

Linux installation

DAT151
January 15, 2025

AlmaLinux information

- Read the AlmaLinux release notes to find specific information on installation of AlmaLinux 9.5:
 - <https://almalinux.org/>
 - <https://wiki.almalinux.org/release-notes/9.5.html>

Before you install

Remember to take backup of all that you do not want to loose...

... in all partitions!!!

Planning (1)

- What distribution?
- Dual (multi) boot?
- New installation or upgrade?
 - Some distros allow upgrade to new major release
 - Anyway... Take a backup first!
- Partitioning?
- Encrypted disks?
- Secure Boot?

Planning (2)

- What software and services to install?
 - Lots of space? Fun to have many programs/services
 - Secure system? Good idea to have few programs/services installed
 - Advice, install a minimum, and then add packages as needed

What is required from your system?

Check

- Release notes
 - [AlmaLinux 9.5 Release Notes](#)
- Distributions often have lists on their web pages
 - [Red Hat Enterprise Linux technology capabilities and limits](#)
- Forums
- Howtos

Installation media (1)

- Installation DVDs
 - A lot of software packages
 - Do not need to be connected to Internet
 - Must anyway update software from Internet
- Live image
 - Runs system directly from CD/DVD/USB stick
 - Can check that system runs on PC without installing anything.
 - Can also be used as a “rescue” CD/DVD/USB stick
 - Fewer software packages – usually a lot to install afterwards
 - [Live images for AlmaLinux](#)

Installation media (2)

- Boot/NetBoot image
 - Same as installation DVD, but software packages are downloaded from Internet
 - Image only used to boot the system during installation
 - Packages are downloaded from Internet during the installation
- Minimal image
 - Similar to installation DVD, but with a minimum of packages
 - Can install a very limited console only OS
- USB stick
 - Same images as for DVD/CD
 - Image must be transferred to USB:
 - Linux: dd command:

```
dd if=AlmaLinux-9-latest-x86_64-boot.iso of=/dev/sd<X>
```

 - Replace <X> with the correct character. Use e.g. *lsblk* to find the character.
 - Windows: E.g. [Rufus](#), [Etcher](#)
 - Observe, file copy to USB stick will not work

Installation media (3)

- Official AlmaLinux images on USB-stick does not work with EFI-boot at the lab
 - Do work with legacy mode (BIOS)
- Can use [image](#) prepared for DAT151.
- Dump DAT151 image to USB stick:

```
dd if=alma-9-efi.img of=/dev/sdX status=progress
```
- Image contains a GPT disk with the boot content
- Image will work as is, although the GPT backup table will not be correctly positioned on USB stick
 - Can be corrected (not necessary):

```
sgdisk -e /dev/sdX
```

Rescue mode

- In boot window, select “Troubleshooting”, then “Rescue a AlmaLinux system”
 - Starts system from CD/DVD/USB without installing anything
- You can mount partitions from hard disk (more later)
- Can check for errors in the system
- Can also use a live CD/DVD/USB to run Linux without installing.
 - Live CD/DVD can also allow to install Linux.

AlmaLinux

- Functionally compatible with its upstream source, Red Hat Enterprise Linux (RHEL)
 - Changed logos etc.
 - First release on March 30, 2021
- Free
- No access to RedHat official support
- Information for RHEL are in generally applicable for AlmaLinux

CentOS

- RedHat clone, similar to AlmaLinux
- January 2014, CentOS joined with Red Hat while staying independent from RHEL
- RedHat has decided that CentOS 8 was the last CentOS version
- AlmaLinux and Rocky Linux was created as a response to RedHat discontinuing CentOS

CentOS stream

- A rolling-release distro that tracks just ahead of Red Hat Enterprise Linux (RHEL) development
- Positioned as a midstream between Fedora and RHEL
- CentOS stream is based on Fedora, and RedHat will be based on CentOS stream
 - CentOS stream will continue, but no more CentOS versions.
- EL-versions (RHEL, AlmaLinux and Rocky Linux) are in general more stable than Fedora (10 year life time for RHEL, new Fedora versions twice a year)
 - But, Fedora has more software and has more features
 - Fedora can be upgraded to new major release, but not RHEL, nor AlmaLinux
 - Some Fedora packages for EL are available in the EPEL repository
 - Packages from Fedora can be repacked for EL, but can require some tweaking
 - Mock is a useful tool

Download AlmaLinux

- [Official](#)
- Mirror sites (e.g.):
 - [UiB](#)
 - [Public active mirrors](#)
- Version 9 images in “9/isos/x86_64/”
- Recommend for lab:
 - AlmaLinux-9-x86_64-dvd.iso (10.0GiB), or
 - AlmaLinux-9-x86_64-boot.iso (804MiB)
 - Will download packages from internet.

Installation

- Burn CD/DVD or create USB stick before you come to the lab!
- Test on your own computer that you can boot from the media.
 - Abort the process when meet with the installer GUI
 - Nothing is installed if you do not continue the installation process
- See also: [How to download and write images](#)

Start installation

- Check CD/DVD/USB?
 - ...to make sure that there are no errors
 - Takes long time! (Not necessary...)

Anaconda

- Installation program for RedHat and clones
- Requires some memory (OK in the lab)
- Try text mode installation if the normal install mode does not work
 - In boot window, select “Troubleshooting”, then install using text mode

In the lab (1)

- UEFI or BIOS (legacy boot)
 - Computers at lab have UEFI firmware
 - If keeping Windows, use same boot type as the Windows install
 - Check in firmware boot window where Windows is located
 - If Windows can be deleted, you can try UEFI, but this often fails at the lab computers
- Use IP printed on computer – use static network configuration
- IP for DNS and Gateway in Assignment 0
- Remember to configure network to be enabled on boot
- Create a user and give the user system privileges
- A root password is useful if problems during boot

In the lab (2)

- Partition disk manually
 - Set up your own partitions (at least / and swap)
 - If UEFI boot, you also need */boot/efi*
 - If you use LVM for / (recommended if EL9), then you also need */boot*
 - Ask the lab assistant if you can delete Windows partitions from computer
 - If you delete Windows, a BIOS boot partition is not needed
 - BIOS boot partition is only needed if legacy boot from UEFI disk where you need to keep an existing installation
- Select “Server with GUI” of “Workstation” installation
 - Select extra packages if you want, but
 - this can also be done later
- Standard installation medium only with Gnome desktop
 - Servers very often do not need a graphical interface
 - Other desktop environments are available if using a [live image](#)

Partitions (from chapter 20)

- Fixed size subsection of a storage device
 - Can format each partition separately
- Partitions can be formatted during installation
- Can chose not to format existing partitions, e.g. a Windows partition, partition with user data etc.
 - */usr/local*
 - */home*
 - */var*
 - Windows partitions

Partition table

- Must exist on the disk before you can create partitions
- Contains information about the partitions on the storage device
- Edited when you change partitions
- Exist two different disk partition table types:
 - Master Boot Record
 - MBR – Master Boot Record
 - UEFI Legacy boot simulates MBR
 - GUID Partition Table
 - GPT - GUID Partition Table
 - Used by UEFI, Unified Extensible Firmware Interface
 - GUID - Globally Unique Identifier
- Details on MBR and GUID in chapter 2 of Unix book.

Logical Volumes (LV)

- Partition is managed by OS, not computer firmware
- Named logical partition
- Can be changed/resized dynamically
- LVM = Logical Volume Manager
 - AlmaLinux uses LVM as default for most partitions
- Btrfs, file-system and logical partitions
 - Default for Fedora 37 and later
 - Logical partitions are dynamic in size

Physical and logical partitions

- The partitions created on the disks and seen by the computer firmware are the physical partitions.
- The LVM logical partitions are handled by and seen by the Linux kernel.
- The LVM partitions are stored on physical partitions.
- A physical partition can have many LVM logical partitions.
- A LVM logical partition can extend several physical partitions and disks.

Root partition

Must have:

- / (root): main file system
 - All other directories are subdirectory of /
 - Other file systems mounted as subdirectories

Boot partition

Can have:

- `/boot`:
 - Contains the kernel and other files necessary at startup
 - Must have `/boot` if boot loader can not read `/`
 - Not in LVM (computer firmware can not read from LVM)
 - A few hundred MiB to a few GiB (2GiB is plenty)
 - My laptop has 295MiB of data in the `/boot` partition
 - Usual to have `/boot` as first partition
 - Machines with old BIOS can not start from partitions that pass cylinder 1023.

UEFI boot partition

- UEFI boot requires a physical partition */boot/efi*
 - Not required if using legacy mode with UEFI (simulates BIOS boot)
- A few hundred MiB
 - My laptop has 165MiB of data in the */boot/efi* partition
- Details in chapter 2

Swap partition

Usual to have:

- Swap:
 - Separate partition for swap give better performance
 - Can alternatively swap to files
 - 1-2 times RAM
 - Computers rich on RAM may not need swap
 - More disks – can be advantage with one swap area per disk
 - No mount point for swap
 - Can be a compressed RAM disk, i.e. no disk partition

More partitions

Can also have

- /home – home directories
 - Useful when reinstalling
 - Necessary if limits on users disk usage
 - Useful on workstations, but not on servers with no regular users
- /var – system logs and server data, e.g. MariaDB databases
 - Can be useful on servers to keep data from server programs
- /tmp – temporary files that can be deleted
 - Modern distros often store /tmp in RAM, i.e. no disk partition
 - Deleted on computer halt
 - If limited space for /tmp – some applications can fail

More partitions:

- Easier to take backup
- Can waste space, i.e. some partitions are full, other with free space
- Btrfs – Partition size is dynamic and given by its content

Partitions for lab machine

Recommend at least:

- `/` - root partition
- `/boot` if `/` on LVM
- `/boot/efi` if UEFI boot
 - Probably you will use legacy boot, i.e. no `/boot/efi`
- swap - swap partition
- An empty partition of at least 10GiB for later use
 - If BIOS or UEFI legacy, create as a logical partition

File systems

Have to set up a file systems on the partitions to be able to use them.

- RHEL/AlmaLinux: ext3 / ext4 / XFS (XFS default from RHEL 7.0)
- MS Windows: fat16, fat32, ntfs
- Mac: HFS / HFS+
- Can use different file systems on different partitions.

Mount point

- Addressing refers to the / directory – called root directory
- Mount point shows where the file system is in relation to /, e.g.:
 - /home
 - /usr/local
 - /var
- Overview of mount points for file systems:
 - df
 - mount
 - findmnt
 - systemctl --type=mount list-units
 - lsblk

In the lab...

- Description on how to make dual-boot work on the lab machines in Assignment 0
 - More in the next lecture (about booting)
- Use dual-boot in the lab if Windows is needed
 - You can probably delete Windows
- If keeping Windows, use the same boot type the existing windows installation

Log files from installation

- Check logs from installation
 - Specially important if something goes wrong...
- Log files from installation in
 - `/var/log/anaconda`
- Parameters used by installer is stored in a kickstart file:
 - `/root/anaconda-ks.cfg`

Booting

Problems during booting?

- Messages are copied to `/var/log/messages`
 - True if `syslogd` is used, default if AlmaLinux 9
- Status of startup scripts with command `journalctl`

Command: `dmesg`

- Prints messages from kernel buffer ring

Boot process

- Firmware (BIOS/UEFI) loads the boot loader (GRUB)
- Boot loader loads the kernel into memory and executes the kernel
- Initialization tasks:
 - probes for hardware (kernel loads device driver modules)
 - start initial process
 - check and mount file systems
 - execute startup scripts

GRUB

Grand Unified Boot Loader

- Default for most Intel based UNIX and Linux systems
- Details in chapter 2
- Can load most operating system (also MS Windows)
- If Windows, the os-prober program should have created a stanza for windows.
- An Windows entry can be added by hand inside `/etc/grub.d/`, i.e. to `/etc/grub.d/40_custom`:

```
menuentry "windows"{  
    set root=(hd0,1)  
    chainloader (hd0,1)+1  
}
```

- Update grub.cfg:
 - `grub2-mkconfig -o /boot/grub2/grub.cfg`