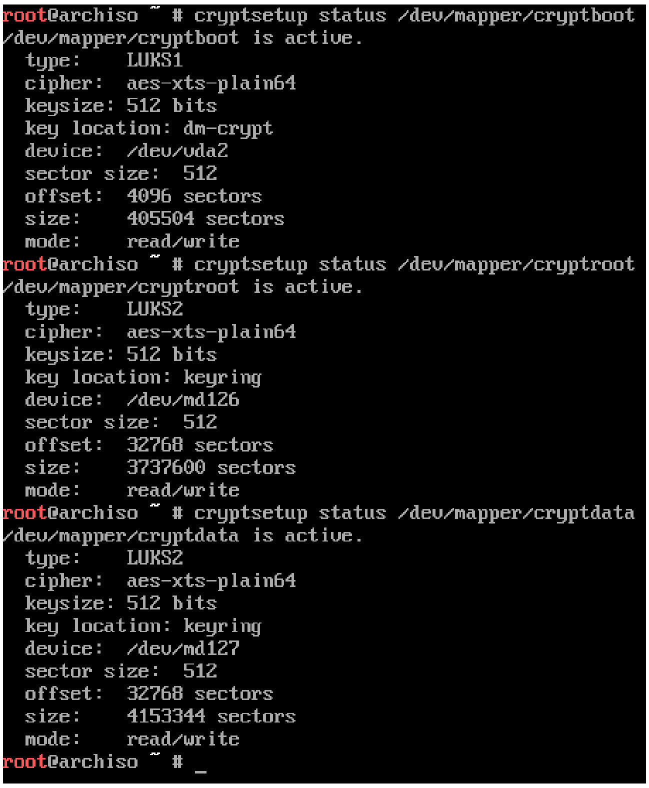
4. Encrypt `/dev/md/data` and map it to `/dev/mapper/cryptdata`:

```
cryptsetup lukfFormat --type luks2 /dev/md/data b12902110.key
cryptsetup open /dev/md/data cryptdata
```

Result Below is the output of `lsblk -f` and `cryptsetup status`:



```
root@archiso ~ # lsblk -f
NAME            FSTYPE            FSVER            LABEL         UUID                                 FSAVAIL FSUSE% MOUNTPOINTS
fd0
loop0           squashfs          4.0                                                                       0   100% /run/archiso/airootfs
sr0             iso9660           Joliet Extension ARCH_202312   2023-12-01-15-40-55-00                     0   100% /run/archiso/bootmnt
sr1
vda
├─vda1
├─vda2          crypto_LUKS       1                              b0ae0010-2ed6-4fed-801c-d8ae94e85fb1
│ └─cryptboot
└─vda3          linux_raid_member 1.2              archiso:linux 420c7ac3-a171-18da-827f-4fd9399d3f75
  └─md126       crypto_LUKS       2                              8b0a0d4e-f544-4e58-84ba-1e3ace621bf4
    └─cryptroot
vdb             linux_raid_member 1.2              archiso:linux 420c7ac3-a171-18da-827f-4fd9399d3f75
└─md126         crypto_LUKS       2                              8b0a0d4e-f544-4e58-84ba-1e3ace621bf4
  └─cryptroot
vdc             linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127         crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata
vdd             linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127         crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata
vde             linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127         crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata
vdf             linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127         crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata
root@archiso ~ #
```



```
root@archiso ~ # cryptsetup status /dev/mapper/cryptboot
/dev/mapper/cryptboot is active.
  type:    LUKS1
  cipher:  aes-xts-plain64
  keysize: 512 bits
  key location: dm-crypt
  device:  /dev/vda2
  sector size:  512
  offset:  4096 sectors
  size:    405504 sectors
  mode:    read/write
root@archiso ~ # cryptsetup status /dev/mapper/cryptroot
/dev/mapper/cryptroot is active.
  type:    LUKS2
  cipher:  aes-xts-plain64
  keysize: 512 bits
  key location: keyring
  device:  /dev/md126
  sector size:  512
  offset:  32768 sectors
  size:    3737600 sectors
  mode:    read/write
root@archiso ~ # cryptsetup status /dev/mapper/cryptdata
/dev/mapper/cryptdata is active.
  type:    LUKS2
  cipher:  aes-xts-plain64
  keysize: 512 bits
  key location: keyring
  device:  /dev/md127
  sector size:  512
  offset:  32768 sectors
  size:    4153344 sectors
  mode:    read/write
root@archiso ~ # _
```

References

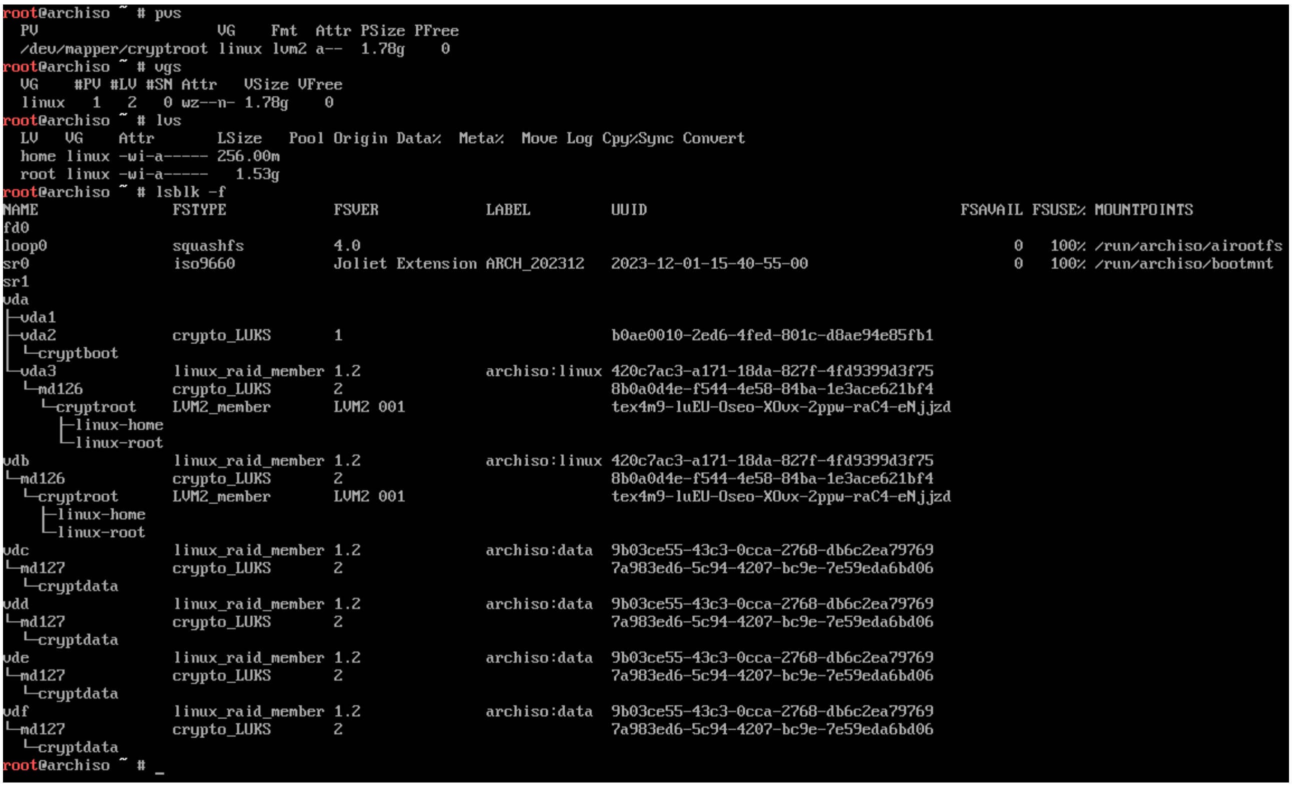
- dm-crypt/Device encryption - ArchWiki
- Linux Unified Key Setup - Wikipedia
- `man dd`
- mdadm raid doesn’t mount - Unix & Linux Stack Exchange
- How to determine what encryption is being used a LUKS partition? - Unix & Linux Stack Exchange
- `man lsblk`

4 LVM Setup

Steps Run the following commands:

```
pvcreate /dev/mapper/cryptroot
vgcreate linux /dev/mapper/cryptroot
lvcreate --size 256M --name home linux
lvcreate --extents 100%FREE --name root linux cryptdata
```

Result Below is the output of `pvs`, `vgs`, `lvs`, and `fdisk -l`:



```
root@archiso ~ # pvs
  PV                    VG    Fmt  Attr PSize PFree
  /dev/mapper/cryptroot linux lvm2 a--  1.78g    0
root@archiso ~ # vgs
  VG    #PV #LV #SN Attr   VSize VFree
  linux   1   2   0 wz--n- 1.78g    0
root@archiso ~ # lvs
  LV   VG    Attr       LSize   Pool Origin Data%  Meta%  Move Log Cpy%Sync Convert
  home linux -wi-a----- 256.00m
  root linux -wi-a-----   1.53g
root@archiso ~ # lsblk -f
NAME               FSTYPE            FSVER            LABEL         UUID                                   FSAVAIL FSUSE% MOUNTPOINTS
fd0
loop0              squashfs          4.0                                                                         0   100% /run/archiso/airootfs
sr0                iso9660           Joliet Extension ARCH_202312   2023-12-01-15-40-55-00                       0   100% /run/archiso/bootmnt
sr1
vda
├─vda1
├─vda2             crypto_LUKS       1                              b0ae0010-2ed6-4fed-801c-d8ae94e85fb1
│ └─cryptboot
└─vda3             linux_raid_member 1.2              archiso:linux 420c7ac3-a171-18da-827f-4fd9399d3f75
  └─md126          crypto_LUKS       2                              8b0a0d4e-f544-4e58-84ba-1e3ace621bf4
    └─cryptroot    LVM2_member       LVM2 001                       tex4m9-luEU-Oseo-XOvx-2ppw-raC4-eNjjzd
      ├─linux-home
      └─linux-root
vdb                linux_raid_member 1.2              archiso:linux 420c7ac3-a171-18da-827f-4fd9399d3f75
└─md126            crypto_LUKS       2                              8b0a0d4e-f544-4e58-84ba-1e3ace621bf4
  └─cryptroot      LVM2_member       LVM2 001                       tex4m9-luEU-Oseo-XOvx-2ppw-raC4-eNjjzd
    ├─linux-home
    └─linux-root
vdc                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata
vdd                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata
vde                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata
vdf                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata
root@archiso ~ # _
```

References

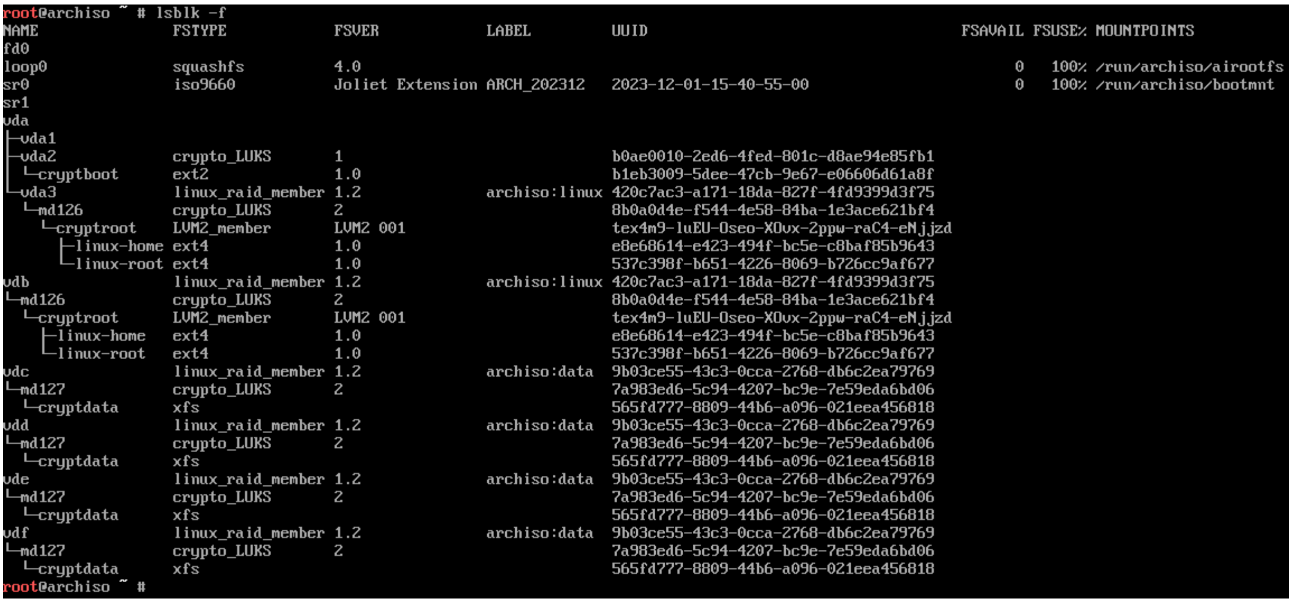
- `man pvcreate`, `man vgcreate` and `man lvcreate`
- Section “LVM usage” of “Partition lab 2024 - HackMD”

5 Formatting

Steps Run the following commands:

```
mkfs.ext4 /dev/linux/home
mkfs.ext4 /dev/linux/root
mkfs.xfs /dev/mapper/cryptdata
mkfs.ext2 /dev/mapper/cryptbooot
```

Result Below is the output of `fdisk -l` after formatting:



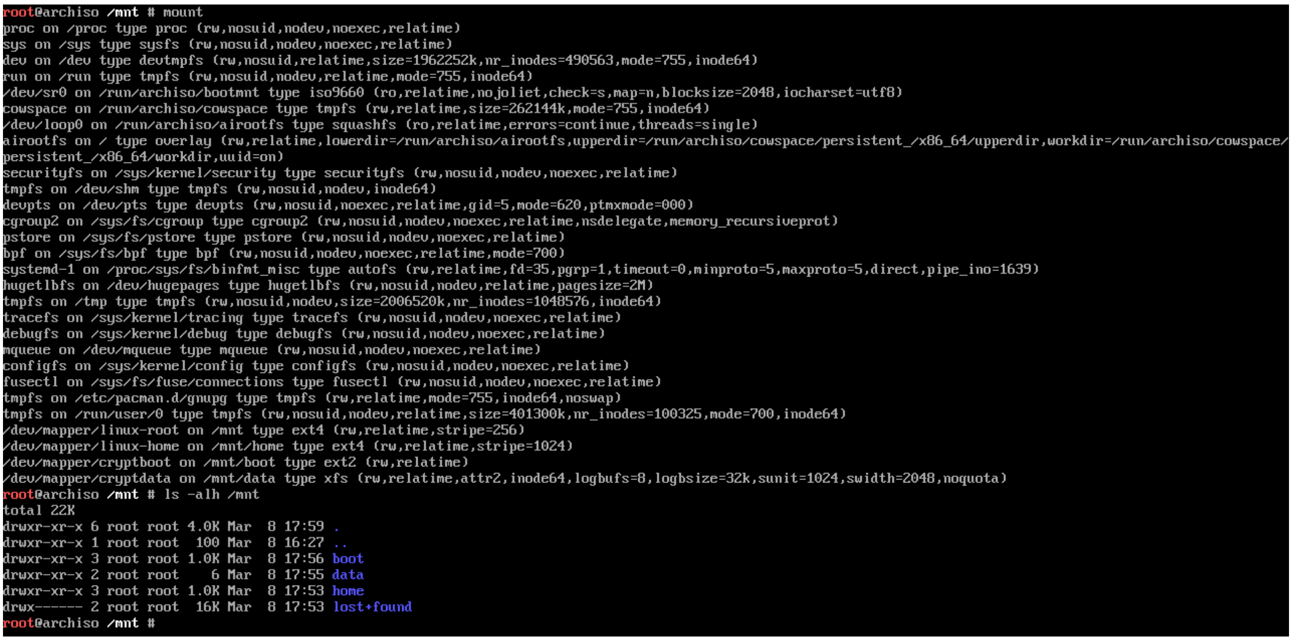
```
root@archiso ~ # lsblk -f
NAME               FSTYPE            FSVER            LABEL         UUID                                   FSAVAIL FSUSE% MOUNTPOINTS
fd0
loop0              squashfs          4.0                                                                         0   100% /run/archiso/airootfs
sr0                iso9660           Joliet Extension ARCH_202312   2023-12-01-15-40-55-00                       0   100% /run/archiso/bootmnt
sr1
vda
├─vda1
├─vda2             crypto_LUKS       1                              b0ae0010-2ed6-4fed-801c-d8ae94e85fb1
│ └─cryptboot      ext2              1.0                            b1eb3009-5dee-47cb-9e67-e06606d61a8f
└─vda3             linux_raid_member 1.2              archiso:linux 420c7ac3-a171-18da-827f-4fd9399d3f75
  └─md126          crypto_LUKS       2                              8b0a0d4e-f544-4e58-84ba-1e3ace621bf4
    └─cryptroot    LVM2_member       LVM2 001                       tex4m9-luEU-Oseo-XOvx-2ppw-raC4-eNjjzd
      ├─linux-home ext4              1.0                            e8e68614-e423-494f-bc5e-c8baf85b9643
      └─linux-root ext4              1.0                            537c398f-b651-4226-8069-b726cc9af677
vdb                linux_raid_member 1.2              archiso:linux 420c7ac3-a171-18da-827f-4fd9399d3f75
└─md126            crypto_LUKS       2                              8b0a0d4e-f544-4e58-84ba-1e3ace621bf4
  └─cryptroot      LVM2_member       LVM2 001                       tex4m9-luEU-Oseo-XOvx-2ppw-raC4-eNjjzd
    ├─linux-home   ext4              1.0                            e8e68614-e423-494f-bc5e-c8baf85b9643
    └─linux-root   ext4              1.0                            537c398f-b651-4226-8069-b726cc9af677
vdc                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata      xfs                                              565fd777-8809-44b6-a096-021eea456818
vdd                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata      xfs                                              565fd777-8809-44b6-a096-021eea456818
vde                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata      xfs                                              565fd777-8809-44b6-a096-021eea456818
vdf                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata      xfs                                              565fd777-8809-44b6-a096-021eea456818
root@archiso ~ #
```

6 Mounting

Steps Run the following commands:

```
mount /dev/linux/root /mnt
mount /dev/linux/home /mnt/home --mkdir
mount /dev/mapper/cryptboot /mnt/boot --mkdir
mount /dev/mapper/cryptdata /mnt/data --mkdir
```

Result Below is the output of `mount` and `ls -alh /mnt`:



```
root@archiso /mnt # mount
proc on /proc type proc (rw,nosuid,nodev,noexec,relatime)
sys on /sys type sysfs (rw,nosuid,nodev,noexec,relatime)
dev on /dev type devtmpfs (rw,nosuid,relatime,size=1962252k,nr_inodes=490563,mode=755,inode64)
run on /run type tmpfs (rw,nosuid,nodev,relatime,mode=755,inode64)
/dev/sr0 on /run/archiso/bootmnt type iso9660 (ro,relatime,nojoliet,check=s,map=n,blocksize=2048,iocharset=utf8)
cowspace on /run/archiso/cowspace type tmpfs (rw,relatime,size=262144k,mode=755,inode64)
/dev/loop0 on /run/archiso/airootfs type squashfs (ro,relatime,errors=continue,threads=single)
airootfs on / type overlay (rw,relatime,lowerdir=/run/archiso/airootfs,upperdir=/run/archiso/cowspace/persistent_/x86_64/upperdir,workdir=/run/archiso/cowspace/
persistent_/x86_64/workdir,uuid=on)
securityfs on /sys/kernel/security type securityfs (rw,nosuid,nodev,noexec,relatime)
tmpfs on /dev/shm type tmpfs (rw,nosuid,nodev,inode64)
devpts on /dev/pts type devpts (rw,nosuid,noexec,relatime,gid=5,mode=620,ptmxmode=000)
cgroup2 on /sys/fs/cgroup type cgroup2 (rw,nosuid,nodev,noexec,relatime,nsdelegate,memory_recursiveprot)
pstore on /sys/fs/pstore type pstore (rw,nosuid,nodev,noexec,relatime)
bpf on /sys/fs/bpf type bpf (rw,nosuid,nodev,noexec,relatime,mode=700)
systemd-1 on /proc/sys/fs/binfmt_misc type autofs (rw,relatime,fd=35,pgrp=1,timeout=0,minproto=5,maxproto=5,direct,pipe_ino=1639)
hugetlbfs on /dev/hugepages type hugetlbfs (rw,nosuid,nodev,relatime,pagesize=2M)
tmpfs on /tmp type tmpfs (rw,nosuid,nodev,size=2006520k,nr_inodes=1048576,inode64)
tracefs on /sys/kernel/tracing type tracefs (rw,nosuid,nodev,noexec,relatime)
debugfs on /sys/kernel/debug type debugfs (rw,nosuid,nodev,noexec,relatime)
mqueue on /dev/mqueue type mqueue (rw,nosuid,nodev,noexec,relatime)
configfs on /sys/kernel/config type configfs (rw,nosuid,nodev,noexec,relatime)
fusectl on /sys/fs/fuse/connections type fusectl (rw,nosuid,nodev,noexec,relatime)
tmpfs on /etc/pacman.d/gnupg type tmpfs (rw,relatime,mode=755,inode64,noswap)
tmpfs on /run/user/0 type tmpfs (rw,nosuid,nodev,relatime,size=401300k,nr_inodes=100325,mode=700,inode64)
/dev/mapper/linux-root on /mnt type ext4 (rw,relatime,stripe=256)
/dev/mapper/linux-home on /mnt/home type ext4 (rw,relatime,stripe=1024)
/dev/mapper/cryptboot on /mnt/boot type ext2 (rw,relatime)
/dev/mapper/cryptdata on /mnt/data type xfs (rw,relatime,attr2,inode64,logbufs=8,logbsize=32k,sunit=1024,swidth=2048,noquota)
root@archiso /mnt # ls -alh /mnt
total 22K
drwxr-xr-x 6 root root 4.0K Mar  8 17:59 .
drwxr-xr-x 1 root root  100 Mar  8 16:27 ..
drwxr-xr-x 3 root root 1.0K Mar  8 17:56 boot
drwxr-xr-x 2 root root    6 Mar  8 17:55 data
drwxr-xr-x 3 root root 1.0K Mar  8 17:53 home
drwx------ 2 root root  16K Mar  8 17:53 lost+found
root@archiso /mnt #
```

7 Arch Installation

Steps

- Run `pacman -Sy --needed archlinux-keyring` to update `archlinux-keyring` to the latest version 20240208-1. Otherwise we would get "signature is unknown trust" errors.
- Follow ArchWiki's installation guide and run the following commands:

```
pacstrap -K /mnt base linux

genfstab -U /mnt >> /mnt/etc/fstab

arch-chroot /mnt

pacman -Syu
pacman -S mdadm lvm2 nano man

ln -s /usr/share/zoneinfo/Asia/Taipei /etc/localtime
hwclock --systohc

# Edit /etc/locale.gen and uncomment en_US.UTF-8.
locale-gen
echo "LANG=en_US.UTF-8" > /etc/locale.conf

# Edit /etc/hostname and change hostname to new-arch-b12902110.

passwd
```

- Move key generated by step 3 to `/etc/cryptsetup-keys.d`.
- Edit `/etc/mkinitcpio.conf` and add `encrypt`, `lvm2`, `mdadm_udev` to `HOOKS`. Also add `/etc/cryptsetup-keys.d/b12902110.key` to `FILES`.

- Run `mkinitcpio -p linux`.
- Add the following lines to `/etc/crypttab`:

```
# UUID of /dev/vda2
cryptboot UUID=b0ae0010-2ed6-4fed-801c-d8ae94e85fb1 /etc/cryptsetup-keys.d/b12902110.key
# UUID of /dev/md/data
cryptdata UUID=7a983ed6-5c94-4207-bc9e-7e59eda6bd06 /etc/cryptsetup-keys.d/b12902110.key
```

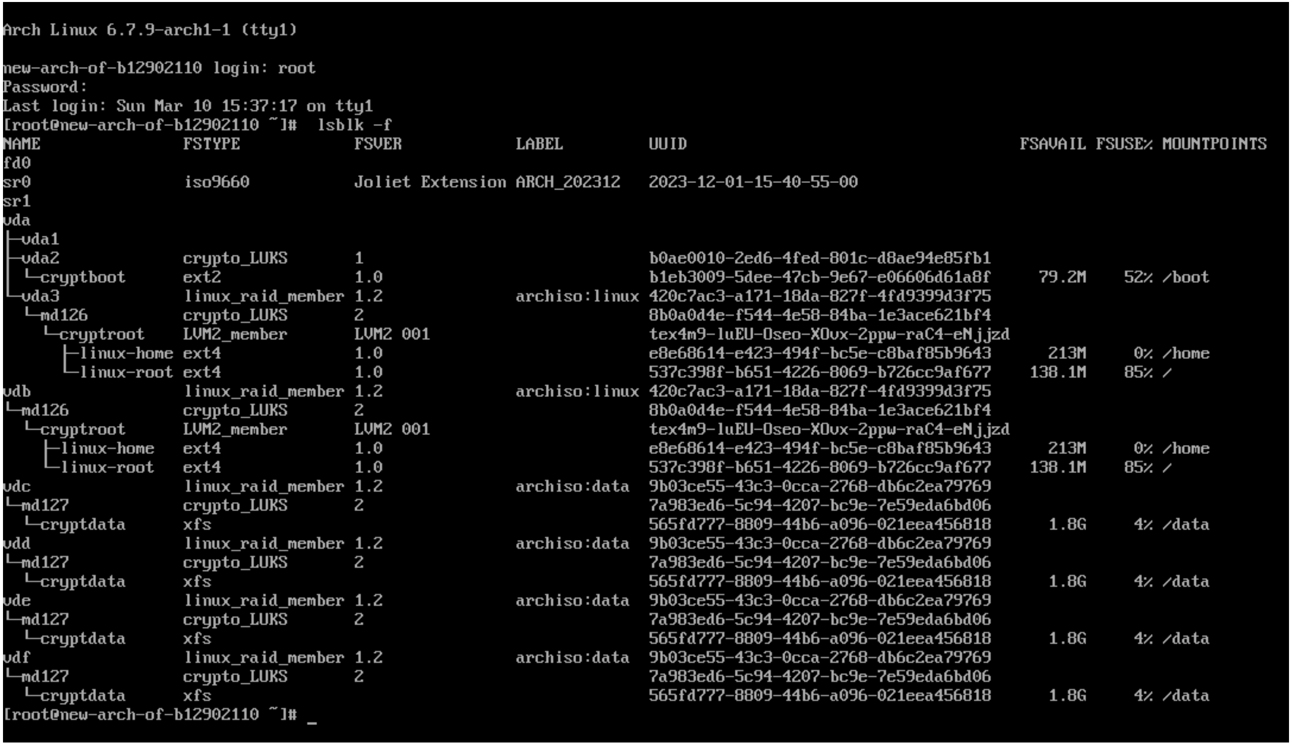
- Run `pacman -S grub` to Install GRUB.
- Edit the following lines in `/etc/default/grub`:

```
GRUB_CMDLINE_LINUX="root=/dev/linux/root \
cryptdevice=UUID=8b0a0d4e-f544-4e58-84ba-1e3ace621bf4:cryptroot \
cryptkey=rootfs:/etc/cryptsetup-keys.d/b12902110.key"

GRUB_ENABLE_CRYPTODISK=y
```

- Run the following commands:

```
grub-install /dev/vda
grub-mkconfig -o /boot/grub/grub.cfg
```

Result After rebooting and logging in, we see that all volumes have been correctly mounted.



```
Arch Linux 6.7.9-arch1-1 (tty1)

new-arch-of-b12902110 login: root
Password:
Last login: Sun Mar 10 15:37:17 on tty1
[root@new-arch-of-b12902110 ~]#  lsblk -f
NAME               FSTYPE            FSVER            LABEL         UUID                                   FSAVAIL FSUSE% MOUNTPOINTS
fd0
sr0                iso9660           Joliet Extension ARCH_202312   2023-12-01-15-40-55-00
sr1
vda
├─vda1
├─vda2             crypto_LUKS       1                              b0ae0010-2ed6-4fed-801c-d8ae94e85fb1
│ └─cryptboot      ext2              1.0                            b1eb3009-5dee-47cb-9e67-e06606d61a8f     79.2M    52% /boot
└─vda3             linux_raid_member 1.2              archiso:linux 420c7ac3-a171-18da-827f-4fd9399d3f75
  └─md126          crypto_LUKS       2                              8b0a0d4e-f544-4e58-84ba-1e3ace621bf4
    └─cryptroot    LVM2_member       LVM2 001                       tex4m9-luEU-Oseo-XOvx-2ppw-raC4-eNjjzd
      ├─linux-home ext4              1.0                            e8e68614-e423-494f-bc5e-c8baf85b9643      213M     0% /home
      └─linux-root ext4              1.0                            537c398f-b651-4226-8069-b726cc9af677    138.1M    85% /
vdb                linux_raid_member 1.2              archiso:linux 420c7ac3-a171-18da-827f-4fd9399d3f75
└─md126            crypto_LUKS       2                              8b0a0d4e-f544-4e58-84ba-1e3ace621bf4
  └─cryptroot      LVM2_member       LVM2 001                       tex4m9-luEU-Oseo-XOvx-2ppw-raC4-eNjjzd
    ├─linux-home   ext4              1.0                            e8e68614-e423-494f-bc5e-c8baf85b9643      213M     0% /home
    └─linux-root   ext4              1.0                            537c398f-b651-4226-8069-b726cc9af677    138.1M    85% /
vdc                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata      xfs                                              565fd777-8809-44b6-a096-021eea456818      1.8G     4% /data
vdd                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata      xfs                                              565fd777-8809-44b6-a096-021eea456818      1.8G     4% /data
vde                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata      xfs                                              565fd777-8809-44b6-a096-021eea456818      1.8G     4% /data
vdf                linux_raid_member 1.2              archiso:data  9b03ce55-43c3-0cca-2768-db6c2ea79769
└─md127            crypto_LUKS       2                              7a983ed6-5c94-4207-bc9e-7e59eda6bd06
  └─cryptdata      xfs                                              565fd777-8809-44b6-a096-021eea456818      1.8G     4% /data
[root@new-arch-of-b12902110 ~]# _
```

References

- Installation guide - ArchWiki (Installation)
- pacstrap(8) —Arch manual pages
- `man genfstab`, `man arch-chroot`, `man hwclock`
- chroot - ArchWiki

- locale.conf(5) —Arch manual pages

Fixing package signature issue:

- [Resolved] Can't import and use PGP keys / Pacman & Package Upgrade Issues / Arch Linux Forums
- pacman/Package signing - ArchWiki (Signature is unknown trust)

`mkinitcpio`:

- mkinitcpio - ArchWiki
- Ramfs, rootfs and initramfs —The Linux Kernel documentation
- RAID - ArchWiki (Configure mkinitcpio)

Encryption:

- dm-crypt/System configuration - ArchWiki (Unlocking in late userspace)
- crypttab(5) —Arch manual pages
- dm-crypt/System configuration - ArchWiki (mkinitcpio)
- Kernel parameters - ArchWiki
- Arch boot process - ArchWiki
- GRUB - ArchWiki (Encrypted /boot)
- dm-crypt/Device encryption - ArchWiki (With a keyfile embedded in the initramfs)
- dm-crypt/Encrypting an entire system - ArchWiki (Encrypted boot partition (GRUB)

GRUB and booting:

- Master boot record - Wikipedia
- Boot sector - Wikipedia
- GNU GRUB - Wikipedia
- GNU GRUB Manual 2.12: BIOS installation
- GNU GRUB Manual 2.12: Simple configuration
- grub-install(8) —Arch manual pages

Others:

- Install Arch Linux on LVM - ArchWiki
- [SOLVED] LVM on LUKS Installation - emergency shell on boot / Installation / Arch Linux Forums
- Mount LVM Partition in Rescue Mode - ShellHacks

8 Trivia

(a) The partition table. That is Master Boot Record (MBR) or GUID Partition Table (GPT).

(b) By default, 5% of the filesystem blocks will be reserved for the super-user. We can see this by running `tunefs -l DEVICE | grep Reserved`.

References:

- disk usage - df -h - Used space + Avail Free space is less than the Total size of /home - Ask Ubuntu
- Ext4 - ArchWiki (Reserved blocks)

(c)
- **FUSE:** A software interface that allows non-privileged users to create their own file systems without needing to modify the kernel code directly. The developer uses the `libfuse` library to write a handler program that handle file I/Os.
- **Advantages:** Can be written in any popular programming language. Easier to debug.
- **Disadvantage:** May be slower.
- **Examples:** GlusterFS, GmailFS.

References:

- Filesystem in Userspace - Wikipedia
- What is the advantage of FUSE (file system in user space)? - Quora
- linux - What makes a fuse file system different than a kernel file system? - Super User

(d) MBR vs. GPT:

	MBR	**GPT**
Meaning	Master Boot Record	GUID Partition Table
Maximum partitions	4 primary, or 3 primary and 1 extended	128
Maximum disk sectors	2^{32} sectors	2^{64} sectors

References:

- Master boot record - Wikipedia
- GUID Partition Table - Wikipedia
- UEFI/GPT-based hard drive partitions | Microsoft Learn

(e) `mount -t ntfs3 DEVICE MOUNTPOINT`

References:

- Comparison of file systems - Wikipedia
- exFAT - Wikipedia
- NTFS - Wikipedia
- NTFS - ArchWiki
- NTFS3 —The Linux Kernel documentation

(f) 1 GB (gigabyte) = 10^9 bytes. 1 GiB (gibibyte) = 1024^3 bytes = 1073741824 bytes. `ls -h` uses powers of 1024 by default.

References:

- Gigabyte - Wikipedia
- `man ls`

(g) Assuming 4 disks. 1st is fastest, 4th is slowest.

	Redundancy (Max. disks that we can lose)	Read speed	Write speed
RAID 0	0	1st	1st
RAID 10	2 (only if 1 in every RAID 1)	2nd	4th
RAID 5	1	3rd	2st
RAID 6	2	3rd	3rd

References:

- Standard RAID levels - Wikipedia
- Nested RAID levels - Wikipedia

(h) Maybe because encryption overhead is the bottleneck, that is, the slowest process of all processes.