



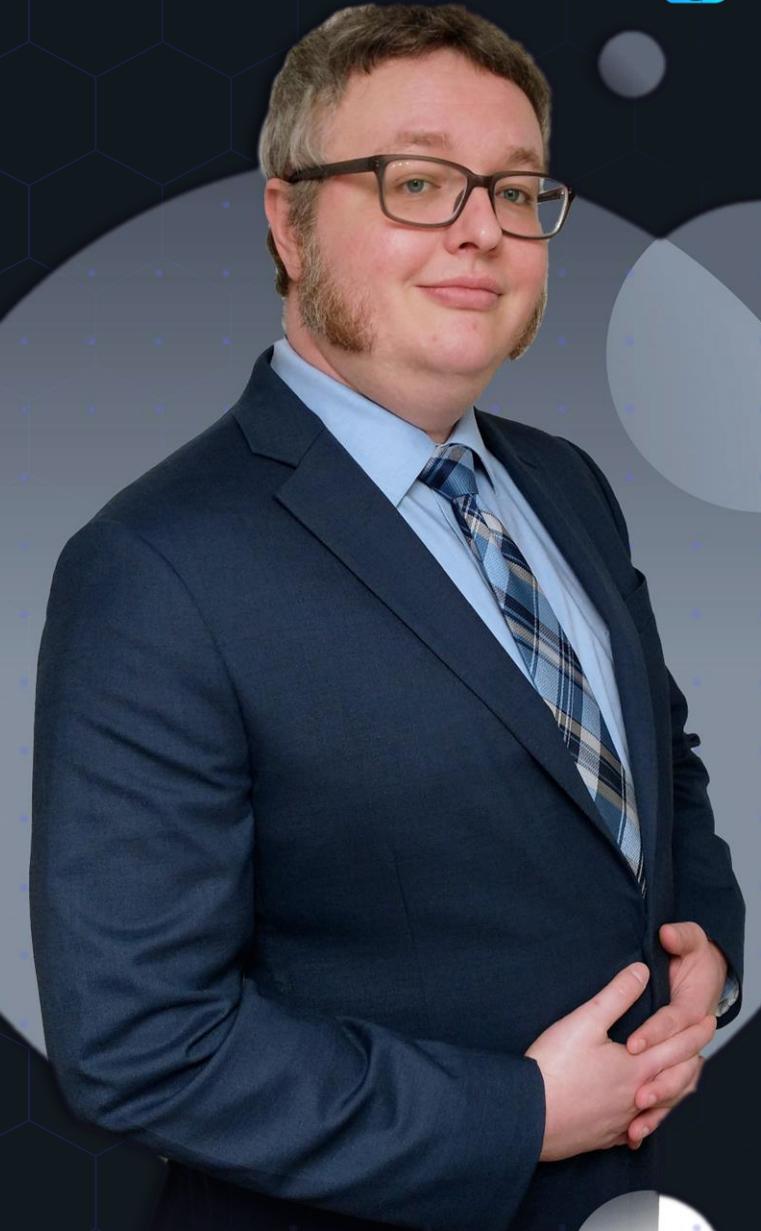
KodeKloud

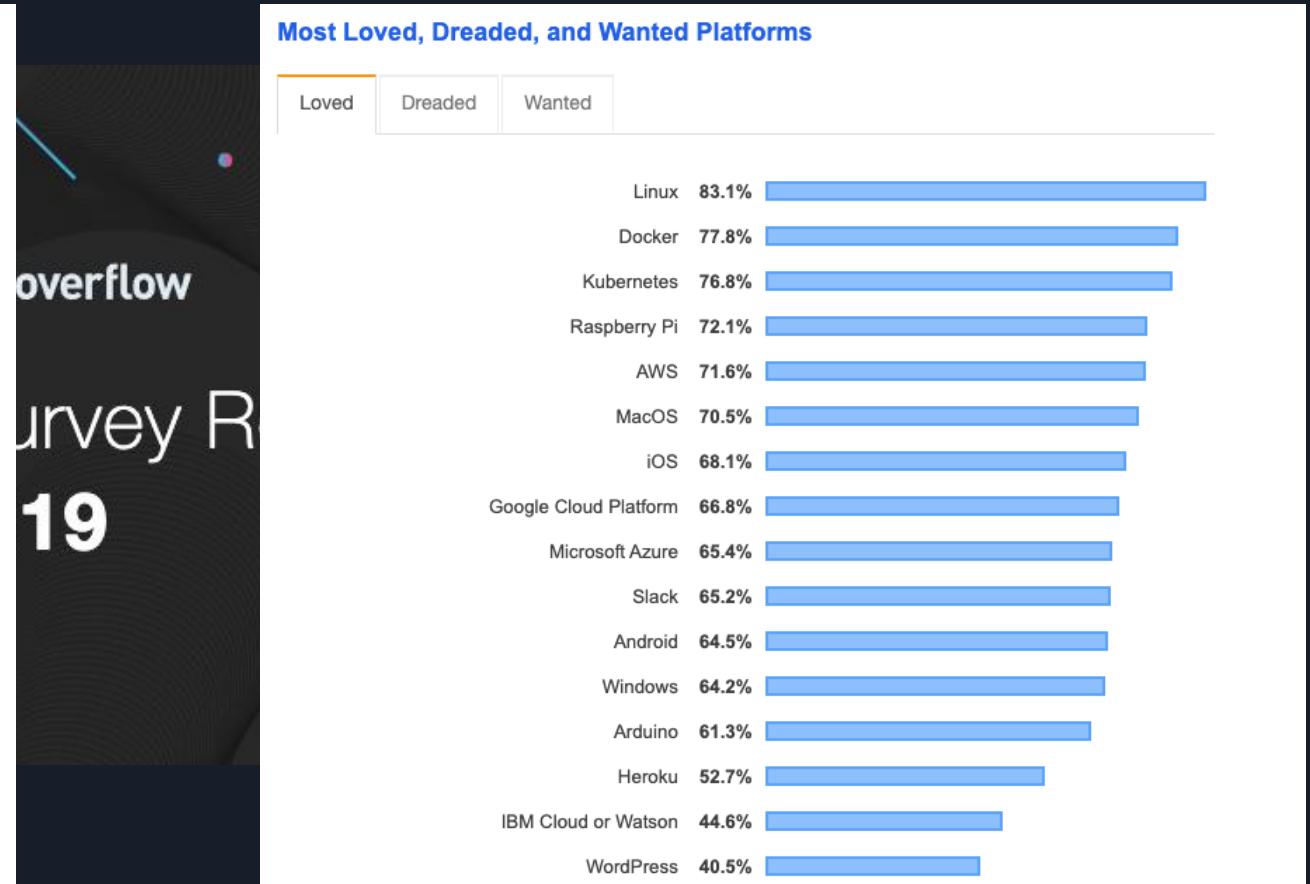
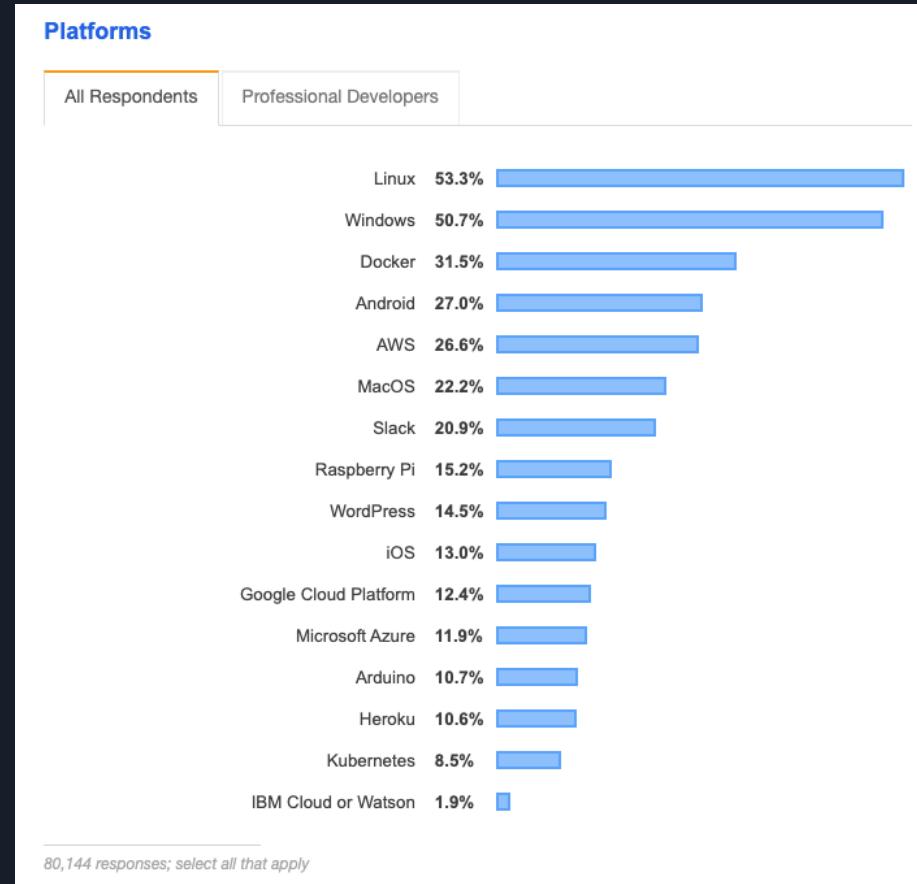
Red Hat Certified System Administrator Preparation Course



Instructor

| Aaron Lockhart





Curriculum



Essential Tools



Shell Scripts



Operate Running Systems



Local Storage



File Systems



Deploy, Configure, and Maintain Systems



Basic Networking



Manage Users and Groups



Managing Security



Manage Containers

Course Format



Videos



Labs



Mock Exams

Course Format

~30 Hours

30%



Videos

60%



Labs

10%

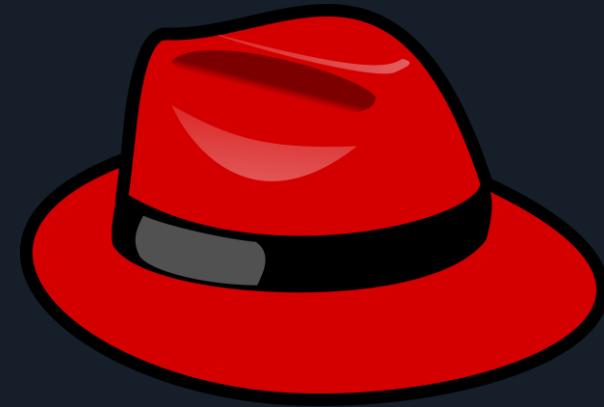


Mock Exams



KodeKloud

Red Hat Certified System Administrator Exam Details



Exam Objectives



Essential Tools



Shell Scripts



Operate Running Systems



Local Storage



File Systems



Deploy, Configure, and Maintain Systems



Basic Networking



Manage Users and Groups



Managing Security



Manage Containers

LFCS Exam Details



180 minutes
(3 hours)



400.00 USD
Valid for 3 years



Performance-based
No multiple choice or true/false



In-person
or
Online proctored

Login Methods



Local text-mode console



Remote text-mode login



Local graphical-mode console



Remote graphical-mode login

```
[OK] Mounted Unit unit for snapd, revision 13270.
[OK] Mounted Unit unit for snapd, revision 13226.
[OK] Mounted Unit unit for lxd, revision 21024.
[OK] Mounted Unit unit for lxd, revision 21245.
[OK] Mounted Unit unit for lxd, revision 17204.
[OK] Reached target Local File Systems.
Starting Load Adenpor profiles...
[OK] Reached target Network...
Starting Create final runtime dir for shutdown pivot root...
Starting Tell Plymouth To Write Out Runtime Data...
Starting Settle Network...
[OK] Finished Settle Network.
Starting Settle Network...
[OK] Finished Settle Network.
Starting Create Volatile Files and Directories...
[OK] Reached target Userangers...
Starting Load UTM about System Boot/Shutdown...
[OK] Finished Update UTM about System Boot/Shutdown.
[OK] Finished Settle Network.
Starting Load Adenpor profiles managed internally by snapd...
Starting Initial cloud-init Job (open-networking)...
[OK] Reached target Initial cloud-init Job (open-networking) managed internally by snapd.
[OK] Started Network Time Synchronization.
[OK] Reached target System Time Set.
[OK] Reached target Network Time Synchronization.
7.059553] cloud-init [655]: Cloud-Init v1.21.3-g99bfa9+0ubuntu2~20.04.1 running 'init-local' at Wed, 2022-01-12 10:58:00 +0000
[OK] Reached Initial Cloud-Init Job (open-networking).
[OK] Reached target Network (Pre).
[OK] Reached target Network (Post).
[OK] Started Network Service.
Starting Wait for Networks to be Configured...
Starting Network Name Resolution...
[OK] Started Network Name Resolution.
[OK] Reached target Network.
[OK] Reached target Host and Network Name Lookups.
```

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	.pk1	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

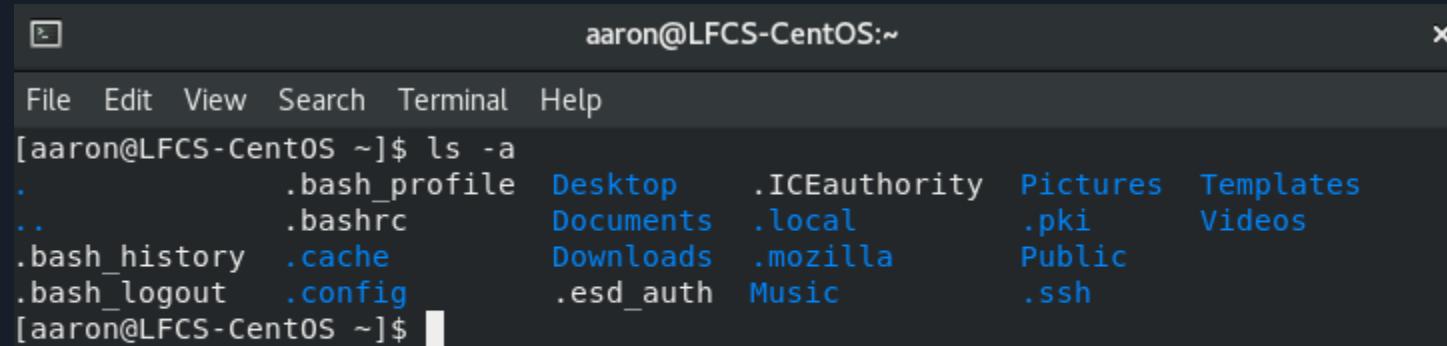
CTRL + ALT + F2

```
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



```
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 ~]$
```

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

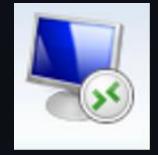
LFCS-CentOS login: aaron
Password:
Last login: Tue Oct 19 20:00:22 on tty2
[aaron@LFCS-CentOS ~]$ exit
```



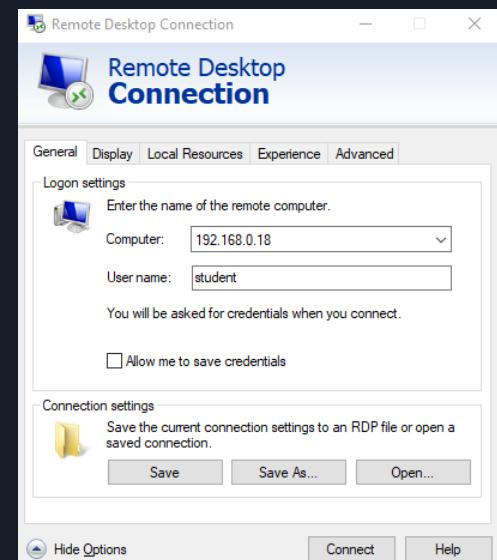
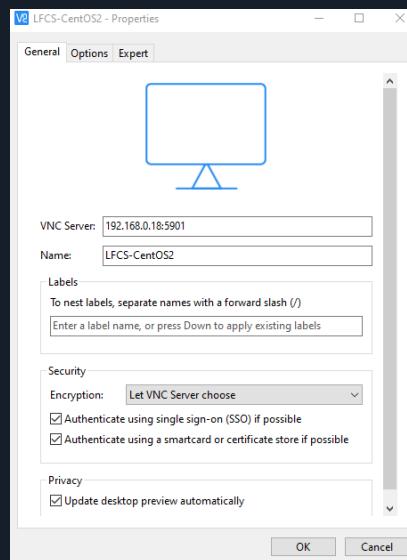
Remote GUI



VNC



RDP



Remote text-mode login



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
        noupdate enp0s3
        valid_lft 1966sec preferred_lft 1966sec
    inet6 fe80::a00:27ff:fe6b:d787/64 scope link noupdate
```

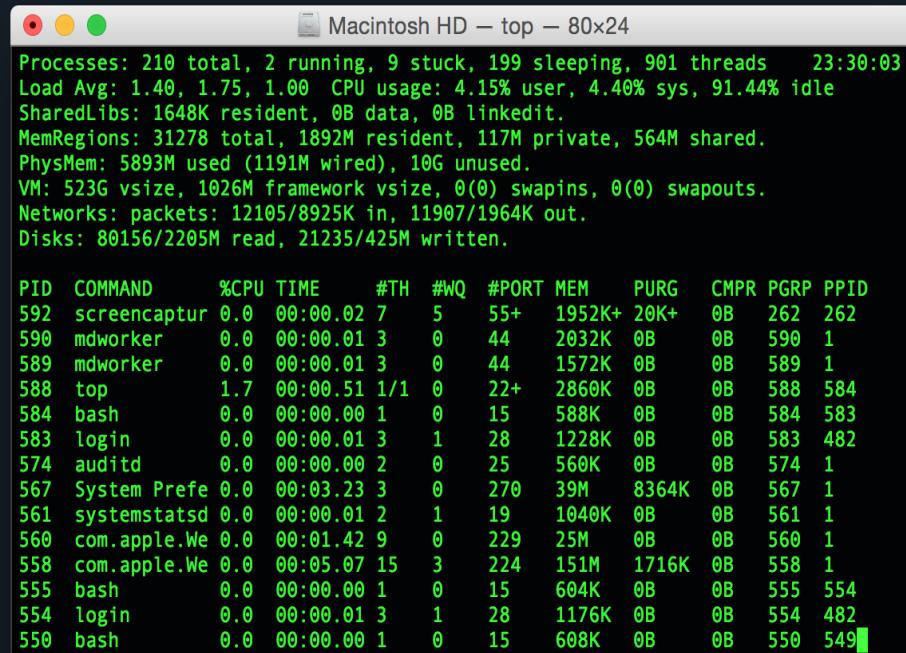
Server



SSH client

Computer

MacOS & Linux



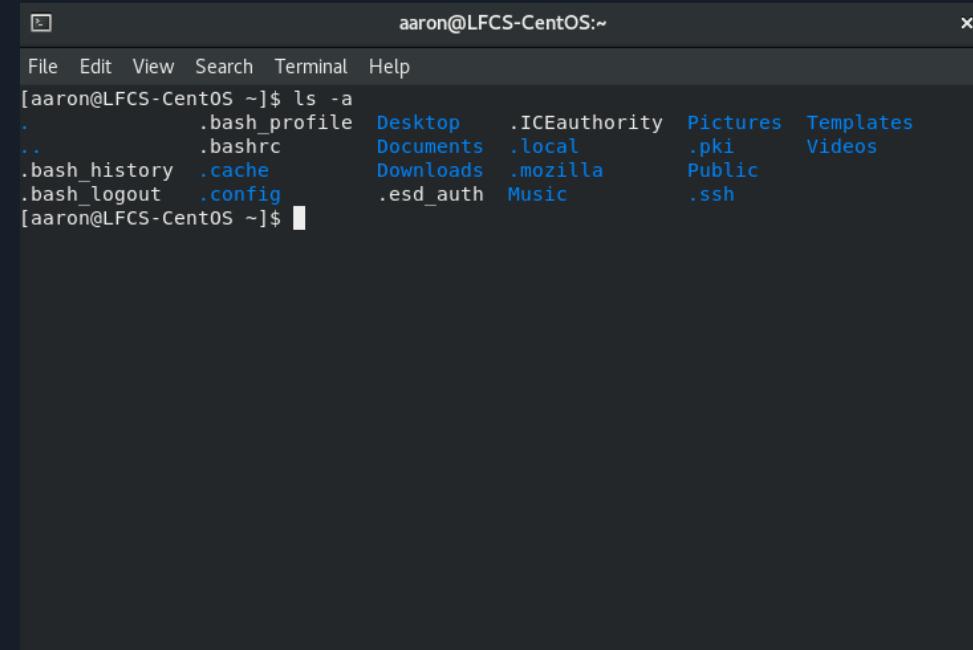
Macintosh HD — top — 80x24

```

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

```



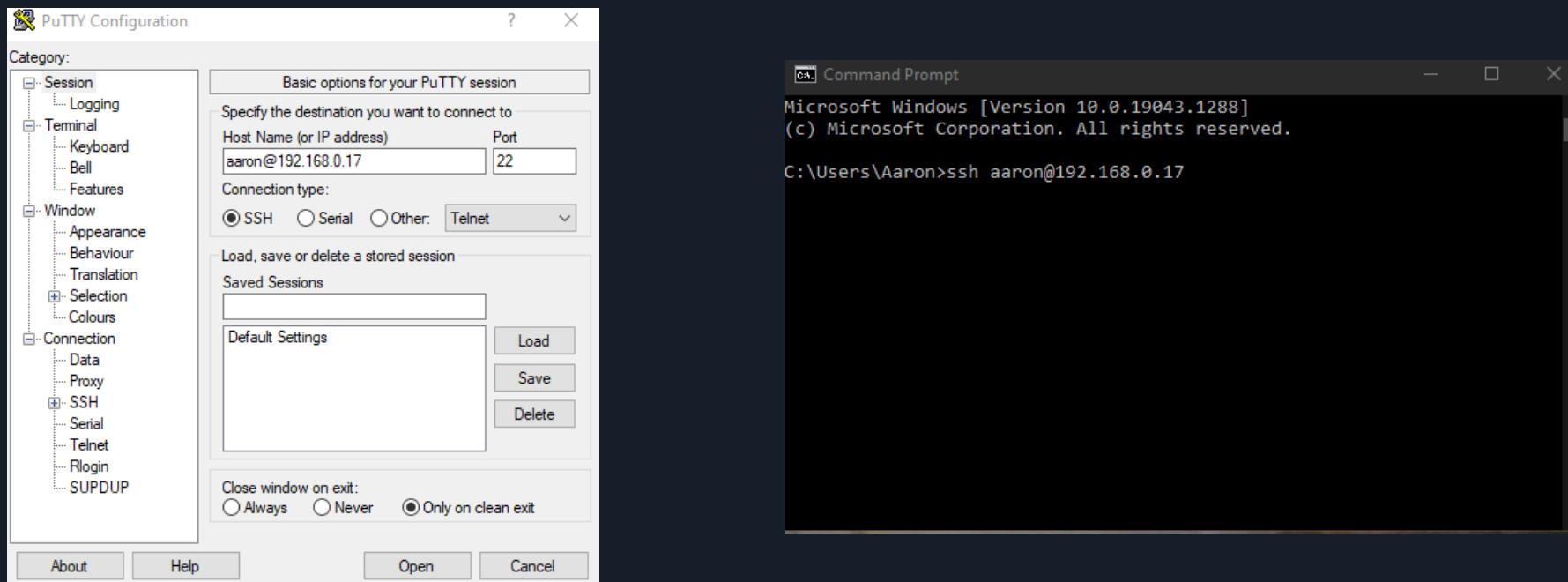
aaron@LFCS-CentOS:~

```

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 ~]$ █

```

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 ~]$
```



KodeKloud

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

1

```
$ apropos directo
```

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
rmdir (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
rmdir (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



KodeKloud

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
```

```
Documents  
Music
```

```
Videos
```

-a all

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

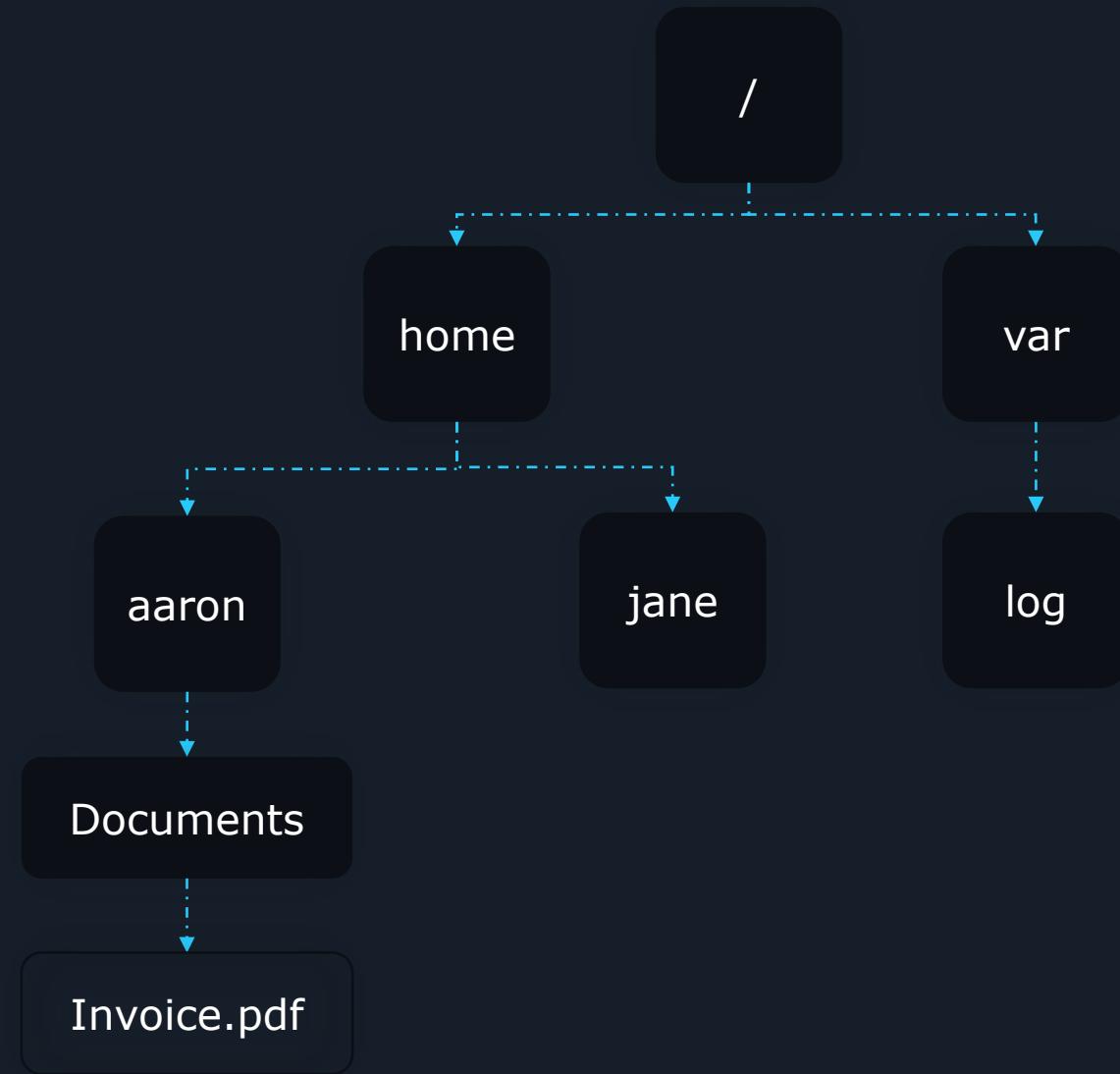
>_

```
$ ls -alh
```

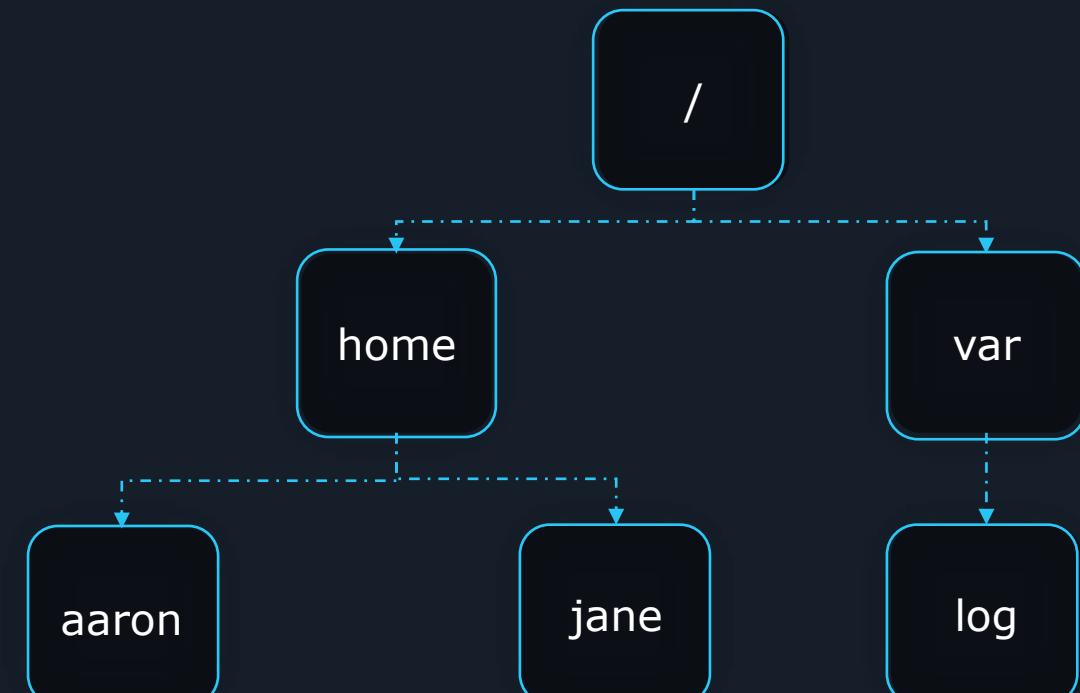
```
total 76K
drwx----- 16 aaron aaron 4.0K Nov  1 17:57 .
drwxr-xr-x  7 root  root  70 Oct 26 16:54 ..
-rw-----  1 aaron aaron 5.0K Nov  1 17:56 .bash_history
-rw-r--r--  1 aaron aaron  18 Jul 27 09:21 .bash_logout
-rw-r--r--  1 aaron aaron 141 Jul 27 09:21 .bash_profile
-rw-r--r--  1 aaron aaron 376 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

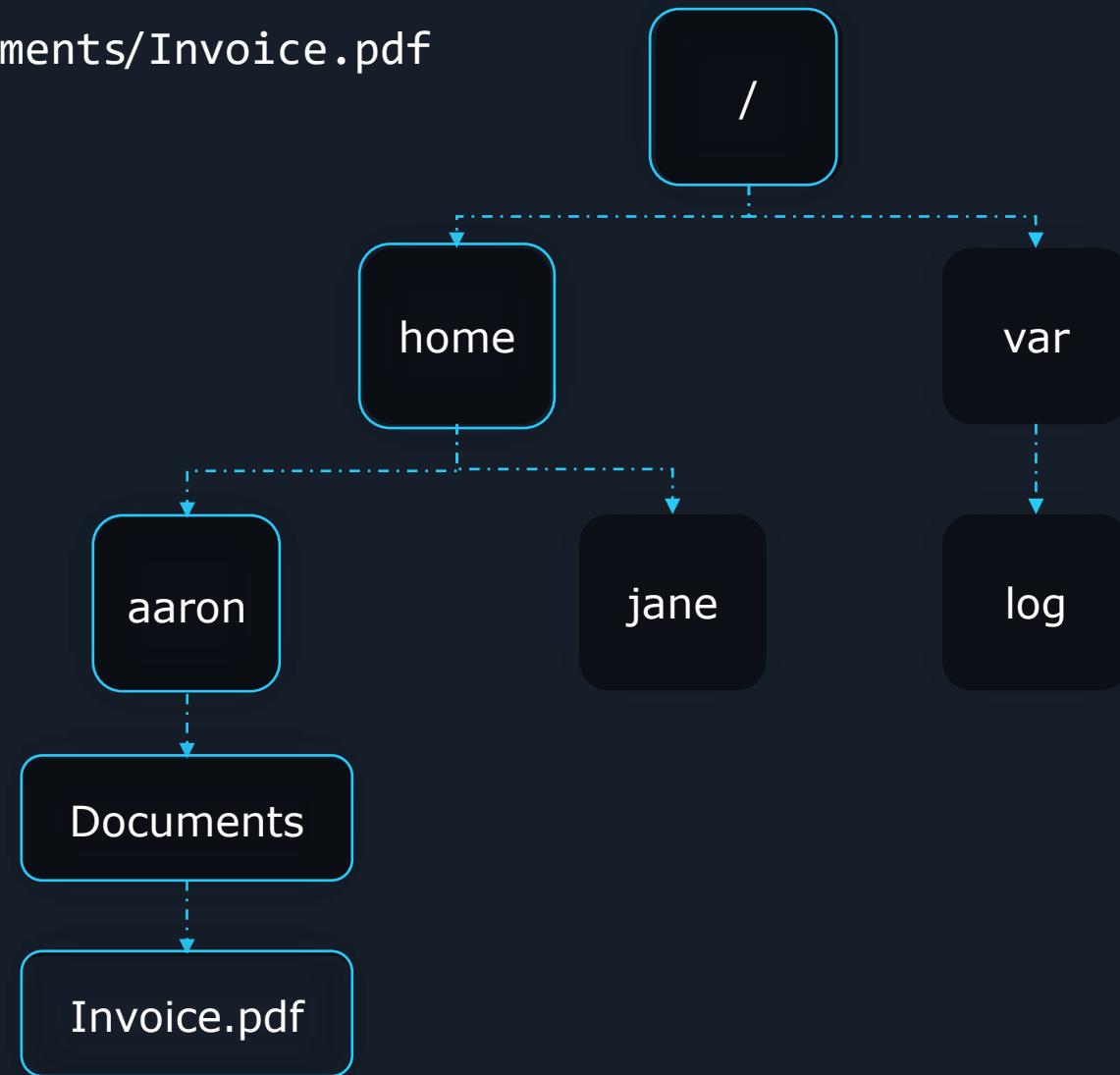
Documents

file path

Invoice.pdf

Absolute Path

/home/aaron/Documents/Invoice.pdf

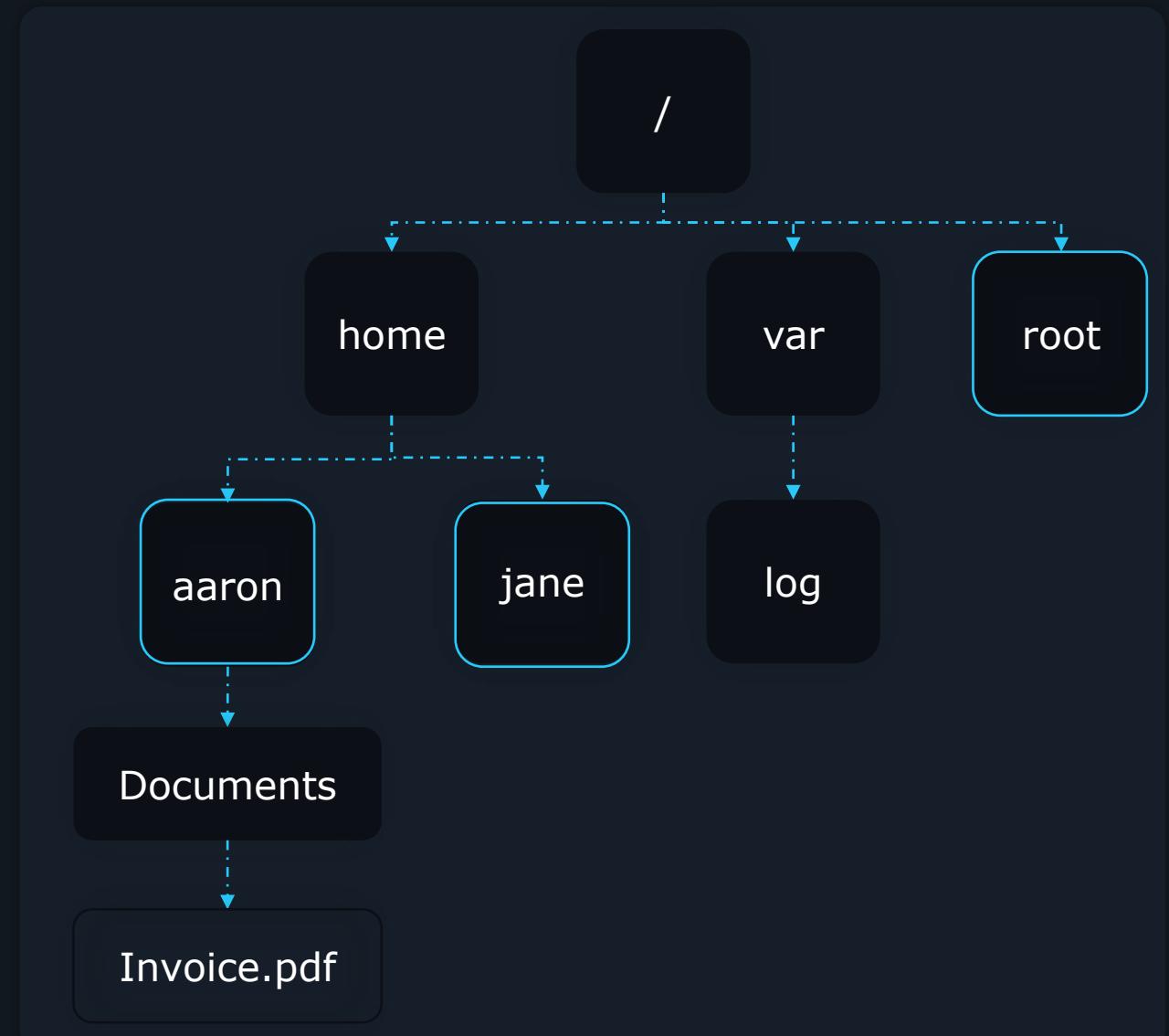


Current / Working Directory

>_

```
$ pwd  
/root
```

```
print working directory
```



Current / Working Directory

>_

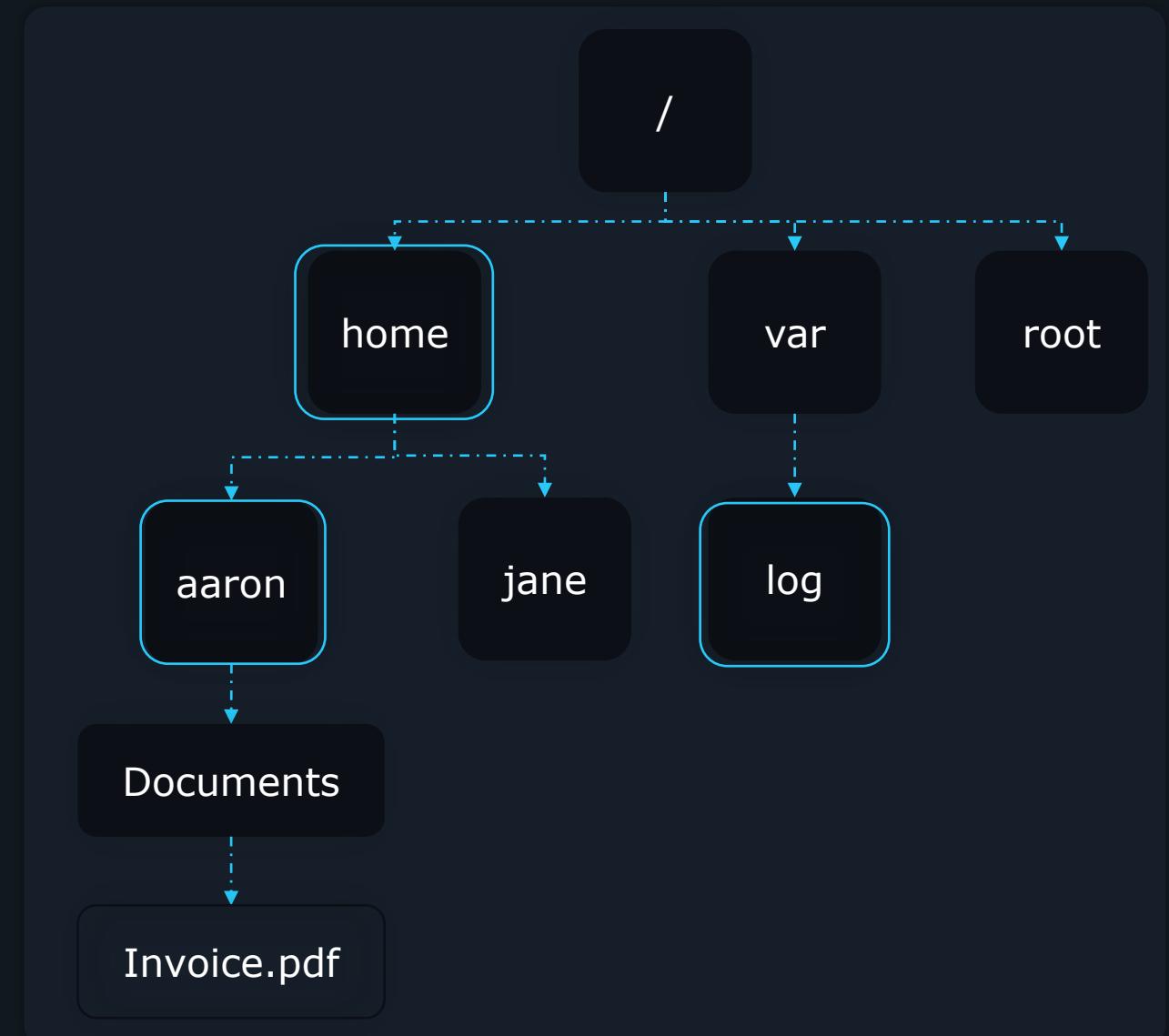
```
$ cd /var/log
```

change directory

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

```
$ cd ..
```

.. = parent directory



Relative Path

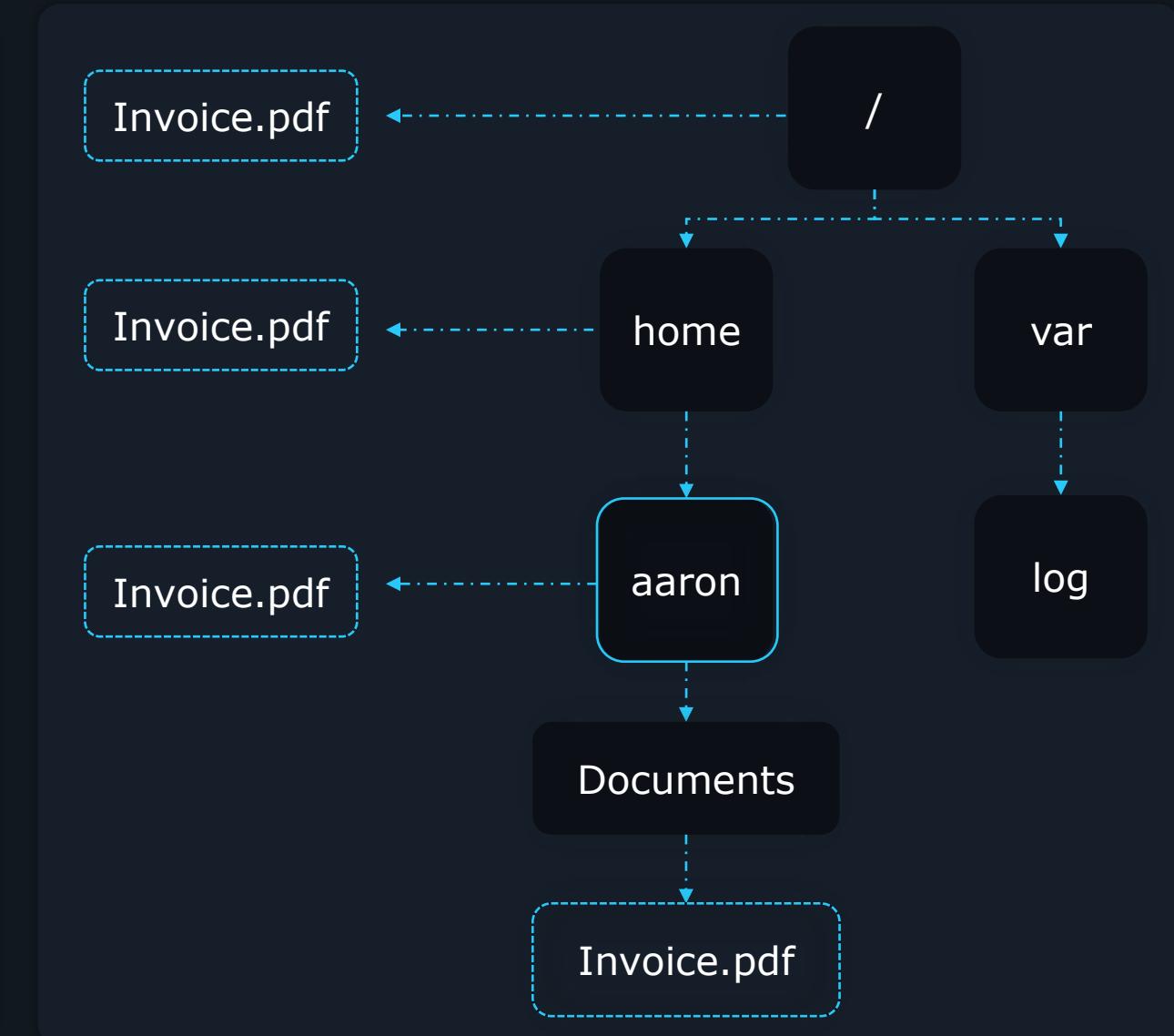
>_

\$ Documents/Invoice.pdf

\$ Invoice.pdf

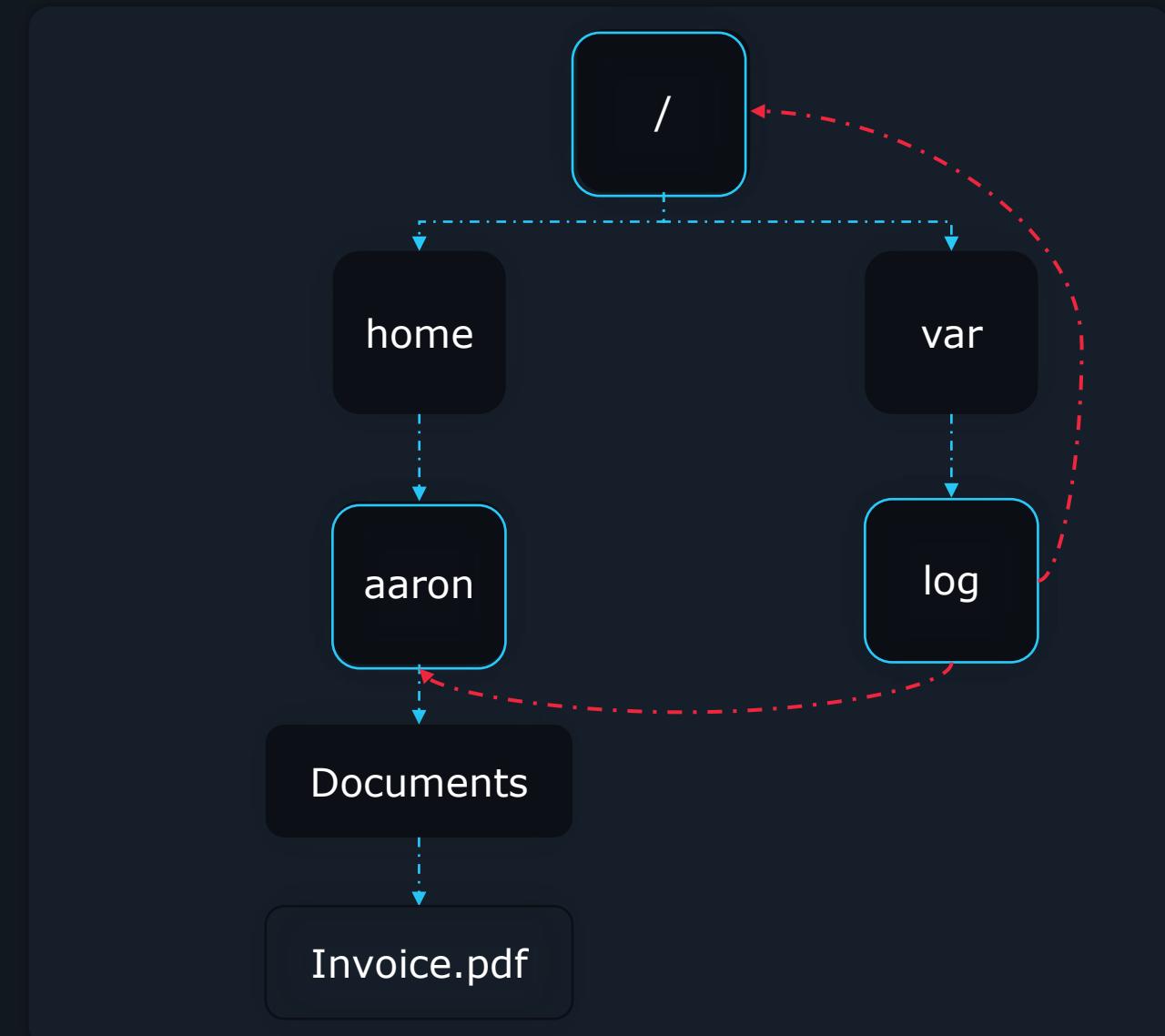
\$../../Invoice.pdf

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



Current / Working Directory

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



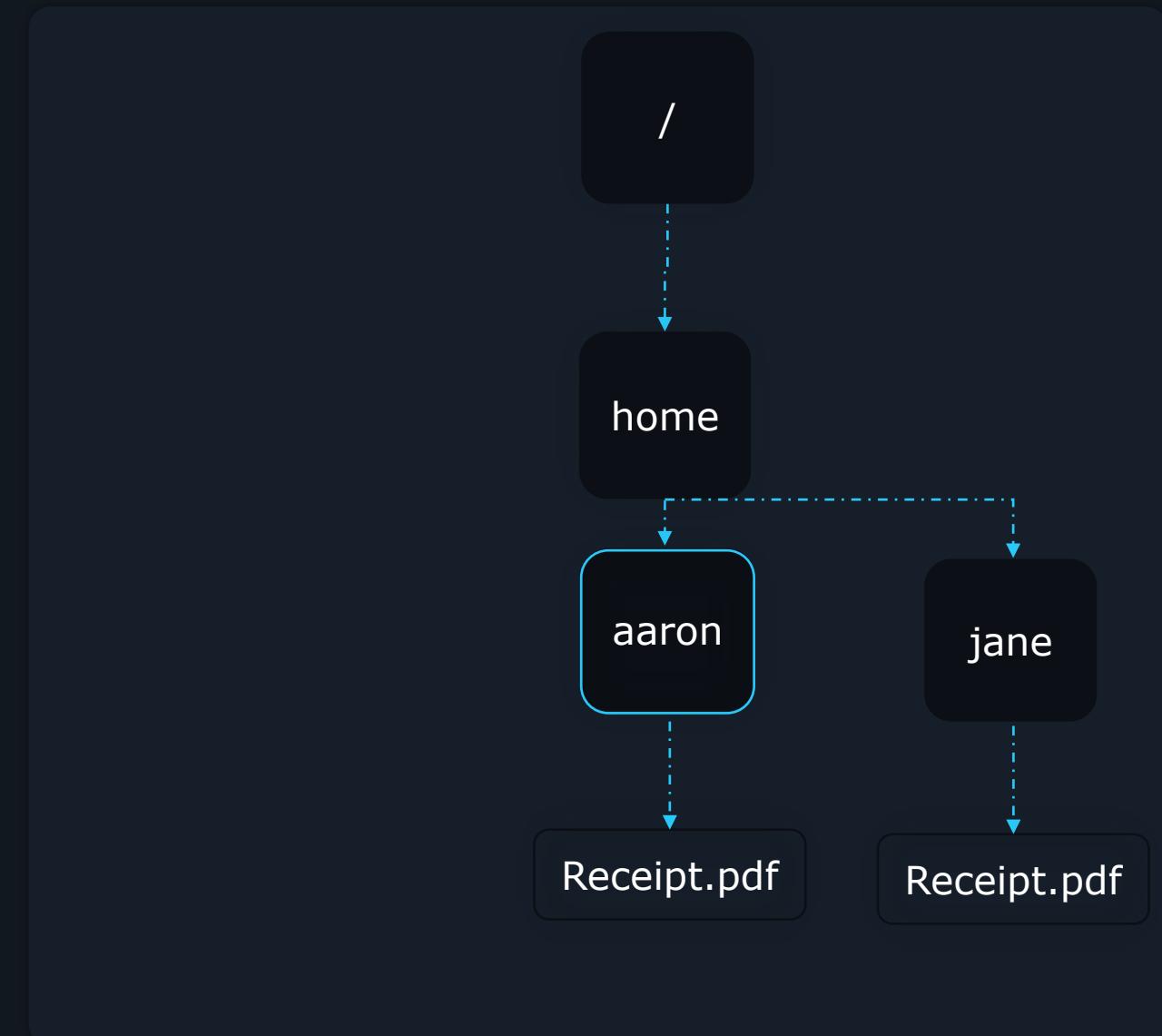
Creating Files

>_

```
$ touch Receipt.pdf
```

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

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

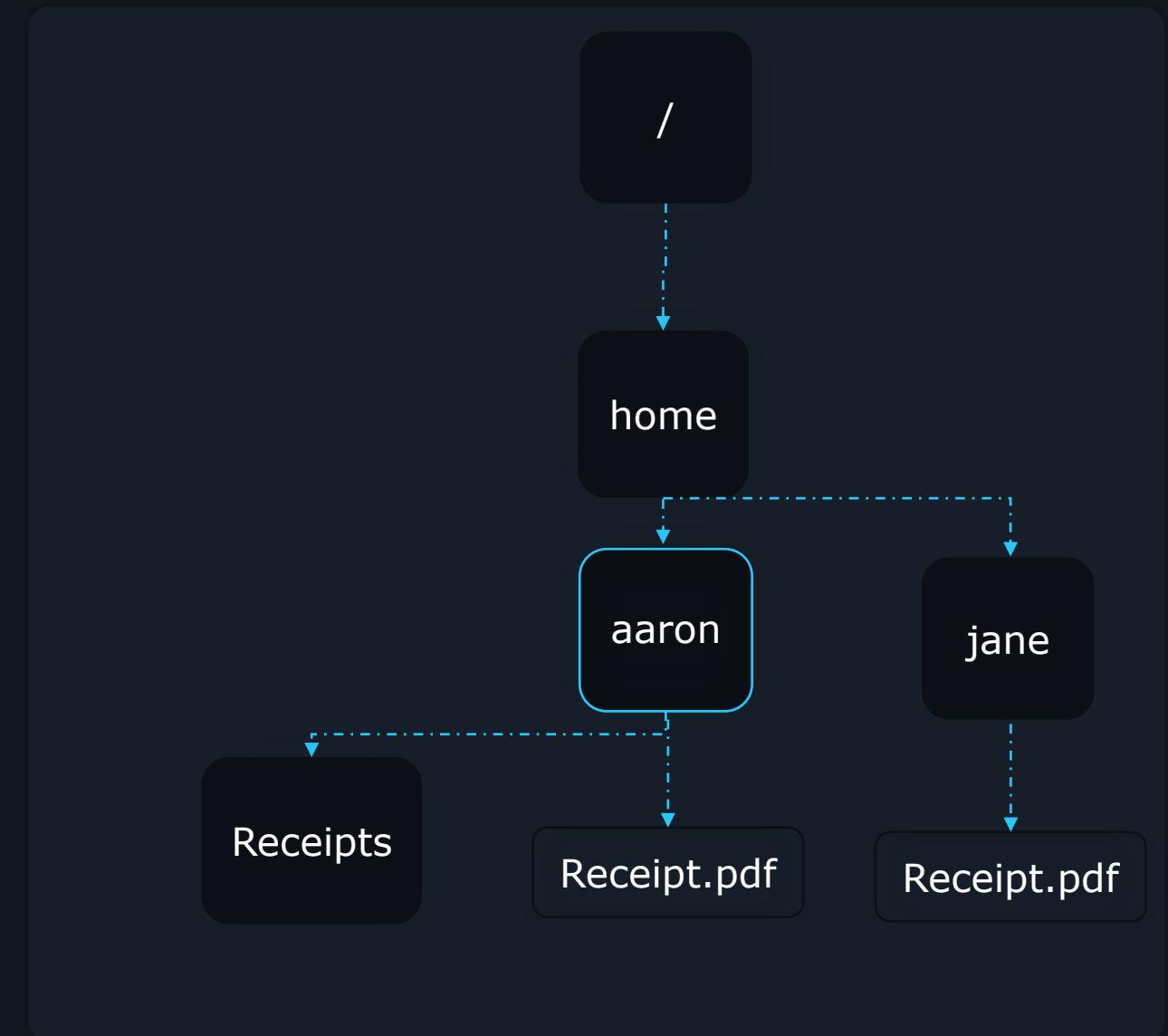


Creating Directories

>_

```
$ mkdir Receipts
```

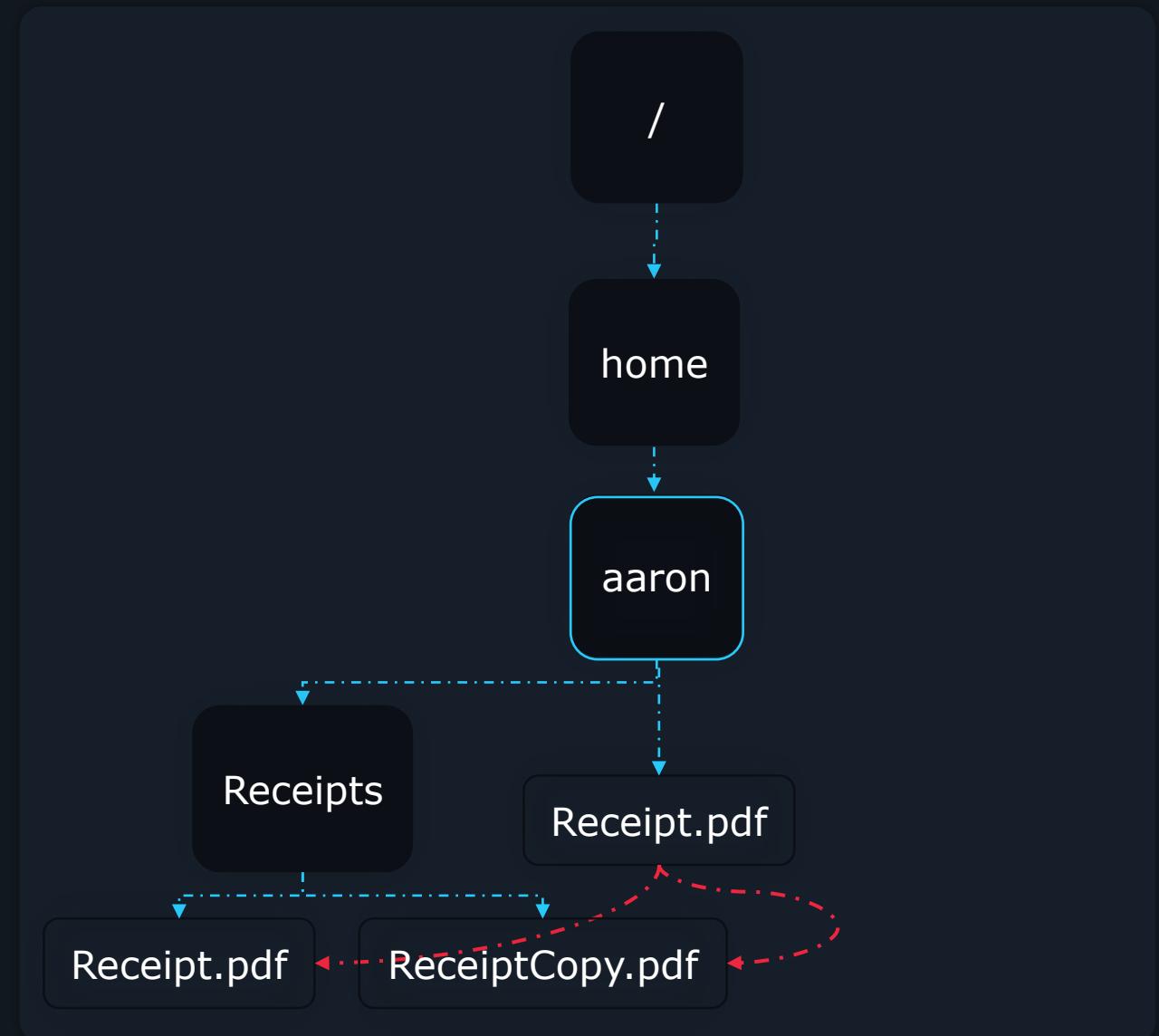
make directory



Copying Files

>_

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

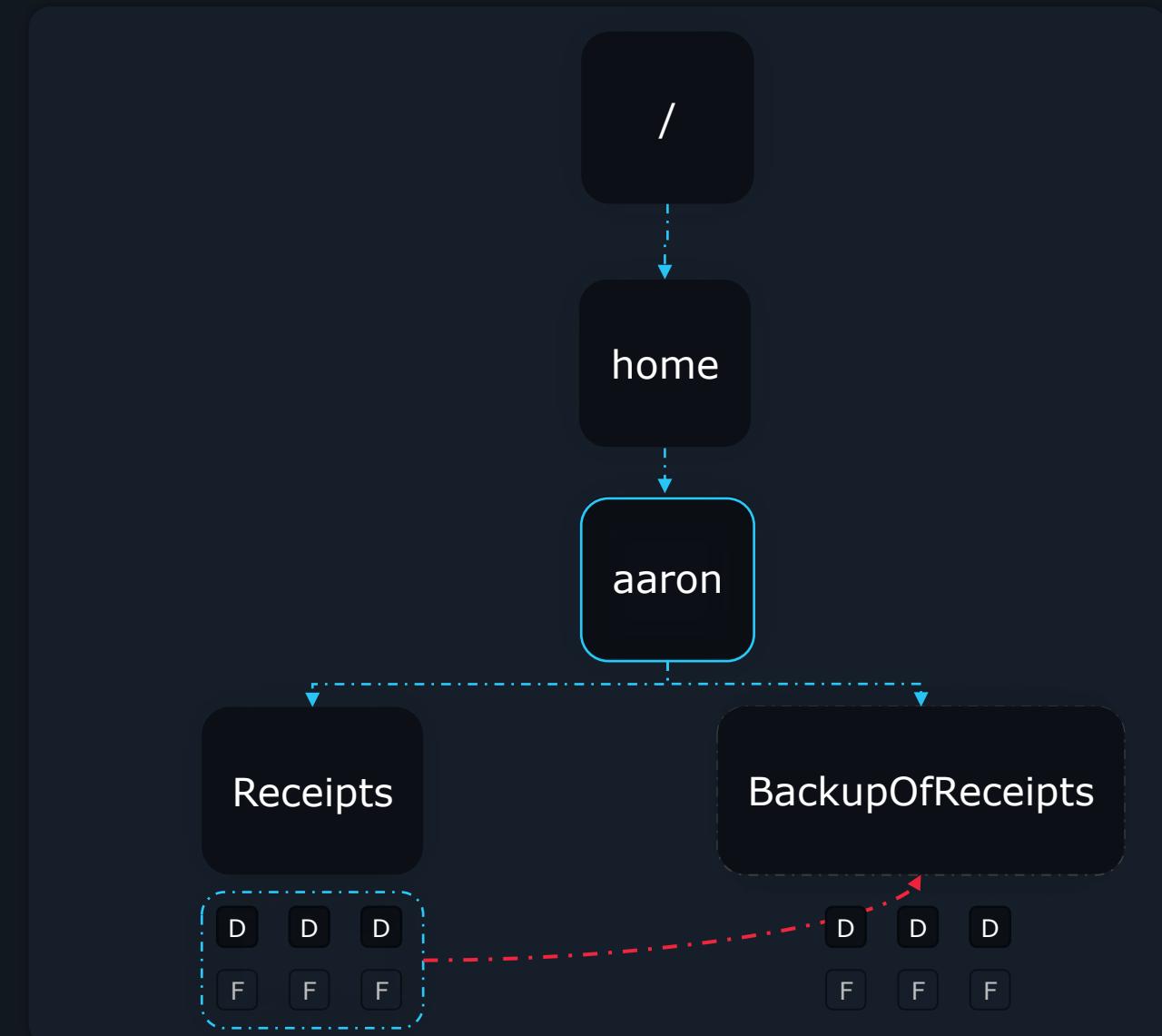


Copying Directories

>_

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

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

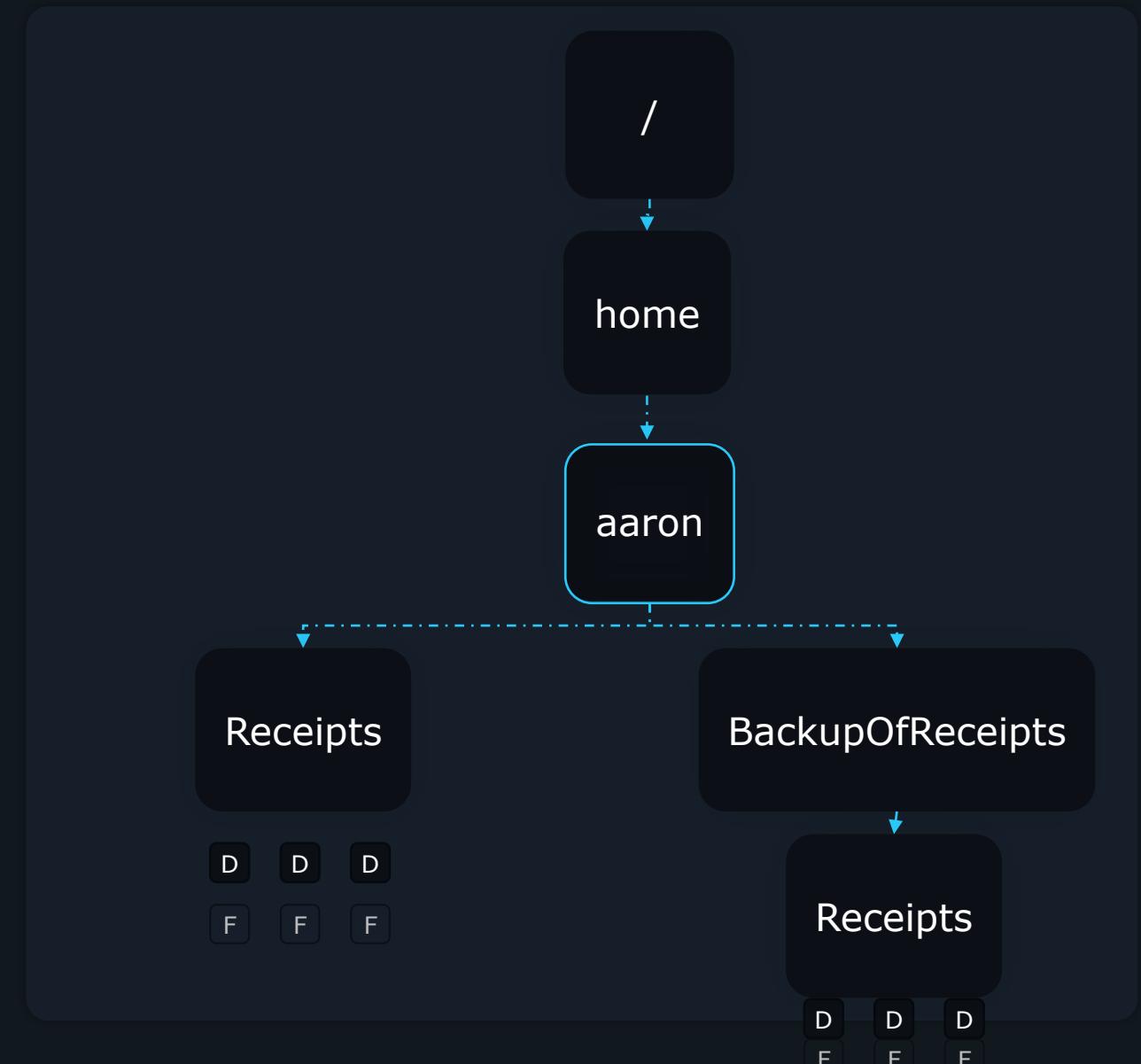


Copying Directories

>_

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

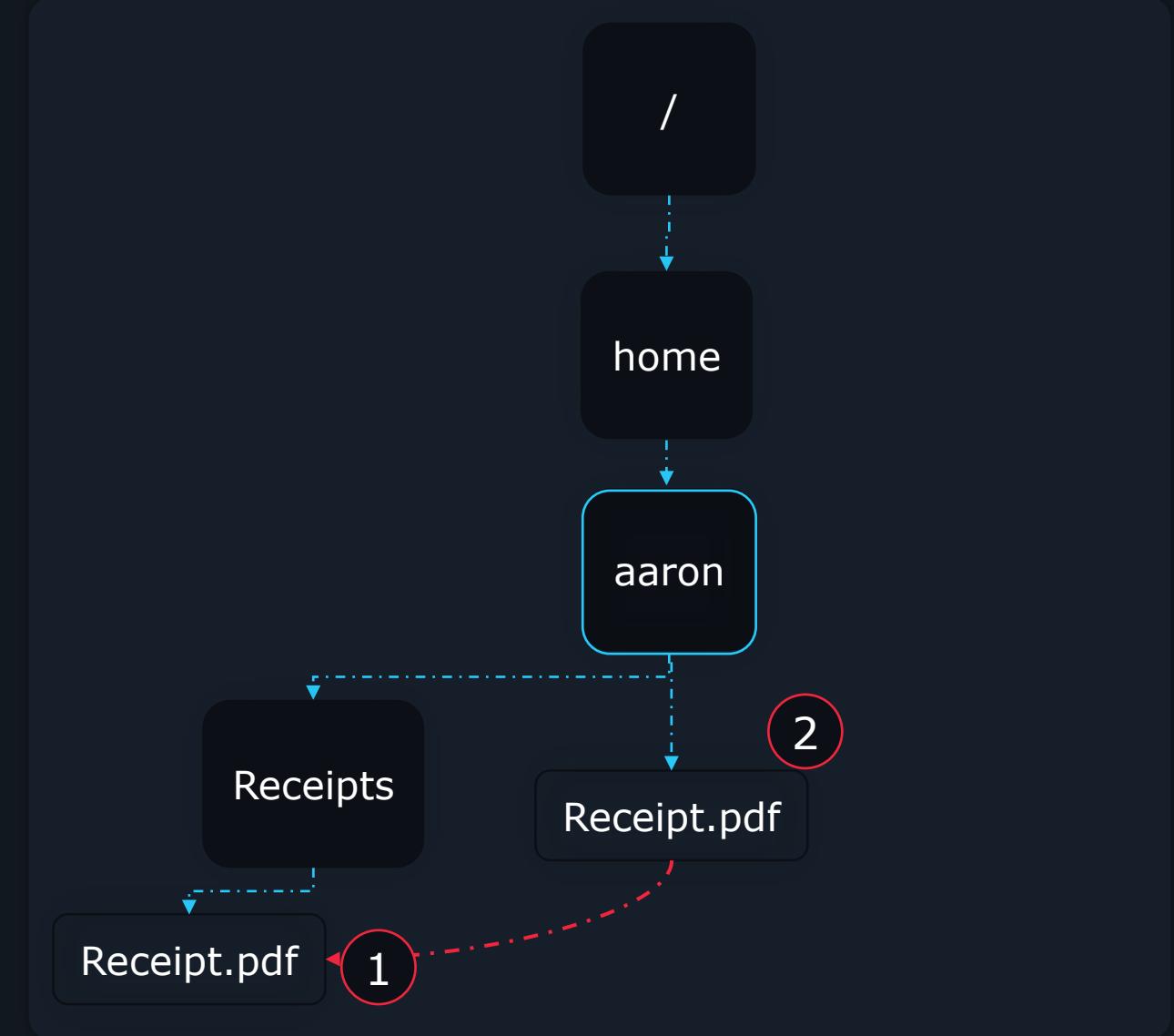
```
$ cp -r Receipts/ BackupOfReceipts/
```



Moving Files

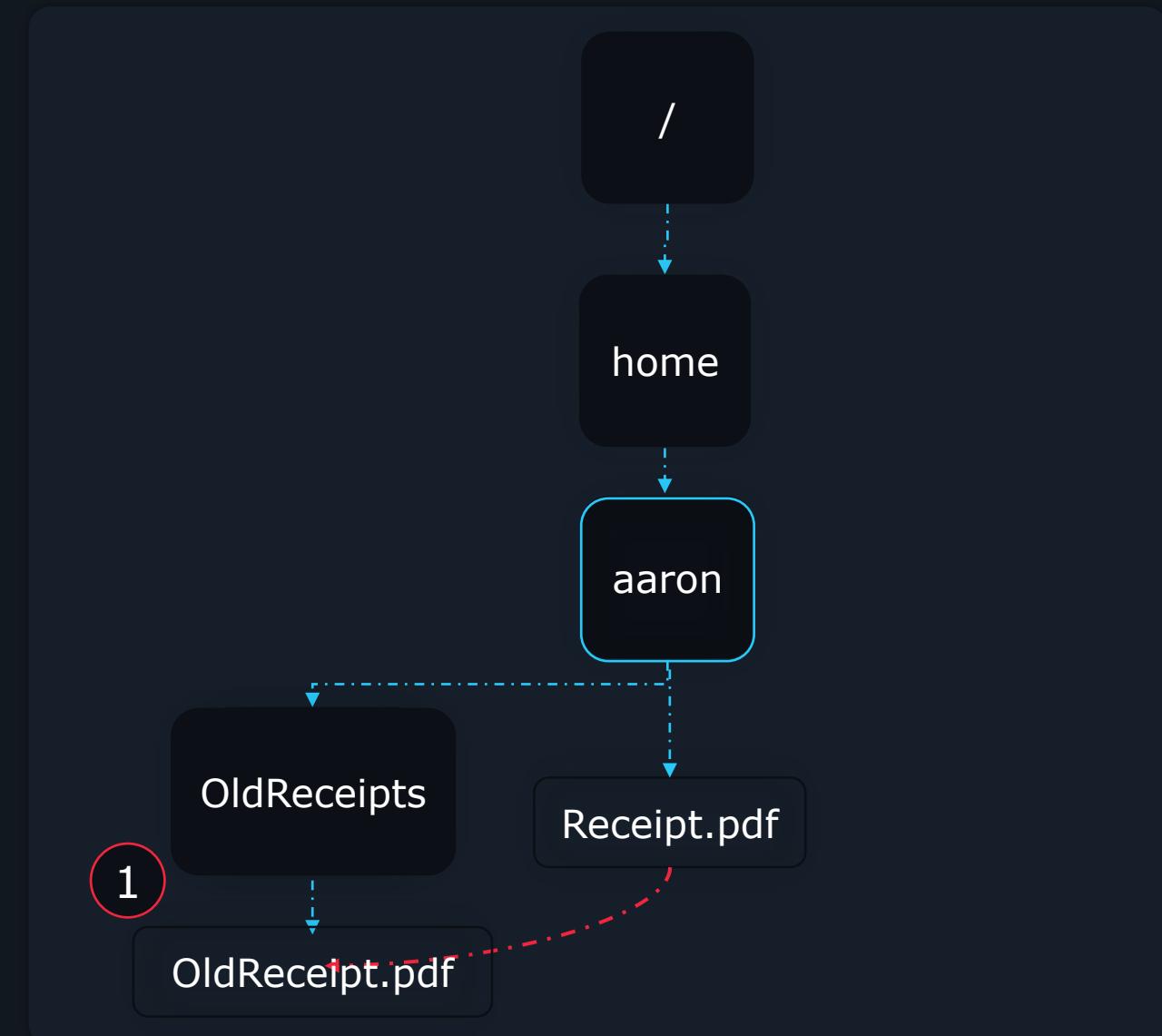
>_

```
$ 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

\$ rm Invoice.pdf

\$ rm -r Invoices/

remove





KodeKloud

Create and Manage Hard Links



Inodes

>_

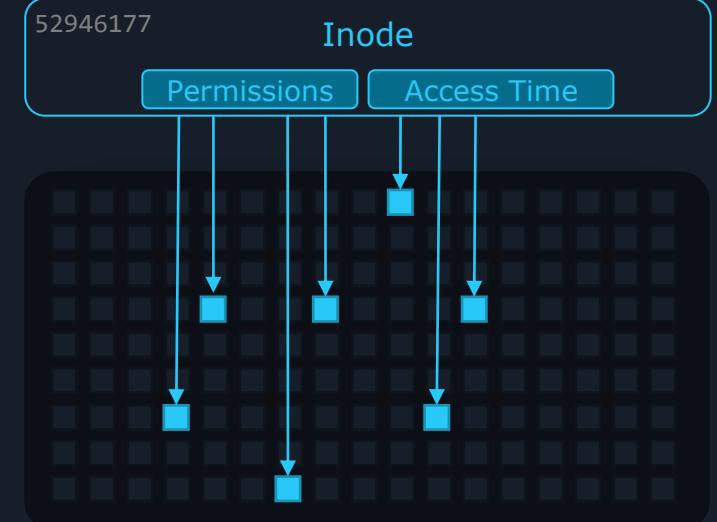
```
$ echo "Picture of Milo the dog" > Pictures/family_dog.jpg
```

```
$ 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



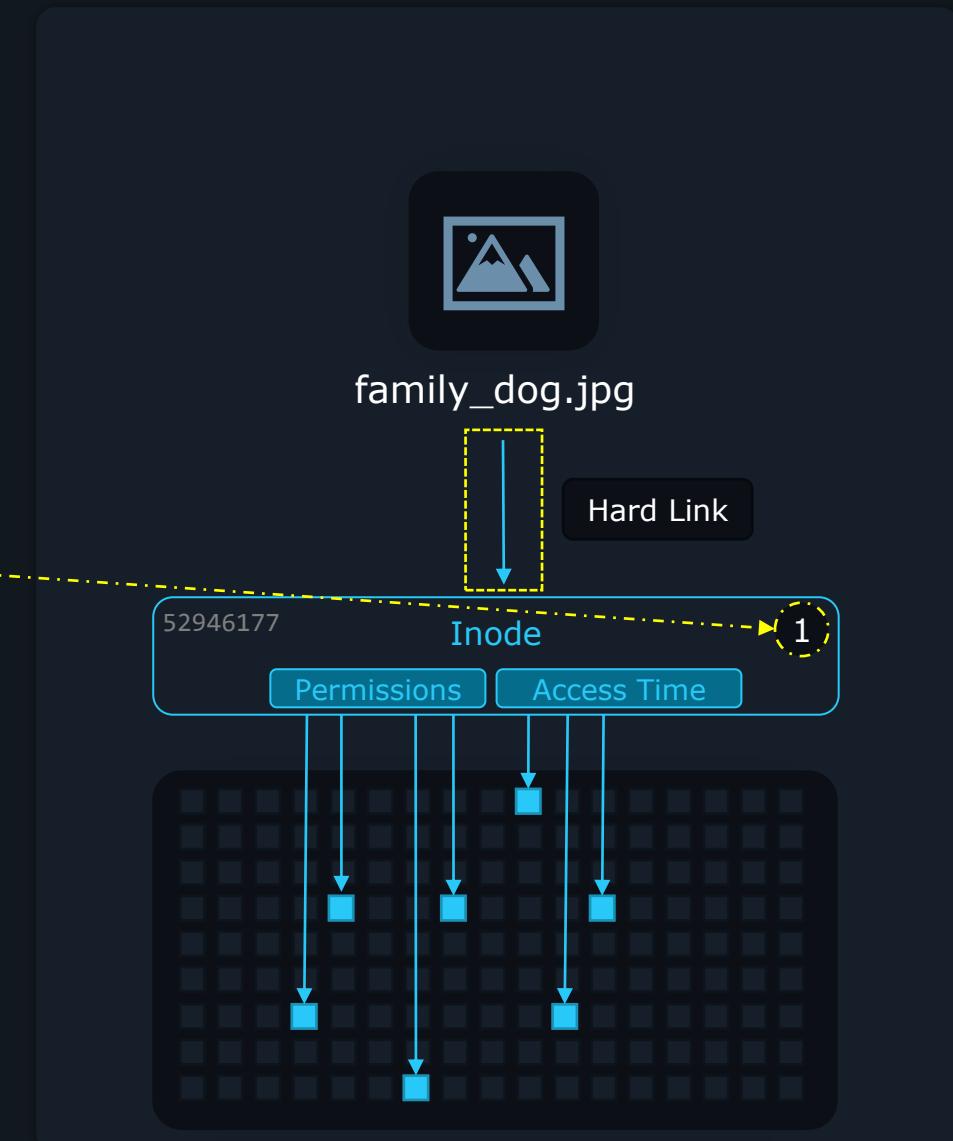
Hard Links

>_

```
$ 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
```

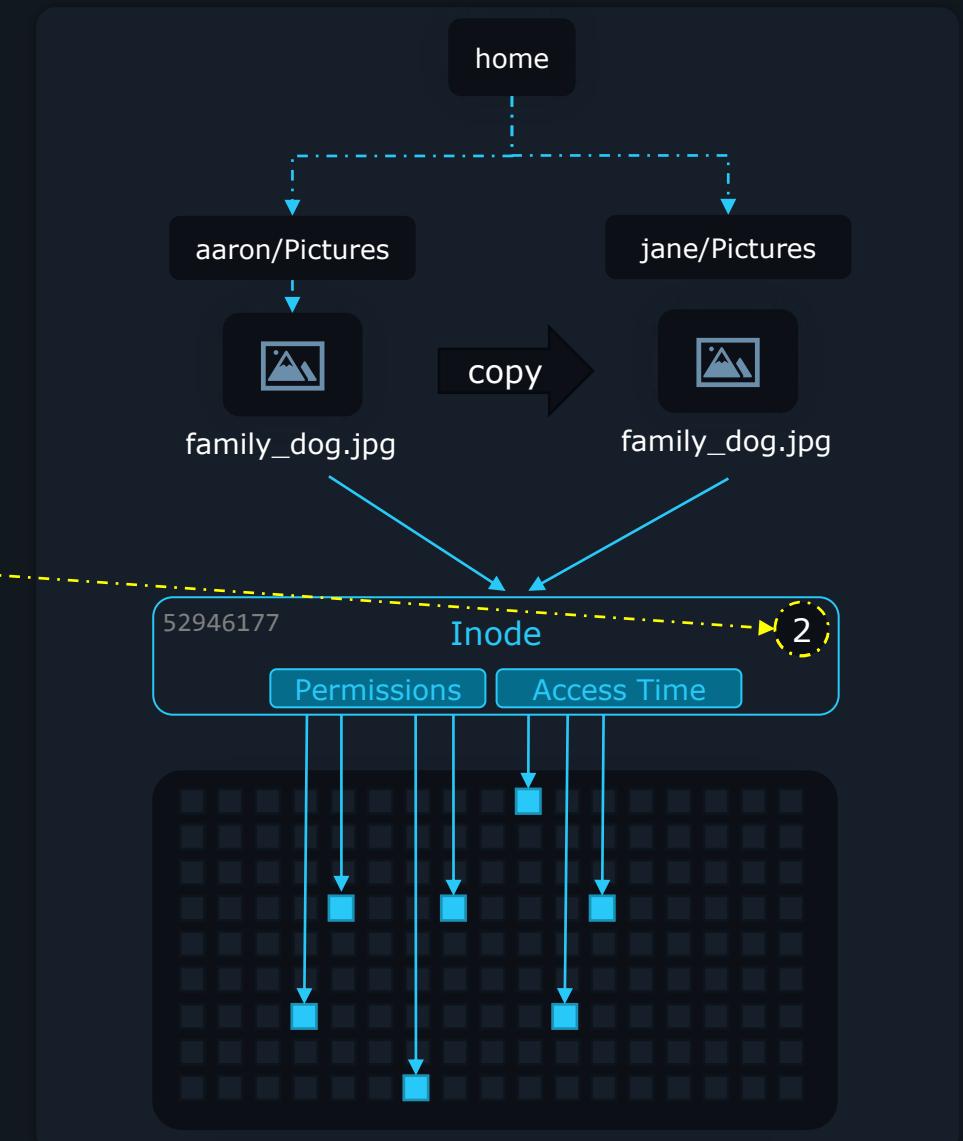


Hard Links

>_

```
$ 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

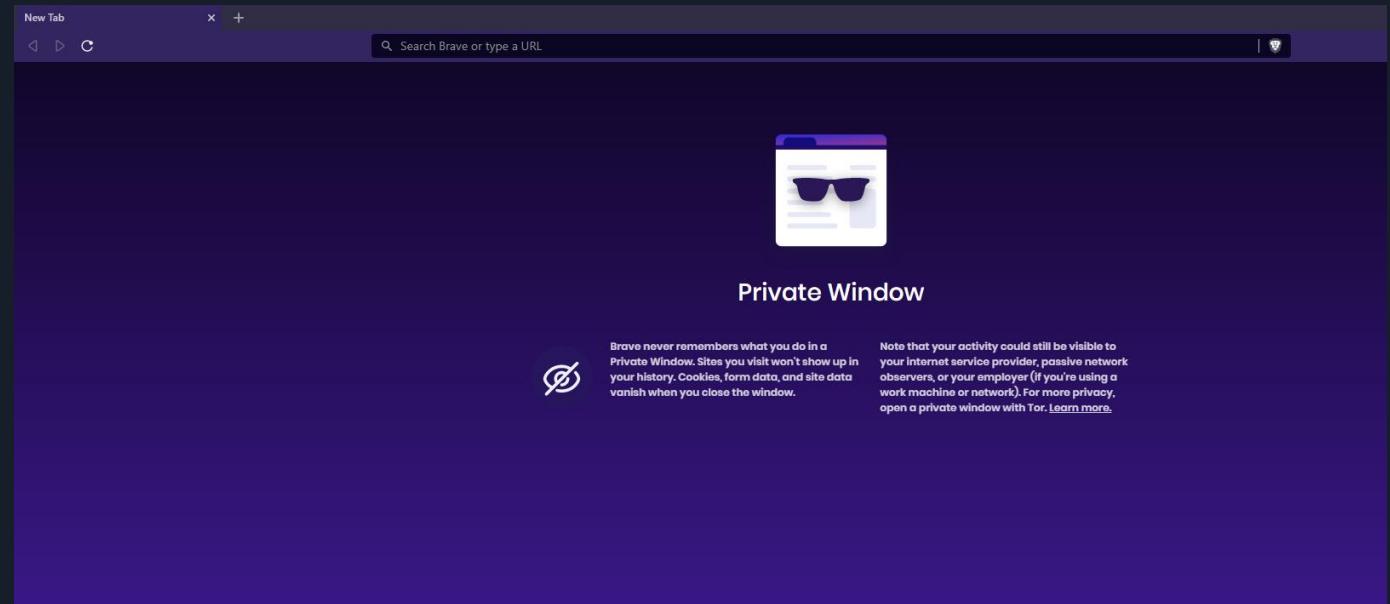


KodeKloud

Create and Manage Soft Links



Soft Links

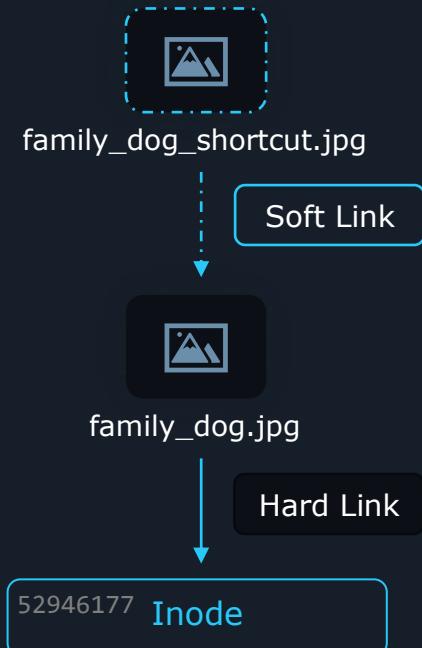


C:\Program Files\MyCoolApp\application.exe

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



KodeKloud

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>Read</u> Directory
w	<u>Write</u> to Directory
x	<u>Execute</u> into
-	No permission

Evaluating Permissions

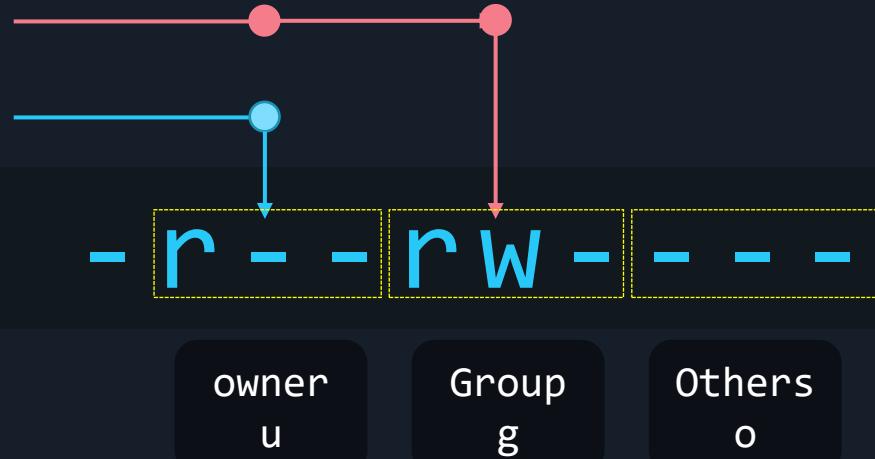
>_

```
(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	1 0 0	0 0 0
6	4	0

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

r w x	r w x	r w x
1 1 1	1 1 1	1 1 1
7	7	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)
```

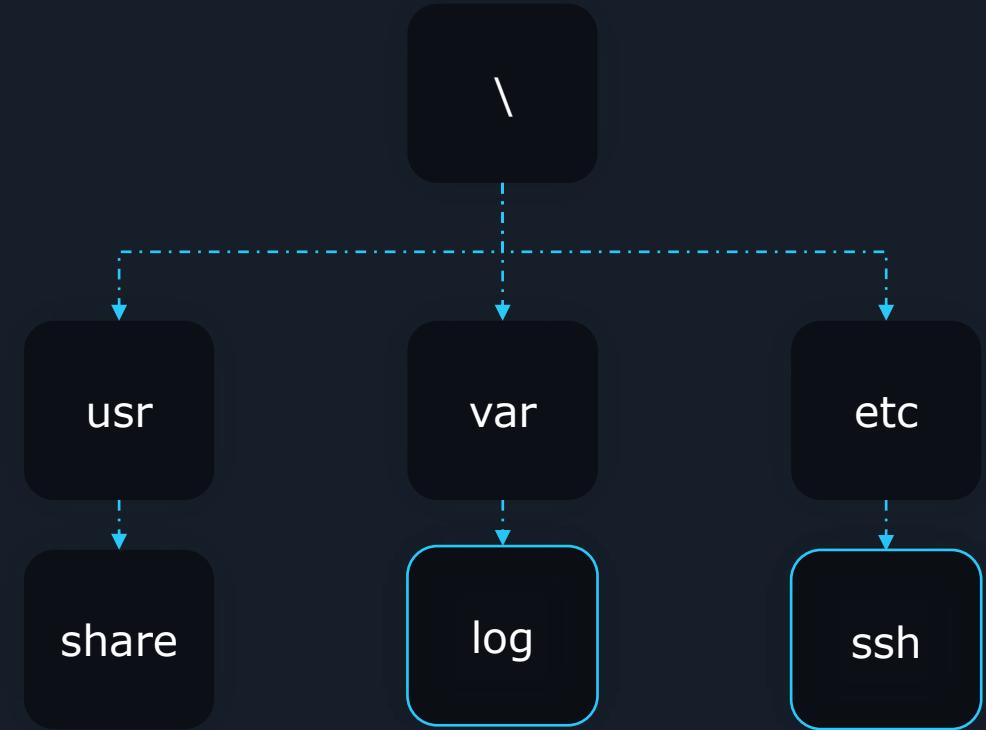
```
$ chmod 640 family_dog.jpg
```



KodeKloud

Search for Files





>_

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

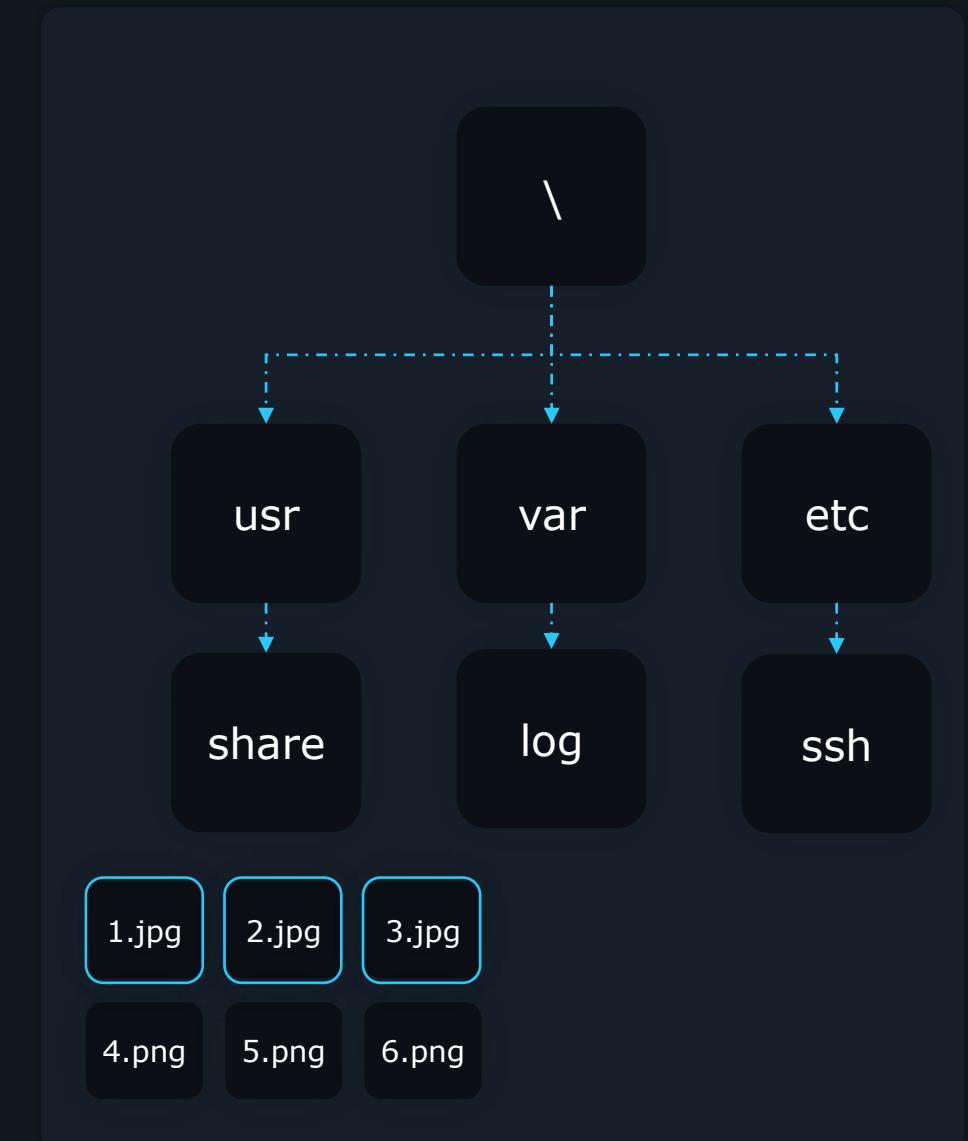
```
1.jpg 2.jpg 3.jpg
```

```
$ 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

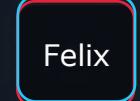
>_

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

```
$ find -name felix
```

```
$ find -iname felix
```

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

 felix Felix felix

Felix

freya

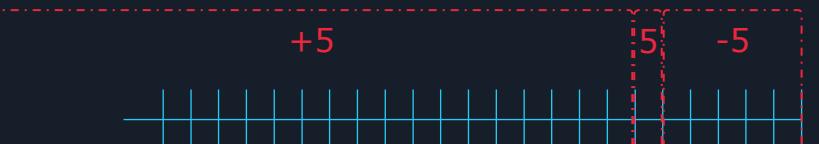
fin

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

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
```

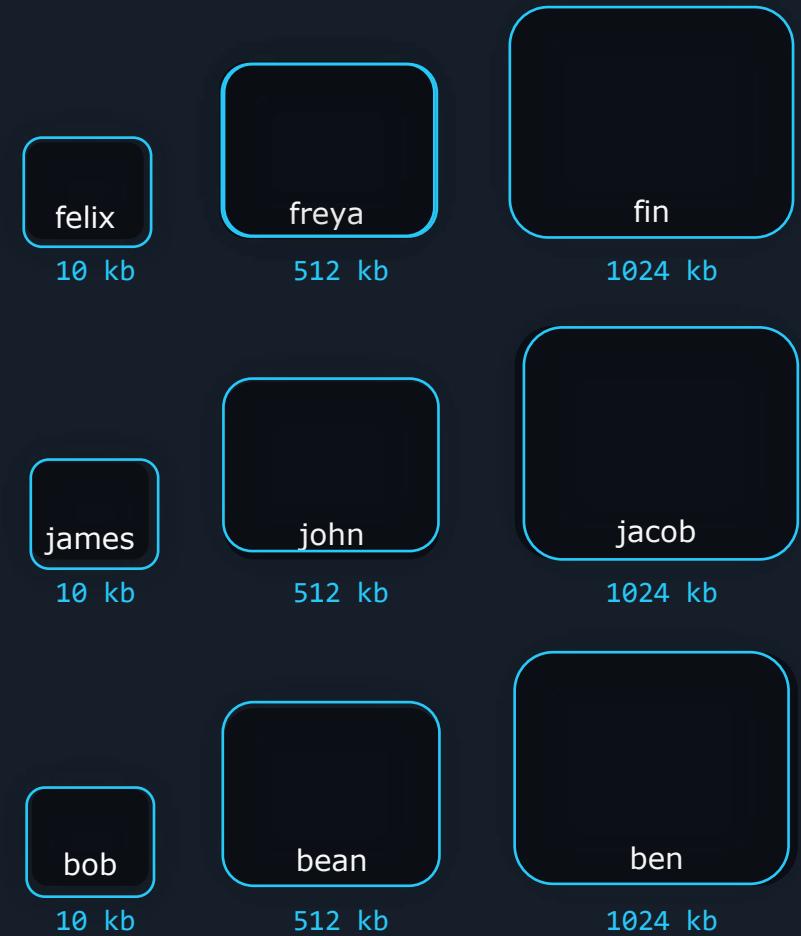


c	bytes
k	kilobytes
M	megabytes
G	gigabytes

Search Expressions

>_

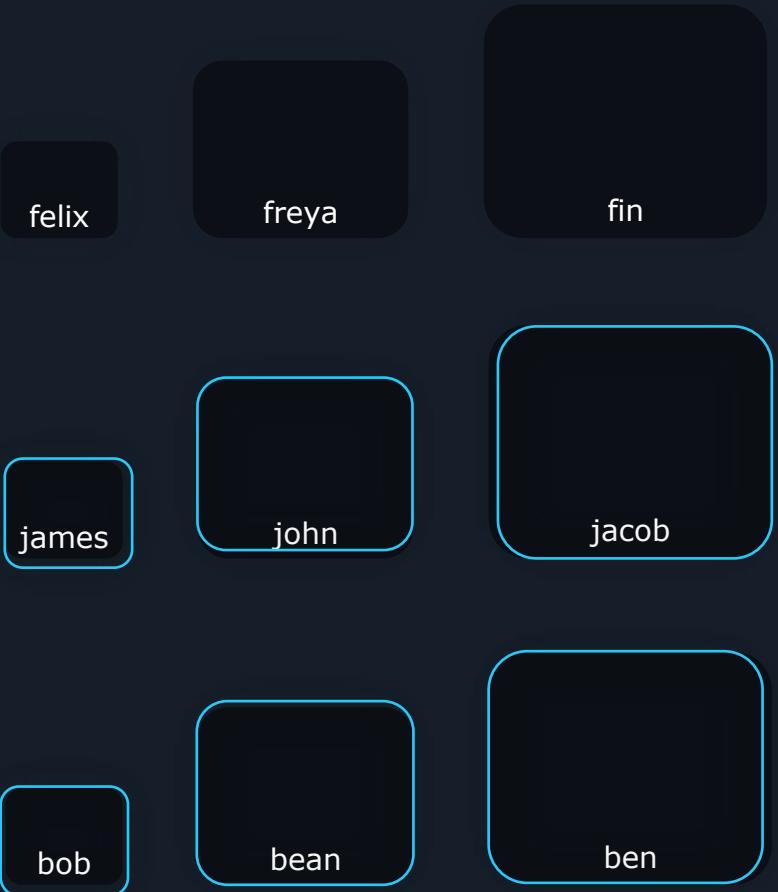
```
$ find -size [size]  
  
$ find -name "f*"  
  
$ find -size 512k  
  
$ find -name "f*" -size 512k      # AND operator  
  
$ find -name "f*" -o -size 512k # OR operator
```



Search Expressions

>_

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



Search Expressions

>_

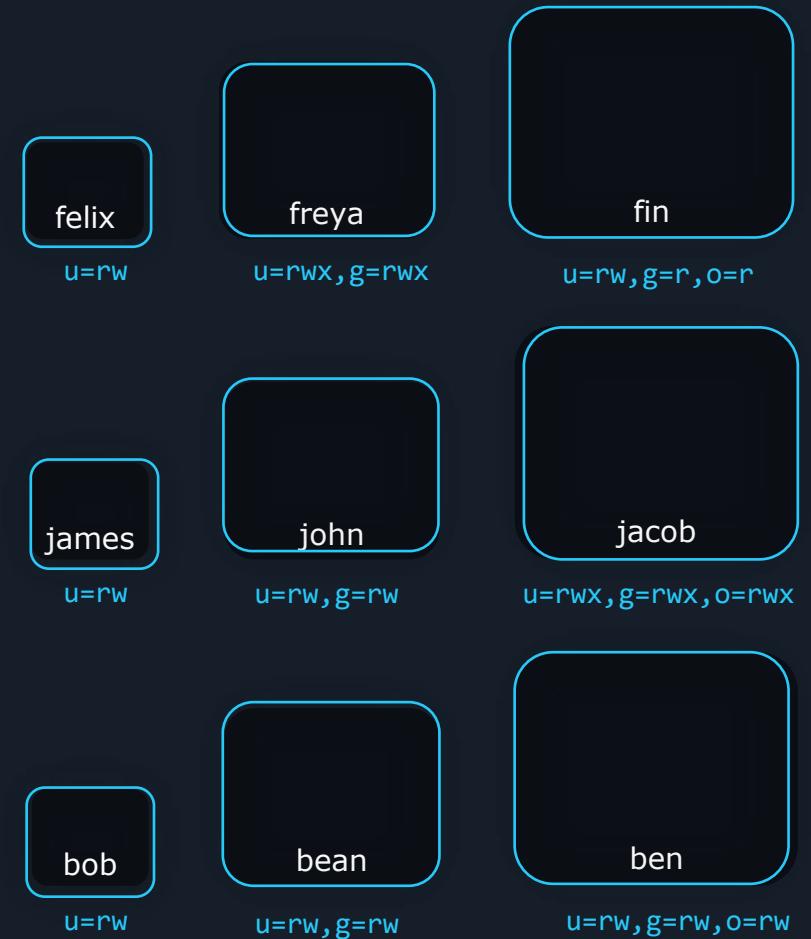
Permissions: 664 = u+rw,g+rw,o+r

```
$ 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
```





KodeKloud

Demo

Compare and Manipulate File Content



tac

>_

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

user1
user2
user3
user4
user5
user6



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

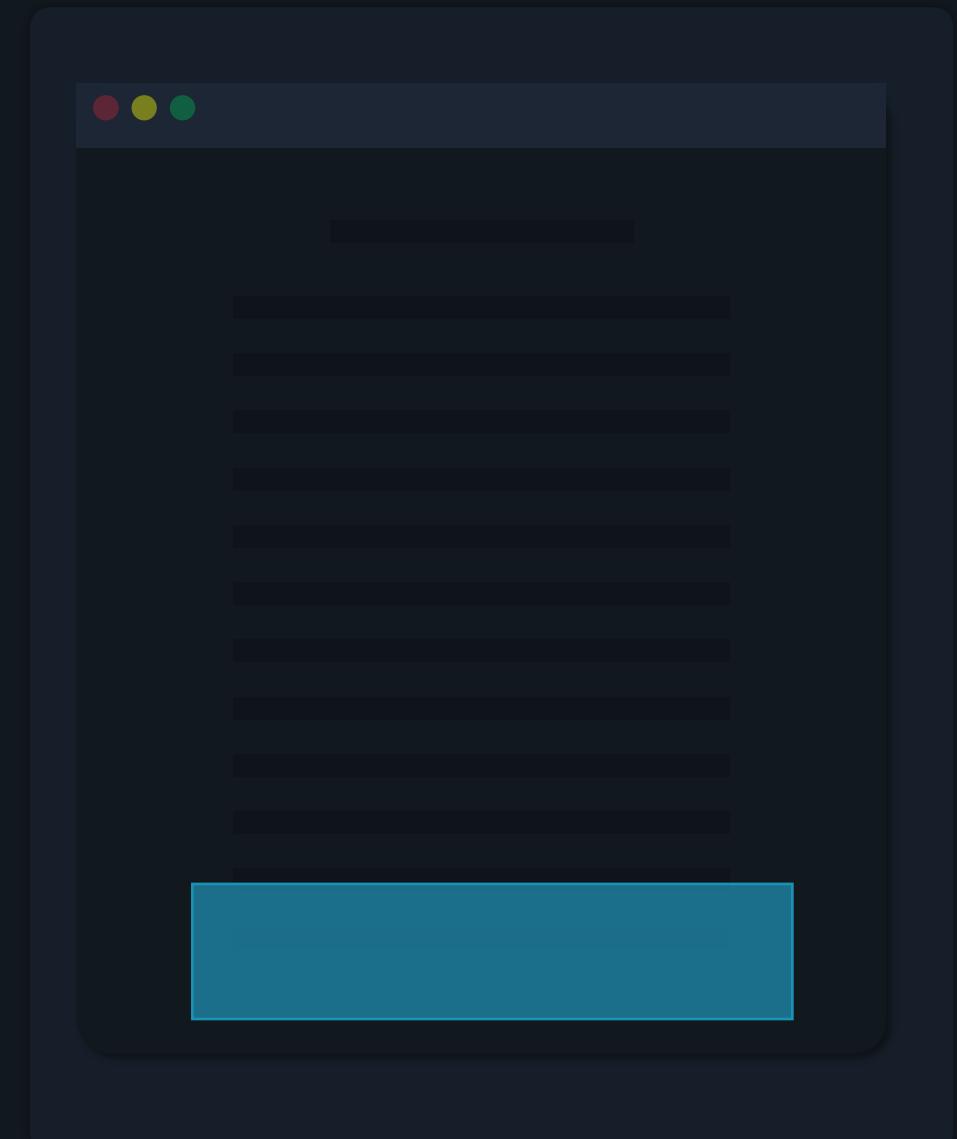
user6
user5
user4
user3
user2
user1



tail

>_

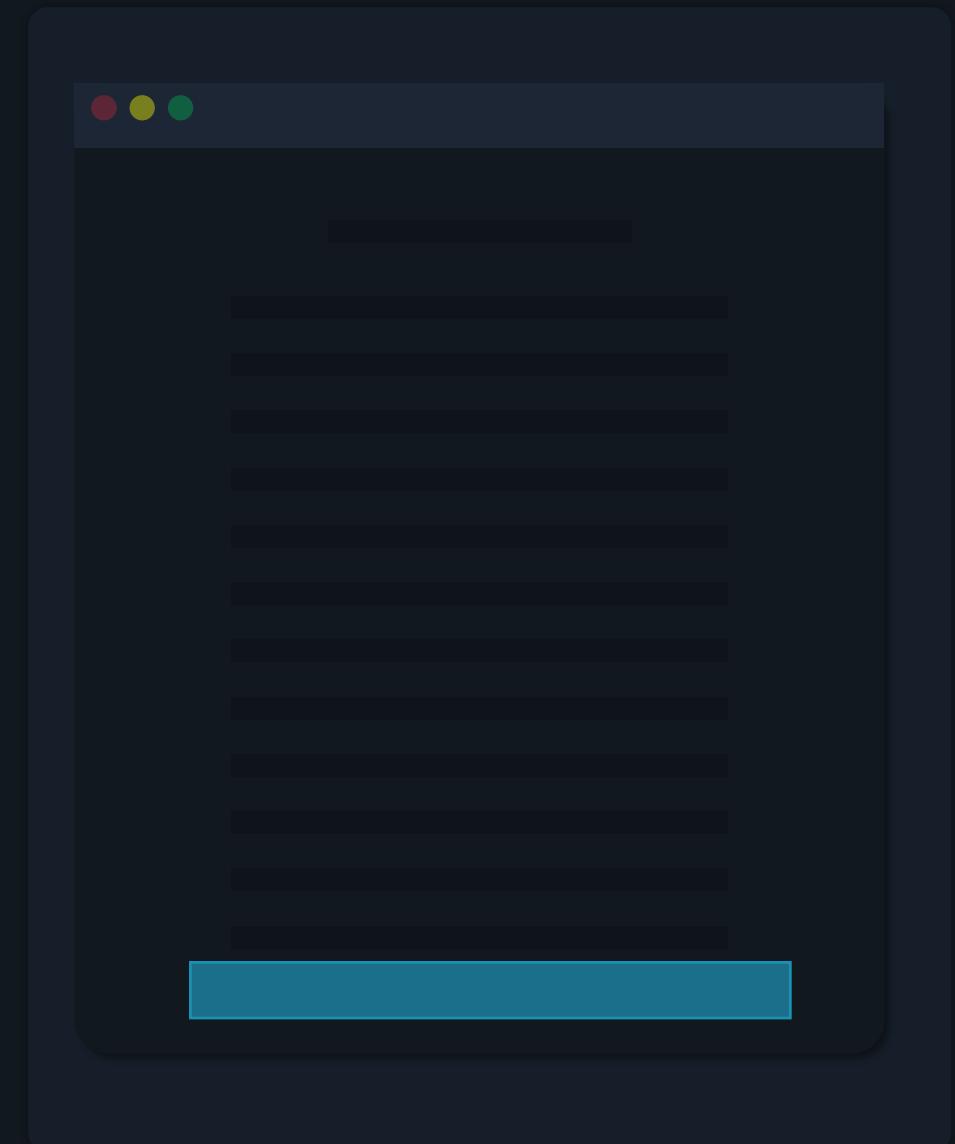
```
$ tail /var/log/dnf.log
2021-11-02T19:22:58-0500 DEBUG DNF version: 4.7.0
2021-11-02T19:22:58-0500 DDEBUG Command: dnf makecache --timer
2021-11-02T19:22:58-0500 DDEBUG Installroot: /
2021-11-02T19:22:58-0500 DDEBUG Releasever: 8
2021-11-02T19:22:58-0500 DEBUG cachedir: /var/cache/dnf
2021-11-02T19:22:58-0500 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 Releaser: 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.
```

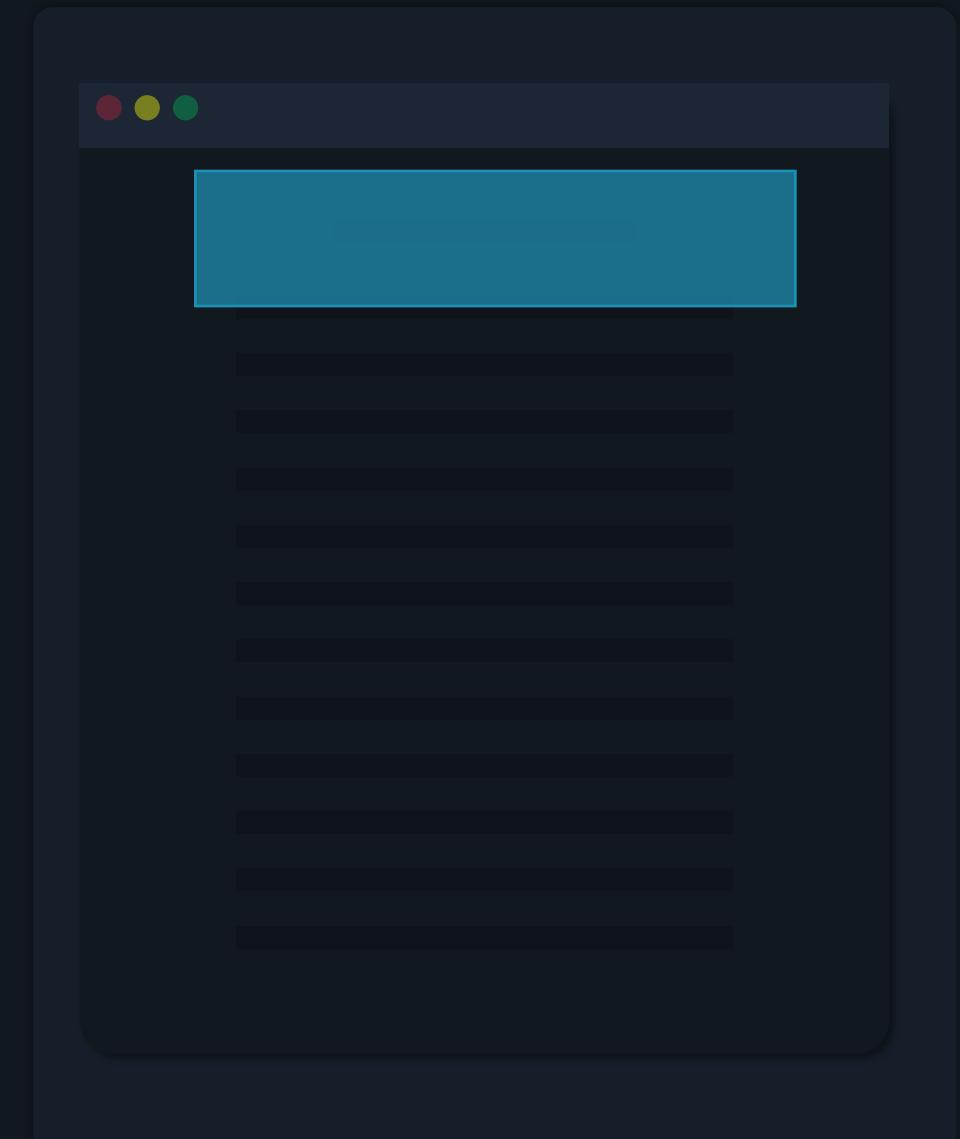


head

>_

```
$ 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']
```

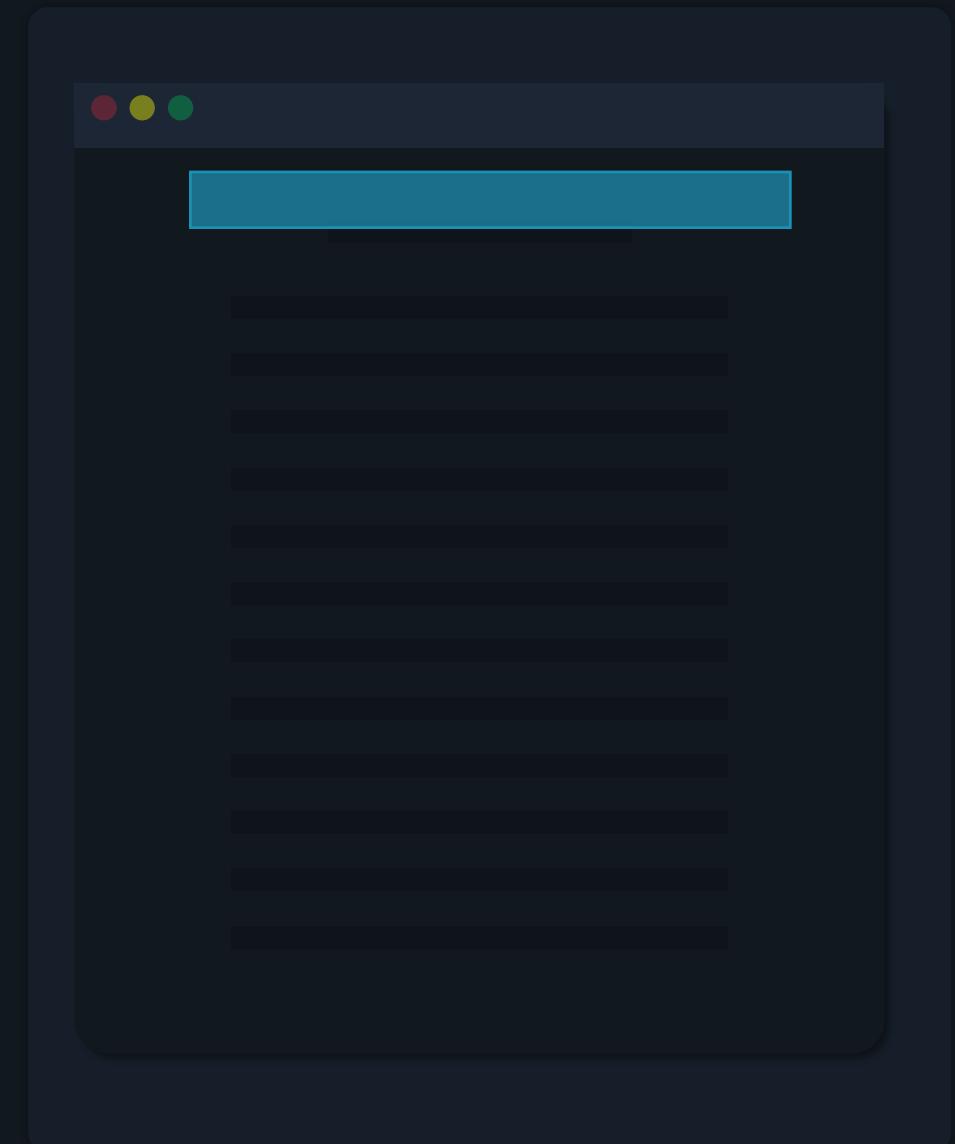


head

>_

```
$ 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

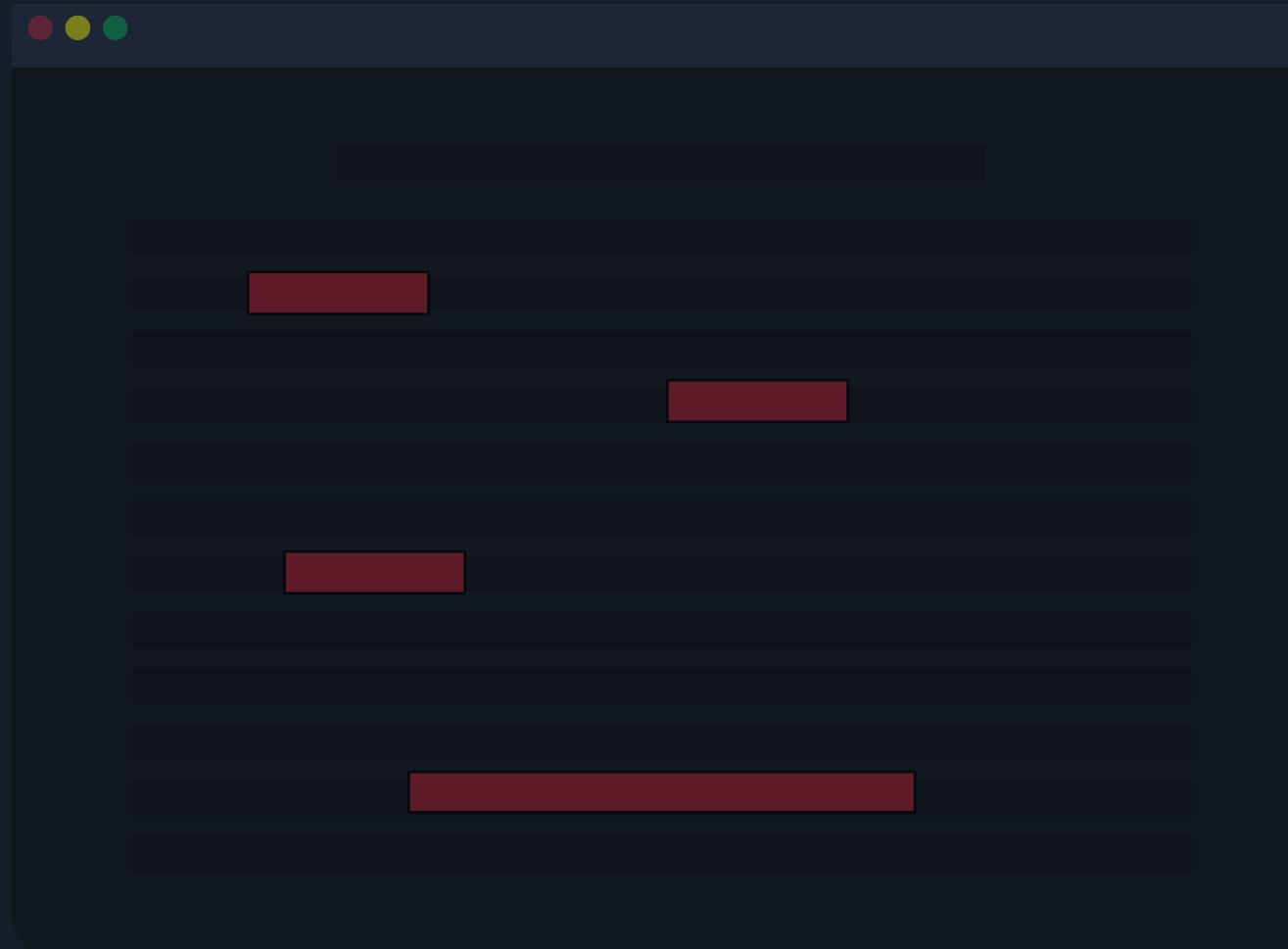


KodeKloud

Search files with Grep



Search files with Grep



A screenshot of a terminal window with a dark background. The window title bar is dark blue with three colored circles (red, yellow, green) on the left. The main area of the terminal shows several lines of text, with specific lines highlighted in red. The highlighted lines are:

```
127.0.0.1 - - [12/Jan/2018:10:41:38 +0000] "GET / HTTP/1.1" 200 12345
127.0.0.1 - - [12/Jan/2018:10:41:38 +0000] "GET / HTTP/1.1" 200 12345
127.0.0.1 - - [12/Jan/2018:10:41:38 +0000] "GET / HTTP/1.1" 200 12345
127.0.0.1 - - [12/Jan/2018:10:41:38 +0000] "GET / HTTP/1.1" 200 12345
```

Searching With Grep

>_

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

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

```
$ 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"
```

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

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
```



KodeKloud

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, or 6

Regex Operators

^

\$

.

*

+

{}

?

|

[]

()

[^]

^ “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 %
```

`+: 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
```

{}: 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)
```

{}: 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/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]*' /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/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"
```

(): Subexpressions

>_

```
$ egrep -r '/dev/[a-z]*[0-9]?' /etc/  
/etc/sane.d/dc25.conf:#port=/dev/ty0p0  
/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]?
ttym0p0

(): 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/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/ttyS0  
/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/ttyS0  
/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]|[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 '/[^\w]' /etc/

<https://regexr.com>

```
/etc/smartmontools/smartd_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 )
```

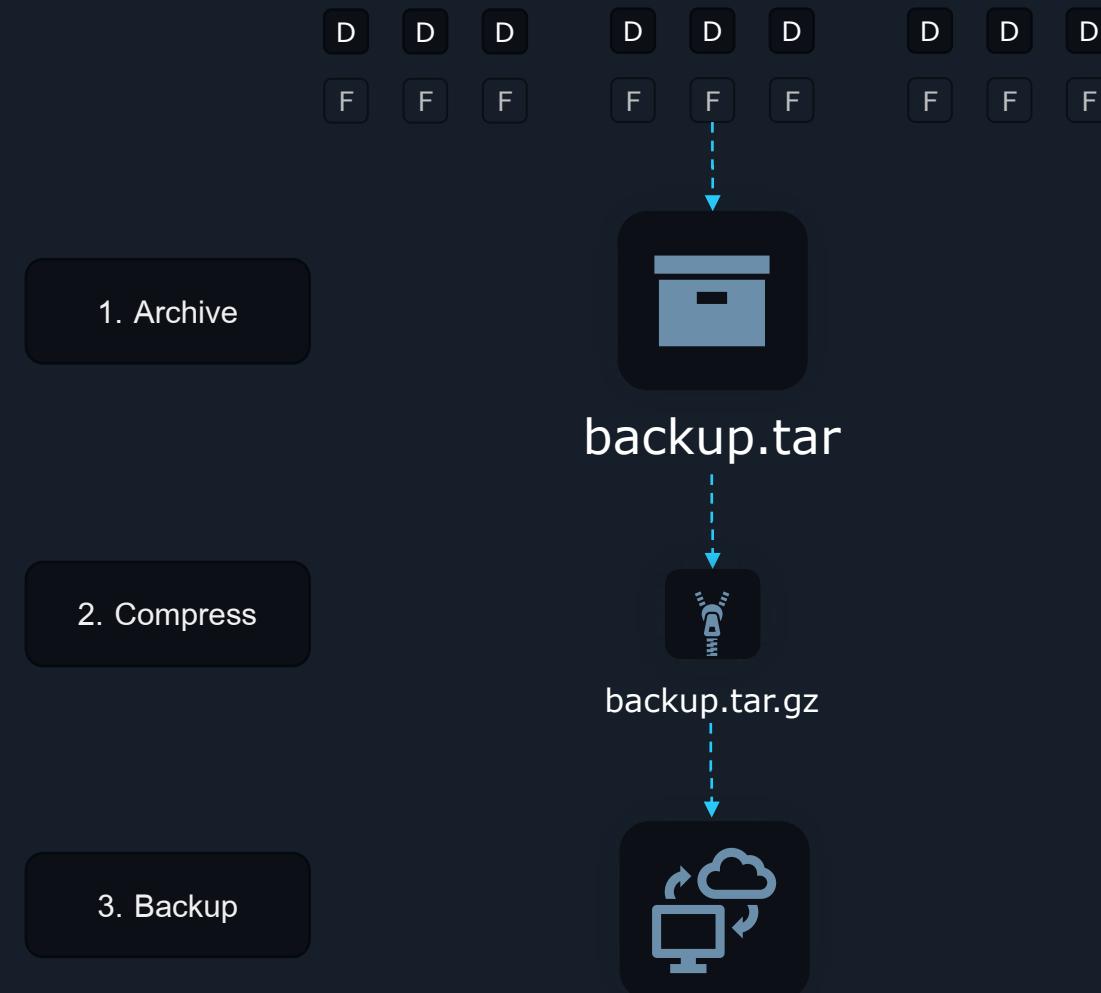


KodeKloud

Archive Files

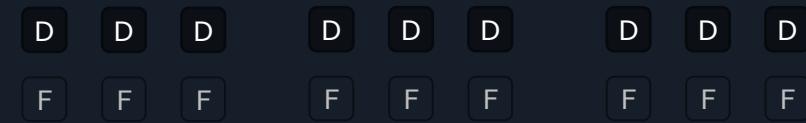


Archiving (Packing), Compressing and Backup



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/
```



KodeKloud

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
```

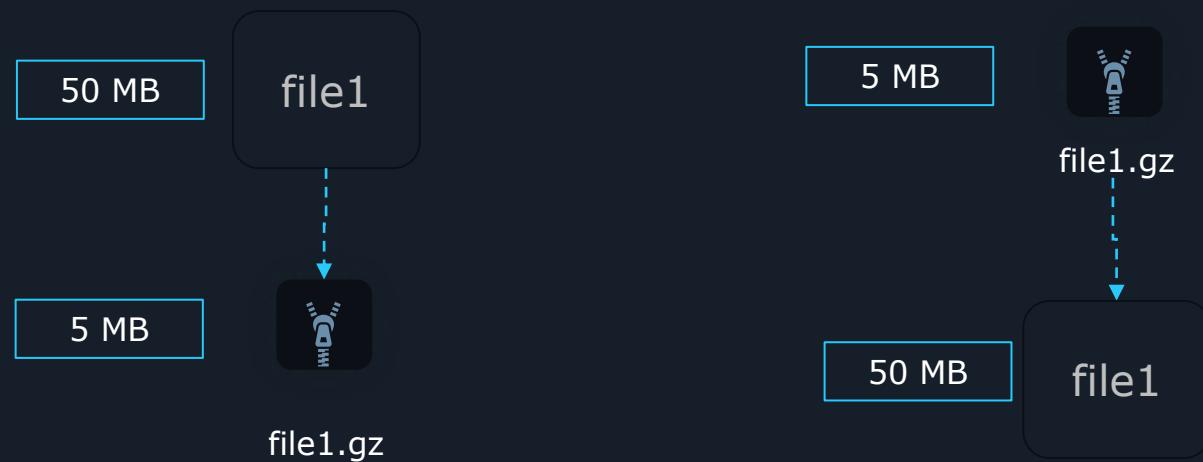
```
$ unxz file3.xz
```

```
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
```



KodeKloud

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
```

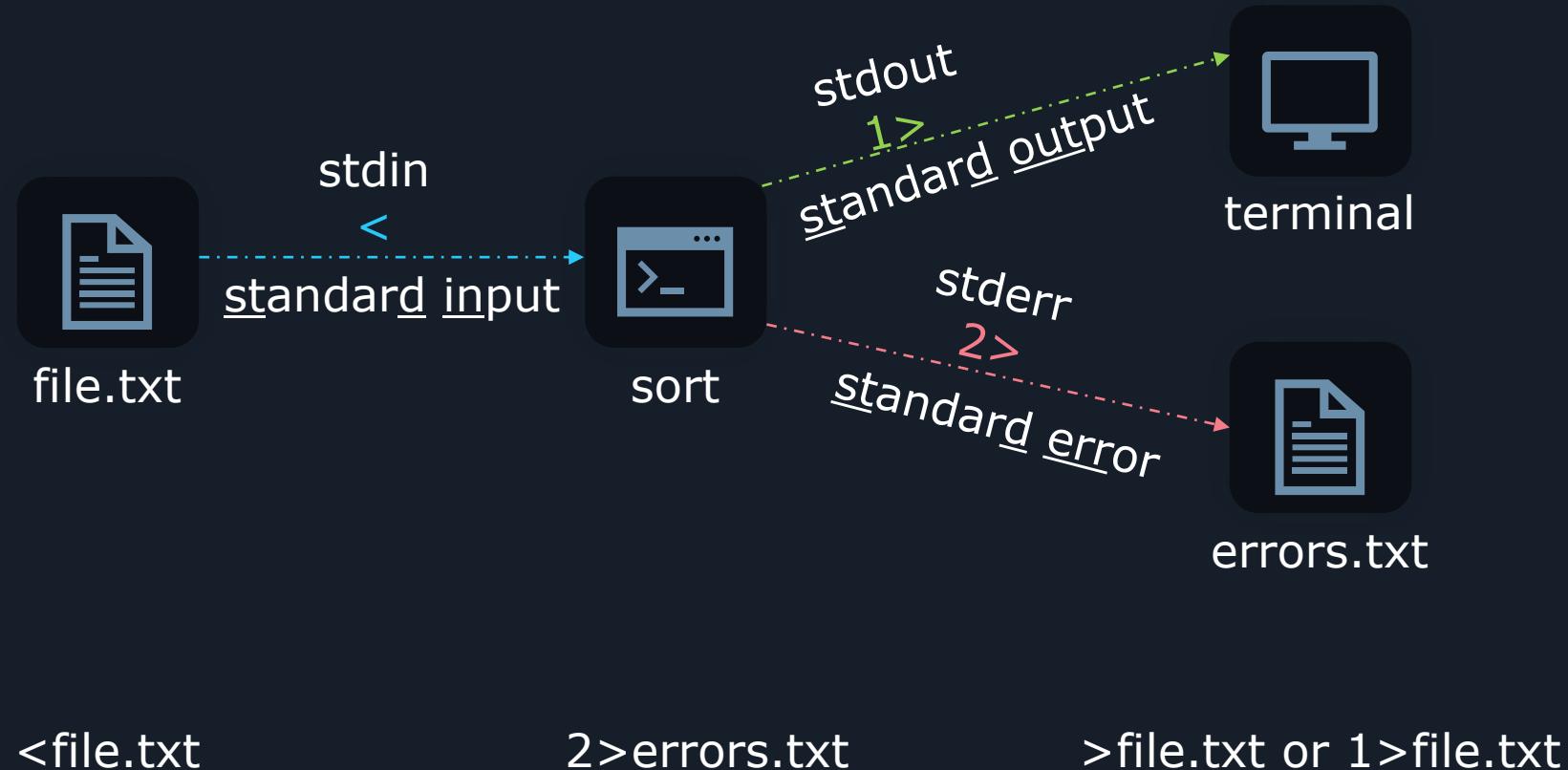
>> file_name #Redirect & Append

Redirecting Output

>_

`date > file.txt``date 1> file.txt`

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



KodeKloud

Archive, Compress, Pack, and Unpack Files Using Star



Packing Files and Directories With star

>_

```
$ star -options file=/path_to_archive.star files
```

```
$ star [-c] file=/home/aaron/archive2.star [file1]
```

```
$ star -tv file=/home/aaron/archive2.star  
file1
```

```
$ star -xv file=/home/aaron/archive2.star
```

```
$ star -xv file=/home/aaron/archive2.star [-C /tmp/]
```



archive2.star

Compression and Decompression With star

>_

```
$ star -cv -z file=/home/aaron/archive2.star.gz file1
```

```
$ star -cv -bz file=/home/aaron/archive2.star.bz2 file1
```

```
$ star -xv file=/home/aaron/archive2.star.gz
```

```
$ star -xv file=/home/aaron/archive2.star.bz2
```



archive2.star

Securely Transfer Files Between
Systems



Securely Transferring Files: scp

>_

```
$ scp aaron@192.168.1.27:/home/aaron/myfile.tgz /home/aaron/myfile.tgz
```

```
$ scp /home/aaron/my_archive.tar aaron@192.168.1.27:/home/aaron/my_archive.tar
```

```
$ scp aaron@192.168.1.27:/home/aaron/familyphoto.jpg aaron@192.168.1.59:/home/aaron/familyphoto.jpg
```

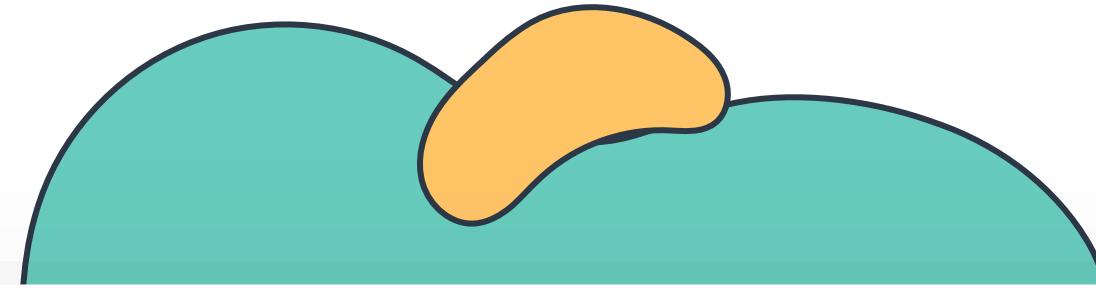
```
$ man scp
```

Securely Transferring Files: stfp

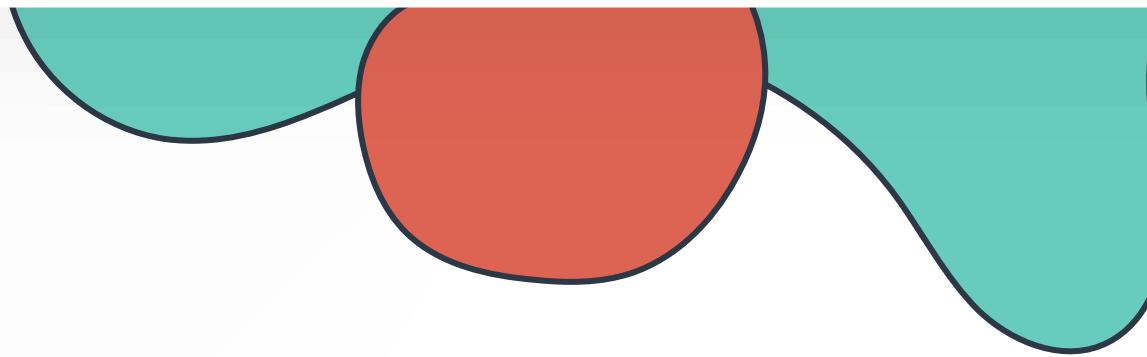
```
>_  
  
$ sftp aaron@192.168.1.27  
  
$ sftp>  
  
$ sftp> help    =  $ sftp> ?  
  
$ sftp> cd Pictures  
  
$ sftp> get familiypicture.jpg  
  
$ sftp> get -r Pictures/  
  
$ sftp> put myarchive.tgz  
  
$ sftp> put -r my_photos/  
  
$ man sftp
```



KodeKloud

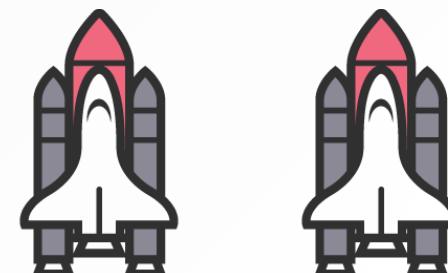


Conditional Logic



```
$ rocket-status lunar-mission  
launching [ ] success [ ] failed
```

```
$ rocket-debug lunar-mission  
overheating
```



```
create-and-launch-rocket
```

```
mission_name=$1
```

```
mkdir $mission_name
```

```
rocket-add $mission_name
```

```
rocket-start-power $mission_name
```

```
rocket-internal-power $mission_name
```

```
rocket-start-sequence $mission_name
```

```
rocket-start-engine $mission_name
```

```
rocket-lift-off $mission_name
```

```
rocket_status=$(rocket-status $mission_name)
```

```
if rocket-status is failed, then run this  
rocket-debug $mission_name
```

Conditional Logic

```
$ rocket-status lunar-mission  
launching [ success ] failed
```

```
$ rocket-debug lunar-mission  
overheating
```

```
create-and-launch-rocket  
mission_name=$1
```

```
mkdir $mission_name
```

```
rocket-add $mission_name
```

```
rocket-start-power $mission_name  
rocket-internal-power $mission_name  
rocket-start-sequence $mission_name  
rocket-start-engine $mission_name  
rocket-lift-off $mission_name
```

```
rocket_status=$(rocket-status $mission_name)
```

```
if rocket-status is failed, then run this  
if [ $rocket_status = "failed" ]  
then  
    rocket-debug $mission_name  
fi
```

Conditional Logic

```
$ rocket-status lunar-mission
launching [ success ] failed
```

```
$ rocket-debug lunar-mission
overheating
```

```
create-and-launch-rocket
```

```
● mission_name=$1
```

```
● mkdir $mission_name
```

```
● rocket-add $mission_name
```

```
● rocket-start-power $mission_name
```

```
● rocket-internal-power $mission_name
```

```
● rocket-start-sequence $mission_name
```

```
● rocket-start-engine $mission_name
```

```
● rocket-lift-off $mission_name
```

```
● rocket_status=$(rocket-status $mission_name)
```

```
● if [ $rocket_status = "failed" ]
```

```
then
```

```
● rocket-debug $mission_name
```

```
fi
```

...

Else If

```
$ rocket-status lunar-mission
launching    success    failed
```

```
$ rocket-debug lunar-mission
overheating
```

```
mission_name=$1

mkdir $mission_name

rocket-add $mission_name

rocket-start-power $mission_name
rocket-internal-power $mission_name
rocket-start-sequence $mission_name
rocket-start-engine $mission_name
rocket-lift-off $mission_name

rocket_status=$(rocket-status $mission_name)

if [ $rocket_status = "failed" ]
then
    rocket-debug $mission_name
elif [ $rocket_status = "success" ]
then
    echo "This is successful"
fi
```

Else

```
$ rocket-status lunar-mission
launching [ ] success [ ] failed
```

```
$ rocket-debug lunar-mission
overheating
```

```
mkdir $mission_name
rocket-add $mission_name
rocket-start-power $mission_name
rocket-internal-power $mission_name
rocket-start-sequence $mission_name
rocket-start-engine $mission_name
rocket-lift-off $mission_name
rocket_status=$(rocket-status $mission_name)
if [ $rocket_status = "failed" ]
then
    rocket-debug $mission_name
elif [ $rocket_status = "success" ]
then
    echo "This is successful"
else
    echo "The state is not failed or success"
fi
```

Conditional Operators

STRING1 == STRING2

Example	Description
["abc" == "abc"]	If string1 is exactly equal to string2 (true)
["abc" != "abc"]	If string1 is not equal to string 2 (false)
[5 -eq 5]	If number1 is equal to number2 (true)
[5 -ne 5]	If number1 is not equal to number2 (false)
[6 -gt 5]	If number1 is greater than number2 (true)
[5 -lt 6]	If number1 is less than number2 (true)

Conditional Operators

`[[STRING1 = STRING2]]`

Example	Description
<code>[["abcd" = *bc*]]</code>	If abcd contains bc (true)
<code>[["abc" = ab[cd]]]</code> or <code>[["abd" = ab[cd]]]</code>	If 3 rd character of abc is c or d (true)
<code>[["abe" = "ab[cd]"]]</code>	If 3 rd character of abc is c or d (false)
<code>[["abc" > "bcd"]]</code>	If "abc" comes after "bcd" when sorted in alphabetical (lexographical) order (false)
<code>[["abc" < "bcd"]]</code>	If "abc" comes before "bcd" when sorted in alphabetical (lexographical) order (true)

Only in BASH

Conditional Operators

[COND1] **&&** [COND2]

[[COND1 **&&** COND2]]

[COND1] **||** [COND2]

[[COND1 **||** COND2]]

Example	Description
[[A -gt 4 && A -lt 10]]	If A is greater than 4 and less than 10
[[A -gt 4 A -lt 10]]	If A is greater than 4 or less than 10

Conditional Operators

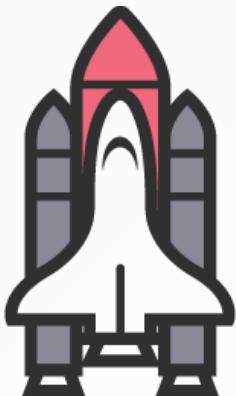
Example	Description
[-e FILE]	if file exists
[-d FILE]	if file exists and is a directory
[-s FILE]	If file exists and has size greater than 0
[-x FILE]	If the file is executable
[-w FILE]	If the file is writeable



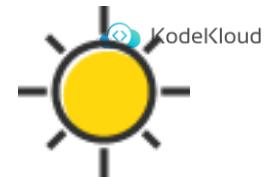
KodeKloud

Loops - For





...



```
$ create-and-launch-rocket lunar-mission
```

```
$ create-and-launch-rocket jupiter-mission
```

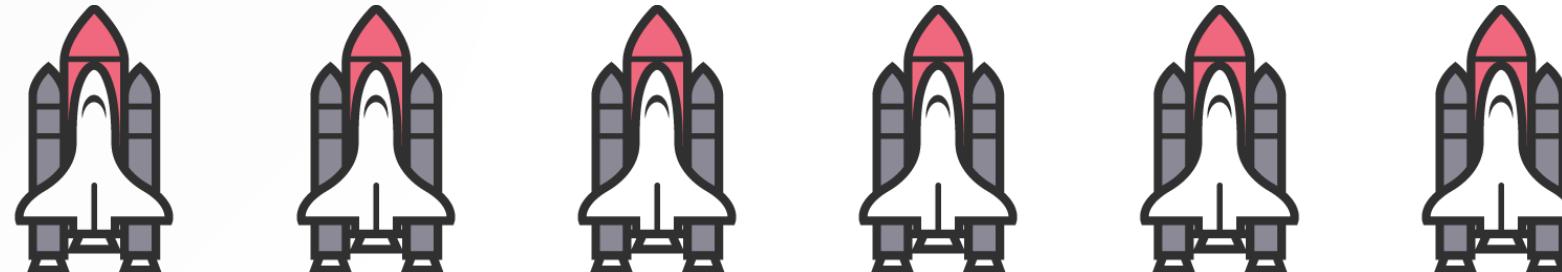
```
$ create-and-launch-rocket saturn-mission
```

```
$ create-and-launch-rocket satellite-mission
```

```
$ create-and-launch-rocket lunar-mission-2
```

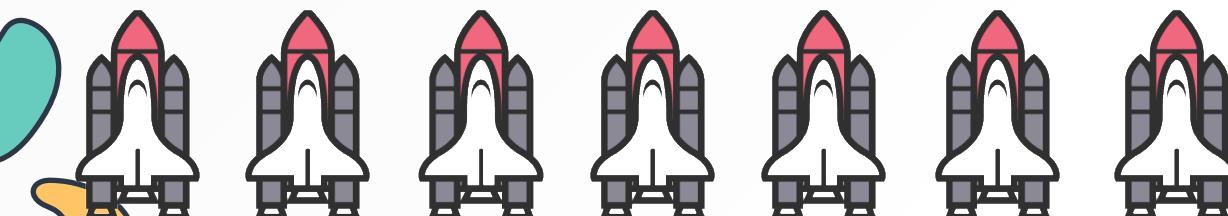
```
$ create-and-launch-rocket mars-mission
```

```
$ create-and-launch-rocket earth-mission
```



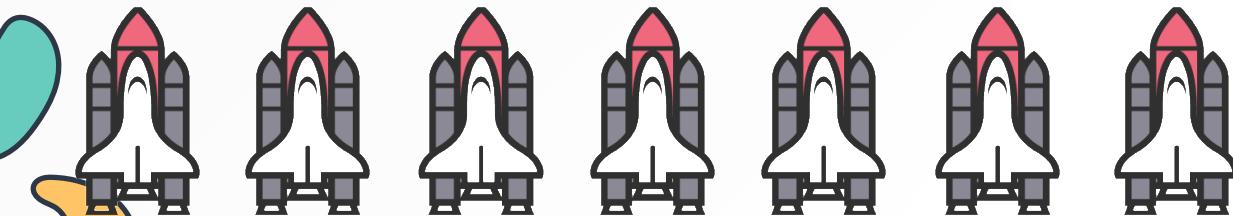
launch-rocket.sh

```
$ create-and-launch-rocket mars-rocket-mission
$ create-and-launch-rocket jupiter-rocket-mission
$ create-and-launch-rocket saturn-rocket-mission
$ create-and-launch-rocket satellite-mission
$ create-and-launch-rocket lunar-mission-2
$ create-and-launch-rocket mars-mission
$ create-and-launch-rocket earth-mission
```



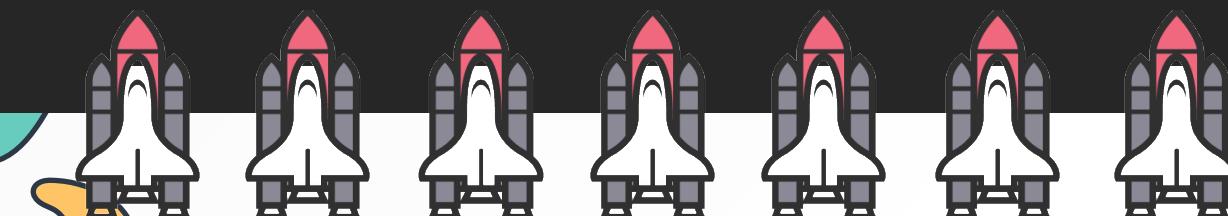
launch-rocket.sh

```
5 For each mission create and launch rocket
for mission in lunar-mission jupiter-mission
do
  create-and-launch-rocket $mission
done
```



launch-rocket.sh

```
❶ for mission in [lunar-mission][jupiter-mission][saturn-mission][satellite-mission][lunar-mission-2]
do
❷ create-and-launch-rocket $mission { earth-mission
done
```



mission-names.txt

```
lunar-mission
jupiter-mission
saturn-mission
satellite-mission
lunar-mission-2
mars-mission
apollo-mission
spitzer-mission
viking-mission
pheonix-mission
chandrayan-mission
gaganyan-mission
aditya-mission
nisar-mission
mangalyaan-mission
columbia-mission
challenger-mission
atlantis-mission
endeavour-mission
mercury-mission
gemini-mission
satellite-mission
```

launch-rocket.sh

```
for mission in $(cat mission-names.txt)
do
    create-and-launch-rocket $mission
done
```

```
for mission in $(cat mission-names.txt)
do
  create-and-launch-rocket $mission
done
```

```
for mission in 1 2 3 4 5 6
do
  create-and-launch-rocket mission-$mission
done
```

```
for mission in {0..100}
do
  create-and-launch-rocket mission-$mission
done
```

mission-1
mission-2
mission-3
mission-4
mission-5
mission-6

mission-1
mission-2
mission-3
mission-4

mission-100



```
for mission in $(cat mission-names.txt)
do
  create-and-launch-rocket $mission
done
```



```
for (( mission = 0 ; mission <= 100; mission++ ))
do
  create-and-launch-rocket mission-$mission
done
```



```
for mission in 1 2 3 4 5 6
do
  create-and-launch-rocket mission-$mission
done
```



```
for mission in {0..100}
do
  create-and-launch-rocket mission-$mission
done
```

...

Use a **For Loop** when you have to:

- Execute a command or a set of commands many times
- Iterate through files
- Iterate through lines within a file
- Iterate through the output of a command



Real life use cases:

```
for file in $(ls)
do
    echo Line count of $file is $(cat $file | wc -l)
done
```

```
for server in $(cat servers.txt)
do
    ssh $server "uptime"
done
```

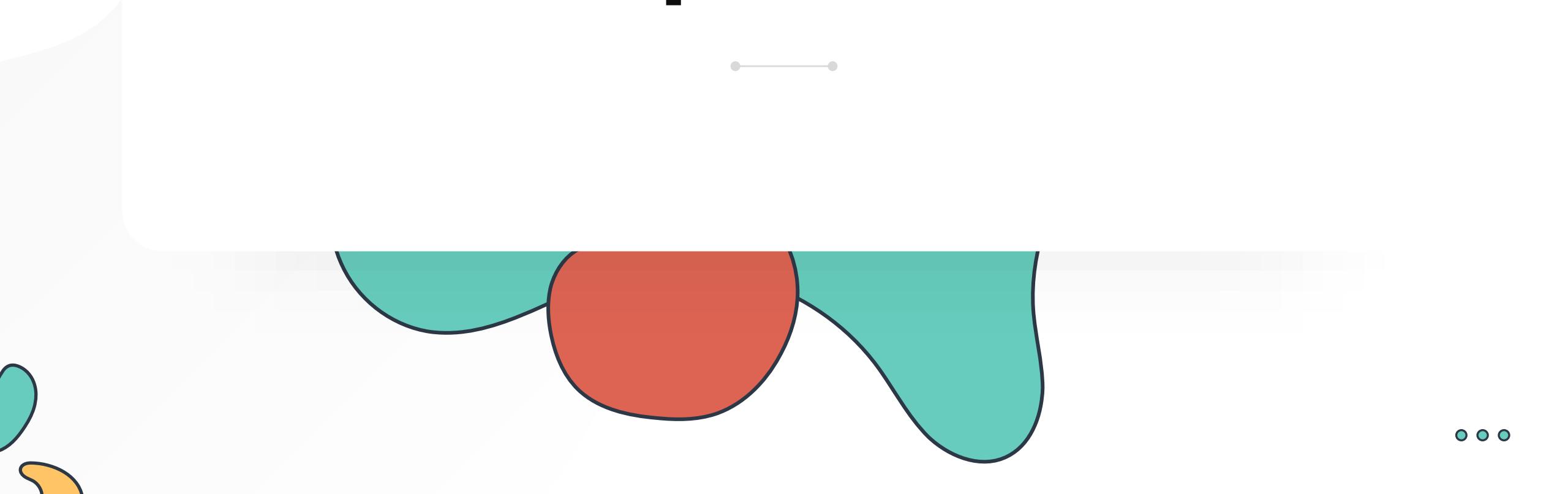
```
for package in $(cat install-packages.txt)
do
    sudo apt-get -y install $package
done
```

...



KodeKloud

Loops - While



A decorative graphic at the bottom of the slide features three wavy, rounded shapes in teal, orange, and red. Between the teal and orange shapes is a horizontal line with two small grey dots. To the right of the red shape are three small teal dots arranged horizontally.

```
$ rocket-status lunar-mission  
success
```

```
create-and-launch-rocket
```

```
mission_name=$1
```

```
mkdir $mission_name
```

```
rocket-add $mission_name
```

```
rocket-start-power $mission_name
```

```
rocket-internal-power $mission_name
```

```
rocket-start-sequence $mission_name
```

```
rocket-start-engine $mission_name
```

```
rocket-lift-off $mission_name
```

```
rocket_status=rocket-status $mission_name
```

```
if [ $rocket_status = "failed" ]
```

```
then
```

```
    rocket-debug $mission_name
```

```
fi
```

```
...
```



```
$ rocket-status lunar-mission
launching
```

```
create-and-launch-rocket
```

```
mission_name=$1
```

```
mkdir $mission_name
```

```
rocket-add $mission_name
```

```
rocket-start-power $mission_name
```

```
rocket-internal-power $mission_name
```

```
rocket-start-sequence $mission_name
```

```
rocket-start-engine $mission_name
```

```
rocket-lift-off $mission_name
```

```
rocket_status=rocket-status $mission_name
```

```
if [$rocket_status = "launching"]
```

```
then
```

```
sleep 2
```

```
rocket_status=rocket-status $mission_name
```

```
fi
```

```
if [ $rocket_status = "failed" ]
```

```
then
```

```
rocket-debug $mission_name
```

```
fi
```

```
$ rocket-status lunar-mission  
launching
```

```
create-and-launch-rocket
```

```
mission_name=$1
```

```
mkdir $mission_name
```

```
rocket-add $mission_name
```

```
rocket-start-power $mission_name
```

```
rocket-internal-power $mission_name
```

```
rocket-start-sequence $mission_name
```

```
rocket-start-engine $mission_name
```

```
rocket-lift-off $mission_name
```

```
rocket_status=rocket-status $mission_name
```

```
if [$rocket_status = "launching"]
```

```
then
```

```
sleep 2
```

```
rocket_status=rocket-status $mission_name
```

```
if [$rocket_status = "launching"]
```

```
then
```

```
sleep 2
```

```
fi
```

```
mkdir $mission_name

rocket-add $mission_name

rocket-start-power $mission_name
rocket-internal-power $mission_name
rocket-start-sequence $mission_name
rocket-start-engine $mission_name
rocket-lift-off $mission_name

rocket_status=rocket-status $mission_name

if [$rocket_status = "launching"]
then
    sleep 2
    rocket_status=rocket-status $mission_name
    if [$rocket_status = "launching"]
    then
        sleep 2
        rocket_status=rocket-status $mission_name
        if [$rocket_status = "launching"]
        then
            sleep 2
        fi
    fi
fi
```

```
rocket-start-engine $mission_name
rocket-lift-off $mission_name
rocket_status=rocket-status $mission_name

while [ $rocket_status = "launching" ]
do
```

```
sleep 2
rocket_status=rocket-status $mission_name
```

done

rocket_status=failed

```
create-and-launch-rocket
● mission_name=$1
● mkdir $mission_name
● rocket-add $mission_name
● rocket-start-power $mission_name
● rocket-internal-power $mission_name
● rocket-start-sequence $mission_name
● rocket-start-engine $mission_name
● rocket-lift-off $mission_name
● rocket_status=rocket-status $mission_name
? while [ $rocket_status = "launching" ]
  do
    ● sleep 2
    ● rocket_status=rocket-status $mission_name
  done
? if [ $rocket_status = "failed" ]
  then
    ● rocket-debug $mission_name
  fi
```

Use a **While Loop** when you have to:

- Execute a command or a set of commands multiple times but you are not sure how many times.
- Execute a command or a set of commands until a specific condition occurs
- Create infinite loops
- Menu driven programs



Real life use cases:

```
while true
Do
    echo "1. Shutdown"
    echo "2. Restart"
    echo "3. Exit Menu"
    read -p "Enter your choice: " choice

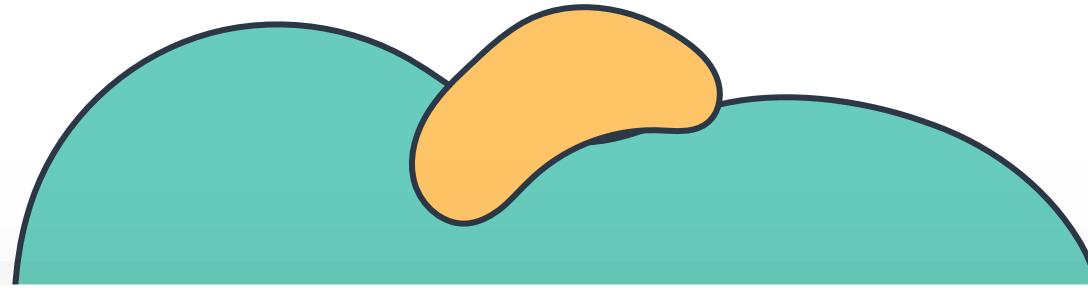
    if [ $choice -eq 1 ]
    then
        shutdown now
    elif [ $choice -eq 2 ]
    then
        shutdown -r now
    elif [ $choice -eq 3 ]
    then
        break
    else
        continue
    fi
```

done

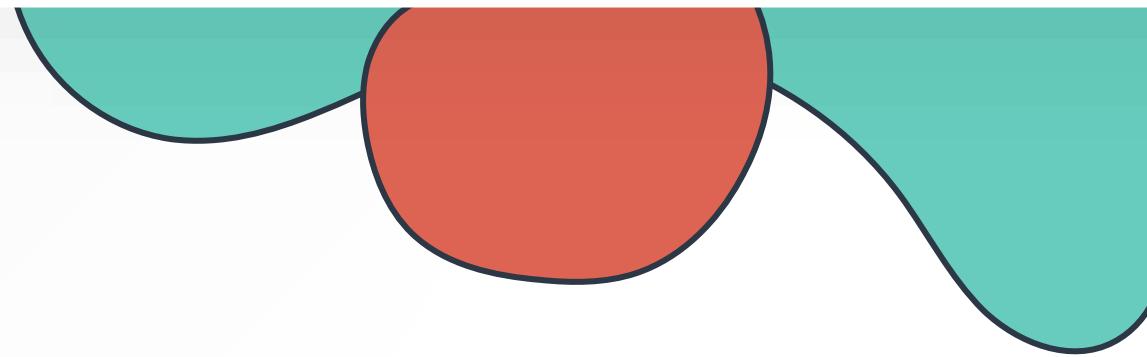




KodeKloud



Input



```
$ create-and-launch-rocket saturn-mission
```

```
$ create-and-launch-rocket  
Enter the mission name: saturn-mission
```

```
$ create-and-launch-rocket  
saturn-mission
```

```
create-and-launch-rocket
```

```
read mission_name
```

```
mkdir $mission_name
```

```
rocket-add $mission_name
```

```
rocket-start-power $mission_name
```

```
rocket-internal-power $mission_name
```

```
rocket-start-sequence $mission_name
```

```
rocket-start-engine $mission_name
```

```
rocket-lift-off $mission_name
```

```
rocket-status $mission_name
```

```
rocket_status=$(rocket-status $mission_name)
```

```
echo "Status of launch: $rocket_status"
```

• • •

```
$ create-and-launch-rocket saturn-mission
```

```
$ create-and-launch-rocket  
Enter the mission name: saturn-mission
```

```
$ create-and-launch-rocket  
saturn-mission
```

```
$ create-and-launch-rocket  
Enter the mission name: saturn-mission
```

```
create-and-launch-rocket
```

```
read -p "Enter mission name:" mission_name
```

```
mkdir $mission_name
```

```
rocket-add $mission_name
```

```
rocket-start-power $mission_name
```

```
rocket-internal-power $mission_name
```

```
rocket-start-sequence $mission_name
```

```
rocket-start-engine $mission_name
```

```
rocket-lift-off $mission_name
```

```
rocket-status $mission_name
```

```
rocket_status=$(rocket-status $mission_name)
```

```
echo "Status of launch: $rocket_status"
```

```
create-and-launch-rocket
```

```
read -p "Enter mission name:" mission_name
```

```
mkdir $mission_name
```

```
rocket-add $mission_name
```

```
rocket-start-power $mission_name
```

```
rocket-internal-power $mission_name
```

```
rocket-start-sequence $mission_name
```

```
rocket-start-engine $mission_name
```

```
rocket-lift-off $mission_name
```

```
rocket-status $mission_name
```

```
rocket_status=$(rocket-status $mission_name)
```

```
echo "Status of launch: $rocket_status"
```

```
create-and-launch-rocket
```

```
mission_name= $1
```

```
mkdir $mission_name
```

```
rocket-add $mission_name
```

```
rocket-start-power $mission_name
```

```
rocket-internal-power $mission_name
```

```
rocket-start-sequence $mission_name
```

```
rocket-start-engine $mission_name
```

```
rocket-lift-off $mission_name
```

```
rocket-status $mission_name
```

```
rocket_status=$(rocket-status $mission_name)
```

```
echo "Status of launch: $rocket_status"
```



KodeKloud

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



KodeKloud

Demo: Interrupt the Boot Process to
Gain Access to a System



Interrupting the Boot Process

e Edit GRUB boot line

CTRL + e Move to end of `linux` line

Add `rd.break` ENTER

Changing the root Password

>_

```
$ remount -o rw /sysroot
```

```
$ chroot /sysroot
```

```
$ passwd root
```

```
$ touch /.autorelabel
```

```
$ systemctl reboot
```



KodeKloud

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-202111027	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



KodeKloud

Manage Tuning Profiles



TuneD



High throughput systems



Low latency



Power saving

TuneD



Power saving profiles



Performance-boosting profiles

TuneD



Throughput-performance



Virtual-guest



Balanced

Installing and Starting TuneD

>_

```
$ sudo yum install tuned
```

```
$ sudo systemctl enable --now tuned
```

```
$ systemctl status tuned.service
```

```
$ tuned-adm active
```

```
$ tuned-adm verify
```

TuneD Configuration Files and Profile Locations

>_

```
$ ls /usr/lib/tuned
```

accelerator-performance	intel-sst	powersave
balanced	latency-performance	recommend.d
desktop	network-latency	throughput-performance
functions	network-throughput	virtual-guest
hpc-compute	optimize-serial-console	virtual-host

```
$ ls /etc/tuned
```

```
tuned-main.conf
```

```
$ man tuned.conf
```

tuned.conf(5)	tuned.conf file format description	tuned.conf(5)
---------------	------------------------------------	---------------

NAME

tuned.conf - TuneD profile definition

DESCRIPTION

This man page documents format of TuneD 2.0 profile definition files. The profile definition is stored in /etc/tuned/<profile_name>/tuned.conf or in /usr/lib/tuned/<profile_name>/tuned.conf file where the /etc/tuned/ directory has higher priority.

Using tuned-adm

>_

```
$ tuned-adm list
```

Available profiles:

- accelerator-performance
 - balanced
 - desktop
 - hpc-compute
 - intel-sst
 - latency-performance
 - network-latency
 - network performance
 - network-throughput
 - optimize-serial-console
 - powersave
 - throughput-performance
 - virtual-guest
 - virtual-host
- Throughput performance based tuning with disabled higher latency STOP states
 - General non-specialized tuned profile
 - Optimize for the desktop use-case
 - Optimize for HPC compute workloads
 - Configure for Intel Speed Select Base Frequency
 - Optimize for deterministic performance at the cost of increased power consumption
 - Optimize for deterministic performance at the cost of increased power consumption, focused on low latency
 - Optimize for streaming network throughput, generally only necessary on older CPUs or 40G+ networks
 - Optimize for serial console use.
 - Optimize for low power consumption
 - Broadly applicable tuning that provides excellent performance across a variety of common server workloads
 - Optimize for running inside a virtual guest
 - Optimize for running KVM guests

Current active profile: virtual-guest

Using tuned-adm

>_

```
$ tuned-adm active
```

```
Current active profile: virtual-guest
```

```
$ tuned-adm profile balanced
```

```
$ tuned-adm profile_info
```

```
Profile name:  
virtual-guest
```

```
Profile summary:  
Optimize for running inside a virtual guest
```

```
Profile description:
```

```
$ tuned-adm recommend
```

```
virtual-guest
```

Using tuned-adm

>_

```
$ tuned-adm verify
```

Verification succeeded, current system settings match the preset profile.
See Tuned log file ('/var/log/tuned/tuned.log') for details.

```
$ tuned-adm auto_profile
```

```
$ tuned-adm profile_mode
```

Profile selection mode: auto

```
$ tuned-adm --help
```

Using tuned-adm

>_

```
$ tuned-adm active
```

```
Current active profile: virtual-guest
```

```
$ tuned-adm list
```

```
Available profiles:
```

- | | |
|---------------------------|---|
| - accelerator-performance | - Throughput performance based tuning with disabled higher latency STOP states |
| - balanced | - General non-specialized tuned profile |
| - desktop | - Optimize for the desktop use-case |
| - hpc-compute | - Optimize for HPC compute workloads |
| - intel-sst | - Configure for Intel Speed Select Base Frequency |
| - latency-performance | - Optimize for deterministic performance at the cost of increased power consumption |
| - network-latency | - Optimize for deterministic performance at the cost of increased power consumption, focused on low latency |
| network performance | |
| - network-throughput | - Optimize for streaming network throughput, generally only necessary on older CPUs or 40G+ networks |
| - optimize-serial-console | - Optimize for serial console use. |
| - powersave | - Optimize for low power consumption |
| - throughput-performance | - Broadly applicable tuning that provides excellent performance across a variety of common server workloads |
| - virtual-guest | - Optimize for running inside a virtual guest |
| - virtual-host | - Optimize for running KVM guests |

```
Current active profile: virtual-guest
```

Using tuned-adm

>_

```
$ sudo tuned-adm profile throughput-performance
```

```
$ tuned-adm active
```

```
Current active profile: throughput-performance
```

```
$ sudo tuned-adm profile virtual-host powersave
```

```
$ tuned-adm active
```

```
Current active profile: virtual-host powersave
```

Dynamic Tuning

```
>_  
$ grep "dynamic_tuning" /etc/tuned/tuned-main.conf  
dynamic_tuning = 0  
  
$ sudo vi /etc/tuned/tuned-main.conf  
  
$ sudo systemctl restart tuned.service  
  
$ grep "dynamic_tuning" /etc/tuned/tuned-main.conf  
dynamic_tuning = 1
```

 tuned-main.conf

dynamic_tuning = 0

dynamic_tuning = 1



KodeKloud

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

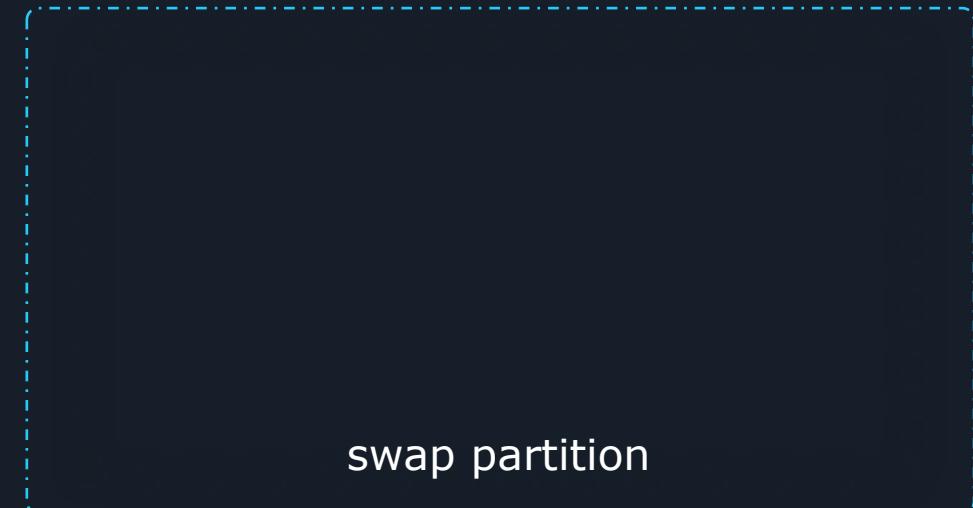


KodeKloud

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



KodeKloud

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
```



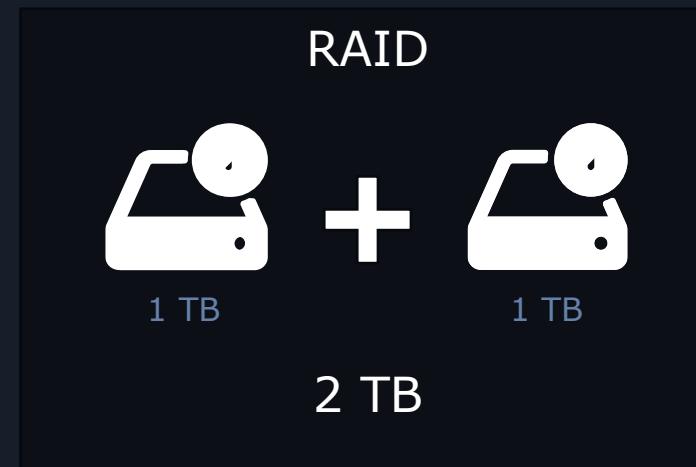
KodeKloud

Create and Manage RAID Devices



Create and Manage RAID Devices

RAID = Redundant Array of Independent Disks



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
```



KodeKloud

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



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



KodeKloud

Demo
Create and Configure
File Systems



Create and Configure File Systems

>_

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

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



KodeKloud

Create, Mount, and Use vfat File Systems



Creating a vfat Filesystem

>_

```
$ sudo fdisk /dev/vdb    t for type; b for W95 FAT32
```

```
$ sudo mkfs.vfat /dev/vdb1 Up to 2GB in size
```

```
$ sudo mkfs.vfat -F 32 /dev/vdb1 2GB or larger; up to 16TB with 4096 byte sector size
```

Mounting and Unmounting vfat Filesystems

>_

```
$ sudo mkdir /myvfat
```

```
$ sudo mount /dev/vdb1 /myvfat/
```

```
$ sudo vi /etc/fstab
```

```
$ sudo umount /myvfat/
```



/etc/fstab

/dev/vdb1 /myvfat vfat defaults 0 0

Integrity Checks For vfat FileSystems

>_

```
$ sudo dosfsck /dev/vdb1    ==  $ sudo fsck.vfat /dev/vdb1
```

```
$ sudo dosfsck == $ sudo fsck.vfat
```

```
$ man dosfsck
```



KodeKloud

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
```

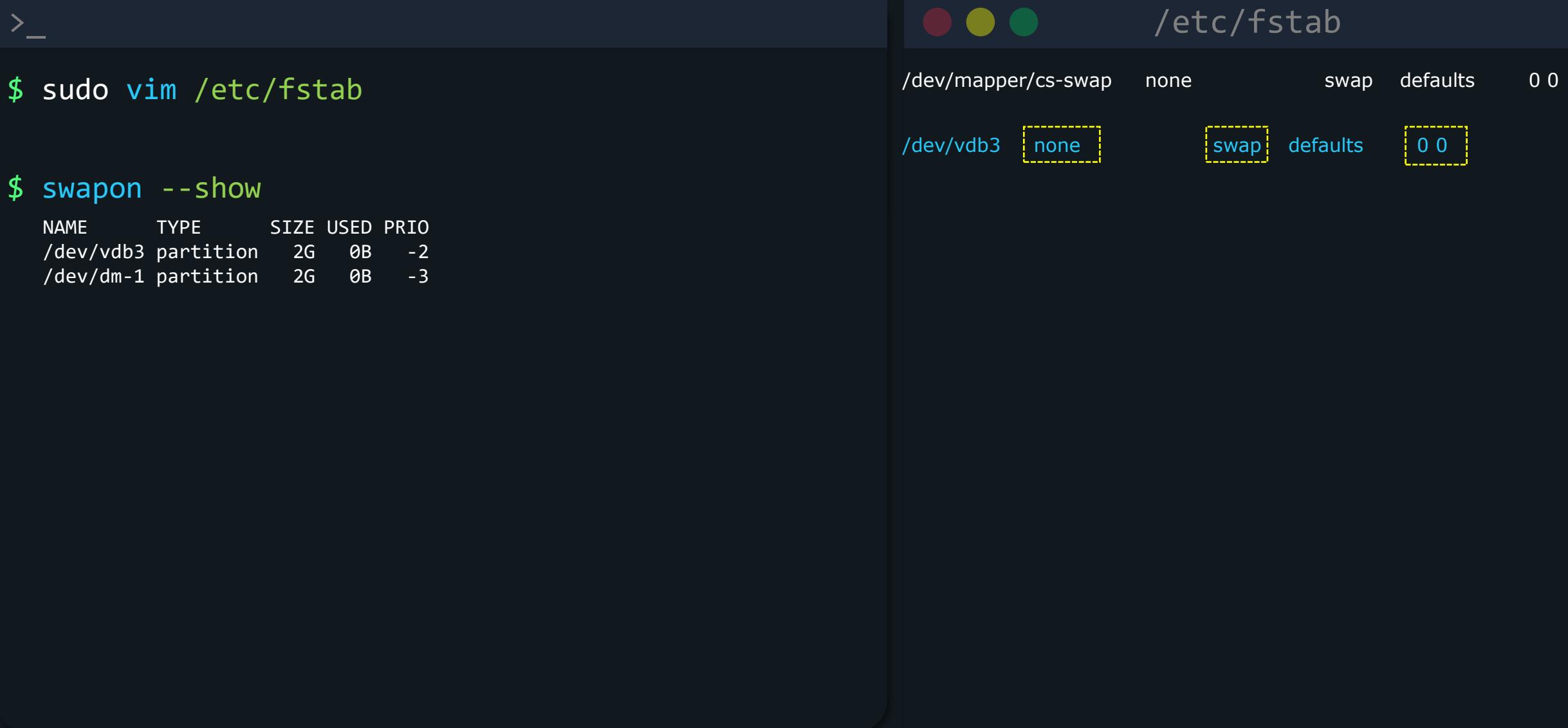
Mount Filesystems At or During Boot

>_

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

```
$ swapon --show
```

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



Filesystem on /dev/mapper/cs-swap mounted at /etc/fstab

Filesystem	Type	Options	Mount Point	
/dev/mapper/cs-swap	none	swap	defaults	0 0
/dev/vdb3	none	swap	defaults	0 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



KodeKloud

Configure Disk Compression



Virtual Data Optimizer (VDO)



Virtual Data Optimizer

Virtual Data Optimizer (VDO)



**Zero-Block
Filtering**



Deduplication



Compression

Virtual Data Optimizer (VDO)



Zero-Block
Filtering



Deduplication



Compression



Virtual Data Optimizer (VDO)



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Filtering



Virtual Data Optimizer (VDO)



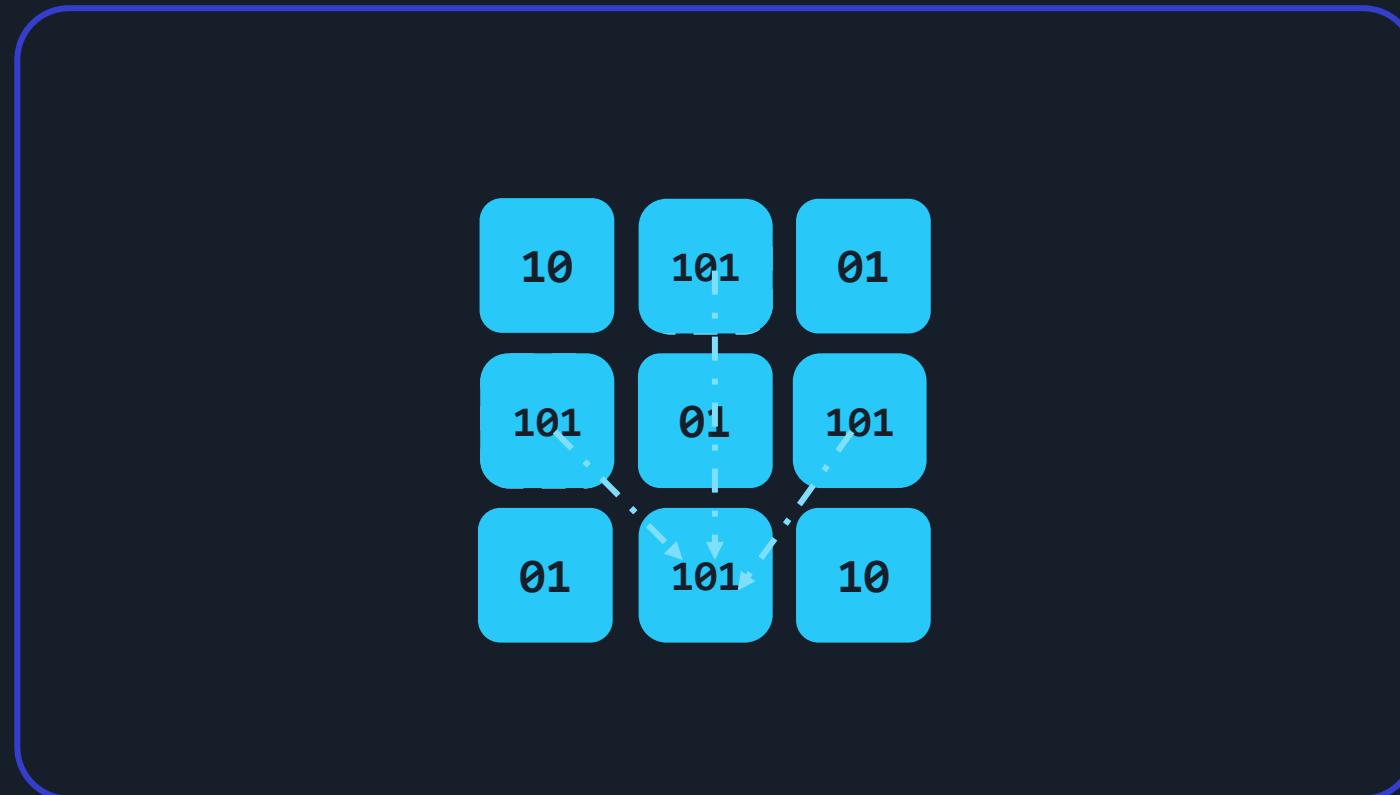
Zero-Block
Filtering



Deduplication



Compression



Virtual Data Optimizer (VDO)



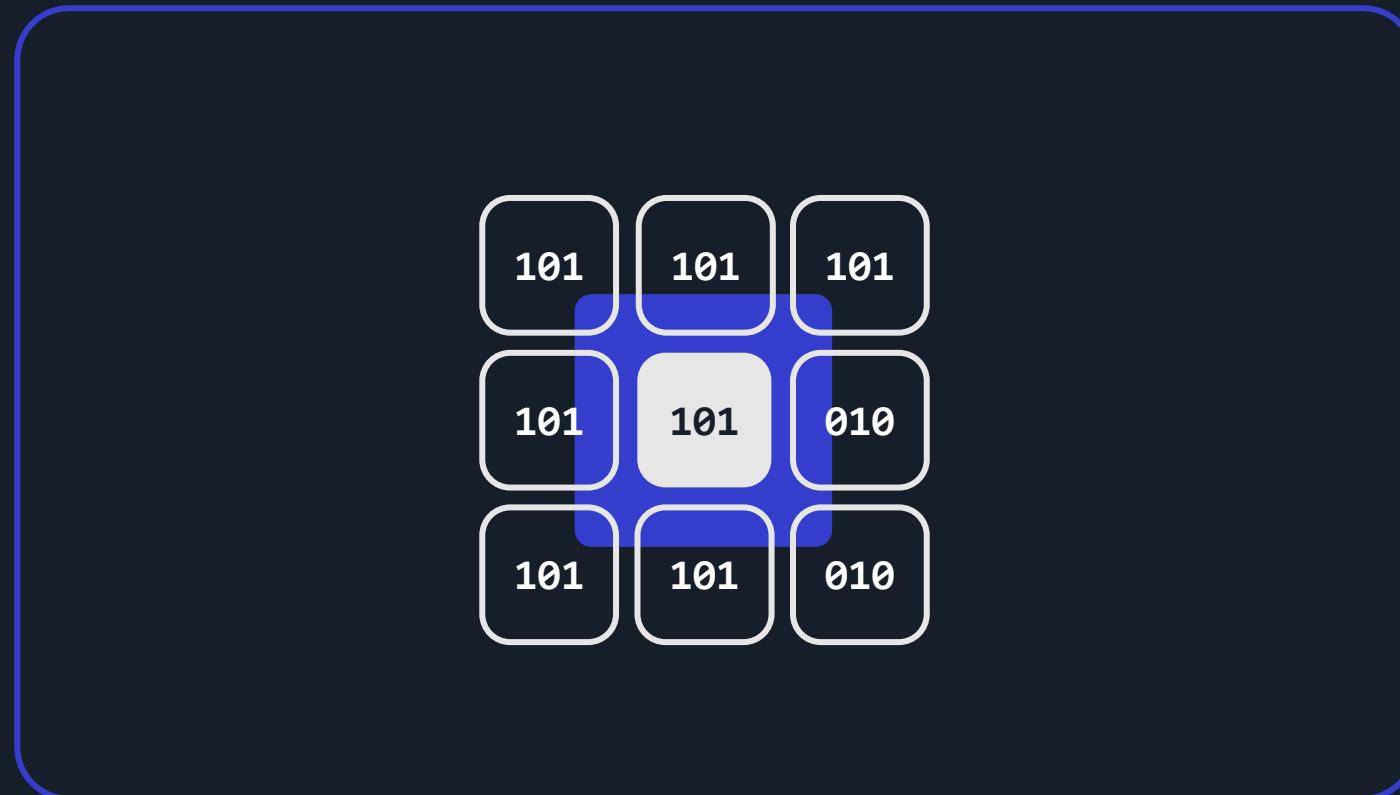
Zero-Block
Filtering



Deduplication



Compression



Installing and Enabling VDO

>_

```
$ sudo yum install vdo
```

```
$ sudo systemctl enable --now vdo.service
```

```
$ sudo systemctl status vdo.service
```

Using VDO With Storage Devices

>_

```
$ sudo vdo create --name=vdo_storage --device=/dev/vdb --vdoLogicalSize=10G
```

```
$ sudo vdostats --human-readable
```

Device	Size	Used	Available	Use%	Space saving%
/dev/mapper/vdo_storage	5.0G	3.0G	2.0G	60%	N/A

Using VDO With Storage Devices

>_

```
$ sudo mkfs.xfs [-K] /dev/mapper/vdo_storage
```

```
$ sudo udevadm settle
```

```
$ sudo vdostats --human-readable
```

Device	Size	Used	Available	Use%	Space saving%
/dev/mapper/vdo_storage	5.0G	3.0G	2.0G	60%	99%

Mounting VDO Devices

```
>_
$ sudo mkdir /mnt/myvdo
```

```
$ sudo vi /etc/fstab
```

```
$ sudo mount -a
```

```
$ df -h /mnt/myvdo
```

Filesystem	Size	Used	Avail	Use%	Mounted on
/dev/mapper/vdo_storage	10G	104M	9.9G	2%	/mnt/myvdo

Three colored circles (red, yellow, green) are positioned above the file path. The file path is /etc/fstab. Below it is the content of the file:

```
/dev/mapper/vdo_storage /mnt/myvdo xfs
netdev.x-systemd.device-timeout=0,x-systemd.requires=vdo.service 0 0
```

Saving Space With VDO

>_

```
$ head -c 50MB /dev/urandom > mydata.txt

$ mkdir /mnt/myvdo/dir{1..10}

$ for i in `seq 1 10` ; do sudo cp /home/aaron/mydata.txt /mnt/myvdo/dir$i ; done ;

$ df -h /mnt/myvdo
Filesystem      Size  Used Avail Use% Mounted on
/dev/mapper/vdo_storage  10G  581M  9.5G   6% /mnt/myvdo

$ sudo vdostats --human-readable
Device          Size      Used Available Use%      Space saving%
/dev/mapper/vdo_storage  5.0G      3.0G      2.0G  60%          94%
```

Saving Space With VDO

>_

```
$ sudo cp /home/aaron/mydata.txt /home/aaron/moredata.txt

$ for i in `seq 1 10` ; do sudo cp /home/aaron/moredata.txt /mnt/myvdo/dir$i ; done ;

$ df -h /mnt/myvdo
Filesystem      Size  Used Avail Use% Mounted on
/dev/mapper/vdo_storage  10G  1.1G  9.0G  11% /mnt/myvdo

$ sudo vdostats --human-readable
Device      Size  Used Available Use%  Space saving%
/dev/mapper/vdo_storage  5.0G  3.1G    1.9G  61%    95%
```



KodeKloud

Manage Layered Storage

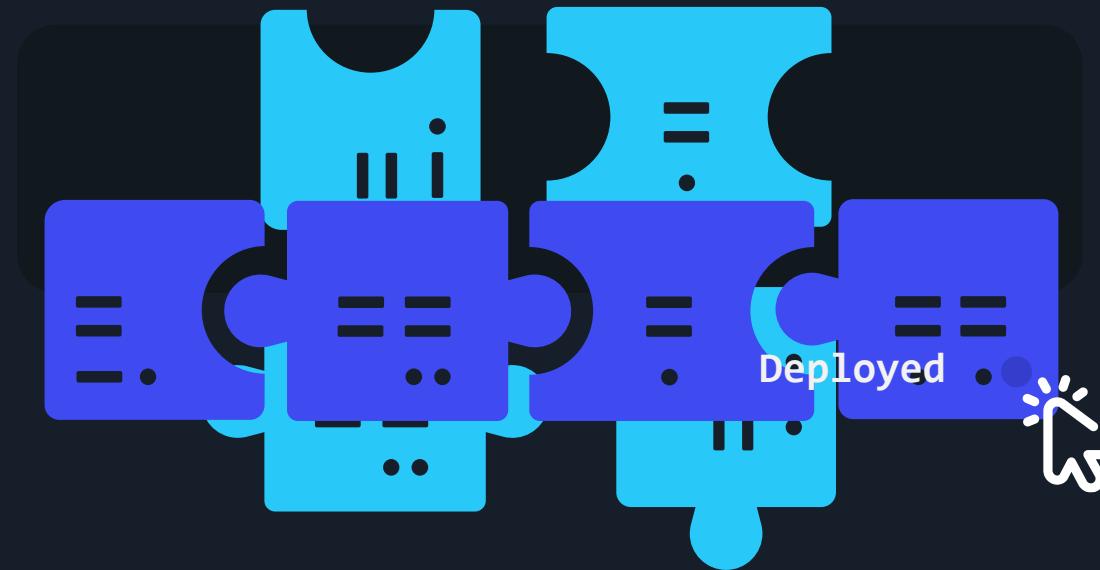


What Is Stratis?

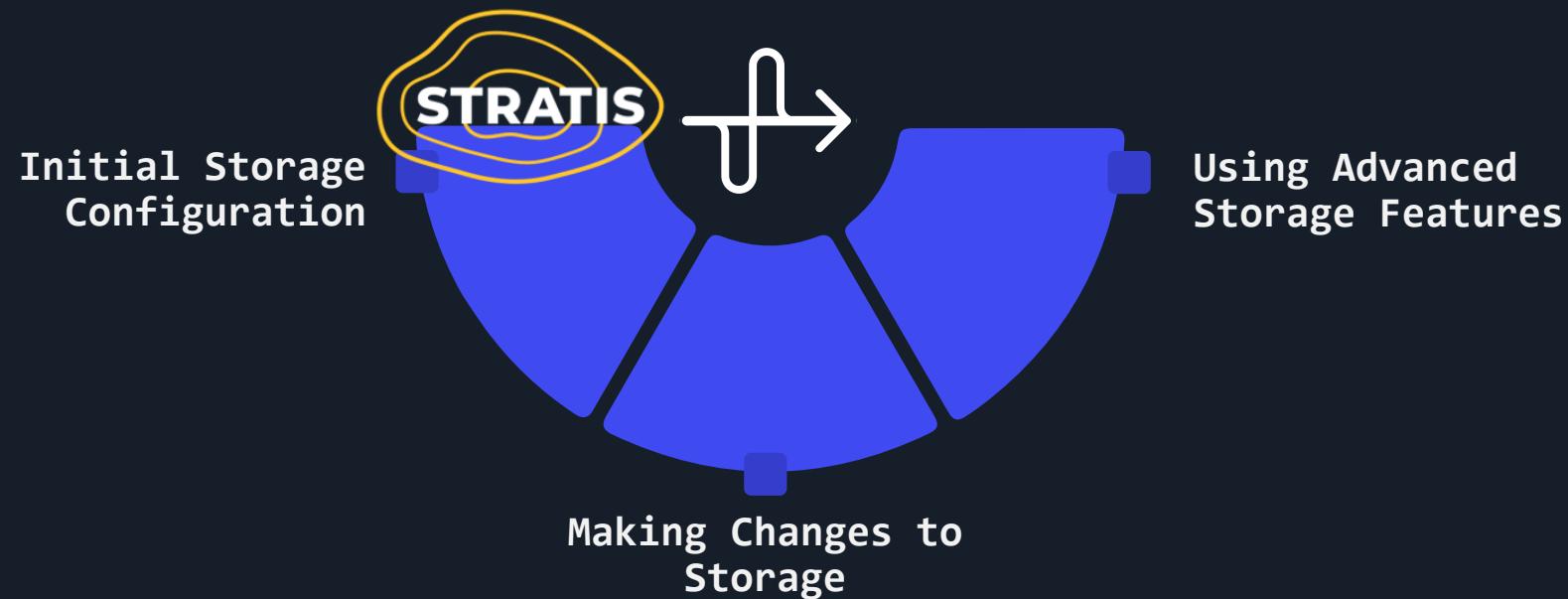


storage-management tool for Linux

What Is Stratis?



What Is Stratis?



What Is Stratis?



What Is Stratis?



 **Filesystem
Snapshots**

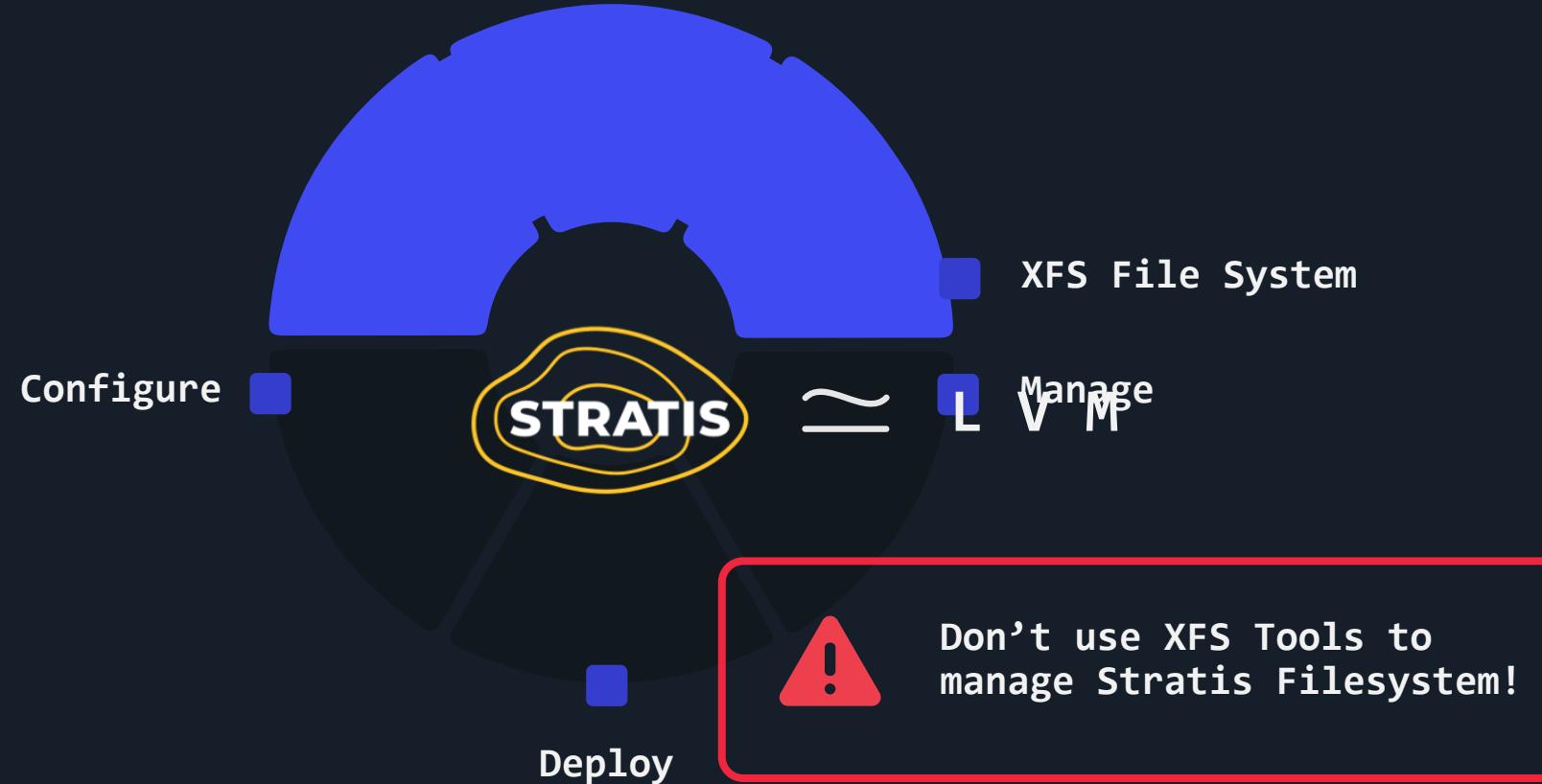


 **Thin
Provisioning**



 **Tiering**

What Is Stratis?



Installing and Starting Stratis

>_

```
$ sudo yum install stratisd stratis-cli
```

```
$ sudo systemctl enable --now stratisd.service
```

Creating a Stratis Pool

>_

```
$ sudo stratis pool create [my-pool] [/dev/vdc]
```

```
$ sudo stratis pool create my-pool /dev/vdc /dev/vdd
```

```
$ sudo stratis pool list
```

Name	Total	Physical	Properties	UUID
my-pool	10 GiB	37.63 MiB	~Ca,~Cr	2729e90c-0c49-414f-905c-f3b872b2d69a

```
$ sudo stratis blockdev
```

Pool Name	Device Node	Physical Size	Tier
my-pool	/dev/vdc	10 GiB	Data

Creating a Stratis Filesystem

>_

```
$ sudo stratis fs create my-pool myfs1
```

```
$ sudo stratis fs
```

Pool Name	Name	Used	Created	Device	UUID
my-pool	myfs1	546 MiB	Jul 27 2022 16:57	/dev/stratis/my-pool/myfs1	224b7b45-5ea2-45b1-8906-edc4960f0418

Mounting a Stratis Filesystem

>_

```
$ sudo mkdir /mnt/mystratis
```

```
$ sudo vi /etc/fstab
```

```
$ sudo mount -a
```

```
$ sudo cp /home/aaron/mydata.txt /mnt/mystratis
```



Adding Storage Devices To the Stratis Pool

>_

```
$ sudo stratis pool add-data [my-pool] /dev/vdd
```

```
$ sudo stratis pool
Name      Total      Physical      Properties      UUID
my-pool  20 GiB  587.66 MiB  19.43 GiB  ~Ca,~Cr  2729e90c-0c49-414f-905c-f3b872b2d69a
```

Filesystem Snapshots With Stratis

>_

```
$ sudo stratis fs snapshot [my-pool] myfs1 [myfs1-snapshot]
```

```
$ sudo stratis fs
```

Pool Name	Name	Used	Created	Device	UUID
my-pool	myfs1-snapshot	594 MiB	Jul 27 2022 17:26	/dev/stratis/my-pool/myfs1-snapshot	b7805e72-1cfb-4935-8d5e-623c83d178c6
my-pool	myfs1	594 MiB	Jul 27 2022 16:57	/dev/stratis/my-pool/myfs1	224b7b45-5ea2-45b1-8906-edc4960f0418

```
$ rm /mnt/mystratis/mydata.txt
```

```
$ sudo stratis fs rename [my-pool] [myfs1] [myfs1-old]
```

```
$ sudo stratis fs rename my-pool myfs1-snapshot myfs1
```

Filesystem Snapshots With Stratis

>_

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

```
$ sudo mount /mnt/mystratis
```

```
$ sudo stratis fs
```

Pool	Name	Used	Created	Device	UUID
my-pool	myfs1-old	594 MiB	Jul 27 2022 16:57	/dev/stratis/my-pool/myfs1-old	224b7b45-5ea2-45b1-8906-edc4960f0418
my-pool	myfs1	594 MiB	Jul 27 2022 17:26	/dev/stratis/my-pool/myfs1	b7805e72-1cfb-4935-8d5e-623c83d178c6

```
$ ls /mnt/mystratis
```

```
total 48832
drwxr-xr-x.  2 root root      24 Jul 27 17:35 .
drwxr-xr-x. 11 root root     185 Jul 27 17:05 ..
-rw-r--r--.  1 root root 50000000 Jul 27 17:35 mydata.txt
```



KodeKloud

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
```



KodeKloud

Manage Startup Processes
and Services



Startup Processes and Services



Boot Up



App1



App2

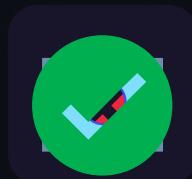
Startup Processes and Services



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);
           └─sshd.service

$ 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>



KodeKloud

Install and Update Software Packages



Subscription Manager

>_

```
$ sudo subscription-manager register --username your-redhat-developer-username --password your-redhat-password

$ sudo subscription-manager attach --auto
```

Repositories

>_

```
$ sudo yum repolist
```

repo id	repo name
rhel-8-for-x86_64-appstream-rpms	Red Hat Enterprise Linux 8 for x86_64 - AppStream (RPMS)
rhel-8-for-x86_64-baseos-rpms	Red Hat Enterprise Linux 8 for x86_64 - BaseOS (RPMS)

```
$ sudo yum repolist -v
```

```
Repo-baseurl      : https://cdn.redhat.com/content/dist/rhel8/8/x86_64/appstream/os
Repo-filename    : /etc/yum.repos.d.redhat.repo
```

Repositories

>_

```
$ sudo yum repolist --all
```

```
repo id  
codeready-builder-for-rhel-8-x86_64-debug-rpms  
codeready-builder-for-rhel-8-x86_64-eus-debug-rpms  
codeready-builder-for-rhel-8-x86_64-eus-rpms  
codeready-builder-for-rhel-8-x86_64-eus-source-rpms  
codeready-builder-for-rhel-8-x86_64-rpms
```

repo id	repo name	status
codeready-builder-for-rhel-8-x86_64-debug-rpms	Red Hat CodeReady Linux Builder for RHEL 8 x86_64 (Debug RPMs)	disabled
codeready-builder-for-rhel-8-x86_64-eus-debug-rpms	Red Hat CodeReady Linux Builder for RHEL 8 x86_64 - Extended Update Support (Debug RPMs)	disabled
codeready-builder-for-rhel-8-x86_64-eus-rpms	Red Hat CodeReady Linux Builder for RHEL 8 x86_64 - Extended Update Support (RPMs)	disabled
codeready-builder-for-rhel-8-x86_64-eus-source-rpms	Red Hat CodeReady Linux Builder for RHEL 8 x86_64 - Extended Update Support (Source RPMs)	disabled
codeready-builder-for-rhel-8-x86_64-rpms	Red Hat CodeReady Linux Builder for RHEL 8 x86_64 (RPMs)	disabled

```
$ sudo subscription-manager repos --enable codeready-builder-for-rhel-8-x86_64-rpms
```

```
$ sudo subscription-manager repos --disable codeready-builder-for-rhel-8-x86_64-rpms
```

```
$ sudo yum-config-manager --enable codeready-builder-for-rhel-8-x86_64-rpms
```

```
$ sudo yum-config-manager --disable codeready-builder-for-rhel-8-x86_64-rpms
```

Repositories

>_

```
$ sudo yum install yum-utils
```

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

```
$ sudo yum-config-manager --add-repo 192.168.1.220/BaseOS.repo
```

```
$ sudo yum repolist -v
```

```
Repo-filename      : /etc/yum.repos.d/docker-ce.repo
```

Repositories

>_

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

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



docker-ce.repo

```
[docker-ce-stable]
name=Docker CE Stable - $basearch
baseurl=https://download.docker.com/linux/rhel/$releasever/$basearch/stable
enabled=1
gpgcheck=1
gpgkey=https://download.docker.com/linux/rhel/gpg
```

Managing Packages With Yum

```
>_
```

```
$ sudo yum search web server
```

```
cockpit.x86_64 : Web Console for Linux servers
```

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

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

```
$ sudo yum 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.
```

Managing Packages With Yum

```
>_
```

```
$ sudo yum install nginx
```

```
$ sudo yum reinstall nginx
```

```
$ sudo yum remove nginx
```

Managing Packages With Yum

```
>_
```

```
$ sudo yum group list
```

```
Server with GUI
```

```
$ sudo yum group list --hidden
```

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

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

Managing Packages With Yum

>_

```
$ sudo wget https://download.nomachine.com/download/7.7/Linux/nomachine_7.7.4_1_x86_64.rpm
```

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

```
$ sudo yum remove nomachine
```

```
$ sudo yum autoremove
```

Updating and Upgrading With Yum

```
>_
```

```
$ sudo yum check-upgrade
```

```
$ sudo yum update
```



KodeKloud

Working With Package Module Streams



Package Module Streams (AppStreams)

>_

```
$ sudo yum module list
```

```
Extra Packages for Enterprise Linux Modular 8 - x86_64
Name           Stream      Profiles Summary
nginx          mainline    common  nginx webserver
nginx          1.20        common [ nginx webserver
                           d]
nodejs         13          default, Javascript runtime
                           develop
                           ment, mi
                           nimal
nodejs         16-epel    default, Javascript runtime
                           develop
                           ment, mi
                           nimal
```

```
$ sudo yum module list nodejs
```

```
Red Hat Enterprise Linux 8 for x86_64 - AppStream (RPMs)
```

Name	Stream	Profiles	Summary
nodejs	10 [d]	common [d], development, minimal, s2i	JavaScript runtime
nodejs	12	common [d], development, minimal, s2i	JavaScript runtime
nodejs	14	common [d], development, minimal, s2i	JavaScript runtime
nodejs	16	common [d], development, minimal, s2i	JavaScript runtime

Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled

```
$ sudo yum install nodejs
```

Package Module Streams (AppStreams)

>_

```
$ sudo yum module install nodejs:14/development
```

```
$ sudo yum module list --installed nodejs
```

Red Hat Enterprise Linux 8 for x86_64 - AppStream (RPMs)		
Name	Stream	Profiles
nodejs	14 [e]	common [d], development [i], minimal, s2i
Summary		
Javascript runtime		

Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled

```
$ sudo yum module reset nodejs
```

```
$ sudo yum module install nodejs:16/development
```

```
$ sudo yum module list --installed nodejs
```

Red Hat Enterprise Linux 8 for x86_64 - AppStream (RPMs)		
Name	Stream	Profiles
nodejs	16 [e]	common [d], development [i], minimal, s2i
Summary		
Javascript runtime		

Hint: [d]efault, [e]nabled, [x]disabled, [i]nstalled



KodeKloud

Demo

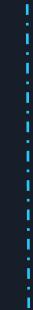
Configure Networking and Hostname



Configure Networking and Hostname



10.0.0.0.9.



device

IP address?
203.0.113.9.



gateway



google



192.168.0.1



KodeKloud

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

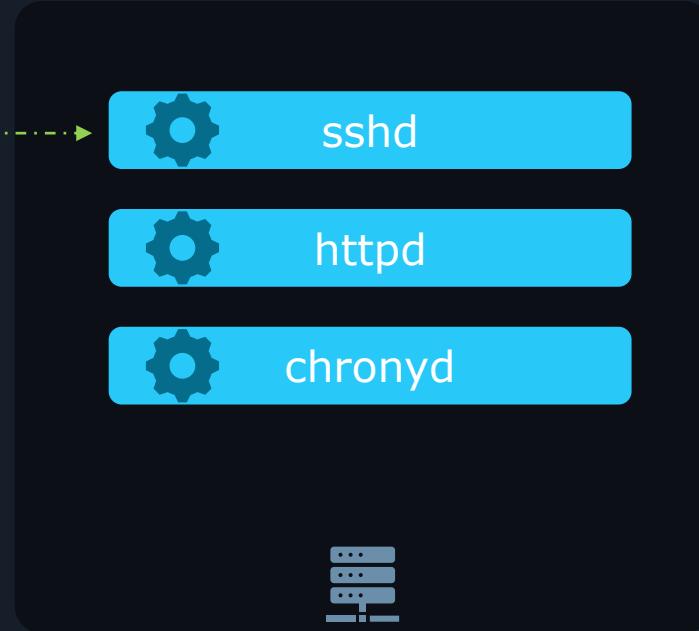
```
$ sudo nmcli connection modify enp0s3 autocnnect yes
```



KodeKloud

Start, Stop, and Check Network Services





Utilities



ss



netstat

Checking Network Services

>_

```
$ sudo ss -[tunlp]
```

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/chrony
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/chrony
udp6	0	0	fe80::a00:27ff:fe6b:546	:::*		1024/NetworkManager

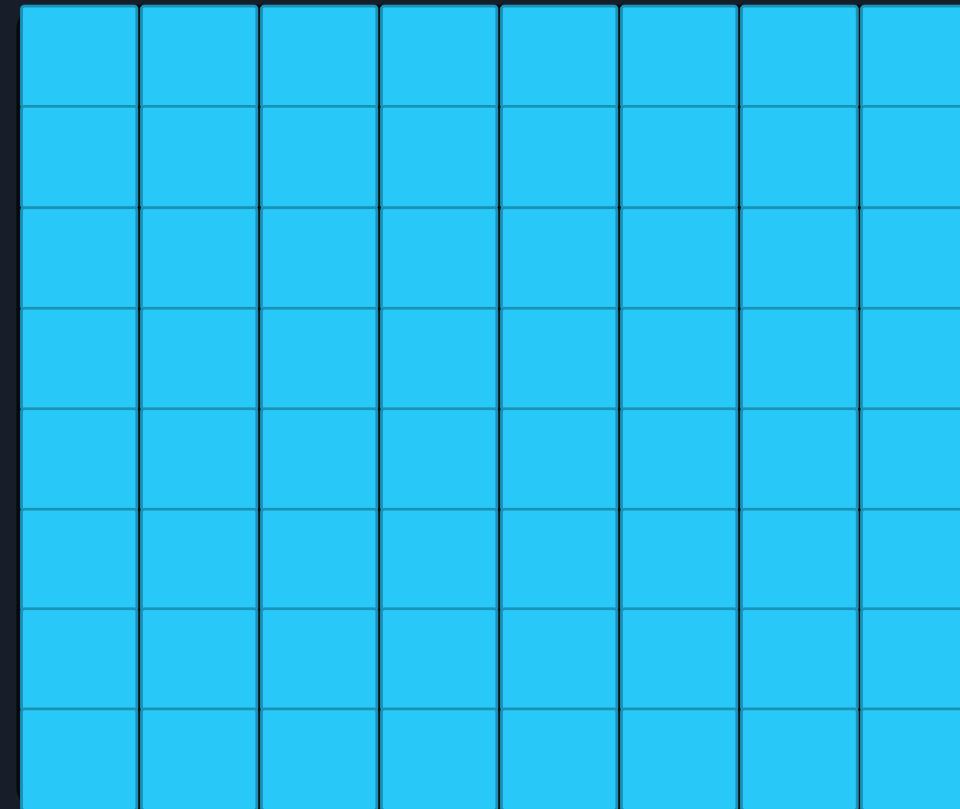


KodeKloud

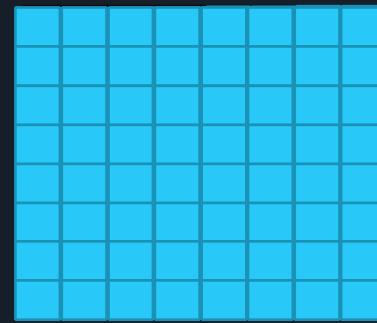
Implement Packet Filtering



Implement Packet Filtering



Implement Packet Filtering

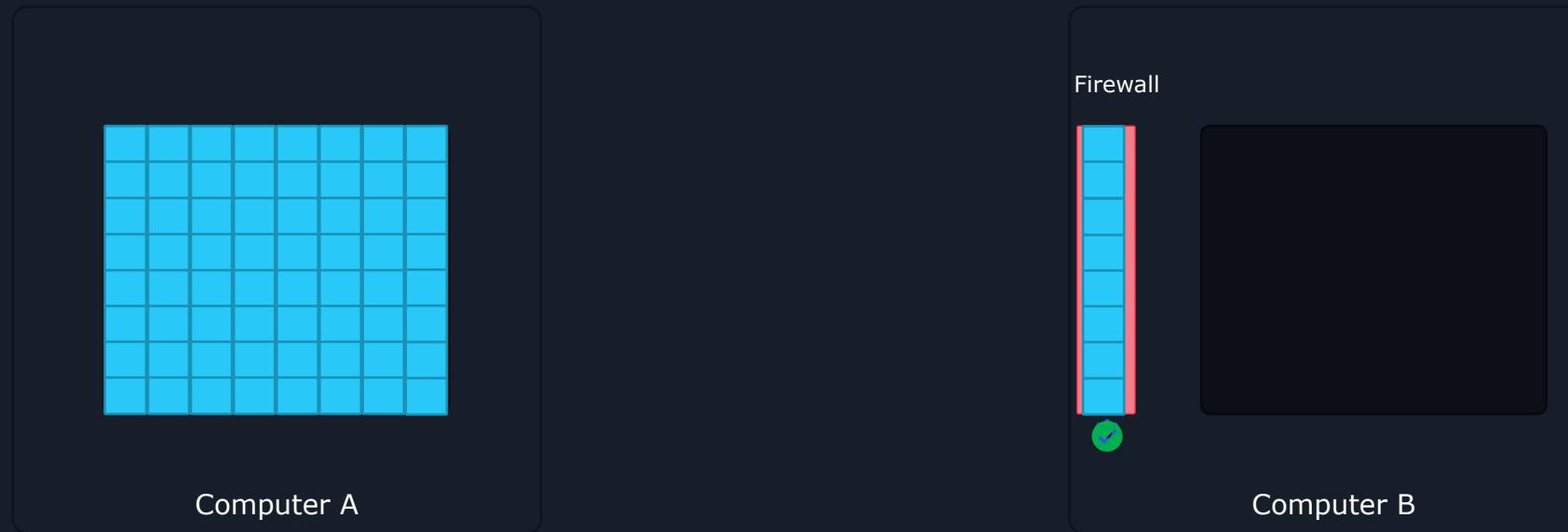


Computer A

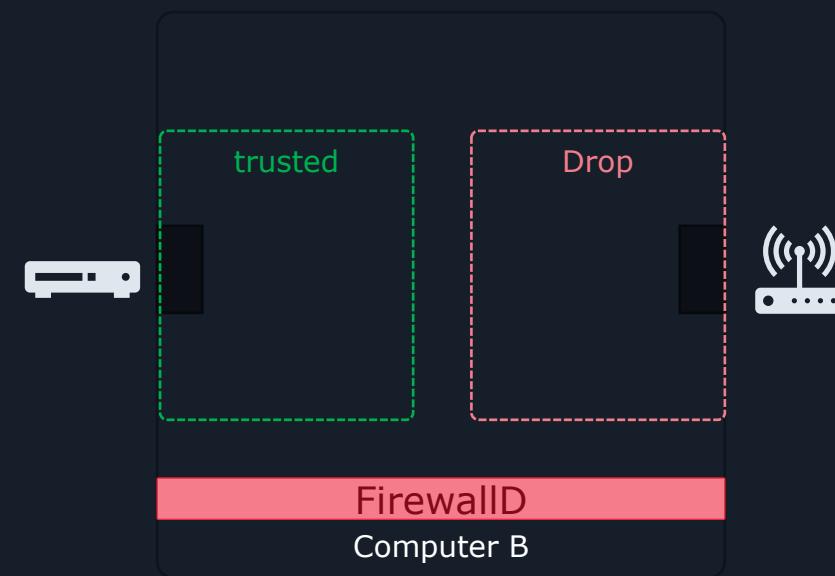


Computer B

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

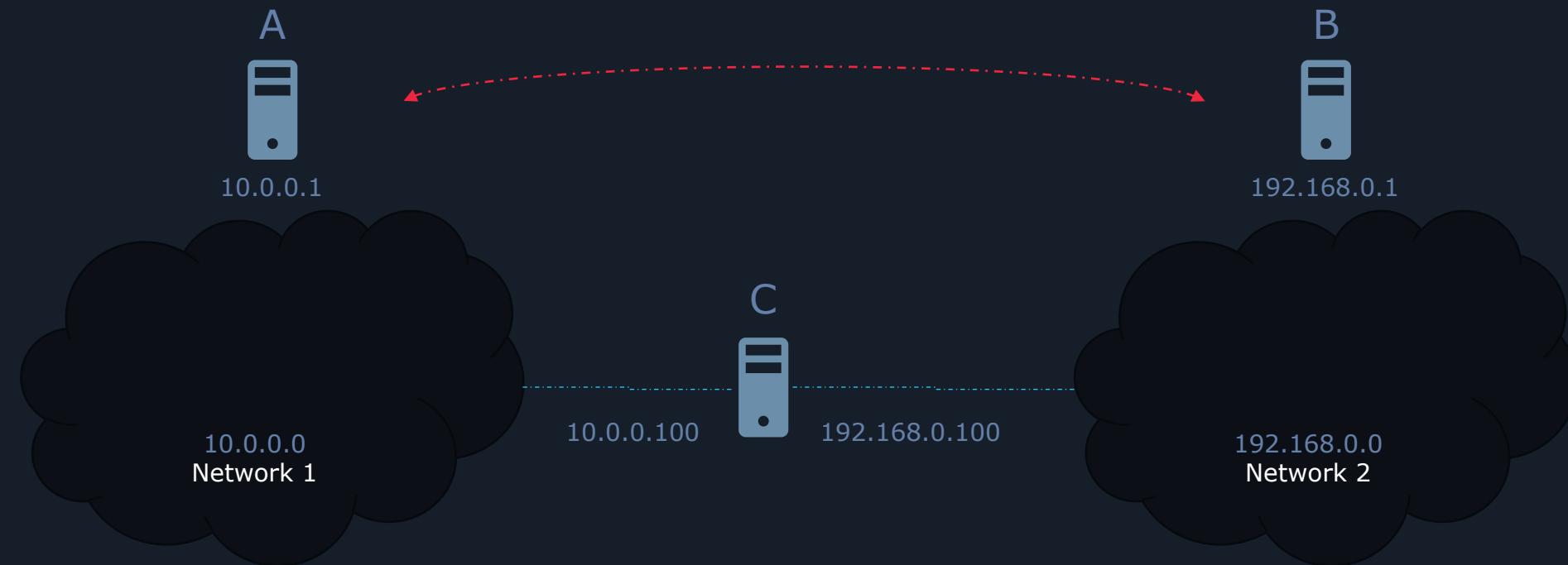


KodeKloud

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'.

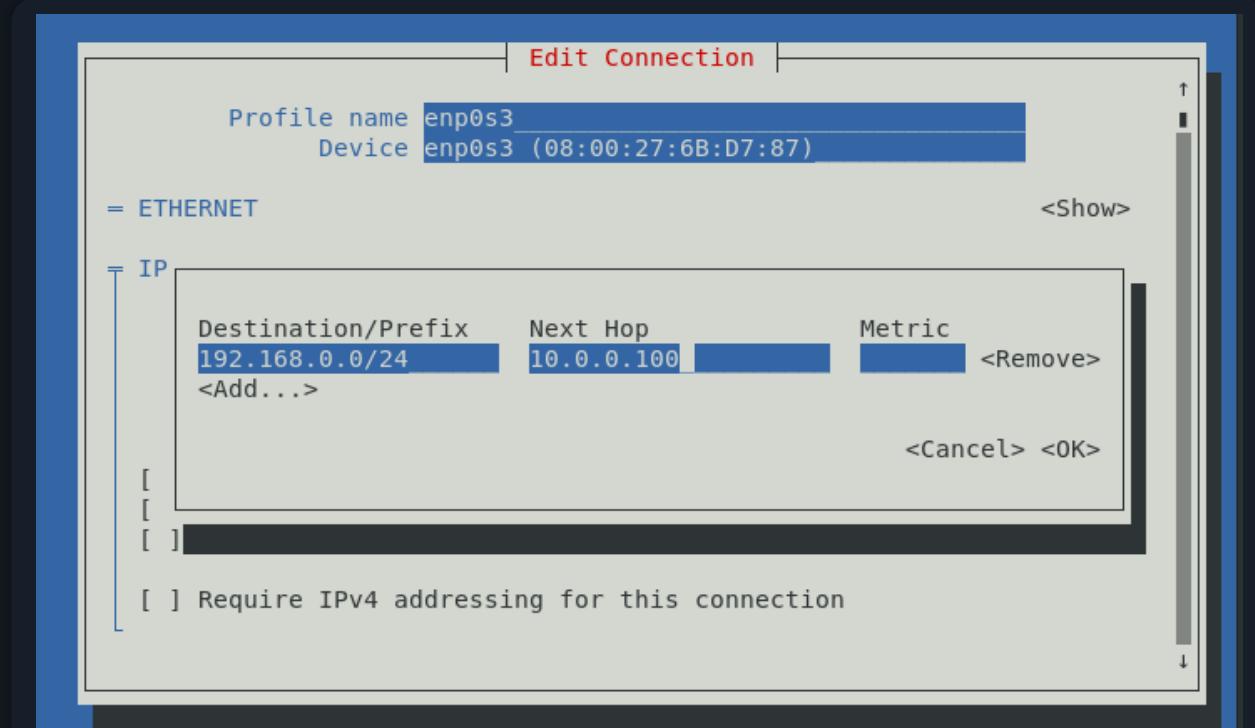
Statically Route IP Traffic

>_

```
$ sudo nmcli
```

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

Connection successfully reapplied to device 'enp0s3'.





KodeKloud

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
```



KodeKloud

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

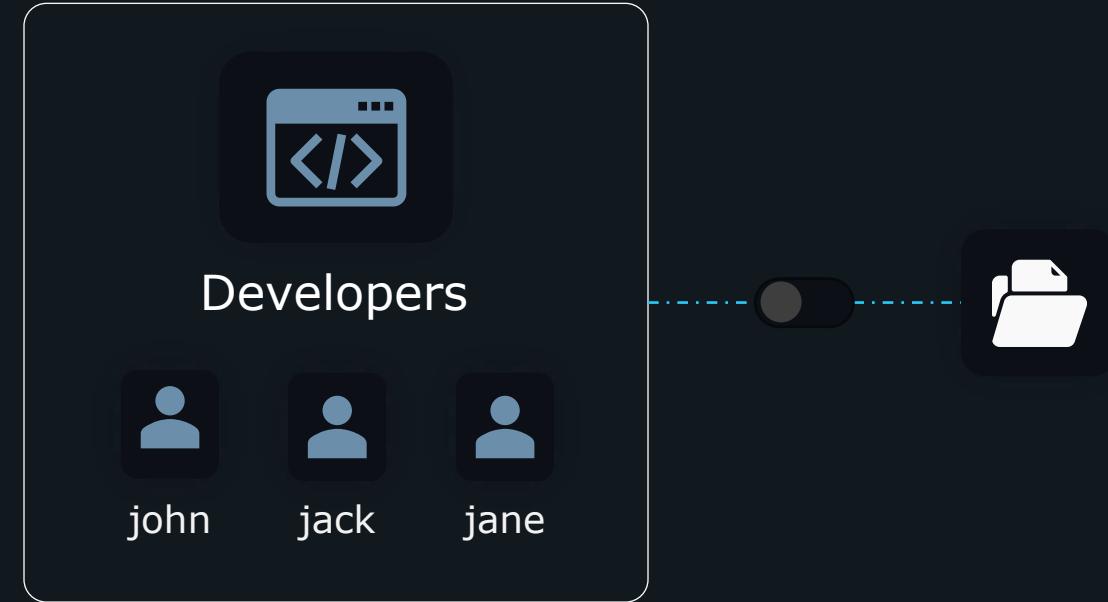


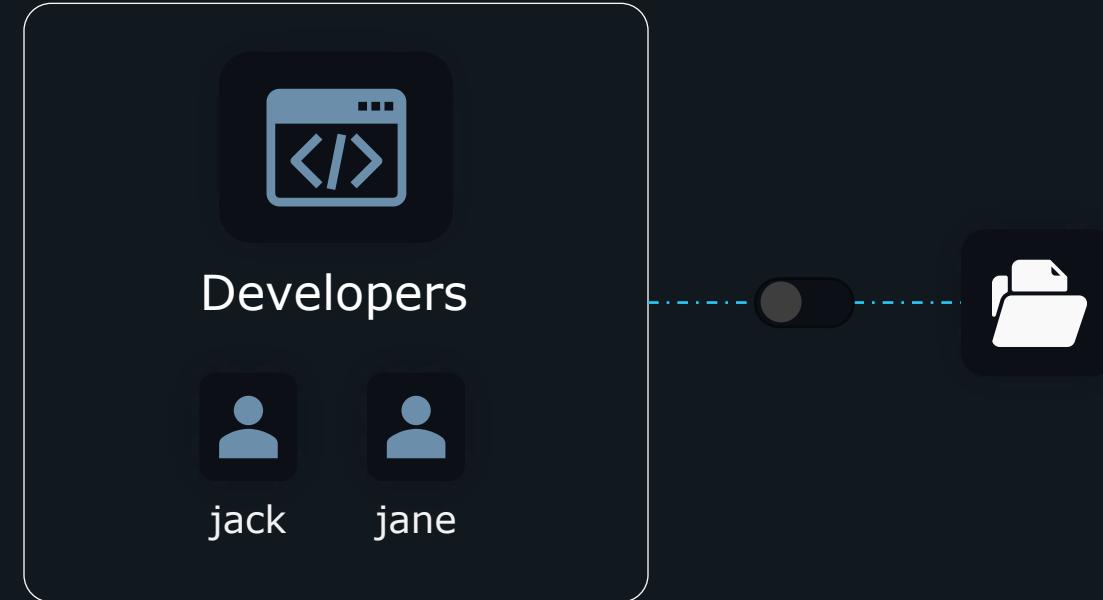
KodeKloud

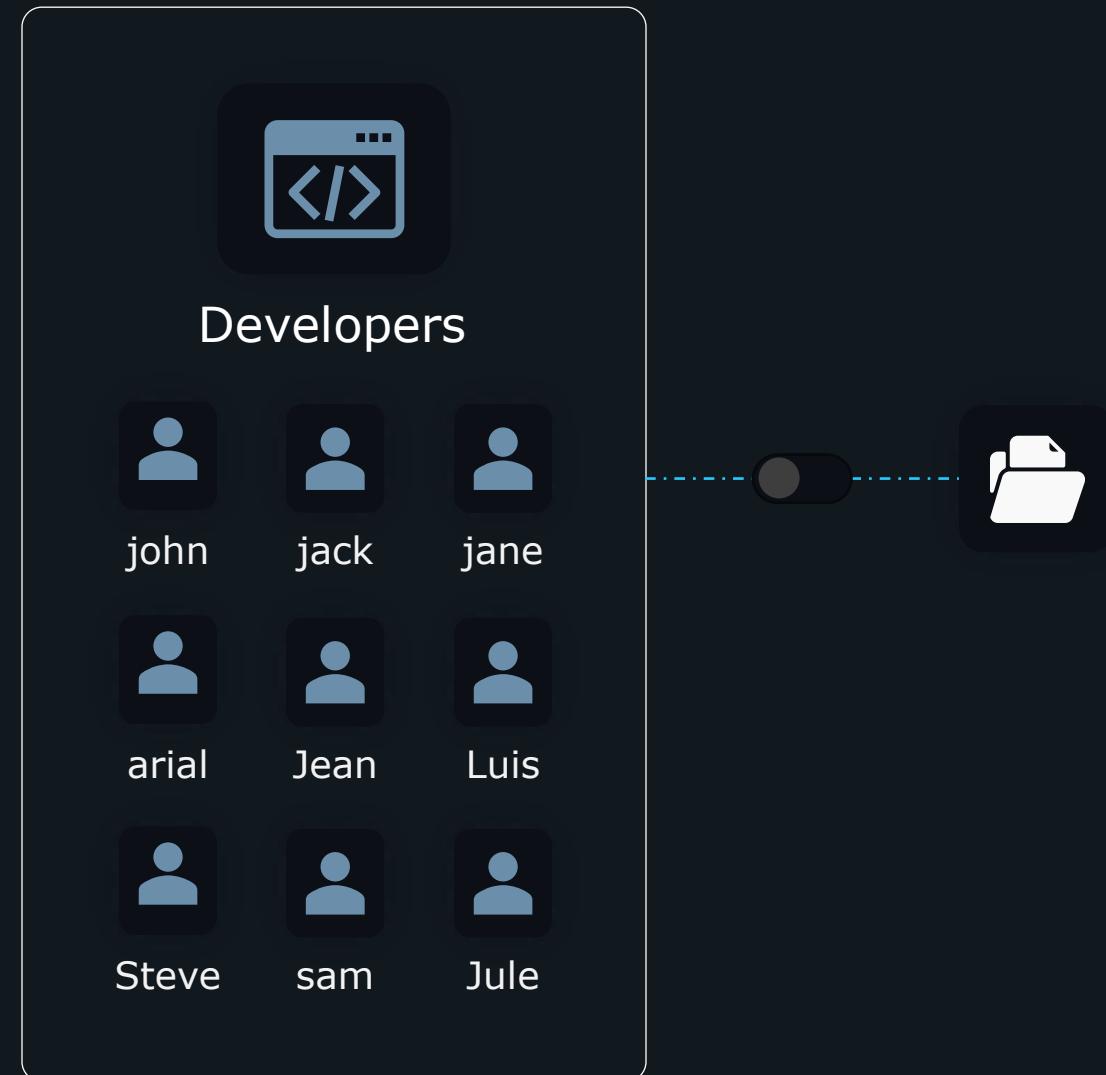
Local Groups and Group Memberships











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





KodeKloud

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
```



KodeKloud

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
```



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SELinux



File and Directory Permissions

r w X r w X r w X

owner

u

Group

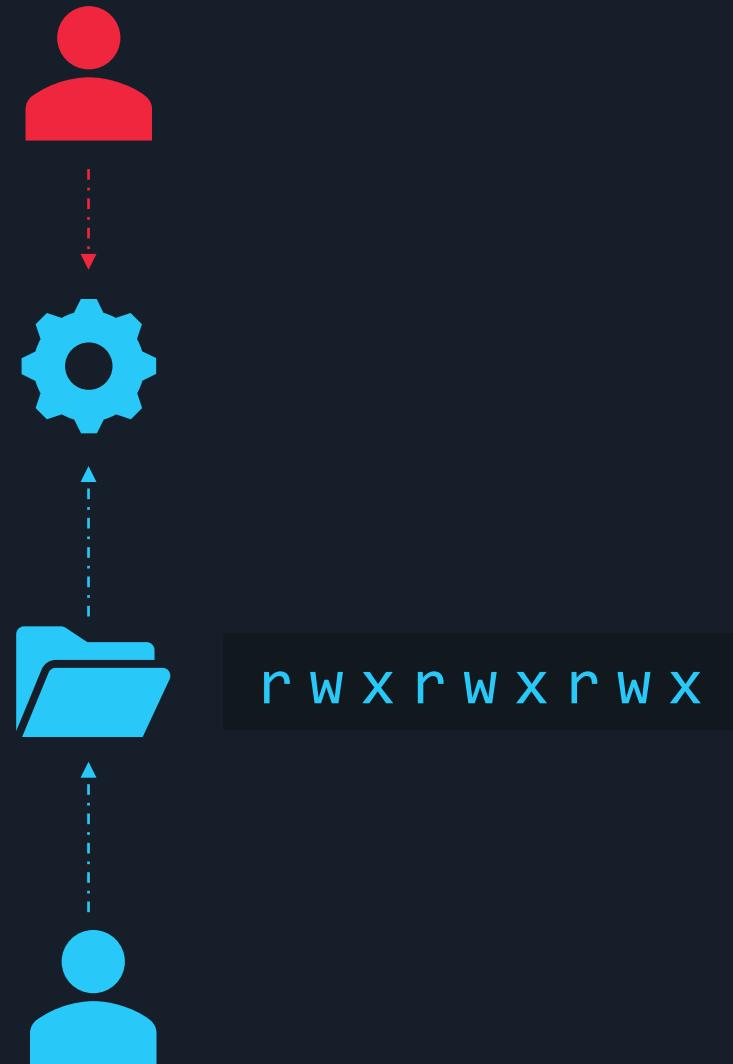
g

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

1

unconfined_u:object_r:user_home_t:s0

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



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Demo: SELinux Policies and Troubleshooting



SELinux Boolean Values

enforcing=0  Permissive mode

selinux=0  Disable SELinux

autorelabel=1  Force autorelabel (equivalent to creating /.autorelabel file)

SELinux Problems and Solutions

>_

```
$ journalctl -xe
```

```
$ ausearch -c 'httpd' --raw | audit2allow -M my-httpd
```

```
$ semodule -X 300 -i my-httpd.pp
```

```
$ systemctl start httpd.service
```

```
$ curl 127.0.0.1:88
```

Restore Default File Contexts

>_

```
$ grep "httpd" /var/log/messages | less
```

```
$ ls -laZ /kodekloud/
```

```
$ semanage fcontext -a -t httpd_sys_content_t "/kodekloud(/.*)?"
```

```
$ restorecon -R /kodekloud
```

```
$ curl 127.0.0.1:88/kodekloud.html
```



KodeKloud

Container Management With Skopeo



Installing Skopeo

```
>_
```

```
$ sudo yum install skopeo
```

Inspecting Repositories

>_

```
$ skopeo inspect docker://registry.fedoraproject.org/fedora:latest
{
  "Name": "registry.fedoraproject.org/fedora",
  "Digest": "sha256:655721ff613ee766a4126cb5e0d5ae81598e1b0c3bcf7017c36c4d72cb092fe9",
  "RepoTags": [
    "24",
    "25",
    "26-modular",
    ...
  ],
  "Created": "2020-04-29T06:48:16Z",
  "DockerVersion": "1.10.1",
  "Labels": {
    "license": "MIT",
    "name": "fedora",
    "vendor": "Fedora Project",
    "version": "32"
  },
  "Architecture": "amd64",
  "Os": "linux",
  "Layers": [
    "sha256:3088721d7dbf674fc0be64cd3cf00c25aab921cacf35fa0e7b1578500a3e1653"
  ],
  "Env": [
    "DISTTAG=f32container",
    "FGC=f32",
    "container=oci"
  ]
}
```

Inspecting Repositories

>_

```
$ skopeo inspect --config docker://registry.fedoraproject.org/fedora:latest | jq
{
  "created": "2020-04-29T06:48:16Z",
  "architecture": "amd64",
  "os": "linux",
  "config": {
    "Env": [
      "DISTTAG=f32container",
      "FGC=f32",
      "container=oci"
    ],
    "Cmd": [
      "/bin/bash"
    ],
    "Labels": {
      "license": "MIT",
      "name": "fedora",
      "vendor": "Fedora Project",
      "version": "32"
    }
  },
  "rootfs": {
    "type": "layers",
    "diff_ids": [
      "sha256:a4c0fa2b217d3fd63d51e55a6fd59432e543d499c0df2b1acd48fbe424f2ddd1"
    ]
  },
  "history": [
    {
      "created": "2020-04-29T06:48:16Z",
      "comment": "Created by Image Factory"
    }
  ]
}
```

Copying Images

>_

```
$ skopeo copy docker://quay.io/buildah/stable docker://registry.kodekloud.com/buildah
```

```
$ skopeo copy oci:busybox_ocilayout:latest dir:myemptydirectory
```

Deleting Images

>_

```
$ skopeo delete docker://localhost:5000/imagename:latest
```

Syncing Registries

>_

```
$ skopeo sync --src docker --dest dir registry.kodekloud.com/busybox /media/usb
```

Man Resources

>_

```
$ man skopeo
```

SKOPEO(1) August 2016 SKOPEO(1)

NAME

skopeo -- Command line utility used to interact with local and remote container images and container image registries

SYNOPSIS

```
skopeo [global options] command [command options]
```

DESCRIPTION

skopeo is a command line utility providing various operations with container images and container image registries.

```
$ man skopeo[copy]
```

skopeo-copy(1) General Commands Manual skopeo-copy(1)

NAME

skopeo-copy - Copy an image (manifest, filesystem layers, signatures) from one location to another.

SYNOPSIS

```
skopeo copy [options] source-image destination-image
```

DESCRIPTION

Copy an image (manifest, filesystem layers, signatures) from one location to another.



KodeKloud

Demo: Containers as Services and Persistent Storage for Containers



Container-tools and Storage Setup

```
>_  
  
$ sudo yum module reset container-tools  
  
$ sudo yum module install container-tools:3.0  
  
$ mkdir -p ~/.config/systemd/user  
  
$ mkdir ~/container_storage  
  
$ echo "KodeKloud" > ~/container_storage/kodekloud.html
```

Create Container and Attach Storage

>_

```
$ podman run -d --name container_service -p 1025:8080 -v ~/container_storage:/var/www/html:Z registry.access.redhat.com/rhscl/httpd-24-rhel7

$ curl 127.0.0.1:/kodekloud.html
```

Create Systemd Unit File

>_

```
$ cd ~/.config/systemd/user  
  
$ podman generate systemd --name container_service --files --new  
  
$ podman kill container_service  
  
$ podman rm container_service
```

Enable Systemd Service

>_

```
$ loginctl enable-linger
```

```
$ systemctl --user daemon-reload
```

```
$ systemctl --user enable --now container-container_service.service
```

```
$ sudo systemctl reboot
```

```
$ podman ps -a
```

```
$ curl 127.0.0.1:1025/kodekloud.txt
```

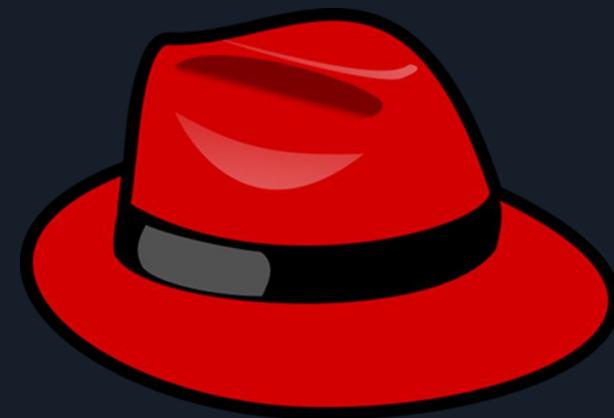


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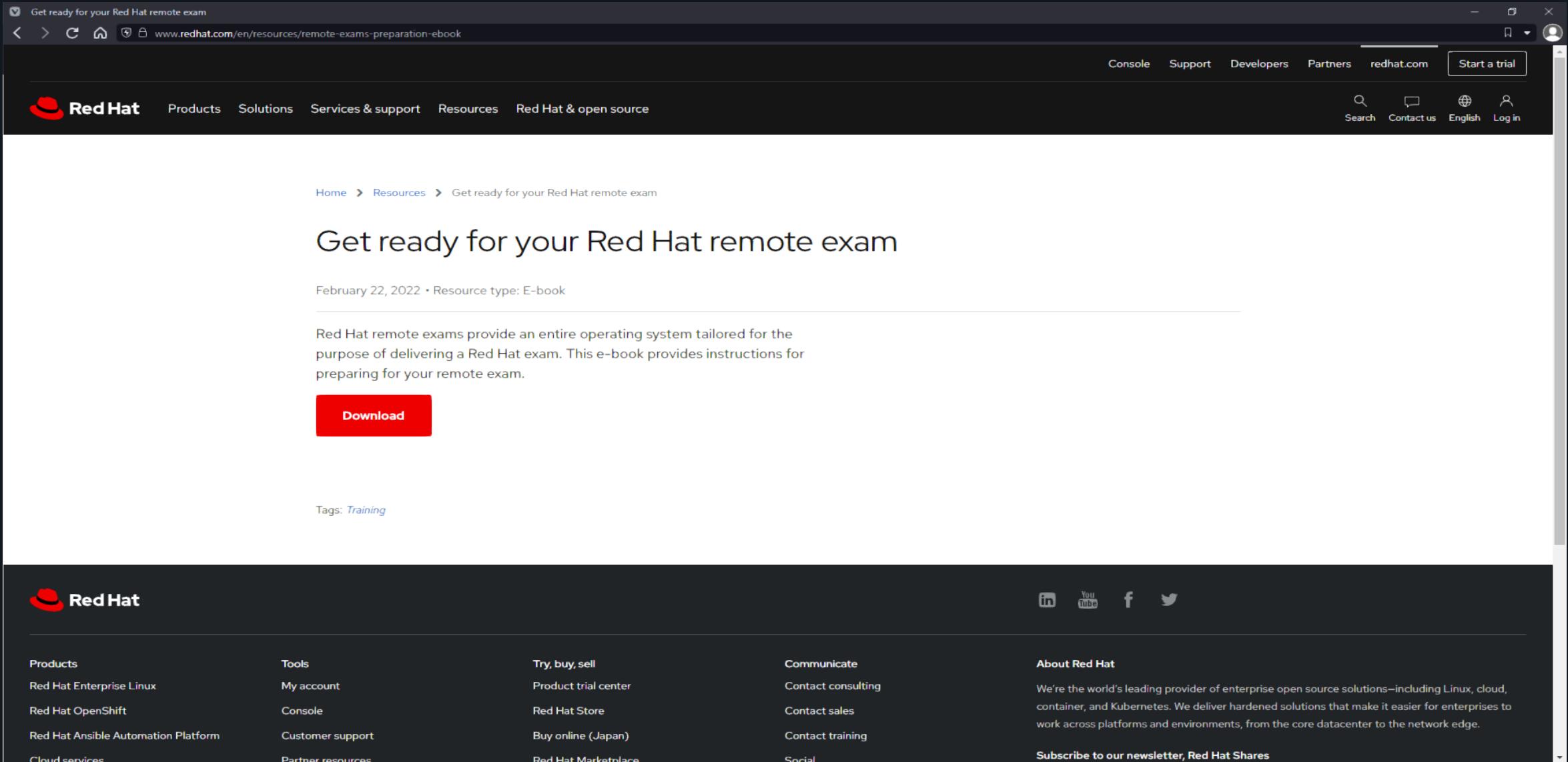
Conclusion



Conclusion



Conclusion



The screenshot shows a web browser displaying the Red Hat website at www.redhat.com/en/resources/remote-exams-preparation-ebook. The page title is "Get ready for your Red Hat remote exam". The Red Hat logo is in the top left. The top navigation bar includes links for "Console", "Support", "Developers", "Partners", "redhat.com", and "Start a trial". On the right, there are links for "Search", "Contact us", "English", and "Log in". The main content area shows the page title, a date of "February 22, 2022", and a resource type of "E-book". A paragraph describes Red Hat remote exams as tailored for delivering a Red Hat exam. A red "Download" button is prominently displayed. Below the main content, there is a "Tags" section with a "Training" link. The footer contains the Red Hat logo, social media links for LinkedIn, YouTube, Facebook, and Twitter, and a navigation menu with links to "Products", "Tools", "Try, buy, sell", "Communicate", and "About Red Hat". The "About Red Hat" section includes a description of Red Hat as a provider of enterprise open source solutions and a link to "Subscribe to our newsletter, Red Hat Shares".

Get ready for your Red Hat remote exam

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Red Hat remote exams provide an entire operating system tailored for the purpose of delivering a Red Hat exam. This e-book provides instructions for preparing for your remote exam.

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Red Hat Certified System Administrator Exam Details



RHCSA Exam Details



180 minutes
(3 hours)



400.00 USD
Valid for 3 years



Performance-based
Simulates on-the-job tasks
No multiple choice or true/false



In-person or online proctored
Red Hat live environment
Single monitor
No headphones
Webcam, speakers, and microphone ON
Quiet, well-lit, and clean testing area

RHCSA Remote Exam ebook



<https://www.redhat.com/en/resources/remote-exams-preparation-ebook>

RHCSA Exam Identification Requirements

You must be 16 years-old or older to take the exam.

Most testing sites and the remote exam require a government-issued photo ID to verify age and identity.

If you are in a region where government ID is not available, contact your local Red Hat office or Red Hat support

<https://www.redhat.com/en/services/training-and-certification/faq>

RHCSA 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

All the best!

 @kodekloud

 @kodekloud1