

# Arch Linux Full Disk Encryption

Full Disk Encryption is probable one of the most important things to do first, when setting up a new system in a world in which #BigBrother is always watching you. The issue we had was, having a keyfile which is needed to decrypt your system is nice, but if its [the keyfile] unencrypted on a USB device it doesn't satisfy our paranoia. So the solution is to encrypt to USB device as well; with a passphrase. And that's what we're going to show here.



This HowTo was initially written in 2015, and was updated in 2017.

## Requirements

- [Arch Linux Download](#)
- Computer

## USB Device Installation

Write the ISO to a removable flash drive. You can also use the traditional way and simply burn the ISO on a CD/DVD.

```
~$: shasum archlinux-$VERSION-dual.iso
~$: dd if=archlinux-$VERSION-dual.iso of=/dev/$DEVICE bs=8192
```

## Booting

```
# if necessary reconfigure your keyboard layout
~$ loadkeys fr
# check for network connectivity
~$ ping 8.8.8.8
# request IP address
~$ ifconfig -a
~$ dhclient $NIC
```

## tmpfs (Paranoia)

```
~$ fdisk -l | grep Disk
~$ mkdir ./mytmpfs
~$ mount tmpfs ./mytmpfs -t tmpfs -o size=32m
~$ cd ./mytmpfs
~$ dd if=/dev/urandom of=secretkey bs=1024 count=4
```

```
~$ mkdir /mnt/boot && mkdir /mnt/home
```

## Partitioning

The partitioning structure of a disk is every users own choice, that's why we recommend reading the paragraph [Partition Scheme](#) in order to get a short introduction about the subject and make up your mind.

Get a pen and a piece of paper and start-off drawing your structure. When done, continue to the next paragraph.

## GPT

Basically there exist two "formats" of partitioning a disk: MBR and GPT. As MBR is from the last century and has many disadvantages in comparison with [GTP](#), we are going to use the latter one. For more detailed information about MBR and other possibility, please refer to the [Partion table](#) paragraph.

```
# gdisk disk-device
```

You will be thrown in a own commandline of the gdisk program, so proceed as follows:

Step	Command	Explanation
1	o	Create a new GUID partition table.
2	n	Create a new partition. (All partition with GPT are primary)
X	w	Write the partition table to disk.
Y	q	Exit gdisk commandline.

## Encryption

### with keyfile

```
~$ cryptsetup -v --cipher aes-xts-plain64 --key-size 512 --hash sha512 --iter-time 5000 --use-urandom luksFormat <device> keyfile
~$ cryptsetup luksOpen -d keyfile /dev/$DEVICE root
~$ cryptsetup luksOpen -d keyfile /dev/$DEVICE home
~$ cfdisk /dev/$DEVICE
~$ cryptsetup -c aes-xts-plain -y -s 512 luksFormat /dev/$DEVICE # USB storage device
~$ mkfs.vfat -F 32 -I /dev/mapper/bootdevice
~$ cfdisk /dev/$DEVICE1 # make it bootable
```

## with password

```
~$ cryptsetup -v --cipher aes-xts-plain64 --key-size 512 --hash sha512 --iter-time 5000 --use-urandom --verify-passphrase luksFormat <device>
~$ cryptsetup luksOpen /dev/$DEVICE $CRYPTSETUP_DEVICE_NAME
~$ mkfs.btrfs /dev/mapper/$CRYPTSETUP_DEVICE_NAME
~$ mount /dev/mapper/$CRYPTSETUP_DEVICE_NAME /mnt
```

## /boot partition

### on disk boot device

```
~$ mkfs.ext3 -L boot /dev/$BOOTDEVICE
# DOS; primary partition + bootable
~$ cfdisk /dev/$BOOTDEVICE
~$ mount /dev/$BOOTDEVICE /mnt/boot
```

### external boot device

```
~$ mkfs.ext3 -L boot /dev/$BOOTDEVICE
~$ cfdisk /dev/$BOOTDEVICE # DOS; primary partition + bootable
~$ mkfs.ext3 -L boot /dev/$BOOTDEVICE
~$ mount /dev/$BOOTDEVICE /mnt/boot
```

## Mounting

```
~$ mkdir /mnt/boot
~$ mount /dev/mapper/$CRYPTSETUP_DEVICE_NAME /mnt
~$ mount /dev/$BOOTDEVICE /mnt/boot
```

## Bootstrapping

```
~$ pacstrap -i /mnt base base-devel
~$ genfstab -U /mnt > /mnt/etc/fstab
~$ arch-chroot /mnt /bin/bash
~$ nano /etc/locale.gen
~$ locale-gen
~$ echo LANG=en_IE.UTF-8 > /etc/locale.conf
~$ nano /etc/vconsole.conf # KEYMAP=fr
~$ ln -sf /usr/share/zoneinfo/$CONTINENT/$COUNTRY /etc/localtime
~$ hwclock --systohc --utc
~$ echo $HOSTNAME > /etc/hostname
```

```
~$ nano /etc/mkinitcpio.conf
# add: keymap keyboard encrypt **before** filesystem in the HOOKS variable
~$ mkinitcpio -p linux
~$ passwd root
```

## syslinux

```
~$ pacman -S syslinux gptfdisk
~$ syslinux-install_update -iam
~$ nano /boot/syslinux/syslinux.cfg # APPEND root=/dev/mapper/group-name
cryptdevice=/dev/sda2:name rw
```

## Unmount & Reboot

Good luck!

```
~$ exit
~$ umount -R /mnt
```

## Troubleshooting

Tiny troubles might pup up. The few below have a tendency to occur due to human interaction failure. ;)

### cryptsetup failed

```
Command failed with code 22: Invalid argument
```

Enter the 'yes' in capslock: YES and hit Enter?

### syslinux

```
Error: /boot/syslinux is empty!
Is /boot mounted?
```

Reinstall syslinux package.

### Write-Protected

If `mount /dev/bootdevice /mnt` gives you an error about write protection; ask yourself if you

have formatted the relative partition in the first place.

## Repairing boot partition

```
~$ cryptsetup luksOpen /dev/$ROOTPARTITION root
~$ mount /dev/mapper/root /mnt
~$ mkfs.ext2 /dev/$BOOTPARTITION
~$ mount /dev/$BOOTPARTITION /mnt/boot
~$ genfstab -U /mnt > /mnt/etc/fstab
~$ arch-chroot /mnt /bin/bash
~$ pacman -R syslinux
~$ pacman -Syy syslinux
~$ syslinux-install_update -iam
~$ nano /boot/syslinux/syslinux.cfg # APPEND root=/dev/mapper/group-name
cryptdevice=/dev/sda2:name rw
~$ pacman -S linux
~$ exit
~$ umount -R /mnt
```

## References

- [https://wiki.archlinux.org/index.php/Dm-crypt/Drive\\_preparation](https://wiki.archlinux.org/index.php/Dm-crypt/Drive_preparation)
- [https://wiki.archlinux.org/index.php/Partitioning#Using\\_GPT\\_-\\_modern\\_method](https://wiki.archlinux.org/index.php/Partitioning#Using_GPT_-_modern_method)
- [http://fedoraproject.org/wiki/Disk\\_Encryption\\_User\\_Guide](http://fedoraproject.org/wiki/Disk_Encryption_User_Guide)

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