

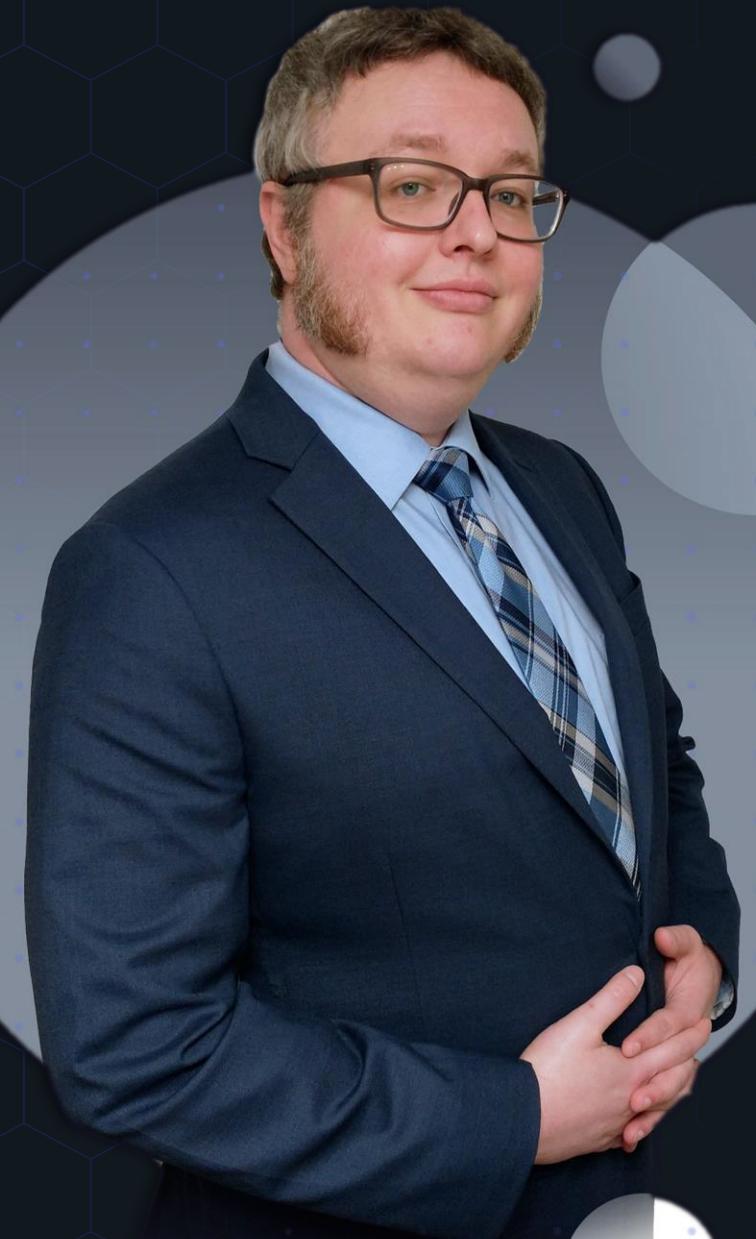
{KODE{LOUD

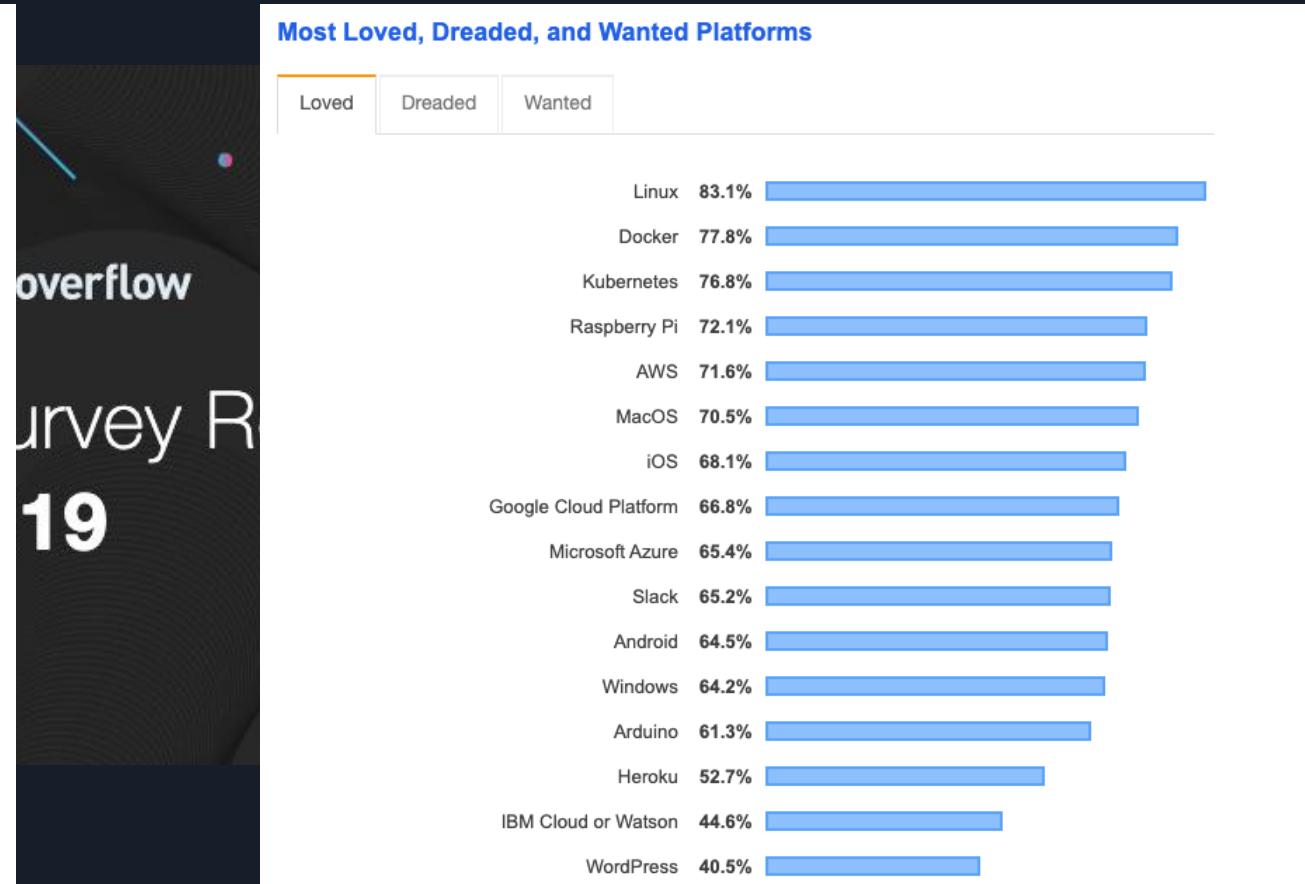
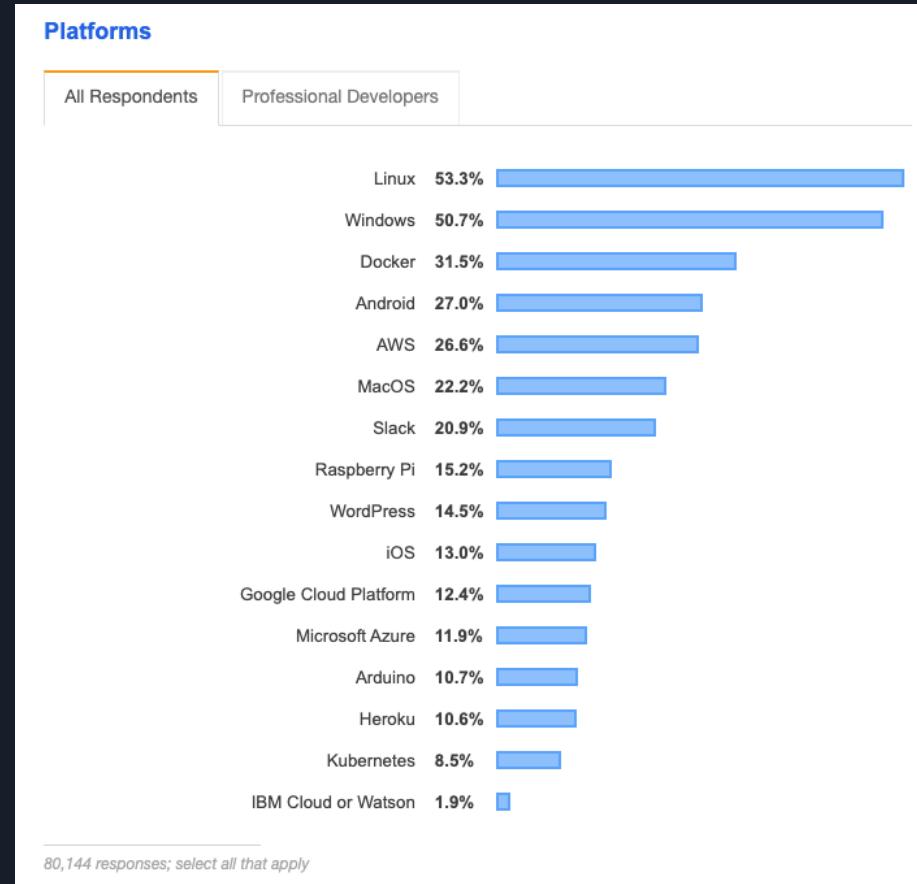
Linux Foundation Certified System
Administrator Preparation Course



Instructor

Aaron Lockhart







Curriculum



Essential
Commands



Operation of
Running Systems



User and Group
Management



Networking



Service
Configuration



Storage
Management

Course Format



Videos



Labs



Mock Exams

Course Format

~30 Hours

30%



Videos

60%



Labs

10%



Mock Exams

{KODE{LOUD

Linux Foundation Certified System Administrator Exam Details



Pre-Requisites

none.

Exam Objectives

25%



Essential Commands

20%



Operation of Running Systems

10%



User and Group Management

12%



Networking

20%



Service Configuration

13%



Storage Management

LFCS Exam Details



120 minutes
(2 hours)



375.00 USD
Valid for 3 years



Performance-based

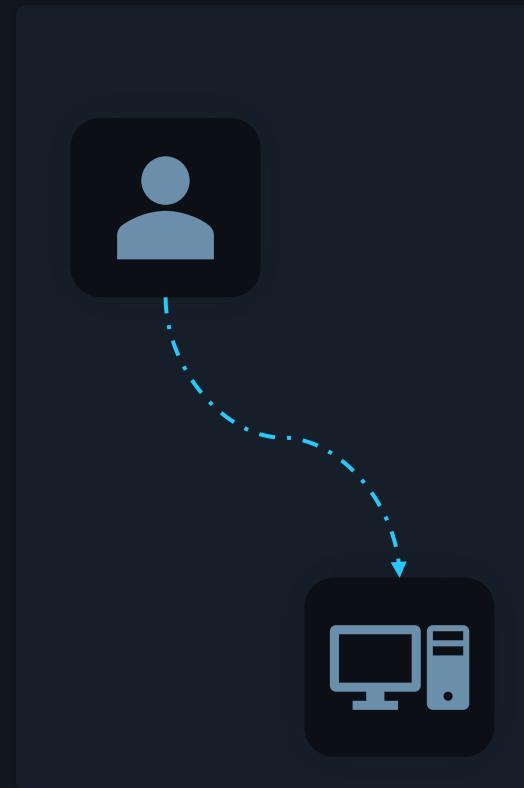
No multiple choice or true/false



Online proctored

{KODE{LOUD

Learning Resources



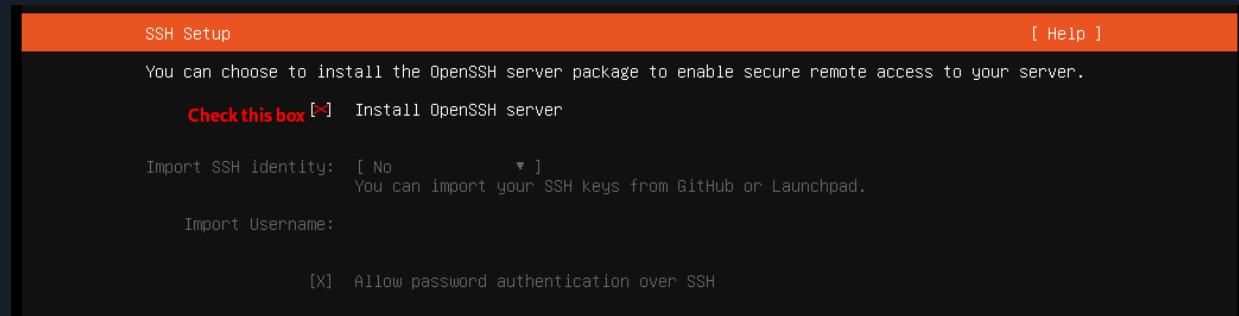
Learning Resources



CentOS Stream 8: <https://centos.org/centos-stream>



Ubuntu Server 20.04: <https://ubuntu.com/download/server>



{KODE{LOUD

Login Methods



Local text-mode console



Remote text-mode login



Local graphical-mode console



Remote graphical-mode login

```
[ OK ] Mounted Mount unit for snapd, revision 18270.  
[ OK ] Mounted Mount unit for coreos, revision 2109.  
[ OK ] Mounted Mount unit for dev, revision 21029.  
[ OK ] Mounted Mount unit for lxd, revision 21545.  
[ OK ] Mounted Mount unit for user, revision 12704.  
[ OK ] Reached target Local File Systems.  
Starting Load AppArmor profiles...  
Starting Create final runtime dir for shutdown pivot root...  
Starting Tell Plymouth To Write Out Runtime Data...  
Starting Create Volatile Files and Directories...  
[ OK ] Finished Set console font and keymap.  
[ OK ] Finished Create final runtime dir for shutdown pivot root.  
[ OK ] Finished Create Volatile Files and Directories.  
Starting Network Time Synchronization...  
Starting Update UTMP about System Boot/Shutdown...  
[ OK ] Finished Update UTMP about System Boot/Shutdown.  
[ OK ] Finished Load AppArmor profiles.  
[ OK ] Load AppArmor profiles managed internally by snapd.  
Starting Initial cloud-init job (pre-networking)...  
[ OK ] Finished Load AppArmor profiles managed internally by snapd.  
[ OK ] Reached Network Configuration.  
[ OK ] Reached target System Time Set.  
[ OK ] Reached target Target System Is Set.  
7.055501 [cloud-init] INFO cloud-init v: 21.2-3-g899faa9-ubuntu2204.1 running 'init-local'  
at Wed, 20 Oct 2021 00:01:32 +0000, up 6,99 seconds.  
[ OK ] Reached target Network (pre).  
[ OK ] Reached target Network (pre).
```

Console

CentOS Linux 8
Kernel 4.18.0-305.19.1.el8_4.x86_64 on an x86_64

Activate the web console with: systemctl enable --now cockpit.socket

centos-vm login: _

Virtual Terminal

```
aaron@LFCS-CentOS:~  
File Edit View Search Terminal Help  
[aaron@LFCS-CentOS ~]$ ls -a  
.. .bash_profile Desktop .ICEauthority Pictures Templates  
. .bashrc Documents .local .pki Videos  
.bash_history .cache Downloads .mozilla Public  
.bash_logout .config .esd_auth Music .ssh  
[aaron@LFCS-CentOS ~]$ █
```

Terminal Emulator

Consoles

```
[ OK ] Mounted Mount unit for snapd, revision 13270.
[ OK ] Mounted Mount unit for core18, revision 2128.
[ OK ] Mounted Mount unit for lxd, revision 21029.
[ OK ] Mounted Mount unit for lxd, revision 21545.
[ OK ] Mounted Mount unit for snapd, revision 12704.
[ OK ] Reached target Local File Systems.
      Starting Load AppArmor profiles...
      Starting Set console font and keymap...
      Starting Create final runtime dir for shutdown pivot root...
      Starting Tell Plymouth To Write Out Runtime Data...
      Starting Create Volatile Files and Directories...
[ OK ] Finished Set console font and keymap.
[ OK ] Finished Create final runtime dir for shutdown pivot root.
[ OK ] Finished Tell Plymouth To Write Out Runtime Data.
[ OK ] Finished Create Volatile Files and Directories.
      Starting Network Time Synchronization...
      Starting Update UTMP about System Boot/Shutdown...
[ OK ] Finished Update UTMP about System Boot/Shutdown.
[ OK ] Finished Load AppArmor profiles.
      Starting Load AppArmor profiles managed internally by snapd...
      Starting Initial cloud-init job (pre-networking)...
[ OK ] Finished Load AppArmor profiles managed internally by snapd.
[ OK ] Started Network Time Synchronization.
[ OK ] Reached target System Time Set.
[ OK ] Reached target System Time Synchronized.
[ 7.050553] cloud-init[655]: Cloud-init v. 21.2-3-g899bfaa9-0ubuntu2~20.04.1 running 'init-local'
at Wed, 20 Oct 2021 00:20:32 +0000. Up 6.99 seconds.
[ OK ] Finished Initial cloud-init job (pre-networking).
[ OK ] Reached target Network (Pre).
      Starting Network Service...
[ OK ] Started Network Service.
      Starting Wait for Network to be Configured...
      Starting Network Name Resolution...
[ OK ] Started Network Name Resolution.
[ OK ] Reached target Network.
[ OK ] Reached target Host and Network Name Lookups.
```

Virtual Terminals

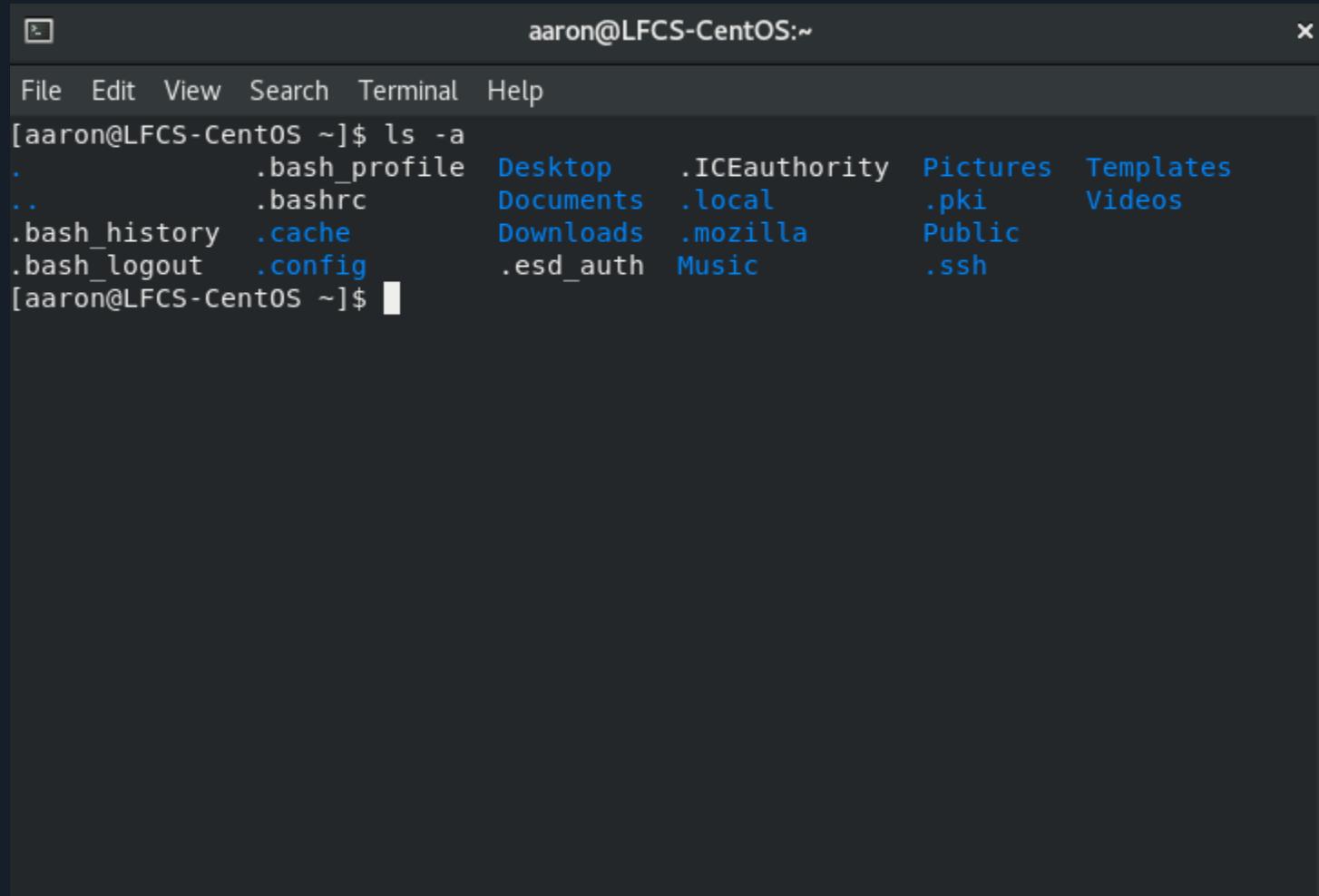
CTRL + ALT + F2

```
CentOS Linux 8
Kernel 4.18.0-305.19.1.el8_4.x86_64 on an x86_64

Activate the web console with: systemctl enable --now cockpit.socket

centos-vm login: _
```

Terminal Emulators



The screenshot shows a terminal window titled "aaron@LFCS-CentOS:~". The window has a dark background and light-colored text. At the top, there is a menu bar with options: File, Edit, View, Search, Terminal, and Help. Below the menu, the terminal prompt "[aaron@LFCS-CentOS ~]\$" is followed by the command "ls -a". The output of the command is displayed, listing various files and directories in the current home directory. The output includes ".bash_profile", ".bashrc", ".bash_history", ".bash_logout", ".cache", ".config", "Desktop", "Documents", ".local", "Downloads", ".esd_auth", ".ICEauthority", ".mozilla", "Music", "Pictures", ".pkki", "Public", "Templates", and "Videos". The "aaron" user is currently logged in.

```
[aaron@LFCS-CentOS ~]$ ls -a
.           .bash_profile  Desktop    .ICEauthority  Pictures  Templates
..          .bashrc        Documents  .local        .pkki     Videos
.bash_history .cache       Downloads  .mozilla      Public
.bash_logout  .config      .esd_auth  Music        .ssh
[aaron@LFCS-CentOS ~]$
```

Local GUI



Local text console

```
CentOS Stream 8
Kernel 4.18.0-338.el8.x86_64 on an x86_64

Activate the web console with: systemctl enable --now cockpit.socket

LFCS-CentOS login: aaron
Password:
Last login: Tue Oct 19 20:00:22 on tty2
[aaron@LFCS-CentOS ~]$ exit
```



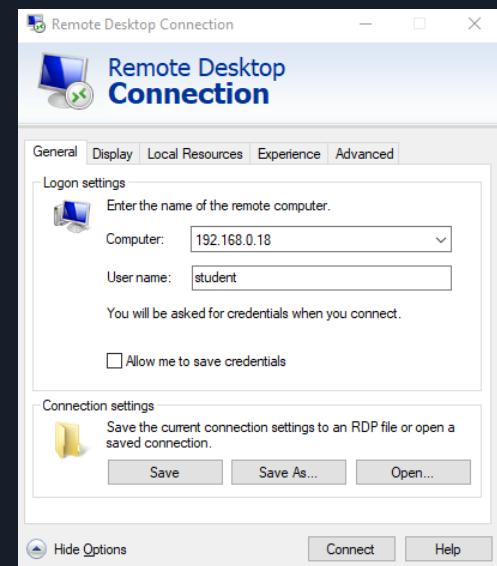
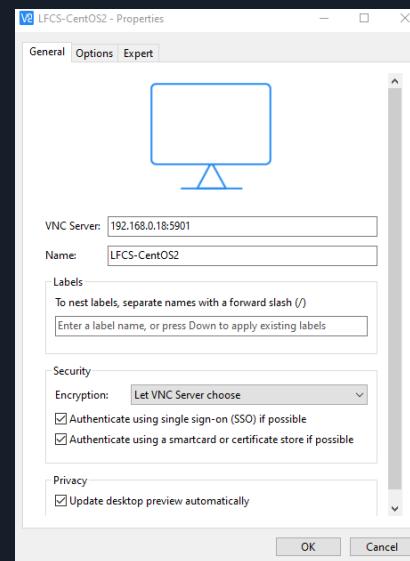
Remote GUI



VNC



RDP



Remote text-mode login



Secure **S**Hell



SSH login

>_

```
$ ip a
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group
default qlen 1000
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
        valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
        valid_lft forever preferred_lft forever
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state
UP group default qlen 1000
    link/ether 08:00:27:6b:d7:87 brd ff:ff:ff:ff:ff:ff
    inet [192.168.0.17]/24 brd 192.168.0.255 scope global dynamic
noprefixroute enp0s3
        valid_lft 1966sec preferred_lft 1966sec
    inet6 fe80::a00:27ff:fe6b:d787/64 scope link noprefixroute
```

Server

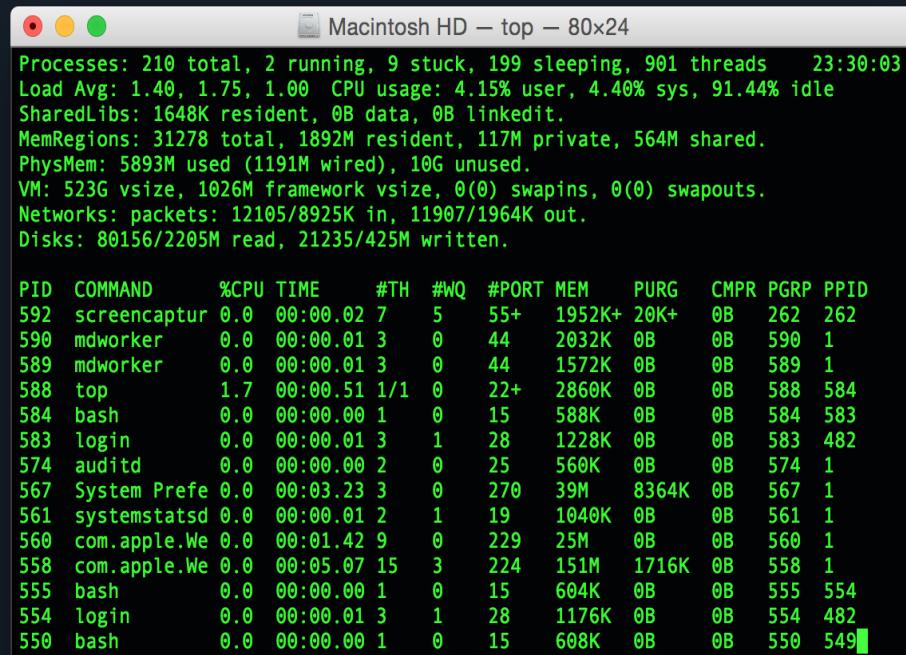


SSH daemon

SSH client

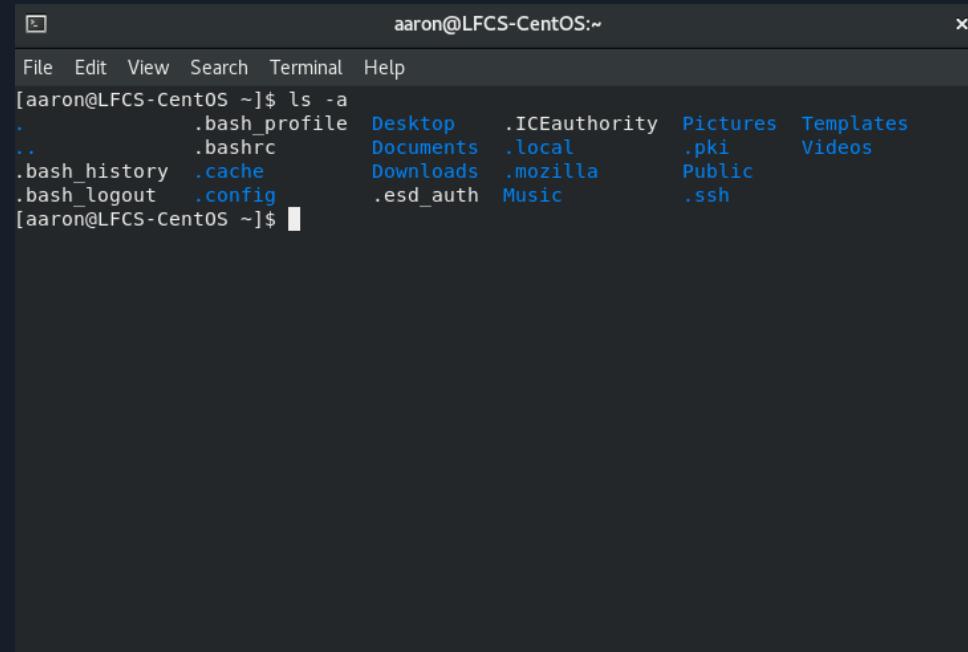
Computer

MacOS & Linux



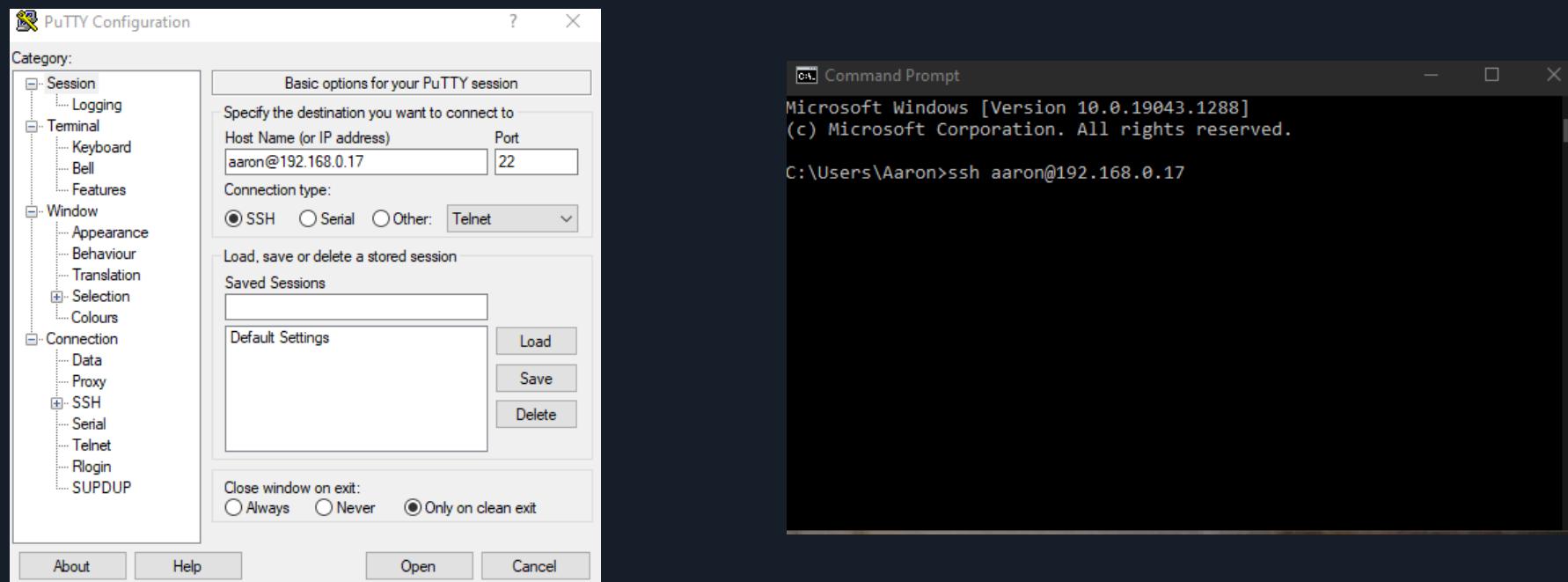
```
Macintosh HD — top — 80x24
Processes: 210 total, 2 running, 9 stuck, 199 sleeping, 901 threads 23:30:03
Load Avg: 1.40, 1.75, 1.00 CPU usage: 4.15% user, 4.40% sys, 91.44% idle
Sharedlibs: 1648K resident, 0B data, 0B linkedit.
MemRegions: 31278 total, 1892M resident, 117M private, 564M shared.
PhysMem: 5893M used (1191M wired), 10G unused.
VM: 523G vsize, 1026M framework vsize, 0(0) swapins, 0(0) swapouts.
Networks: packets: 12105/8925K in, 11907/1964K out.
Disks: 80156/2205M read, 21235/425M written.

PID COMMAND %CPU TIME #TH #WQ #PORT MEM PURG CMPR PGRP PPID
592 screencaptur 0.0 00:00.02 7 5 55+ 1952K+ 20K+ 0B 262 262
590 mdworker 0.0 00:00.01 3 0 44 2032K 0B 0B 590 1
589 mdworker 0.0 00:00.01 3 0 44 1572K 0B 0B 589 1
588 top 1.7 00:00.51 1/1 0 22+ 2860K 0B 0B 588 584
584 bash 0.0 00:00.00 1 0 15 588K 0B 0B 584 583
583 login 0.0 00:00.01 3 1 28 1228K 0B 0B 583 482
574 auditd 0.0 00:00.00 2 0 25 560K 0B 0B 574 1
567 System Prefe 0.0 00:03.23 3 0 270 39M 8364K 0B 567 1
561 systemstatsd 0.0 00:00.01 2 1 19 1040K 0B 0B 561 1
560 com.apple.We 0.0 00:01.42 9 0 229 25M 0B 0B 560 1
558 com.apple.We 0.0 00:05.07 15 3 224 151M 1716K 0B 558 1
555 bash 0.0 00:00.00 1 0 15 604K 0B 0B 555 554
554 login 0.0 00:00.01 3 1 28 1176K 0B 0B 554 482
550 bash 0.0 00:00.00 1 0 15 608K 0B 0B 550 549
```



```
aaron@LFCS-CentOS:~$ ls -a
. .bash_profile Desktop .ICEauthority Pictures Templates
.. .bashrc Documents .local .pki Videos
.bash_history .cache Downloads .mozilla Public
.bash_logout .config .esd_auth Music .ssh
[aaron@LFCS-CentOS ~]$ █
```

Windows



SSH

>_

```
$ ssh aaron@192.168.0.17
aaron@192.168.0.17's password:
Activate the web console with: systemctl enable --now cockpit.socket

Last login: Tue Oct 19 20:27:15 2021 from 192.168.0.3
[aaron@LFC5-CentOS ~]$
```

{KODE{LOUD

Read and Use System
Documentation



--help

>_

\$ ls --help

Usage: ls [OPTION]... [FILE]...
List information about the FILEs (the current directory by default).
Sort entries alphabetically if none of -cftuvSUX nor --sort is specified.

Mandatory arguments to long options are mandatory for short options too.

-a, --all	do not ignore entries starting with .
-A, --almost-all	do not list implied . and ..
-B, --ignore-backups	do not list implied entries ending with ~
-I, --ignore=PATTERN	do not list implied entries matching shell PATTERN
-k, --kibibytes	default to 1024-byte blocks for disk usage
-l	use a long listing format
-c	with -lt: sort by, and show, ctime (time of last modification of file status information); with -l: show ctime and sort by name; otherwise: sort by ctime, newest first

\$ ls -l

bin/	libexec/	sbin/
lib/	local/	share/

--help

>_

\$ journalctl --help

journalctl [OPTIONS...] [MATCHES...]

Query the journal.

Options:

--system	Show the system journal
--user	Show the user journal for the current user
-M --machine=CONTAINER	Operate on local container
-S --since=DATE	Show entries not older than the specified date
-U --until=DATE	Show entries not newer than the specified date
-c --cursor=CURSOR	Show entries starting at the specified cursor
--after-cursor=CURSOR	Show entries after the specified cursor
--show-cursor	Print the cursor after all the entries
-b --boot[=ID]	Show current boot or the specified boot
--list-boots	Show terse information about recorded boots

lines 1-27



PAGE
UP

PAGE
DOWN

q

Manual Pages With man Command

>_

```
$ man journalctl
```

EXAMPLES

Without arguments, all collected logs are shown unfiltered:

```
journalctl
```

With one match specified, all entries with a field matching the expression are shown:

```
journalctl _SYSTEMD_UNIT=avahi-daemon.service
```

If two different fields are matched, only entries matching both expressions at the same time are shown:

```
journalctl _SYSTEMD_UNIT=avahi-daemon.service _PID=28097
```

If two matches refer to the same field, all entries matching either expression are shown:

```
journalctl _SYSTEMD_UNIT=avahi-daemon.service _SYSTEMD_UNIT=dbus.service
```

If the separator "+" is used, two expressions may be combined in a logical OR. The following will show all messages from the Avahi service process with the PID 28097 plus all messages from the D-Bus service (from any of its processes):

```
journalctl _SYSTEMD_UNIT=avahi-daemon.service _PID=28097 + _SYSTEMD_UNIT=dbus.service
```

Manual Pages With `man` Command

>_

```
$ man man
```

The table below shows the section numbers of the manual followed by the types of pages they contain.

- | | |
|---|---|
| 1 | Executable programs or shell commands |
| 2 | System calls (functions provided by the kernel) |
| 3 | Library calls (functions within program libraries) |
| 4 | Special files (usually found in /dev) |
| 5 | File formats and conventions eg /etc/passwd |
| 6 | Games |
| 7 | Miscellaneous (including macro packages and conventions), e.g. man(7), groff(7) |
| 8 | System administration commands (usually only for root) |
| 9 | Kernel routines [Non standard] |

```
$ man 1 printf
```

```
$ man 3 printf
```

Searching For Commands -
apropos

>_

```
$ apropos director
```

directory directories

```
$ apropos director
```

director: nothing appropriate

```
$ sudo mandb
```

```
$ apropos director
```

ls (1)	- list directory contents
ls (1p)	- list directory contents
mcd (1)	- change MSDOS directory
mdeltree (1)	- recursively delete an MSDOS
directory and its contents	
mdir (1)	- display an MSDOS directory
mdu (1)	- display the amount of space
occupied by an MSDOS direc...	
mkdir (1)	- make directories
mkdir (1p)	- make directories
mkdir (2)	- create a directory
mkdir (3p)	- make a directory relative to
directory file descriptor	
mkdirat (2)	- create a directory

Searching For Commands -
apropos

>_

\$ apropos director

```
ls (1)           - list directory contents
ls (1p)          - list directory contents
mcd (1)          - change MSDOS directory
mdeltree (1)     - recursively delete an MSDOS
directory and its contents
mdir (1)          - display an MSDOS directory
mdu (1)          - display the amount of space
occupied by an MSDOS direc...
mkdir (1)         - make directories
mkdir (1p)        - make directories
mkdir (2)         - create a directory
mkdir (3p)        - make a directory relative to
directory file descriptor
mkdirat (2)       - create a directory
```

\$ apropos -s 1,8 director

```
ls (1)           - list directory contents
mcd (1)          - change MSDOS directory
mdeltree (1)     - recursively delete an MSDOS
directory and its contents
mdir (1)          - display an MSDOS directory
mdu (1)          - display the amount of space
occupied by an MSDOS direc...
mkdir (1)         - make directories
```

Sections 1 and 8

>_

```
$ systemctl
```

```
add-requires      emergency
add-wants        enable
cancel           exit
cat              force-reload
condreload       get-default
condrestart      halt
condstop         help
```

```
isolate          is-system-running
kexec            kill
link              list-dependencies
list-jobs         rescue
```

```
poweroff         preset
reboot           reenable
reload           reload-or-restart
```

```
show             show-environment
start            status
stop             suspend
switch-root
```

TAB

TAB

TAB

```
$ systemctl list-dependencies
```

TAB

TAB: Suggest and Autocomplete

>_

```
$ ls /usr/  
bin/          libexec/      sbin/  
lib/          local/        share/
```

TAB

TAB

TAB

{KODE{LOUD

Working With Files and Directories



Listing Files and Directories

>_

```
$ ls
```

Pictures	Desktop
Documents	Videos
Downloads	Music

```
ls list
```

```
$ ls -a
```

.
..
.ssh
.bash_logout
.bash_profile
.bashrc
Pictures
Desktop
Downloads

```
-a all
```

Documents
Music

Videos

Listing Files and Directories

>_

```
$ ls -l /var/log/
total 4064
[drwxr-xr-x.] 2 [root] [root] 4096 [Oct 18 22:52] anaconda
drwx-----. 2 root root 23 Oct 18 22:53 audit
-rw-----. 1 root root 19524 Nov 1 17:56 boot.log
-rw-rw----. 1 root utmp 0 Nov 1 14:08 btmp
-rw-rw----. 1 root utmp 0 Oct 18 22:38 btmp-20211101
drwxr-x---. 2 chrony chrony 6 Jun 24 09:21 chrony
-rw-----. 1 root root 9794 Nov 1 18:01 cron
-rw-----. 1 root root 10682 Oct 26 14:01 cron-20211026
drwxr-xr-x. 2 lp sys 135 Oct 26 14:13 cups
-rw-r--r--. 1 root root 35681 Nov 1 18:13 dnf.rpm.log
-rw-r-----. 1 root root 4650 Nov 1 17:56 firewalld
drwx--x--x. 2 root gdm 6 Oct 19 00:07 gdm
drwxr-xr-x. 2 root root 6 Aug 31 12:07 glusterfs
```

Listing Files and Directories

>_

```
$ ls -a -l ➔ $ ls -al
total 76
drwx----- 16 aaron aaron 4096 Nov  1 17:57 .
drwxr-xr-x.  7 root  root   70 Oct 26 16:54 ..
-rw-----  1 aaron aaron 5085 Nov  1 17:56 .bash_history
-rw-r--r--  1 aaron aaron   18 Jul 27 09:21 .bash_logout
-rw-r--r--  1 aaron aaron  141 Jul 27 09:21 .bash_profile
-rw-r--r--  1 aaron aaron  376 Jul 27 09:21 .bashrc
drwxr-xr-x.  2 aaron aaron    6 Oct 19 00:11 Desktop
drwxr-xr-x.  3 aaron aaron  25 Oct 23 18:15 Documents
drwxr-xr-x.  2 aaron aaron    6 Oct 19 00:11 Downloads
drwxr-xr-x.  2 aaron aaron    6 Oct 19 00:11 Music
drwxr-xr-x.  2 aaron aaron  28 Oct 26 13:37 Pictures
-rw-rw-r--  1 aaron aaron  36 Oct 28 20:06 testfile
```

Listing Files and Directories

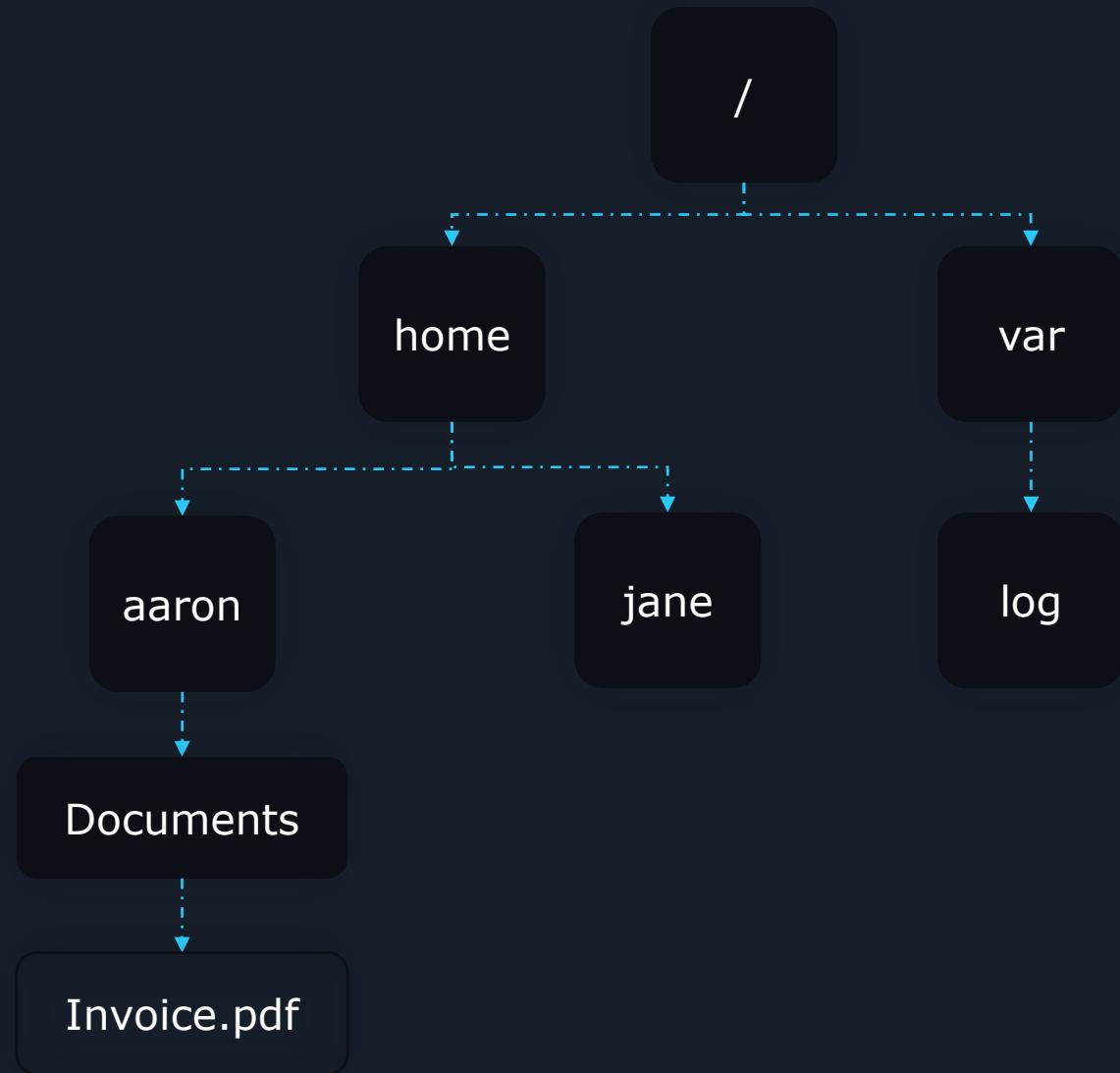
>_

```
$ ls -alh
```

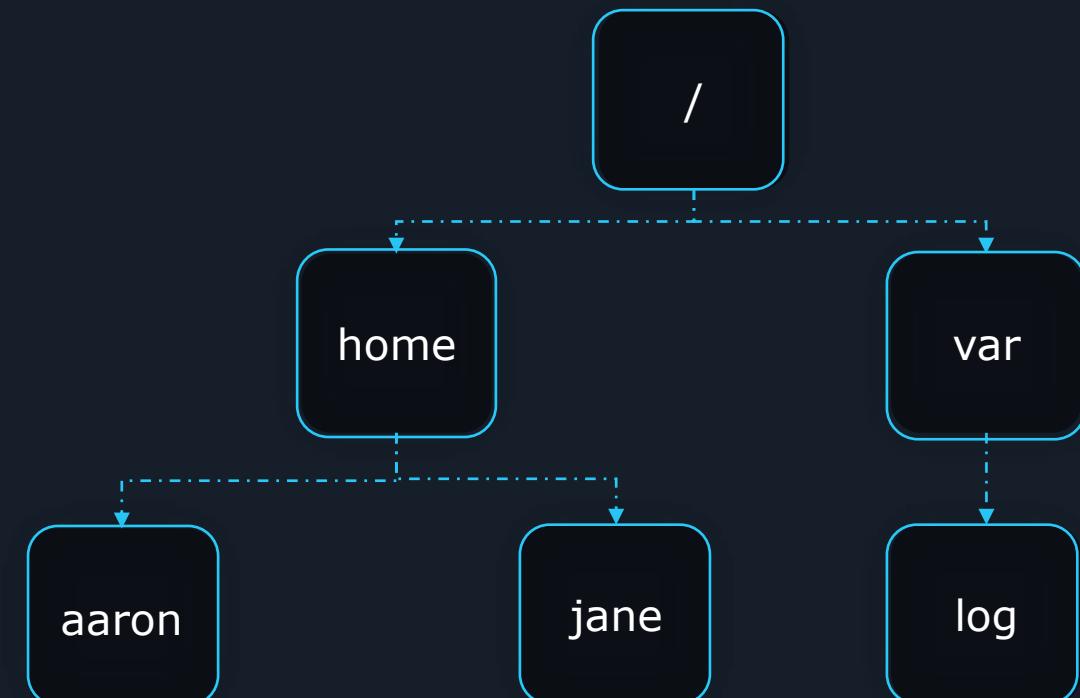
```
total 76K
drwx----- 16 aaron aaron 4.0K Nov  1 17:57 .
drwxr-xr-x.  7 root  root   70 Oct 26 16:54 ..
-rw-----  1 aaron aaron 5.0K Nov  1 17:56 .bash_history
-rw-r--r--  1 aaron aaron   18 Jul 27 09:21 .bash_logout
-rw-r--r--  1 aaron aaron 141 Jul 27 09:21 .bash_profile
-rw-r--r--  1 aaron aaron 376 Jul 27 09:21 .bashrc
drwxr-xr-x.  2 aaron aaron    6 Oct 19 00:11 Desktop
drwxr-xr-x.  3 aaron aaron  25 Oct 23 18:15 Documents
drwxr-xr-x.  2 aaron aaron    6 Oct 19 00:11 Downloads
drwxr-xr-x.  2 aaron aaron    6 Oct 19 00:11 Music
drwxr-xr-x.  2 aaron aaron  28 Oct 26 13:37 Pictures
-rw-rw-r--  1 aaron aaron   36 Oct 28 20:06 testfile
```

-h human readable format

Filesystem Tree



Filesystem Tree



directory path

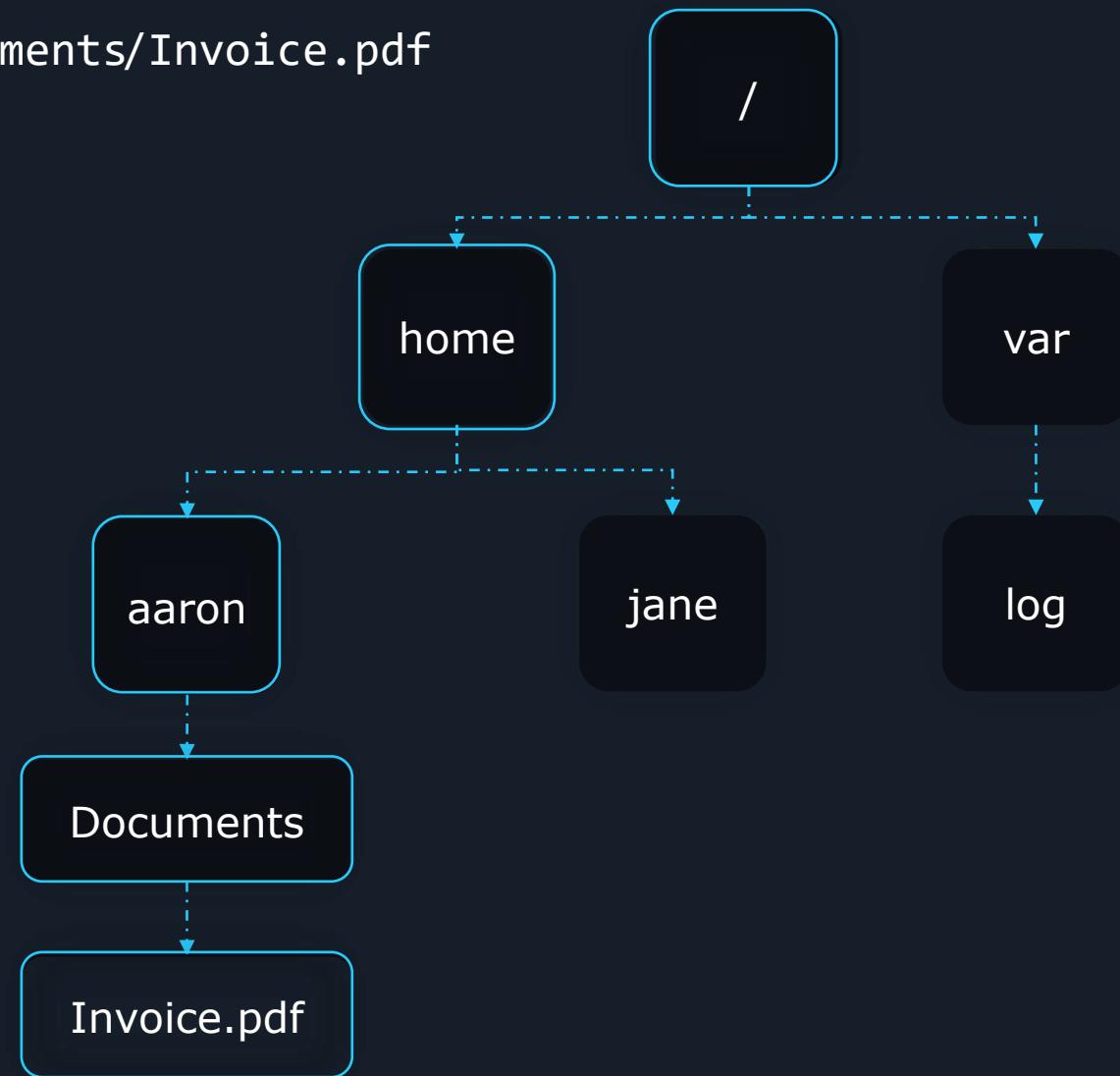
Documents

file path

Invoice.pdf

Absolute Path

/home/aaron/Documents/Invoice.pdf

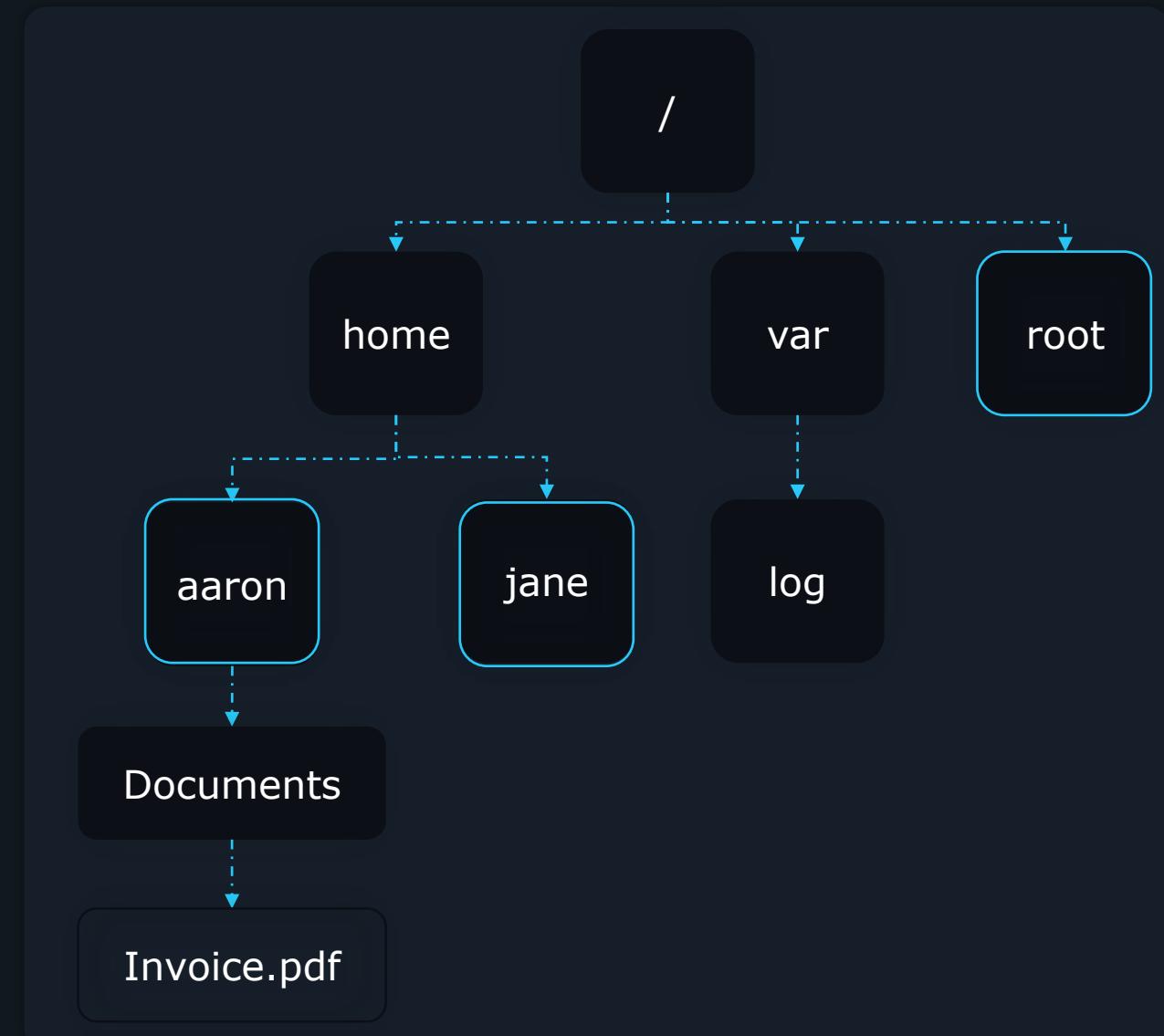


Current / Working Directory

>_

```
$ pwd  
/root
```

```
print working directory
```



Current / Working Directory

>_

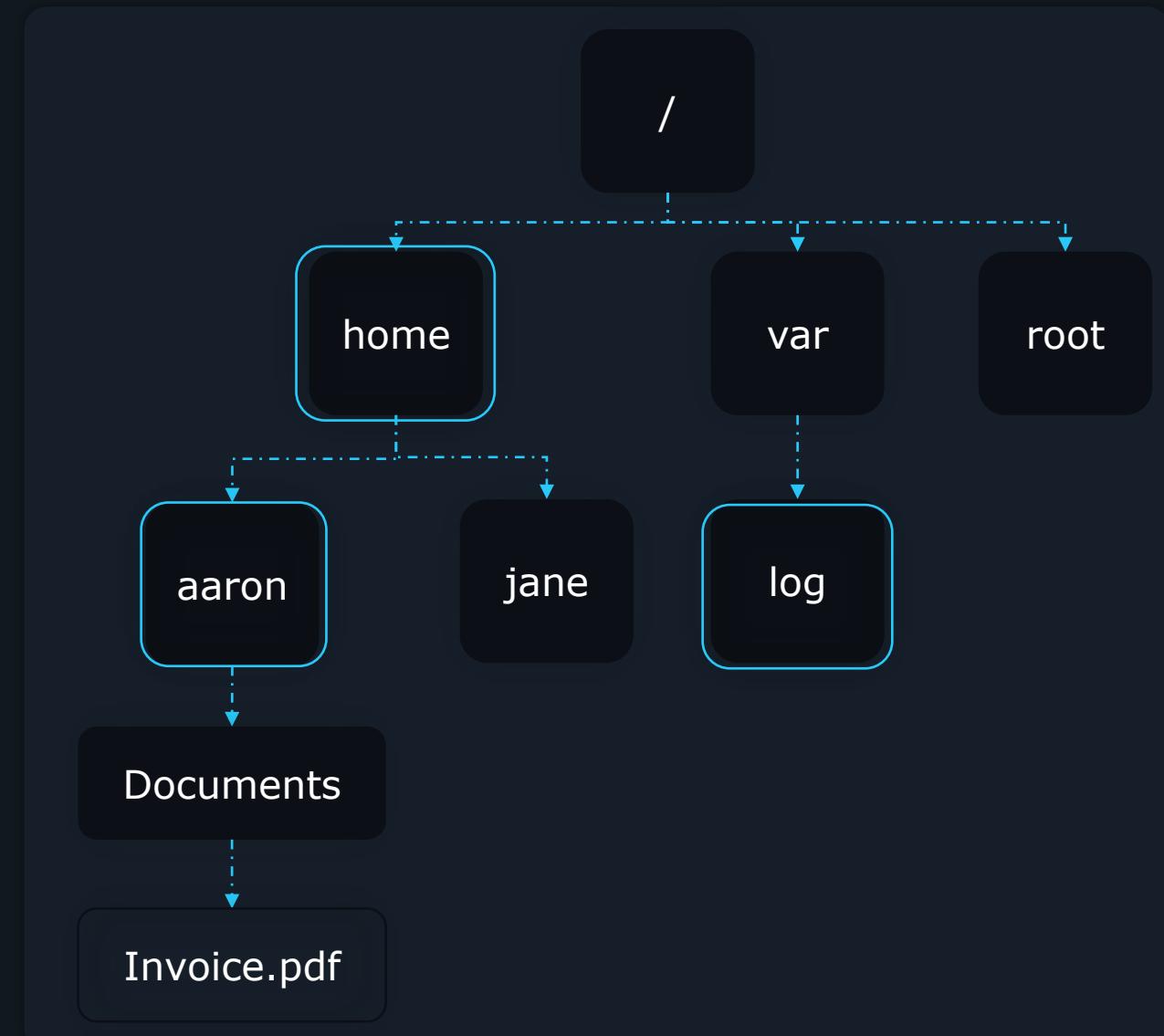
```
$ cd /var/log
```

change directory

```
$ cd /home/aaron
```

```
$ cd ..
```

.. = parent directory



Relative Path

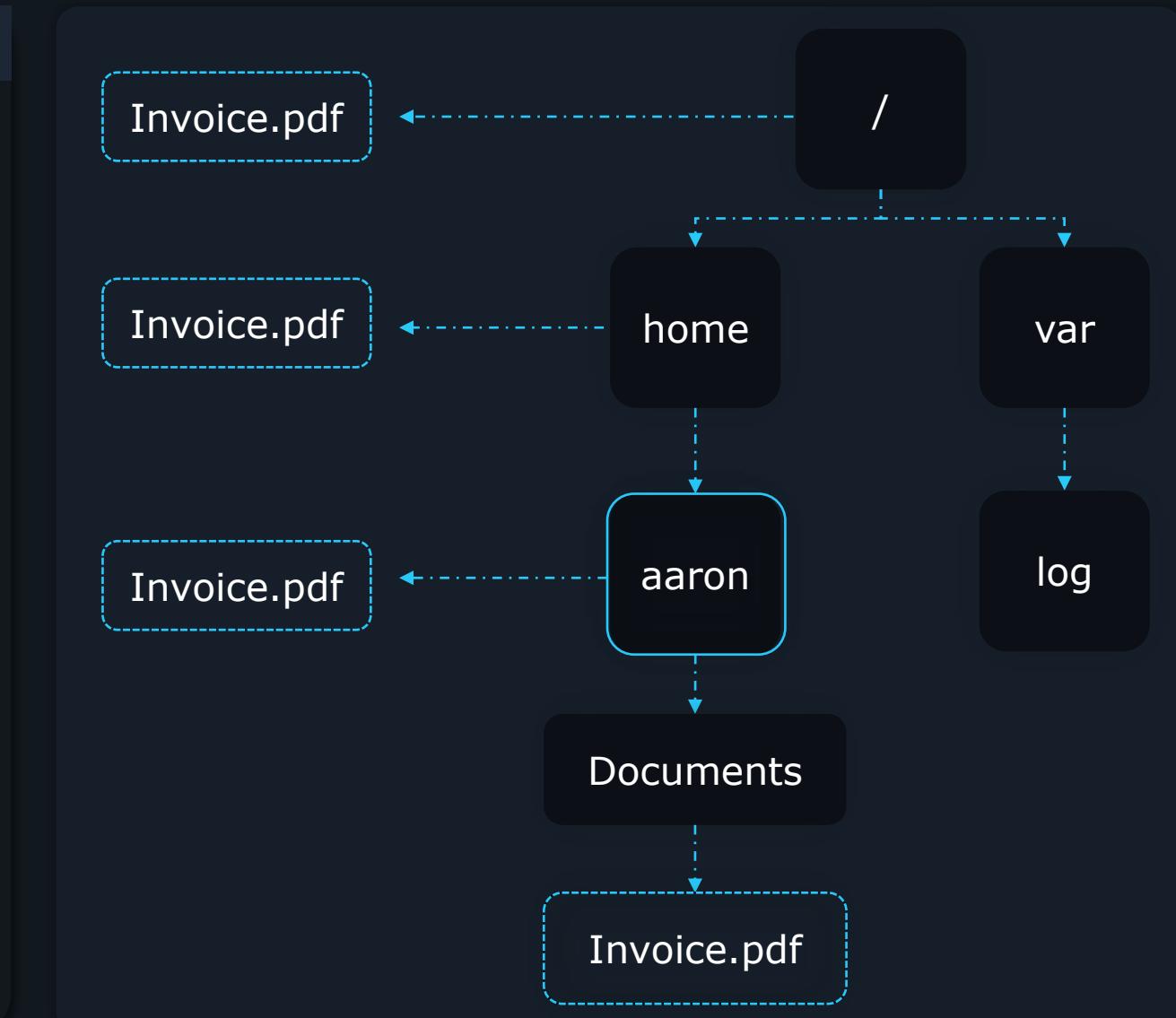
>_

\$ Documents/Invoice.pdf

\$ Invoice.pdf

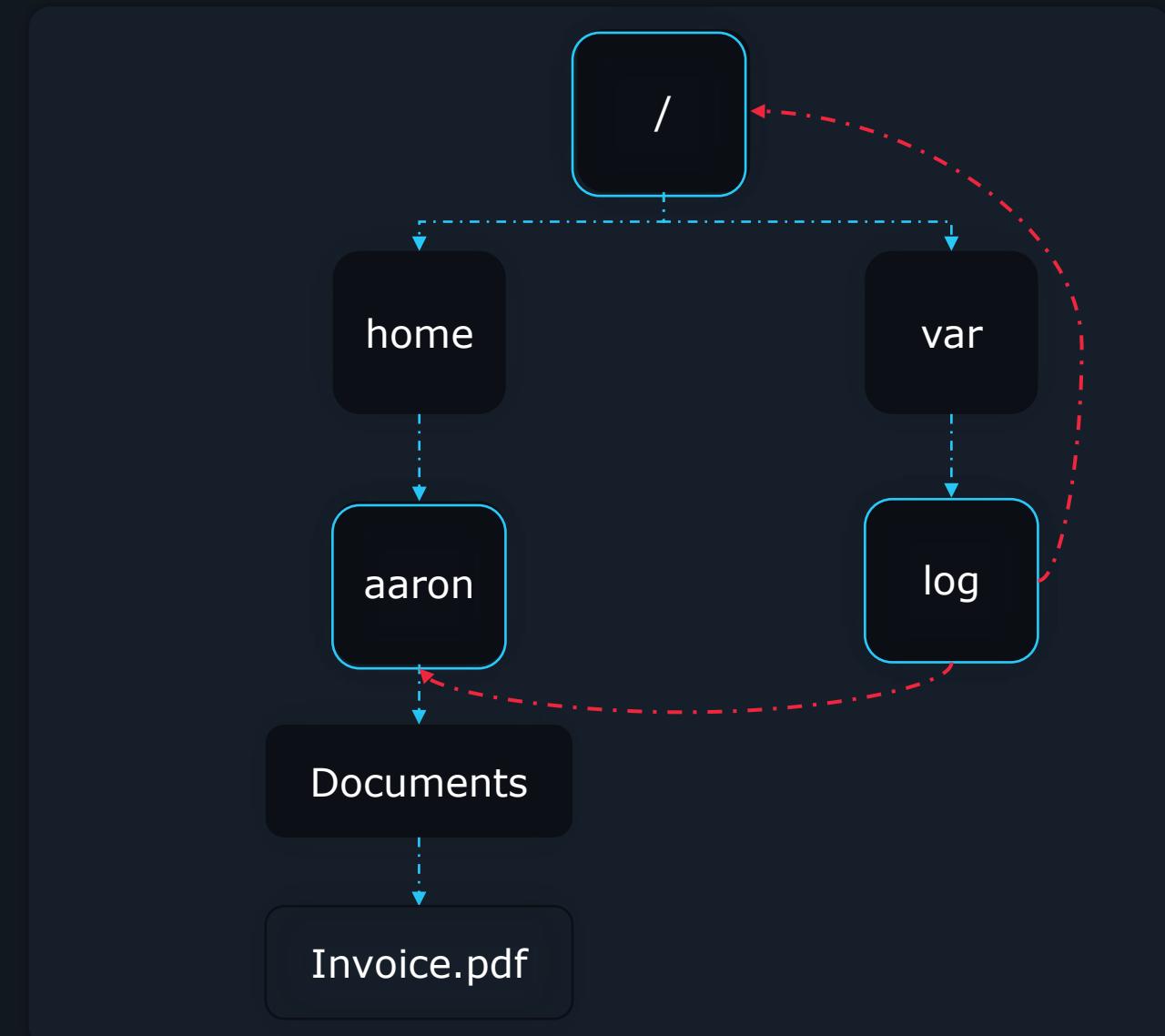
\$../../Invoice.pdf

\$../../..Invoice.pdf



Current / Working Directory

```
>_  
$ cd /      # Go to root directory  
  
$ cd -      # Go to previous directory  
  
$ cd       # Go to home directory
```



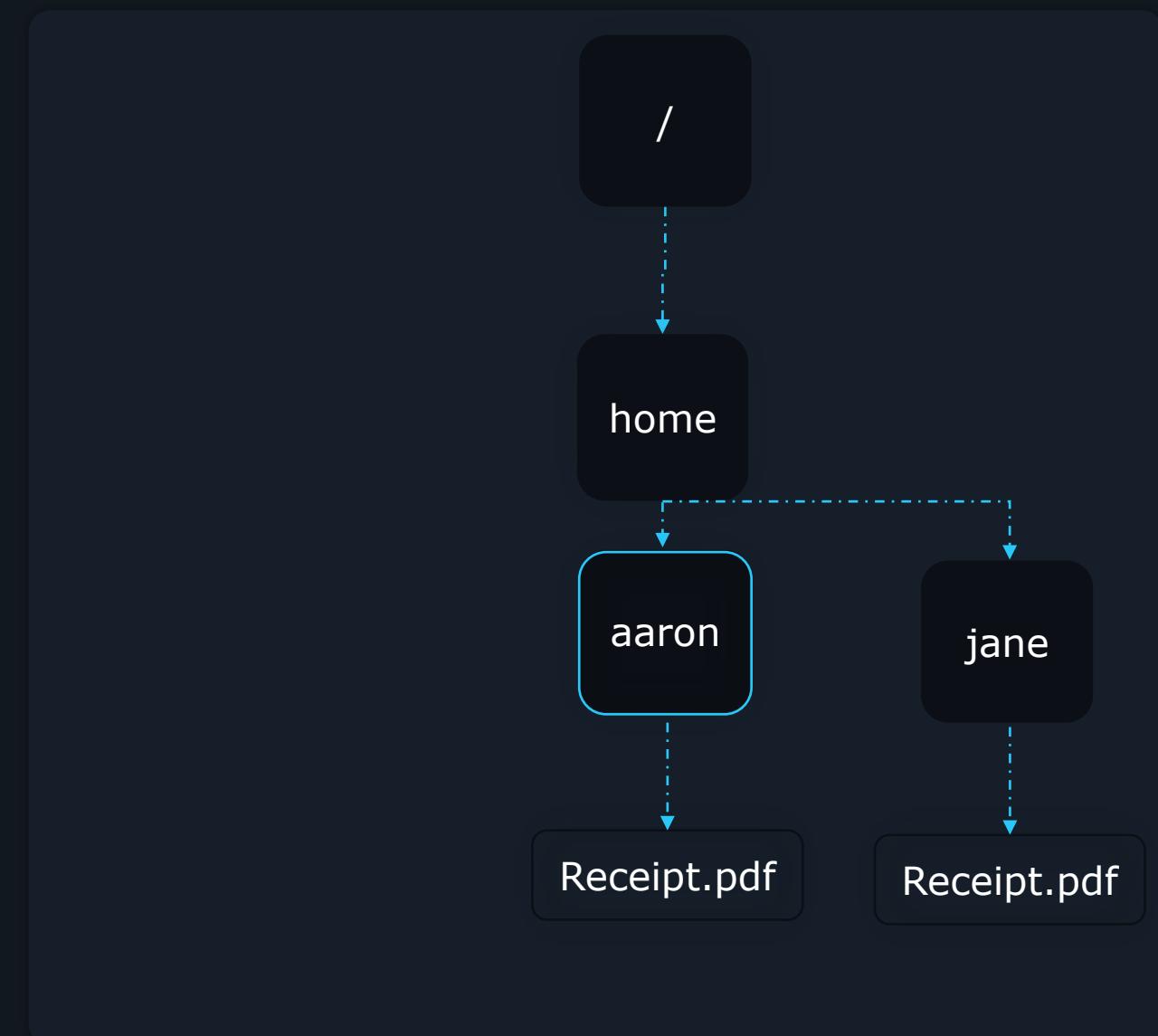
Creating Files

>_

```
$ touch Receipt.pdf
```

```
$ touch /home/jane/Receipt.pdf
```

```
$ touch ../jane/Receipt.pdf
```

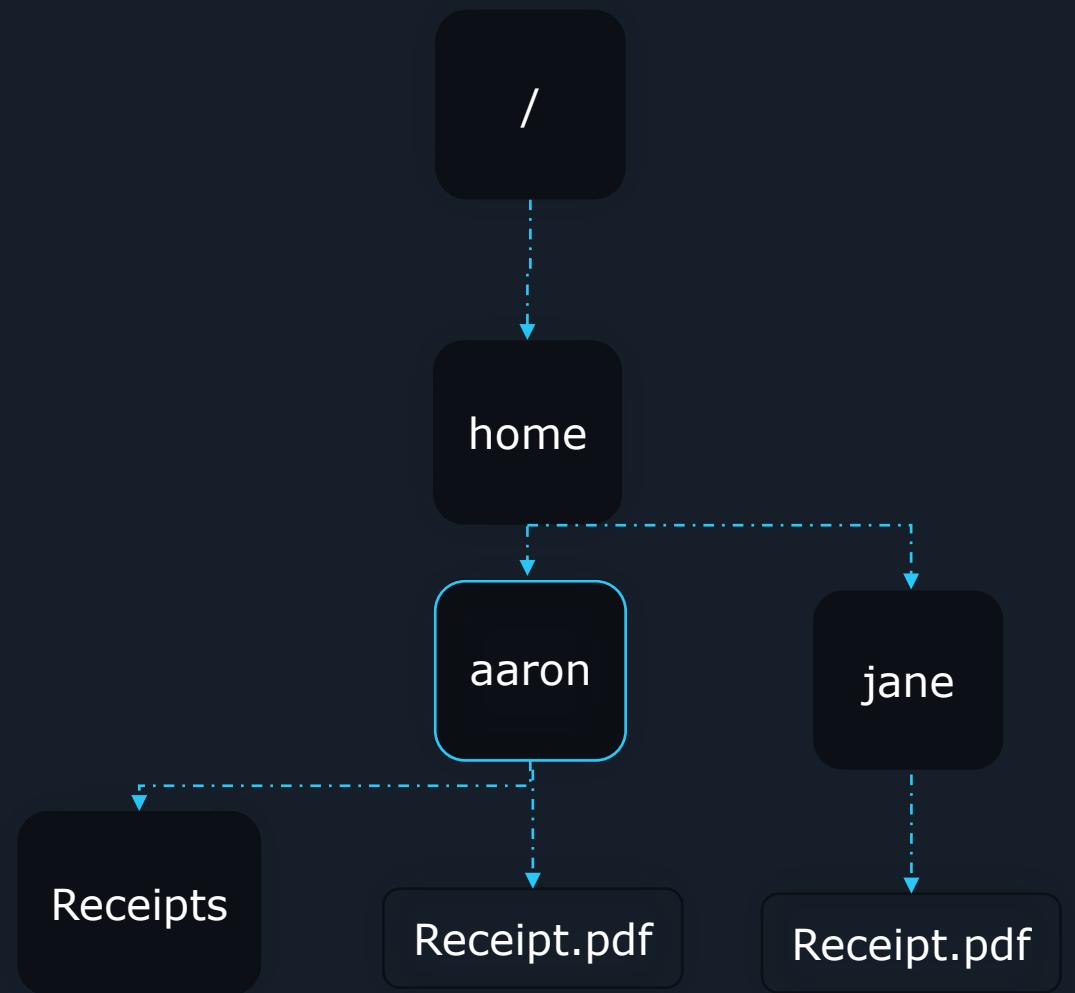


Creating Directories

>_

```
$ mkdir Receipts
```

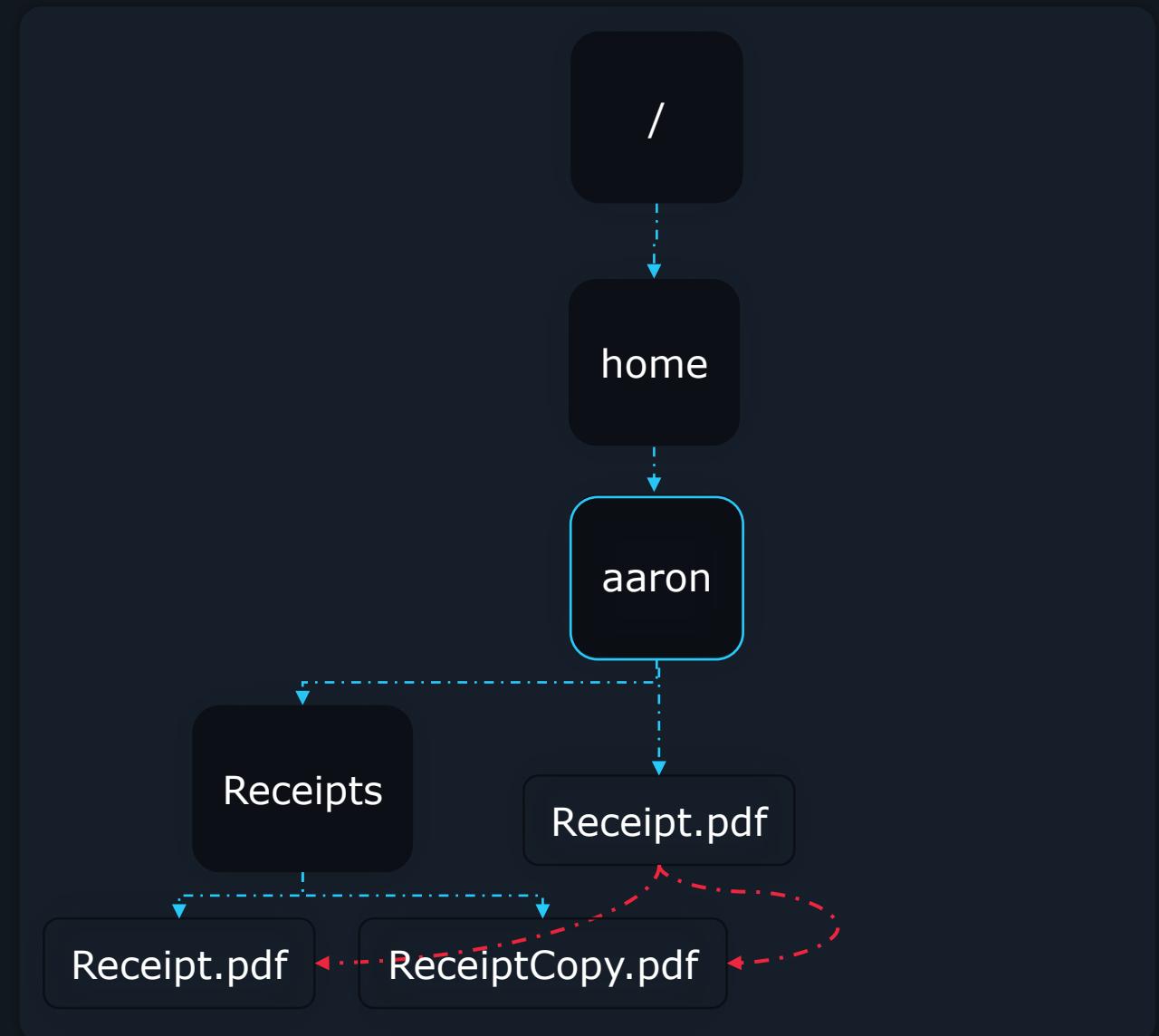
make directory



Copying Files

>_

```
# cp [source] [destination] copy  
  
$ cp Receipt.pdf Receipts/  
  
$ cp Receipt.pdf Receipts  
  
$ cp Receipt.pdf Receipts/ ReceiptCopy.pdf
```

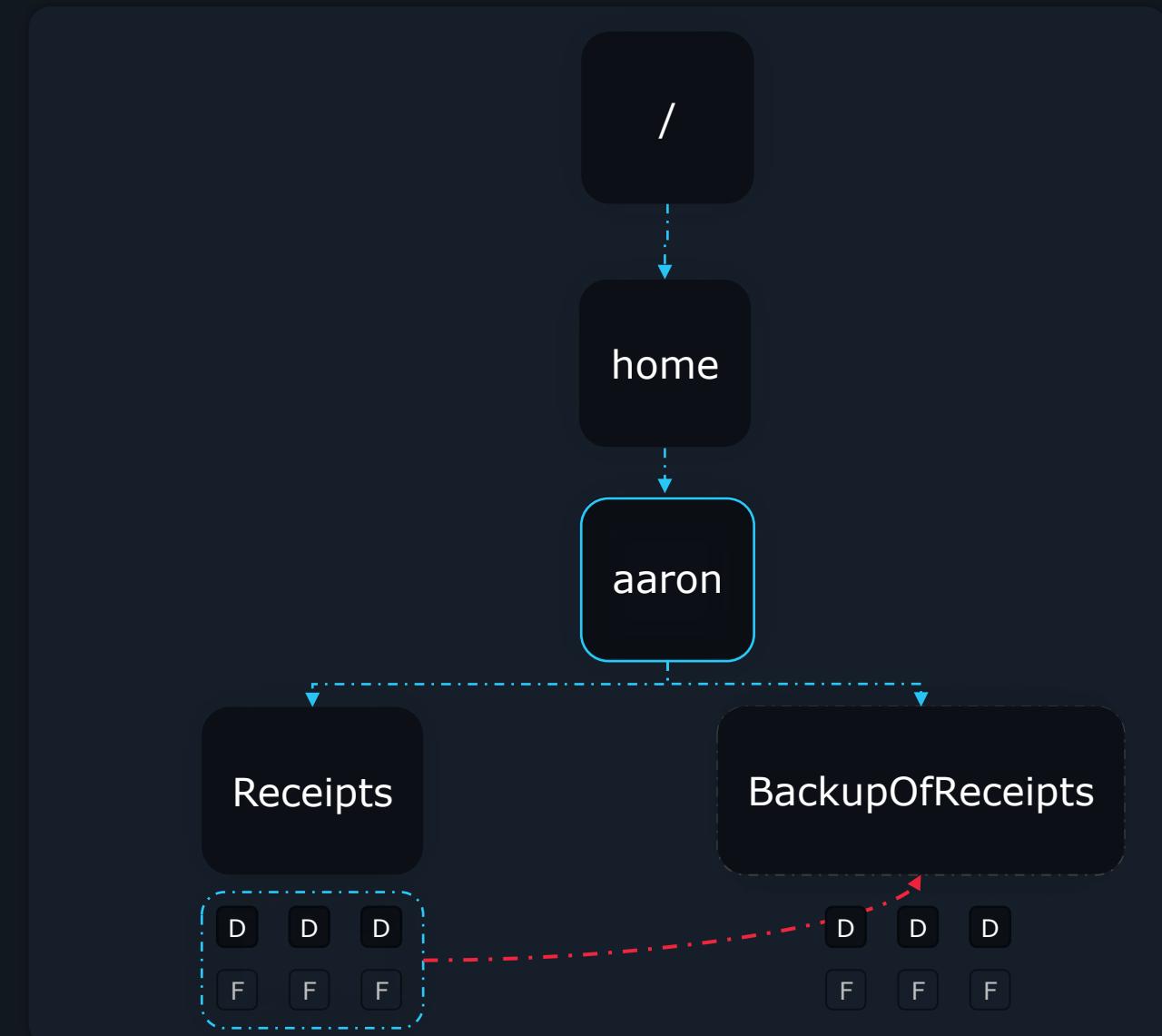


Copying Directories

>_

```
# cp -r [source] [dest] recursive
```

```
$ cp -r Receipts/ BackupOfReceipts/
```

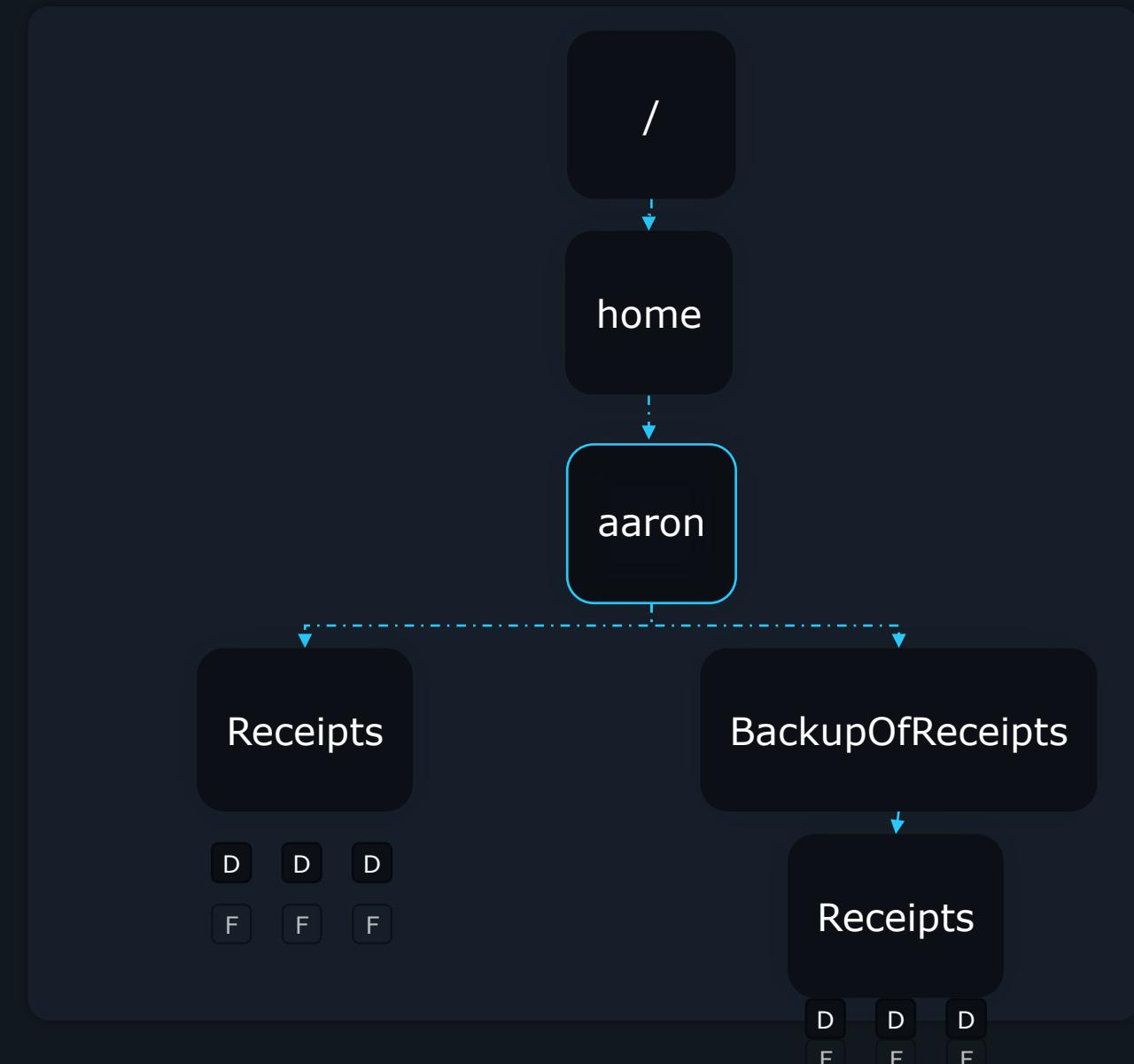


Copying Directories

>_

```
# cp -r [source] [dest] recursive
```

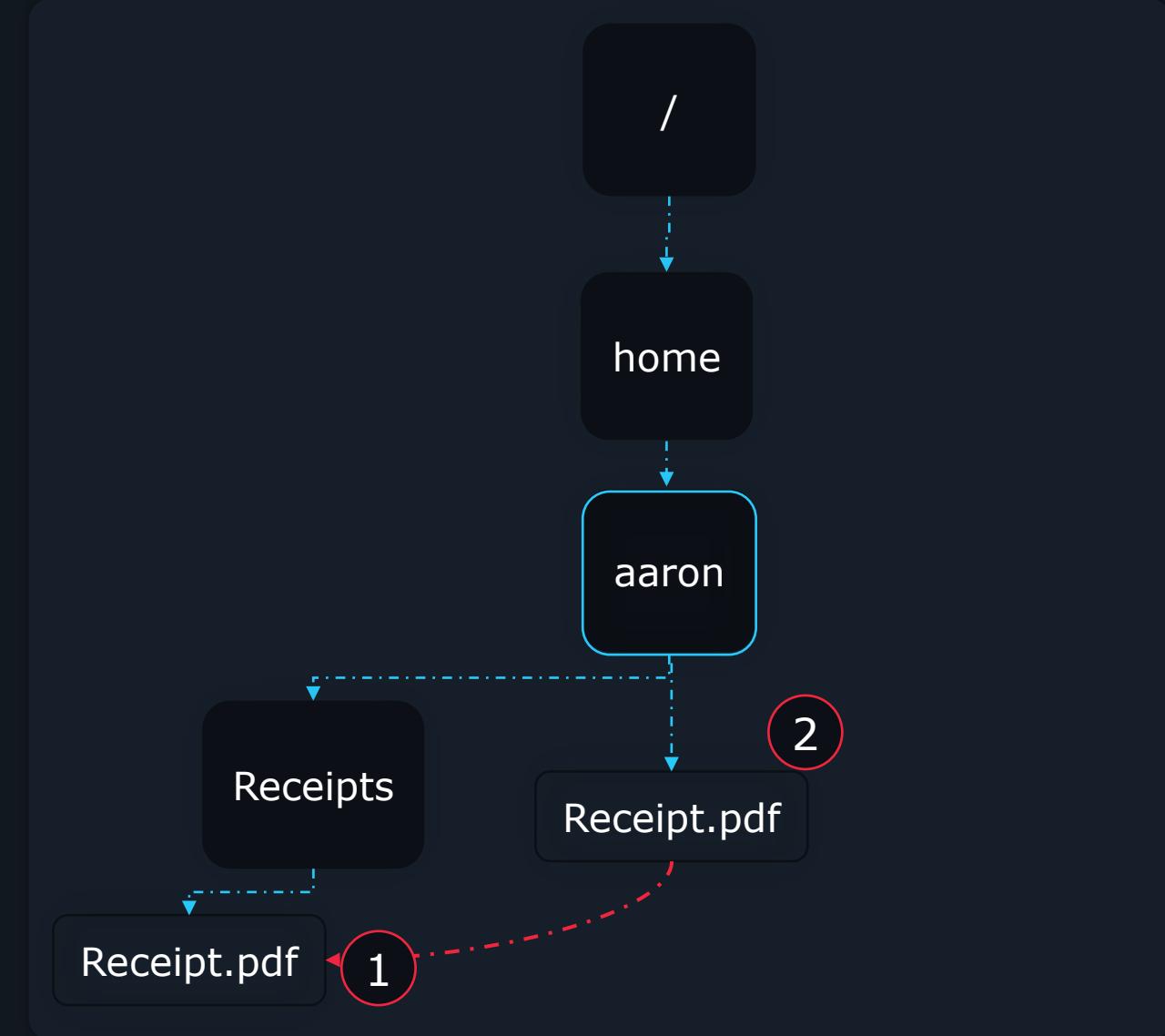
```
$ cp -r Receipts/ BackupOfReceipts/
```



Moving Files

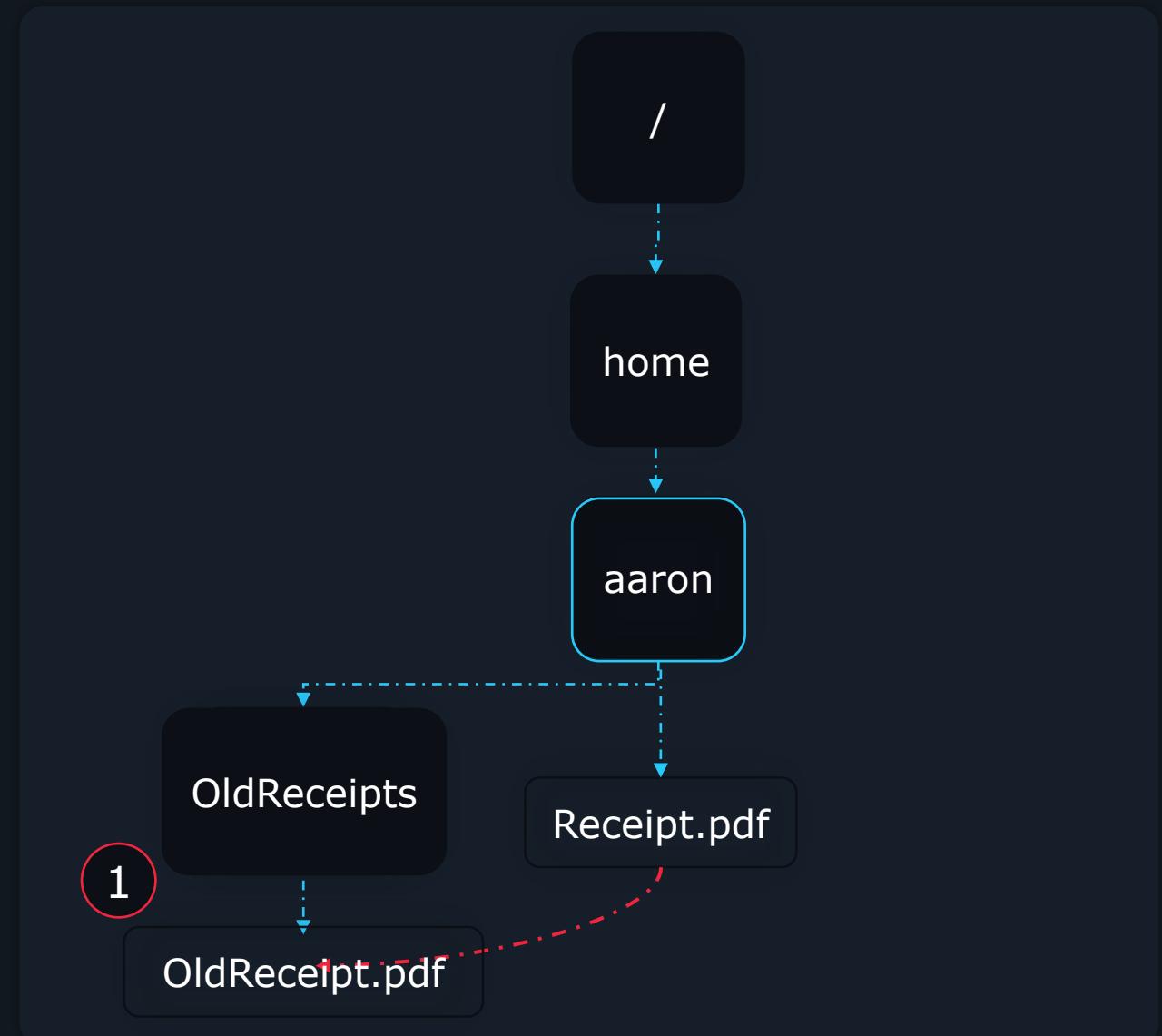
>_

```
$ cp Receipt.pdf Receipts/
```



Moving Files

```
>_  
# mv [source] [dest] move  
  
$ mv Receipt.pdf Receipts/  
  
$ mv Receipt.pdf OldReceipt.pdf  
  
$ mv Receipts/ OldReceipts/
```



Deleting Files and Directories

>_

rm

remove

\$ rm Invoice.pdf

\$ rm -r Invoices/



{KODE{LOUD

Create and Manage Hard Links



Inodes

>_

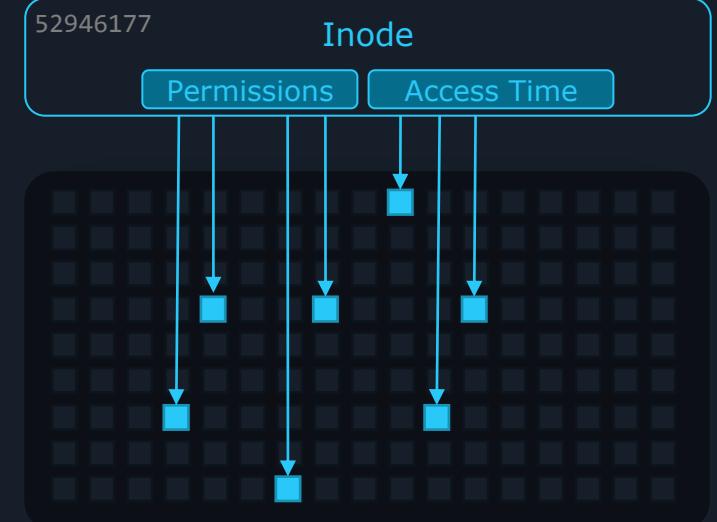
```
$ echo "Picture of Milo the dog" > Pictures/family_dog.jpg
```

```
$ stat Pictures/family_dog.jpg
```

```
File: Pictures/family_dog.jpg
  Size: 49          Blocks: 8          IO Block: 4096   regular file
Device: fd00h/64768d [Inode: 52946177]  Links: 1
Access: (0640/-rw-r----) Uid: ( 1000/    aaron)  Gid: ( 1005/  family)
Context: unconfined_u:object_r:user_home_t:s0
Access: 2021-10-27 16:33:18.949749912 -0500
Modify: 2021-10-27 14:41:19.207278881 -0500
Change: 2021-10-27 16:33:18.851749919 -0500
Birth: 2021-10-26 13:37:17.980969655 -0500
```



family_dog.jpg



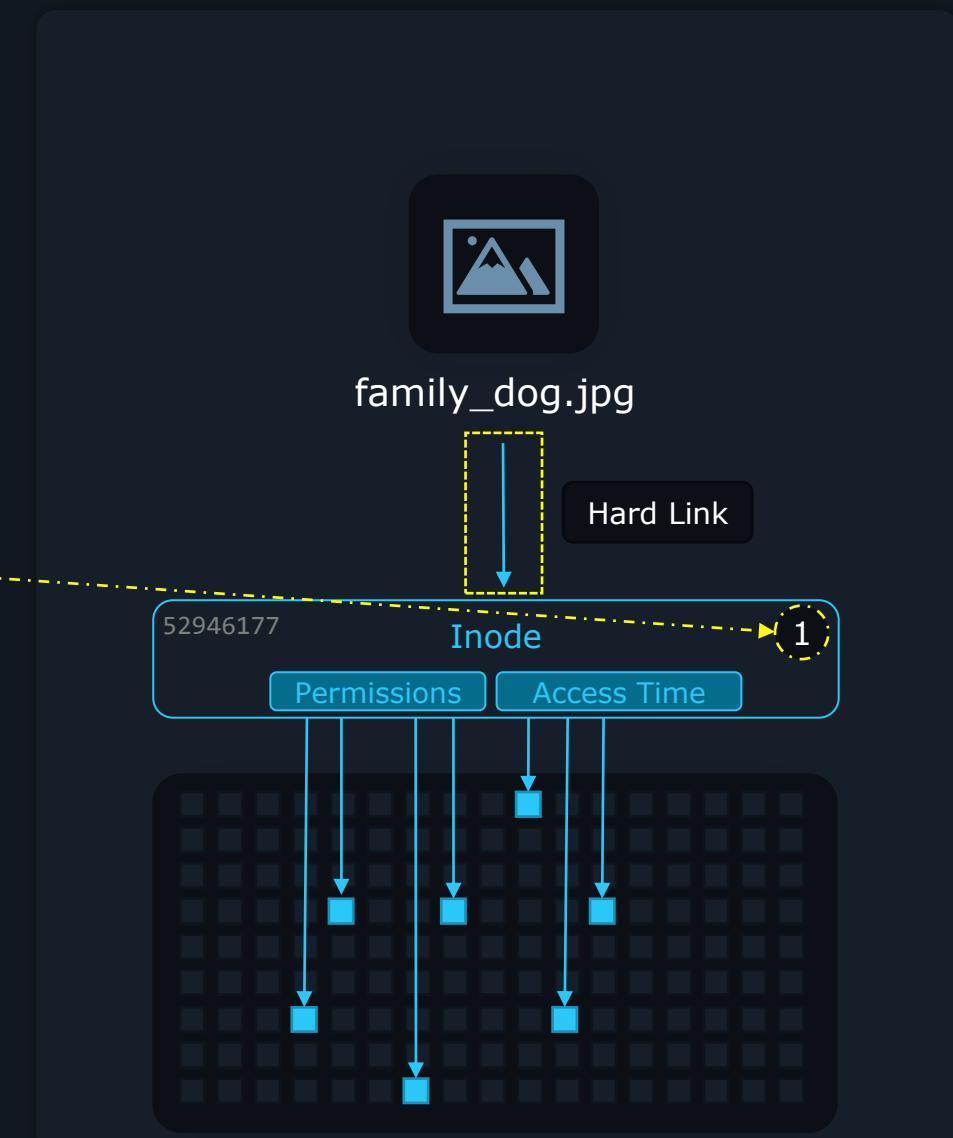
Hard Links

>_

```
$ echo "Picture of Milo the dog" > Pictures/family_dog.jpg
```

```
$ stat Pictures/family_dog.jpg
```

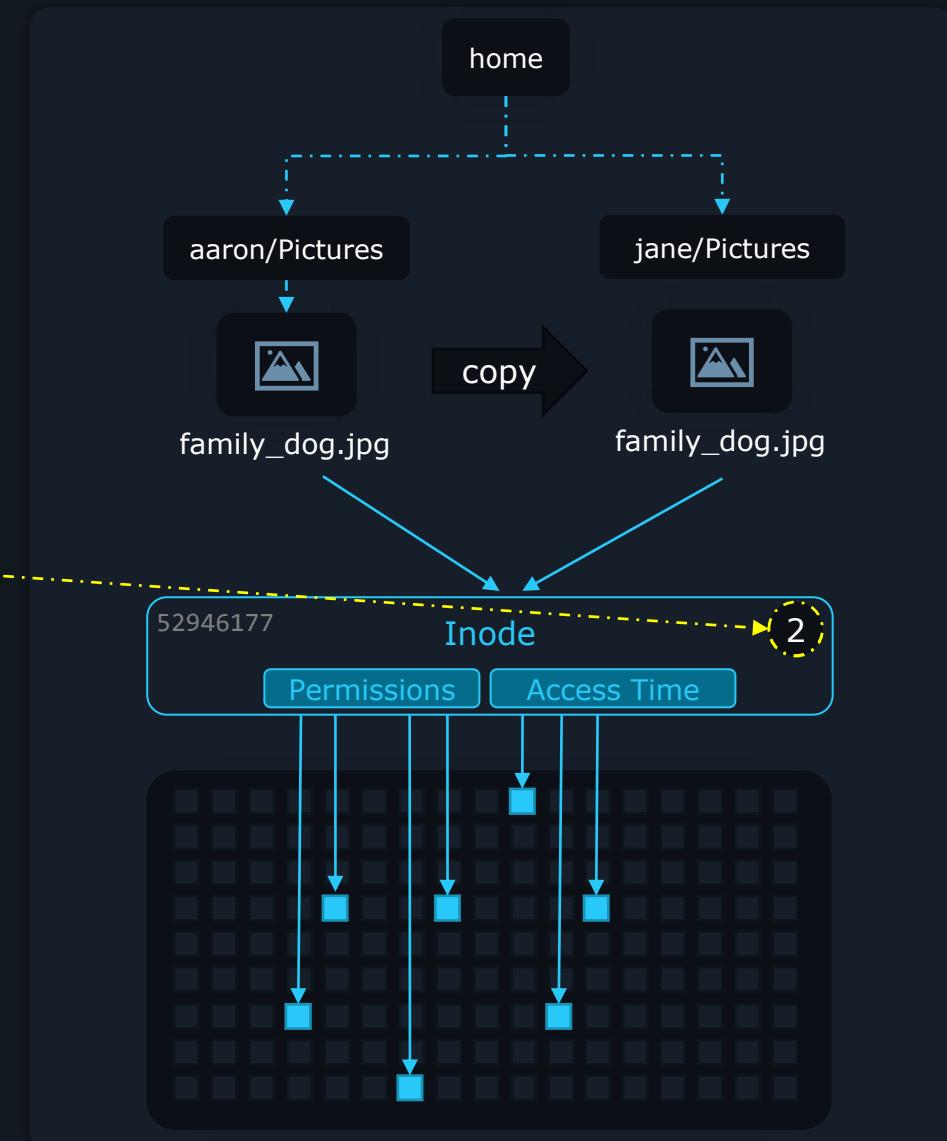
```
File: Pictures/family_dog.jpg
  Size: 49          Blocks: 8          IO Block: 4096   regular file
Device: fd00h/64768d  Inode: 52946177  Links: 1
Access: (0640/-rw-r----) Uid: ( 1000/    aaron)  Gid: ( 1005/    family)
Context: unconfined_u:object_r:user_home_t:s0
Access: 2021-10-27 16:33:18.949749912 -0500
Modify: 2021-10-27 14:41:19.207278881 -0500
Change: 2021-10-27 16:33:18.851749919 -0500
Birth: 2021-10-26 13:37:17.980969655 -0500
```



Hard Links

>_

```
$ cp -r /home/aaron/Pictures/ /home/jane/Pictures/  
# ln path_to_target_file path_to_link_file  
$ ln /home/aaron/Pictures/family_dog.jpg /home/jane/Pictures/family_dog.jpg  
  
$ stat Pictures/family_dog.jpg  
File: Pictures/family_dog.jpg  
  Size: 49          Blocks: 8          IO Block: 4096   regular file  
Device: fd00h/64768d  Inode: 52946177  [Links: 2]  
Access: (0640/-rw-r----) Uid: ( 1000/  aaron)  Gid: ( 1005/  family)  
Context: unconfined_u:object_r:user_home_t:s0  
Access: 2021-10-27 16:33:18.949749912 -0500  
Modify: 2021-10-27 14:41:19.207278881 -0500  
Change: 2021-10-27 16:33:18.851749919 -0500  
Birth: 2021-10-26 13:37:17.980969655 -0500  
  
$ rm /home/aaron/Pictures/family_dog.jpg  
$ rm /home/jane/Pictures/family_dog.jpg
```



Limitations and Considerations

>_

```
$ useradd -a -G family aaron  
$ useradd -a -G family jane  
$ chmod 660 /home/aaron/Pictures/family_dog.jpg
```

Only hardlink to files, not folders



Only hardlink to files on the same filesystem



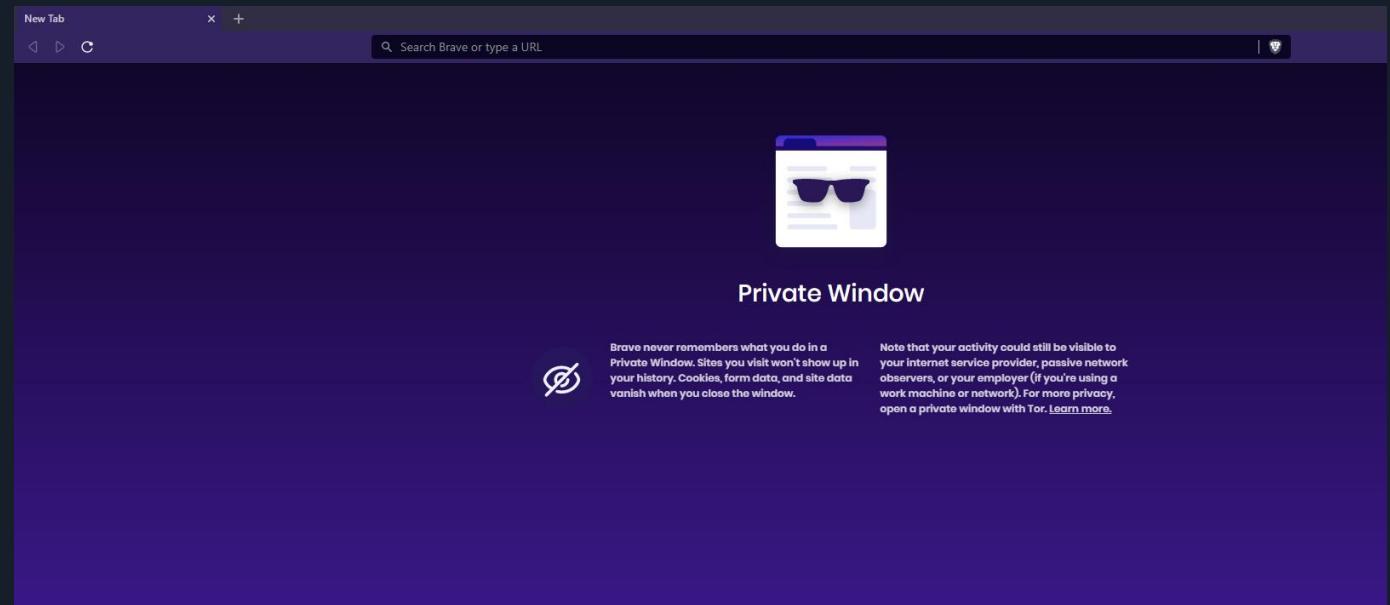
/home/aaron/file /mnt/Backups/file

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Create and Manage Soft Links



Soft Links

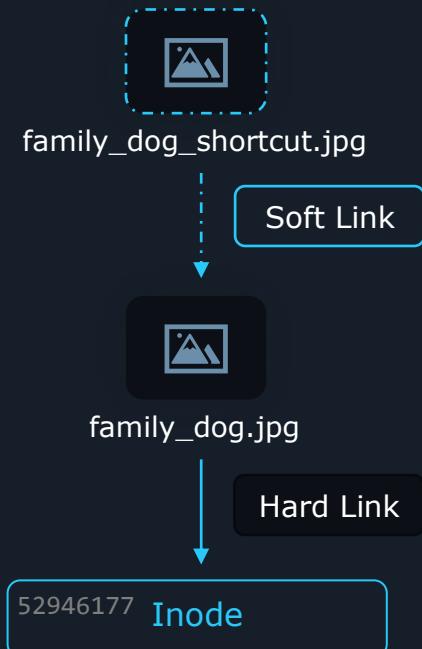


C:\Program Files\MyCoolApp\application.exe

Soft Links

>_

```
# ln -s path_to_target_file path_to_link_file
$ ln -s /home/aaron/Pictures/family_dog.jpg family_dog_shortcut.jpg
$ ls -l
lrwxrwxrwx. 1 aaron aaron family_dog_shortcut.jpg -> /home/aaron/Pictures..
$ readlink family_dog_shortcut.jpg
/home/aaron/Pictures/family_dog.jpg
$ echo "Test" >> fstab_shortcut
bash: fstab_shortcut: Permission denied
$ ls -l
lrwxrwxrwx. 1 aaron aaron family_dog_shortcut.jpg -> /home/aaron/Pictures..
[/home/aaron]$ ln -s Pictures/family_dog.jpg relative_picture_shortcut
```



Soft Links

>_

Softlink to files and folders



Softlink to files on different filesystem as well



/home/aaron/file

/mnt/Backups/file

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List, Set, and Change File Permissions



Owners and Groups

>_

```
$ ls -l  
-rw-r----- 1 aaron family 49 Oct 27 14:41 family_dog.jpg
```

```
# chgrp group_name file/directory
```

change group

```
$ chgrp wheel family_dog.jpg
```

```
$ ls -l  
-rw-r----- 1 aaron wheel 49 Oct 27 14:41 family_dog.jpg
```

```
$ groups
```

```
aaron wheel family
```

```
$ sudo chown jane family_dog.jpg
```

change owner

```
$ ls -l
```

```
-rw-r----- 1 jane family 49 Oct 27 14:41 family_dog.jpg
```

```
$ sudo chown aaron:family family_dog.jpg
```

```
$ ls -l
```

```
-rw-r----- 1 aaron family 49 Oct 27 14:41 family_dog.jpg
```



jane



family

File and Directory Permissions

```
$ ls -l
```

```
-rwxrwxrwx. 1 aaron family 49 Oct 27 14:41 family_dog.jpg
```

File Type	Identifier
DIRECTORY	d
REGULAR FILE	-
CHARACTER DEVICE	c
LINK	l
SOCKET FILE	s
PIPE	p
BLOCK DEVICE	b

File and Directory Permissions

r w X r w X r w X

owner

u

Group

g

Others

o

Bit	Purpose
r	Read File
w	Write to File
x	Execute (run)
-	No permission

Directory Permissions

>_

```
$ ls Pictures/
```

```
$ mkdir Pictures/Family
```

```
$ cd Pictures/
```

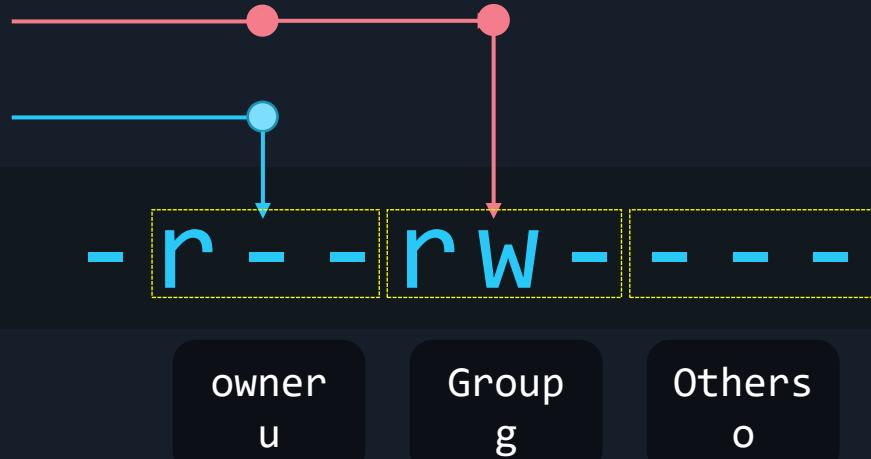


Bit	Purpose
r	<u>R</u> ead Directory
w	<u>W</u> rite to Directory
x	<u>E</u> xecute into
-	No permission

Evaluating Permissions

>_

```
(aaron)$ ls -l  
-r--rw-- 1 aaron family 49 family_dog.jpg  
  
[aaron]$ echo "Add this content to file" >> family_dog.jpg  
bash: family_dog.jpg: Permission denied  
  
(aaron)$ su jane  
  
[(jane)$ echo "Add this content to file" >> family_dog.jpg  
(jane)$ cat family_dog.jpg  
Picture of Milo the dog
```



Adding Permissions

>_

```
# chmod permissions file/directory
```

change mode

```
$ ls -l
```

```
-r--rw----. 1 aaron family 49 Oct 27 14:41 family_dog.jpg
```

```
$ chmod u+w family_dog.jpg
```

```
$ ls -l
```

```
-rw-rw----. 1 aaron family 49 Oct 27 14:41 family_dog.jpg
```

u+[list of permissions]

Option	Examples
user	u+
group	g+
others	o+

Removing Permissions

>_

```
$ ls -l  
-r--rw-r--. 1 aaron family 49 Oct 27 14:41 family_dog.jpg
```

u-[list of permissions]

```
$ chmod o-r family_dog.jpg  
$ ls -l  
-r--r--. 1 aaron family 49 Oct 27 14:41 family_dog.jpg
```

Option	Examples
user	u-
group	g-
others	o-

Setting Exact Permissions

>_

```
$ ls -l  
-r--rw----. 1 aaron family 49 Oct 27 14:41 family_dog.jpg  
$ chmod g=r family_dog.jpg
```

```
$ ls -l  
-r--r-----. 1 aaron family 49 Oct 27 14:41 family_dog.jpg  
$ chmod g=rw family_dog.jpg
```

```
$ ls -l  
-r--rw----. 1 aaron family 49 Oct 27 14:41 family_dog.jpg  
$ chmod g= family_dog.jpg
```

```
$ ls -l  
-r-----. 1 aaron family 49 Oct 27 14:41 family_dog.jpg  
$ chmod g-rwx family_dog.jpg
```

u=[list of permissions]

Option	Examples
user	u=
group	g=
others	o=

Chaining Permissions

>_

```
$ ls -l  
-r-----. 1 aaron family 49 Oct 27 14:41 family_dog.jpg
```

```
$ chmod u+rw,g=r,o= family_dog.jpg
```

```
$ ls -l  
-rw-r----. 1 aaron family 49 Oct 27 14:41 family_dog.jpg
```

```
$ chmod u=rw,g-w family_dog.jpg
```

```
$ ls -l  
-rw-r----. 1 aaron family 49 Oct 27 14:41 family_dog.jpg
```

user: at least read and write
group: only read
others: no permissions

user: only read and write
group: remove write

Octal Permissions

>_

```
$ stat family_dog.jpg
File: family_dog.jpg
  Size: 49          Blocks: 8          IO Block: 4096   regular file
Device: fd00h/64768d  Inode: 52946177      Links: 1
Access: (0640/-rw-r----)  Uid: ( 1000/    aaron)  Gid: (     10/    wheel)
```

Octal Permissions

r w - | r - - | - - -

1	1	0
6		

1	0	0
4		

0	0	0
0		

r w X | r - X | r - X

1	1	1
7		

1	0	1
5		

1	0	1
5		

r w X | r w X | r w X

1	1	1
7		

1	1	1
7		

1	1	1
7		

Binary	Decimal
000	0
001	1
010	2
011	3
100	4
101	5
110	6
111	7

Octal Permissions

r w -	r - -	- - -
$4 + 2 + 0$	$4 + 0 + 0$	$0 + 0 + 0$
= 6	= 4	= 0

r w x	r - x	r - x
4 2 1	4 0 1	4 0 1
7	5	5

Permission	Value
r	4
w	2
x	1

r w x	r w x	r w x
4 2 1	4 2 1	4 2 1
7	7	7

Octal Permissions

>_

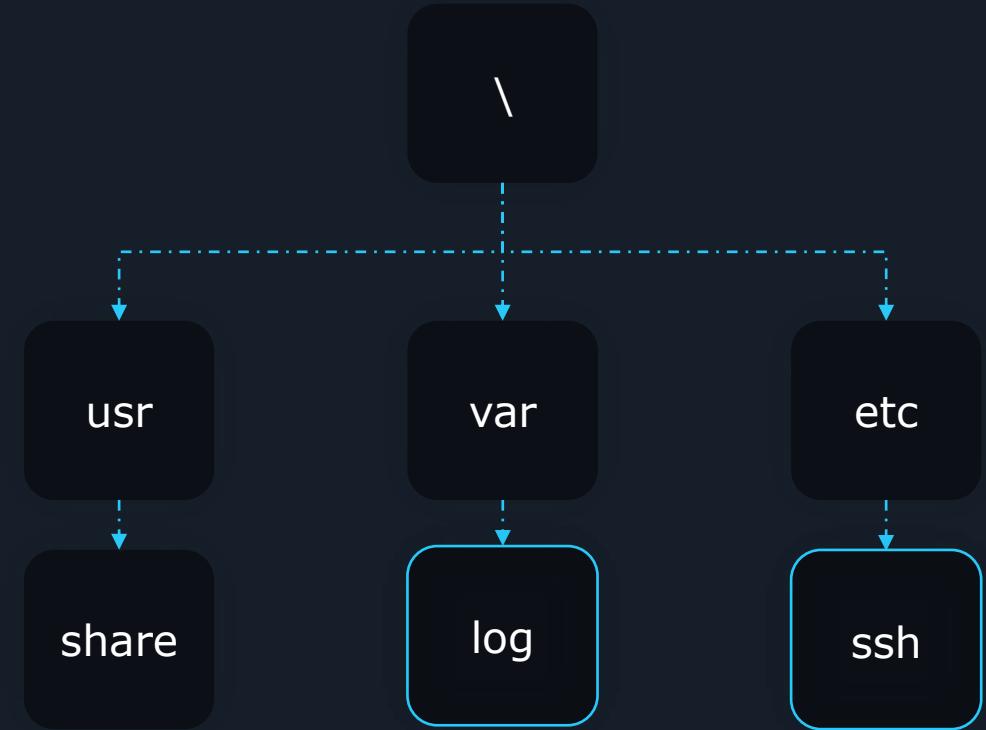
```
$ stat family_dog.jpg
File: family_dog.jpg
Size: 49          Blocks: 8          IO Block: 4096   regular file
Device: fd00h/64768d  Inode: 52946177      Links: 1
Access: (0640/-rw-r----)  Uid: ( 1000/    aaron)  Gid: (     10/    wheel)
```

```
$ chmod 640 family_dog.jpg
```

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Search for Files





>_

```
$ find /usr/share/ -name '*.jpg'
```

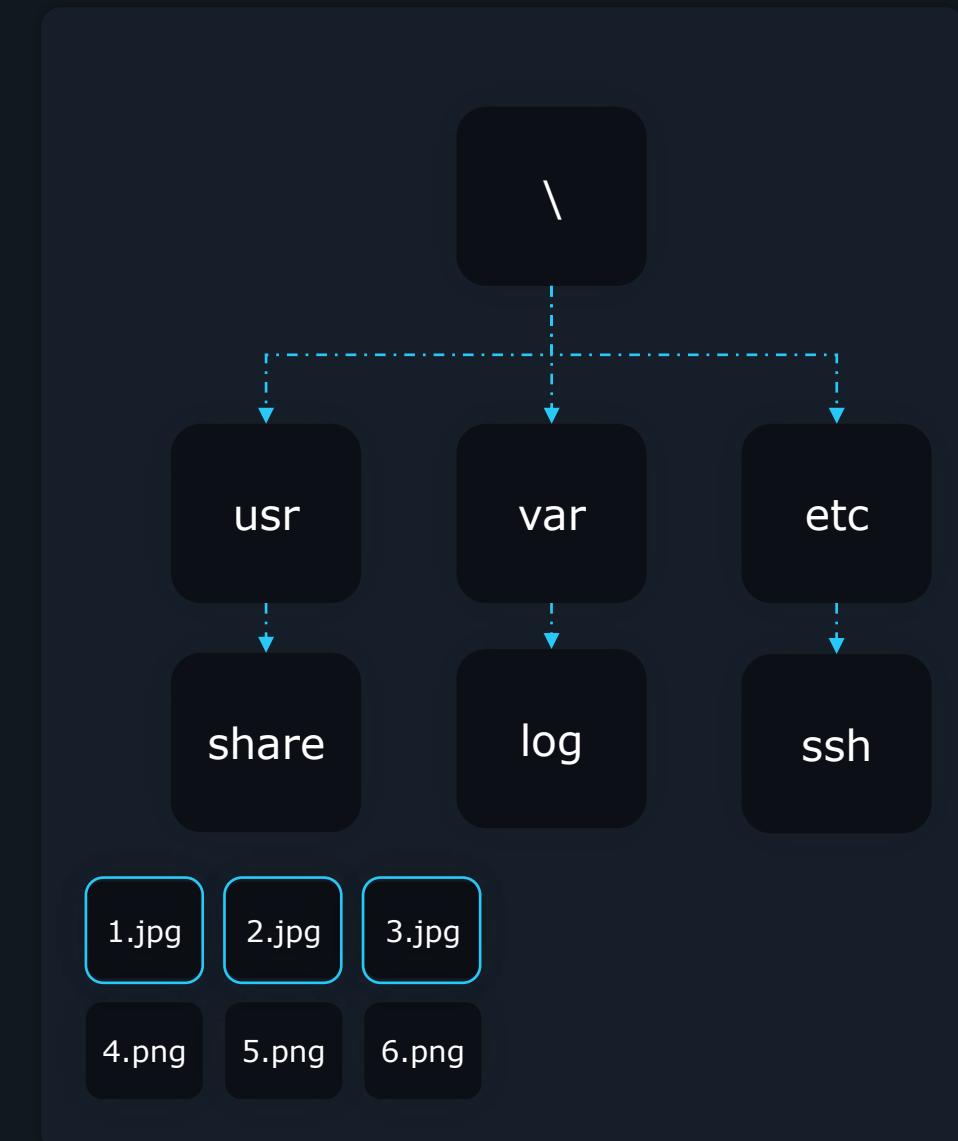
```
1.jpg 2.jpg 3.jpg
```

```
$ find /lib64/ -size +10M
```

```
large-file.txt
```

```
$ find /dev/ -mmin -1
```

```
abc.txt
```



find

>_

```
# find [/path/to/directory] [search_parameters]
```

```
$ find /bin/ -name file1.txt
```

```
$ find -name file1.txt # No path -> search current directory
```

```
$ find /bin/ -name file1.txt $ find -name file1.txt /bin/
```

Go-there

Find it

Search Parameters - Name

>_

```
# find [/path/to/directory] [search_parameters]
```

```
$ find -name felix
```

```
$ find -iname felix
```

```
$ find -name "f*" # Wildcard Expression
```

felix

Felix

felix

Felix

freya

fin

James

Search Parameters – Modified Time

>_

```
$ find -mmin [minute] # modified minute
```

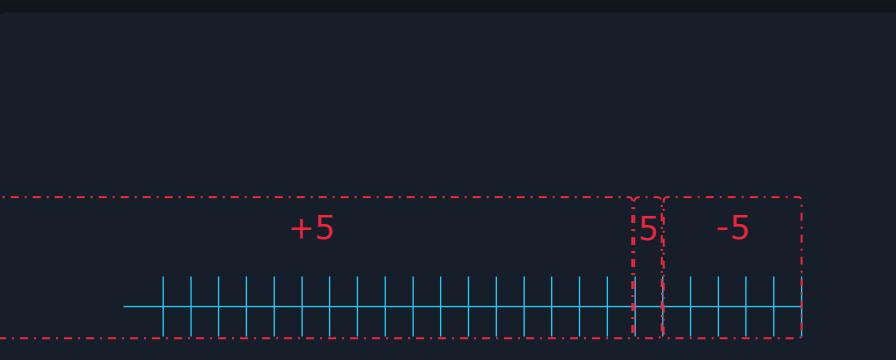
```
$ find -mmin 5
```

```
$ find -mmin -5
```

```
$ find -mmin +5
```

```
$ find -mtime 2 # 24-hour periods
```

```
$ find -cmin -5 # Change Minute
```



+5 5 -5

11:50 11:55 12:00 12:05

Modification = Create or Edit

Modified Time != Change Time

Modified Contents

Change Metadata

Search Parameters - File Size

>_

```
$ find -size [size]  
  
$ find -size 512k          # Exactly 512 kb  
  
$ find -size +512k         # Greater than 512 kb  
  
$ find -size -512k         # Less than 512 kb
```

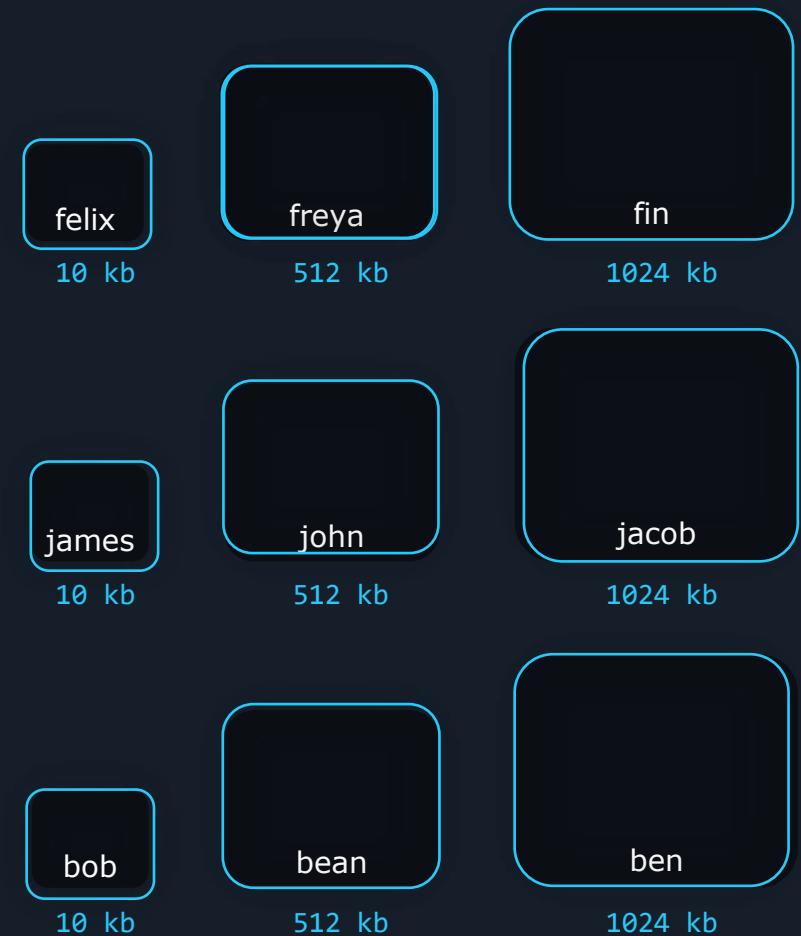


c	bytes
k	kilobytes
M	megabytes
G	gigabytes

Search Expressions

>_

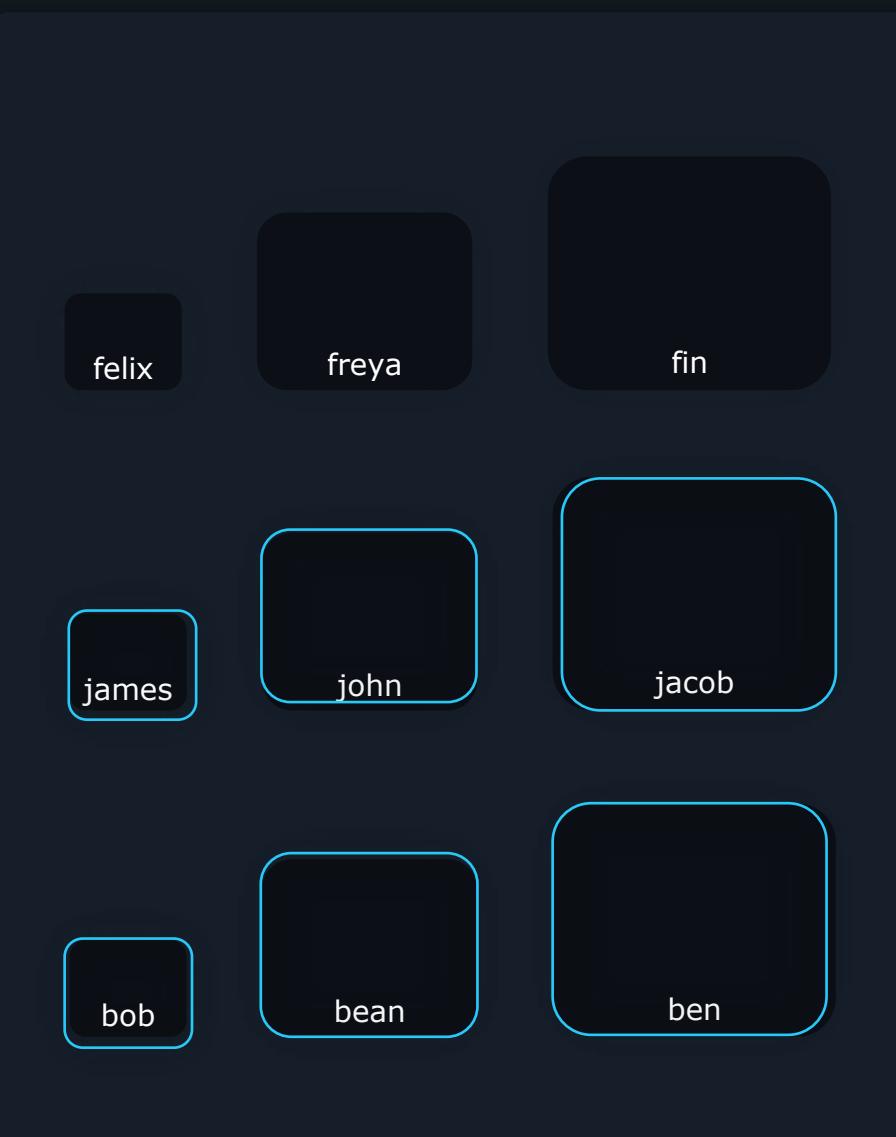
```
$ find -size [size]  
  
$ find -name "f*"  
  
$ find -size 512k  
  
$ find -name "f*" -size 512k      # AND operator  
  
$ find -name "f*" -o -size 512k # OR operator
```



Search Expressions

>_

```
$ find -not -name "f*"          # NOT operator  
$ find \! -name "f*"           # alternate NOT operator
```



Search Expressions

>_

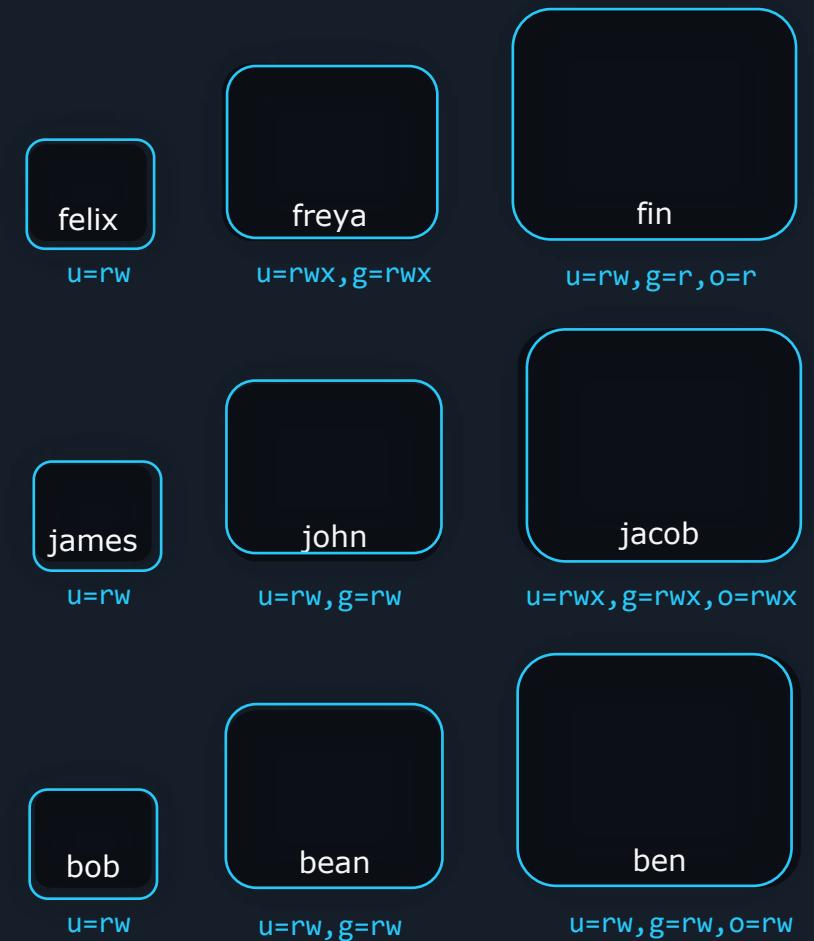
Permissions: 664 = u+rw,g+rw,o+r

```
$ find -perm 664          # find files with exactly 664 permissions  
$ find -perm -664         # find files with at least 664 permissions  
$ find -perm /664          # find files with any of these permissions  
$ find -perm u=rw,g=rw,o=r  # find files with exactly 664 permissions  
$ find -perm -u=rw,g=rw,o=r  # find files with at least 664 permissions  
$ find -perm /u=rw,g=rw,o=r  # find files with any of these permissions
```

Search Expressions

>_

```
$ find -perm 600  
$ find -perm -100  
$ find \! -perm -o=r  
$ find -perm /u=r,g=r,o=r
```



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Demo

Compare and Manipulate File Content



tac

>_

```
$ cat /home/users.txt
```

user1
user2
user3
user4
user5
user6



```
$ tac /home/users.txt
```

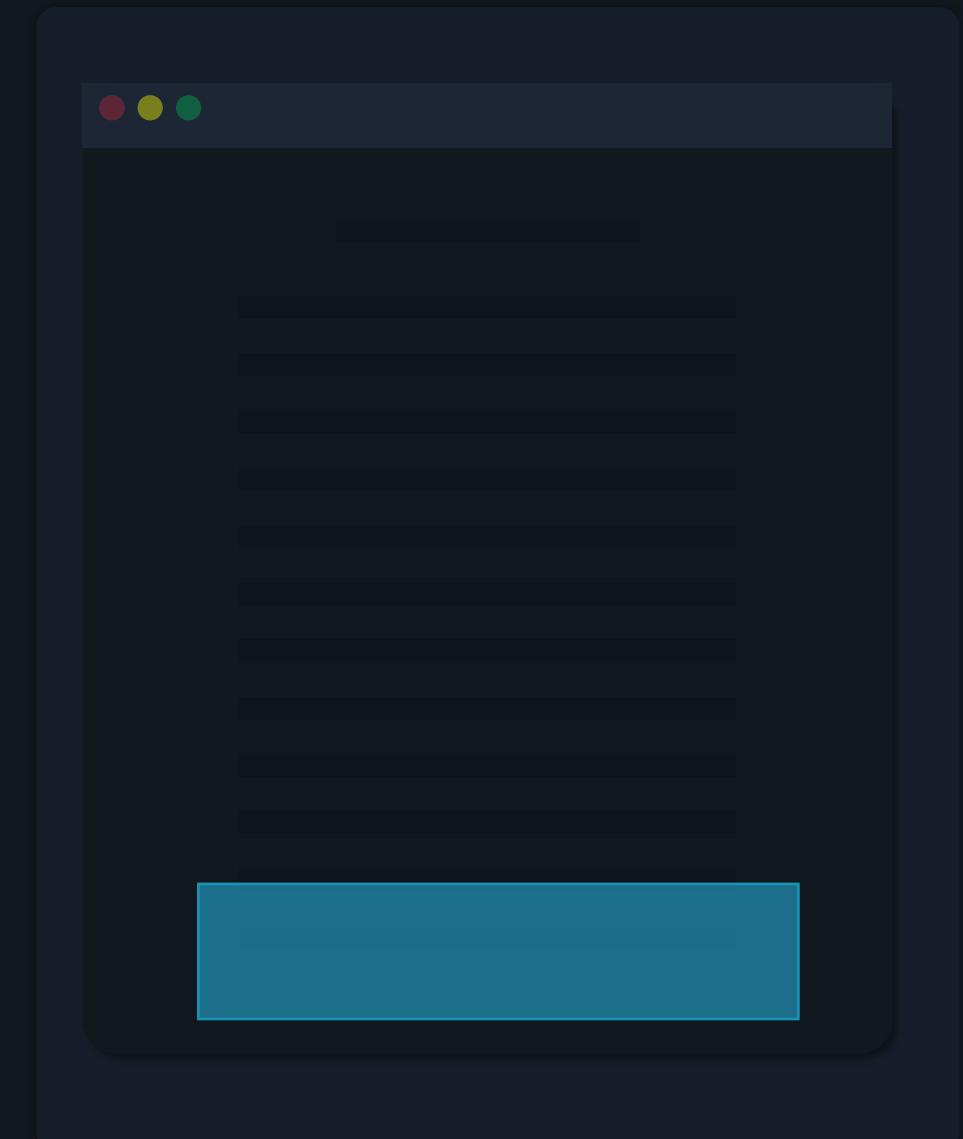
user6
user5
user4
user3
user2
user1



tail

>_

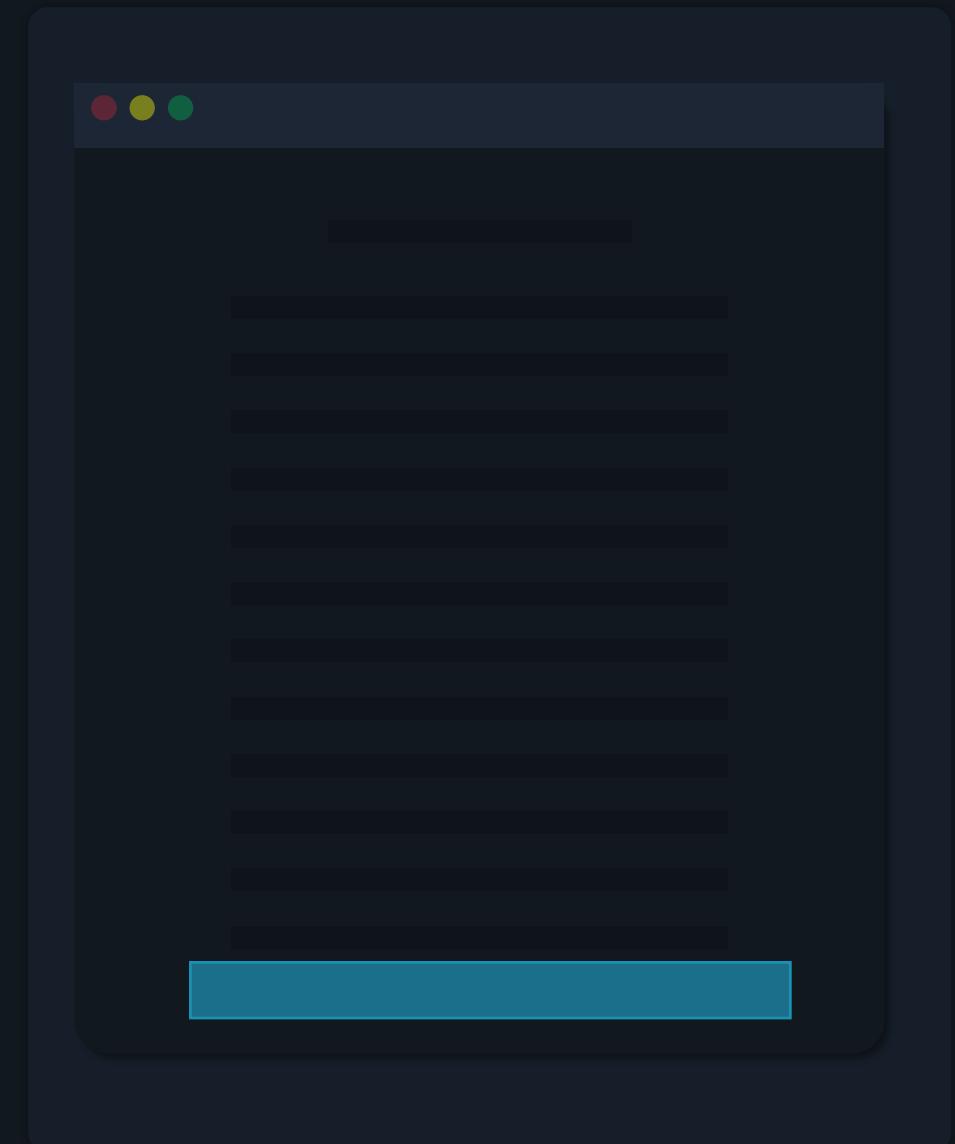
```
$ tail /var/log/dnf.log
2021-11-02T19:22:58-0500 DEBUG DNF version: 4.7.0
2021-11-02T19:22:58-0500 DDEBUG Command: dnf makecache --timer
2021-11-02T19:22:58-0500 DDEBUG Installroot: /
2021-11-02T19:22:58-0500 DDEBUG Releasever: 8
2021-11-02T19:22:58-0500 DEBUG cachedir: /var/cache/dnf
2021-11-02T19:22:58-0500 DDEBUG Base command: makecache
2021-11-02T19:22:58-0500 DDEBUG Extra commands: ['makecache', '--timer']
2021-11-02T19:22:58-0500 DEBUG Making cache files for all metadata
files.
2021-11-02T19:22:58-0500 INFO Metadata cache refreshed recently.
2021-11-02T19:22:58-0500 DDEBUG Cleaning up.
```



tail

>_

```
$ tail -n 20 /var/log/dnf.log
2021-11-02T18:11:47-0500 DEBUG baseos: using metadata from Thu 28 Oct
2021 07:53:22 AM CDT.
2021-11-02T18:11:48-0500 DEBUG reviving: 'extras' can be revived -
repomd matches.
2021-11-02T18:11:48-0500 DEBUG extras: using metadata from Thu 28 Oct
2021 07:49:04 AM CDT.
2021-11-02T18:11:48-0500 DEBUG User-Agent: constructed: 'libdnf
(CentOS Stream 8; generic; Linux.x86_64)'
2021-11-02T18:11:48-0500 DDEBUG timer: sack setup: 2424 ms
2021-11-02T18:11:48-0500 INFO Metadata cache created.
2021-11-02T18:11:48-0500 DDEBUG Cleaning up.
2021-11-02T19:22:58-0500 INFO --- logging initialized ---
2021-11-02T19:22:58-0500 DDEBUG timer: config: 1 ms
2021-11-02T19:22:58-0500 DEBUG DNF version: 4.7.0
2021-11-02T19:22:58-0500 DDEBUG Command: dnf makecache --timer
2021-11-02T19:22:58-0500 DDEBUG Installroot: /
2021-11-02T19:22:58-0500 DDEBUG Releaserver: 8
2021-11-02T19:22:58-0500 DEBUG cachedir: /var/cache/dnf
2021-11-02T19:22:58-0500 DDEBUG Base command: makecache
2021-11-02T19:22:58-0500 DDEBUG Extra commands: ['makecache', '--
timer']
2021-11-02T19:22:58-0500 DEBUG Making cache files for all metadata
files.
2021-11-02T19:22:58-0500 INFO Metadata cache refreshed recently.
2021-11-02T19:22:58-0500 DDEBUG Cleaning up.
```

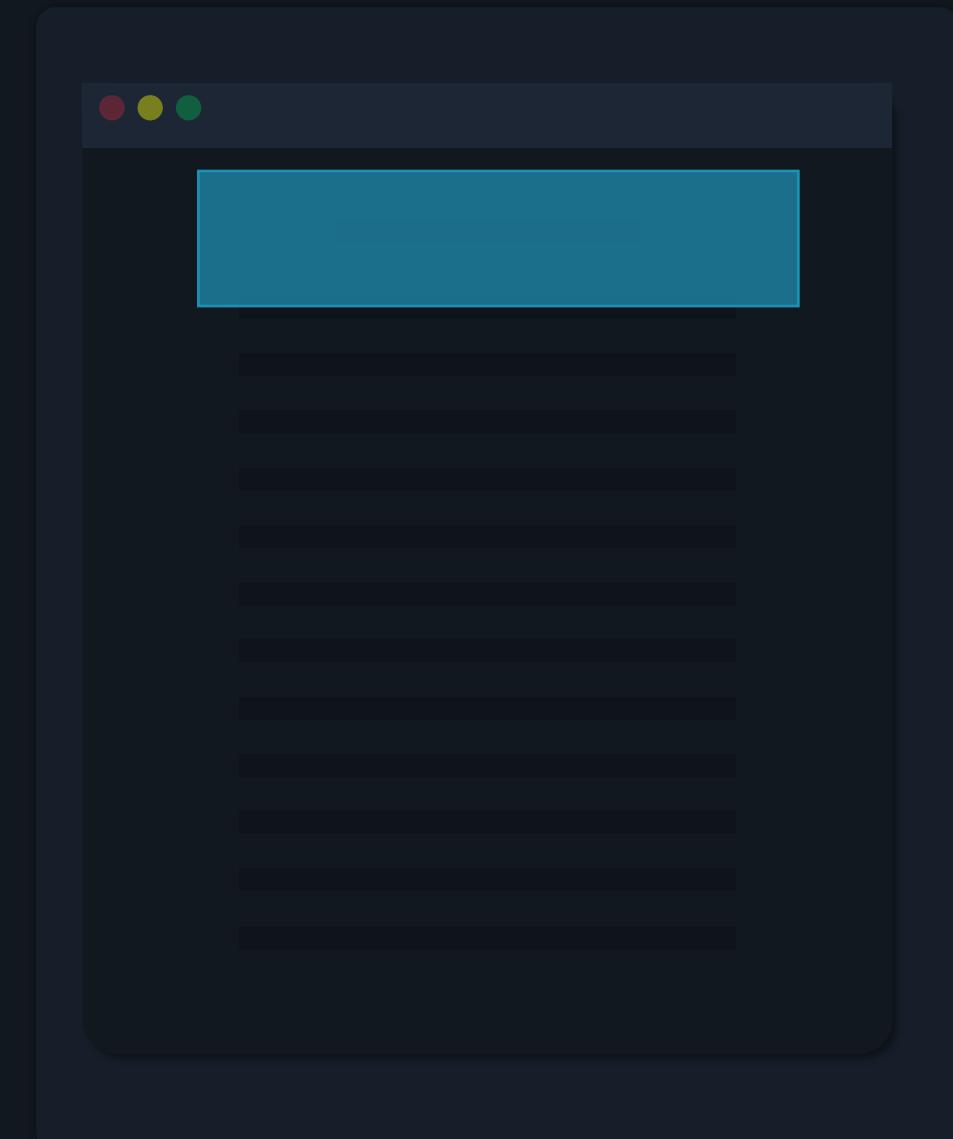


head

>_

```
$ head /var/log/dnf.log
```

```
2021-10-19T00:53:06-0500 INFO --- logging initialized ---
2021-10-19T00:53:06-0500 DDEBUG timer: config: 3 ms
2021-10-19T00:53:06-0500 DEBUG Loaded plugins: builddep, changelog,
config-manager, copr, debug, debuginfo-install, download,
generate_completion_cache, groups-manager, kpatch, needs-restarting,
playground, repoclosure, repodiff, repograph, repomanage, reposync
2021-10-19T00:53:06-0500 DEBUG DNF version: 4.7.0
2021-10-19T00:53:06-0500 DDEBUG Command: dnf makecache --timer
2021-10-19T00:53:06-0500 DDEBUG Installroot: /
2021-10-19T00:53:06-0500 DDEBUG Releasever: 8
2021-10-19T00:53:06-0500 DEBUG cachedir: /var/cache/dnf
2021-10-19T00:53:06-0500 DDEBUG Base command: makecache
2021-10-19T00:53:06-0500 DDEBUG Extra commands: ['makecache', '--timer']
```

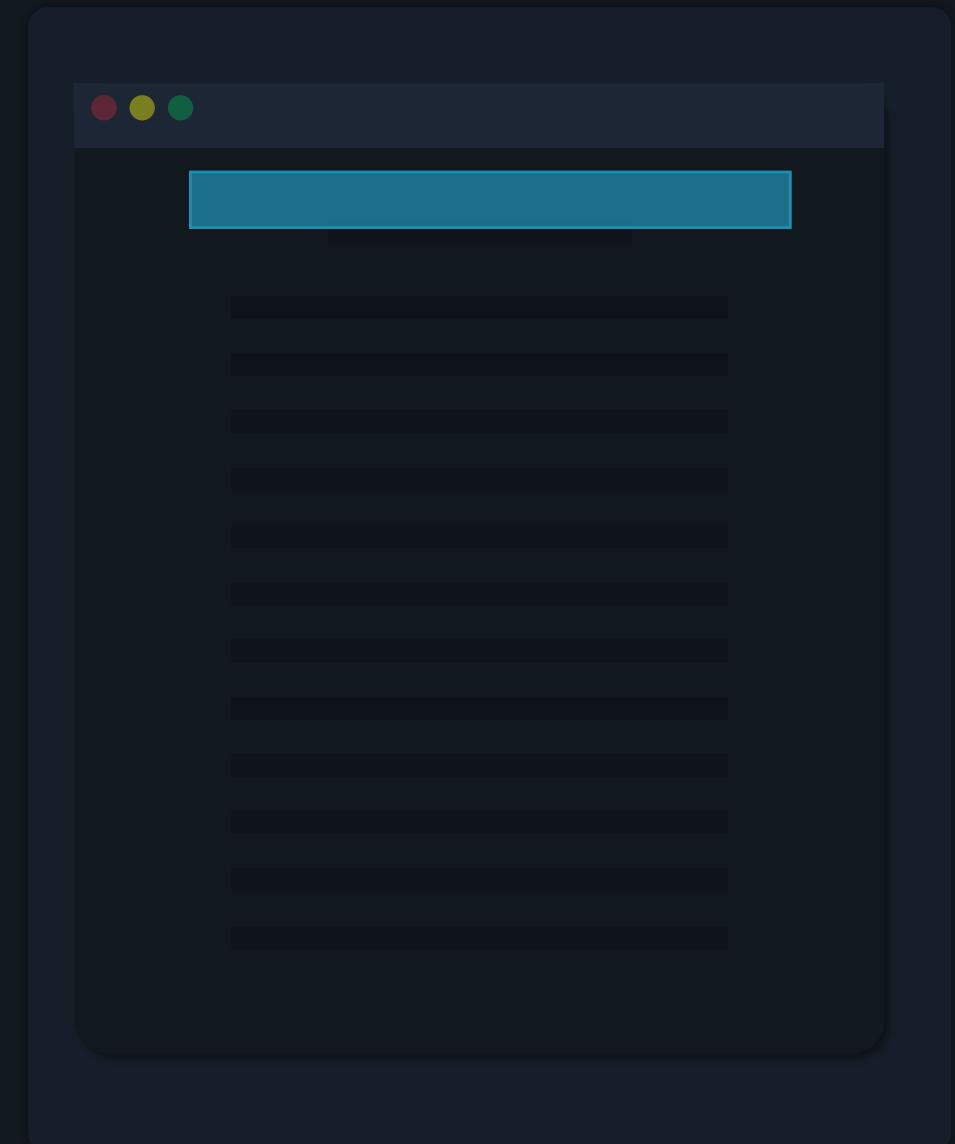


head

>_

```
$ head -n 20 /var/log/dnf.log
```

```
2021-10-19T00:53:06-0500 INFO --- logging initialized ---
2021-10-19T00:53:06-0500 DDEBUG timer: config: 3 ms
2021-10-19T00:53:06-0500 DEBUG DNF version: 4.7.0
2021-10-19T00:53:06-0500 DDEBUG Command: dnf makecache --timer
2021-10-19T00:53:06-0500 DDEBUG Installroot: /
2021-10-19T00:53:06-0500 DDEBUG Releasever: 8
2021-10-19T00:53:06-0500 DEBUG cachedir: /var/cache/dnf
2021-10-19T00:53:06-0500 DDEBUG Base command: makecache
2021-10-19T00:53:06-0500 DDEBUG Extra commands: ['makecache', '--timer']
2021-10-19T00:53:06-0500 DEBUG Making cache files for all metadata files.
2021-10-19T00:53:06-0500 WARNING Failed determining last makecache time.
2021-10-19T00:53:06-0500 DEBUG appstream: has expired and will be
refreshed.
2021-10-19T00:53:06-0500 DEBUG baseos: has expired and will be refreshed.
2021-10-19T00:53:06-0500 DEBUG extras: has expired and will be refreshed.
2021-10-19T00:53:06-0500 DEBUG repo: downloading from remote: appstream
2021-10-19T00:53:25-0500 DEBUG appstream: using metadata from Thu 07 Oct
2021 10:07:51 AM CDT.
2021-10-19T00:53:25-0500 DEBUG repo: downloading from remote: baseos
2021-10-19T00:54:07-0500 DEBUG baseos: using metadata from Thu 07 Oct
2021 10:07:02 AM CDT.
2021-10-19T00:54:07-0500 DEBUG repo: downloading from remote: extras
```



Transforming Text: Sed

>_

```
$ sed 's/canda/canada/g' userinfo.txt stream editor
```

```
ravi seattle usa 39483930 india
mark toronto canada 12345678 canada
john newyork usa 39348495 usa
ravi montreal canada 39484859 canada
mary ottawa canada 39384940 canada
```

```
$ sed 's/canda/canada/' userinfo.txt
```

```
ravi seattle usa 39483930 india
mark toronto canada 12345678 canada
john newyork usa 39348495 usa
ravi montreal canada 39484859 canda
mary ottawa canada 39384940 canda
```



userinfo.txt

```
ravi seattle usa 39483930 india
mark toronto canada 12345678 canada
john newyork usa 39348495 usa
ravi montreal canda 39484859 canda
mary ottawa canda 39384940 canda
```

Transforming Text: Sed

>_

```
$ sed 's/canda/canada' userinfo.txt
```

```
$ sed -i 's/canda/canada/g' userinfo.txt --in-place
```

userinfo.txt

ravi	seattle	usa	39483930	india
mark	toronto	canada	12345678	canada
john	newyork	usa	39348495	usa
ravi	montreal	canada	39484859	canada
mary	ottawa	canada	39384940	canada

cut

>_

```
$ cut -d ',' -f 1 userinfo.txt
```

```
ravi  
mark  
john  
ravi  
mary
```

```
$ cut -d ',' -f 3 userinfo.txt > countries.txt
```

```
userinfo.txt  
  
ravi,seattle,usa,39483930,india  
mark,toronto,canada,12345678,canada  
john,newyork,usa,39348495,usa  
ravi,montreal,canada,39484859,canada  
mary,ottawa,canada,39384940,canada
```

```
countries.txt  
  
usa  
canada  
usa  
canada  
canada
```

uniq and sort

>_

```
$ uniq countries.txt
```

```
usa  
canada  
usa  
canada
```

```
$ sort countries.txt
```

```
canada  
canada  
canada  
usa  
usa
```

```
$ sort countries.txt | uniq
```

```
canada  
usa
```



countries.txt

```
usa  
canada  
usa  
canada  
canada
```

Comparing Files: diff

>_

```
$ diff file1 file2
```

```
1c1
< only exists in file 1
---
> only exists in file 2
4c4
< only exists in file 1
---
> only exists in file 2
```

```
$ diff -c file1 file2
```

```
*** file1 2021-10-28 20:39:43.083264406 -0500
--- file2 2021-10-28 20:40:02.900262846 -0500
*****
*** 1,4 ****
! only exists in file 1
 identical line 2
 identical line 3
!! only exists in file 1
--- 1,4 ---
!! only exists in file 2
 identical line 2
 identical line 3
!! only exists in file 2
```

differences

context



Comparing Files: diff

>_

```
$ diff -y file1 file2  == $ sdiff file1 file2
```

only exists in file 1
identical line 2
identical line 3
only exists in file 1

[|] only exists in file 2
identical line 2
identical line 3
[|] exists in file 2

side-by-side diff

{KODE{LOUD

Search files with Grep



Searching With Grep

>_

```
$ grep 'CentOS' /etc/os-release
```

```
NAME="CentOS Stream"  
PRETTY_NAME="CentOS Stream 8"  
REDHAT_SUPPORT_PRODUCT_VERSION="CentOS Stream"
```

```
grep [options] 'search_pattern' file
```

```
$ grep 'centos' /etc/os-release
```

```
ID="centos"  
CPE_NAME="cpe:/o:centos:centos:8"  
HOME_URL="https://centos.org/"
```

```
$ grep -i 'centos' /etc/os-release
```

```
NAME="CentOS Stream"  
ID="centos"  
PRETTY_NAME="CentOS Stream 8"  
CPE_NAME="cpe:/o:centos:centos:8"  
HOME_URL="https://centos.org/"  
REDHAT_SUPPORT_PRODUCT_VERSION="CentOS Stream"
```

Searching With Grep

>_

```
$ grep -r 'CentOS' /etc/ recursive
grep: /etc/crypttab: Permission denied
grep: /etc/pki/rsyslog: Permission denied
grep: /etc/lvm/archive: Permission denied
grep: /etc/lvm/backup: Permission denied
grep: /etc/lvm/cache: Permission denied
/etc/centos-release:CentOS Stream release 8
/etc/krb5.conf.d/kcm_default_ccache:# On Fedora/RHEL/CentOS, this is /etc/krb5.conf.d/
grep: /etc/grub.d: Permission denied
/etc/yum.repos.d/CentOS-Stream-AppStream.repo:# CentOS-Stream-AppStream.repo
/etc/yum.repos.d/CentOS-Stream-AppStream.repo:# close to the client. You should use this for CentOS updates unless you are
/etc/yum.repos.d/CentOS-Stream-AppStream.repo:name=CentOS Stream $releasever - AppStream
/etc/yum.repos.d/CentOS-Stream-BaseOS.repo:# CentOS-Stream-BaseOS.repo
```

Searching With Grep

>_

```
$ grep -ir 'centos' /etc/ ignore case
grep: /etc/crypttab: Permission denied
grep: /etc/pki/rsyslog: Permission denied
grep: /etc/lvm/archive: Permission denied
grep: /etc/lvm/backup: Permission denied
grep: /etc/lvm/cache: Permission denied
/etc/centos-release:CentOS Stream release 8
/etc/krb5.conf.d/kcm_default_ccache:# On Fedora/RHEL/CentOS, this is /etc/krb5.conf.d/
grep: /etc/grub.d: Permission denied
/etc/yum.repos.d/CentOS-Stream-AppStream.repo:# CentOS-Stream-AppStream.repo
/etc/yum.repos.d/CentOS-Stream-AppStream.repo:# close to the client. You should use this for CentOS updates unless you are
/etc/yum.repos.d/CentOS-Stream-AppStream.repo:name=CentOS Stream $releasever - AppStream
/etc/yum.repos.d/CentOS-Stream-BaseOS.repo:# CentOS-Stream-BaseOS.repo
```

Searching With Grep

>_

```
$ sudo grep -ir 'centos' /etc/  
  
/etc/dnf/vars/contentdir:centos  
/etc/rpm/macros.dist:%centos_ver 8  
/etc/rpm/macros.dist:%centos 8  
/etc/lvm/archive/cs_00000-1586619700.vg:creation_host = "LFCS-CentOS"      # Linux LFCS-CentOS 4.18.0-338.el8.x86_64 #1 SMP  
Fri Aug 27 17:32:14 UTC 2021 x86_64  
/etc/lvm/archive/cs_00000-1586619700.vg:                      creation_host = "LFCS-CentOS"  
/etc/lvm/archive/cs_00000-1586619700.vg:                      creation_host = "LFCS-CentOS"  
/etc/lvm/backup/cs:creation_host = "LFCS-CentOS"      # Linux LFCS-CentOS 4.18.0-338.el8.x86_64 #1 SMP Fri Aug 27 17:32:14 UTC  
2021 x86_64  
/etc/lvm/backup/cs:                      creation_host = "LFCS-CentOS"  
/etc/lvm/backup/cs:                      creation_host = "LFCS-CentOS"  
/etc/centos-release:CentOS Stream release 8
```

Searching With Grep

>_

```
$ grep -vi 'centos' /etc/os-release          --invert-match
VERSION="8"
ID_LIKE="rhel fedora"
VERSION_ID="8"
PLATFORM_ID="platform:el8"
ANSI_COLOR="0;31"
BUG_REPORT_URL="https://bugzilla.redhat.com/"
REDHAT_SUPPORT_PRODUCT="Red Hat Enterprise Linux 8"
```

Searching With Grep

>_

```
$ grep -i 'red' /etc/os-release
BUG_REPORT_URL="https://bugzilla.redhat.com/"
REDHAT_SUPPORT_PRODUCT="Red Hat Enterprise Linux 8"
REDHAT_SUPPORT_PRODUCT_VERSION="CentOS Stream"
```

```
$ grep -wi 'red' /etc/os-release          words
REDHAT_SUPPORT_PRODUCT="Red Hat Enterprise Linux 8"
```

Searching With Grep

>_

```
$ grep -i 'centos' /etc/os-release
```

```
NAME="CentOS Stream"  
ID="centos"  
PRETTY_NAME="CentOS Stream 8"  
CPE_NAME="cpe:/o:centos:centos:8"  
HOME_URL="https://centos.org/"  
REDHAT_SUPPORT_PRODUCT_VERSION="CentOS Stream"
```

```
$ grep -oi 'red' /etc/os-release
```

--only-matching

```
CentOS  
centos  
CentOS  
centos  
centos  
centos  
CentOS
```

{KODE{LOUD

Analyze Text With Regular Expressions

.*

Regular Expressions

203.102.3.5

5.23

x is an integer

x is greater than 3 ($x > 3$)

x is less than 8 ($x < 8$)

$x = 4, 5, \text{ or } 6$

^ “The line begins with”

>_

```
$ less /etc/login.defs
```

```
#  
# Please note that the parameters in this configuration file control the  
# behavior of the tools from the shadow-utils component. None of these  
# tools uses the PAM mechanism, and the utilities that use PAM (such as the  
# passwd command) should therefore be configured elsewhere. Refer to  
# /etc/pam.d/system-auth for more information.  
  
# *REQUIRED*  
# Directory where mailboxes reside, _or_ name of file, relative to the  
# home directory. If you _do_ define both, MAIL_DIR takes precedence.  
# QMAIL_DIR is for Qmail  
#  
#QMAIL_DIR      Maildir  
MAIL_DIR        /var/spool/mail  
#MAIL_FILE      .mail
```

```
$ grep '^#' /etc/login.defs
```

```
$ grep -v '^#' /etc/login.defs
```

MAIL_DIR	/var/spool/mail
UMASK	022
HOME_MODE	0700
PASS_MAX_DAYS	99999
PASS_MIN_DAYS	0
PASS_MIN_LEN	5
PASS_WARN_AGE	7
UID_MIN	1000
UID_MAX	60000
SYS_UID_MIN	201
SYS_UID_MAX	999
GID_MIN	1000
GID_MAX	60000
SYS_GID_MIN	201
SYS_GID_MAX	999
CREATE_HOME	yes

^ “The line begins with”

>_

```
$ grep '^PASS' /etc/login.defs
```

PASS_MAX_DAYS	99999
PASS_MIN_DAYS	0
PASS_MIN_LEN	5
PASS_WARN_AGE	7

\$ “The line ends with”

>_

```
$ grep '7' /etc/login.defs
# 022 is the default value, but 027, or even 077, could be considered
HOME_MODE 0700
PASS_WARN_AGE      7

$ grep '7$' /etc/login.defs
PASS_WARN_AGE      7

$ grep 'mail$' /etc/login.defs
MAIL_DIR  /var/spool/mail
#MAIL_FILE .mail
```

^PASS

mail\$

. “Match any ONE character”

>_

```
$ grep -r 'c.t' /etc/
/etc/man_db.conf:# manpath. If no catpath string is used, the catpath will default to the
/etc/man_db.conf:# the database cache for any manpaths not mentioned below unless explicitly
/etc/man_db.conf:# location of catpaths and the creation of database caches; it has no effect
/etc/man_db.conf:#DEFINE      cat      cat
/etc/man_db.conf:# directives may be given for clarity, and will be concatenated together in
/etc/man_db.conf:# is that you only need to explicitly list extensions if you want to force a
/etc/man_db.conf:# Range of terminal widths permitted when displaying cat pages. If the
/etc/man_db.conf:# terminal falls outside this range, cat pages will not be created (if
/etc/man_db.conf:# If CATWIDTH is set to a non-zero number, cat pages will always be
/etc/man_db.conf:# NOCACHE keeps man from creating cat pages.
/etc/nanorc:## Use cut-from-cursor-to-end-of-line by default.
/etc/nanorc:# set cutfromcursor
/etc/nanorc:## (The old form cut; is deprecated.)
/etc/nanorc:## double click), and execute shortcuts. The mouse will work in the X
```

```
$ grep -wr 'c.t' /etc/
```

. “Match any ONE character”

>_

```
$ grep -wr 'c.t' /etc/
/etc/brltty/Input/mn/all.txt:Left: append to existing cut buffer from selected character
/etc/brltty/Input/mn/all.txt:Up: start new cut buffer at selected character
/etc/brltty/Input/mn/all.txt:Down: rectangular cut to selected character
/etc/brltty/Input/mn/all.txt:Right: linear cut to selected character
grep: /etc/libvirt: Permission denied
grep: /etc/wpa_supplicant/wpa_supplicant.conf: Permission denied
/etc/mime.types:application/vnd.commonspace           csp cst
/etc/mime.types:# wav: audio/x-wav, cpt: application/mac-compactpro
/etc/mime.types:application/mac-compactpro            cpt
grep: /etc/sudo-ldap.conf: Permission denied
grep: /etc/sudo.conf: Permission denied
grep: /etc/sudoers: Permission denied
grep: /etc/sudoers.d: Permission denied
grep: /etc/iscsi/iscsid.conf: Permission denied
grep: /etc/firewalld: Permission denied
/etc/mcelog/triggers/cache-error-trigger:  if [ "$(cat $F)" != "0" ] ; then
/etc/smartmontools/smartd_warning.sh:  cat <<EOF
```

Special Characters

>_

```
$ grep '.' /etc/login.defs

SYS_UID_MIN          201
SYS_UID_MAX          999
#
# Min/max values for automatic gid selection in groupadd
#
GID_MIN              1000
GID_MAX              60000
# System accounts
SYS_GID_MIN          201
SYS_GID_MAX          999
#
# If defined, this command is run when removing a user.
# It should remove any at/cron/print jobs etc. owned by
# the user to be removed (passed as the first argument).
#
#USERDEL_CMD          /usr/sbin/userdel_local
#
# If useradd should create home directories for users by default
# On RH systems, we do. This option is overridden with the -m flag on
# useradd command line.
#
CREATE_HOME           yes
# This enables userdel to remove user groups if no members exist.
```

\: Escaping For Special Characters

>_

```
$ grep '\.' /etc/login.defs

# behavior of the tools from the shadow-utils component. None of these
# passwd command) should therefore be configured elsewhere. Refer to
# /etc/pam.d/system-auth for more information.
#   home directory. If you _do_ define both, MAIL_DIR takes precedence.
#MAIL_FILE .mail
# Default initial "umask" value used by login(1) on non-PAM enabled
systems.
# Default "umask" value for pam_umask(8) on PAM enabled systems.
# home directories if HOME_MODE is not set.
# for increased privacy. There is no One True Answer here: each sysadmin
# must make up their mind.
# home directories.
# If HOME_MODE is not set, the value of UMASK is used to create the mode.
#           PASS_MAX_DAYS      Maximum number of days a password may be
used.
#           PASS_MIN_DAYS      Minimum number of days allowed between
password changes.
#           PASS_MIN_LEN        Minimum acceptable password length.
#           PASS_WARN_AGE       Number of days warning given before a
password expires.
```

*: Match The Previous Element 0 Or More Times

>_

let* ➔ lettt

\$ grep -r 'let*' /etc/

```
/etc/pnm2ppa.conf:# configuration file (/etc/pnm2ppa.conf), and not from
configuration files
/etc/pnm2ppa.conf:#silent 1
/etc/pnm2ppa.conf:# (Older versions of pnm2ppa required larger left and
right margins to avoid
/etc/pnm2ppa.conf:# printer failure with "flashing lights", but this
problem is believed to
/etc/pnm2ppa.conf:#leftmargin    10
/etc/pnm2ppa.conf:# and color ink print cartridges. This changes a
little whenever you
/etc/pnm2ppa.conf:# if there is a horizontal offset between right-to-left
and left-to-right
/etc/pnm2ppa.conf:# density of black ink used: 1 (least ink), 2 (default),
4 (most).
/etc/pnm2ppa.conf:# a calibration file /etc/pnm2ppa.gamma, in which case
these
/etc/pnm2ppa.conf:# gEnh(i) = (int) ( pow ( (double) i / 256, Gamma ) *
256 )
/etc/pnm2ppa.conf:# Valid choices are: a4, letter, legal:
/etc/pnm2ppa.conf:#papersize letter # this is the default
/etc/pnm2ppa.conf:#papersize legal
```

*: Match The Previous Element 0 Or More Times

>_

```
$ grep -r '/.*/' /etc/  Begins with /; has 0 or more characters between; ends with a /  
/etc/man_db.conf:# before /usr/man.  
/etc/man_db.conf:MANDB_MAP      /usr/man  
      /var/cache/man/fsstnd  
/etc/man_db.conf:MANDB_MAP      /usr/share/man  
      /var/cache/man  
/etc/man_db.conf:MANDB_MAP      /usr/local/man  
      /var/cache/man/oldlocal  
/etc/man_db.conf:MANDB_MAP      /usr/local/share/man  
      /var/cache/man/local  
/etc/man_db.conf:MANDB_MAP      /usr/X11R6/man  
      /var/cache/man/X11R6  
/etc/man_db.conf:MANDB_MAP      /opt/man          /var/cache/man/opt  
/etc/nanorc:# set quotestr "^( [ ]*( [#:>| } ]| // ))+"  
/etc/nanorc:## include "/path/to/syntax_file.nanorc"  
/etc/nanorc:include "/usr/share/nano/*.nanorc"  
/etc/pbm2ppa.conf:# Sample configuration file for the HP720/HP820/HP1000  
PPA Printers  
/etc/pbm2ppa.conf:# /etc/pbm2ppa.conf  
/etc/pnm2ppa.conf:# /etc/pnm2ppa.conf  
/etc/pnm2ppa.conf:# configuration file (/etc/pnm2ppa.conf), and not from  
configuration files  
/etc/pnm2ppa.conf:# a calibration file /etc/pnm2ppa.gamma, in which case  
these  
/etc/mailcap:audio/*; /usr/bin/xdg-open %s
```

+: Match The Previous Element 1 Or More Times

>_

```
$ grep -r '0*' /etc/  
/etc/pnm2ppa.conf:  
/etc/pnm2ppa.conf:#black_ink 1  
/etc/pnm2ppa.conf:#color_ink 1  
/etc/pnm2ppa.conf:#cyan_ink 1  
/etc/pnm2ppa.conf:#magenta_ink 1  
/etc/pnm2ppa.conf:#yellow_ink 1  
/etc/mailcap:###  
/etc/mailcap:### Begin Red Hat Mailcap  
/etc/mailcap:###  
/etc/mailcap:  
/etc/mailcap:audio/*; /usr/bin/xdg-open %s  
/etc/mailcap:  
/etc/mailcap:image/*; /usr/bin/xdg-open %s  
/etc/mailcap:  
/etc/mailcap:application/msword; /usr/bin/xdg-open %s  
/etc/mailcap:application/pdf; /usr/bin/xdg-open %s  
/etc/mailcap:application/postscript ; /usr/bin/xdg-open %s  
/etc/mailcap:  
/etc/mailcap:text/html; /usr/bin/xdg-open %s ; copiousoutput  
/etc/subuid-:aaron:100000:65536  
/etc/subuid-:bob:165536:65536  
/etc/subuid-:charles:231072:65536  
/etc/subuid-:david:296608:65536
```

+: Match The Previous Element 1 Or More Times

>_

\$ grep -r '0*' /etc/

0+

```
/etc/pnm2ppa.conf:  
/etc/pnm2ppa.conf:#black_ink 1  
/etc/pnm2ppa.conf:#color_ink 1  
/etc/pnm2ppa.conf:#cyan_ink 1  
/etc/pnm2ppa.conf:#magenta_ink 1  
/etc/pnm2ppa.conf:#yellow_ink 1  
/etc/mailcap:###  
/etc/mailcap:### Begin Red Hat Mailcap  
/etc/mailcap:###  
/etc/mailcap:  
/etc/mailcap:  
/etc/mailcap:audio/*; /usr/bin/xdg-open %s  
/etc/mailcap:  
/etc/mailcap:image/*; /usr/bin/xdg-open %s  
/etc/mailcap:  
/etc/mailcap:application/msword; /usr/bin/xdg-open %s  
/etc/mailcap:application/pdf; /usr/bin/xdg-open %s  
/etc/mailcap:application/postscript ; /usr/bin/xdg-open %s  
/etc/mailcap:  
/etc/mailcap:text/html; /usr/bin/xdg-open %s ; copiousoutput  
/etc/subuid-:aaron:10000:65536  
/etc/subuid-:bob:165536:65536  
/etc/subuid-:charles:231072:65536
```

+: Match The Previous Element 1 Or More Times

>_

0+ ➔ 000

\$ grep -r '0+' /etc/

```
/etc/brltty/Keyboard/keypad.ktb:bind KP0+!KP2 MENU_NEXT_ITEM
/etc/brltty/Keyboard/keypad.ktb:bind KP0+!KP7 MENU_FIRST_ITEM
/etc/brltty/Keyboard/keypad.ktb:bind KP0+!KP1 MENU_LAST_ITEM
/etc/brltty/Keyboard/keypad.ktb:bind KP0+!KP9 MENU_PREV_SETTING
/etc/brltty/Keyboard/keypad.ktb:bind KP0+!KP3 MENU_NEXT_SETTING
/etc/brltty/Keyboard/keypad.ktb:bind KP0+!KP5 MENU_PREV_LEVEL
/etc/brltty/Keyboard/keypad.ktb:bind KP0+!KPEnter PREFMENU
/etc/brltty/Keyboard/keypad.ktb:bind KP0+!KPPlus PREFSAVE
/etc/brltty/Keyboard/keypad.ktb:bind KP0+!KPMinus PREFLOAD
grep: /etc/libvirt: Permission denied
grep: /etc/wpa_supplicant/wpa_supplicant.conf: Permission denied
/etc/mime.types:application/vnd.d2l.coursepackage1p0+zip
grep: /etc/sudo-ldap.conf: Permission denied
grep: /etc/sudo.conf: Permission denied
grep: /etc/sudoers: Permission denied
grep: /etc/sudoers.d: Permission denied
grep: /etc/iscsi/iscsid.conf: Permission denied
/etc/sane.d/mustek_pp.conf:#           - cis1200+ (for Mustek 1200CP+
& OEM versions),
/etc/sane.d/mustek_pp.conf:# scanner Mustek-1200CP+ 0x378 cis1200+
/etc/sane.d/mustek_pp.conf:# scanner mustek-cis1200+ * cis1200+
/etc/sane.d/teco1.conf:scsi "RELISYS" "VM3530+" Scanner * * * 0
```

\$ man grep

In basic regular expressions the meta-characters ?, +, {, |, (, and) lose their special meaning; instead use the backslashed versions \?, \+, \{, \|, \(), and \).

+: Match The Previous Element 1 Or More Times

>_

```
$ grep -r '0\+' /etc/  
  
/etc/pnm2ppa.conf:# The setting is correct when alignments "0" are  
correct.  
/etc/pnm2ppa.conf:#colorshear    0  
/etc/pnm2ppa.conf:#blackshear   0  
/etc/pnm2ppa.conf:# 0 = no black ink. This affects black ink bordered by  
whitespace  
/etc/pnm2ppa.conf:# (i.e., 256 times ( i*(1.0/256) ) to the power Gamma ),  
/etc/pnm2ppa.conf:# where (int) i is the ppm color intensity, in the range  
0 - 255.  
/etc/pnm2ppa.conf:# the corresponding color. Gamma = 1.0 corresponds to  
no  
/etc/pnm2ppa.conf:#GammaR 1.0      # red enhancement  
/etc/pnm2ppa.conf:#GammaG 1.0      # green enhancement  
/etc/pnm2ppa.conf:#GammaB 1.0      # blue enhancement  
/etc/pnm2ppa.conf:# which gives Gamma = 1.0 - 0.033 * GammaIdx :  
/etc/pnm2ppa.conf:#RedGammaIdx  0  
/etc/pnm2ppa.conf:#GreenGammaIdx 0  
/etc/pnm2ppa.conf:#BlueGammaIdx  0  
/etc/pnm2ppa.conf:# by default the printing sweeps are now bidirectional  
(unimode 0);  
/etc/pnm2ppa.conf:# set their values to 0 to switch off the corresponding  
ink type:  
/etc/subuid-:aaron:100000:65536  
/etc/subuid-:charles:231072:65536
```

Extended Regular Expressions

>_

```
$ grep -Er '0+' /etc/ ➔ $ egrep r '0+' /etc/
/etc/pnm2ppa.conf:# The setting is correct when alignments "0" are
correct.
/etc/pnm2ppa.conf:#colorshear    0
/etc/pnm2ppa.conf:#blackshear   0
/etc/pnm2ppa.conf:# 0 = no black ink. This affects black ink bordered by
whitespace
/etc/pnm2ppa.conf:# (i.e., 256 times ( i*(1.0/256) ) to the power Gamma ),
/etc/pnm2ppa.conf:# where (int) i is the ppm color intensity, in the range
0 - 255.
/etc/pnm2ppa.conf:# the corresponding color. Gamma = 1.0 corresponds to
no
/etc/pnm2ppa.conf:#GammaR 1.0      # red enhancement
/etc/pnm2ppa.conf:#GammaG 1.0      # green enhancement
/etc/pnm2ppa.conf:#GammaB 1.0      # blue enhancement
/etc/pnm2ppa.conf:# which gives Gamma = 1.0 - 0.033 * GammaIdx :
/etc/pnm2ppa.conf:#RedGammaIdx  0
/etc/pnm2ppa.conf:#GreenGammaIdx 0
/etc/pnm2ppa.conf:#BlueGammaIdx  0
/etc/pnm2ppa.conf:# by default the printing sweeps are now bidirectional
(unimode 0);
/etc/pnm2ppa.conf:# set their values to 0 to switch off the corresponding
ink type:
/etc/subuid-:aaron:100000:65536
/etc/subuid-:charles:231072:65536
```

{ \cdot } Previous Element Can Exist “this many” Times

>

{ }: Previous Element Can Exist “this many” Times

>_

```
$ egrep -r '10{,3}' /etc/  
  
/etc/pnm2ppa.conf:#xoffset 160  
/etc/pnm2ppa.conf:# sweeps of the print head, adjust these in units of  
1"/600 (1 dot).  
/etc/pnm2ppa.conf:# valid blackness choices are 1 2 3 4; controls the  
/etc/pnm2ppa.conf:# density of black ink used: 1 (least ink), 2 (default),  
4 (most).  
/etc/pnm2ppa.conf:# (i.e., 256 times ( i*(1.0/256)) to the power Gamma ),  
/etc/pnm2ppa.conf:# the corresponding color. Gamma = 1.0 corresponds to  
no  
/etc/pnm2ppa.conf:#GammaR 1.0      # red enhancement  
/etc/pnm2ppa.conf:#GammaG 1.0      # green enhancement  
/etc/pnm2ppa.conf:#GammaB 1.0      # blue enhancement  
/etc/pnm2ppa.conf:# which gives Gamma = 1.0 - 0.033 * GammaIdx :  
/etc/pnm2ppa.conf:# (unimode 1) uncomment the next line . (The command  
line options --uni  
/etc/pnm2ppa.conf:#unimode 1  
/etc/pnm2ppa.conf:#black_ink 1  
/etc/pnm2ppa.conf:#color_ink 1  
/etc/pnm2ppa.conf:#cyan_ink 1  
/etc/pnm2ppa.conf:#magenta_ink 1  
/etc/pnm2ppa.conf:#yellow_ink 1  
/etc/subuid-:aaron:100000:65536  
/etc/subuid-:bob:165536:65536  
/etc/subuid-:charles:231072:65536
```

{ }: Previous Element Can Exist “this many” Times

>_

```
$ egrep -r '0{3}' /etc/  
  
/etc/vmware-tools/vgauth/schemas/xmldsig-core-schema.xsd:      [2]  
http://www.w3.org/Consortium/Legal/PR-FAQ-20000620.html#DTD  
/etc/vmware-tools/vgauth/schemas/xmldsig-core-schema.xsd:<schema  
xmlns="http://www.w3.org/2001/XMLSchema"  
xmlns:ds="http://www.w3.org/2000/09/xmldsig#"  
targetNamespace="http://www.w3.org/2000/09/xmldsig#" version="0.1"  
elementFormDefault="qualified">  
grep: /etc/firewalld: Permission denied  
/etc/smartmontools/smartd.conf:# Monitor 4 ATA disks connected to a 3ware  
6/7/8000 controller which uses  
/etc/smartmontools/smartd.conf:# Monitor 2 ATA disks connected to a 3ware  
9000 controller which  
/etc/smartmontools/smartd.conf:# Monitor 2 SATA (not SAS) disks connected  
to a 3ware 9000 controller which  
/etc/nanorc:## of tabs and spaces. 187 in ISO 8859-1 (0000BB in Unicode)  
and 183 in  
/etc/nanorc:## ISO-8859-1 (0000B7 in Unicode) seem to be good values for  
these.  
/etc/pbm2ppa.conf:# Sample configuration file for the HP720/HP820/HP1000  
PPA Printers  
/etc/pbm2ppa.conf:# 1000:                                HP DeskJet 1000Cse,  
1000Cxi  
/etc/pbm2ppa.conf:#version 1000  
/etc/pnm2ppa.conf:#version 1000  
/etc/subuid-:aaron:100000:65536
```

?: Make The Previous Element Optional

>_

```
$ egrep -r 'disabled?' /etc/  
t to 0 to disable polling.  
/etc/vmware-tools/tools.conf.example:# Set to true to disable the  
deviceHelper plugin.  
/etc/vmware-tools/tools.conf.example:#disabled=false  
/etc/containers/storage.conf:# Value 0%disabled  
/etc/dleyna-server-service.conf:# 0 = disabled  
/etc/dleyna-server-service.conf:# You can't enable levels disabled at  
compile time  
/etc/dleyna-server-service.conf:# If netf is enabled but the list is  
empty, it behaves as disabled.  
/etc/tuned/tuned-main.conf:# Dynamically tune devices, if disabled only  
static tuning will be used.  
/etc/tuned/tuned-main.conf:# Recommend functionality, if disabled  
"recommend" command will be not  
/etc/enscript.cfg:# Enable / disable page prefeed.  
grep: /etc/firewalld: Permission denied  
/etc/mcelog/mcelog.conf:# An upstream bug prevents this from being  
disabled  
/etc/smartmontools/smartd.conf:# -o VAL Enable/disable automatic  
offline tests (on/off)  
/etc/smartmontools/smartd.conf:# -S VAL Enable/disable attribute  
autosave (on/off)  
/etc/smartmontools/smartd_warning.sh:# Plugin directory (disabled if  
empty)
```

{ \cdot } Previous Element Can Exist “this many” Times

>

| : Match One Thing Or The Other

>_

```
$ egrep -r 'enabled|disabled' /etc/  
  
/etc/vmware-tools/tools.conf.example:#           disabled.  
/etc/vmware-tools/tools.conf.example:#disabled=false  
/etc/dleyna-server-service.conf:# 0 = disabled  
/etc/dleyna-server-service.conf:# You can't enable levels disabled at  
compile time  
/etc/dleyna-server-service.conf:netf-enabled=false  
/etc/dleyna-server-service.conf:# If netf is enabled but the list is  
empty, it behaves as disabled.  
/etc/tuned/tuned-main.conf:# Dynamically tune devices, if disabled only  
static tuning will be used.  
/etc/tuned/tuned-main.conf:# Recommend functionality, if disabled  
"recommend" command will be not  
/etc/tuned/tuned-main.conf:# /etc/sysctl.conf. If enabled, these sysctls  
will be re-applied  
grep: /etc/firewalld: Permission denied  
/etc/mcelog/mcelog.conf:# An upstream bug prevents this from being  
disabled  
/etc/mcelog/mcelog.conf:dimm-tracking-enabled = yes  
/etc/mcelog/mcelog.conf:socket-tracing-enabled = yes  
/etc/smartmontools/smartd_warning.sh:# Plugin directory (disabled if  
empty)  
/etc/nanorc:## To make sure an option is disabled, use "unset <option>".
```

| : Match One Thing Or The Other

>_

```
$ egrep -ir 'enabled?|disabled?' /etc/  
grep: /etc/firewalld: Permission denied  
/etc/mcelog/mcelog.conf:# An upstream bug prevents this from being  
disabled  
/etc/mcelog/mcelog.conf:# Enable DIMM-tracking  
/etc/mcelog/mcelog.conf:dimm-tracking-enabled = yes  
/etc/mcelog/mcelog.conf:# Disable DIMM DMI pre-population unless supported  
on your system  
/etc/mcelog/mcelog.conf:socket-tracing-enabled = yes  
/etc/smartmontools/smartd.conf:# First ATA/SATA or SCSI/SAS disk. Monitor  
all attributes, enable  
/etc/smartmontools/smartd.conf:# -o VAL Enable/disable automatic  
offline tests (on/off)  
/etc/smartmontools/smartd.conf:# -S VAL Enable/disable attribute  
autosave (on/off)  
/etc/smartmontools/smartd_warning.sh:# Plugin directory (disabled if  
empty)  
/etc/nanorc:## Please note that you must have configured nano with --  
enable-nanorc  
/etc/nanorc:## To make sure an option is disabled, use "unset <option>".  
/etc/nanorc:## When soft line wrapping is enabled, make it wrap lines at  
blanks  
/etc/nanorc:## Enable vim-style lock-files. This is just to let a vim  
user know you
```

[]: Ranges Or Sets

>_

```
$ egrep -r 'c[au]t' /etc/ [a-z] [0-9] [abz954]
```

```
/etc/man_db.conf:# Range of terminal widths permitted when displaying cat  
pages. If the  
/etc/man_db.conf:# terminal falls outside this range, cat pages will not  
be created (if  
/etc/man_db.conf:# If CATWIDTH is set to a non-zero number, cat pages will  
always be  
/etc/man_db.conf:# NOCACHE keeps man from creating cat pages.  
/etc/nanorc:## Use cut-from-cursor-to-end-of-line by default.  
/etc/nanorc:# set cutfromcursor  
/etc/nanorc:## (The old form, 'cut', is deprecated.)  
/etc/nanorc:## double click), and execute shortcuts. The mouse will work  
in the X  
/etc/nanorc:## Don't display the helpful shortcut lists at the bottom of  
the screen.  
/etc/nanorc:## (The old form, 'justifytrim', is deprecated.)  
/etc/nanorc:## Disallow file modification. Why would you want this in an  
rcfile? ;)  
/etc/nanorc:# bind M-B cutwordleft main  
/etc/nanorc:# bind M-N cutwordright main  
/etc/mailcap:application/msword; /usr/bin/xdg-open %s  
/etc/mailcap:application/pdf; /usr/bin/xdg-open %s  
/etc/mailcap:application/postscript ; /usr/bin/xdg-open %s
```

[]: Ranges Or Sets

>_

```
$ egrep -r '/dev/.*' /etc/
/etc/smartmontools/smard.conf:#/dev/twa0 -d 3ware,1 -a -s L/.../2/03
/etc/smartmontools/smard.conf:# On FreeBSD /dev/tws0 should be used
instead
/etc/smartmontools/smard.conf:#/dev/twl0 -d 3ware,0 -a -s L/.../2/01
/etc/smartmontools/smard.conf:#/dev/twl0 -d 3ware,1 -a -s L/.../2/03
/etc/smartmontools/smard.conf:#/dev/hdc,0 -a -s L/.../2/01
/etc/smartmontools/smard.conf:#/dev/hdc,1 -a -s L/.../2/03
/etc/smartmontools/smard.conf:#/dev/sdd -d hpt,1/1 -a -s L/.../7/01
/etc/smartmontools/smard.conf:#/dev/sdd -d hpt,1/2 -a -s L/.../7/02
/etc/smartmontools/smard.conf:#/dev/sdd -d hpt,1/3 -a -s L/.../7/03
/etc/smartmontools/smard.conf:#/dev/sdd -d hpt,1/4/1 -a -s L/.../2/01
/etc/smartmontools/smard.conf:#/dev/sdd -d hpt,1/4/2 -a -s L/.../2/03
/etc/smartmontools/smard_warning.sh: hostname=`eval $cmd 2>/dev/null` ||
continue
/etc/smartmontools/smard_warning.sh: dnsdomain=`eval $cmd 2>/dev/null` ||
continue
/etc/smartmontools/smard_warning.sh: nisdomain=`eval $cmd 2>/dev/null` ||
continue
/etc/smartmontools/smard_warning.sh: echo "$cmd </dev/null"
/etc/smartmontools/smard_warning.sh: "$cmd" </dev/null
/etc/smartmontools/smard_warning.sh: echo "$cmd </dev/null"
/etc/smartmontools/smard_warning.sh: "$cmd" </dev/null
/etc/smartmontools/smard_warning.sh: echo "exec '$SMARTD_MAILER'
</dev/null"
```

[]: Ranges Or Sets

>_

```
$ egrep -r '/dev/[a-z]*' /etc/  
  
/etc/smartmontools/smartd.conf:#/dev/twa0 -d 3ware,1 -a -s L/.../..2/03  
/etc/smartmontools/smartd.conf:# On FreeBSD /dev/tws0 should be used instead  
/etc/smartmontools/smartd.conf:#/dev/twl0 -d 3ware,0 -a -s L/.../..2/01  
/etc/smartmontools/smartd.conf:#/dev/twl0 -d 3ware,1 -a -s L/.../..2/03  
/etc/smartmontools/smartd.conf:#/dev/hdc,0 -a -s L/.../..2/01  
/etc/smartmontools/smartd.conf:#/dev/hdc,1 -a -s L/.../..2/03  
/etc/smartmontools/smartd.conf:#/dev/sdd -d hpt,1/1 -a -s L/.../..7/01  
/etc/smartmontools/smartd.conf:#/dev/sdd -d hpt,1/2 -a -s L/.../..7/02  
/etc/smartmontools/smartd.conf:#/dev/sdd -d hpt,1/3 -a -s L/.../..7/03  
/etc/smartmontools/smartd.conf:#/dev/sdd -d hpt,1/4/1 -a -s L/.../..2/01  
/etc/smartmontools/smartd.conf:#/dev/sdd -d hpt,1/4/2 -a -s L/.../..2/03  
/etc/smartmontools/smartd_warning.sh: hostname=`eval $cmd 2>/dev/null` || continue  
/etc/smartmontools/smartd_warning.sh: dnsdomain=`eval $cmd 2>/dev/null` || continue  
/etc/smartmontools/smartd_warning.sh: nisdomain=`eval $cmd 2>/dev/null` || continue  
/etc/smartmontools/smartd_warning.sh: echo "$cmd </dev/null"  
/etc/smartmontools/smartd_warning.sh: "$cmd" </dev/null  
/etc/smartmontools/smartd_warning.sh: echo "$cmd </dev/null"  
/etc/smartmontools/smartd_warning.sh: "$cmd" </dev/null  
/etc/smartmontools/smartd_warning.sh: echo "exec '$SMARTD_MAILER' </dev/null"
```

[]: Ranges Or Sets

>_

```
$ egrep -r '/dev/[a-z]*[0-9]' /etc/
/etc/sane.d/umax_pp.conf:# /dev/ppi1, ...
/etc/sane.d/fujitsu.conf:#scsi /dev/sg1
/etc/sane.d/v4l.conf:/dev/bttv0
/etc/sane.d/v4l.conf:/dev/video0
/etc/sane.d/v4l.conf:/dev/video1
/etc/sane.d/v4l.conf:/dev/video2
/etc/sane.d/v4l.conf:/dev/video3
/etc/sane.d/gphoto2.conf:port=serial:/dev/ttymd1
/etc/sane.d/kodak.conf:#scsi /dev/sg1
/etc/sane.d/ma1509.conf:#/dev/usscanner0
/etc/sane.d/mustek_usb.conf:#/dev/usbscanner0
/etc/sane.d/snapscan.conf:# For SCSI scanners specify the generic device, e.g. /dev/sg0 on Linux.
/etc/sane.d/snapscan.conf:# /dev/sg0
grep: /etc/firewalld: Permission denied
/etc/smartmontools/smartd.conf:# For example /dev/twe0, /dev/twe1, and so on.
/etc/smartmontools/smartd.conf:#/dev/twa0 -d 3ware,0 -a -s L/.../.../2/01
/etc/smartmontools/smartd.conf:#/dev/twa0 -d 3ware,1 -a -s L/.../.../2/03
/etc/smartmontools/smartd.conf:# On FreeBSD /dev/tws0 should be used instead
/etc/smartmontools/smartd.conf:#/dev/twl0 -d 3ware,0 -a -s L/.../.../2/01
/etc/smartmontools/smartd.conf:#/dev/twl0 -d 3ware,1 -a -s L/.../.../2/03
```

[]: Ranges Or Sets

>_

```
$ egrep -r '/dev/[a-z]*[0-9]?' /etc/
/etc/smartmontools/smard.conf:#/dev/twa0 -d 3ware,1 -a -s L/.../2/03
/etc/smartmontools/smard.conf:# On FreeBSD /dev/tws0 should be used instead
/etc/smartmontools/smard.conf:#/dev/twl0 -d 3ware,0 -a -s L/.../2/01
/etc/smartmontools/smard.conf:#/dev/twl0 -d 3ware,1 -a -s L/.../2/03
/etc/smartmontools/smard.conf:#/dev/hdc,0 -a -s L/.../2/01
/etc/smartmontools/smard.conf:#/dev/hdc,1 -a -s L/.../2/03
/etc/smartmontools/smard.conf:#/dev/sdd -d hpt,1/1 -a -s L/.../7/01
/etc/smartmontools/smard.conf:#/dev/sdd -d hpt,1/2 -a -s L/.../7/02
/etc/smartmontools/smard.conf:#/dev/sdd -d hpt,1/3 -a -s L/.../7/03
/etc/smartmontools/smard.conf:#/dev/sdd -d hpt,1/4/1 -a -s L/.../2/01
/etc/smartmontools/smard.conf:#/dev/sdd -d hpt,1/4/2 -a -s L/.../2/03
/etc/smartmontools/smard_warning.sh: hostname=`eval $cmd 2>/dev/null` || continue
/etc/smartmontools/smard_warning.sh: dnsdomain=`eval $cmd 2>/dev/null` || continue
/etc/smartmontools/smard_warning.sh: nisdomain=`eval $cmd 2>/dev/null` || continue
/etc/smartmontools/smard_warning.sh: echo "$cmd </dev/null"
/etc/smartmontools/smard_warning.sh: "$cmd" </dev/null
/etc/smartmontools/smard_warning.sh: echo "$cmd </dev/null"
/etc/smartmontools/smard_warning.sh: "$cmd" </dev/null
/etc/smartmontools/smard_warning.sh: echo "exec '$SMARTD_MAILER' </dev/null"
```

(): Subexpressions

>_

```
$ egrep -r '/dev/[a-z]*[0-9]?' /etc/  
/etc/sane.d/dc25.conf:#port=/dev/tty0p0  
/etc/sane.d/dc25.conf:#port=/dev/tty01  
/etc/sane.d/u12.conf:# device /dev/usbscanner  
/etc/sane.d/u12.conf:# device /dev/usbscanner  
/etc/sane.d/dmc.conf:/dev/camera  
/etc/sane.d/umax.conf:/dev/scanner  
/etc/sane.d/umax.conf:/dev/usbscanner  
/etc/sane.d/epjitsu.conf:#usb /dev/usb/scanner0  
/etc/sane.d/epjitsu.conf:# if echo "$nal" | grep -q  
'\\.nal$' - 2>/dev/null; then  
/etc/sane.d/epson.conf:#usb /dev/usbscanner0  
/etc/sane.d/epson.conf:#usb /dev/usb/scanner0  
/etc/sane.d/umax1220u.conf:#/dev/scanner  
/etc/sane.d/umax1220u.conf:#/dev/usb/scanner0  
/etc/sane.d/umax_pp.conf:# device : /dev/parport0, /dev/parport1, .....  
/etc/sane.d/umax_pp.conf:# on *BSD, you may provide the device name of the  
ppi device: /dev/ppi0,  
/etc/sane.d/umax_pp.conf:# /dev/ppi1, ...  
/etc/sane.d/fujitsu.conf:#scsi /dev/sg1  
/etc/sane.d/fujitsu.conf:#usb /dev/usb/scanner0  
/etc/sane.d/v4l.conf:/dev/bttv0  
/etc/sane.d/v4l.conf:/dev/video0  
/etc/sane.d/v4l.conf:/dev/video1  
/etc/sane.d/v4l.conf:/dev/video2
```

$$1+2*3$$

$$1+6 = 7$$

$$(1+2)*3$$

$$3*3 = 9$$

(): Subexpressions

>_

```
$ egrep -r '/dev/([a-z]*[0-9]?)*' /etc/
/etc/sane.d/coolscan3.conf:#scsi:/dev/scanner
/etc/sane.d/coolscan3.conf:#usb:/dev/usbscanner
/etc/sane.d/dc210.conf:port=/dev/ttyS0
/etc/sane.d/dc210.conf:#port=/dev/ttym1
/etc/sane.d/dc210.conf:#port=/dev/term/a
/etc/sane.d/dc210.conf:#port=/dev/ttym0p0
/etc/sane.d/dc210.conf:#port=/dev/ttym01
/etc/sane.d/dc240.conf:port=/dev/ttym50
/etc/sane.d/dc240.conf:#port=/dev/ttym1
/etc/sane.d/dc240.conf:#port=/dev/term/a
/etc/sane.d/dc240.conf:#port=/dev/ttym0p0
/etc/sane.d/dc240.conf:#port=/dev/ttym01
/etc/sane.d/dc25.conf:port=/dev/ttym50
/etc/sane.d/dc25.conf:#port=/dev/ttym1
/etc/sane.d/dc25.conf:#port=/dev/term/a
/etc/sane.d/dc25.conf:#port=/dev/ttym0p0
/etc/sane.d/dc25.conf:#port=/dev/ttym01
/etc/sane.d/u12.conf:# device /dev/usbscanner
/etc/sane.d/u12.conf:# device /dev/usbscanner
/etc/sane.d/dmc.conf:/dev/camera
/etc/sane.d/umax.conf:/dev/scanner
/etc/sane.d/umax.conf:/dev/usbscanner
```

[a-z]*[0-9]?

tty0p0

(): Subexpressions

>_

```
$ egrep -r egrep -r '/dev/(([a-z]|[A-Z])*[0-9]?)*' /etc/  
  
/etc/sane.d/coolscan3.conf:#scsi:/dev/scanner  
/etc/sane.d/coolscan3.conf:#usb:/dev/usbscanner  
/etc/sane.d/dc210.conf:port=/dev/ttyS0  
/etc/sane.d/dc210.conf:#port=/dev/ttymd1  
/etc/sane.d/dc210.conf:#port=/dev/term/a  
/etc/sane.d/dc210.conf:#port=/dev/tty0p0  
/etc/sane.d/dc210.conf:#port=/dev/tty01  
/etc/sane.d/dc240.conf:port=/dev/ttyS0  
/etc/sane.d/dc240.conf:#port=/dev/ttymd1  
/etc/sane.d/dc240.conf:#port=/dev/term/a  
/etc/sane.d/dc240.conf:#port=/dev/tty0p0  
/etc/sane.d/dc240.conf:#port=/dev/tty01  
/etc/sane.d/dc25.conf:port=/dev/ttyS0  
/etc/sane.d/dc25.conf:#port=/dev/ttymd1  
/etc/sane.d/dc25.conf:#port=/dev/term/a  
/etc/sane.d/dc25.conf:#port=/dev/tty0p0  
/etc/sane.d/dc25.conf:#port=/dev/tty01  
/etc/sane.d/u12.conf:# device /dev/usbscanner  
/etc/sane.d/u12.conf:# device /dev/usbscanner  
/etc/sane.d/dmc.conf:/dev/camera  
/etc/sane.d/umax.conf:/dev/scanner  
/etc/sane.d/umax.conf:/dev/usbscanner
```

([a-z]|[A-Z])*[0-9]?)*

[^]: Negated Ranges Or Sets

>_

```
$ egrep -r 'http[^s]' /etc/
/etc/containers/registries.conf.d/001-rhel-
shortnames.conf:"openshift4/ose-egress-http-proxy" =
"registry.redhat.io/openshift4/ose-egress-http-proxy"
/etc/containers/registries.conf.d/001-rhel-shortnames.conf:"rhel8/httpd-
24" = "registry.redhat.io/rhel8/httpd-24"
/etc/containers/registries.conf.d/001-rhel-shortnames.conf:"rhscl/httpd-
24-rhel7" = "registry.access.redhat.com/rhscl/httpd-24-rhel7"
/etc/containers/registries.conf.d/001-rhel-shortnames.conf:"ubi8/httpd-24"
= "registry.redhat.io/ubi8/httpd-24"
/etc/containers/registries.d/default.yaml:# For reading signatures, schema
may be http, https, or file.
/etc/containers/registries.d/default.yaml:#      sigstore:
http://privateregistry.com/sigstore/
/etc/wgetrc:# You can set the default proxies for Wget to use for http,
https, and ftp.
/etc/wgetrc:#https_proxy = http://proxy.yoyodyne.com:18023/
/etc/wgetrc:#http_proxy = http://proxy.yoyodyne.com:18023/
/etc/wgetrc:#ftp_proxy = http://proxy.yoyodyne.com:18023/
/etc/enscript.cfg:# along with Enscript. If not, see
<http://www.gnu.org/licenses/>.
grep: /etc/firewalld: Permission denied
/etc/smartmontools/smartd.conf:# Home page is:
http://www.smartmontools.org
```

[abc123]

[a-z]

http[^s] ➔ **http** **https**

[^]: Negated Ranges Or Sets

>_

```
$ egrep -r '/[^a-z]' /etc/
```

<https://regexr.com>

```
/etc/smartmontools/smard_warning.sh:           cmd="$plugindir/${ad#@}"  
/etc/qemu-ga/fsfreeze-hook:for file in "$FSFREEZE_D"/* ; do  
/etc/man_db.conf:MANPATH_MAP      /usr/X11R6/bin                  /usr/X11R6/man  
/etc/man_db.conf:MANPATH_MAP      /usr/bin/X11                   /usr/X11R6/man  
/etc/man_db.conf:MANDB_MAP       /usr/X11R6/man                  /var/cache/man/X11R6  
/etc/nanorc:## Each user can save his own configuration to ~/.nanorc  
/etc/nanorc:## Don't convert files from DOS/Mac format.  
/etc/nanorc:# set quotestr "^( [ ]*( #:>| })|//))+"  
/etc/nanorc:## Fix Backspace/Delete confusion problem.  
/etc/nanorc:include "/usr/share/nano/*.nanorc"  
/etc/pbm2ppa.conf:# Sample configuration file for the HP720/HP820/HP1000 PPA Printers  
/etc/pbm2ppa.conf:# 1/4 inch margins all around (at 600 DPI)  
/etc/pbm2ppa.conf:# 1/4 inch margins all around (at 600 DPI)  
/etc/pbm2ppa.conf:# 1/4 inch margins all around (at 600 DPI)  
/etc/pnm2ppa.conf:# paper.  Units are dots (1/600 inch).  Add a positive number of dots to  
/etc/pnm2ppa.conf:# sweeps of the print head, adjust these in units of 1"/600 (1 dot).  
/etc/pnm2ppa.conf:# gEnh(i) = (int) ( pow ( (double) i / 256, Gamma ) * 256 )
```

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Archive Files



Archiving (Packing), Compressing and Backup



Archiving (Packing)

`tar = tape archive`



backup.tar tarball

Packing Files and Directories With tar

>_

```
$ tar --list --file archive.tar
```

```
file1  
file2  
file3
```

```
$ tar -tf archive.tar
```

```
file1  
file2  
file3
```

```
$ tar tf archive.tar
```

```
file1  
file2  
file3
```



archive.tar

Packing Files and Directories With tar

>_

```
$ tar --create --file archive.tar file1 = $ tar cf archive.tar file1
```

```
$ tar --append --file archive.tar file2 = $ tar rf archive.tar file2
```

```
$ tar --create --file archive.tar Pictures/  
Pictures/  
Pictures/family_dog.jpg
```

```
$ tar --create --file archive.tar /home/aaron/Pictures/  
/home/aaron/Pictures/  
/home/aaron/Pictures/family_dog.jpg
```

Packing Files and Directories With tar

>_

```
$ tar --list --file archive.tar == $ tar tf archive.tar
```

```
Pictures/  
Pictures/family_dog.jpg
```

```
$ tar --extract --file archive.tar == $ tar xf archive.tar
```

```
/home/aaron/work/Pictures/  
/home/aaron/work/Pictures/family_dog.jpg
```

```
$ tar --extract --file archive.tar --directory /tmp/ == $ tar xf archive.tar -C /tmp/
```

```
$ sudo tar --extract --file archive.tar --directory /tmp/
```

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Compress and Decompress Files



Compression And Decompression Utilities

>_

```
$ gzip file1
```

```
file1.gz
```

```
$ bzip2 file2
```

```
file2.bz2
```

```
$ xz file3
```

```
file3.bz2
```

```
$ gunzip file1.gz
```

```
file1
```

```
$ bunzip file2.bz2
```

```
file2
```

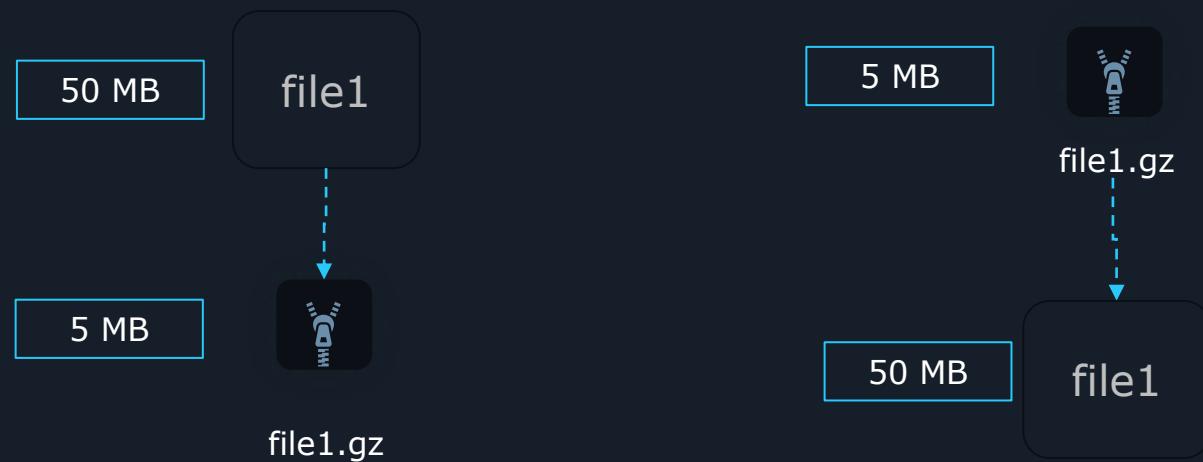
```
$ unxz file3.xz
```

```
file3
```

```
gzip --decompress file1.gz
```

```
bzip2 --decompress file2.bz2
```

```
xz --decompress file3.xz
```



Compression And Decompression Utilities

>_

```
$ gzip --help
```

Usage: gzip [OPTION]... [FILE]...
Compress or uncompress FILEs (by default, compress FILES in-place).

Mandatory arguments to long options are mandatory for short options too.

-c, --stdout	write on standard output, keep original files unchanged
-d, --decompress	decompress
-f, --force	force overwrite of output file and compress links
-h, --help	give this help
-k, --keep	keep (don't delete) input files
-l, --list	list compressed file contents
-L, --license	display software license
-n, --no-name	do not save or restore the original name and timestamp
-N, --name	save or restore the original name and timestamp
-q, --quiet	suppress all warnings
-r, --recursive	operate recursively on directories
--rsyncable	make rsync-friendly archive
-S, --suffix=SUF	use suffix SUF on compressed files
--synchronous	synchronous output
-t, --test	test compressed file integrity
-v, --verbose	verbose mode
-V, --version	display version number

```
$ gzip --keep file1
```

file1 file1.gz

```
$ bzip2 --keep file2
```

file2 file2.bz2

```
$ xz --keep file3
```

file3 file3.xz

```
$ gzip --list file1
```

compressed	uncompressed	ratio	name
71	78	39.7%	file1

Compression And Decompression Utilities

>_

```
$ zip archive file1 == $ zip archive.zip file1  
adding: file1 (deflated 40%)
```

```
$ zip -r archive.zip Pictures/ -r = recursively  
adding: Pictures/ (stored 0%)  
adding: Pictures/family_dog.jpg (stored 0%)
```

```
$ unzip archive.zip  
Archive: archive.zip  
replace file1? [y]es, [n]o, [A]ll, [N]one, [r]ename: N
```

Compression And Decompression With tar

>_

```
$ tar --create --file archive.tar file1
```

```
$ gzip archive.tar
```

```
archive.tar.gz
```

```
$ gzip --keep archive.tar
```

```
archive.tar      archive.tar.gz
```

```
$ tar --create --gzip --file archive.tar.gz file1 ➔ $ tar czf archive.tar.gz file1
```

```
$ tar --create --bzip2 --file archive.tar.bz2 file1 ➔ $ tar cjf archive.tar.bz2 file1
```

```
$ tar --create --xz --file archive.tar.xz file1 ➔ $ tar cJf archive.tar.xz file1
```

```
$ tar --create --autocompress --file archive.tar.gz file1
```

```
$ tar caf archive.xz file1
```

```
$ tar --extract --file archive.tar.gz
```

```
$ tar xf archive.tar.gz file1
```

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Backup to a Remote System



Syncing Two Directories

>_

```
$ rsync -a Pictures/ aaron@9.9.9.9:/home/aaron/Pictures/
```

```
$ rsync -a aaron@9.9.9.9:/home/aaron/Pictures/ Pictures/
```

```
$ rsync -a Pictures/ /Backups/Pictures/
```

rsync = remote synchronization



Remote Server
/home/aaron/Pictures



SSH daemon



Local Server
Pictures/

Disk Imaging

>_

```
$ sudo dd if=/dev/vda of=diskimage.raw bs=1M status=progress
```

1340080128 bytes (1.3GB, 1.2GB) copied, 3s, 432 MB/s

```
$ sudo dd if=diskimage.raw of=/dev/vda bs=1M status=progress
```

1340080128 bytes (1.3GB, 1.2GB) copied, 3s, 432 MB/s



{KODE{LOUD

Redirecting Input and Output



Redirecting Output

>_

```
$ cat file.txt
```

```
6  
5  
1  
3  
4  
2
```

```
$ sort file.txt
```

```
1  
2  
3  
4  
5  
6
```

```
$ sort file.txt > sortedfile.txt
```

```
$ cat sortedfile.txt
```

```
1  
2  
3  
4  
5  
6
```

```
> file_name #Redirect Output
```

Redirecting Output

>_

```
$ date  
Mon Nov  8 18:50:25 CST 2021
```

```
$ date > file.txt
```

```
$ cat file.txt
```

```
Mon Nov  8 18:50:30 CST 2021
```

```
> file_name #Redirect & Overwrite
```

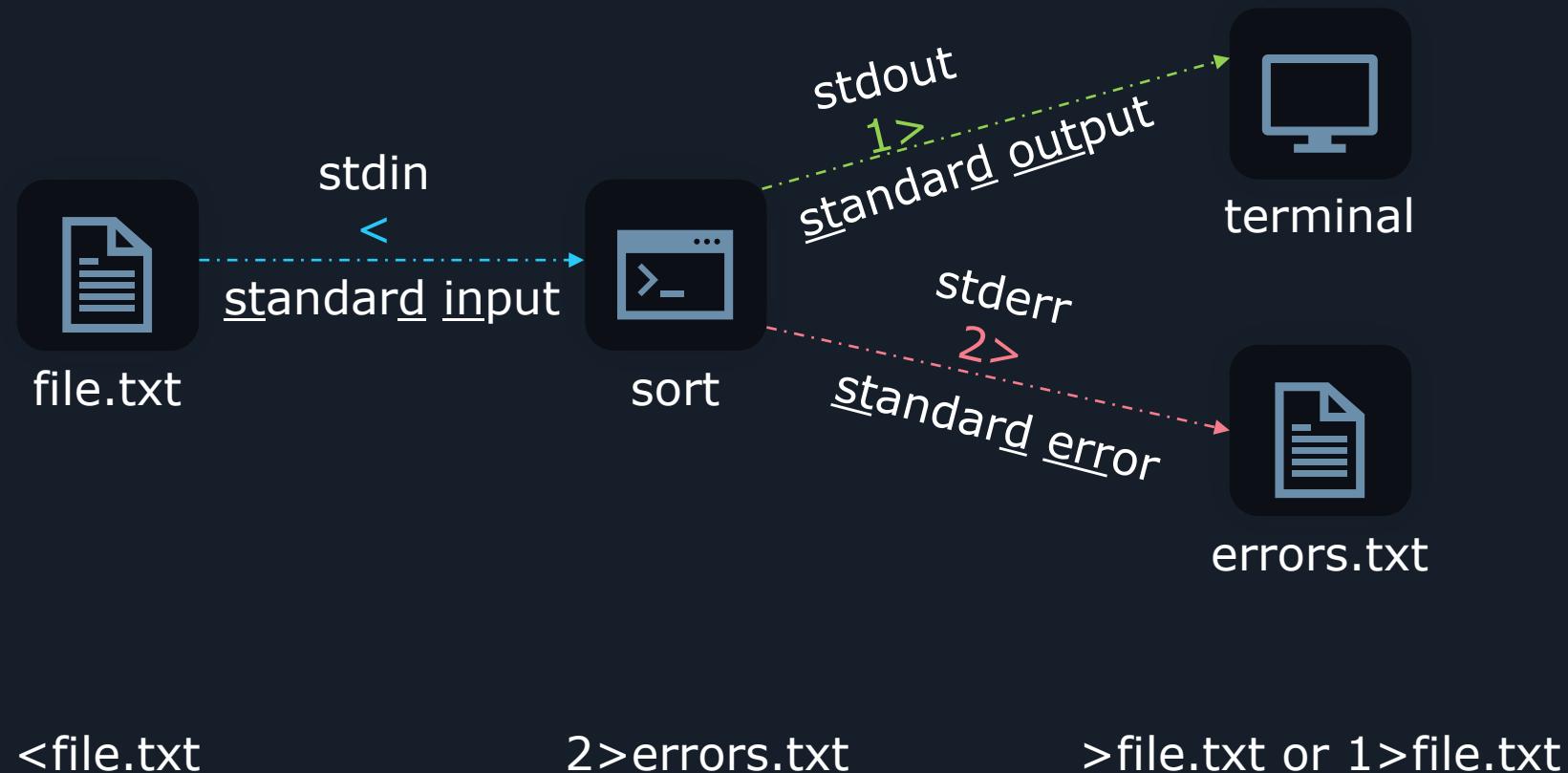
Redirecting Output

>_

```
$ date >> file.txt  
  
$ cat file.txt  
Mon Nov  8 18:50:30 CST 2021  
Mon Nov  8 18:50:31 CST 2021  
Mon Nov  8 18:50:32 CST 2021  
Mon Nov  8 18:50:33 CST 2021  
Mon Nov  8 18:50:34 CST 2021  
Mon Nov  8 18:50:35 CST 2021
```

>> file_name #Redirect & Append

stdin, stdout, and stderr



Redirecting Errors

>_

```
$ grep -r '^The' /etc/
```

```
grep: /etc/cups/ssl: Permission denied
grep: /etc/cups/subscriptions.conf.0: Permission denied
grep: /etc/cups/subscriptions.conf: Permission denied
grep: /etc/ssh/sshd_config: Permission denied
grep: /etc/chrony.keys: Permission denied
grep: /etc/brlapi.key: Permission denied
/etc/brltty/Input/tn/all.txt:The two keys at the left
rear (2 columns, 1 row):
/etc/brltty/Input/tn/all.txt:The four keys at the left
middle (cross):
/etc/brltty/Input/tn/all.txt:The six keys at the left
front (2 columns, 3 row):
/etc/brltty/Input/tn/all.txt:The one key at the right
rear (1 column, 1 row):
/etc/brltty/Input/tn/all.txt:The two keys at the right
rear (1 column, 2 rows):
/etc/brltty/Input/tn/all.txt:The four keys at the right
rear (1 column, 4 rows):
/etc/brltty/Input/tn/all.txt:The twelve keys of the
numeric pad (3 columns, 4 rows):
grep: /etc/libvirt: Permission denied
grep: /etc/wpa_supplicant/wpa_supplicant.conf:
Permission denied
grep: /etc/sudo-ldap.conf: Permission denied
```

```
$ grep -r '^The' /etc/ [2]>/dev/null
```

```
/etc/brltty/Input/tn/all.txt:The two keys at the left
rear (2 columns, 1 row):
/etc/brltty/Input/tn/all.txt:The four keys at the left
middle (cross):
/etc/brltty/Input/tn/all.txt:The six keys at the left
front (2 columns, 3 row):
/etc/brltty/Input/tn/all.txt:The one key at the right
rear (1 column, 1 row):
/etc/brltty/Input/tn/all.txt:The two keys at the right
rear (1 column, 2 rows):
/etc/brltty/Input/tn/all.txt:The four keys at the right
rear (1 column, 4 rows):
/etc/brltty/Input/tn/all.txt:The twelve keys of the
numeric pad (3 columns, 4 rows):
```

Redirecting Output

>_

```
$ grep -r '^The' /etc/ 1>output.txt 2>errors.txt
```

overwrite

```
$ grep -r '^The' /etc/ 1>>output.txt 2>>errors.txt
```

append

Redirecting Output

>_

```
$ grep -r '^The' /etc/
grep: /etc/cups/ssl: Permission denied
grep: /etc/cups/subscriptions.conf.0: Permission denied
grep: /etc/cups/subscriptions.conf: Permission denied
grep: /etc/ssh/sshd_config: Permission denied
grep: /etc/chrony.keys: Permission denied
grep: /etc/brlapi.key: Permission denied
/etc/brltty/Input/tn/all.txt:The two keys at the left
rear (2 columns, 1 row):
/etc/brltty/Input/tn/all.txt:The four keys at the left
middle (cross):
/etc/brltty/Input/tn/all.txt:The six keys at the left
front (2 columns, 3 row):
/etc/brltty/Input/tn/all.txt:The one key at the right
rear (1 column, 1 row):
/etc/brltty/Input/tn/all.txt:The two keys at the right
rear (1 column, 2 rows):
/etc/brltty/Input/tn/all.txt:The four keys at the right
rear (1 column, 4 rows):
/etc/brltty/Input/tn/all.txt:The twelve keys of the
numeric pad (3 columns, 4 rows):
grep: /etc/libvirt: Permission denied
grep: /etc/wpa_supplicant/wpa_supplicant.conf:
Permission denied
grep: /etc/sudo-ldap.conf: Permission denied
```

```
$ grep -r '^The' /etc/ > all_output.txt 2>&1
$ grep -r '^The' /etc/ 1>all_output.txt 2>&1
$ grep -r '^The' /etc/ 2>&1 1>all_output.txt
grep: /etc/cups/classes.conf: Permission denied
grep: /etc/cups/cups-files.conf: Permission denied
grep: /etc/cups/cups-files.conf.default: Permission denied
grep: /etc/cups/cupsd.conf: Permission denied
grep: /etc/cups/cupsd.conf.default: Permission denied
grep: /etc/cups/printers.conf: Permission denied
grep: /etc/cups/snmp.conf.default: Permission denied
grep: /etc/cups/ssl: Permission denied
grep: /etc/cups/subscriptions.conf.0: Permission denied
grep: /etc/cups/subscriptions.conf: Permission denied
grep: /etc/ssh/sshd_config: Permission denied
grep: /etc/ssh/ssh_host_ecdsa_key: Permission denied
grep: /etc/ssh/ssh_host_ed25519_key: Permission denied
grep: /etc/ssh/ssh_host_rsa_key: Permission denied
grep: /etc/nftables: Permission denied
grep: /etc/audit: Permission denied
grep: /etc/gssproxy/99-nfs-client.conf: Permission denied
```

Redirecting Input

>_

```
$ sort file.txt
```

from file

```
$ sendemail someone@example.com
```

from keyboard

Hi Someone,

How are you today?

...

Talk to you soon

Bye

```
$ sendemail someone@example.com < emailcontent.txt
```

from file

Heredoc and Here String

>_

```
$ sort <<EOF
```

```
> 6  
> 3  
> 2  
> 5  
> 1  
> 4
```

```
> EOF
```

```
1  
2  
3  
4  
5  
6
```

Here document or heredoc

```
$ bc <<<1+2+3+4
```

```
10
```

Here string

Piping

>_

```
$ grep -v '^#' /etc/login.defs
```

```
PASS_MAX_DAYS      99999
PASS_MIN_DAYS      0
PASS_MIN_LEN       5
PASS_WARN_AGE      7

UID_MIN             1000
UID_MAX             60000
SYS_UID_MIN         201
SYS_UID_MAX         999

GID_MIN             1000
GID_MAX             60000
SYS_GID_MIN         201
SYS_GID_MAX         999

CREATE_HOME          yes
USERGROUPS_ENAB     yes

[ENCRYPT_METHOD]    SHA512
```

```
$ grep -v '^#' /etc/login.defs | sort
```

```
CREATE_HOME          yes
ENCRYPT_METHOD      SHA512
GID_MAX              60000
GID_MIN              1000
HOME_MODE            0700
MAIL_DIR             /var/spool/mail
PASS_MAX_DAYS        99999
PASS_MIN_DAYS        0
PASS_MIN_LEN         5
PASS_WARN_AGE        7

SYS_GID_MAX          999
SYS_GID_MIN          201
SYS_UID_MAX          999
SYS_UID_MIN          201
UID_MAX               60000
UID_MIN               1000
UMASK                 022
USERGROUPS_ENAB      yes
```

Piping

>_

```
$ grep -v '^#' /etc/login.defs | sort $ grep -v '^#' /etc/login.defs | sort | column -t
```

CREATE_HOME	yes	CREATE_HOME	yes
ENCRYPT_METHOD	SHA512	ENCRYPT_METHOD	SHA512
GID_MAX	60000	GID_MAX	60000
GID_MIN	1000	GID_MIN	1000
HOME_MODE	0700	HOME_MODE	0700
MAIL_DIR	/var/spool/mail	MAIL_DIR	/var/spool/mail
PASS_MAX_DAYS	99999	PASS_MAX_DAYS	99999
PASS_MIN_DAYS	0	PASS_MIN_DAYS	0
PASS_MIN_LEN	5	PASS_MIN_LEN	5
PASS_WARN_AGE	7	PASS_WARN_AGE	7
SYS_GID_MAX	999	SYS_GID_MAX	999
SYS_GID_MIN	201	SYS_GID_MIN	201
SYS_UID_MAX	999	SYS_UID_MAX	999
SYS_UID_MIN	201	SYS_UID_MIN	201
UID_MAX	60000	UID_MAX	60000
UID_MIN	1000	UID_MIN	1000
UMASK	022	UMASK	022
USERGROUPS_ENAB	yes	USERGROUPS_ENAB	yes

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Boot, Reboot, and Shutdown Systems



Reboot and Shutdown

>_

```
$ systemctl reboot
```

system control

```
$ sudo systemctl reboot
```

[sudo] password for aaron:

```
$ sudo systemctl poweroff
```

[sudo] password for aaron:

Reboot and Shutdown

>_

```
$ sudo systemctl reboot --force
```

[sudo] password for aaron:

```
$ sudo systemctl poweroff --force
```

[sudo] password for aaron:

```
$ sudo systemctl reboot --force --force
```

[sudo] password for aaron:

```
$ sudo systemctl poweroff --force --force
```

[sudo] password for aaron:

Reboot and Shutdown

>_

```
$ sudo shutdown 02:00
```

[sudo] password for aaron:

00:00 to 23:59

```
$ sudo shutdown +15
```

[sudo] password for aaron:

```
$ sudo shutdown -r 02:00
```

[sudo] password for aaron:

```
$ sudo shutdown -r +15
```

[sudo] password for aaron:

```
$ sudo shutdown -r +1 'Scheduled restart to do an offline-backup of our database'
```

[sudo] password for aaron:

wall message

{KODE{LOUD

Use Scripting to Automate Tasks



Scripting

>_

```
[aaron@centos-vm]$
```

```
$ date
```

```
Mon Dec 6 16:28:09 CST 2021
```

command interpreter



script file

```
$ command1
```

```
$ command2
```

```
$ command3
```

Scripting

>_

```
$ touch script.sh
```

```
$ vim script.sh
```

```
$ chmod u+x script.sh
```

or

```
$ chmod +x script.sh
```



script.sh

```
#!/bin/bash
```

```
#! shebang
```

```
#Log the date and time the script was last  
executed
```

```
date >> /tmp/script.log
```

```
cat /proc/version >> /tmp/script.log
```

ESC

:

w

q

Scripting

>_

```
$ /home/aaron/script.sh ➔ $ ./script.sh
```

```
$ cat /tmp/script.log
```

```
Mon Dec  6 17:06:16 CST 2021
Linux version 4.18.0-348.2.1.el8_5.x86_64
(mockbuilder@kbuilder.bsys.centos.org) (gcc version 8.5.0 20210514 (Red Hat
8.5.0-4) (GCC)) #1 SMP Tue Nov 16 14:42:35 UTC 2021
```

Scripting

>_

\$ help

```
job_spec [&]
(( expression ))
. filename [arguments]
:
[ arg... ]
[[ expression ]]
alias [-p] [name[=value] ... ]
bg [job_spec ...]
bind [-lpsvPSVX] [-m keymap] [-f file>
break [n]
builtin [shell-builtin [arg ...]]
caller [expr]
case WORD in [PATTERN [| PATTERN]...)>
cd [-L|[-P [-e]] [-@]] [dir]
command [-pVv] command [arg ...]
compgen [-abcdefgjksuv] [-o option] [>
complete [-abcdefgjksuv] [-pr] [-DE] >
compopt [-o]+o option] [-DE] [name ..>
continue [n]
coproc [NAME] command [redirections]
declare [-aAfFgilnrtux] [-p] [name[=v>
dirs [-clpv] [+N] [-N]
disown [-h] [-ar] [jobspec ... | pid >
echo [-neE] [arg ...]

history [-c] [-d offset] [n] or hist>
if COMMANDS; then COMMANDS; [ elif C>
jobs [-lnprs] [jobspec ...] or jobs >
kill [-s sigspec | -n signum | -sigs>
let arg [arg ...]
local [option] name[=value] ...
logout [n]
mapfile [-d delim] [-n count] [-O or>
popd [-n] [+N | -N]
printf [-v var] format [arguments]
pushd [-n] [+N | -N | dir]
pwd [-LP]
read [-ers] [-a array] [-d delim] [->
readarray [-n count] [-O origin] [-s>
readonly [-aAf] [name[=value] ...] o>
return [n]
select NAME [in WORDS ... ;] do COMM>
set [-abefhkmnptuvxBCHP] [-o option->
shift [n]
shopt [-pqsu] [-o] [optname ...]
source filename [arguments]
suspend [-f]
test [expr]
time [-p] pipeline
```

Scripting

```
>_  
$ vim archive-dnf.sh  
  
$ chmod +x archive-dnf.sh  
  
$ ./archive-dnf.sh  
  
$ ls /tmp  
archive.tar.gz  
  
$ tar tf /tmp/archive.tar.gz  
etc/dnf/  
etc/dnf/modules.d/  
etc/dnf/modules.d/container-tools.module  
etc/dnf/modules.d/llvm-toolset.module  
etc/dnf/modules.d/perl.module  
etc/dnf/modules.d/perl-DBD-SQLite.module  
etc/dnf/modules.d/perl-DBI.module  
etc/dnf/modules.d/perl-IO-Socket-SSL.module
```



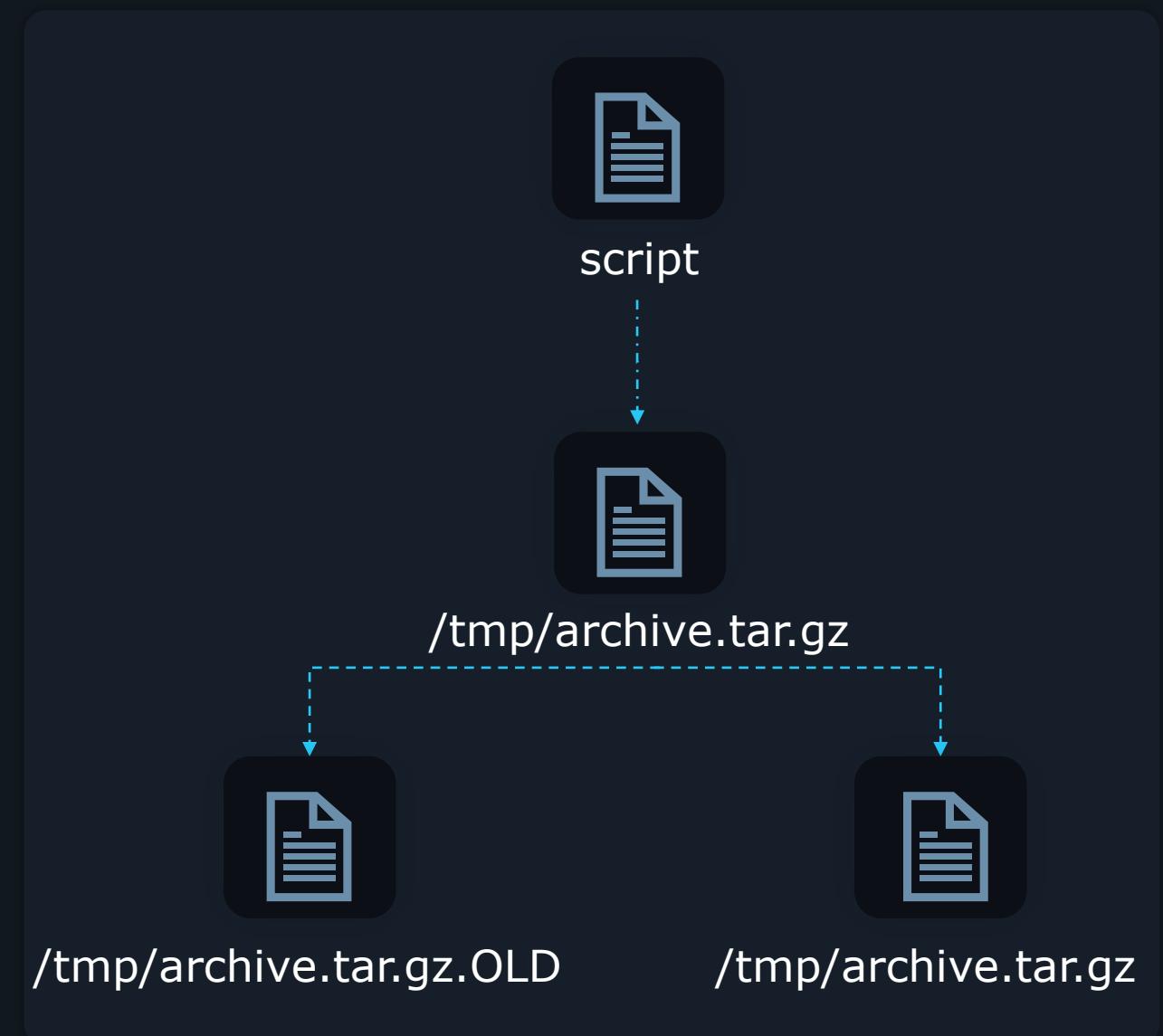
archive-dnf.sh

```
#!/bin/bash
```

```
tar acf /tmp/archive.tar.gz /etc/dnf
```

Scripting

```
>_  
$ help if  
$ help test
```



Scripting

>_

```
$ vim archive-dnf-2.sh
```

```
$ chmod +x archive-dnf-2.sh
```

```
$ ./archive-dnf-2.sh
```

```
$ ls /tmp  
archive.tar.gz  
archive.tar.gz.OLD  
script.logs
```



archive-dnf-2.sh

```
#!/bin/bash
```

```
if [ -f /tmp/archive.tar.gz ]; then  
    mv /tmp/archive.tar.gz  
    /tmp/archive.tar.gz.OLD  
    tar acf /tmp/archive.tar.gz /etc/dnf/  
else  
    tar acf /tmp/archive.tar.gz /etc/dnf/  
fi
```

Scripting

>_

```
$ vim check-grub-timeout.sh  
$ chmod +x check-grub-timeout.sh  
$ ./check-grub-timeout.sh  
Grub has a timeout of 5 seconds.
```



check-grub-timeout.sh

```
#!/bin/bash  
  
if grep -q '5' /etc/default/grub; then  
    echo 'Grub has a timeout of 5 seconds.'  
else  
    echo 'Grub DOES NOT have a timeout of 5 seconds.'  
fi
```

>_

```
$ cat /etc/cron.hourly/0anacron
#!/bin/sh
# Check whether 0anacron was run today already
if test -r /var/spool/anacron/cron.daily; then
    day=`cat /var/spool/anacron/cron.daily`
fi
if [ `date +%Y%m%d` = "$day" ]; then
    exit 0
fi

# Do not run jobs when on battery power
online=1
for psupply in AC ADP0 ; do
    sysfile="/sys/class/power_supply/$psupply/online"

    if [ -f $sysfile ] ; then
        if [ `cat $sysfile 2>/dev/null`x = 1x ]; then
            online=1
            break
        else
            online=0
        fi
    fi
done
if [ $online = 0 ]; then
    exit 0
fi
```

Shell Scripts for Beginners



COURSE CONTENT

▼ Course Introduction 1 Topic

▼ Shell Script Introduction 12 Topics

▼ Flow Control 8 Topics

▼ Shebang 7 Topics

▼ Project - E-Commerce Application 4 Topics

▼ Conclusion 1 Topic

<https://kodekloud.com/courses/shell-scripts-for-beginners/>

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Manage Startup Processes
and Services



Startup Processes and Services



Boot Up



App1



App2

Startup Processes and Services



Boot Up



App1



App2

init = initialization system

Units



service



socket



device



timer

init = initialization system

Startup Processes and Services

>_

```
$ man systemd.service
```

SYSTEMD.SERVICE(5)

systemd.service

SYSTEMD.SERVICE(5)

NAME

systemd.service - Service unit configuration

SYNOPSIS

service.service

DESCRIPTION

A unit configuration file whose name ends in ".service" encodes information about a process controlled and supervised by systemd.

This man page lists the configuration options specific to this unit type. See `systemd.unit(5)` for the common options of all unit configuration files. The common configuration items are configured in the generic "[Unit]" and "[Install]" sections. The service specific configuration options are configured in the "[Service]" section.

Startup Processes and Services

>_

```
$ systemctl cat sshd.service
# /usr/lib/systemd/system/sshd.service
[Unit]
Description=OpenSSH server daemon
Documentation=man:sshd(8) man:sshd_config(5)
After=network.target sshd-keygen.target
Wants=sshd-keygen.target

[Service]
Type=notify
EnvironmentFile=-/etc/crypto-policies/back-ends/opensslserver.config
EnvironmentFile=-/etc/sysconfig/sshd
ExecStart=/usr/sbin/sshd -D $OPTIONS $CRYPTO_POLICY
ExecReload=/bin/kill -HUP $MAINPID
KillMode=process
Restart=on-failure
RestartSec=42s

[Install]
WantedBy=multi-user.target
```

Startup Processes and Services

>_

```
$ sudo systemctl edit --full sshd.service
[Unit]
Description=OpenSSH server daemon
Documentation=man:sshd(8) man:sshd_config(5)
After=network.target sshd-keygen.target
Wants:sshd-keygen.target

[Service]
Type=notify
EnvironmentFile=/etc/crypto-policies/back-ends/opensslserver.config
EnvironmentFile=/etc/sysconfig/sshd
ExecStart=/usr/sbin/sshd -D $OPTIONS $CRYPTO_POLICY
ExecReload=/bin/kill -HUP $MAINPID
KillMode=process
Restart=on-failure
RestartSec=42s

[Install]
WantedBy=multi-user.target
```

```
$ sudo systemctl revert sshd.service
```

Startup Processes and Services

>_

```
$ sudo systemctl status sshd.service
sshd.service - OpenSSH server daemon
  Loaded: loaded (/usr/lib/systemd/system/sshd.service; enabled; vendor preset>
  Active: active (running) since Wed 2021-12-08 16:48:53 CST; 15min ago
    Docs: man:sshd(8)
          man:sshd_config(5)
  Main PID: 1031 (sshd)
    Tasks: 1 (limit: 23555)
   Memory: 2.1M
      CGroup: /system.slice/sshd.service
              └─1031 /usr/sbin/sshd -D -oCiphers=aes256-gcm@openssh.com, chacha20-p>
```

```
Dec 08 16:48:53 LFCS-CentOS systemd[1]: Starting OpenSSH server daemon...
Dec 08 16:48:53 LFCS-CentOS sshd[1031]: Server listening on 0.0.0.0 port 22.
Dec 08 16:48:53 LFCS-CentOS sshd[1031]: Server listening on :: port 22.
Dec 08 16:48:53 LFCS-CentOS systemd[1]: Started OpenSSH server daemon.
```

q

Startup Processes and Services

>_

```
$ sudo systemctl stop sshd.service
```

```
$ sudo systemctl start sshd.service
```

```
$ sudo systemctl restart sshd.service
```

```
$ sudo systemctl reload sshd.service
```

```
$ sudo systemctl status sshd.service
```

```
Dec 08 17:26:20 LFCS-CentOS sshd[3952]: Received SIGHUP; restarting.  
Dec 08 17:26:20 LFCS-CentOS systemd[1]: Reloaded OpenSSH server daemon.
```

```
$ sudo systemctl reload-or-restart sshd.service
```

Startup Processes and Services

>_

```
$ sudo systemctl disable sshd.service  
  
$ sudo systemctl status sshd.service  
Loaded: loaded (/etc/systemd/system/sshd.service; disabled;  
        )  
       Main PID: 1 (sshd)  
          Status: active (running)  
           CPU: 0.000 CPU(s) since start  
          Memory: 1.9M (4.0 kB swap)  
             CPU: 0.000 CPU(s) since start  
           Memory: 1.9M (4.0 kB swap)  
  
$ sudo systemctl is-enabled sshd.service  
disabled  
  
$ sudo systemctl enable sshd.service
```

Startup Processes and Services

>_

```
$ sudo systemctl enable sshd.service  
$ sudo systemctl start sshd.service  
$ sudo systemctl enable --now sshd.service  
$ sudo systemctl disable --now sshd.service
```

Startup Processes and Services

>_

```
$ sudo systemctl mask atd.service
```

```
$ sudo systemctl enable atd.service
```

```
Failed to enable unit: Unit file /etc/systemd/system/atd.service is masked.
```

```
$ sudo systemctl start atd.service
```

```
Failed to start atd.service: Unit atd.service is masked.
```

```
$ sudo systemctl unmask atd.service
```

```
$ sudo systemctl list-units --type service --all
```

UNIT	LOAD	ACTIVE	SUB	DESCRIPTION
accounts-daemon.service	loaded	active	running	Accounts Service
alsa-restore.service	loaded	inactive	dead	Save/Restore Sound Card >
alsa-state.service	loaded	active	running	Manage Sound Card State >
● apparmor.service	not-found	inactive	dead	apparmor.service
atd.service	loaded	active	running	Job spooling tools
auditd.service	loaded	active	running	Security Auditing Service
auth-rpcgss-module.service	loaded	inactive	dead	Kernel Module supportin>

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Locate and Analyze
System Log Files



Logging Daemons

>_

```
$ ls /var/log/
```

anaconda	dnf.rpm.log	secure
audit	firewalld	secure-20211026
boot.log	gdm	secure-20211102
boot.log-20211026	glusterfs	speech-dispatcher
boot.log-20211027	hawkey.log	spooler
boot.log-20211028	hawkey.log-20211026	spooler-20211026
boot.log-20211101	hawkey.log-20211102	spooler-20211102
boot.log-20211102	kdump.log	sssd
boot.log-20211104	lastlog	swtpm
boot.log-20211108	libvirt	tuned

```
$ su
```

Password:

```
$ sudo --login
```

[sudo] password for aaron:



Status messages



Error messages



Warning messages

rsyslog = rocket-fast system for log processing

Finding the Correct Log File

>_

```
$ grep -r 'ssh' /var/log/
/var/log/secure:Nov 15 14:47:28 LFCS-CentOS sshd[1021]: Server listening on :: port 22.
/var/log/secure:Nov 15 15:10:16 LFCS-CentOS sshd[1018]: Server listening on 0.0.0.0 port 22.
/var/log/secure:Nov 15 15:10:16 LFCS-CentOS sshd[1018]: Server listening on :: port 22.
/var/log/secure:Nov 16 17:31:35 LFCS-CentOS sshd[1026]: Server listening on 0.0.0.0 port 22.
/var/log/secure:Nov 16 19:45:53 centos-vm sshd[1709]: Accepted password for aaron from 192.168.0.1 port 57626
ssh2/var/log/boot.log-20211104:[ OK ] Reached target sshd-keygen.target.
/var/log/boot.log-20211104:[ OK ] Reached target sshd-keygen.target.
/var/log/boot.log-20211104:[ OK ] Reached target sshd-keygen.target.
/var/log/boot.log-20211108:[ OK ] Reached target sshd-keygen.target.
/var/log/boot.log-20211108:[ OK ] Reached target sshd-keygen.target.
```

Finding the Correct Log File

>_

```
$ less /usr/log/secure
```

```
Nov 16 17:48:31 LFCS-CentOS sshd[3380]: Accepted password for aaron from 192.168.0.3 port 63798 ssh2
Nov 16 17:49:16 LFCS-CentOS unix_chkpwd[3470]: password check failed for user (aaron)
Nov 16 17:36:09 LFCS-CentOS sudo[3113]:    aaron : TTY=pts/0 ; PWD=/home/aaron ; USER=root ; COMMAND=/bin/bash
Nov  2 21:01:57 LFCS-CentOS sudo[6592]:    aaron : TTY=pts/0 ; PWD=/home/aaron/Pictures ; USER=root ; COMMAND=/bin/killall less
Nov 16 17:56:44 LFCS-CentOS passwd[3581]: pam_unix(passwd:chauthtok): password changed for root
```

```
$ less /usr/log/messages
```

```
Nov  2 10:31:08 LFCS-CentOS systemd[1]: Starting dnf makecache...
Nov  2 10:31:09 LFCS-CentOS dnf[3572]: CentOS Stream 8 - AppStream          14 kB/s | 4.4 kB   00:00
Nov  2 10:31:10 LFCS-CentOS dnf[3572]: CentOS Stream 8 - BaseOS           3.3 kB/s | 3.9 kB   00:01
Nov  2 10:31:11 LFCS-CentOS dnf[3572]: CentOS Stream 8 - Extras          6.9 kB/s | 3.0 kB   00:00
Nov  2 10:31:11 LFCS-CentOS dnf[3572]: Metadata cache created.
Nov  2 10:31:11 LFCS-CentOS systemd[1]: dnf-makecache.service: Succeeded.
```

```
$ ls /var/log/
```

anaconda	dnf.rpm.log	secure
audit	firewalld	secure-20211026
boot.log	gdm	secure-20211102
boot.log-20211026	glusterfs	speech-dispatcher
boot.log-20211027	hawkey.log	spooler

Following Log Files

>_

```
$ tail -F /var/log/secure
```

```
Nov 16 17:49:27 LFCS-CentOS sshd[3468]: Failed password for aaron from 192.168.0.3 port 63821 ssh2
Nov 16 17:49:28 LFCS-CentOS sshd[3468]: Connection reset by authenticating user aaron 192.168.0.3 port 63821
[preauth]
Nov 16 17:49:28 LFCS-CentOS sshd[3468]: PAM 2 more authentication failures; logname= uid=0 euid=0 tty=ssh ruser=
rhost=192.168.0.3 user=aaron
Nov 16 17:56:44 LFCS-CentOS passwd[3581]: pam_unix(passwd:chauthtok): password changed for root
Nov 16 17:56:44 LFCS-CentOS passwd[3581]: gkr-pam: couldn't update the login keyring password: no old password
was entered
Nov 16 18:09:36 LFCS-CentOS gdm-password][3827]: gkr-pam: unlocked login keyring
Nov 16 18:21:11 LFCS-CentOS login[4116]: LOGIN ON tty1 BY aaron
Nov 16 18:21:16 LFCS-CentOS systemd[4249]: pam_unix(systemd-user:session): session opened for user gdm by
(uid=0)
```

CTRL + C

journalctl

>_

```
$ which sudo
```

```
/bin/sudo
```

```
$ journalctl /bin/sudo
```

```
-- Logs begin at Tue 2021-11-16 17:31:32 CST, end at Tue 2021-11-16 18:31:22 CS>
Nov 16 17:36:09 LFCS-CentOS sudo[3113]:    aaron : TTY=pts/0 ; PWD=/home/aaron >
Nov 16 17:36:09 LFCS-CentOS sudo[3113]: pam_systemd(sudo-i:session): Cannot cre>
Nov 16 17:36:09 LFCS-CentOS sudo[3113]: pam_unix(sudo-i:session): session opene
lines 1-4/4 (END)
```

journal control

```
$ journalctl -u [sshd.service]
```

```
-- Logs begin at Tue 2021-11-16 17:31:32 CST, end at Tue 2021-11-16 18:40:01 CS>
Nov 16 17:31:35 LFCS-CentOS systemd[1]: Starting OpenSSH server daemon...
Nov 16 17:31:35 LFCS-CentOS sshd[1026]: Server listening on 0.0.0.0 port 22.
Nov 16 17:31:35 LFCS-CentOS sshd[1026]: Server listening on :: port 22.
Nov 16 17:31:35 LFCS-CentOS systemd[1]: Started OpenSSH server daemon.
Nov 16 17:48:31 LFCS-CentOS sshd[3380]: Accepted password for aaron from 192.16>
Nov 16 17:48:31 LFCS-CentOS sshd[3380]: pam_unix(sshd:session): session opened >
Nov 16 17:49:16 LFCS-CentOS sshd[3468]: pam_unix(sshd:auth): authentication fai>
Nov 16 17:49:18 LFCS-CentOS sshd[3468]: Failed password for aaron from 192.168.>
Nov 16 17:49:23 LFCS-CentOS sshd[3468]: Failed password for aaron from 192.168.>
```

journalctl

>_

\$ journalctl

```
-- Logs begin at Tue 2021-11-16 17:31:32 CST, end at Tue 2021-11-16 18:40:01 CS>
Nov 16 17:31:32 LFCS-CentOS kernel: Linux version 4.18.0-348.el8.x86_64 (mockbu>
Nov 16 17:31:32 LFCS-CentOS kernel: Command line: BOOT_IMAGE=(hd0,msdos1)/vmlin>
Nov 16 17:31:32 LFCS-CentOS kernel: x86/fpu: Supporting XSAVE feature 0x001: 'x>
Nov 16 17:31:32 LFCS-CentOS kernel: x86/fpu: Supporting XSAVE feature 0x002: 'S>
Nov 16 17:31:32 LFCS-CentOS kernel: x86/fpu: Supporting XSAVE feature 0x004: 'A>
Nov 16 17:31:32 LFCS-CentOS kernel: x86/fpu: xstate_offset[2]: 576, xstate_siz>
Nov 16 17:31:32 LFCS-CentOS kernel: x86/fpu: Enabled xstate features 0x7, conte>
Nov 16 17:31:32 LFCS-CentOS kernel: BIOS-provided physical RAM map:
```

>

\$ journalctl -e

```
Nov 16 18:39:05 LFCS-CentOS dbus-daemon[870]: [system] Successfully activated s>
Nov 16 18:39:05 LFCS-CentOS systemd[1]: Started Fingerprint Authentication Daem>
Nov 16 18:39:08 LFCS-CentOS gdm-password][5133]: gkr-pam: unlocked login keyring
Nov 16 18:39:08 LFCS-CentOS gnome-shell[2302]: Could not delete runtime/persist>
Nov 16 18:39:08 LFCS-CentOS NetworkManager[1015]: <info> [1637109548.8989] age>
Nov 16 18:39:35 LFCS-CentOS systemd[1]: fprintd.service: Succeeded.
Nov 16 18:40:01 LFCS-CentOS anacron[3666]: Job `cron.weekly' started
Nov 16 18:40:01 LFCS-CentOS anacron[3666]: Job `cron.weekly' terminated
Nov 16 18:40:01 LFCS-CentOS anacron[3666]: Normal exit (2 jobs run)
lines 994-1016/1016 (END)
```

journalctl

>_

```
$ journalctl -f
```

```
-- Logs begin at Tue 2021-11-16 17:31:32 CST. --
Nov 16 18:39:05 LFCS-CentOS systemd[1]: Starting Fingerprint Authentication Daemon...
Nov 16 18:39:05 LFCS-CentOS dbus-daemon[870]: [system] Successfully activated service 'net.reactivated.Fprint'
Nov 16 18:39:05 LFCS-CentOS systemd[1]: Started Fingerprint Authentication Daemon.
Nov 16 18:39:08 LFCS-CentOS gdm-password][5133]: gkr-pam: unlocked login keyring
Nov 16 18:39:08 LFCS-CentOS gnome-shell[2302]: Could not delete runtime/persistent state file: Error removing
file /run/user/1000/gnome-shell/runtime-state-LE.:0/screenShield.locked: No such file or directory
Nov 16 18:39:08 LFCS-CentOS NetworkManager[1015]: <info>  [1637109548.8989] agent-manager:
agent[0ab43b020b23916f,:1.238/org.gnome.Shell.NetworkAgent/1000]: agent registered
Nov 16 18:39:35 LFCS-CentOS systemd[1]: fprintd.service: Succeeded.
Nov 16 18:40:01 LFCS-CentOS anacron[3666]: Job `cron.weekly' started
Nov 16 18:40:01 LFCS-CentOS anacron[3666]: Job `cron.weekly' terminated
Nov 16 18:40:01 LFCS-CentOS anacron[3666]: Normal exit (2 jobs run)
```

CTRL + C

journalctl

>_

```
$ journalctl -p err
```

```
-- Logs begin at Tue 2021-11-16 17:31:32 CST, end at Tue 2021-11-16  
18:56:04 CS>  
Nov 16 17:31:33 LFCS-CentOS kernel: [drm:vmw_host_log [vmwgfx]] *ERROR*  
Failed >  
Nov 16 17:31:33 LFCS-CentOS kernel: [drm:vmw_host_log [vmwgfx]] *ERROR*  
Failed >  
Nov 16 17:31:35 LFCS-CentOS alsactl[882]: alsa-lib  
main.c:1405:(snd_use_case_mg)  
Nov 16 17:31:42 LFCS-CentOS pulseaudio[1883]: module-rescue-stream is  
obsolete >
```

```
$ journalctl -p
```

```
alert crit debug emerg err info notice warning
```

TAB

TAB

info

warning

err

crit

`journalctl`

>_

```
$ journalctl -p info -g '^b'
```

```
-- Logs begin at Tue 2021-11-16 17:31:32 CST, end at Tue 2021-11-16  
19:01:48 CS>  
Nov 16 17:31:32 LFCS-CentOS kernel: BIOS-provided physical RAM map:  
Nov 16 17:31:32 LFCS-CentOS kernel: BIOS-e820: [mem 0x0000000000000000-  
0x00000000>  
Nov 16 17:31:32 LFCS-CentOS kernel: BIOS-e820: [mem 0x000000000009fc00-  
0x00000000>
```

```
$ journalctl -S 02:00
```

```
-- Logs begin at Tue 2021-11-16 17:31:32 CST, end at Tue 2021-11-16  
19:01:48 CS>  
Nov 16 17:31:32 LFCS-CentOS kernel: Linux version 4.18.0-348.el8.x86_64  
(mockbu>  
Nov 16 17:31:32 LFCS-CentOS kernel: Command line:  
BOOT_IMAGE=(hd0,msdos1)/vmlin>  
Nov 16 17:31:32 LFCS-CentOS kernel: x86/fpu: Supporting XSAVE feature  
0x001: 'x
```

```
journalctl
```

```
>_
```

```
$ journalctl -S 01:00 -U 02:00
```

```
-- Logs begin at Tue 2021-11-16 17:31:32 CST, end at Tue 2021-11-16  
19:01:48 CS>
```

```
$ journalctl -S '2021-11-16 12:04:55'
```

```
-- Logs begin at Tue 2021-11-16 17:31:32 CST, end at Tue 2021-11-16  
19:01:48 CS>  
Nov 16 17:31:32 LFCS-CentOS kernel: Linux version 4.18.0-348.el8.x86_64  
(mockbu>  
Nov 16 17:31:32 LFCS-CentOS kernel: Command line:  
BOOT_IMAGE=(hd0,msdos1)/vmlin>  
Nov 16 17:31:32 LFCS-CentOS kernel: x86/fpu: Supporting XSAVE feature  
0x001: 'x>  
Nov 16 17:31:32 LFCS-CentOS kernel: x86/fpu: Supporting XSAVE feature  
0x002: 'S>
```

`journalctl`

>_

```
$ journalctl -b 0
```

```
-- Logs begin at Tue 2021-11-16 17:31:32 CST, end at Tue 2021-11-16  
19:01:48 CS>  
Nov 16 17:31:32 LFCS-CentOS kernel: Linux version 4.18.0-348.el8.x86_64  
(mockbu>  
Nov 16 17:31:32 LFCS-CentOS kernel: Command line:  
BOOT_IMAGE=(hd0,msdos1)/vmlin>  
Nov 16 17:31:32 LFCS-CentOS kernel: x86/fpu: Supporting XSAVE feature  
0x001: 'x>  
Nov 16 17:31:32 LFCS-CentOS kernel: x86/fpu: Supporting XSAVE feature  
0x002: 'S
```

```
$ journalctl -b -1
```

```
Specifying boot ID or boot offset has no effect, no persistent journal  
was found.
```

```
$ mkdir /var/log/journal/
```

See Who Logged In

>_

```
$ last
```

```
aaron    tty2          tty2          Tue Nov 16 17:31  still logged in
reboot   system boot  4.18.0-348.el8.x Tue Nov 16 17:31  still running
aaron    tty2          tty2          Mon Nov 15 15:13 - down  (00:01)
reboot   system boot  4.18.0-348.el8.x Mon Nov 15 15:10 - 15:15 (00:05)
aaron    tty2          tty2          Mon Nov 15 14:47 - down  (00:22)
```

```
$ lastlog
```

Username	Port	From	Latest
setroubleshoot			**Never logged in**
flatpak			**Never logged in**
gdm	tty1		Tue Nov 16 18:21:16 -0600 2021
clevis			**Never logged in**
gnome-initial-setup			**Never logged in**
tcpdump			**Never logged in**
sshd			**Never logged in**
aaron	tty3		Tue Nov 16 18:21:11 -0600 2021
jane	pts/1	192.168.0.3	Tue Nov 16 19:18:55 -0600 2021

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Schedule Tasks To
Run At a Set Time



Scheduling Jobs With cron

>_

```
$ cat /etc/crontab
SHELL=/bin/bash
PATH=/sbin:/bin:/usr/sbin:/usr/bin
MAILTO=root

# For details see man 4 crontabs

# Example of job definition:
# .---- minute (0 - 59);
# | .---- hour (0 - 23)
# | | .---- day of month (1 - 31)
# | | | .---- month (1 - 12) OR jan,feb,mar,apr ...
# | | | | .---- day of week (0 - 6) (Sunday=0 or 7) OR
# | | | | sun,mon,tue,wed,thu,fri,sat
# | | | |
# * * * * * user-name command to be executed

35 6 * * * root /bin/some_command --some_options
```

* = match all possible values (i.e., every hour)
, = match multiple values (i.e., 15,45)
- = range of values (i.e., 2-4)
/ = specifies steps (i.e., */4)

Scheduling Jobs With cron

>_

```
$ which touch
```

```
/usr/bin/touch
```

```
$ crontab -e
```

```
35 6 * * * /usr/bin/touch test_passed
```

```
0 3 * * 0 /usr/bin/touch test_passed
```

```
0 3 * * 7 /usr/bin/touch test_passed
```

```
0 3 15 * * /usr/bin/touch test_passed
```

```
0 3 * * * /usr/bin/touch test_passed
```

```
0 * * * * /usr/bin/touch test_passed
```

```
~
```

```
~
```

```
~
```

```
~
```

```
~
```

```
~
```

```
~
```

```
~
```

Scheduling Jobs With cron

>_

```
$ crontab -l
```

```
35 6 * * * /usr/bin/touch aaron_test
```

```
$ sudo crontab -l
```

```
0 * * * * /usr/bin/touch root_test
```

```
$ sudo crontab -e -u jane
```

```
30 * * * * /usr/bin/touch jane_test
```

```
$ crontab -r
```

```
$ sudo crontab -r -u jane
```

daily = </etc/cron.daily/>

hourly = </etc/cron.hourly/>

monthly = </etc/cron.monthly/>

weekly = </etc/cron.weekly/>

Scheduling Jobs With cron

>_

```
$ touch shellscript  
$ sudo cp shellscript /etc/cron.hourly/  
$ sudo chmod +rx /etc/cron.hourly/shellscript  
$ sudo rm /etc/cron.hourly/shellscript
```

Scheduling Jobs With anacron

>_

```
$ sudo vim /etc/anacrontab
#period in days    delay in minutes    job-identifier    command
1              5            cron.daily          nice run-parts
/etc/cron.daily
7              25           cron.weekly        nice run-parts
/etc/cron.weekly
@monthly 45      cron.monthly       nice run-parts /etc/cron.monthly
3              10           test job          /usr/bin/touch /root/anacron_created_this
7              10           test job          /usr/bin/touch /root/anacron_created_this
@weekly     10           test job          /usr/bin/touch /root/anacron_created_this
@monthly    10           test job          /usr/bin/touch /root/anacron_created_this
```

```
$ anacron -T
anacron: Invalid syntax in /etc/anacrontab on line 17 - skipping this line
```

Scheduling Jobs With at

>_

```
$ at 15:00
```

```
warning: commands will be executed using /bin/sh
at> /usr/bin/touch file_created_by_at
```

CTRL + d

```
$ at 'August 20 2022'
```

```
$ at '2:30 August 20 2022'
```

```
$ at 'now + 30 minutes'
```

```
$ at 'now + 3 hours'
```

```
$ at 'now + 3 days'
```

```
$ at 'now + 3 weeks'
```

```
$ at 'now + 3 months'
```

```
$ atq
```

```
20 Wed Nov 17 08:30:00 2021 a aaron
```

```
$ at -c 20
```

```
LESSOPEN=\|\|/usr/bin/lesspipe.sh\ %s; export LESSOPEN
cd /home/aaron || {
    echo 'Execution directory inaccessible' >&2
    exit 1
}
${SHELL:-/bin/sh} << 'marcinDELIMITER1d46213b'
command1
command2
marcinDELIMITER1d46213b
```

```
$ atrm 20
```

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Updating Software



Upgrading With the Package Manager

>_

```
$ dnf check-upgrade
```

CentOS Stream 8 - AppStream	11 kB/s 4.4 kB	00:00
CentOS Stream 8 - BaseOS	14 kB/s 3.9 kB	00:00
CentOS Stream 8 - Extras	7.5 kB/s 3.0 kB	00:00

Installing:

kernel	x86_64	4.18.0-348.2.1.el8_5	baseos	7.0 M
kernel-devel	x86_64	4.18.0-348.2.1.el8_5	baseos	20 M
alsa-sof-firmware.noarch		1.9-1.el8	baseos	
bpftool.x86_64		4.18.0-348.2.1.el8_5	baseos	
device-mapper.x86_64		8:1.02.181-1.el8	baseos	
Obsoleting Packages				
kernel-headers.x86_64		4.18.0-348.2.1.el8_5	baseos	
kernel-headers.x86_64		4.18.0-348.el8	@baseos	

```
$ sudo dnf upgrade
```

Transaction Summary

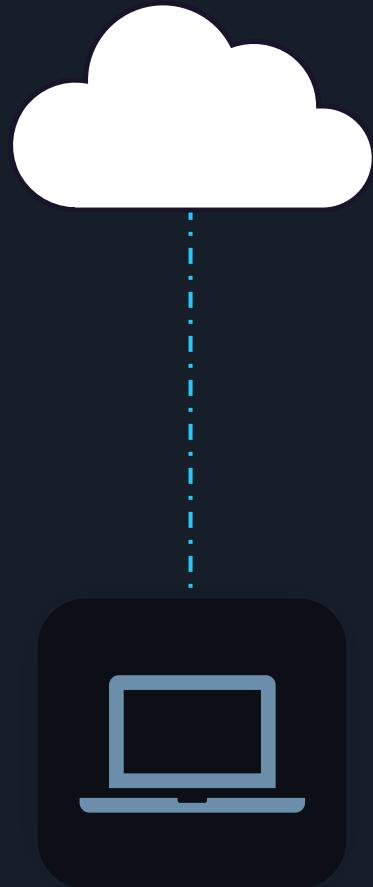
```
=====  
Install 4 Packages  
Upgrade 17 Packages
```

```
Total download size: 137 M  
Is this ok [y/N]: y
```

Manage Software With dnf



Software Repository



Manage Software With dnf

>_

```
$ sudo dnf repolist
```

repo id	repo name
appstream	CentOS Stream 8 - AppStream
baseos	CentOS Stream 8 - BaseOS
extras	CentOS Stream 8 - Extras

```
$ sudo dnf repolist -v
```

verbose

```
Repo-id          : appstream
Repo-name        : CentOS Stream 8 - AppStream
Repo-revision    : 8-stream
Repo-distro-tags: [cpe:/o:centos-stream:centos-stream:8]: , , 8, C, 0,
                  : S, S, a, e, e, m, n, r, t, t
Repo-updated     : Wed 17 Nov 2021 04:37:56 PM CST
Repo-pkgs        : 13,413
Repo-available-pkgs: 12,077
Repo-size        : 31 G
Repo-mirrors     : http://mirrorlist.centos.org/?release=8-
stream&arch=x86_64&repo=AppStream&infra=stock
Repo-baseurl     : http://centos.mirror.lstn.net/8-stream/AppStream/x86_64/os/
                  : (9 more)
Repo-expire      : 172,800 second(s) (last: Sat 20 Nov 2021 08:45:40 PM CST)
Repo-filename    : /etc/yum.repos.d/CentOS-Stream-AppStream.repo
```

Manage Software With dnf

>_

```
$ sudo dnf repolist --all
```

repo id	repo name	status
ha-source	CentOS Stream 8 - HighAvailability - Source	disabled
media-appstream	CentOS Stream 8 - Media - AppStream	disabled
media-baseos	CentOS Stream 8 - Media - BaseOS	disabled
powertools	CentOS Stream 8 - PowerTools	disabled
powertools-source	CentOS Stream 8 - PowerTools - Source	disabled
resilientstorage	CentOS Stream 8 - ResilientStorage	disabled
resilientstorage-source	CentOS Stream 8 - ResilientStorage - Source	disabled
rt	CentOS Stream 8 - RealTime	disabled
rt-source	CentOS Stream 8 - RT - Source	disabled

```
$ sudo dnf config-manager --enable powertools
```

```
$ sudo dnf config-manager --disable powertools
```

Manage Software With dnf

>_

```
$ sudo dnf config-manager --add-repo https://download.docker.com/linux/centos/docker-ce.repo
```

```
$ sudo dnf repolist -v
```

```
Repo-id          : docker-ce-stable
Repo-name        : Docker CE Stable - x86_64
Repo-revision    : 1637198749
Repo-updated    : Wed 17 Nov 2021 07:25:49 PM CST
Repo-pkgs        : 56
Repo-available-pkgs: 56
Repo-size        : 1.3 G
Repo-baseurl     : https://download.docker.com/linux/centos/8/x86_64/stable
Repo-expire      : 172,800 second(s) (last: Sun 21 Nov 2021 07:37:29 PM CST)
Repo-filename    : /etc/yum.repos.d/docker-ce.repo
```

```
$ sudo rm /etc/yum.repos.d/docker-ce.repo
```

Manage Software With dnf

>_

```
$ sudo search web server
```

cockpit.x86_64: Web Console for Linux servers

```
$ sudo search 'web server'
```

nginx.x86_64: A high performance web server and reverse proxy server

```
$ sudo dnf info nginx
```

Description : Nginx is a web server and a reverse proxy server for HTTP, SMTP, POP3 and

: IMAP protocols, with a strong focus on high concurrency, performance and low
 : memory usage.

Manage Software With dnf

>

```
$ sudo dnf install nginx
```

Installing:

nginx
9.module e18.0.0+184+e34fea82

Installing dependencies

nginx-all-modules

nginx-filesystem

9.module_el8.0.0+184+e34fea82
nginx-mod-http-image-filter

9.module_e18.0.0+184+e34fea82
 nginx-mod-http-perl

nginx-mod-keepalive module el8 0.0+18/

```
  nginx-mod-http-xslt-filter  
 9 module_e18_0_01841e34fcfa82
```

9.module_nginx-0.8.0+184+e541ead02
 nginx-mod-mail

=====
=====

x86_64		1:1.14.1-
appstream		570 k
noarch		1:1.14.1-
appstream		23 k
noarch		1:1.14.1-
appstream		24 k
x86_64		1:1.14.1-
appstream		35 k
x86_64		1:1.14.1-
appstream		45 k
x86_64		1:1.14.1-
appstream		33 k
x86_64		

Install 8 Packages

Total download size: 881 k

Installed size: 2.0 M

Is this ok [y/N]: y

Manage Software With dnf

>_

```
$ sudo dnf reinstall nginx
```

```
=====
=====
Package          Architecture      Version
Repository      Size
=====
=====
Reinstalling:
  nginx           x86_64          1:1.14.1-
  9.module_el8.0.0+184+e34fea82
  570 k
  appstream
```

```
Transaction Summary
=====
=====
```

```
Total download size: 570 k
```

```
Installed size: 1.7 M
```

```
Is this ok [y/N]: y
```

Manage Software With dnf

>_

```
$ sudo dnf remove nginx
```

Dependencies resolved.

Package	Architecture	Version	Repository	Size
nginx	x86_64	1:1.14.1-9.module_el8.0.0+184+e34fea82	@appstream	1.7 M
Removing unused dependencies:				
nginx-all-modules	noarch	1:1.14.1-9.module_el8.0.0+184+e34fea82	@appstream	0
nginx-filesystem	noarch	1:1.14.1-9.module_el8.0.0+184+e34fea82	@appstream	0
nginx-mod-http-image-filter	x86_64			

Removing:

Package	Architecture	Version	Repository	Size
nginx	x86_64	1:1.14.1-9.module_el8.0.0+184+e34fea82	@appstream	1.7 M

Transaction Summary

Remove	8 Packages
Freed space:	2.0 M

Is this ok [y/N]: y

Manage Software With dnf

>_

```
$ sudo dnf remove libcurl-7.61.1-22.el8.x86_64  
$ sudo dnf remove libcurl-7.61.1-22.el8  
$ sudo dnf remove libcurl
```

Manage Software With dnf

>_

```
$ sudo dnf group list
```

Available Environment Groups:

- Server
- Minimal Install
- Workstation
- Virtualization Host
- Custom Operating System
- Server with GUI**

Installed Environment Groups:

Installed Groups:

- Container Management
- Headless Management

Available Groups:

- .NET Core Development
- RPM Development Tools
- Development Tools
- Graphical Administration Tools
- Legacy UNIX Compatibility
- Network Servers
- Scientific Support
- Security Tools
- Smart Card Support
- System Tools

```
$ sudo dnf group install 'Server with GUI'
```

```
$ sudo dnf group install --with-optional 'Server with GUI'
```

```
$ sudo dnf group remove 'Server with GUI'
```

Manage Software With dnf

>_

```
$ sudo dnf group list --hidden
```

```
Available Groups:  
  Backup Client  
  Conflicts AppStream  
  Debugging Tools  
  Desktop Debugging and Performance Tools  
  DNS Name Server  
  .NET Core Development  
  FTP Server  
  GNOME Applications  
  Graphics Creation Tools  
  Guest Agents  
  Internet Applications  
  Java Platform  
  Legacy X Window System Compatibility  
  Office Suite and Productivity  
  Atomic Host ostree support  
  KVM platform specific packages  
  Hyper-v platform specific packages  
  VMware platform specific packages  
  Remote Desktop Clients  
  RPM Development Tools  
  TeX formatting system  
  Virtualization Client  
  Virtualization Hypervisor  
  Virtualization Platform
```

Manage Software With dnf

>_

```
$ wget https://download.nomachine.com/download/7.7/Linux/nomachine_7.7.4_1_x86_64.rpm
--2021-11-21 20:12:39-- https://download.nomachine.com/download/7.7/Linux/nomachine_7.7.4_1_x86_64.rpm
Resolving download.nomachine.com (download.nomachine.com)... 83.222.232.25
Connecting to download.nomachine.com (download.nomachine.com)|83.222.232.25|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 48431612 (46M) [application/x-redhat-package-manager]
Saving to: ‘nomachine_7.7.4_1_x86_64.rpm’

nomachine_7.7.4_1_x86_64.rpm
100%[=====] 46.19M 10.1MB/s    in 5.2s

2021-11-21 20:12:45 (8.93 MB/s) - ‘nomachine_7.7.4_1_x86_64.rpm’ saved [48431612/48431612]
```

```
$ sudo dnf install ./nomachine_7.7.4_1_x86_64.rpm
```

```
$ sudo dnf remove nomachine
```

Manage Software With dnf

>_

```
nginx-mod-http-image-filter.x86_64
```

```
$ sudo dnf autoremove
```

```
$ sudo dnf history
```

ID	Command line		
	Date and time	Action(s)	Altered
<hr/>			
<hr/>			
11	install nginx		
2021-11-21 19:51	Install	8	
10	upgrade		
2021-11-20 20:45	I, U	21	
9			
2021-11-18 17:53	Upgrade	6	
8			
2021-11-16 19:21	I, U	109	
7			
2021-11-10 19:32	I, U	46	
6	update		
2021-11-04 22:57	Upgrade	6	
5	install elfutils-libelf-devel		

Manage Software With dnf

>_

```
$ sudo dnf
```

```
Display all 107 possibilities? (y or n) y
alias debug-restore groupinstall
install-n playground repo-packages
swap
autoremove deplist grouplist
install-na prov repo-pkgs
up
autoremove-n dg groupremove
install-nevra provides repoquery
update
autoremove-na distribution-synchronization groups
kpatch rei repoquery-n
updateinfo
autoremove-nevra distro-sync groups-manager
list reinstall repoquery-na
update-minimal
build-dep distrosync groupupdate
list-sec remove repoquery-nevra
update-to
builddep downgrade grp
list-security remove-n repository-packages
upgrade
```

TAB

TAB

y

{KODE{LOUD

Identify the Component
a File Belongs To



Using dnf to Identify File Origins

>_

```
$ dnf provides /etc/anacrontab
[cronie-anacron]-1.5.2-4.el8.x86_64 : Utility for running regular jobs
Repo       : baseos
Matched from:
Filename   : /etc/anacrontab

cronie-anacron-1.5.2-6.el8.x86_64 : Utility for running regular jobs
Repo       : @System
Matched from:
Filename   : /etc/anacrontab
```

```
$ sudo rm /etc/anacrontab
```

```
$ dnf reinstall cronie-anacron
Reinstalling:
 cronie-anacron           x86_64        1.5.2-6.el8      baseos      42 k

Transaction Summary
=====
Total download size: 42 k
Installed size: 46 k
Is this ok [y/N]: y
```

Using dnf to Identify File Origins

>

```
$ dnf provides docker
```

`podman-docker-3.1.0-0.13.module_el8.5.0+733+9bb5dfffa.noarch` : Emulate Docker CLI
: using podman

Repo : appstream

Matched from:

Provide : docker = 3.1.0-0.13.module_el8.5.0+733+9bb5dfffa

podman-docker-3.3.0-0.15.module_el8.5.0+870+f792de72.noarch : Emulate Docker CLI
: using podman

Repo : appstream

Matched from:

Provide : docker = 3.3.0-0.15.module_el8.5.0+870+f792de72

podman-docker-3.3.0-0.17.module_el8.5.0+874+6db8bee3.noarch : Emulate Docker CLI
: using podman

Using dnf to Identify File Origins

>_

```
$ dnf repoquery --list nginx
/etc/logrotate.d/nginx
/etc/nginx/fastcgi.conf
/etc/nginx/fastcgi.conf.default
/etc/nginx/fastcgi_params
/etc/nginx/fastcgi_params.default
/etc/nginx/koi-utf
/etc/nginx/koi-win
/etc/nginx/mime.types
/etc/nginx/mime.types.default
/etc/nginx/nginx.conf
/etc/nginx/nginx.conf.default
/etc/nginx/scgi_params
/etc/nginx/scgi_params.default
/etc/nginx/uwsgi_params
/etc/nginx/uwsgi_params.default
/etc/nginx/win-utf
/usr/bin/nginx-upgrade
/usr/lib/.build-id
```

-l is short for "list"

```
$ dnf repoquery -l nginx | grep conf
/etc/nginx/fastcgi.conf
/etc/nginx/fastcgi.conf.default
/etc/nginx/nginx.conf
/etc/nginx/nginx.conf.default
```

{KODE{LOUD

Verify the Integrity of Resources
and Key Processes



Verify Key Resources and Processes

>_

```
$ df
```

Filesystem	1K-blocks	Used	Available	Use%	Mounted on
devtmpfs	1881280	0	1881280	0%	/dev
tmpfs	1910688	0	1910688	0%	/dev/shm
tmpfs	1910688	9456	1901232	1%	/run
tmpfs	1910688	0	1910688	0%	/sys/fs/cgroup
/dev/mapper/cs-root	17811456	8231080	9580376	47%	/
/dev/vda1	1038336	445204	593132	43%	/boot
tmpfs	382136	24	382112	1%	/run/user/1000

```
$ du -sh /bin/
```

238M	/bin/
------	-------

```
$ df -h
```

Filesystem	Size	Used	Avail	Use%	Mounted on
devtmpfs	1.8G	0	1.8G	0%	/dev
tmpfs	1.9G	0	1.9G	0%	/dev/shm
tmpfs	1.9G	9.3M	1.9G	1%	/run
tmpfs	1.9G	0	1.9G	0%	/sys/fs/cgroup
/dev/mapper/cs-root	17G	7.9G	9.2G	47%	/
/dev/vda1	1014M	435M	580M	43%	/boot
tmpfs	374M	24K	374M	1%	/run/user/1000

Verify Key Resources and Processes

>_

```
$ free -h
```

	total	used	free	shared	buff/cache	available
Mem:	[3.6Gi]	[1.0Gi]	1.5Gi	15Mi	1.1Gi	[2.4Gi]
Swap:	2.0Gi	0B	2.0Gi			

1 Mebibyte = 2^{20} = 1,048,576 bytes

1 Megabyte = 1,000,000 bytes

Verify Key Resources and Processes

>_

```
$ uptime
```

```
17:24:55 up 32 min, 1 user, load average: [0.05], [0.05], [0.01]
```

6.00, 0.31, 0.18

6.12, 7.12, 7.30

```
$ lspci
```

```
00:00.0 Host bridge: Intel Corporation 440FX - 82441FX PMC [Natoma] (rev 02)
00:01.0 ISA bridge: Intel Corporation 82371SB PIIX3 ISA [Natoma/Triton II]
00:01.1 IDE interface: Intel Corporation 82371AB/EB/MB PIIX4 IDE (rev 01)
00:02.0 VGA compatible controller: VMware SVGA II Adapter
00:03.0 Ethernet controller: Intel Corporation 82540EM Gigabit Ethernet
Controller (rev 02)
00:04.0 System peripheral: InnoTek Systemberatung GmbH VirtualBox Guest Service
00:05.0 Multimedia audio controller: Intel Corporation 82801AA AC'97 Audio
Controller (rev 01)
00:06.0 USB controller: Apple Inc. KeyLargo/Intrepid USB
00:07.0 Bridge: Intel Corporation 82371AB/EB/MB PIIX4 ACPI (rev 08)
00:0b.0 USB controller: Intel Corporation 82801FB/FBM/FR/FW/FRW (ICH6 Family)
USB2 EHCI Controller
00:0d.0 SATA controller: Intel Corporation 82801HM/HEM (ICH8M/ICH8M-E) SATA
Controller [AHCI mode] (rev 02)
```

```
$ lscpu
```

```
Architecture:           x86_64
CPU op-mode(s):         32-bit, 64-bit
Byte Order:             Little Endian
CPU(s):                 2
On-line CPU(s) list:   0,1
Thread(s) per core:    1
Core(s) per socket:    2
Socket(s):              1
NUMA node(s):           1
Vendor ID:              GenuineIntel
CPU family:             6
Model:                  158
Model name:             Intel(R) Core(TM) i9-9900K CPU @ 3.60GHz
Stepping:               13
CPU MHz:                3600.002
BogoMIPS:               7200.00
Hypervisor vendor:     KVM
Virtualization type:   full
L1d cache:              32K
L1i cache:              32K
L2 cache:                256K
L3 cache:                16384K
NUMA node0 CPU(s):      0,1
Flags:                  fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
pat pse36 clflush mmx fxsr sse sse2 ht syscall nx rdtscp lm constant_tsc rep_good
nopl xtopology nonstop_tsc cpuid tsc_known_freq pni pclmulqdq ssse3 cx16 pcid sse4_1
sse4_2 x2apic movbe popcnt aes xsave avx rdrand hypervisor lahf_lm abm 3dnowprefetch
invpcid_single fsgsbase avx2 invpcid rdseed clflushopt md_clear flush_l1d
arch_capabilities
```

Verify Key Resources and Processes

>_

```
$ sudo xfs_repair -v /dev/vdb1
```

```
Phase 1 - find and verify superblock...
- block cache size set to 175968 entries
Phase 2 - using internal log
- zero log...
zero_log: head block 103 tail block 103
- scan filesystem freespace and inode maps...
- found root inode chunk
Phase 3 - for each AG...
- scan and clear agi unlinked lists...
- process known inodes and perform inode discovery...
- agno = 0
- agno = 1
- agno = 2
- agno = 3
- process newly discovered inodes...
Phase 4 - check for duplicate blocks...
- setting up duplicate extent list...
- check for inodes claiming duplicate blocks...
- agno = 0
- agno = 1
- agno = 2
- agno = 3
Phase 5 - rebuild AG headers and trees...
- agno = 0
- agno = 1
- agno = 2
- agno = 3
- reset superblock...
Phase 6 - check inode connectivity...
- resetting contents of realtime bitmap and summary inodes
- traversing filesystem ...
- agno = 0
- agno = 1
- agno = 2
- agno = 3
- traversal finished ...
- moving disconnected inodes to lost+found ...
Phase 7 - verify and correct link counts...
```

```
done
```

Verify Key Resources and Processes

>_

```
$ sudo fsck.ext4 [-v][-f][-p]/dev/vdb2
```

```
11 inodes used (0.00%, out of 262144)
  0 non-contiguous files (0.0%)
  0 non-contiguous directories (0.0%)
    # of inodes with ind/dind/tind blocks: 0/0/0
    Extent depth histogram: 3
36942 blocks used (3.52%, out of 1048576)
  0 bad blocks
  1 large file
```

```
  0 regular files
  2 directories
  0 character device files
  0 block device files
  0 fifos
  0 links
  0 symbolic links (0 fast symbolic links)
  0 sockets
```

```
-----
  2 files
```

Verify Key Resources and Processes

>_

```
$ systemctl list-dependencies
```

```
default.target
• └─accounts-daemon.service
• └─gdm.service
• └─nvmefc-boot-connections.service
• └─rtkit-daemon.service
• └─systemd-update-utmp-runlevel.service
• └─udisks2.service
```

```
$ sudo pkill chronyd
```

```
$ systemctl list-dependencies
```

```
• └─multi-user.target
•   ├─atd.service
•   ├─auditd.service
•   ├─avahi-daemon.service
•   └─chronyd.service
```

```
$ systemctl status chronyd.service
```

```
● chronyd.service - NTP client/server
   Loaded: loaded (/usr/lib/systemd/system/chronyd.service; enabled;
   vendor pre>
             Active: inactive (dead) since Tue 2022-02-22 17:50:12 CST; 1min 47s ago
```

```
$ sudo systemctl start chronyd.service
```

{KODE{LOUD

Change Kernel
Runtime Parameters



Kernel Runtime Parameters

>_

```
$ sysctl -a
```

```
[fs].pipe-user-pages-hard = 0  
fs.pipe-user-pages-soft = 16384  
sysctl: permission denied on key 'fs.protected_fifos'  
sysctl: permission denied on key 'fs.protected_hardlinks'  
sysctl: permission denied on key 'fs.protected_regular'
```

```
$ sudo sysctl -a
```

```
net.ipv6.conf.default.addr_gen_mode = 0  
net.ipv6.conf.default.autoconf = 1  
net.ipv6.conf.default.dad_transmits = 1  
[net.ipv6.conf.default.disable_ipv6 = 0]  
net.ipv6.conf.default.disable_policy = 0  
[vm].admin_reserve_kbytes = 8192
```

```
$ sudo sysctl -w net.ipv6.conf.default.disable_ipv6=1
```

```
net.ipv6.conf.default.disable_ipv6 = 1
```

```
$ sudo sysctl net.ipv6.conf.default.disable_ipv6
```

```
net.ipv6.conf.default.disable_ipv6 = 1
```

Kernel Runtime Parameters

>_

```
$ man sysctl.d
```

SYNOPSIS

```
/etc/sysctl.d/*.conf
```

```
$ sysctl -a | grep vm
```

```
vm.panic_on_oom = 0
vm.percpu_pagelist_fraction = 0
vm.stat_interval = 1
vm.swappiness = 30
```

```
$ sudo vim /etc/sysctl.d/swap-less.conf
```

```
$ sudo sysctl -p /etc/sysctl.d/swap-less.conf
```

● ● ● swap-less.conf

```
vm.swappiness=29
```

{KODE{LOUD

SELinux



File and Directory Permissions

r w X r w X r w X

owner

u

Group

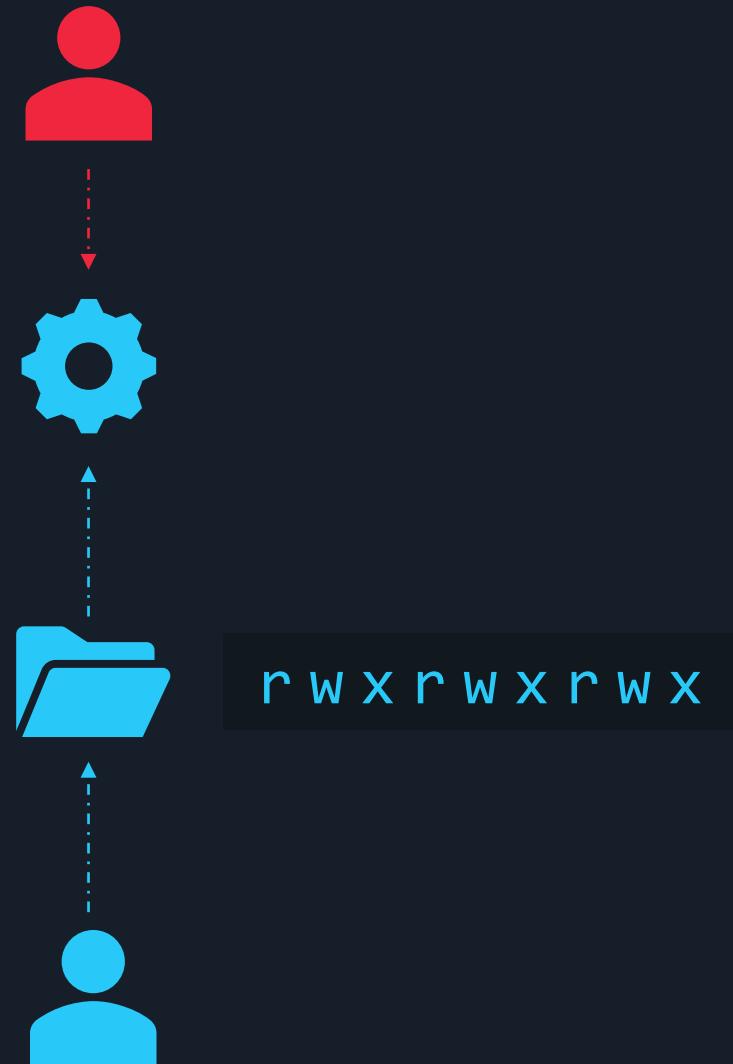
g

Others

o

Bit	Purpose
r	Read File
w	Write to File
x	Execute (run)
-	No permission

SELinux



SELinux Contexts

>_

```
$ ls -l  
-rw-rw-r--. 1 aaron aaron 160 Dec 1 18:19 archive.tar.gz
```

```
$ ls -Z  
unconfined_u:object_r:user_home_t:s0 archive.tar.gz
```

SELinux Context Label

>_

unconfined_u:object_r:user_home_t:s0

user role type level

SELinux User	Roles
developer_u	developer_r, docker_r
guest_u	guest_r
root	staff_r, sysadm_r, system_r, unconfined_r

SELinux Contexts

1. Only certain users can enter certain roles and certain types.
2. It lets authorized users and processes do their job, by granting the permissions they need.
3. Authorized users and processes are allowed to take **only** a limited set of actions.
4. Everything else is denied.

```
unconfined_u:object_r:user_home_t:s0
```

user	role	type	level
unconfined_u	object_r	user_home_t	s0

SELinux Contexts

>_

```
$ ps axZ
```

```
system_u:system_r:accounts_t:s0    995 ?      Ssl    0:00 /usr/libexec/accoun
system_u:system_r:NetworkManager_t:s0 1024 ?      Ssl    0:00 /usr/sbin/NetworkMa
system_u:system_r:sshd_t:s0-s0:c0.c1023 1030 ?  Ss    0:00 /usr/sbin/sshd -D -
system_u:system_r:tuned_t:s0        1032 ?      Ssl    0:00 /usr/libexec/platfo
system_u:system_r:cupsd_t:s0-s0:c0.c1023 1033 ?  Ss    0:00 /usr/sbin/cupsd -l
```

```
$ ls -Z /usr/sbin/sshd
```

```
system_u:object_r:sshd_exec_t:s0 /usr/sbin/sshd
```

```
$ ps axZ
```

```
unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023 1875 ?  Ss    0:00 /usr/lib/
system_u:system_r:init_t:s0           1881 ?  S    0:00 (sd-pam)
unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023 1891 ?  Ssl   0:00 /usr/bin
```

SELinux Contexts

>_

```
$ id -Z  
unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023
```

```
$ sudo semanage login -l
```

Login Name	SELinux User	MLS/MCS Range	Service
__default__	unconfined_u	s0-s0:c0.c1023	*
root	unconfined_u	s0-s0:c0.c1023	*

```
$ sudo semanage user -l
```

SELinux User	Prefix	MCS Level	MCS Range	SELinux Roles
guest_u	user	s0	s0	guest_r
root	user	s0	s0-s0:c0.c1023	staff_r sysadm_r system_r unconfined_r
staff_u	user	s0	s0-s0:c0.c1023	staff_r sysadm_r unconfined_r
sysadm_u	user	s0	s0-s0:c0.c1023	

SELinux Modes

>_

```
$ getenforce
```

Enforcing

Enforcing

Permissive

Disabled

{KODE{LOUD

Manage Local User Accounts



Local User Accounts

>_

```
$ sudo useradd john
```

```
$ ls -a /etc/skel
```

```
. . . .bash_logout .bash_profile .bashrc
```

```
$ useradd --defaults
```

```
GROUP=100  
HOME=/home  
INACTIVE=-1  
EXPIRE=  
SHELL=/bin/bash  
SKEL=/etc/skel  
CREATE_MAIL_SPOOL=yes
```

```
= $ useradd -D
```

```
$ cat /etc/login.defs
```

```
# Please note that the parameters in this configuration file control the  
# behavior of the tools from the shadow-utils component. None of these  
# tools uses the PAM mechanism, and the utilities that use PAM (such as  
the  
# passwd command) should therefore be configured elsewhere. Refer to  
# /etc/pam.d/system-auth for more information.
```



john



john



/home/john



/bin/bash



```
.bash_logout .bash_profile .bashrc
```

Local User Accounts

>_

```
$ sudo passwd john
```

Changing password for user john.
New password:

```
$ sudo userdel john
```

```
$ sudo userdel --remove john
```

≡ \$ sudo userdel -r john

```
$ sudo useradd --shell /bin/othershell --home-dir /home/otherdirectory/ john
```

```
$ sudo useradd -s /bin/othershell -d /home/otherdirectory/ john
```

```
$ sudo useradd -s /bin/othershell john
```

Local User Accounts

>_

```
$ cat /etc/passwd
```

```
john:x:1001:1001:/home/otherdirectory:/bin/othershell
```

```
$ sudo useradd --uid 1100 smith
```

```
= $ sudo useradd -u 1100 smith
```

```
$ ls -l /home/
```

```
drwx-----. 16 aaron    aaron    4096 Dec 16 10:01 aaron
drwx-----.  4 jane     jane     113  Dec 16 13:00 jane
drwx-----.  3 john     john     78   Oct 19 19:39 john
drwx-----.  3 smith    smith    78   Oct 19 19:39 smith
```

```
$ ls -ln /home/
```

```
drwx-----. 16 1000    1000    4096 Dec 16 10:01 aaron
drwx-----.  4 1001    1001     13  Dec 16 13:00 jane
drwx-----.  3 1002    1002     78  Oct 19 19:39 john
drwx-----.  3 1100    1100     78  Oct 19 19:39 smith
```

Local User Accounts

>_

```
$ id
```

```
uid=1000(aaron) gid=1000(aaron) groups=1000(aaron),10(wheel),1005(family)  
context=unconfined_u:unconfined_r:unconfined_t:s0-s0:c0.c1023
```

```
$ whoami
```

```
aaron
```

```
$ sudo useradd --system sysacc
```

```
$ sudo userdel -r john
```

```
$ sudo userdel -r smith
```

```
$ useradd --help
```

```
Usage: useradd [options] LOGIN  
useradd -D  
useradd -D [options]
```

Local User Accounts

>_

```
$ sudo useradd john  
  
$ sudo usermod --home /home/otherdirectory --move-home john  
  
$ sudo usermod -d /home/otherdirectory -m john  
  
$ sudo usermod --login jane john == $ sudo usermod -l jane john  
  
$ sudo usermod --shell /bin/othershell jane == $ sudo usermod -s /bin/othershell jane
```

Local User Accounts

>_

```
$ sudo usermod --lock jane           == $ sudo usermod -L jane  
$ sudo usermod --unlock jane         == $ sudo usermod -U jane  
$ sudo usermod --expiredate 2021-12-10 jane == $ sudo usermod -e 2021-12-10 jane  
# Date format: YEAR-MONTH-DAY  
  
$ sudo usermod --expiredate "" jane == $ sudo usermod -e "" jane
```

Local User Accounts

>_

```
$ sudo chage --lastday 0 jane
```

```
= $ sudo chage -d 0 jane
```

```
$ sudo chage --lastday -1 jane
```

```
= $ sudo chage -d -1 jane
```

```
$ sudo chage --maxdays 30 jane
```

```
= $ sudo chage -M 30 jane
```

```
$ sudo chage --maxdays -1 jane
```

```
= $ sudo chage -M -1 jane
```

```
$ sudo chage --list jane
```

```
= $ sudo chage -l jane
```

```
$ sudo userdel -r jane
```

```
$ sudo groupdel john
```

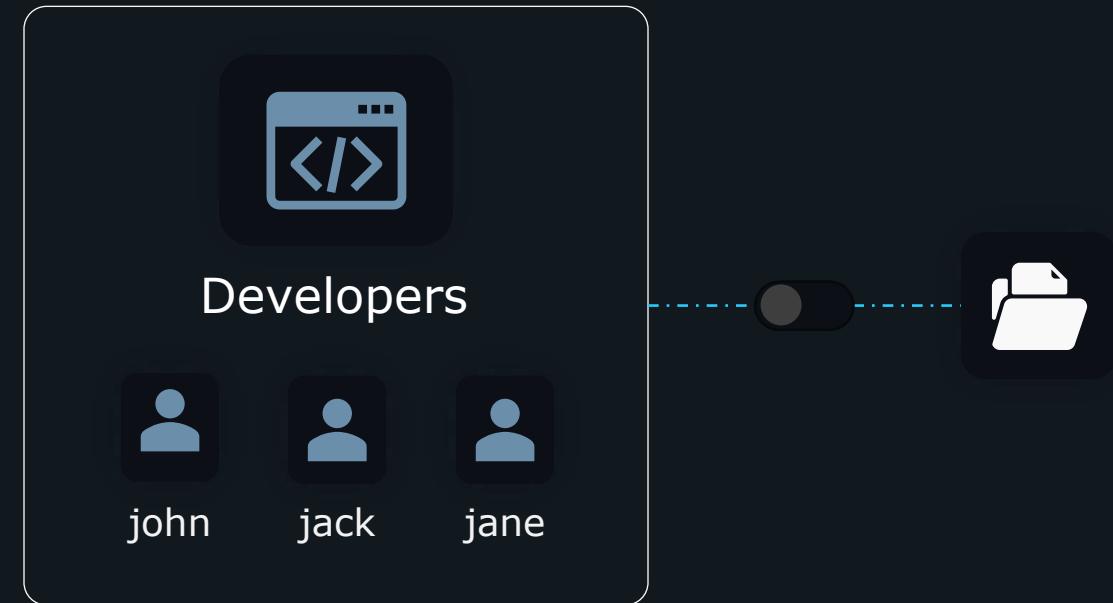
chage = change age

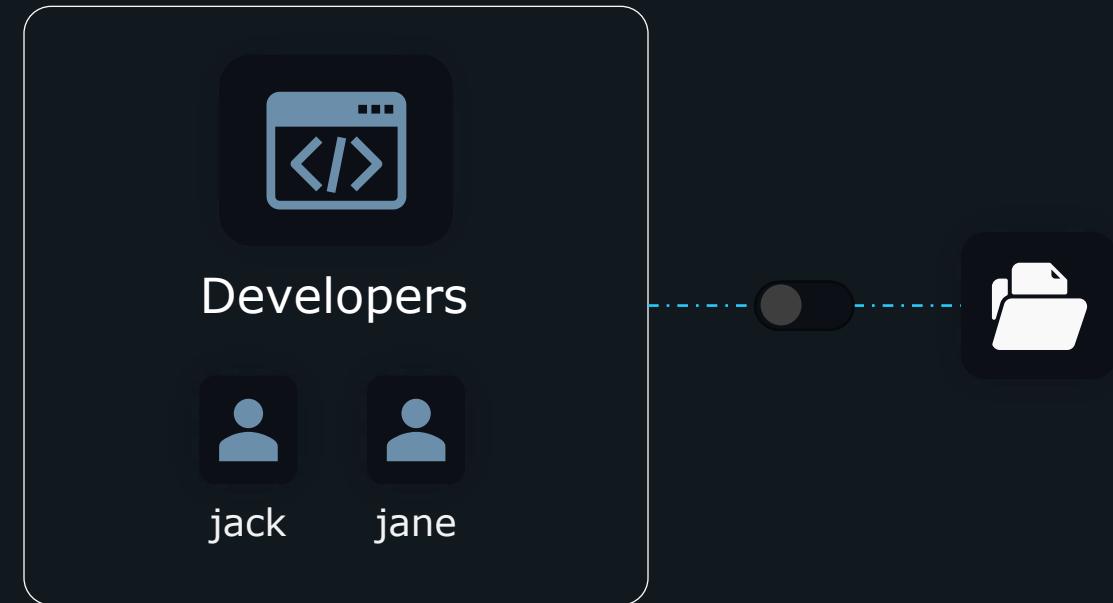
{KODE{LOUD

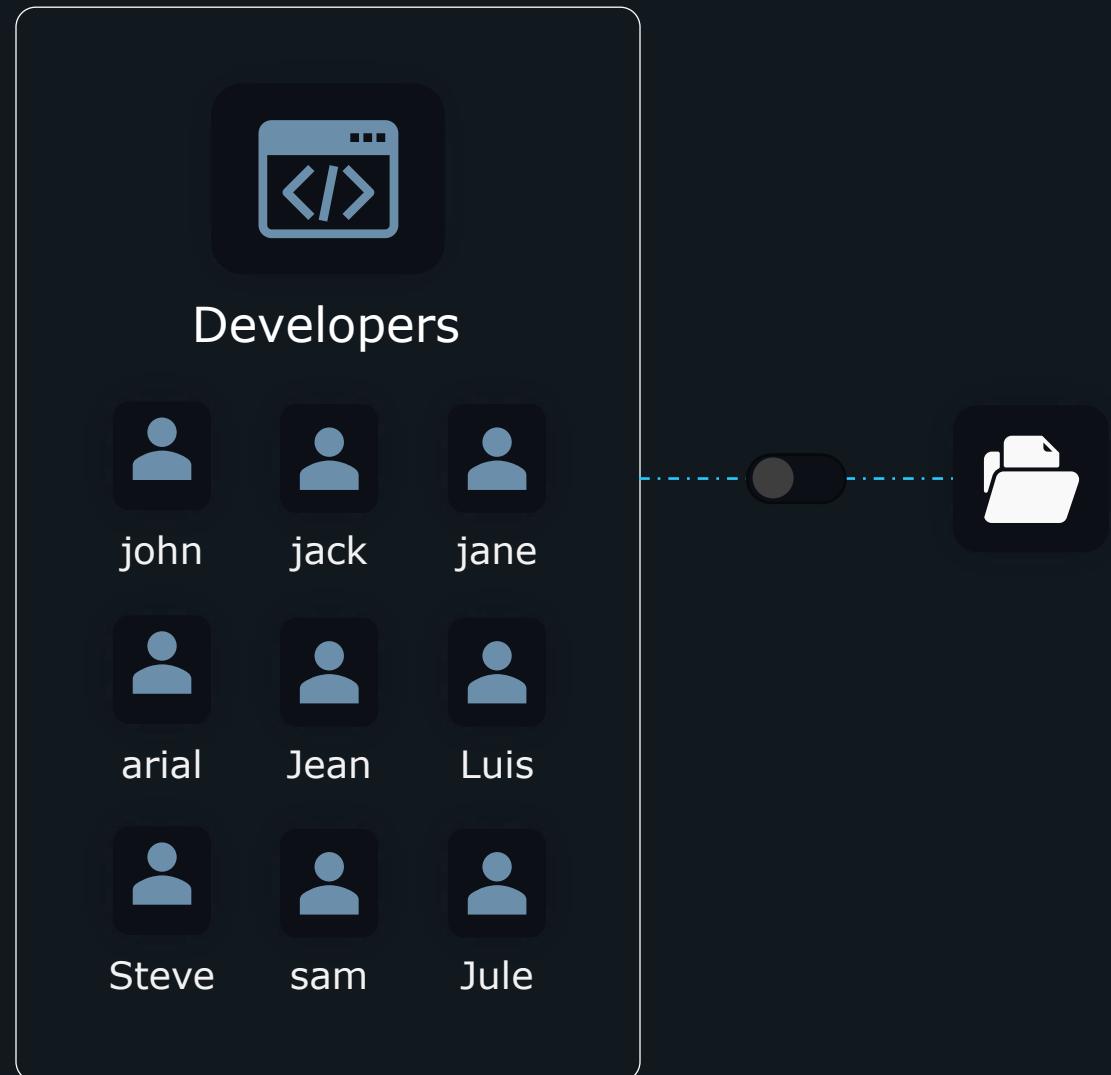
Local Groups and Group Memberships











Local Groups and Memberships

>_

```
$ sudo useradd john
```

```
$ sudo groupadd developers
```

```
$ sudo gpasswd --add john developers
```

```
$ sudo gpasswd --a john developers
```

```
$ groups john
```

```
[john: john]developers
```

```
$ sudo gpasswd --delete john developers
```

```
$ sudo gpasswd -d john developers
```



developers



john

Local Groups and Memberships

>_

```
$ sudo usermod -g developers john  
$ sudo usermod --gid [developers] [john]
```

```
$ groups john  
john: developers
```

```
$ gpasswd --help  
-a, --add USER           add USER to GROUP
```



developers



john

Local Groups and Memberships

>_

```
$ sudo groupmod --new-name programmers developers
```

```
$ sudo groupmod -n programmers developers
```

```
$ sudo groupdel programmers
```

groupdel: cannot remove the primary group of user 'john'

```
$ sudo usermod --gid john john
```

```
$ sudo groupdel programmers
```



programmers



john

{KODE{LOUD

Manage System-wide
Environment Profiles



Manage System-wide Environment Profiles

>_

```
$ printenv == $ env
```

```
PATH=/home/aaron/.local/bin:/home/aaron/bin:/usr/local/bin:/usr/local/sbin  
:/usr/bin:/usr/sbin  
HISTSIZE=1000  
GJS_DEBUG_TOPICS=JS_ERROR;JS_LOG  
SESSION_MANAGER=local/unix:@/tmp/.ICE-unix/2260,unix/unix:/tmp/.ICE-  
unix/2260
```

```
$ HISTSIZE=2000
```

```
$ history
```

```
1 sudo nano -w /etc/hosts  
2 ssh student@192.168.0.18  
3 ssh student@LFCS-CentOS2  
4 ls  
5 ls -laF  
6 cd .ssh  
7 ls  
8 nano -w known_hosts  
9 exit  
10 rm .ssh/known_hosts
```

Manage System-wide Environment Profiles

>_

```
$ printenv
```

```
PWD=/home/aaron
SSH_ASKPASS=/usr/libexec.openssh/gnome-ssh-askpass
HOME=/home/aaron
```

```
$ echo $HOME
```

```
/home/aaron
```

```
$ touch $HOME/saved_file == $ touch /home/aaron/saved_file
```

Manage System-wide Environment Profiles

>_

```
$ cat .bashrc
```

```
# .bashrc

# Source global definitions
if [ -f /etc/bashrc ]; then
    . /etc/bashrc
fi

# User specific environment
if ! [[ "$PATH" =~ "$HOME/.local/bin:$HOME/bin:" ]]
then
    PATH="$HOME/.local/bin:$HOME/bin:$PATH"
fi
export PATH
```

```
$ sudo vim /etc/environment
```

```
$ logout
```

```
$ echo $KODEKLOUD
```

<https://kodekloud.com>



environment

KODEKLOUD=https://kodekloud.com

Manage System-wide Environment Profiles

>_

```
$ sudo vim /etc/profile.d/lastlogin.sh
```

```
$ logout
```

```
$ ls
```

```
lastlogin
```

```
$ cat lastlogin
```

```
Your last login was at: Thursday DEC 16 11:19:27 CDT 2021
```



environment

```
echo "Your last login was at: " >  
$HOME/lastlogin
```

```
date >> $HOME/lastlogin
```

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Manage Template
User Environment



Manage Template User Environment

>_

```
$ sudo vim /etc/skel/README
```

```
$ sudo useradd trinity
```

```
$ sudo ls -a /home/trinity
.  ..  .bash_logout  .bash_profile  .bashrc  README
```

```
$ cat README
```

Please don't run CPU-intensive processes between 8AM and 10PM.



README

Please don't run CPU-intensive processes between 8AM and 10PM.

Manage Template User Environment

>_

```
$ sudo vim /home/trinity/.bashrc
```

```
$ echo $PATH
```

```
/home/trinity/.local/bin:/home/trinity/bin:/usr/local/bin:/usr/bin:/usr/local/sbin:/usr/sbin
```

```
$ specialtool == $ /opt/specialtool
```

```
$ sudo vim /etc/skel/.bashrc
```



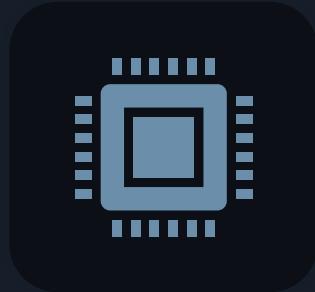
.bashrc

```
PATH="$HOME/.local/bin:$HOME/bin:$PATH"
```

```
PATH="$HOME/.local/bin:$HOME/bin  
[opt/bin]$PATH"
```

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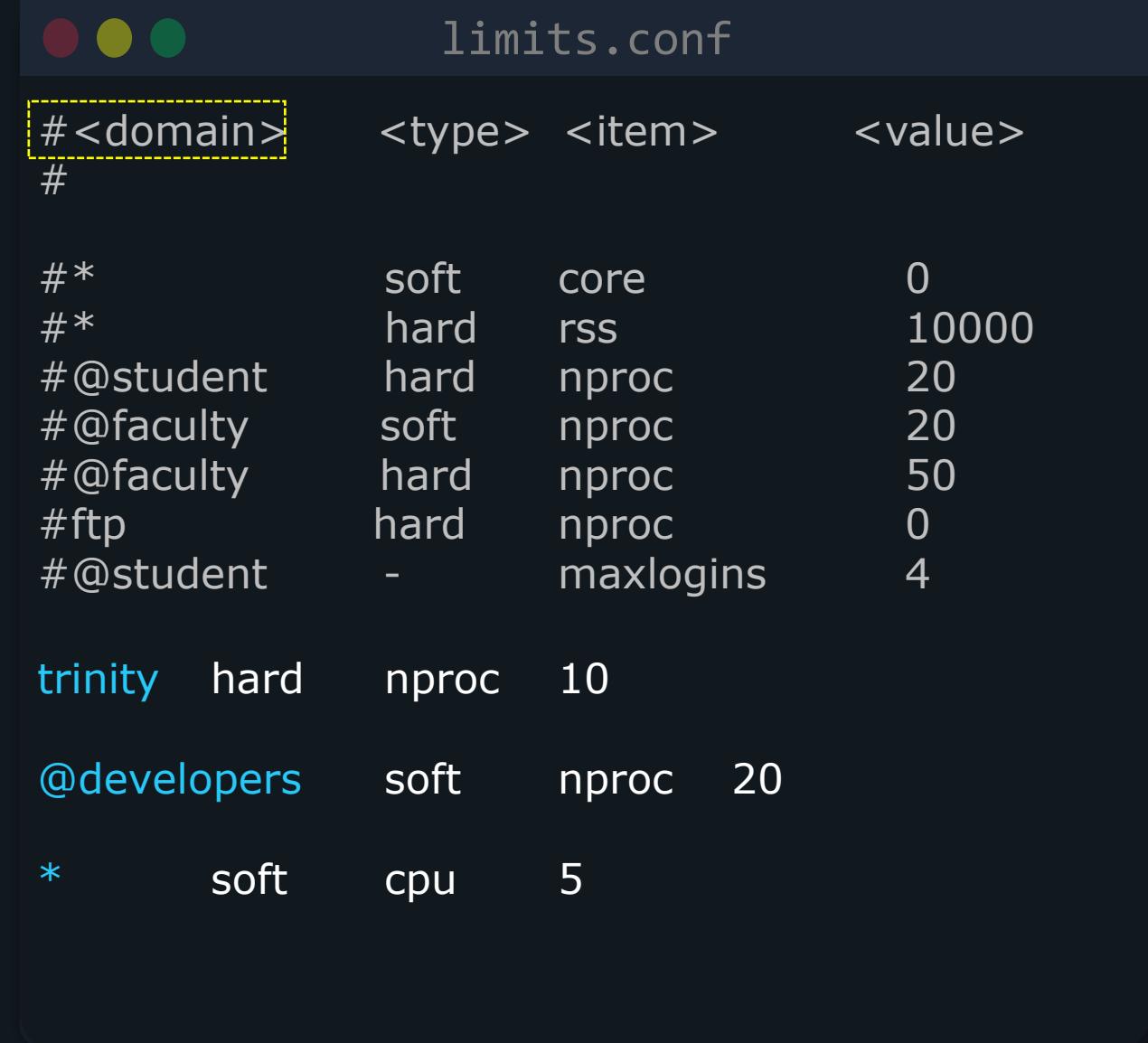
Configure User Resource Limits



User Resource Limits

>_

```
$ sudo vim /etc/security/limits.conf
```



```
limits.conf
#<domain>      <type>  <item>      <value>
#
#*
#*
#@student        hard    nproc        20
#@faculty       soft    nproc        20
#@faculty       hard    nproc        50
#ftp            hard    nproc        0
#@student        -      maxlogins   4
trinity        hard    nproc        10
@developers     soft    nproc        20
*              soft    cpu          5
```

User Resource Limits

>_

```
$ sudo vim /etc/security/limits.conf
```

limits.conf

```
#<domain>    <type>      <item>      <value>
#
#*
#*
#@student     hard       nproc       20
#@faculty    soft       nproc       20
#@faculty    hard       nproc       50
#ftp         hard       nproc       0
#@student     -          maxlogins  4

trinity   hard       nproc       30
trinity   hard       nproc       20
trinity   soft       nproc       10
trinity   -          nproc       20
```

User Resource Limits

>_

```
$ sudo vim /etc/security/limits.conf
```

```
$ man limits.conf
```

LIMITS.CONF(5) Linux-PAM Manual
LIMITS.CONF(5)

NAME
 limits.conf - configuration file for the
pam_limits module

DESCRIPTION
 The pam_limits.so module applies ulimit
limits, nice priority and
 number of simultaneous login sessions limit to
user login sessions.

 This description of the configuration file
syntax applies to the
 /etc/security/limits.conf file and *.conf
files in the
 /etc/security/limits.d directory.

The syntax of the lines is as follows:

<domain><type><item><value>

limits.conf

#<domain>	<type>	<item>	<value>
#*	soft	core	0
#*	hard	rss	10000
#@student	hard	nproc	20
#@faculty	soft	nproc	20
#@faculty	hard	nproc	50
#ftp	hard	nproc	0
#@student	-	maxlogins	4
trinity	hard	nproc	30
trinity	hard	fsize	1024
trinity	hard	cpu	1

User Resource Limits

>_

```
$ sudo vim /etc/security/limits.conf
```

```
$ sudo -iu trinity
```

```
$ ps | less
```

PID	TTY	TIME	CMD
6314	pts/0	00:00:00	bash
6348	pts/0	00:00:00	ps
6349	pts/0	00:00:00	less

```
$ ls -a | grep bash | less
```

```
bash: fork: retry: Resource temporarily unavailable.  
bash: fork: retry: Resource temporarily unavailable.
```



limits.conf

#	@student	-	maxlogins	4
	trinity	-	nproc	3

User Resource Limits

>_

```
$ logout
```

```
$ ulimit -a
```

core file size	(blocks, -c) 0
data seg size	(kbytes, -d) unlimited
scheduling priority	(-e) 0
file size	(blocks, -f) unlimited
pending signals	(-i) 14722
max locked memory	(kbytes, -l) 64
max memory size	(kbytes, -m) unlimited
open files	(-n) 1024
pipe size	(512 bytes, -p) 8
POSIX message queues	(bytes, -q) 819200
real-time priority	(-r) 0
stack size	(kbytes, -s) 8192
cpu time	(seconds, -t) unlimited
max user processes	(-u) 14722
virtual memory	(kbytes, -v) unlimited
file locks	(-x) unlimited

```
$ ulimit -u 5000
```

{KODE{LOUD

Manage User Privileges



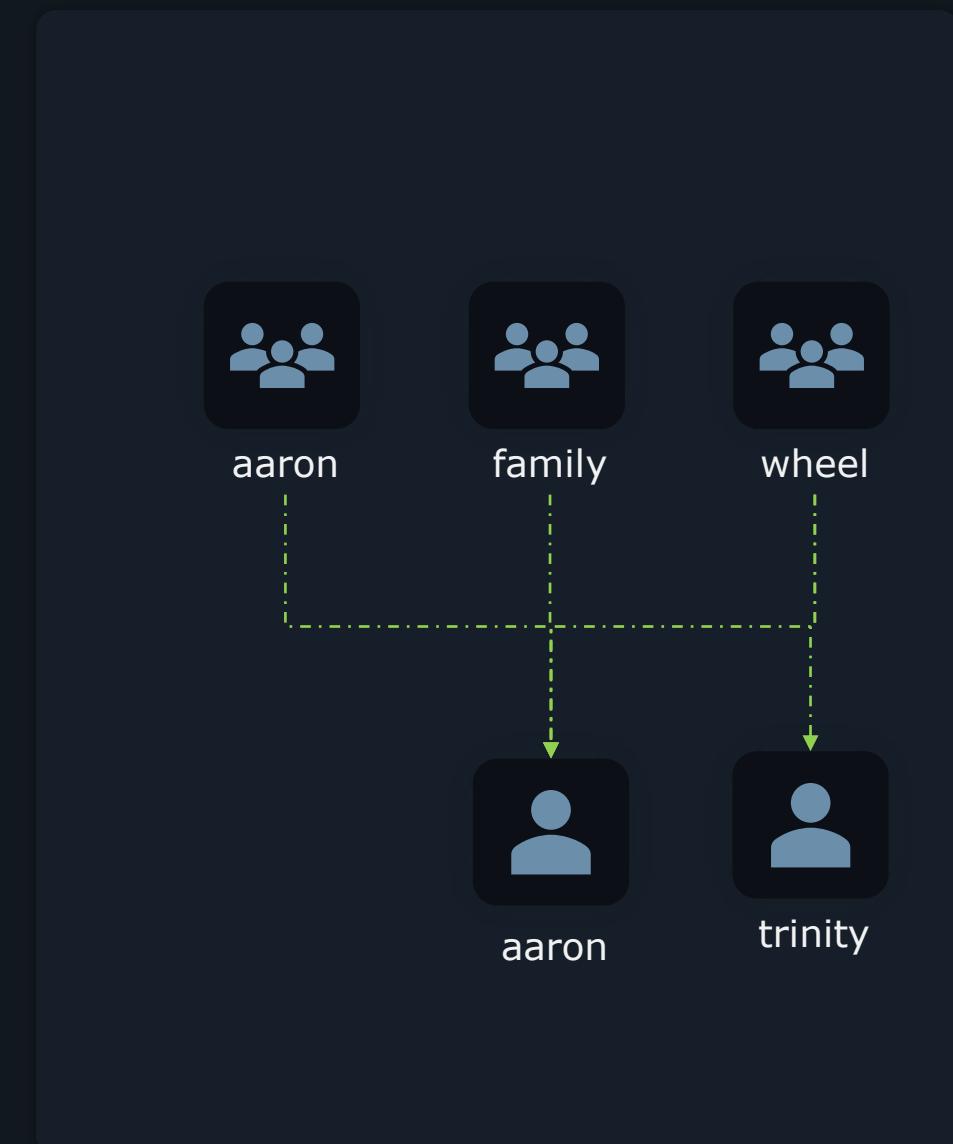
Manage User Privileges

>_

```
$ groups
```

```
aaron family wheel
```

```
$ sudo gpasswd -a trinity wheel
```



Manage User Privileges

>_

```
$ sudo gpasswd -d trinity wheel  
$ sudo visudo
```



sudoers

Allows people in group wheel
to run all commands

%wheel ALL=(ALL) ALL

user/group host=(run_as_user)
command_list

Manage User Privileges

>_

```
$ sudo -u trinity ls /home/trinity
```

Desktop Documents Downloads Music Pictures

```
$ sudo ls
```

```
$ sudo stat /bin
```

```
$ sudo echo "Test passed?"
```

Sorry, user trinity is not allowed to execute '/bin/echo Test passed?' as root on LFCS-CentOS.



sudoers

```
trinity    ALL=(ALL)          ALL
%developers ALL=(ALL)          ALL
trinity    ALL=(aaron,john)    ALL
trinity    ALL=ALL
trinity    ALL=(ALL) /bin/ls, /bin/stat
trinity    ALL= /bin/ls, /bin/stat
# %wheel   ALL=(ALL) NOPASSWD: ALL
trinity    ALL= NOPASSWD:ALL
```

{KODE{LOUD

Manage Access to
the Root Account



Manage Access to the Root Account

>_

```
$ sudo ls /root/  
anaconda-ks.cfg  initial-setup-ks.cfg
```

```
$ sudo --login == $ sudo -i
```

```
$ logout
```

```
$ su - == $ su -l == $ su --login
```

Manage Access to the Root Account

>_

```
$ sudo --login
```

```
$ su -
```

```
$ sudo passwd root
```

```
$ sudo passwd --unlock root == $ sudo passwd -u root
```

```
$ su -
```

```
$ sudo passwd --lock root == $ sudo passwd -l root
```

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Demo

Configure Networking and Hostname



Configure Networking and Hostname



10.0.0.0.9.



device

IP address?
203.0.113.9.



gateway



google



192.168.0.1

{KODE{LOUD

Starting Network
Services At Boot



Starting Network Services At Boot

>_

```
$ systemctl status NetworkManager.service
```

```
NetworkManager.service - Network Manager
Loaded: loaded (/usr/lib/systemd/system/NetworkManager.service; enabled; vendor preset: enabled)
Active: active (running) since Mon 2021-12-20 00:57:02 CST; 2h 31min ago
Docs: man:NetworkManager(8)
Main PID: 1024 (NetworkManager)
Tasks: 3 (limit: 23555)
Memory: 8.1M
CGroup: /system.slice/NetworkManager.service
    └─1024 /usr/sbin/NetworkManager --no-daemon
```

```
$ sudo dnf install NetworkManager
```

```
$ sudo systemctl start NetworkManager.service
```

```
$ sudo systemctl enable NetworkManager.service
```

Starting Network Services At Boot

>_

```
$ nmcli connection show
```

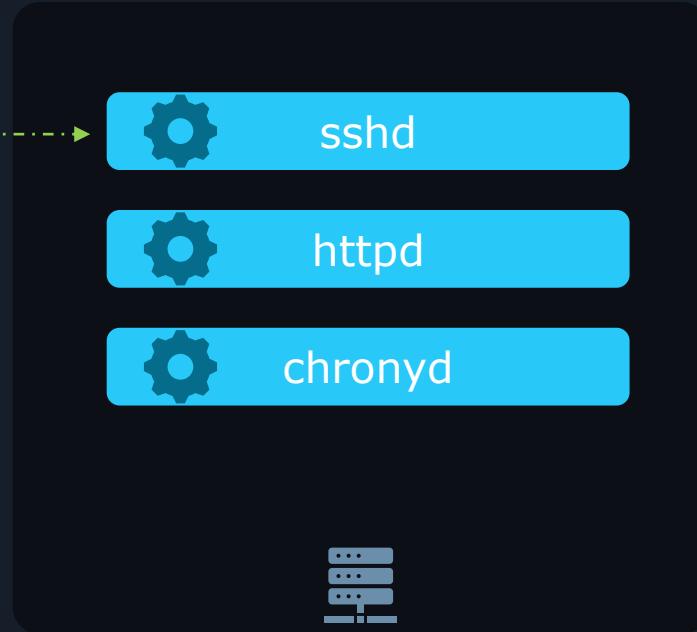
NAME	UUID	TYPE	DEVICE
enp0s3	fadff03a-8b55-4b81-b582-3e84b50fa8f5	ethernet	enp0s3

```
$ sudo nmcli connection modify enp0s3 autocnnect yes
```

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Start, Stop, and Check Network Services





Utilities



ss



netstat

Checking Network Services

>_

```
$ sudo ss -ltunlp
```

Netid	State	Recv-Q	Send-Q	Local Address:Port
tcp	LISTEN	0	128	0.0.0.0:22

```
$ sudo ss -tunlp
```

```
$ ss --help
```

Usage: ss [OPTIONS]
ss [OPTIONS] [FILTER]

-l = listening

-t = TCP connections

-u = UDP connections

-n = numeric values

-p = processes

listening, tcp, udp, numeric,
process

"tunl,p Tunnel programs"

Checking Network Services

>_

```
$ sudo ss -ltunp
```

Netid	State	Recv-Q	Send-Q
udp	UNCONN	0	0
tcp	LISTEN	0	128
tcp	LISTEN	0	128
udp	UNCONN	0	0

Local Address:Port	Peer Address:Port	Process
127.0.0.1:323	0.0.0.0:*	users:("chronyd",pid=3669,fd=7))
0.0.0.0:22	0.0.0.0:*	users:("sshd",pid=1031,fd=5))
[::]:22	[::]:*	users:("sshd",pid=1031,fd=7))
[::1]:323	[::]:*	users:("chronyd",pid=3669,fd=8))

```
$ systemctl status chronyd.service
```

chronyd.service - NTP client/server
 Loaded: loaded (/usr/lib/systemd/system/chronyd.service; enabled; vendor preset: enabled)
 Active: active (running) since Mon 2021-12-20 01:21:06 CST; 1h 47min ago
 Docs: man:chronyd(8)
 man:chrony.conf(5)
 Main PID: 3669 (chronyd)

```
$ systemctl status sshd.service
```

sshd.service - OpenSSH server daemon
 Loaded: loaded (/usr/lib/systemd/system/sshd.service; enabled; vendor preset: enabled)
 Active: active (running) since Mon 2021-12-20 00:57:02 CST; 2h 12min ago
 Docs: man:sshd(8)
 man:sshd_config(5)
 Main PID: 1031 (sshd)

Checking Network Services

>_

```
$ sudo systemctl stop chronyd.service
```

```
$ sudo ss -ltunp
```

Netid	State	Recv-Q	Send-Q	Local Address:Port	Peer Address:Port	Process
tcp	LISTEN	0	128	0.0.0.0:22	0.0.0.0:*	users:(("sshd",pid=1031,fd=5))
tcp	LISTEN	0	128	[::]:22	[::]:*	users:(("sshd",pid=1031,fd=7))

```
$ sudo systemctl disable chronyd.service
```

```
$ sudo systemctl enable chronyd.service
```

```
$ sudo systemctl start chronyd.service
```

Checking Network Services

>_

```
$ sudo ss -ltunp
```

Netid	State	Recv-Q	Send-Q	Local Address:Port	Peer Address:Port	Process
tcp	LISTEN	0	128	0.0.0.0:22	0.0.0.0:*	users:(("sshd",pid=1031,fd=5))
tcp	LISTEN	0	128	[::]:22	[::]:*	users:(("sshd",pid=1031,fd=7))

```
$ ps 1031
```

PID	TTY	STAT	TIME	COMMAND
1031	?	Ss	0:00	/usr/sbin/sshd -D -oCiphers=aes256-gcm@openssh.com,chacha20-poly1305@openssh.com,aes256-ctr,aes256-cbc,aes128-gcm@openssh.co

```
$ sudo lsof -p 1031
```

COMMAND	PID	USER	FD	TYPE	DEVICE	SIZE/OFF	NODE	NAME
sshd	1031	root	cwd	DIR	253,0	224	128	/
sshd	1031	root	rtd	DIR	253,0	224	128	/
sshd	1031	root	txt	REG	253,0	886312	439287	/usr/sbin/sshd
sshd	1031	root	mem	REG	253,0	6940392	51404414	/var/lib/sss/mc/group

Checking Network Services

>_

```
$ sudo netstat -ltunp
```

Active Internet connections (only servers)

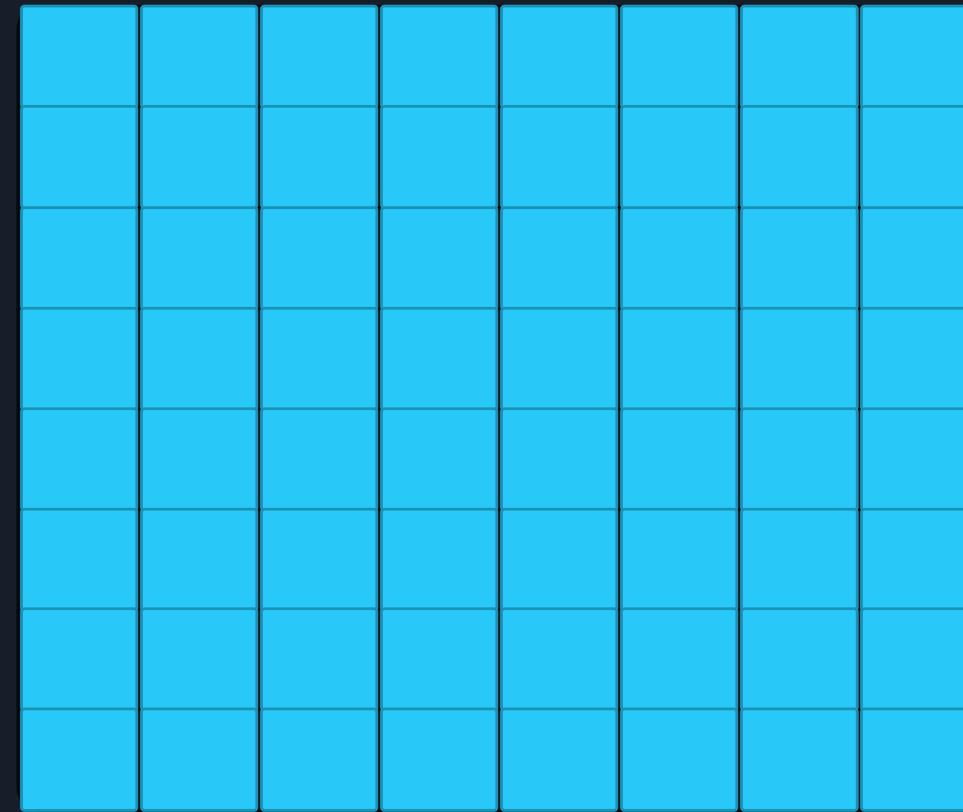
Proto	Recv-Q	Send-Q	Local Address	Foreign Address	State	PID/Program name
tcp	0	0	0.0.0.0:111	0.0.0.0:*	LISTEN	1/systemd
tcp	0	0	192.168.122.1:53	0.0.0.0:*	LISTEN	1664/dnsmasq
tcp	0	0	0.0.0.0:22	0.0.0.0:*	LISTEN	1031/sshd
tcp	0	0	127.0.0.1:631	0.0.0.0:*	LISTEN	1030/cupsd
tcp6	0	0	:::111	:::*	LISTEN	1/systemd
tcp6	0	0	:::22	:::*	LISTEN	1031/sshd
tcp6	0	0	:::631	:::*	LISTEN	1030/cupsd
udp	0	0	0.0.0.0:5353	0.0.0.0:*		872/avahi-daemon: r
udp	0	0	0.0.0.0:46828	0.0.0.0:*		872/avahi-daemon: r
udp	0	0	192.168.122.1:53	0.0.0.0:*		1664/dnsmasq
udp	0	0	0.0.0.0:67	0.0.0.0:*		1664/dnsmasq
udp	0	0	0.0.0.0:111	0.0.0.0:*		1/systemd
udp	0	0	127.0.0.1:323	0.0.0.0:*		3669/chronyrd
udp6	0	0	:::5353	:::*		872/avahi-daemon: r
udp6	0	0	:::46504	:::*		872/avahi-daemon: r
udp6	0	0	:::111	:::*		1/systemd
udp6	0	0	:::323	:::*		3669/chronyrd
udp6	0	0	fe80::a00:27ff:fe6b:546	:::*		1024/NetworkManager

{KODE{LOUD

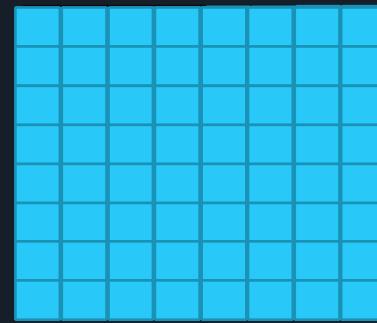
Implement Packet Filtering



Implement Packet Filtering



Implement Packet Filtering

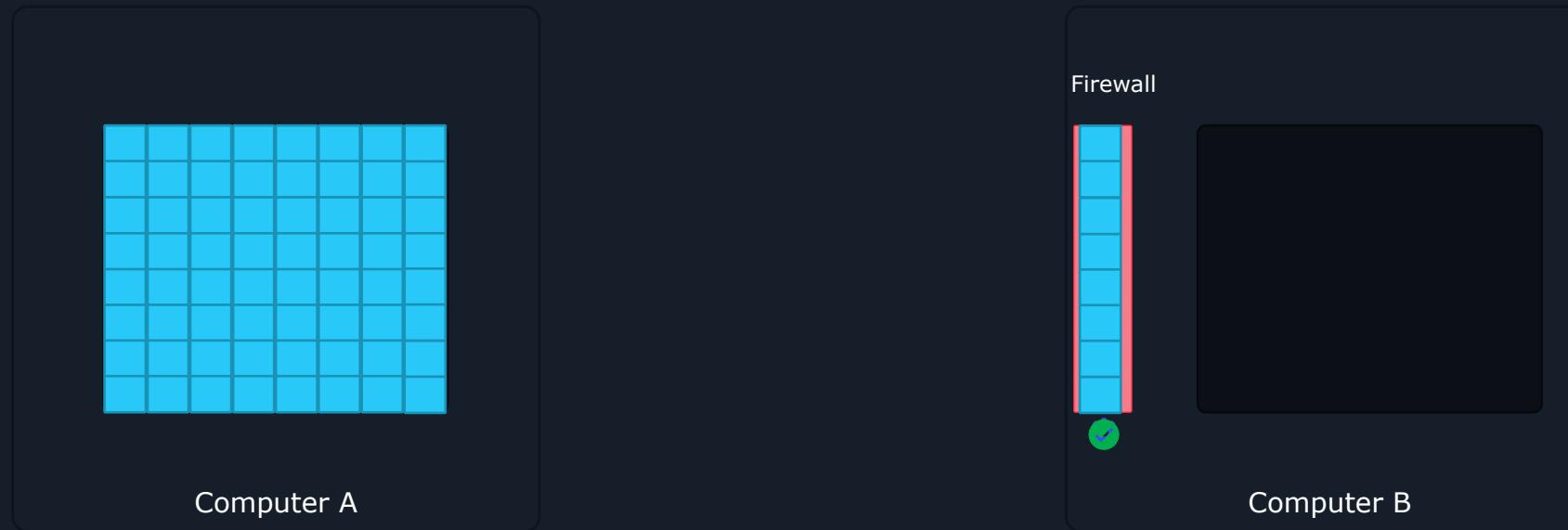


Computer A

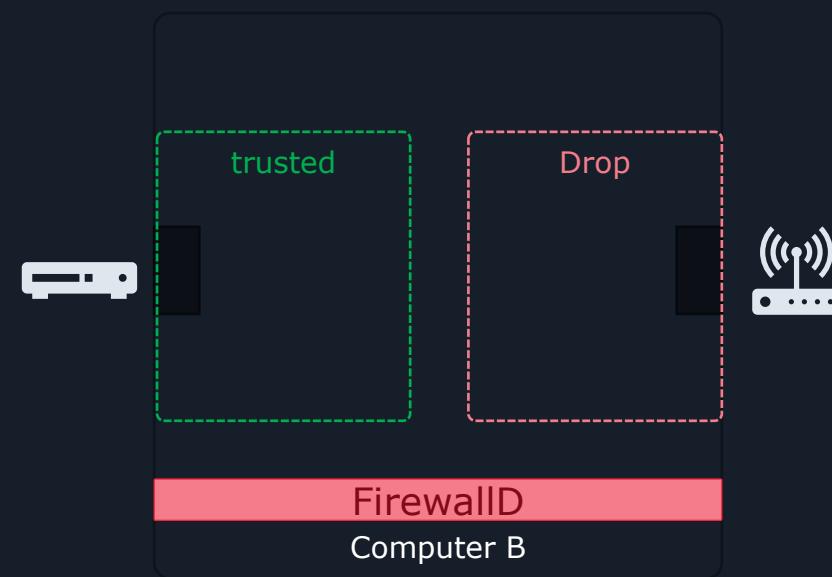


Computer B

Implement Packet Filtering



firewallD



Implement Packet Filtering

>_

```
$ firewall-cmd --get-default-zone  
public
```

```
$ firewall-cmd --set-default-zone=public
```

```
$ sudo firewall-cmd --list-all  
public (active)  
  target: default  
  icmp-block-inversion: no  
  interfaces: enp0s3  
  sources:  
  services: cockpit dhcpcv6-client ssh
```

```
$ sudo firewall-cmd --info-service=cockpit  
Ports: 9090/tcp
```

Implement Packet Filtering

>_

```
$ sudo firewall-cmd --add-service=http == $ sudo firewall-cmd --add-port=80/tcp  
success
```

```
$ sudo firewall-cmd --list-all  
public (active)  
  target: default  
  icmp-block-inversion: no  
  interfaces: enp0s3  
  sources:  
  services: cockpit dhcpcv6-client http ssh
```

```
$ sudo firewall-cmd --remove-service=http == $ sudo firewall-cmd --remove-port=80/tcp  
success
```

Implement Packet Filtering

```
>_
$ sudo firewall-cmd --add-source=10.11.12.0/24 --
zone=trusted
success
```

```
$ firewall-cmd --get-active-zones
public
interfaces: enp0s3
trusted
sources: 10.11.12.0/24
```

```
$ sudo firewall-cmd --remove-source=10.11.12.0/24
--zone=trusted
success
```

Trusted zone:
10.11.12.0 to 10.11.12.255

Implement Packet Filtering

>_

```
$ sudo firewall-cmd --add-port=12345/tcp
```

```
success
```

```
$ sudo firewall-cmd --list-all
```

```
public (active)
  target: default
  icmp-block-inversion: no
  interfaces: enp0s3
  sources:
  services: cockpit dhcpcv6-client http ssh
  ports: 12345
```

```
$ sudo firewall-cmd --runtime-to-permanent
```

```
success
```

```
$ sudo firewall-cmd --add-port=12345/tcp --permanent
```

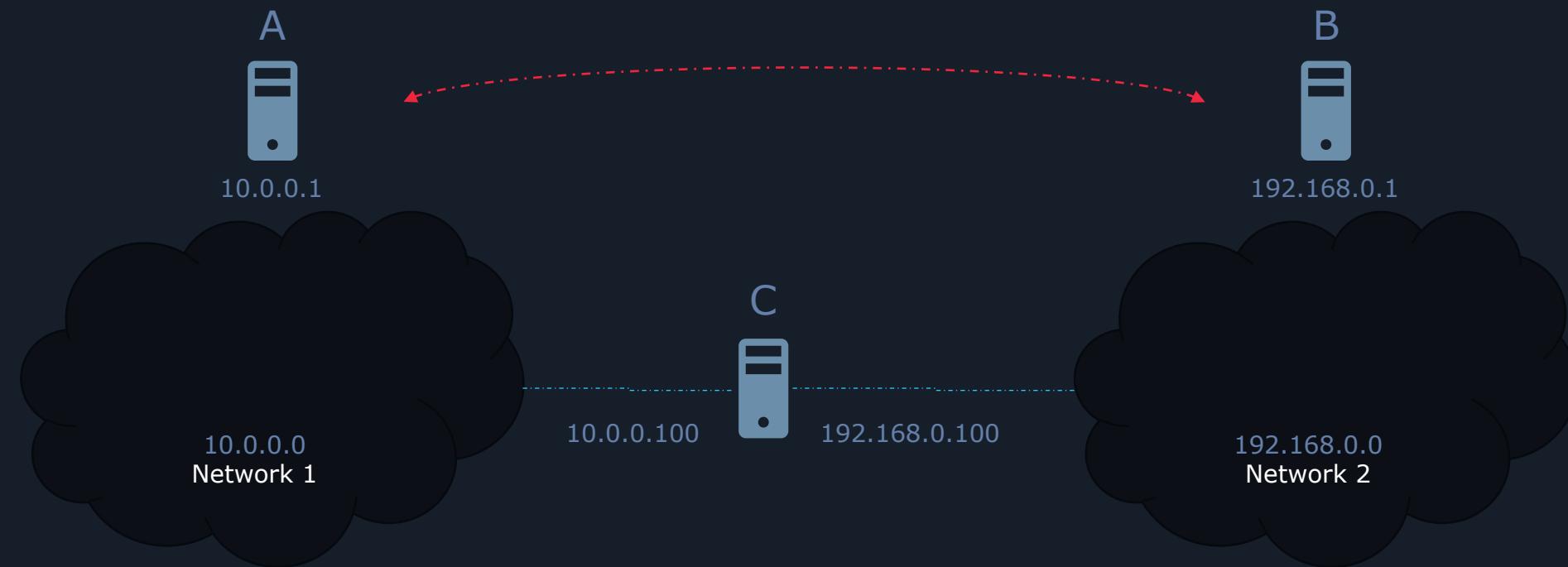
```
success
```

{KODE{LOUD

Statically Route IP Traffic



Statically Route IP Traffic



Statically Route IP Traffic

>_

```
$ sudo ip route add 192.168.0.0/24 via 10.0.0.100
```

```
$ sudo ip route add 192.168.0.0/24 via 10.11.12.100
```

```
$ sudo ip route add 192.168.0.0/24 via 10.11.12.100 dev enp0s3
```

```
$ sudo ip route del 192.168.0.0/24
```

```
$ sudo ip route add default via 10.0.0.100           Gateway
```

```
$ sudo ip route del default via 10.0.0.100
```

Statically Route IP Traffic

>_

```
$ nmcli connection show
  NAME      UUID           TYPE      DEVICE
  enp0s3   fadff03a-8b55-4b81-b582-3e84b50fa8f5  ethernet  enp0s3

$ sudo nmcli connection modify enp0s3 +ipv4.routes "192.168.0.0/24 10.0.0.100"

$ sudo nmcli device reapply enp0s3
Connection successfully reapplied to device 'enp0s3'.

$ ip route show
192.168.0.0/24 via 10.0.0.100 dev enp0s3 proto static metric 100

$ sudo nmcli connection modify enp0s3 -ipv4.routes "192.168.0.0/24 10.0.0.100"

$ sudo nmcli device reapply enp0s3
Connection successfully reapplied to device 'enp0s3'.
```

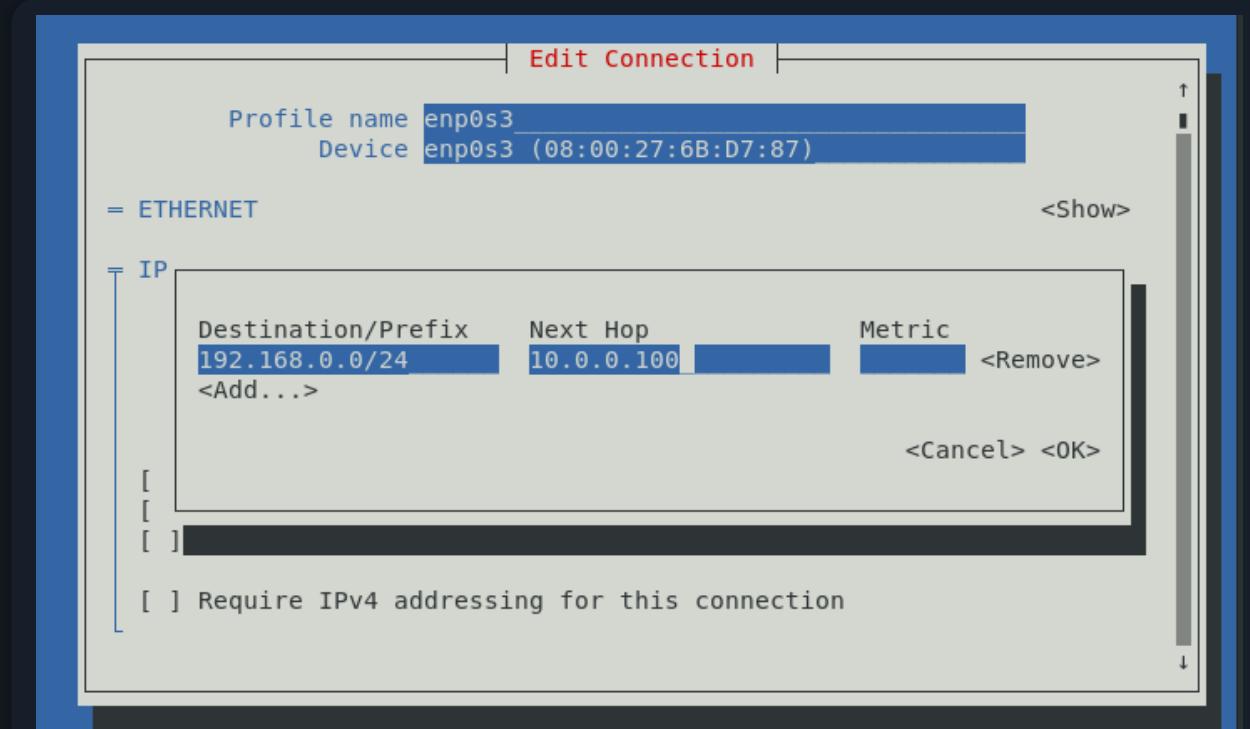
Statically Route IP Traffic

>_

```
$ sudo nmcli
```

```
$ sudo nmcli device reapply enp0s3
```

Connection successfully reapplied to device 'enp0s3'.



{KODE{LOUD

Synchronize Time
Using Network Peers



Synchronize Time

>_

```
$ systemctl status chronyd.service
```

```
Selected source 185.82.232.254 (2.centos.pool.ntp.org)
System clock was stepped by -0.000844 seconds
```

```
$ timedatectl
```

```
Local time: Mon 2021-12-20 01:02:20 CST
Universal time: Mon 2021-12-20 07:02:20 UTC
RTC time: Mon 2021-12-20 07:02:20
Time zone: America/Chicago (CST, -0600)
System clock synchronized: no
NTP service: inactive
RTC in local TZ: no
```



Real time:
12:00:05



Server time:
12:00:06

chrony daemon

Synchronize Time

>_

```
$ sudo timedatectl set-timezone America/New_York
```

```
$ timedatectl list-timezones
```

```
America/Adak
America/Anchorage
America/Anguilla
America/Antigua
America/Araguaina
America/Argentina/Buenos_Aires
America/Argentina/Catamarca
America/Argentina/Cordoba
```

Synchronize Time

>_

```
$ sudo dnf install chrony
```

```
$ sudo systemctl start chronyd.service
```

```
$ sudo systemctl enable chronyd.service
```

```
Created symlink /etc/systemd/system/multi-user.target.wants/chronyd.service →  
/usr/lib/systemd/system/chronyd.service.
```

```
$ timedatectl
```

```
Local time: Mon 2021-12-20 01:22:49 CST  
          Universal time: Mon 2021-12-20 07:22:49 UTC  
                  RTC time: Mon 2021-12-20 07:22:46  
                Time zone: America/Chicago (CST, -0600)  
System clock synchronized: yes  
          NTP service: active  
RTC in local TZ: no
```

```
$ sudo systemctl set-ntp true
```

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Configure a Caching DNS Server



Configure a Caching DNS Server

Other DNS Server
google.com:203.113.5.9



Other DNS Server

google.com:203.113.5.9



ISP's DNS Server

google.com:203.113.5.9



Laptop

Configuring a Caching DNS Server

>_

```
$ sudo dnf install bind bind-utils
```

```
=====
 Package          Arch    Version       Repository      Size
 =====
 Installing:
 bind            x86_64  32:9.11.26-6.el8   appstream     2.1 M
 bind-utils      x86_64  32:9.11.26-6.el8   appstream     451 k
 Transaction Summary
 =====
 Install 11 Packages

 Total download size: 24 M
 Installed size: 67 M
 Is this ok [y/N]: y
```

```
$ man named.conf
```

NAME

named.conf - configuration file for named

SYNOPSIS

named.conf

DESCRIPTION

named.conf is the configuration file for named. Statements are enclosed in braces and terminated with a semi-colon. Clauses in the statements are also semi-colon terminated. The usual comment styles are supported:

/etc/named.conf

Configuring a Caching DNS Server

>_

```
$ ip a
```

```
2: enp0s3: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc fq_codel state UP group default qlen 1000  
    link/ether 08:00:27:6b:d7:87 brd ff:ff:ff:ff:ff:ff  
    inet 192.168.0.17/24 brd 192.168.0.255 scope global dynamic  
        noprefixroute enp0s3
```

```
$ sudo vim /etc/named.conf
```

● ● ● named.conf

```
listen-on port 53 { 127.0.0.1; };  
  
listen-on port 53 { 127.0.0.1; 192.168.0.17; };  
  
listen-on port 53 { any; };  
  
allow-query { localhost; };  
  
allow-query { localhost; 192.168.0.0/24; };  
  
allow-query { any; };  
  
recursion yes;
```

Configuring a Caching DNS Server

```
>_  
  
$ sudo systemctl start named.service  
  
$ sudo systemctl enable named.service  
  
$ sudo firewall-cmd --add-service=dns  
  
$ sudo firewall-cmd --add-service=dns --permanent  
  
$ dig @127.0.0.1 google.com    == $ dig @localhost google.com  
;; Query time: 82 msec  
  
$ dig @127.0.0.1 google.com  
;; Query time: 0 msec  
  
$ dig @127.0.0.1 google.com  
ns2.google.com. 172454 IN A 216.239.34.10
```

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Demo

Maintain a DNS Zone

Maintaining a DNS Zone



example.com

10.11.12.9



name server

Name	Address
example.com	10.11.12.9
hotmail.com	65.55.72.135
reddit.com	72.247.244.88
hush.com	65.39.178.43

Maintaining a DNS Zone

>_

```
$ sudo vim /etc/named.conf
```

/etc/named.conf

```
zone "." IN {  
    type hint;  
    file "named.ca";  
};
```

```
zone "example.com" IN {  
    type master;  
    file "example.com.zone";  
};
```

Maintaining a DNS Zone

>_

```
$ sudo ls /var/named  
data  dynamic  named.ca  named.empty  named.localhost  named.loopback  slaves  
  
$ sudo cp --preserve=ownership /var/named/named.localhost /var/named/example.com.zone
```

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Configure Email Aliases



Email Aliases



aaron@example.com

=



/var/spool/mail/aaron

aaron@example.com

contact@example.com

=

/var/spool/mail/aaron

advertising@example.com

complaints@example.com

Email Aliases

```
>_  
  
$ sudo dnf install postfix  
  
$ sudo systemctl start postfix  
  
$ sudo systemctl enable postfix  
  
$ sendmail aaron@localhost <<< "Hello, I'm just testing email."  
  
$ cat /var/spool/mail/aaron  
From aaron@LFCS-CentOS.localdomain Tue Jan  4 07:37:09 2022  
Return-Path: <aaron@LFCS-CentOS.localdomain>  
X-Original-To: aaron@localhost  
Delivered-To: aaron@localhost  
Received: by LFCS-CentOS.localdomain (Postfix, from userid 1000)  
          id AD02A25E105; Tue,  4 Jan 2022 07:37:09 -0600 (CST)  
Message-Id: <20220104133709.AD02A25E105@LFCS-CentOS.localdomain>  
Date: Tue,  4 Jan 2022 07:37:09 -0600 (CST)  
From: Aaron <aaron@LFCS-CentOS.localdomain>  
  
Hello, I'm just testing email.
```

Email Aliases

>_

```
$ sudo vim /etc/aliases
```

```
$ sudo newaliases
```

```
$ sendmail advertising@localhost <<<"Hello, I'm  
just testing email."
```

```
$ cat /var/spool/mail/aaron
```

```
From aaron@LFCS-CentOS.localdomain Tue Jan 4 07:45:12 2022  
Return-Path: <aaron@LFCS-CentOS.localdomain>  
X-Original-To: advertising@localhost  
Delivered-To: advertising@localhost  
Received: by LFCS-CentOS.localdomain (Postfix, from userid 1000)  
          id 341BD25E105; Tue, 4 Jan 2022 07:45:12 -0600 (CST)  
Message-Id: <20220104134512.341BD25E105@LFCS-CentOS.localdomain>  
Date: Tue, 4 Jan 2022 07:45:12 -0600 (CST)  
From: Aaron <aaron@LFCS-CentOS.localdomain>
```

Hello, I'm just testing email.



aliases

advertising: aaron

Email Aliases

>_

```
$ sudo vim /etc/aliases
```

```
$ sudo newaliases
```



aliases

contact: aaron,john,jane

/var/spool/mail/aaron

/var/spool/mail/john

/var/spool/mail/jane

advertising: aaron

advertising: aaron@somewebsite.com

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Configure IMAP and IMAPS Service



Configure IMAP and IMAPS

>_

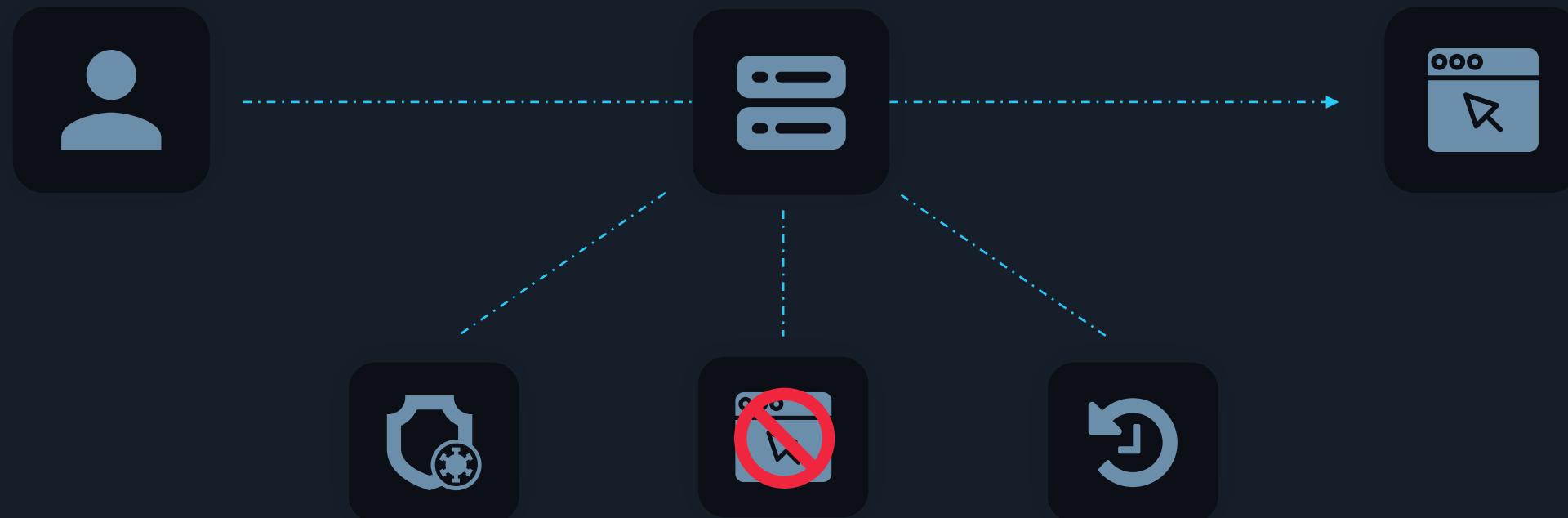
```
$ sudo dnf install dovecot  
  
$ sudo systemctl start dovecot  
  
$ sudo systemctl enable dovecot  
  
$ sudo firewall-cmd --add-service=imap  
  
$ sudo firewall-cmd --add-service=imaps  
  
$ sudo firewall-cmd --runtime-to-permanent
```

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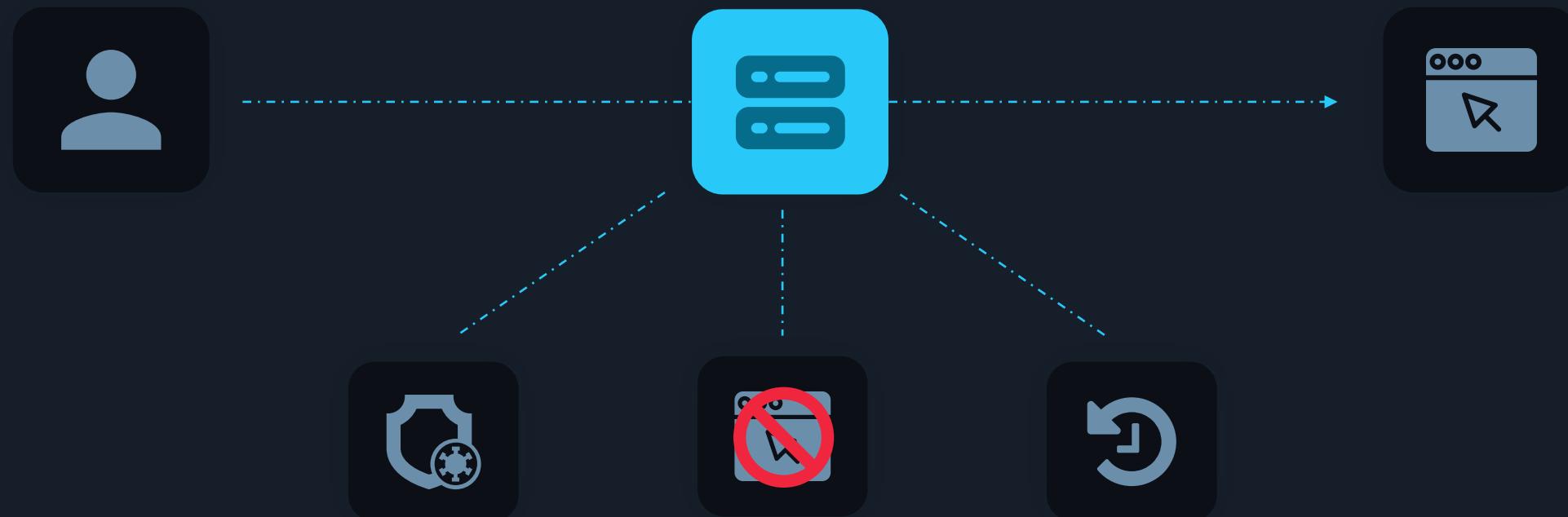
Demo
Restrict Access to the HTTP Proxy Server



HTTP Proxy



HTTP Proxy



HTTP Proxy

>_

```
$ sudo dnf install squid  
$ sudo systemctl start squid  
$ sudo systemctl enable squid  
$ sudo firewall-cmd --add-service=squid  
$ sudo firewall-cmd --add-service=squid --permanent
```

{KODE{LOUD

Demo

Configure An HTTP Server



Configure HTTP Server

```
>_  
  
$ sudo dnf install httpd  
  
$ sudo firewall-cmd --add-service=http  
  
$ sudo firewall-cmd --add-service=https  
  
$ sudo firewall-cmd --runtime-to-permanent  
  
$ sudo dnf install mod_ssl  
  
$ sudo systemctl start httpd  
  
$ sudo systemctl enable httpd
```

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Demo

List, Create, Delete,
and Modify Physical Storage Partitions



Physical Storage Partitions

>_

```
$ lsblk
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
vda	8:0	0	20G	0	disk	
└─vda1	8:1	0	1G	0	part	/boot
└─vda2	8:2	0	19G	0	part	
└─cs-root	253:0	0	17G	0	lvm	/
└─cs-swap	253:1	0	2G	0	lvm	[SWAP]

block devices

```
vda  
  vda1  
  vda2  
vdb  
  vdb1  
  vdb2  
  vdb3  
vdc  
  vdc1
```

Physical Storage Partitions

>_

```
$ lsblk
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
vda	8:0	0	20G	0	disk	
└─vda1	8:1	0	1G	0	part	/boot
└─vda2	8:2	0	19G	0	part	
└─cs-root	253:0	0	17G	0	lvm	/
└─cs-swap	253:1	0	2G	0	lvm	[SWAP]

```
$ fdisk
```

```
$ cfdisk
```

/dev/

/dev/vda1

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Configure and Manage Swap Space



Create and Manage Swap Space



Create and Manage Swap Space

>_

```
$ swapon --show
```

NAME	TYPE	SIZE	USED	PRIOR
/dev/dm-1	partition	2G	0B	-2

```
$ lsblk
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
vda	8:0	0	20G	0	disk	
└─vda1	8:1	0	1G	0	part	/boot
└─vda2	8:2	0	19G	0	part	
└─cs-root	253:0	0	17G	0	lvm	/
└─cs-swap	253:1	0	2G	0	lvm	[SWAP]
vdb	8:16	0	10G	0	disk	
└─vdb1	8:17	0	4G	0	part	
└─vdb2	8:18	0	4G	0	part	
└─vdb3	8:19	0	2G	0	part	

Create and Manage Swap Space

>_

```
$ sudo mkswap /dev/vdb3
```

```
Setting up swapspace version 1, size = 2 GiB (2146430976 bytes)
no label, UUID=6d6f451e-5fa4-4cd5-b627-b0f39c810002
```

```
$ sudo swapon --verbose /dev/vdb3
```

```
swapon: /dev/vdb3: found signature [pagesize=4096, signature=swap]
swapon: /dev/vdb3: pagesize=4096, swapsize=2146435072, devsize=2146435072
swapon /dev/vdb3
```

```
$ swapon --show
```

NAME	TYPE	SIZE	USED	PRI0
/dev/dm-1	partition	2G	0B	-2
/dev/vdb3	partition	2G	0B	-3

Create and Manage Swap Space

>_

```
$ sudo swapoff /dev/vdb3
```

```
$ sudo dd if=/dev/zero of=/swap bs=1M count=128
```

```
$ sudo dd if=/dev/zero of=/swap bs=1M count=2048 status=progress
```

```
1436549120 bytes (1.4 GB, 1.3 GiB) copied, 2 s, 717 MB/s
2048+0 records in
2048+0 records out
2147483648 bytes (2.1 GB, 2.0 GiB) copied, 2.71801 s, 790 MB/s
```

```
$ sudo chmod 600 /swap
```

Create and Manage Swap Space

>_

```
$ sudo mkswap /swap
```

```
Setting up swapspace version 1, size = 2 GiB (2147479552 bytes)
no label, UUID=cff8e9dc-54fa-4661-a48e-497610b2f07b
```

```
$ sudo swapon --verbose /swap
```

```
swapon: /swap: found signature [pagesize=4096, signature=swap]
swapon: /swap: pagesize=4096, swapsize=2147483648, devsize=2147483648
swapon /swap
```

```
$ swapon --show
```

NAME	TYPE	SIZE	USED	PRI0
/dev/dm-1	partition	2G	268K	-2
/swap	file	2G	0B	-3

{KODE{LOUD

Demo
Create and Configure
File Systems



Create and Configure File Systems

>_

```
$ sudo mkfs.xfs /dev/vdb1          make filesystem
```

```
$ sudo mkfs.ext4 /dev/vdb1
```

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Configure Systems to
Mount Filesystems At or During Boot



Mount Filesystems At or During Boot

>_

```
$ ls /mnt/  
$ sudo mount /dev/vdb1 /mnt/  
$ sudo touch /mnt/testfile  
$ ls -l /mnt/  
-rw-rw-r--. 1 aaron aaron      30 Jan 31 14:30 testfile
```

```
$ lsblk
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
vda	8:0	0	20G	0	disk	
└─vda1	8:1	0	1G	0	part	/boot
└─vda2	8:2	0	19G	0	part	
└─cs-root	253:0	0	17G	0	lvm	/
└─cs-swap	253:1	0	2G	0	lvm	[SWAP]
vdb	8:16	0	10G	0	disk	
└─vdb1	8:17	0	4G	0	part	
└─vdb2	8:18	0	4G	0	part	
└─vdb3	8:19	0	2G	0	part	/mnt

Mount Filesystems At or During Boot

>_

```
$ sudo umount /mnt/
```

```
$ lsblk
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
vda	8:0	0	20G	0	disk	
└─vda1	8:1	0	1G	0	part	/boot
└─vda2	8:2	0	19G	0	part	
└─cs-root	253:0	0	17G	0	lvm	/
└─cs-swap	253:1	0	2G	0	lvm	[SWAP]
vdb	8:16	0	10G	0	disk	
└─vdb1	8:17	0	4G	0	part	
└─vdb2	8:18	0	4G	0	part	
└─vdb3	8:19	0	2G	0	part	

```
$ ls /mnt/
```

Mount Filesystems At or During Boot

>_

```
$ lsblk
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
vda	8:0	0	20G	0	disk	
└─vda1	8:1	0	1G	0	part	/boot
└─vda2	8:2	0	19G	0	part	
└─cs-root	253:0	0	17G	0	lvm	/
└─cs-swap	253:1	0	2G	0	lvm	[SWAP]
vdb	8:16	0	10G	0	disk	
└─vdb1	8:17	0	4G	0	part	
└─vdb2	8:18	0	4G	0	part	
└─vdb3	8:19	0	2G	0	part	

```
$ sudo mkdir /mybackups/
```

Mount Filesystems At or During Boot

>_

```
$ sudo vim /etc/fstab
```

```
$ sudo systemctl daemon-reload
```

/etc/fstab			
/dev/mapper/cs-root	/	xfs	defaults 0 0
/dev/vdb1	/mybackups	xfs	defaults 0 2
/dev/vdb2	/mybackups	etx4	defaults 0 2
# After editing this file, run 'systemctl daemon-reload' to update # systemd # units generated from this file.			

Mount Filesystems At or During Boot

>_

```
$ ls /mybackups/
```

```
$ lsblk
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
vda	8:0	0	20G	0	disk	
└─vda1	8:1	0	1G	0	part	/boot
└─vda2	8:2	0	19G	0	part	
└─cs-root	253:0	0	17G	0	lvm	/
└─cs-swap	253:1	0	2G	0	lvm	[SWAP]
vdb	8:16	0	10G	0	disk	
└─vdb1	8:17	0	4G	0	part	
└─vdb2	8:18	0	4G	0	part	
└─vdb3	8:19	0	2G	0	part	

Mount Filesystems At or During Boot

>_

```
$ sudo systemctl reboot
```

```
$ ls -l /mybackups/
```

```
-rw-rw-r--. 1 aaron aaron 30 Jan 31 14:30 testfile
```

```
$ lsblk
```

NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT
vda	8:0	0	20G	0	disk	
└─vda1	8:1	0	1G	0	part	/boot
└─vda2	8:2	0	19G	0	part	
└─cs-root	253:0	0	17G	0	lvm	/
└─cs-swap	253:1	0	2G	0	lvm	[SWAP]
vdb	8:16	0	10G	0	disk	
└─vdb1	8:17	0	4G	0	part	
└─vdb2	8:18	0	4G	0	part	/mybackups
└─vdb3	8:19	0	2G	0	part	

Mount Filesystems At or During Boot

>_

```
$ man fstab
```

FSTAB(5)

File Formats

FSTAB(5)

NAME

`fstab` - static information about the filesystems

SYNOPSIS

`/etc/fstab`

DESCRIPTION

The file `fstab` contains descriptive information about the filesystems the system can mount. `fstab` is only read by programs, and not written; it is the duty of the system administrator to properly create and maintain this file. The order of records in `fstab` is important because `fsck(8)`, `mount(8)`, and `umount(8)` sequentially iterate through `fstab` doing their thing.

Each filesystem is described on a separate line. Fields on each line are separated by tabs or spaces. Lines starting with '#' are comments. Blank lines are ignored.

The following is a typical example of an `fstab` entry:

```
LABEL=t-home2    /home        ext4      defaults,auto_da_alloc      0  2
```

Mount Filesystems At or During Boot

>_

```
$ sudo vim /etc/fstab
```

```
$ swapon --show
```

NAME	TYPE	SIZE	USED	PRIOS
/dev/vdb3	partition	2G	0B	-2
/dev/dm-1	partition	2G	0B	-3

The screenshot shows a terminal window with two sections. The top section displays the contents of the /etc/fstab file, which includes entries for swap partitions. The bottom section shows the output of the 'swapon --show' command, listing the swap partitions and their current mount status.

Filesystem Mount Options

Filesystem	Type	Options	Priority
/dev/mapper/cs-swap	swap	none	0
/dev/vdb3	swap	none	0

Swap Status

Filesystem	Swap Type	Mount Options	Priority
/dev/vdb3	swap	none	0

Mount Filesystems At or During Boot

>_

```
$ sudo vim /etc/fstab
```

```
$ sudo blkid /dev/vdb1
```

```
/dev/vdb1: LABEL="FirstFS" UUID="9ab8cfa5-2813-4b70-ada0-7abd0ad9d289"  
BLOCK_SIZE="512" TYPE="xfs" PARTUUID="569a3fcc-f9eb-9147-888d-  
9e3ffe9ccdb0"
```

			/etc/fstab
	UUID=3b93b1ba-e44a-4f75-aa38-c93ed32e34e2	/boot	xfs defaults 0 0
	/dev/vda1	/boot	xfs defaults 0 0

UUID=9ab8cfa5-2813-4b70-ada0-7abd0ad9d289	/mybackups	xfs	defaults	0 0
---	------------	-----	----------	-----

{KODE{LOUD

Configure Systems to
Mount Filesystems On Demand



On Demand Mounting



On Demand Mounting



Fileserver

Mount Filesystems on Demand

>_

```
$ sudo dnf install autofs  
$ sudo systemctl start autofs.service  
$ sudo systemctl enable autofs.service
```

Mount Filesystems on Demand

>_

```
$ sudo dnf install nfs-utils  
$ sudo systemctl start nfs-server.service  
$ sudo systemctl enable nfs-server.service
```

Mount Filesystems on Demand

>_

```
$ sudo vim /etc/exports
```

```
$ sudo systemctl reload nfs-server.service
```



/etc/exports

/etc 127.0.0.1(ro)

Mount Filesystems on Demand

>_

```
$ sudo vim /etc/auto.master
```

 /etc/auto.master

```
/shares/ /etc/auto.shares --timeout=400
```

Mount Filesystems on Demand

>_

```
$ sudo vim /etc/auto.shares
```

/etc/auto.master

shares /etc/auto.shares

● ● ● /etc/auto.shares

mynetworkshare -fstype=auto 127.0.0.1:/etc

mynetworkshare -fstype=nfs4 127.0.0.1:/etc

mynetworkshare -fstype=auto,ro 127.0.0.1:/etc

mynetworkshare -fstype=auto,ro nfs1.example.com:/etc

myext4files -fstype=auto :/dev/vdb2

Mount Filesystems on Demand

>_

```
$ sudo systemctl reload autofs
```

```
$ ls /shares/
```

```
$ ls /shares/mynetworkshare/
```

```
mysharedfile1      mysharedfile2
```

Mount Filesystems on Demand

>_

```
$ sudo vim /etc/auto.master
```



/etc/auto.master

/shares/ /etc/auto.shares --timeout=400



/etc/auto.shares --timeout=400

Mount Filesystems on Demand

>_

```
$ sudo vim /etc/auto.shares
```

```
$ sudo systemctl reload autofs
```

```
$ ls /mynetworkshare/  
mysharedfile1      mysharedfile2
```

```
$ ls /localfiles/myext4files/  
mysharedfile3      mysharedfile4
```



/etc/auto.shares

```
mynetworkshare -fstype=auto 127.0.0.1:/etc  
myext4files -fstype=auto :/dev/vdb2
```

```
/mynetworkshare -fstype=auto 127.0.0.1:/etc
```

```
/localfiles/myext4files -fstype=auto :/dev/vdb2
```

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Evaluate and Compare the Basic
Filesystem Features and Options



Filesystem Features and Options

>_

```
$ findmnt
```

TARGET	SOURCE	FSTYPE	OPTIONS
/	/dev/mapper/cs-root		
/proc	proc	proc	rw,nosuid,nodev,noexec,
/proc/sys/fs/binfmt_misc	systemd-1	autofs	rw,relatime,fd=37,pgrp=
/dev	devtmpfs	devtmpf	rw,nosuid,seclabel,size
/dev/shm	tmpfs	tmpfs	rw,nosuid,nodev,seclabe
/dev/pts	devpts	devpts	rw,nosuid,noexec,relati
/dev/hugepages	hugetlbfs	hugetlb	rw,relatime,seclabel,pa
/dev/mqueue	mqueue	mqueue	└/boot
/dev/vda1	xfs	xfs	rw,relatime,seclabel,at
/var/lib/nfs/rpc_pipefs	sunrpc	rpc_pip	rw,relatime
/mybackups	/dev/vdb1	xfs	rw,relatime,seclabel,at

```
$ findmnt -t xfs,ext4
```

TARGET	SOURCE	FSTYPE	OPTIONS
/	/dev/mapper/cs-root	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota
/boot	/dev/vda1	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota
/mybackups	/dev/vdb1	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota

Filesystem Features and Options

>_

```
$ findmnt -t xfs,ext4
```

TARGET	SOURCE	FSTYPE	OPTIONS
/	/dev/mapper/cs-root	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota
└/boot	/dev/vda1	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota
└/mybackups	/dev/vdb1	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota

```
$ sudo touch /mybackups/testfile2
```

```
$ sudo mount -o ro /dev/vdb2 /mnt
```

```
$ findmnt -t xfs,ext4
```

TARGET	SOURCE	FSTYPE	OPTIONS
/	/dev/mapper/cs-root	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota
└/boot	/dev/sda1	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota
└/mybackups	/dev/sdb1	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota
└/mnt	/dev/sdb2	ext4	ro,relatime,seclabel

```
$ sudo touch /mnt/testfile
```

```
touch: cannot touch '/mnt/testfile': Read-only file system
```

Filesystem Features and Options

>_

```
$ sudo umount /mnt
```

```
$ sudo mount -o ro,noexec,nosuid /dev/vdb2 /mnt
```

```
$ findmnt -t xfs,ext4
```

TARGET	SOURCE	FSTYPE	OPTIONS
/	/dev/mapper/cs-root	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota
/boot	/dev/sda1	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota
/mybackups	/dev/sdb1	xfs	rw,relatime,seclabel,attr2,inode64,logbufs=8,logbsize=32k,noquota
/mnt	/dev/sdb2	ext4	ro,nosuid,noexec,relatime,seclabel

```
$ sudo mount -o rw,noexec,nosuid /dev/vdb2 /mnt
```

mount: /mnt: /dev/sdb2 already mounted on /mnt.

```
$ sudo mount -o [remount],rw,noexec,nosuid /dev/vdb2 /mnt
```

Filesystem Features and Options

>_

```
$ man mount
```

FILESYSTEM-INDEPENDENT MOUNT OPTIONS

Some of these options are only useful when they appear in the /etc/fstab file.

Some of these options could be enabled or disabled by default in the system kernel. To check the current setting see the options in /proc/mounts. Note that filesystems also have per-filesystem

specific default mount options (see for example tune2fs -l output for extN filesystems).

The following options apply to any filesystem that is being mounted (but not every filesystem actually honors them – e.g., the sync option today has an effect only for ext2, ext3, ext4, fat, vfat and ufs):

async All I/O to the filesystem should be done asynchronously.
(See also the sync option.)

atime Do not use the noatime feature, so the inode access time is controlled by kernel defaults. See also the descriptions of the relatime and strictatime mount options.

Filesystem Features and Options

>_

```
$ man xfs
```

MOUNT OPTIONS

The following XFS-specific mount options may be used when mounting an XFS filesystem. Other generic options may be used as well; refer to the `mount(8)` manual page for more details.

`allocsize=size`

Sets the buffered I/O end-of-file preallocation size when doing delayed allocation writeout. Valid values for this option are page size (typically 4KiB) through to 1GiB, inclusive, in power-of-2 increments.

The default behavior is for dynamic end-of-file preallocation size, which uses a set of heuristics to optimise the preallocation size based on the current allocation patterns within the file

and the access patterns to the file. Specifying a fixed `allocsize` value turns off the dynamic behavior.

```
$ sudo umount /dev/vdb1
```

```
$ sudo mount -o allocsize=32K /dev/vdb1 /mybackups
```

Mount Filesystems At or During Boot

>_

```
$ sudo vim /etc/fstab
```

```
$ sudo systemctl reboot
```

```
$ findmnt -t xfs,ext4
```

TARGET	SOURCE	FSTYPE	OPTIONS
/	/dev/mapper/cs-root	xfs	rw,relatime,seclabel,attr2,inode64,logbu
/boot	/dev/sda1	xfs	rw,relatime,seclabel,attr2,inode64,logbu
/mybackups	/dev/sdb1	xfs	ro,noexec,relatime,seclabel,attr2,inode6



/etc/fstab

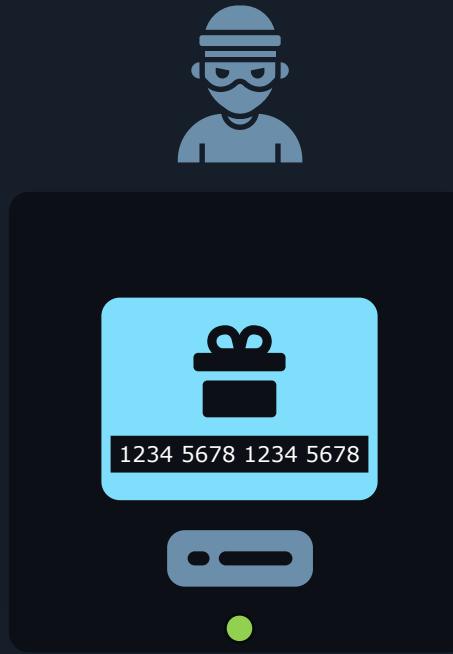
```
/dev/vdb1 /mybackups xfs defaults 0 2
```

```
/dev/vdb1 /mybackups xfs ro,noexec 0 2
```

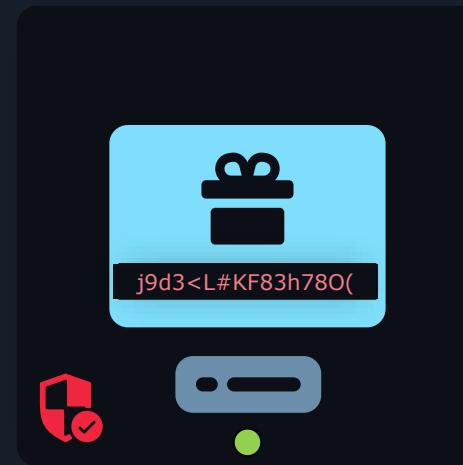
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Create and Configure Encrypted Storage





Encrypted Storage



Encrypted Storage

>_

```
$ sudo cryptsetup --verify-passphrase open --type plain /dev/vde mysecuredisk
```

```
$ sudo mkfs.xfs /dev/mapper/mysecuredisk
```

```
$ sudo mount /dev/mapper/mysecuredisk /mnt
```

```
$ sudo umount /mnt
```

```
$ sudo cryptsetup close mysecuredisk
```

Encrypted Storage

>_

```
$ sudo cryptsetup luksFormat /dev/vde
```

```
$ cryptsetup
```

create	luksDump	luksOpen	remove
isLuks	luksFormat	luksRemoveKey	resize
luksAddKey	luksHeaderBackup	luksResume	status
luksClose	luksHeaderRestore	luksSuspend	
luksDelKey	luksKillSlot	luksUUID	

TAB

TAB

Encrypted Storage

>_

```
$ sudo cryptsetup luksFormat /dev/vde
```

WARNING!
=====

This will overwrite data on /dev/vde irrevocably.

Are you sure? (Type 'yes' in capital letters)

```
$ sudo cryptsetup luksChangeKey /dev/vde
```

```
$ sudo cryptsetup open /dev/vde mysecuredisk
```

```
$ sudo mkfs.xfs /dev/mapper/mysecuredisk
```

```
$ sudo cryptsetup close mysecuredisk
```

Encrypted Storage

>_

```
$ sudo cryptsetup luksFormat /dev/vde2
```

```
$ sudo cryptsetup open /dev/vde2 mysecuredisk
```

```
$ sudo cryptsetup --verify-passphrase open --type plain /dev/vde2 mysecuredisk
```

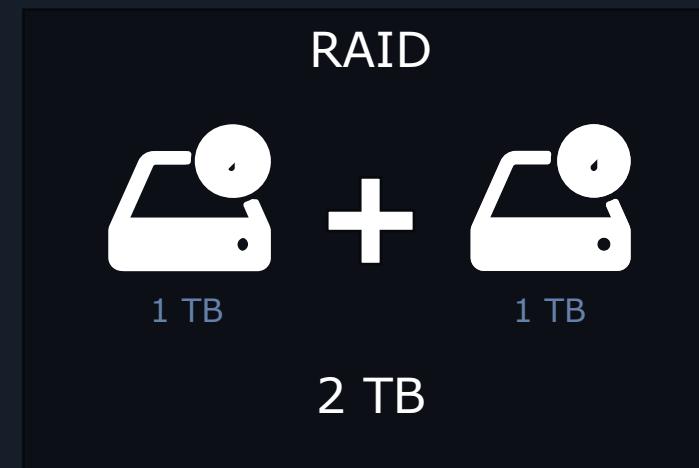
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Create and Manage RAID Devices



Create and Manage RAID Devices

RAID = Redundant Array of Independent D



Create and Manage RAID Devices

>_

```
$ sudo vgremove --force my_volume  
  
$ sudo pvremove /dev/vdc /dev/vdd /dev/vde  
  
$ sudo mdadm --create /dev/md0 --level=0 --raid-devices=3 /dev/vdc /dev/vdd /dev/vde  
  
$ sudo mkfs.ext4 /dev/md0  
  
$ sudo mdadm --stop /dev/md0
```

Create and Manage RAID Devices

>_

```
$ sudo mdadm --zero-superblock /dev/vdc /dev/vdd /dev/vde  
  
$ sudo mdadm --create /dev/md0 --level=1 --raid-devices=2 /dev/vdd --spare-devices=1 /dev/vde  
  
$ sudo mdadm --stop /dev/md0  
  
$ sudo mdadm --zero-superblock /dev/vdc /dev/vdd /dev/vde  
  
$ sudo mdadm --create /dev/md0 --level=1 --raid-devices=2 /dev/vdc /dev/vdd  
  
$ sudo mdadm --manage /dev/md0 --add /dev/vde  
  
$ cat /proc/mdstat  
  
$ sudo mdadm --manage /dev/md0 --remove /dev/vde
```

Create and Manage RAID Devices

>_

```
$ sudo mdadm --stop /dev/md0  
  
$ sudo mdadm --zero-superblock /dev/vdc /dev/vdd /dev/vde  
  
$ sudo mdadm --create --verbose /dev/md0 --level=10 --raid-devices=4 /dev/vdc /dev/vdd /dev/vde /dev/vdf
```

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User and Group Disk Quotas For Filesystems



User and Group Filesystem Quotas

>_

```
$ sudo dnf install quota
```

```
$ sudo vim /etc/fstab
```

```
$ sudo systemctl reboot
```



/etc/fstab

/dev/vdb1 /mybackups xfs ro,noexec 0 2

/dev/vdb1 /mybackups xfs defaults,usrquota,grpquota 0 2

Create and Manage RAID Devices

>_

```
$ sudo quotacheck --create-files --user --group /dev/vdb2      aquota.group      aquota.user
```

```
$ sudo quotaon /mnt/
```

Create and Manage RAID Devices

>_

```
$ sudo mkdir /mybackups/aaron/
```

```
$ sudo chown aaron:aaron /mybackups/aaron
```

```
$ fallocate --length 100M /mybackups/aaron/100Mfile
```

```
$ sudo edquota --user aaron
```

Disk quotas for user aaron (uid 1000):

Filesystem	blocks	soft	hard	inodes	soft	hard
/dev/vdb1	102400	0	0	2	0	0

blocks
102400

Disk quotas for user aaron (uid 1000):

Filesystem	blocks	soft	hard	inodes	soft	hard
/dev/vdb1	102400	150M	200M	2	0	0

```
$ fallocate --length 60M /mybackups/aaron/60Mfile
```

Create and Manage RAID Devices

>_

```
$ sudo quota --user aaron
Disk quotas for user aaron (uid 1000):
Filesystem          blocks      quota      limit      grace
/dev/vdb1            163840*    153600    204800    6days
                                                               files      quota      limit      grace
```

```
$ fallocate --length 40M /mybackups/aaron/40Mfile
fallocate: fallocate failed: Disk quota exceeded
```

```
$ sudo edquota --user aaron
Disk quotas for user aaron (uid 1000):
Filesystem          blocks      soft      hard      inodes      soft      hard
/dev/vdb1            102400      0        0        4          0        5
```

```
$ touch /mybackups/aaron/newfile
touch: cannot touch '/mybackups/aaron/newfile': Disk quota exceeded
```

Create and Manage RAID Devices

>_

```
$ sudo quota --edit-period
```

Grace period before enforcing soft limits for users:

Time units may be: days, hours, minutes, or seconds

Filesystem	Block grace period	Inode grace period
/dev/vdb1	7days	7days

```
$ sudo edquota --group adm
```

Disk quotas for group adm (gid 4):

Filesystem	blocks	soft	hard	inodes	soft	hard
/dev/vdb1	0	0	0	0	0	0

```
$ sudo quota --group adm
```

Disk quotas for group adm (gid 4): none

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Conclusion



Conclusion



Conclusion

The screenshot shows two versions of the Linux Foundation Certification website side-by-side, both displaying the Linux Foundation Certified System Administrator (LFCS) certification page.

Top Navigation Bar: Both versions feature a top navigation bar with icons for back, forward, search, and user profile. The URL in the address bar is <https://training.linuxfoundation.org/certification/linux-foundation-certified-sysadmin-lfcs/>.

Header: The header includes the "THE LINUX FOUNDATION" logo, "Training & Certification" menu item, and dropdown menus for Catalog, Resources, Explore, and My Portal. On the right, there is a search icon, a language dropdown set to USA, a "Linux Foundation" dropdown, and a "Sign In" button.

Breadcrumbs: Below the header, the breadcrumb trail shows "Certification > System Administration > Linux Foundation Certified System Administrator (LFCS)".

Certification Section: A blue banner at the top says "CERTIFICATION".

Left Column Content: This section contains "Exam Details & Resources". It includes a paragraph about the exam being an online, proctored, performance-based test, and links to various resources:

- Linux Foundation Certification Prep Guide
- Linux Foundation Certification Exams: Candidate Handbook
- Linux Foundation Certification Practice Questions (LFCS)
- Frequently Asked Questions
- LFCS & LFCE Important Instructions
- Linux Foundation Certification Policies

Right Column Content: This section includes a "Gift this certification" button and a note for corporate quotes. It also features a large price box for the course + exam.

Price Box: A prominent dark blue box displays the price of \$575 for "Course + Exam" and a "Buy Bundle" button. Below it, a link says "Get a Quote" and a "100% Money Back Guarantee".

Bottom Includes: A section titled "Includes" lists what candidates will learn, such as working profICIENTLY to design, install, configure, and manage a system installation, and having an understanding of key concepts like file systems and memory management.

Conclusion

Credly

Back

Share your badge

Broadcast your achievement to friends and colleagues to get the recognition you deserve.



LFCS: Linux Foundation Certified Systems Administrator
Issued by [The Linux Foundation](#)

Promote
Share your achievement on social media.

 LinkedIn  Twitter

 Facebook  ZipRecruiter

Publish
Send your badge or take it offline.

 Email  Download Badge Image

 Public Link  Download Certificate

 Embed Code

[View dashboard](#)

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Linux Foundation Certified System Administrator Exam Details



LFCS Exam Details



120 minutes
(2 hours)



375.00 USD
Valid for 3 years



Performance-based
Simulates on-the-job tasks
No multiple choice or true/false
20 to 25 performance-based tasks



Online proctored
No Virtual Machines
Chromium-based browser
Proctoring plugins
Single monitor
No headphones
Webcam, speakers, and microphone ON
Quiet, well-lit, and clean testing area

LFCS Exam Compatibility Check



<https://www.examslocal.com/ScheduleExam/Home/CompatibilityCheck>

LFCS Exam Identification Requirements

- Your primary ID document cannot be expired, and must contain a photograph, full name, and signature
- The name on your primary ID document must **exactly** match the verified name on your exam checklist
- If your name contains non-Latin characters, you will need to have a secondary ID that contains your full name in Latin characters **OR** a notarized English translation of your primary ID along with your non-Latin ID

Primary ID	Secondary ID
Passport	Debit (ATM)
Government-issued driver's license/permit	CardCredit Card
Government-Issued local language ID (plastic card with photo and signature)	Health Insurance Card
National Identity card	U.S. Social Security Card
State or province-issued identity card 住民基本台帳 (Basic resident register with Photo) or マイナンバーカード (My number card)	Employee ID Card
	Student ID Card
	Japanese Health Insurance Card

LFCS Exam Resources Allowed

- Man pages
- Documents installed by the distribution (i.e., `/usr/share` and its subdirectories)
- Packages that are part of the distribution (may also be installed by the candidate if not available by default)
- Resources can **only** be accessed via the terminal inside of the exam environment

LFCS Exam Environment

- Base node (hostname: node-1) and a number of LXD containers and remote nodes accessible by SSH
- If no SSH instructions are provided, answer using the base node (hostname: node-1)
- After finishing work on a remote node, **always** return to node-1
- Nested SSH is not supported
- All nodes are configured for `root` and `student` users to SSH as root
- All nodes are referenced in `/etc/hosts`
- **Never** reboot node-1, as this takes about 15 minutes; other nodes can be rebooted freely
- Use `sudo -i` to get root access at any time
- **Do not** modify the firewall on the base node (hostname: node-1)

LFCS Exam Technical Instructions

- Get root privileges using `sudo -i`
- **Do not** stop or tamper with the `certerminal` process
- **Do not** block incoming ports `8080/tcp`, `4505/tcp`, and `4506/tcp`
- Use `Ctrl+Alt+W` instead of `Ctrl+W`
- `Ctrl+C` and `Ctrl+V` are **not** supported in the exam terminal
- For Linux, select text for copy and use the `middle mouse button` (or `both left and right simultaneously`) to paste
- For Mac, use `⌘+C` to copy and `⌘+V` to paste
- For Windows, use `Ctrl+Insert` to copy and `Shift+Insert` to paste
- You may need to modify system security policies to install some services or applications
- Only one terminal console is available during the exam. Use Terminal multiplexers like GNU Screen and tmux to create virtual consoles

LFCS Exam FAQs

<https://training.linuxfoundation.org/about/faqs/certification-faq/>

<https://trainingsupport.linuxfoundation.org>

LFCS Exam Registration

The screenshot shows the LFCS Exam Registration page. At the top left, there's a 'CERTIFICATION' button with a user icon. The main title is 'Linux Foundation Certified System Administrator (LFCS)' in large white font. Below it is a brief description: 'The Linux Foundation Certified System Administrator (LFCS) exam is ideal for candidates looking to validate their Linux system administration skill set.' To the right of the description is a large image of a digital certificate. The certificate features the 'THE LINUX FOUNDATION' logo at the top, followed by 'CERTIFIED SYSADMIN' in large blue letters, all set against a blue background. Below the certificate, the price '\$375' is displayed, with 'Exam only' written underneath. To the right of the price is a blue 'Enroll Today' button and a smaller link 'Get a Quote'. At the bottom of the page, there are three social sharing icons: a thumbs-up icon, a share icon, and a sun icon.

<https://training.linuxfoundation.org/certification/linux-foundation-certified-sysadmin-lfcs/>

All the best! + .

 @kodekloud

 @kodekloud1

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