

Linux File System Hierarchy Structure

The Linux File System Hierarchy Structure is governed by the Filesystem Hierarchy Standard, a set of guidelines that determines the structure and contents of directories in Unix-type operating systems, including Linux. These standards are maintained by the Linux Foundation.

The File System Hierarchy starts at the root directory of the file system, from which all other directories and their contents branch out. The file system logically organizes files and folders, with each directory serving a specific purpose.

1. / (Root):

Primary hierarchy root and root directory of the entire file system hierarchy.

- Every single file and directory start from the root directory.
- The only root user has the right to write under this directory.
- /root is the root user's home directory, which is not the same as /

```
cherry@rocky-8:/
File Edit View Search Terminal Help
[cherry@rocky-8 /]$
[cherry@rocky-8 /]$ pwd
/
[cherry@rocky-8 /]$
[cherry@rocky-8 /]$ ls
bin  dev  home  lib64  mnt  proc  run  srv  tmp  var
boot  etc  lib  media  opt  root  sbin  sys  usr
```

2. /home

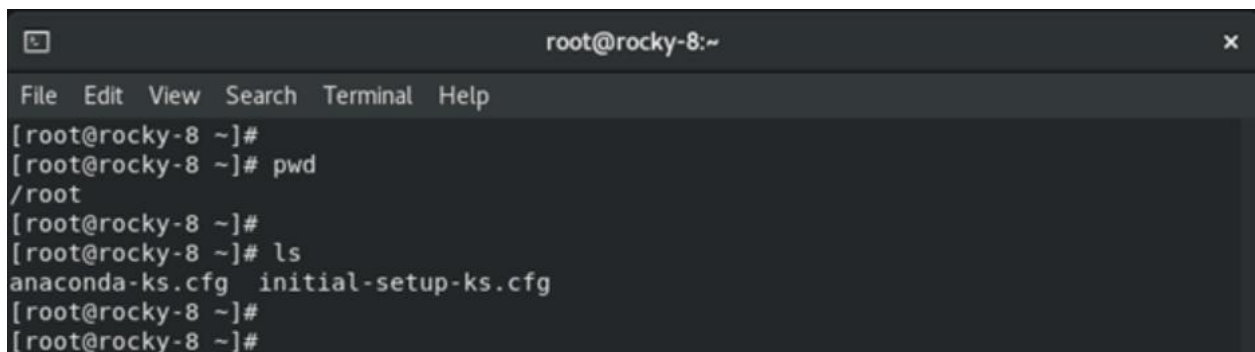
The /home directory is a directory that contains users' personal files. The directory is the entry point for any login user on the Linux system. It stores folders, files, and personal data that is specific to an individual user.

Folders in the /home directory take the form /home/USERNAME where USERNAME is the name of the login user. For example, if we have a login user called mike, the home directory for the user will be /home/mike.

```
cherry@rocky-8:~
File Edit View Search Terminal Help
[cherry@rocky-8 ~]$
[cherry@rocky-8 ~]$ ls
Desktop  Documents  Downloads  Music  Pictures  Public  Templates  Videos
[cherry@rocky-8 ~]$
[cherry@rocky-8 ~]$
[cherry@rocky-8 ~]$
```

3. /root

This is the home directory of the root account, also known as the root user's home directory. The /root directory stores configuration files for the root account in the same way each regular user's home directory contains configuration files and regular files for that user.

A terminal window titled 'root@rocky-8:~' with a menu bar (File, Edit, View, Search, Terminal, Help). The terminal shows the following commands and output:

```
[root@rocky-8 ~]#  
[root@rocky-8 ~]# pwd  
/root  
[root@rocky-8 ~]#  
[root@rocky-8 ~]# ls  
anaconda-ks.cfg  initial-setup-ks.cfg  
[root@rocky-8 ~]#  
[root@rocky-8 ~]#
```

4./Boot

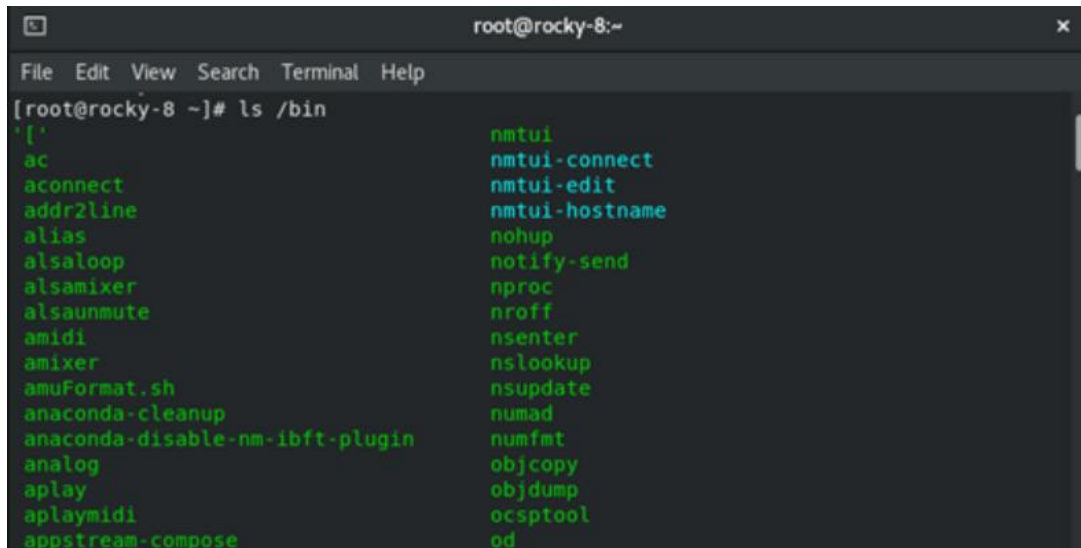
Another critical directory is the /boot directory. The directory, as the name implies, contains essential files needed to successfully boot the system. These files include the grub bootloader files, root filesystem files, Linux kernel files (vmlinuz), and other boot configuration files.

```
root@rocky-8:~  
File Edit View Search Terminal Help  
[root@rocky-8 ~]#  
[root@rocky-8 ~]# ls /boot  
config-4.18.0-372.26.1.el8_6.x86_64  
config-4.18.0-372.9.1.el8.x86_64  
efi  
grub2  
initramfs-0-rescue-81107587b2a04768a3554021d97ed188.img  
initramfs-4.18.0-372.26.1.el8_6.x86_64.img  
initramfs-4.18.0-372.26.1.el8_6.x86_64kdump.img  
initramfs-4.18.0-372.9.1.el8.x86_64.img  
initramfs-4.18.0-372.9.1.el8.x86_64kdump.img  
loader  
symvers-4.18.0-372.26.1.el8_6.x86_64.gz  
symvers-4.18.0-372.9.1.el8.x86_64.gz  
System.map-4.18.0-372.26.1.el8_6.x86_64  
System.map-4.18.0-372.9.1.el8.x86_64  
vmlinuz-0-rescue-81107587b2a04768a3554021d97ed188  
vmlinuz-4.18.0-372.26.1.el8_6.x86_64  
vmlinuz-4.18.0-372.9.1.el8.x86_64  
[root@rocky-8 ~]#  
[root@rocky-8 ~]#  
[root@rocky-8 ~]# uname -r  
4.18.0-372.26.1.el8_6.x86_64  
[root@rocky-8 ~]#  
[root@rocky-8 ~]#
```

Linux Kernels

5./bin

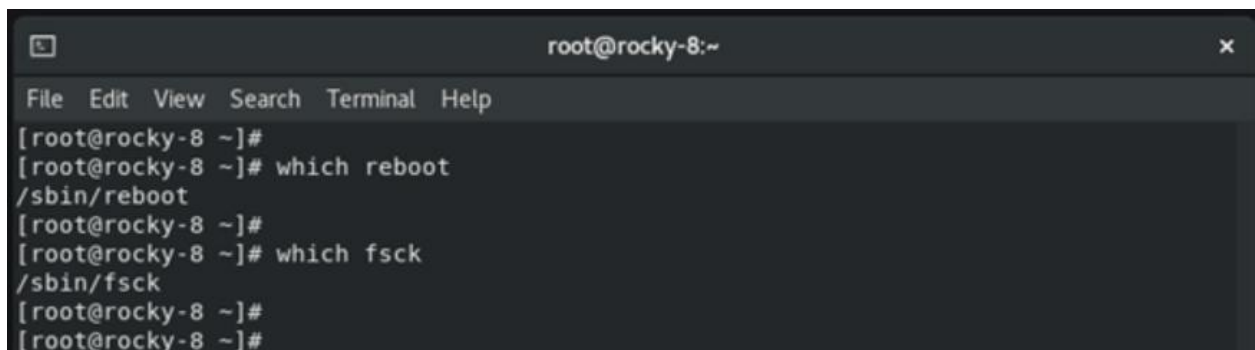
The /bin directory contains binary executables or Linux programs. These include common Linux commands that are made available for all users in single-user mode. These include cat, chown, chmod, ping, cp, mkdir, ls, cat, rm, and mv just to mention a few.

A terminal window titled 'root@rocky-8:~' with a menu bar (File, Edit, View, Search, Terminal, Help). The command '[root@rocky-8 ~]# ls /bin' has been executed, displaying a two-column list of files in the /bin directory. The files are: ac, aconnect, addr2line, alias, alsaloop, alsamixer, alsaunmute, amidi, amixer, amuFormat.sh, anaconda-cleanup, anaconda-disable-nm-ibft-plugin, analog, aplay, aplaymidi, appstream-compose, nmtui, nmtui-connect, nmtui-edit, nmtui-hostname, nohup, notify-send, nproc, nroff, nsenter, nslookup, nsupdate, numad, numfmt, objcopy, objdump, ocsptool, and od.

```
[root@rocky-8 ~]# ls /bin
ac                  nmtui
acconnect          nmtui-connect
addr2line           nmtui-edit
alias               nmtui-hostname
alsaloop            nohup
alsamixer            notify-send
alsaunmute          nproc
amidi               nroff
amixer              nsenter
amuFormat.sh        nslookup
anaconda-cleanup    nsupdate
anaconda-disable-nm-ibft-plugin numad
analog              numfmt
aplay               objcopy
aplaymidi           objdump
appstream-compose   ocsptool
od
```

6./sbin

Unlike the /bin directory, the /sbin directory contains binary executables and command line tools that are preserved for the root user. These are privileged commands used for system administration tasks. Examples of such commands include fdisk, route, reboot, mkfs, init, and fsck to mention a few.

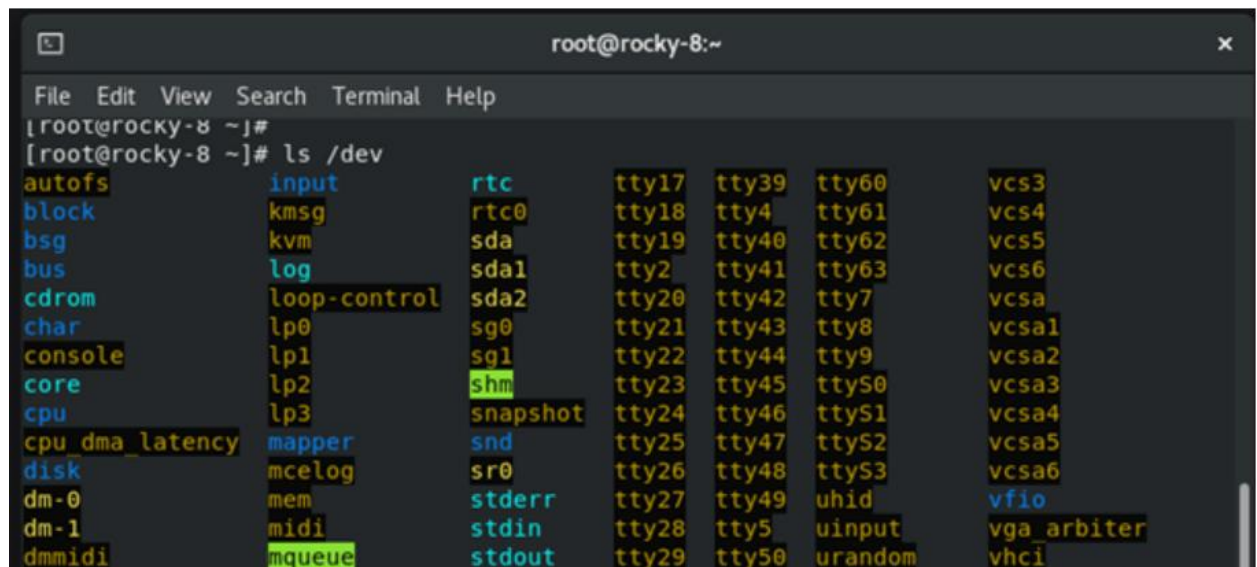
A terminal window titled 'root@rocky-8:~' with a menu bar (File, Edit, View, Search, Terminal, Help). The user has entered two 'which' commands to find the location of 'reboot' and 'fsck'. The output shows both commands are located in the /sbin directory.

```
[root@rocky-8 ~]#
[root@rocky-8 ~]# which reboot
/sbin/reboot
[root@rocky-8 ~]#
[root@rocky-8 ~]# which fsck
/sbin/fsck
[root@rocky-8 ~]#
[root@rocky-8 ~]#
```

7./dev

The /dev directory contains special files that are representative of devices attached to the system. These include consoles, hard drives, or any other

peripheral devices plugged into the system. A good example of a device file is /dev/sda which represents the first SATA hard drive attached to the Linux system.



```
root@rocky-8:~  
File Edit View Search Terminal Help  
[root@rocky-8 ~]#  
[root@rocky-8 ~]# ls /dev  
autofs          input           rtc             tty17           tty39           tty60           vcs3  
block           kmsg           rtc0            tty18           tty4             tty61           vcs4  
bsg             kvm            sda             tty19           tty40           tty62           vcs5  
bus             log            sda1            tty2             tty41           tty63           vcs6  
cdrom           loop-control    sda2            tty20           tty42           tty7            vcsa  
char            lp0            sg0             tty21           tty43           tty8            vcsa1  
console         lp1            sg1             tty22           tty44           tty9            vcsa2  
core            lp2            shm             tty23           tty45           ttyS0           vcsa3  
cpu             lp3            snapshot        tty24           tty46           ttyS1           vcsa4  
cpu_dma_latency mapper          snd             tty25           tty47           ttyS2           vcsa5  
disk            mcelog         sr0             tty26           tty48           ttyS3           vcsa6  
dm-0            mem            stderr          tty27           tty49           uhid            vfio  
dm-1            midi           stdin           tty28           tty5             uinput          vga_arbiter  
dmmidi          mqueue         stdout          tty29           tty50           urandom         vhci
```

8./etc

The /etc directory contains host-specific system-wide configuration files. It stores configuration files required by all programs as well as startup and shutdown shell scripts.

The configuration files can be modified using a text editor such as nano or vim by the root or sudo user which is a regular user with elevated privileges to run certain root commands.

```
root@rocky-8:~  
File Edit View Search Terminal Help  
[root@rocky-8 ~]#  
[root@rocky-8 ~]# ls /etc  
accountsservice      hosts                protocols  
adjtime              hp                  pulse  
aliases              idmapd.conf         qemu-ga  
alsa                 init.d              qemu-kvm  
alternatives         initial-setup        ras  
anaconda             inittab             rc0.d  
anacrontab           inputrc             rc1.d  
asound.conf          iproute2            rc2.d  
at.deny              iscsi               rc3.d  
audit               issue               rc4.d  
authselect           issue.d             rc5.d  
avahi               issue.net           rc6.d  
bash_completion.d   kdump              rc.d
```

9./tmp

On Linux systems, temporary files are stored in the /tmp directory. These are temporary files created by the system and users. Files in this directory are usually a few kilobytes in size and are, in most cases, deleted when a system is rebooted.

```
root@rocky-8:~  
File Edit View Search Terminal Help  
[root@rocky-8 ~]#  
[root@rocky-8 ~]# ls /tmp  
anaconda.log  
dbus.log  
dnf.librepo.log  
ks-script-f9pl887e  
ks-script-j4n6pst0  
packaging.log  
program.log  
sensitive-info.log  
systemd-private-1f809a5a2a5a4df7811e452fe0338fb8-chronyd.service-Tm7N76  
systemd-private-1f809a5a2a5a4df7811e452fe0338fb8-colord.service-pg2xHA  
systemd-private-1f809a5a2a5a4df7811e452fe0338fb8-geoclue.service-ZfeKrZ  
systemd-private-1f809a5a2a5a4df7811e452fe0338fb8-ModemManager.service-1gvFM2  
systemd-private-1f809a5a2a5a4df7811e452fe0338fb8-rtkit-daemon.service-cvy980  
tracker-extract-files.1000  
tracker-extract-files.1001
```

10./opt

The /opt directory contains add-on applications or software packages that are provided by a third-party vendor and are not installed through your operating system package manager. Each such application has its own subdirectory which contains all the essential files needed for it to run.

```
root@rocky-8:~  
File Edit View Search Terminal Help  
[root@rocky-8 ~]#  
[root@rocky-8 ~]# ls /opt  
teamviewer  
[root@rocky-8 ~]#
```

11./var

Var stands for variable. As the name suggests the /var directory is a directory that contains files that are constantly changing in size such as log and spool files.

```
root@rocky-8:~  
File Edit View Search Terminal Help  
[root@rocky-8 ~]#  
[root@rocky-8 ~]# ls /var  
account cache db ftp gopher lib lock mail opt run tmp  
adm crash empty games kerberos local log nis preserve spool yp  
[root@rocky-8 ~]#  
[root@rocky-8 ~]#  
[root@rocky-8 ~]#
```

Here is a list of the salient directories contained in the /var directory:

- /var/log - Contains system and application log files.
- /var/cache - Contains cached data from programs.

- `/var/mail` - Contains users' mailboxes
- `/var/spool` - Comprises queued or spooled files for various programs.
- `/var/spool/cron` - Contains spooled files for cron jobs.
- `/var/spool/at` - Contains spooled jobs for at.
- `/var/spool/lpd` - Contains spooled files for printing.
- `/var/opt` - Contains variable data files for the `/opt` directory.